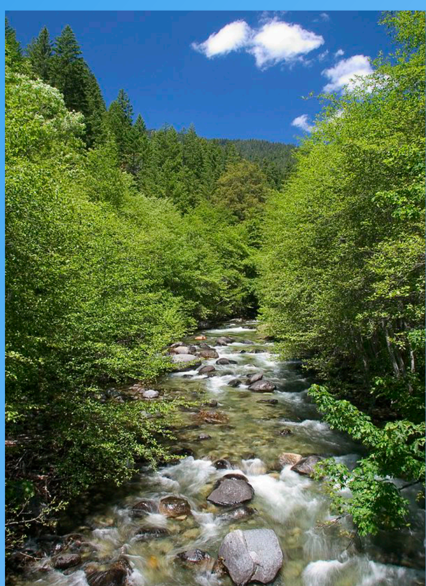
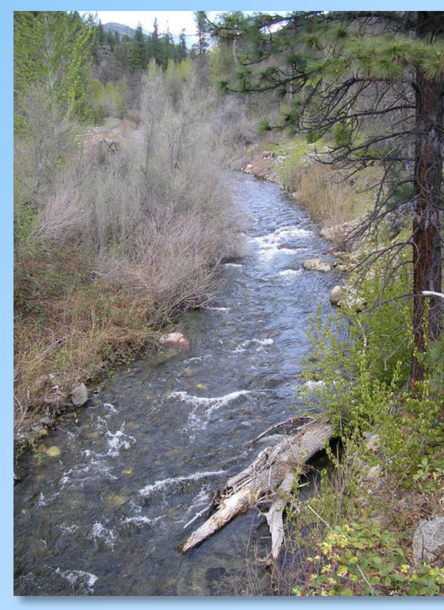
Influence of Snowpack, Streamflow, Air Temperature, and Wildfire Smoke on Klamath Basin Stream Temperatures, 1995-2017





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Prepared for:
Klamath Tribal Water Quality Consortium
December 2020

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Photo credits for cover page:
Clockwise from top: Confluence of Klamath River and Blue Creek (E. Asarian, August 25, 2017), Beaver Creek near confluence with Klamath River (E. Asarian, April 20, 2005), confluence of Elk Creek and Klamath River (E. Asarian, April 20, 2005), Little North Fork Salmon River (SRRC, June 4, 2005), and Klamath River (E. Asarian, April 20, 2005).

EXECUTIVE SUMMARY

Key Points

- Snowpack, streamflow, air temperature, and wildfire smoke are all useful predictors of water temperatures in our Klamath Basin study area.
- Summer water temperatures (especially in July) have warmed over our 1995–2017 study period, coincident with climate-driven increases in air temperatures and decreases in snowpack and river flow.
- Wildfire smoke has limited increases in August water temperatures, but has not affected annual maximum water temperatures because in most years fires do not start until after the year's hottest water temperatures have already occurred.
- At some sites, summer water temperatures have cooled as riparian vegetation and stream channel morphology recovered from previous disturbances including a major flood in 1997.

Background

High summer water temperatures are a primary factor limiting production of culturally and economically important salmon and steelhead in the Klamath River and its tributaries. Since the early 1990s, Native American Tribes, federal and state agencies, non-governmental organizations, and universities have collaboratively monitored summer water temperatures in the Klamath Basin using continuous probes. This report is the most comprehensive analysis of this dataset to date. Our project area spans from J.C. Boyle Reservoir in southern Oregon downstream to the Klamath River Estuary in California, including tributary watersheds such as the Shasta River, Scott River, Salmon River, and many other streams, although for the Trinity River we only included one site.

Goals of this study were to 1) acquire, compile, and quality check all available continuous stream temperature data collected within the study area since 1989, 2) quantify interannual (i.e., between years) variation within individual sites and attempt to quantitatively attribute that variation to climate factors (e.g., snowpack, streamflow, air temperature, and wildfire smoke), 3) test whether time series trends are present within individual sites and all sites collectively, and 4) qualitatively explain the causes of time series trends. Results will be used to refine monitoring plans and to inform prioritization of approaches for restoring aquatic habitat and watersheds.

Data Compilation and Preparation for Analysis

The compiled stream temperature dataset spans 1989 to 2017, with a total of 556 sites and 4354 unique site-year combinations. Since data were relatively sparse prior to 1995 and during high-flow months, we focus most of our analyses on July through September at 87 long-term sites that have at least 14 years of data in the 1995–2017 period. Data sources included the U.S. Forest Service, Salmon River Restoration Council, Yurok Tribe, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, Quartz Valley Indian Reservation, Karuk Tribe, and Humboldt State University. After an intensive screening process that corrected errors and inconsistencies, and identified overlap between the data sources, we calculated summary statistics for each site and year. These statistics included seasonal metrics (Maximum Daily Maximum Temperature [MDMT], Maximum Weekly Maximum Temperature [MWMT], and Maximum Weekly Average Temperature [MWAT] and monthly metrics (mean temperature and mean daily maximum temperature).

Each site was assigned to a reach in the National Stream Internet (NSI) Geographic Information System (GIS) stream network, providing GIS variables such as drainage area and mean annual

precipitation that are useful predictors of stream temperature. We summarized climate data for each site to get annual time series of: monthly average air temperature (from the PRISM model which uses a statistical model to combine data from many ground-based weather stations), April 1 snowpack (from a University of Arizona model that combines PRISM with ground-based snowpack measurements), and monthly average wildfire smoke (based on atmospheric clarity remote-sensed from satellites). In addition, we combined several U.S. Geological Survey (USGS) flow gages into a single monthly average basin-wide hydrologic index which we assigned to all sites.

Seasonal Patterns in Stream Temperature

Stream temperatures in the study area typically peak in late July or early August. There is considerable year-to-year and site-to-site variation in the date that peak temperatures occur.

Causes of Interannual Variation in Stream Temperature

We used linear mixed-effects models to explore how monthly stream temperatures at each of 87 long-term monitoring sites responded to interannual variation in climate (i.e., streamflow, snowpack, air temperature, and wildfire smoke). We tested models with various combinations of predictor variables before selecting a final model structure that we used for all months and temperature metrics. The final models include: 1) fixed effects for air temperature, smoke, and a categorical variable that differentiates the mainstems of the Klamath and Trinity rivers from all other tributaries, 2) random slopes that allow the relationship between stream temperature, streamflow and snowpack to vary by site, 3) a random intercept for site, and 4) a three-way interaction of smoke with drainage area and the mainstem/tributary categorical variable (i.e., the cooling effect of smoke varies with drainage area, and the slope of that relationship is different for tributaries than it is for mainstem rivers). Root mean squared errors (RMSE) varied by metric (range: 0.41 °C–0.58 °C) but all indicated excellent model fit.

Some monthly differences in the relative importance of climate predictor variables were apparent. The cooling effect of flow diminished substantially from July to September. In contrast, the warming effect of monthly air temperature and the cooling effect of snowpack were relatively constant between months (except that snow had a stronger effect on mean daily maximum stream temperature in July than other months). Smoke had a greater cooling effect in August than in July and September, and a greater cooling effect on mean daily maximum stream temperature than mean stream temperature.

For mean daily maximum August stream temperature (the metric most strongly cooled by smoke), smoke had the greatest cooling effect in tributaries with the largest drainage areas (2.4°C in Salmon River), the least cooling effect in tributaries with the smallest drainage areas (0.1°C in Aikens Creek), and an intermediate effect in the mainstem Klamath and Trinity rivers (1.5–1.6°C). Riparian and topographic shading may diminish the cooling effect of smoke in small tributaries.

Models that included random slopes for flow and snowpack had substantially better fits than models without random slopes, indicating site-specific variation in relationships between those climate variables and stream temperature. Unfortunately, we were unable to find any quantitative variables to adequately explain this variation at tributary sites. At mainstem Klamath River sites, random slopes for flow and snowpack become more negative (i.e., greater cooling effect) as water flowed downstream from Iron Gate Dam, suggesting that reservoir effects diminish with distance as the river gathers tributary flow.

Overall Long-Term Trends

We used linear mixed-effects models to assess long-term (1995-2017) trends in stream temperature. When all sites are analyzed together, seven of nine stream temperature metrics had positive slopes (i.e., temperatures increased over the study period). Slopes for July, +0.65 (95% CI: 0.59–0.72) and +0.56 (95% CI: 0.49–0.63) °C/decade for mean temperature and mean daily maximum temperature, respectively, were much higher than August or September. Slopes for MDMT (+0.24 [95% CI: 0.18–0.29] °C/decade), MWMT (+0.27 [95% CI: 0.21–0.32] °C/decade), and MWAT (+0.41 [95% CI: 0.36–0.45] °C/decade) were positive, with magnitudes intermediate between those of July and August/September.

In addition, we used linear mixed-effects models to statistically account for the influence of climate (i.e., streamflow, snowpack, air temperature, and smoke) on monthly stream temperatures, yielding a "climate-adjusted stream temperature" which we used to evaluate if other factors (e.g., riparian vegetation, channel morphology, etc.) besides climate are contributing to long-term trends. In contrast to the stream temperature trends (mentioned in the previous paragraph) that were mostly warming or flat, the climate-adjusted stream temperature trends were cooling or flat, indicating the warming stream temperatures are due largely to climate (e.g., rising air temperature, declining streamflow, and declining snowpack). The reasons for these decreases are unclear, but we speculate it may be due to recovery of riparian vegetation and channel conditions from past disturbances such as the 1997 flood.

Site-Specific Long-Term Trends

Evidence of stream temperature trends was generally weaker at mainstem Klamath River and Trinity River sites than at tributary sites. The steepest slopes at mainstem sites occurred in July, with several sites having slopes greater than +1 °C/decade and one site having a p-value as low as 0.012. Compared to July, evidence of temperature trends at mainstem sites was weak for seasonal metrics and the months of August and September, with most slopes ranging from +0.5°C/decade to -0.5°C/decade and only one site having a p-value less than 0.10.

Sites where stream temperatures are strongly cooled by high flows (i.e., that have highly negative flow random slopes) also tended to have steep increases in stream temperature over the study period. This includes many of the sites that provide summer holding habitat for adult spring-run Chinook salmon in the Salmon River. Peak summer temperatures in many of these reaches are likely already at or exceeding thermal suitability for this species, so continued temperature increases threaten the continued existence of this population.

We can qualitatively explain some of the causes in site-specific trends in stream temperature and climate-adjusted stream temperature. For example, several sites (Elk, Grider, Tompkins, Beaver, and Thompson creeks) experienced major geomorphic changes (scouring of riparian vegetation, sediment deposition, and widening of stream channels) during the 1997 flood which resulted in many years of elevated summer temperatures. Temperatures at those sites then cooled as channels recovered. As a result, those five sites all have strong cooling trends in stream temperature (and climate-adjusted stream temperature) over the 1995–2017 period. In contrast, one site where temperatures have increased strongly over the study period is Jenny Creek downstream of Spring Creek. Resolution of a water rights dispute led to increased diversions from Spring Creek in 2003-2015 relative to 1996-2002. As a result of reduced input of cool Spring Creek water, summer temperature in lower Jenny Creek warmed substantially over the 1995–2017 period.

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ELECTRONIC APPENDIX 1: MS Excel spreadsheet of stream temperature data, including: a) daily summary table, b) monthly summary table, c) annual summary table, d) site location table, and e) pivot charts for data exploration.

ELECTRONIC APPENDIX 2: The original temporal resolution (15-120 minute) stream temperature data were too large for Excel (limited to 1 million rows), so instead are provided as a separate tab-delimited text file (.csv)

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1 INTRODUCTION

1.1 DESCRIPTION OF STUDY AREA

The project area is a portion of the Klamath Basin in northern California and southern Oregon, USA (Figure 1). The project area spans from J.C. Boyle Reservoir on the Klamath River downstream to Turwar just upstream of the Klamath estuary, and includes all tributaries except for the Trinity River, although we did include the mouth of the Trinity River.

1.2 PREVIOUS STREAM TEMPERATURE ASSESSMENTS

Water temperatures have long been identified as a primary factor limiting production of salmon and steelhead within the study area and have been a priority for fisheries management and research (Kier Associates 1991, NRC 2004, NMFS 2014). Most of the streams in the project area are listed as impaired under the Clean Water Act Section 303(d) for temperature, and the North Coast Regional Water Quality Control Board[1] and Oregon Department of Environmental Quality has established many Total Maximum Daily Loads (e.g., NCRWQCB 2010). Previous assessments of stream temperatures within the study area include the analysis of long-term trends (Bartholow 2005, Isaak et al. 2018, Mallory et al. 2018), regression models (Flint et al. 2008, Flint et al. 2012, Asarian and Kann 2013), spatial stream network models (Asarian 2017, Asarian et al. 2019), simulation models (Campbell et al. 2001, Watercourse Engineering, Inc. 2003, PacifiCorp 2004, Campbell et al. 2010, NCRWQCB 2010, Perry et al. 2011, Willis and Holmes 2019), Klamath National Forest annual monitoring reports for stream temperature (Laurie 2012) and stream shade (Laurie and Reichert 2011), other annual monitoring reports (YTEP 2012, Karuk Tribe 2013, QVIR 2013, Watercourse Engineering 2015), riparian vegetation assessments (Alexander 1992, Cressey and Greenberg 2008), climate change assessments (Perry et al. 2011, Asarian et al. 2019), evaluation of the thermal refugia and salmonids' thermal tolerances (Sutton et al. 2002, Sutton et al. 2007, Sutton and Soto 2012, Strange 2011, Brewitt 2014, Brewitt and Danner 2014, Brewitt et al. 2017), analysis of mainstem river temperatures using thermal infrared imaging (Watershed Sciences 2010, Stillwater Sciences 2018), and the effects of wildfire smoke on stream temperatures (David et al. 2018).

In addition to the local analyses mentioned in the previous paragraph, there have been two major regional stream temperature compilations and analysis projects that overlap our study area. The Humboldt State University's Forest Science Project (HSU FSP) compiled data for 1990-1998 from a multitude of entities, including private timber companies, state and federal agencies, non-profit organizations, and consultants (Lewis et al. 2000). Lewis et al. (2000) then applied statistical models to these data to evaluate relationships between water temperature and variables including air temperature, distance from the Pacific Ocean, elevation, watershed area, and site-specific attributes (e.g., channel width, gradient, and canopy). The NorWeST[2] stream temperature model uses observed temperature data, Geographic Information Systems (GIS) data, and a multivariate spatial statistics model to produce a spatially continuous prediction of mean August temperature throughout the entire stream network (Chandler et al. 2016; Isaak et al. 2016, 2017). The U.S. Forest Service's Rocky Mountain Research Laboratory (USFS RMRS) initially applied the NorWeST model in 2015 to the North Coast of California including the Klamath Basin, primarily using data from readily available national databases. RMRS re-ran the regional NorWeST model in 2017 using many additional datasets including data compiled as

[1] http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/
[2] http://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.html

part of Riverbend Sciences' projects in the Klamath Basin (this report), Salmon River (Asarian et al. 2019), South Fork Trinity River (Asarian 2016), Yurok Ancestral Territory (Asarian 2017), and Eel River (Asarian et al. 2016).

1.3 STUDY GOALS

Goals of this study were to 1) acquire, compile, and quality check all available continuous stream temperature data within the project area, 2) quantify interannual (i.e., between years) variation within individual sites and attempt to quantitatively attribute that variation to environmental factors (e.g., streamflow and air temperature), 3) test whether time series trends are present within individual sites and all sites collectively, and 4) qualitatively attempt to explain the causes of time series trends. Results will be used to refine monitoring plans and to inform prioritization of approaches for restoring aquatic habitat and watersheds.

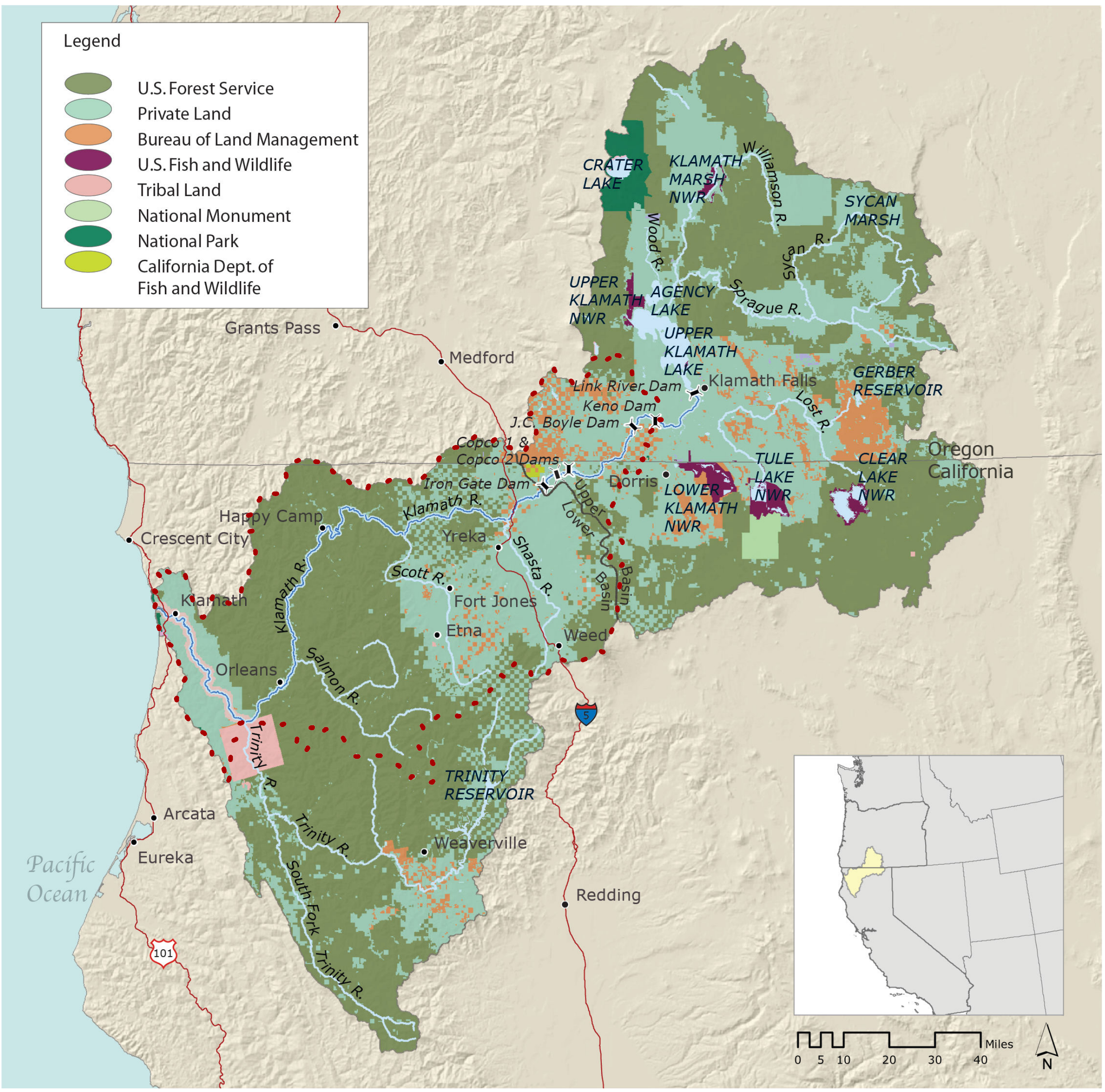


Figure 1. Project area (red dotted line) overlaid on map of land ownership in the Klamath Basin. Map adapted from Stillwater Sciences et al. (2012).

2 METHODS

2.1 OVERVIEW OF DATA SOURCES AND METHODS

Figure 3 provides a flow chart showing an overview of the data sources and major data analysis steps used in this project.

2.2 STREAM TEMPERATURE DATA SOURCES ACQUIRED AND COMPILED

Data for the years 1989 through 2017 were acquired from a multitude of sources (Table 1). Most datasets were acquired at their original temporal resolution, which ranged from 15 to 120 minutes, although a few datasets were obtained as daily summaries[3]. There are a total of 31.1 million measurements. Some probe deployments were included in multiple source compilations, resulting in up to three copies of the same data (i.e., overlap, see section 2.6). The overlap was retained in the master database, but was not used for analysis. Excluding the overlap, there were a total of 556 sites and 4354 unique site-year combinations (Table 1). The number of years of data available at a site ranged from one to 24. The number of sites per year ranged from five to 243 (Figure 2). Some datasets were acquired and compiled as part of previous Riverbend Sciences' projects (Asarian 2017, Asarian et al. 2019). Figure 4 provides a site map.

2.2.1 SALMON RIVER RESTORATION COUNCIL

The Salmon River Restoration Council (SRRC[4]) collects stream temperature data at long-term monitoring sites on the Salmon River and tributaries during the summer season. The monitoring program is coordinated with the Klamath National Forest, Six Rivers National Forest, and the Karuk Tribe. These data were compiled by Asarian et al. (2019).

2.2.2 US FOREST SERVICE, NATURAL RESOURCE INFORMATION SYSTEM AQUATIC SURVEYS

Most water temperature data collected by U.S. Forest Service (USFS) within the study area, including data collected by staff from the Klamath National Forest (KNF) and Six Rivers National Forest (SRNF), are input into the national Natural Resource Information System (NRIS) Aquatic Surveys (AqS) database. Hydrologist Callie McConnell of the USFS office in Corvallis, Oregon extracted all NRIS AqS temperature data within the study area in December 2016 and provided it for use in this project. NRIS AqS also includes most, but not all, stream temperature data collected by the Karuk Tribe's fisheries program, as well as most data collected by SRRC since 2010.

2.2.1 US FOREST SERVICE, SIX RIVERS NATIONAL FOREST

With the onset of continuous temperature sensor technology, the SRNF in partnership with the HSU FSP initiated a stream temperature monitoring program in 1994. Some SRNF temperature data are included within the NRIS AqS database. However, USFS stream temperature data for the lower Salmon River that were not available in the NRIS AqS database for this assessment were obtained from LeRoy Cyr, Orleans Ranger District fish biologist, for the years 2011-2017.

[3] All the data from the U.S. BLM Medford Office, and a portion of the data from the Karuk Tribe.
[4] http://srrc.org/publications/index.php

Table 1. Summary of stream temperature data compiled for use in this project. Grey text in the *Overlap* column indicate portions of data sources that were excluded from analysis because they overlap (i.e., are duplicate copies of the same data) with other data sources or had data quality issues. Totals do not equal the sum of the individual rows because some sites and reaches are shared between datasets, and totals do not include the datasets flagged as overlap. Data sources are listed in descending order of number of site-years. *Sites before stnd.* is the original number of sites prior to standardization of adjacent comparable sites (see section 2.6).

Source Entity Full Name	Source Entity Abbreviated	Overlap with other datasets?	First Year	Last Year	Site-Years	Sites	Sites before stnd.
U.S. Forest Service Natural Resource Information System Aquatic Surveys	USFS_NRIS_AqS	No	1989	2016	1976	299	374
		Suspect data or coords, not used	1997	2016	34	20	20
		Dup./Already in USFS_NRIS_AqS as another site	1997	2006	13	3	4
Salmon River Restoration Council	SRRC	No	1995	2017	442	85	92
		To be superseded by USFS_NRIS_AqS when NRIS is fixed	1999	2016	32	10	10
		Dup./Superseded by USFS_NRIS_AqS	1997	2016	259	44	45
Yurok Tribe Fisheries Program	YTFP	No	1995	2016	517	72	73
		Dup./Superseded by USFS_NRIS_AqS	2003	2003	1	1	1
U.S. Fish and Wildlife Service	USFWS	No	1999	2016	348	45	47
		Suspect data or coords, not used	2013	2016	3	1	1
Six Rivers National Forest	SRNF	No	1996	2017	239	35	35
		Dup./Superseded by USFS_NRIS_AqS	1996	2010	257	28	28
U.S. Bureau of Land Management, Klamath Falls	BLM_Kfalls	No	2001	2015	208	15	16
U.S. Bureau of Land Management, Medford	BLM_Medford	No	1993	2015	132	11	15
Yurok Tribe Environmental Program	YTEP	No	2015	2016	143	75	75
Quartz Valley Indian Reservation	QVIR	No	2007	2016	129	35	35
Humboldt State University's Forest Science Project	HSU_FSP	No	1994	1998	127	75	75
		Dup./Superseded by SRNF	1998	1998	2	2	2
		Dup./Superseded by USFS_NRIS_AqS	1997	1998	15	14	14
California Department of Fish and Wildlife, Yreka	CDFW_Yreka	No	2008	2016	48	5	8
Karuk Tribe Water Quality	KarukWQ	No	2005	2017	39	3	3
TOTALS (EXCLUDING OVERLAP)			1989	2017	4380	558	845

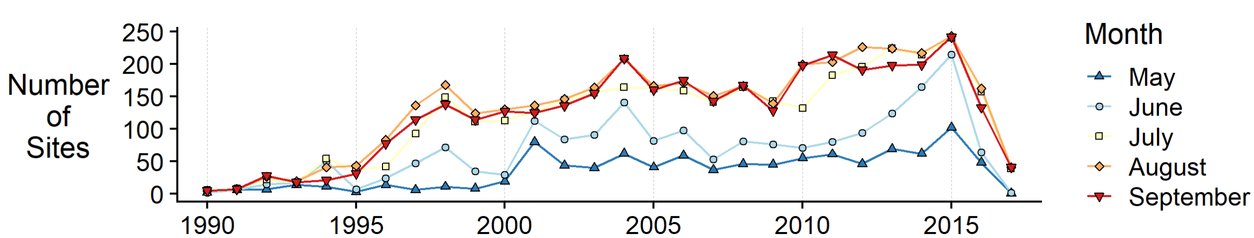
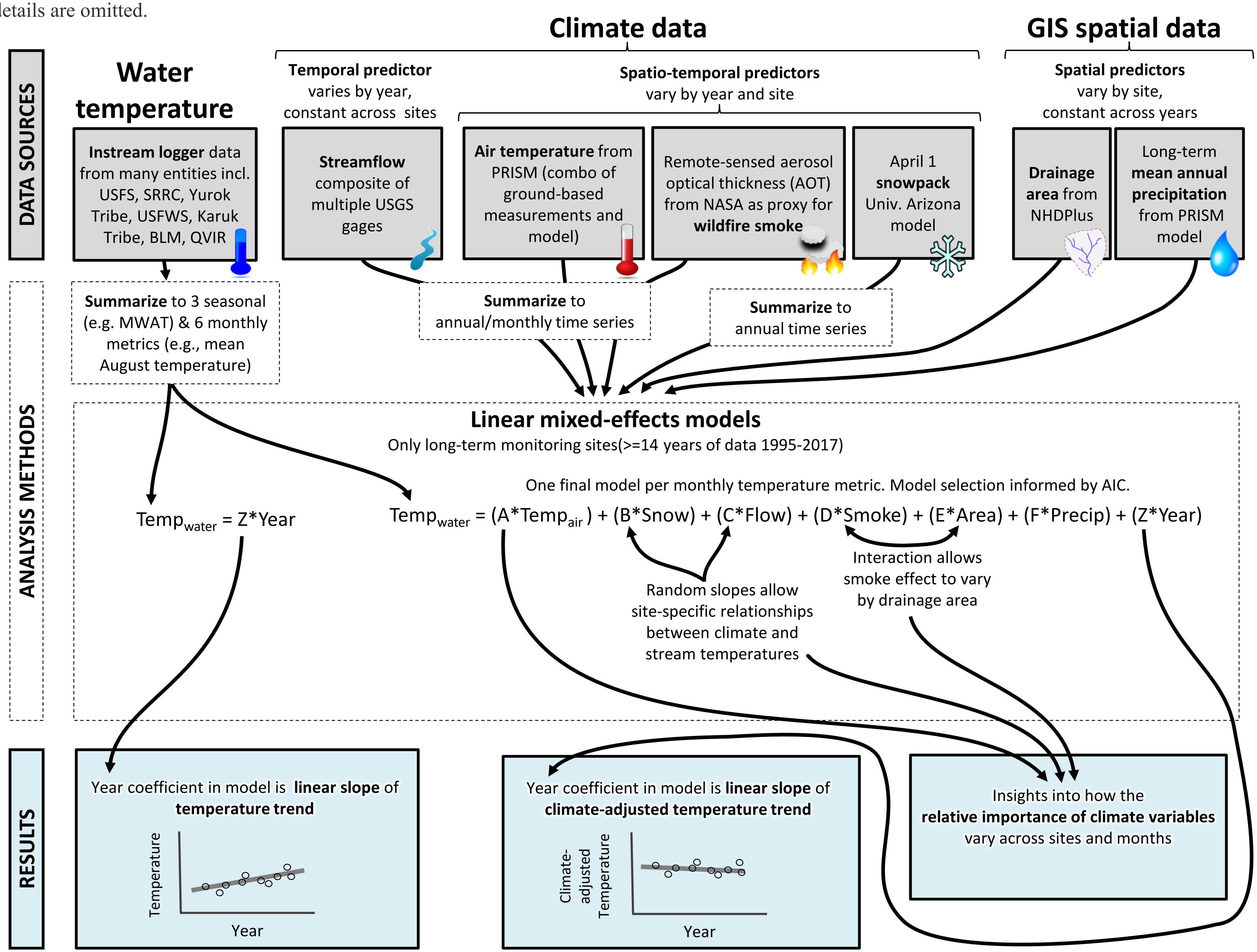


Figure 2. The number of sites per year with stream temperature available in the compiled database, excluding overlap.

Figure 3. Flow chart with overview of data sources and major data analysis steps used in stream temperature analyses. For simplicity and clarity, some steps and details are omitted.



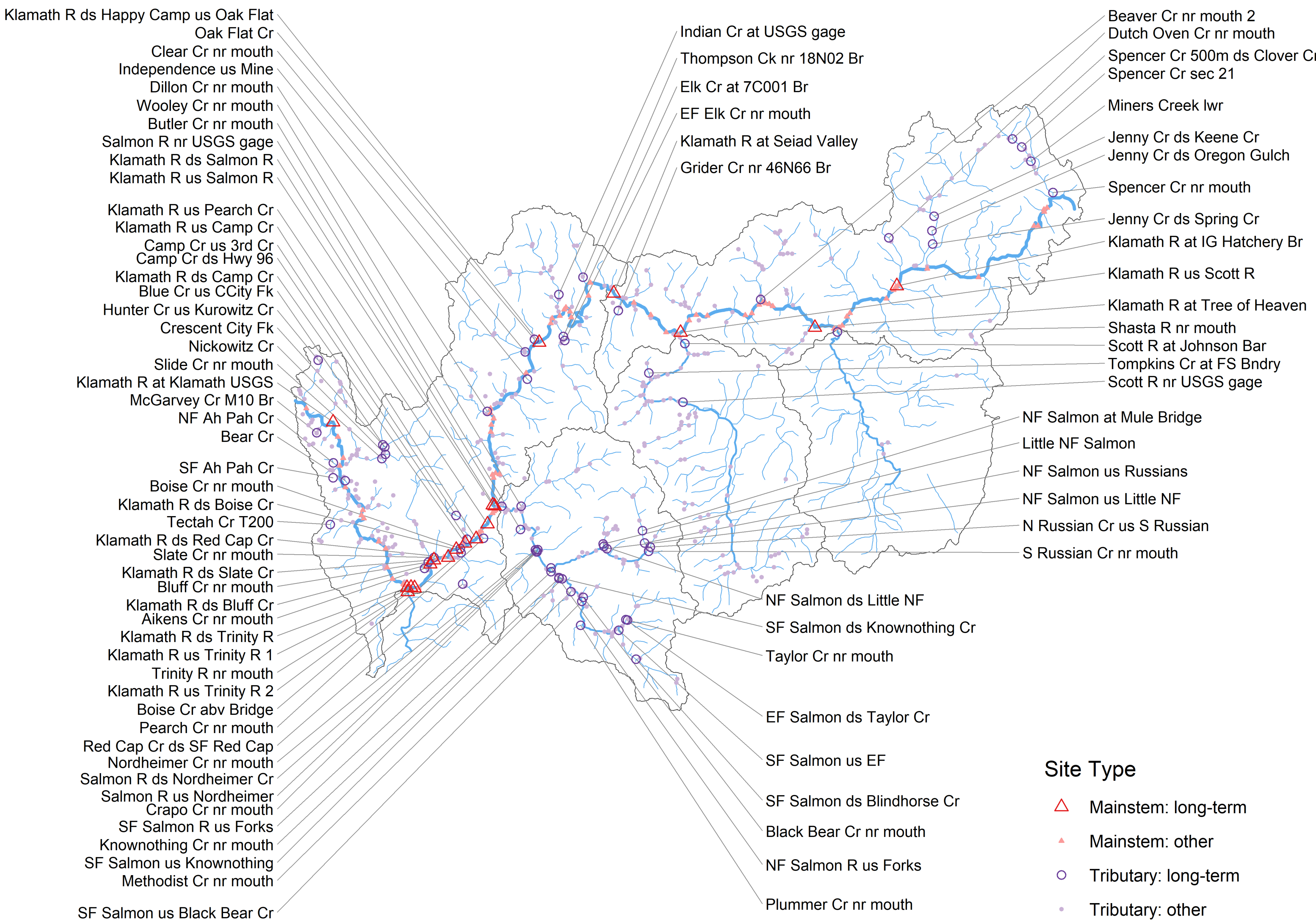


Figure 4. Map showing locations of the 558 temperature monitoring sites for which we compiled data. Most analyses in this report were limited to the 87 ‘long-term’ sites (labeled on this map) that have at least 14 years of data. “Mainstem” signifies sites on Klamath River or Trinity River.

2.2.2 QUARTZ VALLEY INDIAN RESERVATION

The Quartz Valley Indian Reservation (QVIR) monitors water temperatures at many sites within the Scott River sub-basin, with a focus on coho spawning and rearing habitat. A higher resolution of sampling sites exists in the vicinity of the Quartz Valley Reservation on Shackleford and Mill Creeks (QVIR 2008, 2009, 2011, 2013). We obtained most of QVIR's data from QVIR's Sarah Schaefer in spring 2017, except for the Scott River multi-parameter sonde data (Asarian and Robinson 2020) which we obtained from QVIR's Crystal Robinson in spring 2019. Recent data are available through the Karuk Tribe's online water quality portal[5].

2.2.3 CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE (YREKA OFFICE)

The California Department of Fish and Wildlife's (CDFW) Yreka office monitors stream temperature at various places within the Shasta River sub-basin. We obtained data from CDFW's Bill Chesney (now retired) for a subset of CDFW's key locations such as Big Springs Creek and the mouth of the Shasta River. CDFW has additional data on file that we did not obtain (section 5.1).

2.2.4 U.S. BUREAU OF LAND MANAGEMENT (MEDFORD AND KLAMATH FALLS OFFICES)

The Medford and Klamath Falls offices of the U.S. Bureau of Land Management (US BLM) monitor stream temperatures in the Klamath River and its tributaries between J.C. Boyle Dam and Iron Gate Dam. We obtained US BLM Klamath Falls office data in the Spencer Creek and Jenny Creek drainages as well as the Klamath River from Chelsea Aquino in September 2016. We obtained data for sites in the Camp Creek and Jenny Creek watersheds from Tim Montfort in October 2016.

2.2.5 KARUK TRIBE DEPARTMENT OF NATURAL RESOURCES

The Karuk Tribe Water Quality Program monitors water temperature and other water quality parameters at three sites on the Klamath River and one site each on the Shasta, Scott, and Salmon rivers (Karuk Tribe 2013). Recent data are available on the Karuk Tribe's online water quality portal[6]. For this project, we only acquired and utilized data for the tributary sites. The Karuk Tribe Fisheries Program (KTFP) participates in collaborative monitoring of water temperatures with the USFS and SRRC. The vast majority of these temperature data collected have been input into the NRIS AqS database, so we did not include any additional KTFP data in our analyses. The KTFP does have some additional data (primarily associated with special studies such as thermal refugia monitoring) that could be compiled at some point in the future.

2.2.6 U.S FISH AND WILDLIFE SERVICE

The U.S. Fish and Wildlife Service[7] (USFWS) office in Arcata, California collects stream temperature data at a network of monitoring sites within the Klamath Basin including the Trinity River sub-basin and maintains the data in a well-organized Microsoft Access database. Data were received from USFWS fisheries biologist Aaron David in February 2017.

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[5] http://waterquality.karuk.us:8080/

[6] http://waterquality.karuk.us:8080/

[7] http://www.fws.gov/arcata/fisheries/activities/waterQuality/klamathWQ.html

2.2.7 YUROK TRIBE FISHERIES PROGRAM

The Yurok Tribe Fisheries Program (YTFP) collects temperature data on the lower mainstem Klamath River (McCovey 2003) and its tributaries (Gale 1998, Gale et al. 1998, Voight and Gale 1998, Gale and Randolph 2000, Gale et al. 2003, Beesley and Fiori 2007) including the lower Trinity River. Several different divisions and projects of YTFP are involved in the temperature monitoring, and the names of those divisions have changed since consistent temperature monitoring began in the mid-1990s. Associated projects included thermal refugia (Sutton et al. 2002, Belchik 2003, Benson and Holt 2005, Naman 2005, Strange 2011b) and telemetry of adult chinook salmon (Strange 2003, 2005, 2006, 2007, 2008, 2011a) and sturgeon (McCovey 2009a), and pathology of adult chinook salmon (McCovey 2009b, McCovey and Strange 2011). We attempted to obtain all of the YTFP data through the year 2016, and received data from YTFP biologist Jamie Holt, YTFP biologist Sarah Beesley, and USFWS biologist Dan Gale (previously with YTFP). Some of these data were compiled in previous projects (Asarian 2017), but we compiled additional data for this project.

2.2.8 YUROK TRIBE ENVIRONMENTAL PROGRAM

From spring 2015 through spring 2017, the Yurok Tribe Environmental Program (YTEP[8]) installed a network of more than 100 temperature monitoring sites on Lower Klamath tributaries and springs. Nearly all of these data through spring 2017 were compiled by Asarian (2017) and are available for use in this project. In addition, YTEP also collects stream temperature data at long-term monitoring sites on the Klamath River and tributaries, primarily during the summer season (YTEP 2005, YTEP 2012) but due to time constraints and overlap with other datasets, these were not utilized for this project (see Appendix C for details).

2.2.9 HUMBOLDT STATE UNIVERSITY'S FOREST SCIENCE PROJECT

As noted above in section 1.2, HSU FSP compiled data from the North Coast of California for 1990-1998 from a multitude of entities, including private timber companies, state and federal agencies, non-profit organizations, and consultants (Lewis et al. 2000). The FSP was later renamed the Institute for Forest and Watershed Management and is now dissolved. The data are extremely well organized and were rigorously reviewed during the Lewis et al. (2000) analysis, but one deficiency of the publicly shared version of the database is that there is no way to ascertain which entity collected any particular piece of data, which inhibits transparency and made it difficult to determine potential overlap with other datasets.

2.3 ADDITIONAL DATASETS NOT ACQUIRED OR COMPILED

The datasets we compiled (section 2.1) span most of the study area. The primary remaining areas with relatively little data in our database are the private lands in the Scott and Shasta valleys. In addition, two private timber companies (Green Diamond Resource Company and the Michigan-California Timber Company which is an affiliate of Timber Products) with substantial land holdings declined requests to share their extensive stream temperature datasets for this project, but those gaps are not particularly consequential because Tribal and USFS data are available at sites either nearby or within these land ownerships.

During the outreach and research over the course of this project, we became aware of many datasets that we were either not able to obtain the original electronic data, or did not have time to

[8] http://www.yuroktribe.org/departments/ytep/water_reports.htm

compile and quality check the data. Some (but not all) of these data, particularly those in the Trinity River and Lower Klamath River, are currently being compiled and analyzed by Riverbend Sciences and the Yurok Tribe as part of a separate Trinity River project scheduled for completion in 2020. Appendix A describes the additional datasets not acquired or compiled.

2.4 QUALITY CONTROL AND CLEANING OF STREAM TEMPERATURE DATA

Data collected with continuous probes, such as the temperature data that are the subject of this project, must be cleaned/trimmed to remove data corrupted when a probe malfunctions or is exposed to air either during pre/post deployment or when water levels decline over the course of the season. The condition of the datasets we received varied among data sources and year, so a fairly intensive screening and trimming process was initiated, informed by protocols from Dunham et al. (2005), Sowder and Steel (2012), and U.S. EPA (2014). All data values for the period when the sensors appear to be exposed to air were removed but the data from the remainder of the probes' deployment when water was flowing in the respective stream reaches were retained. Additional details on the processes we used are provided in Asarian (2017).

A list of all specific issues identified in the review were sent back to original data providers to give them an opportunity to correct their datasets for future uses.

2.5 ASSIGNING STREAM TEMPERATURE MONITORING SITES TO STREAM NETWORK GIS

All stream temperature datasets had x-y spatial coordinates (e.g., UTM or latitude/longitude); however, assigning each site to a GIS stream network (rather than solely x-y coordinates) greatly increases the utility of the data. We selected the National Stream Internet (NSI) Hydrography Network[9] as the GIS stream network due to its use in the NorWeST model. NSI network was created by the U.S. Forest Service's Rocky Mountain Research Lab (USFS RMRL) by modifying the NHD-Plus[10] Version 2 medium-resolution (1:100,000-scale) hydrography layer for all streams in the contiguous United States. NHD-plus contains a large database of descriptors for each reach (e.g., stream name, watershed area, stream gradient, climate variables, and percent of various land-use types within the watershed) which are useful predictor variables in spatial analyses. Assigning the temperature monitoring points to NSI/NHD-plus stream reaches allowed the data to be easily integrated into NorWeST and other stream network models. Each stream temperature monitoring station was assigned to reaches in the NSI Hydrography Network GIS using steps described in Asarian (2017). In addition, each station was assigned to a 1-km NorWeST prediction reach which is based on the same hydrography as the NSI but has shorter reaches and includes all NorWeST covariates (i.e., predictor variables).

2.6 IDENTIFYING OVERLAPPING DATA AND STANDARDIZING SITE LOCATIONS

As noted above in section 2.1, some deployments were included in multiple source compilations, resulting in up to three copies of the same data. Using a combination of automated and manual methods, we conducted a detailed review to identify and exclude these duplicate (i.e., overlapping) data. After seasonal summary statistics were calculated (see section 2.7), we grouped data by year and 1-km NorWeST reach ID and produced a spreadsheet listing all site-

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[9] http://www.fs.fed.us/rm/boise/AWAE/projects/NationalStreamInternet/NSI_network.html
[10] http://www.horizon-systems.com/nhdplus/NHDPlusV2_home.php

years. If a reach had multiple sites (either from the same source or different sources) within the same year, we compared the maximum weekly average temperature (MWMT) values and automatically flagged those that were within 0.02°C of each other because we assumed that indicated those data were duplicate copies. We also manually reviewed site-years that had too short a duration to have seasonal summary statistics (see section 2.7.3) and manually flagged any that were deemed duplicate copies. Where overlap was identified, we flagged one copy of the data as overlap to be excluded from analysis, giving priority to the largest and actively maintained source datasets[11]. The overlap was retained (and flagged) in the master compiled database, but was not used for analysis. This review process detected additional issues (mislabeled sites and incorrect coordinates) in the source databases which were then corrected in the compiled versions.

2.7 CALCULATION OF DAILY AND SEASONAL SUMMARIES

2.7.1 DAILY SUMMARY STATISTICS

Most data were acquired at their original temporal resolution, which ranged from 15 to 120 minutes. On days when data completeness was at least 80% (e.g., if data's temporal resolution is 30 minutes, then at least 38 out of the maximum possible 48 measurements must be present), we calculated daily summary statistics including number of measurements, minimum, maximum, mean, and range. All metrics were calculated using R 3.5.1 (R Core Team 2018).

2.7.2 INITIAL CALCULATION OF SEASONAL AND MONTHLY SUMMARY STATISTICS

Key seasonal temperature metrics were selected based on a review of previous stream temperature analyses (Lewis et al. 2000, Welsh et al. 2001, Dunham et al. 2005, Isaak et al. 2010, McCullough 2010) and calculated for each site and year, including:

- *Maximum Daily Maximum Temperature (MDMT)* – The highest instantaneous maximum temperature recorded during the summer (Figure 5).
- *Maximum Weekly Maximum Temperature (MWMT)* – The highest seven-day average of the daily maximum temperature. In simple terms, it is the average daily maximum temperature during the warmest seven-day period of the year. Steps for calculation (Figure 5):
    - Step 1. Calculate maximum temperature for each day.
    - Step 2. Calculate 7-Day Average of the Daily Maximum (7DADM), which is the average of the daily maximum temperature (Step 1) for the three prior days, the current day, and three following days.
    - Step 3. Select highest 7DADM (Step 2) value of the year.
- *Maximum Weekly Average Temperature (MWAT)* – The highest seven-day moving average of the daily average temperatures. In simple terms, it is the average daily temperature during the warmest seven-day period of the year. Steps for calculation (Figure 5):
    - Step 1. Calculate mean temperature for each day.

[11] Order of priority: USFS_NRIS_AqS (highest), SRNF, SRRC, KarukWQ, USFWS, HSU_FSP, and YTFP (lowest). There were no overlap between USGS and other datasets.

- Step 2. Calculate 7-Day Average of the Daily Average (7DADA), which is calculated for each day as the average of the daily mean temperature (Step 1) for the three prior days, the current day, and three 3 following.
- Step 3. Select highest 7DADA (Step 2) value of the year.

- *Mean Monthly Temperature* and *Mean Daily Maximum Monthly Temperature* – For any month for which data were available for 90% (i.e., 28 of 30 or 31) of days, we calculated mean monthly temperature as the average of all daily average temperatures within the month, and mean daily maximum monthly temperature as the average of all daily maximum temperatures within the month.

The date of occurrence of MDMT, MWMT, and MWAT was also calculated. In cases where the same maximal value was reached on more than one date, the seasonal statistic date was assigned to the date on which a larger number of sites had the maximal value[12].

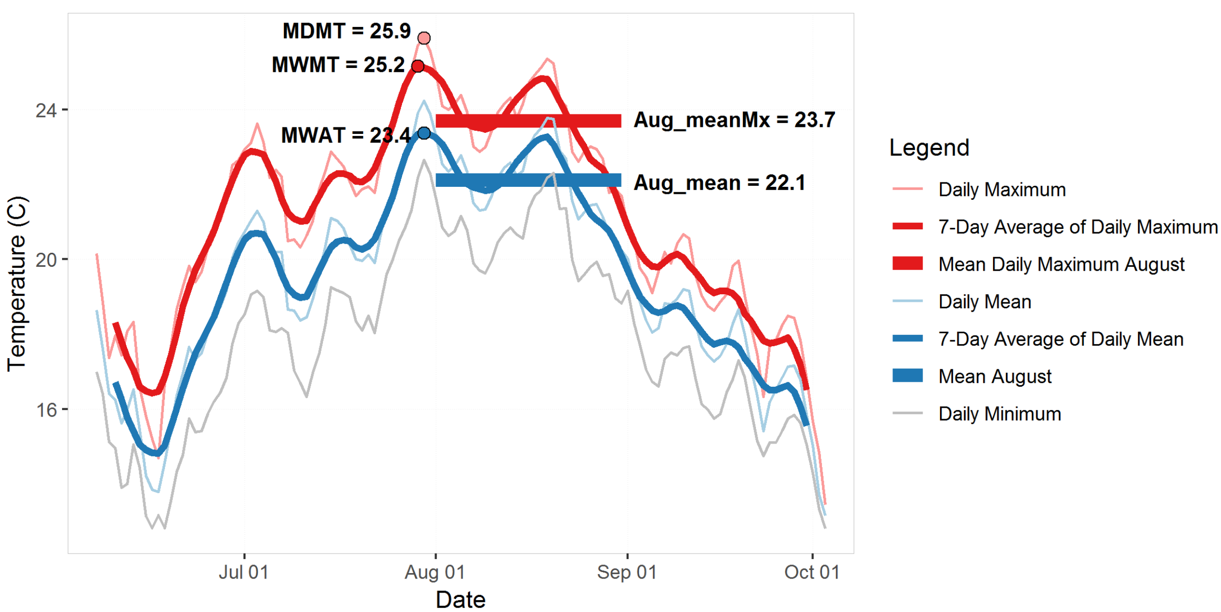

Figure 5. Daily time series of daily maximum, daily mean, daily minimum, 7-day average of daily maximum, and 7-day average of daily mean water temperatures at an example site-year (mouth of South Fork Salmon River in 2016). Maximum daily maximum temperature (MDMT), maximum weekly maximum temperature (MWMT), maximum weekly average temperature (MWAT) are the highest annual values for daily maximum, 7-day average of daily maximum, and 7-day average of daily mean, respectively. Mean daily maximum August temperature (Aug_meanMx), and mean August temperature (Aug_mean) are also shown.

2.7.3 REFINING SEASONAL STATISTICS ACCORDING TO DATA COMPLETENESS

Seasonal summary statistics are relatively simple to calculate when data are available for the entire warm season (i.e., June–Sept.); however, many available datasets only contained data for part of the summer season and thus had to be screened for comparability. Seasonal statistics may be biased low if they are calculated from only a short period and did not include the warmest days of the year. Conversely, excluding seasonal statistics when gaps occurred outside the warmest days would be an unnecessary loss of important information. As described in Section

[12] Potential alternatives would be to randomly choose one of the dates, or to assign the mean date, but in cases where long distances separate the occurrence of maximal values, then the mean date might be during a cool period. For example, if maximal values are reached on July 1 and July 30, then the mean date would be July 16.

2.7.2, seasonal statistics were initially calculated for all years and sites. Values were then either retained (i.e., kept) or excluded (i.e., deleted) based on data completeness.

Similar to Asarian (2017), we applied an automated multi-step procedure to screen data completeness. Since MWMT, MWAT, and MDMT almost always occur in July or August, seasonal statistics were retained[13] for datasets which included all of July and August[14]. For datasets that were missing some days in July or August, seasonal statistics were only automatically retained if the data were present at that site for each day on which that statistic occurred in at least two other sites[15]. This approach makes maximal use of available data while minimizing the chance that un-representative statistics were retained.

2.8 WATERSHED DELINEATION

Using the NHDPlus Version 2 BasinDelineator tool[16] in ArcGIS, we delineated a GIS polygon for the watershed contributing to each NHDPlus reach. These polygons allowed us to summarize a variety of GIS data, including climate, to the watershed level for use in stream temperature models.

2.9 ENVIRONMENTAL DATA USED IN STREAM TEMPERATURE MODELS

As described in the following sections, we used a variety of environmental and GIS data in our stream temperature analyses (Figure 3).

2.9.1 ELEVATION

We used the National Elevation Dataset (NED) and GIS to extract the elevation for each site of interest based on its spatial coordinates.

2.9.2 DRAINAGE AREA

Drainage area (i.e., contributing watershed areas) for each reach was obtained from NHDPlus/NSI. In NHDPlus, drainage area at the bottom of a reach is assigned to all sites within that reach. Reaches split at tributary confluences, so most reaches are only a few kilometers long and actual drainage area does not increase much from the top to the bottom of a reach; however, in headwater reaches, actual drainage area can increase several fold along the reach, so the drainage areas assigned to some temperature monitoring sites may be higher than actual.

2.9.3 CANOPY

In some temperature models we experimented with using the average canopy data provided by NorWeST for each 1-km reach. These reach summaries were calculated in GIS by overlaying the canopy layer from the 2011 National Land Cover Database (NLCD) on the stream hydrography and calculating the average canopy value for each reach. The NLCD canopy values are a remote sensing product derived from Landsat satellite imagery (Homer et al. 2015).

2.9.4 SLOPE

In some temperature models we experimented with using the average channel slope data provided by NHDPlus/NSI for each reach.

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[13] Seasonal statistics were initially calculated for all years and sites. Values were then either retained (i.e., kept) or excluded (i.e. deleted) based on data completeness.
[14] Actually June 28 through September 2 because the 7-Day Average of the Daily Maximum (7DADM) and 7-Day Average of the Daily Average (7DADA) require data to be present for three days before and three days after.
[15] We chose two sites as the threshold rather than one site because a single site might have unique characteristics or a data quality issue whereas two or more sites should indicate a more widespread pattern.
[16] http://www.horizon-systems.com/nhdplus/NHDPlusV2_tools.php#NHDPlusV2%20BasinDelineator%20Tool

2.9.5 AIR TEMPERATURE

PRISM[17] (Parameter-elevation Regressions on Independent Slopes Model) combines data from ground-based weather stations with GIS data and a statistical model to produce a spatially continuous 4-km grid of climate variables including air temperature and precipitation (Daly et al. 2008). PRISM provides two gridded products for each climate variable: "normals" (long-term monthly or annual averages for the years 1981-2010) and a monthly time series. By uploading GIS polygons to the USGS Geo Data Portal (GDP) website[18], we were able to obtain a monthly PRISM time series at several spatial scales: 1) PRISM pixel closest to each long-term temperature monitoring site, and 2) average of all PRISM pixels within the entire study area.

2.9.6 STREAMFLOW

Streamflow is monitored at many fewer stations than stream temperatures, therefore it was not possible to develop unique flow estimates for each stream temperature monitoring site within our large study area. Instead, we adapted methods from Isaak et al. (2017) and developed a single basin-wide hydrologic index that averages data from several gages across the study area. We downloaded daily streamflow data from the USGS National Water Information System (NWIS) database for long-term gages within our study area. There are some additional flow data[19] available for our study area beyond the USGS sites, but these do not cover our entire study period so we did not use them. Our hydrologic index is based on five areas where flow is relatively unimpaired by diversions or dams: gaged data for Salmon River, gaged data for Indian Creek, and estimated flows from three ungaged areas between mainstem Klamath River gages (1. Iron Gate to Seiad, 2. Seiad to Iron Gate, and 3. Orleans to Klamath). Following methods from Asarian and Walker (2016), we estimated these ungaged accretions using a water balance (downstream gage minus upstream gage minus any gaged tributaries). We summarized each of these five unimpaired flow estimates into an annual time series for each month, then standardized (subtracted mean and divided by standard deviation) each month separately, and then averaged those standardized values together to obtain a standardized basin-wide annual time series for each month. This basin-wide flow index was assigned to all temperature monitoring sites within the study area.

2.9.7 APRIL 1 SNOWPACK

Streams flowing from high elevation areas receive winter and spring snow which can result in spring and summer flows that are higher than in lower-elevation rain-dominated areas, providing a cooling influence on summer stream temperatures. There are some long-term Snow Course monitoring stations within the study area which could be used as a general watershed-wide index of snowpack between years. However, we needed higher spatial resolution snowpack data for water temperature models to explain differences between sites and not just between years. We used annual time series of modeled April 1 (the typical annual peak) snow water equivalent (SWE) in snowpack from two sources:

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[17] http://www.prism.oregonstate.edu

[18] https://cida.usgs.gov/gdp/

[19] Spencer Creek is gaged by Oregon Water Resources Department for 2002 to present (https://apps.wrd.state.or.us/apps/sw/hydro_near_real_time/display_hydro_graph.aspx?station_nbr=11510000), Jenny Creek is gaged by BLM office in Medford but flows are only measured during low-flow wadeable conditions (not online but available by request from Tim Montfort), several sites in the Scott and Shasta sub-basins are gaged by the California Department of Water Resources and other entities (http://wdl.water.ca.gov/waterdatalibrary/index.cfm, http://cdec.water.ca.gov/cdecstation2), and the Yurok Tribe Environmental Program gages several tributaries to the Lower Klamath River.

1) University of California Los Angeles Drought Monitoring System's implementation[20] (Xiao et al. 2016) of the Variable Infiltration Capacity (VIC) model (Liang et al. 1994). The model's spatial resolution is 1/16° (approximately 6 km) and is driven by gridded climate data similar to Livneh et al. (2013).

2) University of Arizona (Broxton et al. 2016, Dawson et al. 2018, Zeng et al. 2018) estimates snowpack at a 4km resolution by combining ground-based measurements of SWE and snow depth with gridded PRISM precipitation and temperature data (Daly et al. 2008).

For each NHDPlus reach, we then overlaid the delineated watershed polygon (Section 2.8) to extract an annual time series 1982–present. Snowpack is greatest at the highest elevations of the Salmon River and Scott River sub-basins, and remains longer into the summer there, especially the headwaters of the South Fork Salmon River (Figure 6). Additional discussion of snowpack datasets, and comparisons to ground-based measurements, are provided in Asarian et al. (2019).

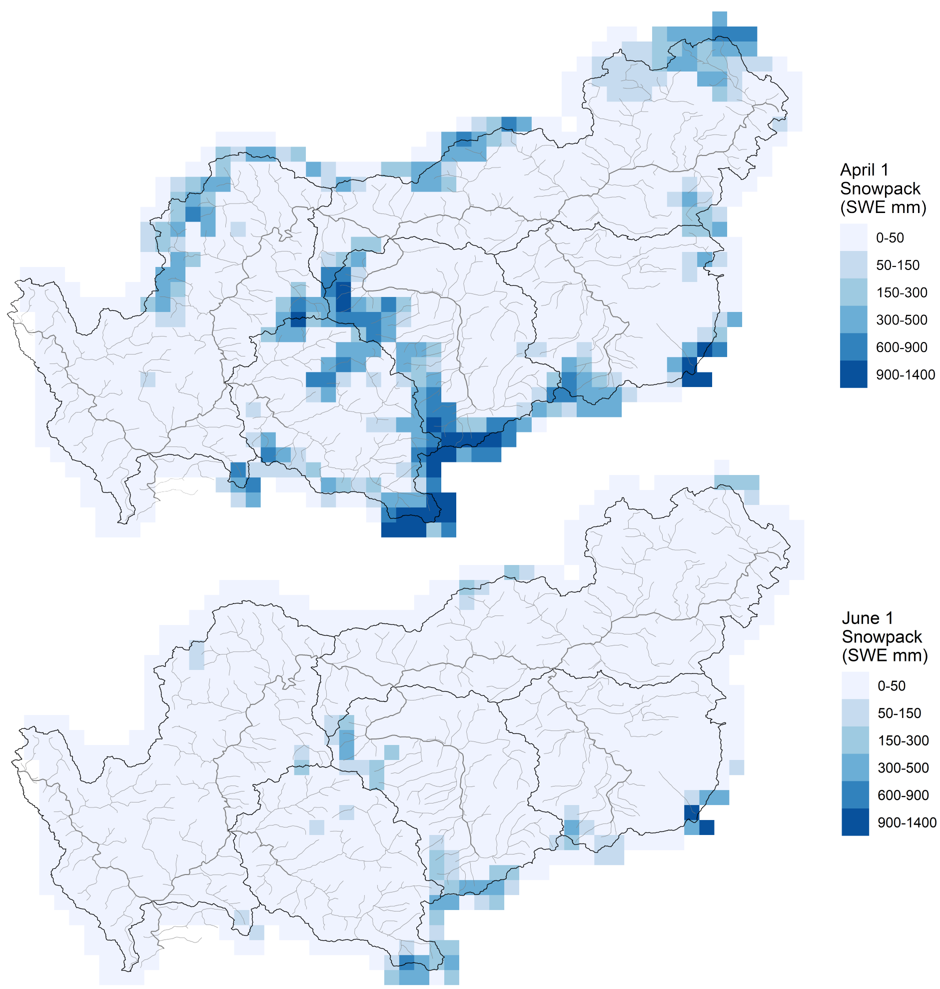

Figure 6. Mean April 1 (top panel) and June 1 (bottom panel) snow water equivalent (SWE) of snowpack from University of Arizona model (Zeng et al. 2018) for the period 1995–2017. Spatial resolution is 4 km. Black lines are sub-basin boundaries. Grey lines are rivers and streams with drainage area ≥10 km^2.

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[20] http://hydro.ucla.edu/SurfaceWaterGroup/forecast/monitor_pnw/index.shtml

2.9.8 MEAN ANNUAL PRECIPITATION

PRISM[21] combines data from ground-based weather stations with GIS data and a statistical model to produce spatially continuous 1-km and 4-km grids of climate variables including air temperature and precipitation (Daly et al. 2008). NHDPlus/NSI provides mean annual precipitation (i.e., precipitation normals) for the period 1971-2000 from PRISM (Daly et al. 2008) for the watershed draining to each NSI reach.

2.9.9 WILDFIRE SMOKE (AEROSOL OPTICAL THICKNESS, AOT)

Wildfire smoke reflects solar radiation and cools stream temperatures (David et al. 2018). We used aerosol optical thickness (AOT) as a proxy for wildfire smoke. AOT indicates the degree to which aerosols reduce transmission of light through the atmosphere by absorption or scattering. We combined AOT data from two sources: 1) Multi-Angle Implementation of Atmospheric Correction (MAIAC) (Lyapustin et al. 2018), and 2) Modern-Era Retrospective Analysis for Research and Applications version 2 (MERRA-2) (Buchard et al. 2017, Randles et al 2017). Lyapustin et al. (2018) applied the MAIAC algorithm to MODerate resolution Imaging Spectroradiometer (MODIS) satellite sensor data to provide gridded AOT estimates at a 1-km spatial resolution, typically with a twice-daily temporal resolution. These data have some missing values due to clouds (or dense smoke plumes which are confused with clouds). We infilled these gaps using a two-step process. First, for days on which there were more than one AOT value available per pixel, we averaged those values together. Second, we used the autoFRK package in R to infill remaining spatial gaps within the day using automatic fixed rank kriging (Tzeng and Huang 2018, Tzeng et al. 2019). Due to its flexibility and computational efficiency, fixed rank kriging works well for spatio-temporal interpolation of high-resolution air quality datasets (Zammit-Mangion and Cressie 2017). Computer memory limitations necessitated splitting the study area into three geographic areas (Lower Klamath/Salmon, Upper Klamath/Scott/Shasta, and Trinity) which were each run separately with autoFRK for each year. Any values predicted by autoFRK that exceeded the maximum possible AOT value (four) were set to four. After infilling gaps, we merged the three areas back together and then generated annual time series for each month by summarizing the data at two spatial scales: 1) the delineated watershed polygon contributing to each NHDPlus reach (Section 2.8), and 2) a 3-km buffer around each temperature monitoring site. The MAIAC AOT data are not available prior to the launch of the MODIS satellites in 2000, but the Modern-Era Retrospective Analysis for Research and Applications version 2 (MERRA-2) provides AOT data at a 50-km resolution for 1982–present based on a combination of other datasets including remote-sensed burned area (Buchard et al. 2017, Randles et al 2017). We used linear regression to develop a relationship between the log-transformed MERRA-2 AOT and log-transformed MAIAC AOT data for 2000–2017 ($r^2 = 0.75$ for 3-km buffers and $r^2 = 0.75$ for watersheds), from which we estimated AOT for 1982–1999.

2.10 LINEAR MIXED EFFECTS MODELS TO ACCOUNT FOR SITE-SPECIFIC VARIATION OF STREAM TEMPERATURE RESPONSE TO INTERANNUAL CLIMATE VARIABILITY

Air temperature sensitivity is the expected change in stream temperature per unit change in air temperature (Mayer 2012, Luce et al. 2014). Similarly, streamflow sensitivity is the expected change in stream temperature per unit change in streamflow (Luce et al. 2014). To account for the spatial variation in climate sensitivity across our long-term monitoring sites, we constructed

[21] http://www.prism.oregonstate.edu

linear mixed-effects models for the 87 sites that had at least 14 years of stream temperature data. In addition to flow and air temperature, we also included wildfire smoke (AOT) and April 1 snowpack. We tested several combinations of variables and model structures and then used AIC to inform selection of a final model. We assessed multicollinearity by calculating condition index according to Belsley et al. (1980) and avoided models with a condition number greater than 30. Models were fit using R 3.5.3 (R Core Team 2018) and the lme4 package version 1.1-19 (Bates et al. 2015). To obtain 95% confidence intervals for coefficients, we multiplied the standard error by 1.96. Root mean squared error (RMSE) for the final models was obtained using the merTools package version 0.4.1 (Knowles and Frederick 2018).

All summer temperature metrics are highly correlated with each other (section 3.1), making it unnecessary to do every analysis on every metric. Due to time and budget constraints, we limited our linear mixed effects models to the months of July, August, and September, when much more data are available than for other months. For each of these three months, we constructed two models, one for mean temperature and the other for mean daily maximum temperature. We used monthly summaries for our linear mixed effects models and because the exact day that seasonal temperature metrics such as MWAT, MWMT, and MDAT occur varies between years and sites, making it more difficult to construct models to predict those alternative metrics based on climate variables like air temperature, streamflow, and smoke. Complete time series for all metrics including months May–September are included in Appendix C.

2.11 LONG-TERM TRENDS IN STREAM TEMPERATURE AND CLIMATE-ADJUSTED STREAM TEMPERATURE

At 87 long-term monitoring sites (defined as having at least 14 years of temperature data), we used linear mixed-effects models and regression models to calculate slopes and evaluated the statistical significance of these trends. Two models were run for each temperature metric, one to provide an overall slope representing all sites and another to provide separate slopes for each individual site. The first was a linear mixed-effects model with a fixed effect of year and a random effect that allowed the intercept to vary by site. The year coefficient provides the single linear slope representing the trend of all long-term sites. The second was a linear regression model with year as a fixed effect and an interaction of year and site. The year coefficient for each individual site provides a linear slope for each individual long-term site.

In addition to evaluating long-term trends in stream temperature as described in the preceding paragraph, we also evaluated long-term trends in climate-adjusted stream temperature, which we define as the underlying trend in stream temperature once the effects of interannual variation in climate (air temperature, streamflow, snowpack, and smoke) are accounted for using statistical models (Figure 3). The linear mixed-effects model for climate-adjusted stream temperature builds on the final model for each temperature metric (section 2.10) by adding year as a variable. Two linear mixed effect mixed-effects models were run for each of the six temperature metrics (mean temperature and mean daily temperature for the each of three months [July, August, and Septembers]), the first to provide an overall slope representing all sites and the second to provide separate slopes for each individual site. The first model included a fixed effect for year, a random intercept for site, random slopes which allow the slopes of streamflow and snowpack to vary by site, and a three-way interaction of smoke with drainage area and a categorical variable that differentiates the mainstem Klamath/Trinity rivers from all other tributaries. The year coefficient provides the single linear trend slope representing all long-term sites. The second model was similar to the first except that the fixed effect of year was removed and replaced by an interaction of site and year which provided an estimate of the year slope for each site. We used the associated p-values[22] provided by the lmerTest package (Kuznetsova et al. 2017).

To obtain 95% confidence intervals for year slopes, we multiplied the standard error by 1.96.

3 RESULTS AND DISCUSSION

3.1 OVERALL SEASONAL PATTERNS IN STREAM TEMPERATURE AND RELATIONSHIPS BETWEEN TEMPERATURE METRICS

Stream temperatures in the project area typically peak in July or August (Figure 7). Averaged across all years and sites, the peak occurs around August 1 (Figure 7). There is considerable year-to-year (and to a lesser extent, site-to-site) variation in the date that peak temperatures occur (Figure 8). MWMT temperatures occurred earlier in 2015 than in any other year (Figure 8).

Maximum weekly maximum temperature (MWMT), maximum weekly average temperature (MWAT), annual single maximum (MDMT), August mean, and August mean daily maximum temperatures are all highly correlated (Figure 9). The strongest correlation is between MWMT and MDMT, with a Pearson Correlation Coefficient of 0.997 (Figure 9).

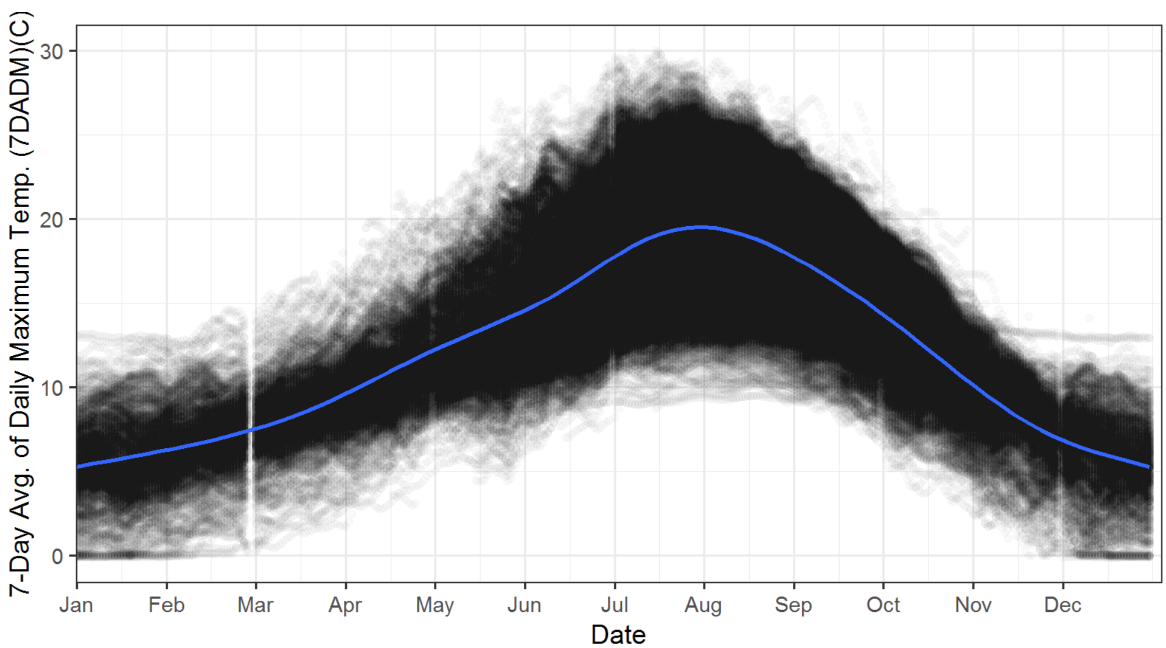


Figure 7. Seven-day moving averages of daily maximum temperature (7DADM) for every site and every year in the project area. Blue line is LOESS (LOcally Estimated Scatterplot Smoothing) smoother.

[22] We recognize that these P-values are unreliable due to uncertainty regarding the number of degrees of freedom; however, we choose to use them as an index of evidence given lack of other suitable methods.

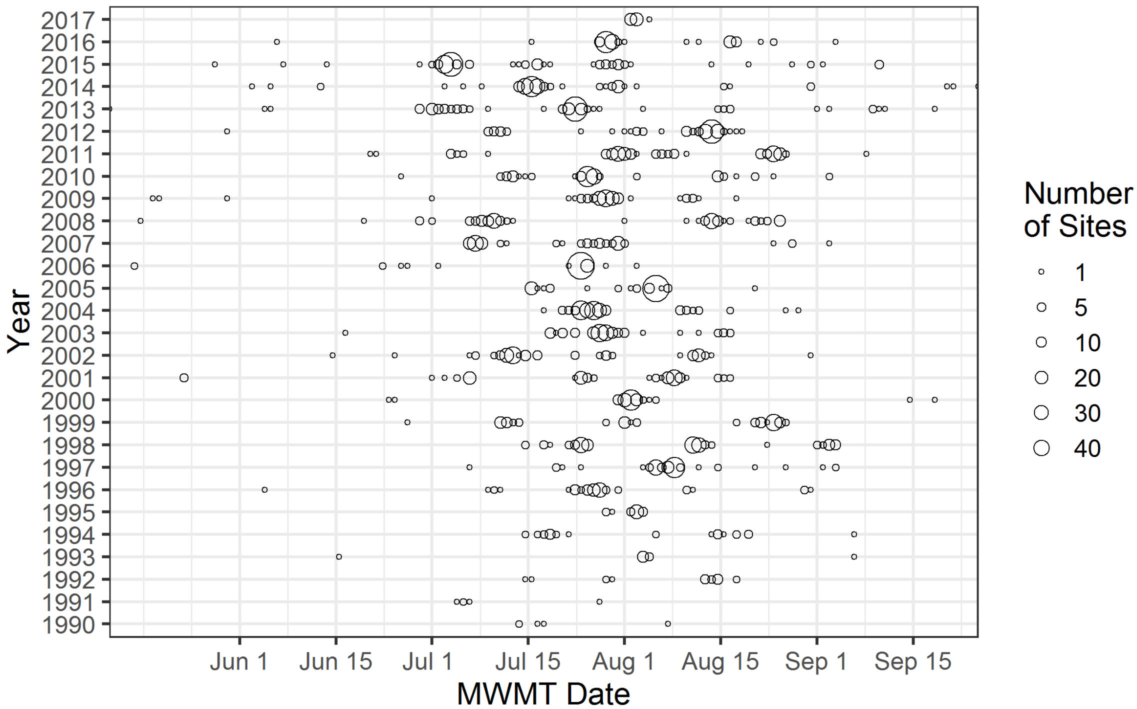


Figure 8. Date each year 1990–2017 upon which MWMT temperature occurred at all sites in the project area. Size of circles corresponds to the number of sites.

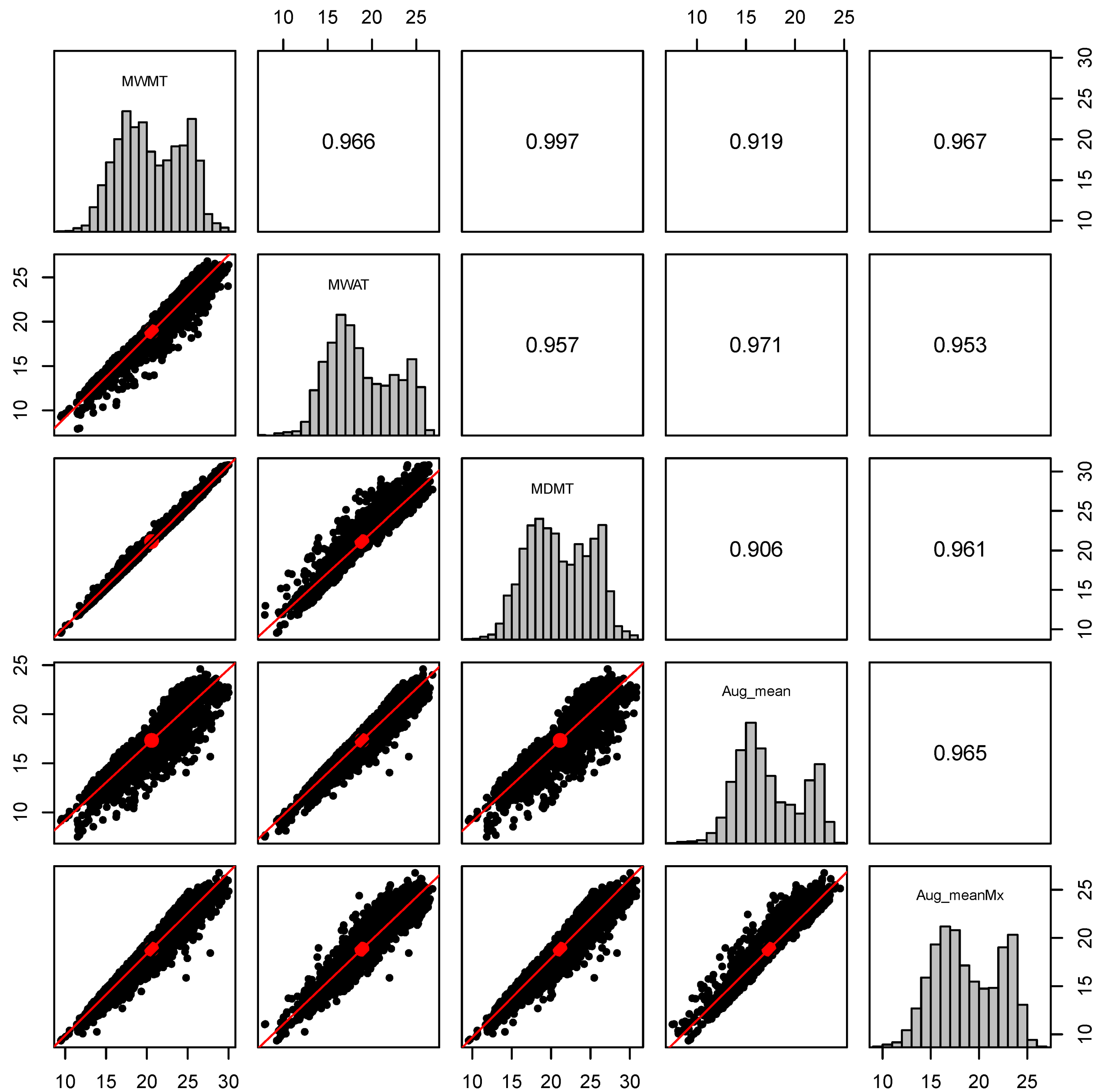


Figure 9. Correlation matrix comparing maximum weekly maximum temperature (MWMT), maximum weekly average temperature (MWAT), annual single maximum (MDMT), August mean (Aug_mean), and August mean daily maximum temperatures (Aug_meanMx) for the entire project area dataset. The matrix includes a row and column for each variable, and the intersection of a row and column shows the correlation between a pair of variables. For example, the left column of the bottom row is a plot of MWMT vs. Aug_meanMx with linear trend line shown in red and each dot representing a single site and year, and the number (0.955) in the right column of the upper row is the Pearson Correlation Coefficient[23] between MWMT and Aug_mean. Grey bars along the symmetrical axis of the matrix are histograms showing the distribution of data for each variable.

[23] 1.000 would indicate a perfect positive correlation between the variables while zero would indicate a complete lack of relationship between the two variables

3.2 ANNUAL TIME SERIES OF BASINWIDE SUMMARIES OF STREAM TEMPERATURE AND CLIMATE

Streamflow, air temperature (Isaak et al. 2017), snowpack (Steel et al. 2018), and wildfire smoke (David et al. 2018) can affect water temperatures. Figure 10 shows annual time series of basin-scale (entire study area) summaries of these variables for the period 1990–2017. Appendix C shows an annual time series for each of these variables at each long-term monitoring site for the period 1990–2017. Wildfire smoke is higher in August than other months although July and September also had substantial amounts of smoke in some years (Figure 10a). Interannual patterns in snowpack are relatively similar between the two modeled snowpack datasets, although absolute values are typically higher in the VIC dataset than the UA dataset (Figure 10c). Interannual patterns in the basin-scale flow index (Figure 10d) largely track the snowpack datasets (Figure 10c), with some exceptions including 2010 when June storms elevated July–September flows beyond what would be expected based solely in snowpack or May flows.

The number of sites where stream temperatures were monitored each year varied according to available resources, conditions, and changes to monitoring plans. This complicates basin-wide comparisons of interannual variation in stream temperature, because calculating a simple average of all sites within a year could be biased due to different groups of sites being available in different years. Thus, to generate representative summaries that could be compared across years, we used linear mixed-effects models with random effects to calculate adjusted averages that account for the varying groups of sites monitored each year (Figure 10e,f). In 1990 through 1995, there were only a few sites monitored per year (Figure 10g,h), so summaries are substantially less reliable in those years. Similarly, only a few sites per years were monitored during the month of May, so summaries for that month are also less reliable than other months, particularly prior to 2000.

3.3 LINEAR MIXED EFFECTS MODELS TO ACCOUNT FOR SITE-SPECIFIC VARIATION IN SENSITIVITY OF STREAM TEMPERATURE TO INTERANNUAL CLIMATE VARIABILITY

Table 2 presents the Akaike information criterion (AIC) values for the linear mixed-effects models that we evaluated. All models include fixed effects for the spatial variables drainage area and mean annual precipitation. Although the structure of the lowest-AIC model varied somewhat between temperature metrics, in the interest of facilitating comparison of coefficients across temperature metrics, for our final models we used the same model structure for all months and temperature metrics rather than a customized configuration. The final models include: 1) fixed effects for air temperature, smoke, and a categorical variable that differentiates the mainstem Klamath and Trinity rivers from all other tributaries, 2) random slopes that allow the streamflow and snowpack slopes to vary by site, 3) a random intercept for site, and 4) a three-way interaction of smoke with drainage area and mainstem categorical (Table 2). Root mean squared errors (RMSE) indicate excellent model fit, with RMSE ranging from a low of 0.41 °C for August mean temperature to a high of 0.58 °C for July mean daily maximum temperature (Table B3 in Appendix B).

Drainage area was the most powerful spatial predictor variable (Figure 11). Some monthly differences are apparent in the relative importance of predictor variables in the final models. The cooling influence of monthly flow diminishes substantially from July to September, as does the cooling influence of mean annual precipitation (Figure 11). Conversely, the warming effect of monthly air temperature and the cooling effect of April 1 snowpack are relatively constant between months, with the exception of snow having a stronger cooling influence on mean daily maximum stream temperature in July than other months (Figure 11). Smoke had a greater cooling effect in August than in July and September. In addition, smoke had a greater cooling effect on mean daily maximum temperature than mean temperature (Figure 11), corroborating results from David et al. (2018).

The final models include a three-way interaction of smoke with drainage area and a categorical variable that differentiates the mainstem Klamath/Trinity rivers from all other tributaries. Relative to the simpler two-way interaction of smoke and drainage area, the three-way interaction only improves AIC for the August models, not the July or September models (Table 2). For mean daily maximum August stream temperature, smoke has the greatest cooling effect in tributaries with the largest drainage areas (2.4°C in Salmon River), the least cooling effect in tributaries with the smallest drainage areas (0.1°C in Aikens Creek), and an intermediate cooling effect in medium-sized tributaries (1.5°C Beaver Creek) and the mainstem Klamath and Trinity rivers (1.5–1.6°C) (Figure 12). Riparian and topographic shading may be responsible for the diminished cooling effect of smoke in the smallest tributaries relative to larger streams and mainstem rivers that receive much more solar radiation.

Models that included random slopes for flow and April 1 snowpack had substantially better fits than models without random slopes (i.e., see large Δ AIC values in the "Air, flow, snow, smoke interaction with area" model row of Table 2), indicating site-specific variation in relationships between those climate variables and stream temperature. Unfortunately, despite considerable effort, we were not able to find any quantitative variables (e.g., drainage area, average snowpack, elevation, etc.) to adequately explain the variation between sites in random slopes for flow (Figure 13, Figure 15) or April 1 snowpack (Figure 14, Figure 15, as well as Figure B24 in Appendix B). Exploratory scatterplots (not shown) indicate that drainage area and long-term mean April 1 snowpack are weakly correlated with the flow random slope (and to an even less extent, April 1 snowpack random slope) at tributary sites in the months of July and August; however, due to considerable scatter and the presence of outliers[24], we chose not to incorporate these interactions into our models. In July, random slopes for April 1 snowpack appear to be more negative (i.e., greater cooling) at sites in the watersheds of the Salmon River, Scott River, Beaver Creek, Jenny Creek, and Spencer Creek than the remainder of the study area. There also appear to be longitudinal patterns along the mainstem Klamath River, with random slopes for flow becoming more negative (i.e., greater cooling effect on temperatures) as water flows downstream from Iron Gate Dam until leveling off downstream around Seiad Valley or the Salmon River (depends on the metric and month) (Figure 15), which are located 60–135 miles downstream of the dam. This suggests that water temperatures in the river near the dam are much less correlated with basin-wide hydrologic conditions (i.e., our composite flow index) than to the internal dynamics of the Iron Gate Reservoir, and that those reservoir effects diminish with distance downstream as the river gathers tributary flow.

[24] These outliers are caused by external factors that cannot be quantitatively represented by model variables but are qualitatively identifiable and are discussed below in section 3.4.2. They include: 1) several sites where debris torrents flattened channels and scoured riparian vegetation in the January 1, 1997 flood, and 2) changes in water diversions affecting lower Jenny Creek. Since our statistical models use a basin-wide composite flow index rather than measured site-specific flow and therefore do not account for the diversion, the flow random slopes for Jenny Creek downstream of Spring Creek are confounding statistical artifacts.

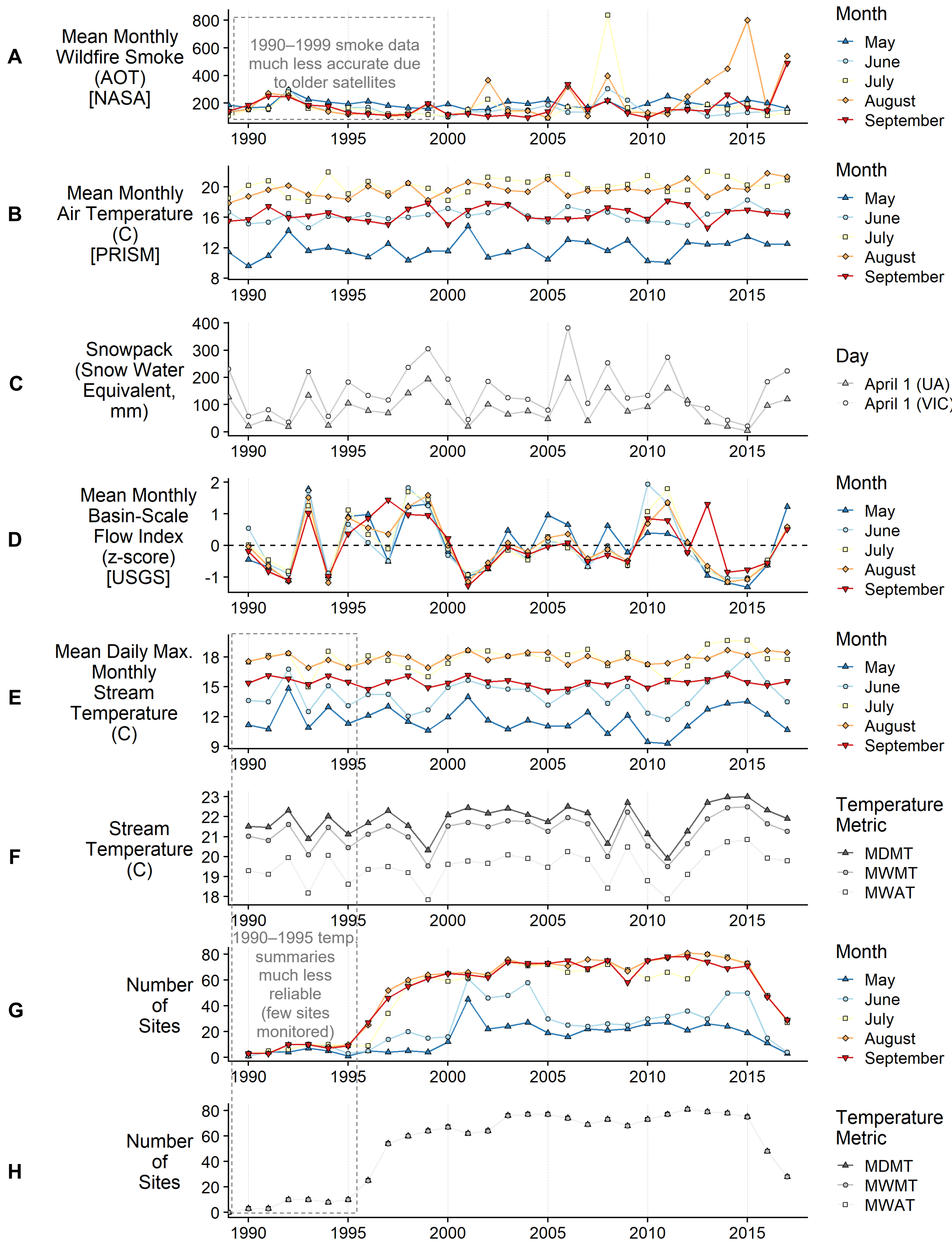


Figure 10. Annual basin-wide time series 1990–2017 of: A) mean monthly aerosol optical thickness (a proxy for wildfire smoke) estimated from satellites, B) basin-wide mean monthly air temperature (from PRISM model), C) April 1 modeled snowpack, D) basin-wide hydrologic index (average of several USGS gages). At long-term monitoring sites only: E) measured mean daily maximum monthly stream temperature, F) measured seasonal stream temperature metrics (MDMT, MWMT, and MWAT), G) number of sites per year with sufficient data to calculate mean monthly stream temperature, and H) number of sites per year with sufficient data to calculated seasonal stream temperature metrics (MDMT, MWMT, and MWAT). Values in E/F are not regular arithmetic averages but rather use a linear mixed-effects model to account for the varying group of sites monitored each year.

Table 2. Comparison of linear mixed-effects models to predict stream temperatures in the Klamath Basin, including presentation of Akaike information criterion (AIC) values. Lower AIC values generally indicate better models. Key to other abbreviations: Area = drainage area, Precip = long-term average annual watershed precipitation, Air = site air temperature for month, Domain air = basin-average air temperature for month, Main = categorical variable of mainstem Klamath/Trinity river or tributary, Flow = Multi-gage streamflow index for month, Snow = April 1 snowpack, Smoke = aerosol optical thickness (AOT) for month, (1 | Site) = random intercept, (0 + variable | Site) = random slope.

Model name	Fixed effects and interactions	Random effects	Δ AIC					
			Jul mean daily max	Jul mean	Aug mean daily max	Aug mean	Sept mean daily max	Sept mean
Final (Air, flow with random slopes, snow with random slopes, smoke 3-way interaction)	Area + Precip + Main + Air + Smoke + Main:Area:Smoke	(1|Site) + (0 + Flow|Site) + (0 + Snow|Site)	1.8	0.9	0.9	0.0	1.8	1.1
Air, flow with random slopes, snow with random slopes, smoke interaction with area	Area + Precip + Main + Air + Smoke + Area:Smoke	(1|Site) + (0 + Flow |Site) + (0 + Snow|Site)	0.0	0.0	28.7	11.3	0.0	0.0
Air, flow with random slopes, snow with random slopes, smoke interaction with random slopes	Area + Precip + Main + Air	(1|Site) + (0 + Flow|Site) + (0 + Snow|Site) + (0 + Smoke|Site)	8.0	15.6	34.4	53.0	6.9	6.5
Air, flow with random slopes, snow with random slopes, smoke	Area + Precip + Main + Air + Smoke	(1|Site) + (0 + Flow|Site) + (0 + Snow|Site)	6.0	13.6	48.7	66.6	5.4	4.5
Air, flow with random slopes, snow, smoke, with random slopes	Area + Precip + Main + Air + Snow	(1|Site) + (0 + Flow|Site) + (0 + Smoke|Site)	60.2	89.9	43.1	75.1	17.2	16.9
Air, flow with random slopes, snow, smoke	Area + Precip + Main + Air + Snow + Smoke	(1|Site) + (0 + Flow |Site)	58.2	87.9	57.6	88.5	16.6	15.4
Air, flow, snow, smoke interaction with area	Area + Precip + Main + Air + Flow + Snow + Smoke + Area:Smoke	(1|Site)	321.9	349.9	107.9	119.4	19.6	11.6
Air, flow, snow, smoke	Area + Precip + Main + Air + Flow + Snow + Smoke	(1|Site)	323.8	355.3	126.5	172.3	25.5	17.1
Air, flow, snow	Area + Precip + Main + Air + Flow + Snow	(1|Site)	336.8	358.4	308.1	251.4	41.9	15.7
Basin air, flow, snow	Area + Precip + Main + BasinAir + Flow + Snow	(1|Site)	323.6	377.3	153.4	238.8	161.0	189.9
Air, snow	Area + Precip + Main + Air + Snow	(1|Site)	721.2	824.6	312.6	280.7	41.1	20.1
Air, flow, smoke	Area + Precip + Main + Air + Flow + Smoke	(1|Site)	594.9	653.3	293.1	458.7	230.7	352.9
Air, flow	Area + Precip + Main + Air + Flow	(1|Site)	664.5	702.6	507.1	569.6	286.6	378.1
Air	Area + Precip + Main + Air	(1|Site)	1263.1	1383.7	633.2	823.4	300.8	390.5

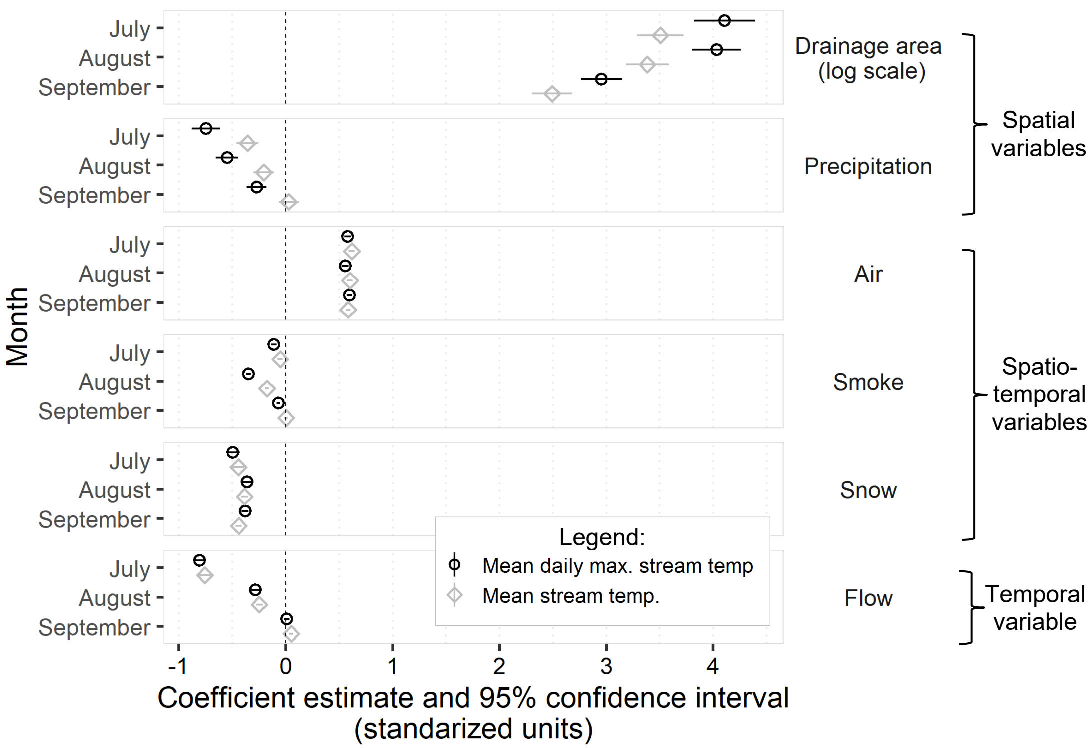


Figure 11. Coefficient estimates for numeric predictor variables in the six final models (two stream temperature metrics for each of three months). Values less than zero indicate variables with a cooling influence on stream temperatures whereas values greater than zero indicate variables that warm stream temperatures. Categorical variables and interactions are excluded from this figure.

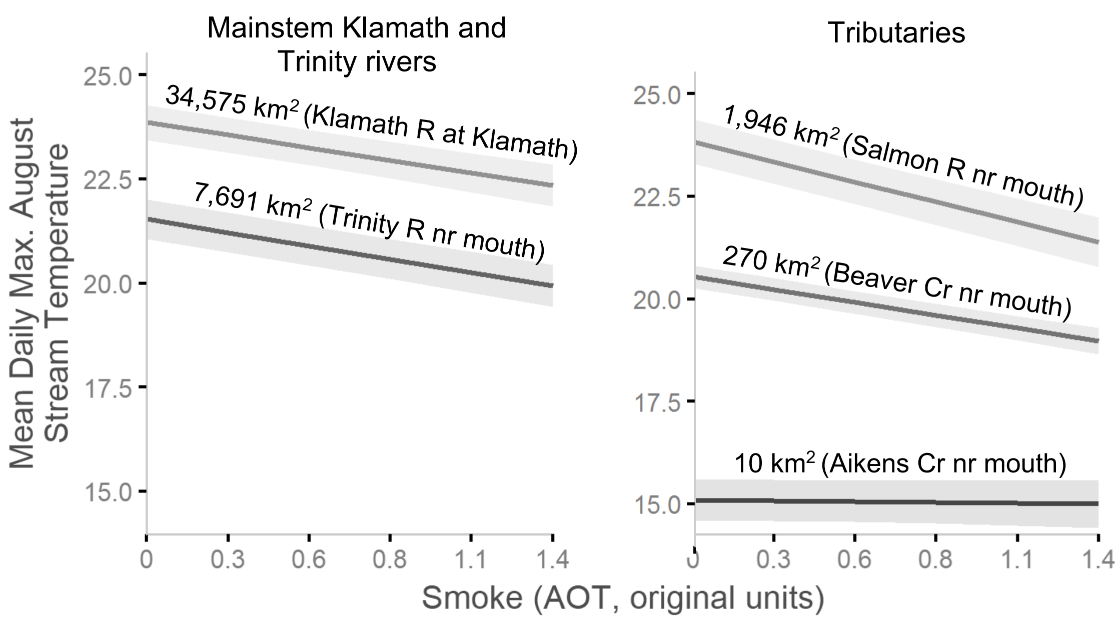


Figure 12. Interaction plot from final model showing estimated effects of smoke on mean daily maximum August stream temperature for mainstem (left panel) and tributary (right panel) sites with varying drainage areas. The sites shown are representative of the minimum and maximum drainage areas within their respective categories (i.e., mainstem vs. tributary), and a mid-sized tributary. Shaded areas are 95% confidence intervals. The x-axis spans the minimum and maximum smoke values observed during the study period. For this figure, all other variables (air temperature, snow, flow, and precipitation) were held at their average values.

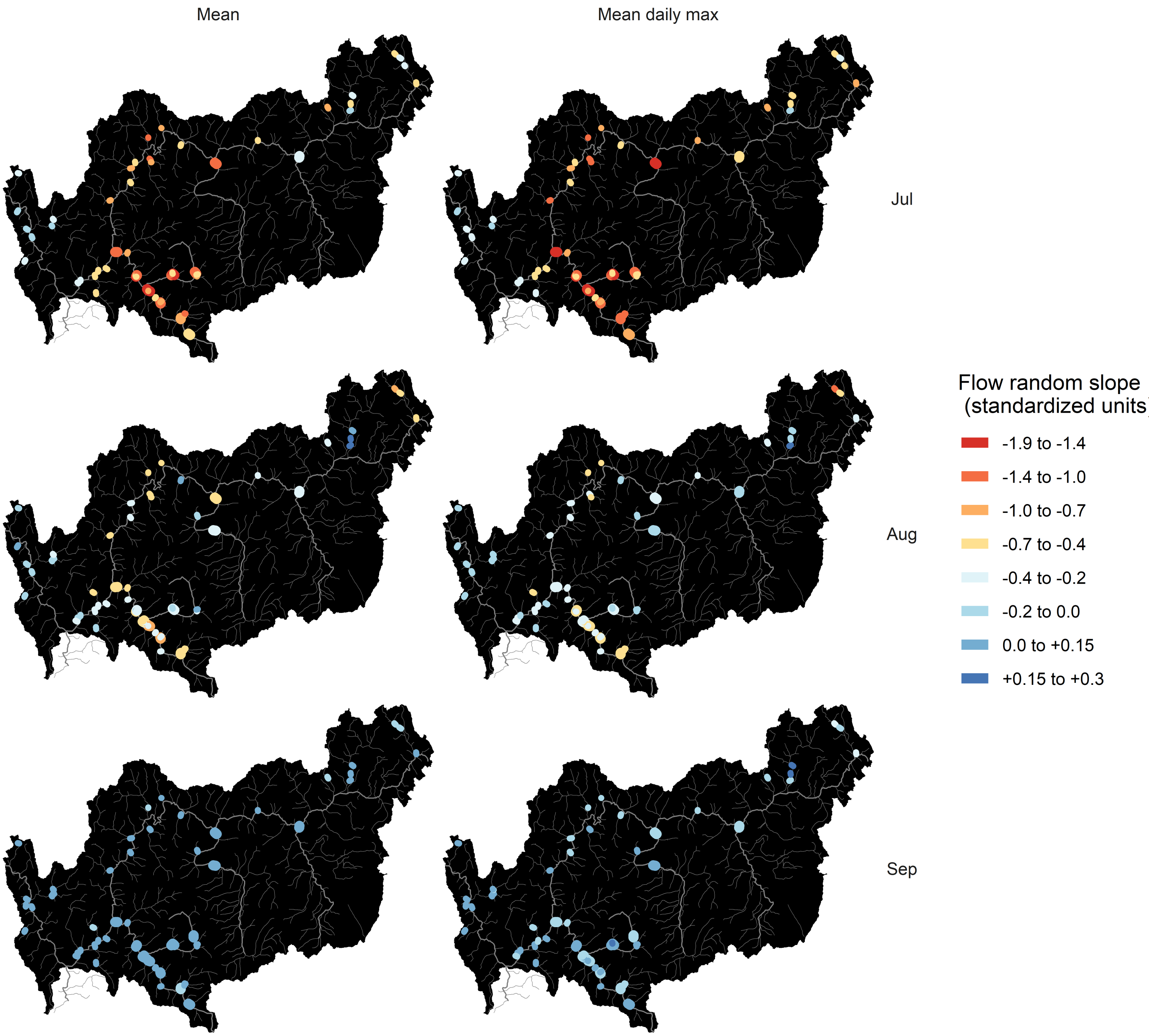


Figure 13. Maps showing flow random slopes for monthly mean (left panels) and monthly mean daily maximum (right panels) stream temperature for July (top panels), August (middle panels), and September (bottom panels) at 68 long-term tributary monitoring sites (for legibility, mainstem Klamath and Trinity river sites are shown in Figure 15 instead of here). Negative slopes indicate cooler stream temperatures when flows are high; positive slopes indicate warmer stream temperatures when flows are high. Sites are displayed as 1-km long reaches, with thick lines for sites in Shasta River, Salmon River, SF Salmon River, and NF Salmon River, and thin lines for sites on other streams. Only streams with drainage area ≥10 km^2 are shown.

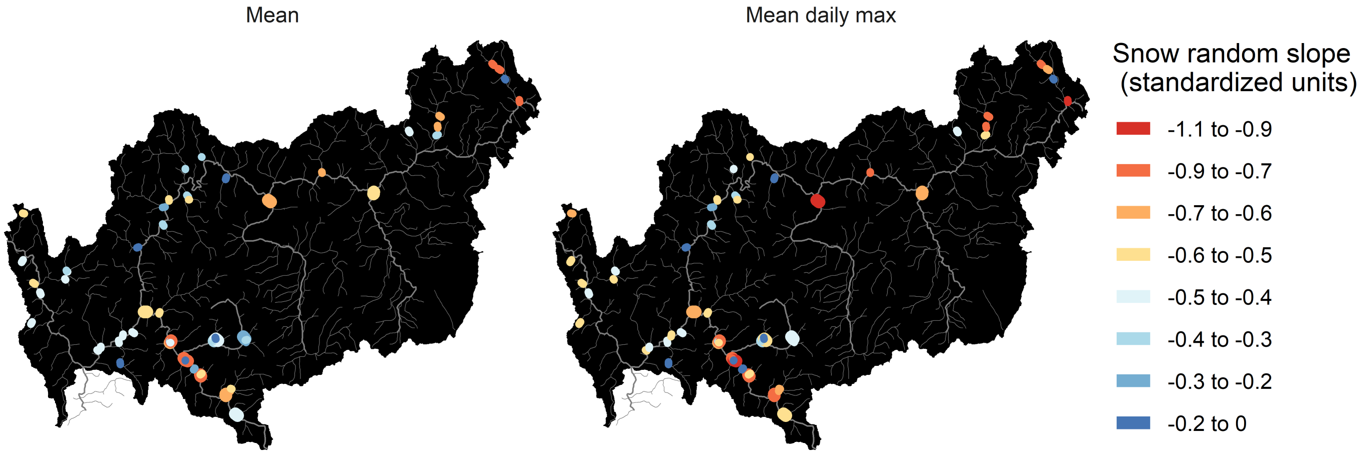


Figure 14. Maps showing April 1 snowpack random slopes for July mean (left panels) and monthly mean daily maximum (right panels) stream temperature at 68 long-term tributary monitoring sites (for legibility, mainstem Klamath and Trinity river sites are shown in Figure 15 instead of here). Highly negative slopes indicate cooler stream temperatures when snowpack was high; slopes closer to zero indicate that a lesser cooling effect of snowpack. Sites are displayed as 1-km long reaches, with thick lines for sites in Shasta River, Salmon River, SF Salmon River, and NF Salmon River, and thin lines for sites on other streams. Only streams with drainage area ≥10 km2 are shown. Similar maps for August and September are shown in Figure B24 in Appendix B.

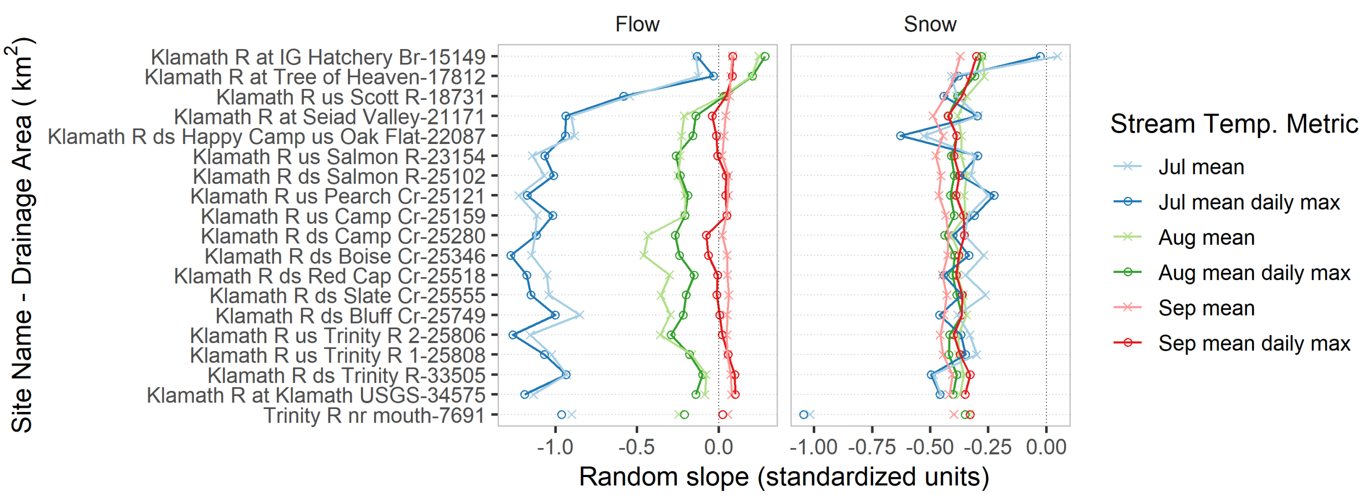


Figure 15. Random slopes for flow and April 1 snowpack for monthly mean and monthly mean daily maximum stream temperature for July, August, and September at 19 long-term monitoring sites on the mainstem Klamath and Trinity rivers. Negative slopes (points to left of dotted line) indicate sites where stream temperatures are cooler when flows are high; positive slopes (points to right of dotted line) indicate sites where stream temperatures are warmer when flows are high. Klamath River sites are arranged from upstream (top) to downstream (bottom) order.

3.4 LONG-TERM TRENDS IN STREAM TEMPERATURE AND CLIMATE-ADJUSTED STREAM TEMPERATURE

3.4.1 OVERALL TRENDS

To test for the presence of long-term trends in stream temperature, we calculated slopes for the period 1995-2017 and applied statistical tests (Figure 16 to Figure 22, Table B4). Linear mixed-effects models fit using all 87 long-term sites had positive slopes (i.e., increasing temperatures) for seven of nine stream temperature metrics ($p<0.001$ to 0.005); the only two metrics with slopes less than zero were mean daily maximum temperature for August and September (Figure 16a, Table 4 in Appendix B) and the evidence for these decreases was very weak ($p=0.239$ and $p=0.384$, respectively). Slopes for July, +0.65 (95% CI: 0.59–0.72) and +0.56 (95% CI: 0.49–0.63) °C/decade for mean temperature and mean daily maximum temperature, respectively, were much higher than August or September. Slopes for MDMT (+0.24 [95% CI: 0.18–0.29] °C/decade), MWMT (+0.27 [95% CI: 0.21–0.32] °C/decade), and MWAT (+0.41 [95% CI: 0.36–0.45] °C/decade) were positive, with magnitudes intermediate between those of July and August/September.

Overall slopes for climate-adjusted temperature metrics were either negative (i.e., cooling temperatures) or close to zero (Figure 16b). Slopes were more negative for mean daily maximums than for means, and more negative in August than in July and September (Figure 16b). The reasons for these decreases are unclear, but we speculate it may be due to recovery of riparian vegetation and channel conditions from past flood events (e.g., January 1, 1997).

3.4.2 SITE-SPECIFIC TRENDS

The medians of the slopes for individual sites (Figure 17a,b) were similar to those of the overall study area (Figure 16a,b). Site-specific variation in the slopes is evident (Figure 17, Figure 18, Figure 19).

Evidence of stream temperature trends was generally weaker at mainstem Klamath River and Trinity River sites than at tributary sites (i.e., note higher p-values [lighter colors] in Figure 19 than Figure 18). The steepest slopes at mainstem sites occurred in July, with several sites having slopes higher than +1 °C/decade and one site having a p-value as low as 0.012 (Figure 19). Evidence of temperature trends at mainstem sites was weak for seasonal metrics and the months of August and September, with most slopes ranging from +0.5°C/decade to -0.5°C/decade and only site having a p-value less than 0.10 (Figure 19).

For the months of July and August, the decadal slope of stream temperature trends is correlated with flow random slope (Figure 23). In other words, sites where stream temperatures are strongly cooled by high flows (i.e., that have highly negative flow random slopes as shown in Figure 13) also tended to have steep increases in stream temperature over the study period. Many of the sites where temperatures are most affected by flow, and are also increasing the fastest, provide important habitat for the Salmon River's population of spring-run Chinook salmon (Figure 23). These fish live in these habitats though the entire summer, and under current conditions peak summer temperatures in many of these reaches are likely at or exceeding thermal suitability for this species. Continued temperature increases threaten the continued existence of this population.

We can qualitatively explain some of the causes in site-specific trends in stream temperature and climate-adjusted stream temperature. These factors are discussed in separate paragraphs below: A) January 1, 1997 flood event, and B) changes in diversions at Spring Creek. Some of these sites affected by these factors are noticeable outliers in part because of outliers driven by factors other than climate, discussed in the following paragraphs

A flood occurred in our study area on January 1, 1997. During this event, there were many landslides, debris torrents, and culvert failures, particularly in watersheds with high road densities (de la Fuente and Elder 1997). This led to scouring of riparian vegetation, sediment deposition, widening of stream channels, and increased summer stream temperatures (Cover et al. 2010). The Klamath National Forest (KNF) conducted a detailed inventory of damages within their lands, but information is lacking for private lands outside the KNF. Many streams within the KNF experienced some changes during the flood, but effects were greatest in Walker, Deep, Ukonom, Tompkins, Grider, Kelsey, Middle, Portuguese, and Elk creeks and to a lesser extent Beaver, Thompson, and Indian creeks (de la Fuente and Elder 1997). Of the subset of these tributaries that are long-term monitoring sites, we only have temperature data for 1997 and other nearby years (i.e., 1998–1999) from Elk, Grider, Tompkins, Beaver, and Thompson creeks. All five of these sites show declining (i.e., cooling) trends in climate-adjusted stream temperature over the 1995–2017 period (Figure 18), suggesting that they had elevated temperatures in the immediate post-flood years and that temperatures have declined over the past two decades as stream channels and riparian vegetation recovered from that event.

Spring Creek is a high-baseflow spring-fed tributary to Jenny Creek. In many years, a substantial portion of Spring Creek is diverted into the adjacent Fall Creek watershed for hydropower production. When not diverted, Spring Creek has a substantial cooling effect on Jenny Creek during the summer. Due to a water rights dispute, this diversion did not occur from 1990 through April 2003 (ODEQ 2019). The diversion substantially increased water temperatures in 2003-2015 relative to 1996-2002 (see graphs in Appendix C), which resulted in positive slopes for temperature and climate-adjusted temperature for the 1995-2017 trend period at the Jenny Creek downstream of Spring Creek site (Figure 18).

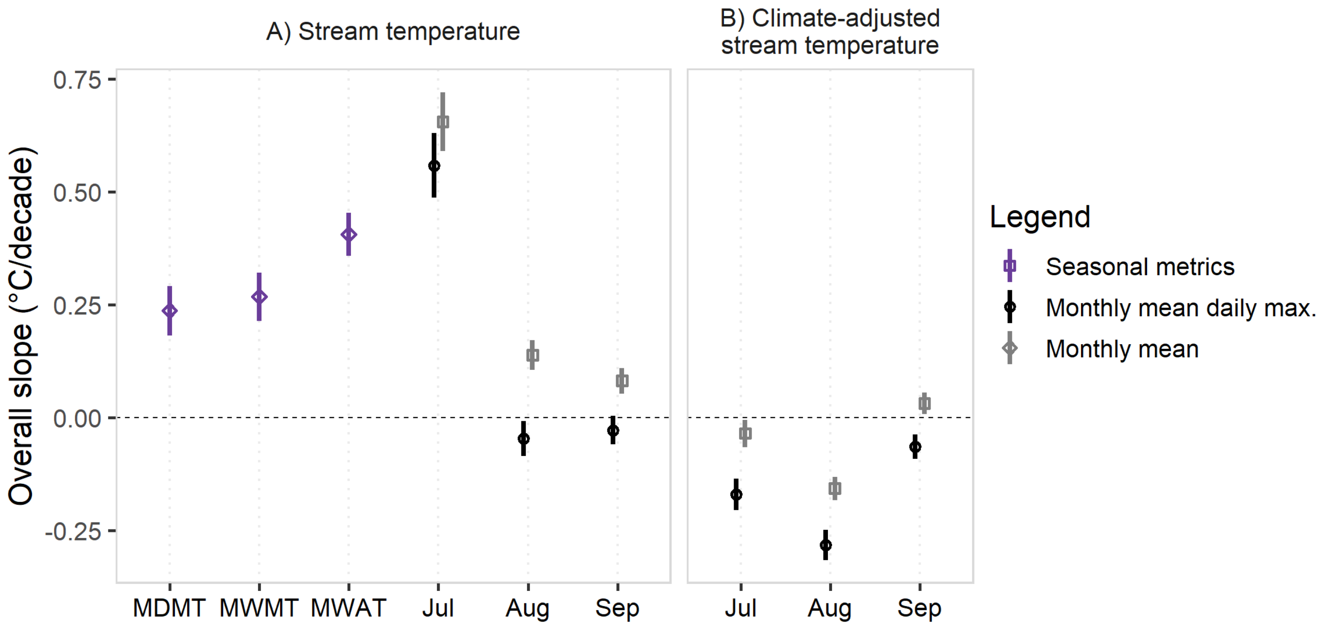


Figure 16. Overall slopes of 1995–2017 trends for A) nine stream temperature metrics [MDMT, MWMT, MWAT, and monthly mean and monthly mean daily maximum temperature for July, August, and September], and B) six climate-adjusted temperature metrics. Bar ends are 95% confidence intervals. Positive slopes indicate metrics that increased during the study period while negative slopes indicate metrics that decreased during the study period.

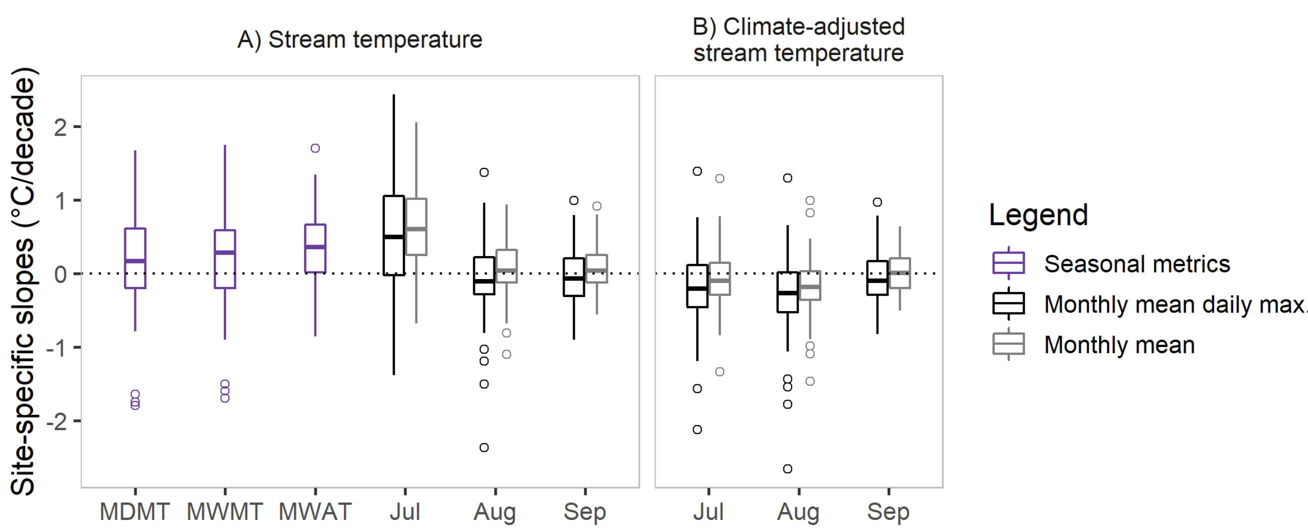
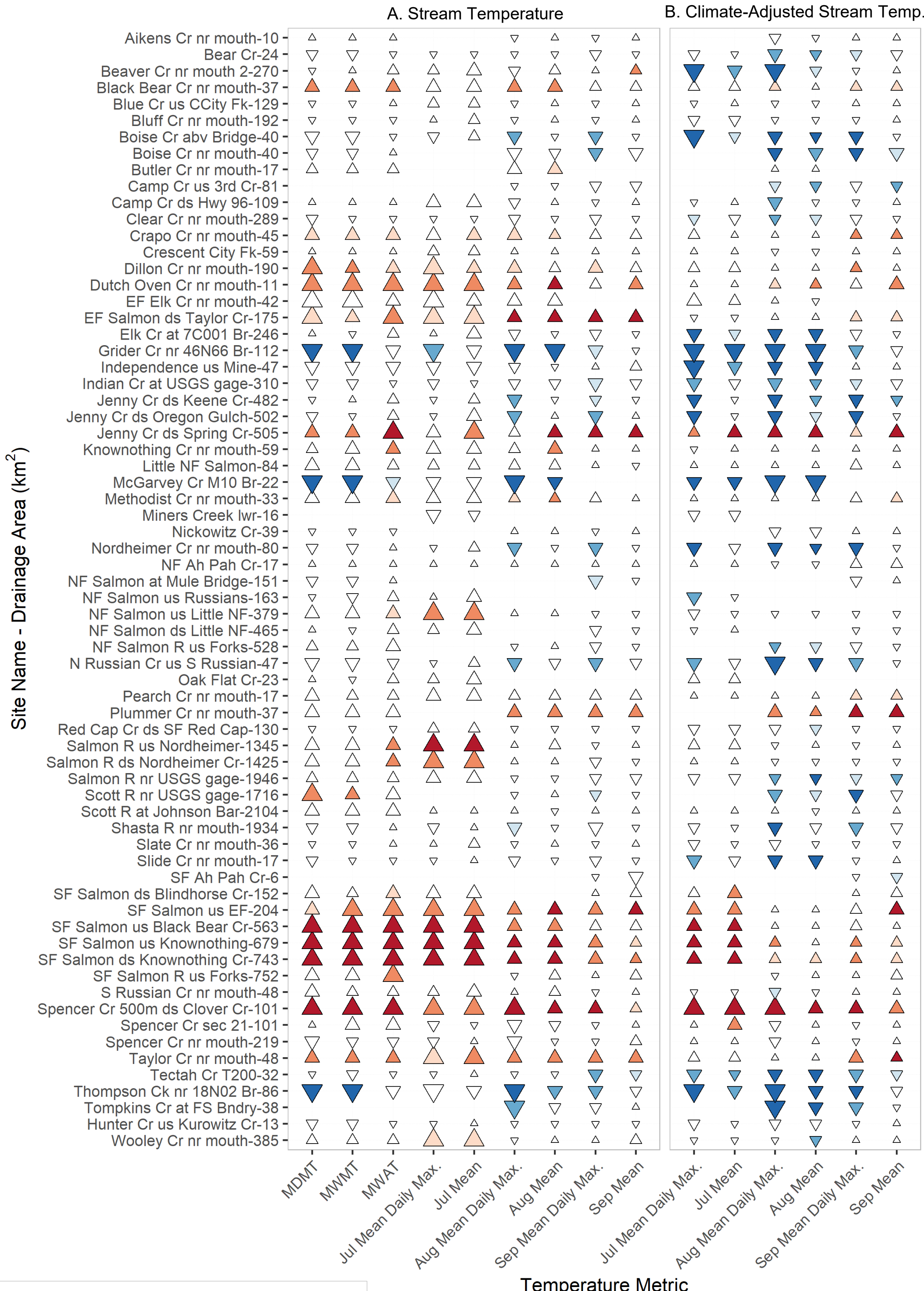


Figure 17. Boxplot showing the range of variation in slopes at 87 long-term sites in the study area for the 1995–2017 trend period for A) nine stream temperature metrics [MDMT, MWMT, MWAT, and monthly mean and monthly mean daily maximum temperature for July, August, and September], and B) six climate-adjusted temperature metrics. The horizontal line inside the box is median, the upper and lower edges of the box are 25th and 75th percentiles, the upper whisker extends to the highest value that is within 1.5 times the interquartile range (75th minus 25th percentile) from the box's edge, and points plotted beyond the whiskers are outliers. Slopes for individual sites are presented in Figure 18 and Figure 19.



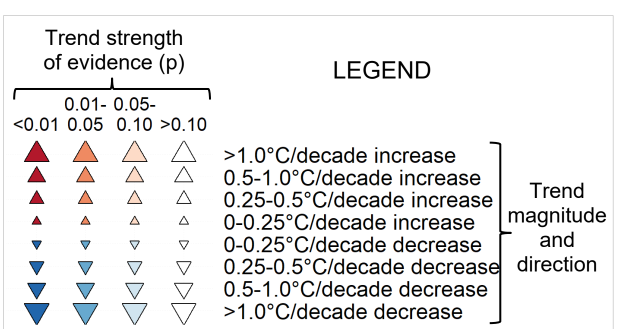
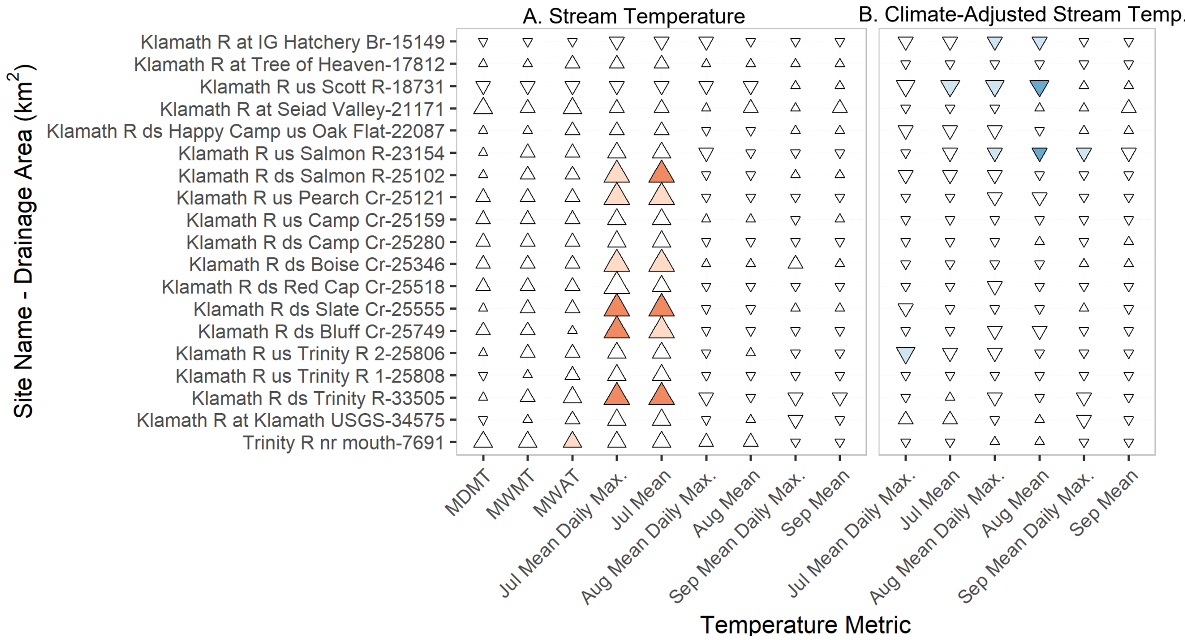


Figure 18. Site-specific slopes of 1995–2017 trends at 66 long-term site on tributaries in the study area for A) nine stream temperature metrics [MDMT, MWMT, MWAT, and monthly mean and monthly mean daily maximum temperature for July, August, and September], and B) six climate-adjusted temperature metrics. Symbol shape shows direction (increasing/decreasing), size shows magnitude (°C/decade), and shading shows strength of evidence (darker means stronger evidence). Annual time series graphs are available in Appendix C. Key to abbreviations: Cr = Creek, R = River, nr = near, SF = South Fork, NF = North Fork, EF = East Fork, S = South, N = North, us = upstream, ds = downstream.



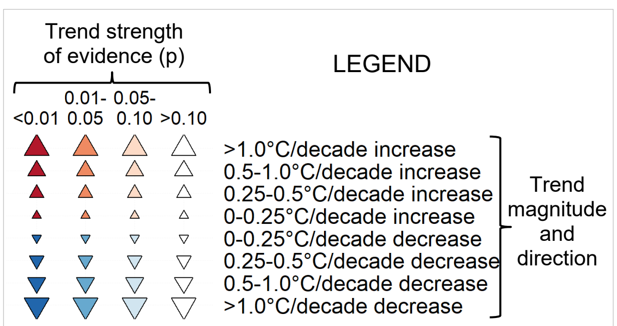


Figure 19. Site-specific slopes of 1995–2017 trends at 19 long-term sites on the mainstem Klamath and Trinity rivers for A) nine stream temperature metrics [MDMT, MWMT, MWAT, and monthly mean and monthly mean daily maximum temperature for July, August, and September], and B) six climate-adjusted temperature metrics. Symbol shape shows direction (increasing/decreasing), size shows magnitude (°C/decade), and shading shows strength of evidence (darker means stronger evidence). Annual time series graphs are available in Appendix C. Key to abbreviations: Cr = Creek, R = River, nr = near, us = upstream, ds = downstream.

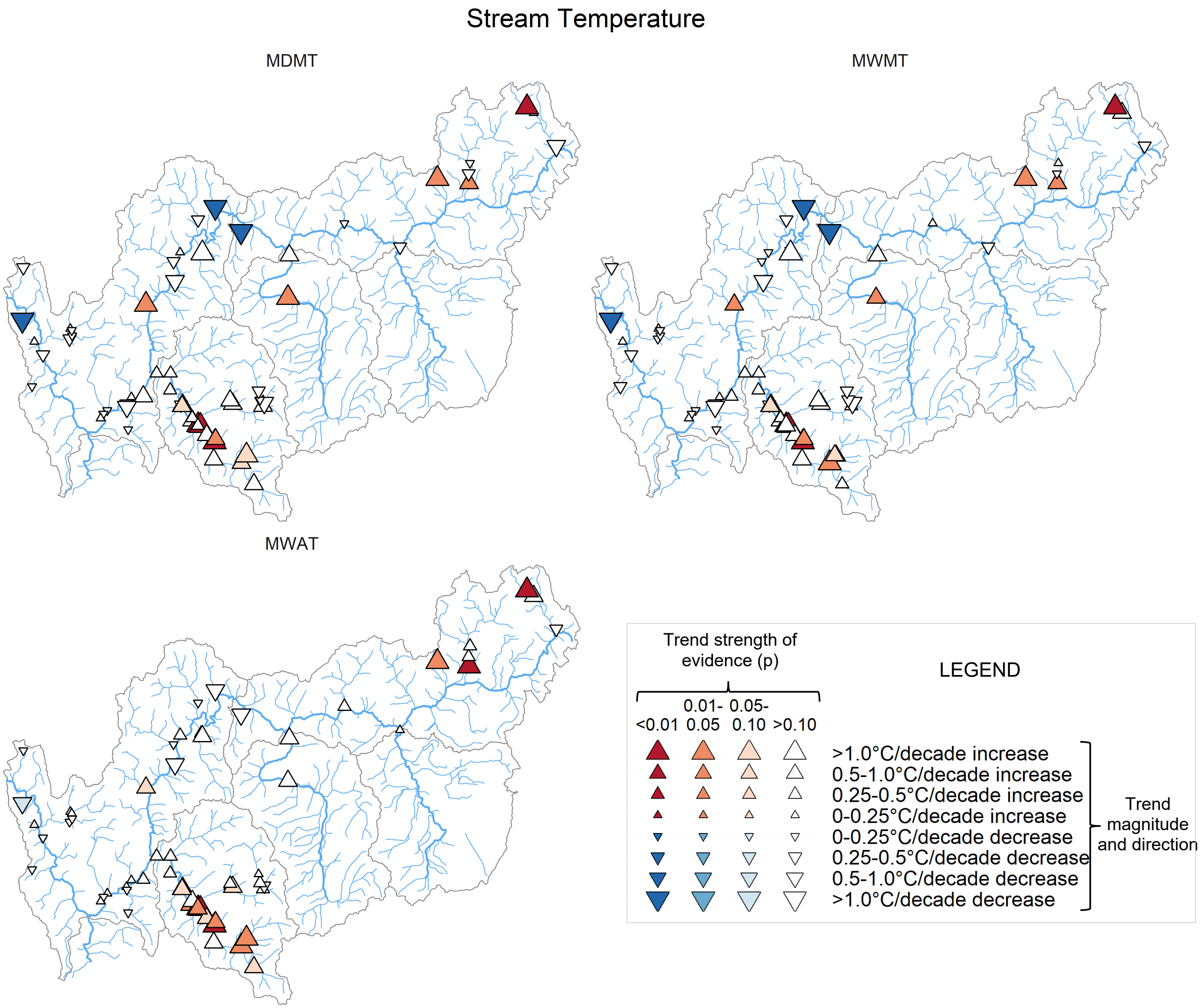


Figure 20. Map of site-specific results of statistical trend tests at 68 long-term sites in the study area for maximum daily maximum temperature (MDMT), maximum weekly maximum temperature (MWMT), and maximum weekly average temperature (MWAT). Symbol shape shows direction (increasing/decreasing), size shows magnitude (°C/decade), and shading shows statistical significance (darker means more significant).

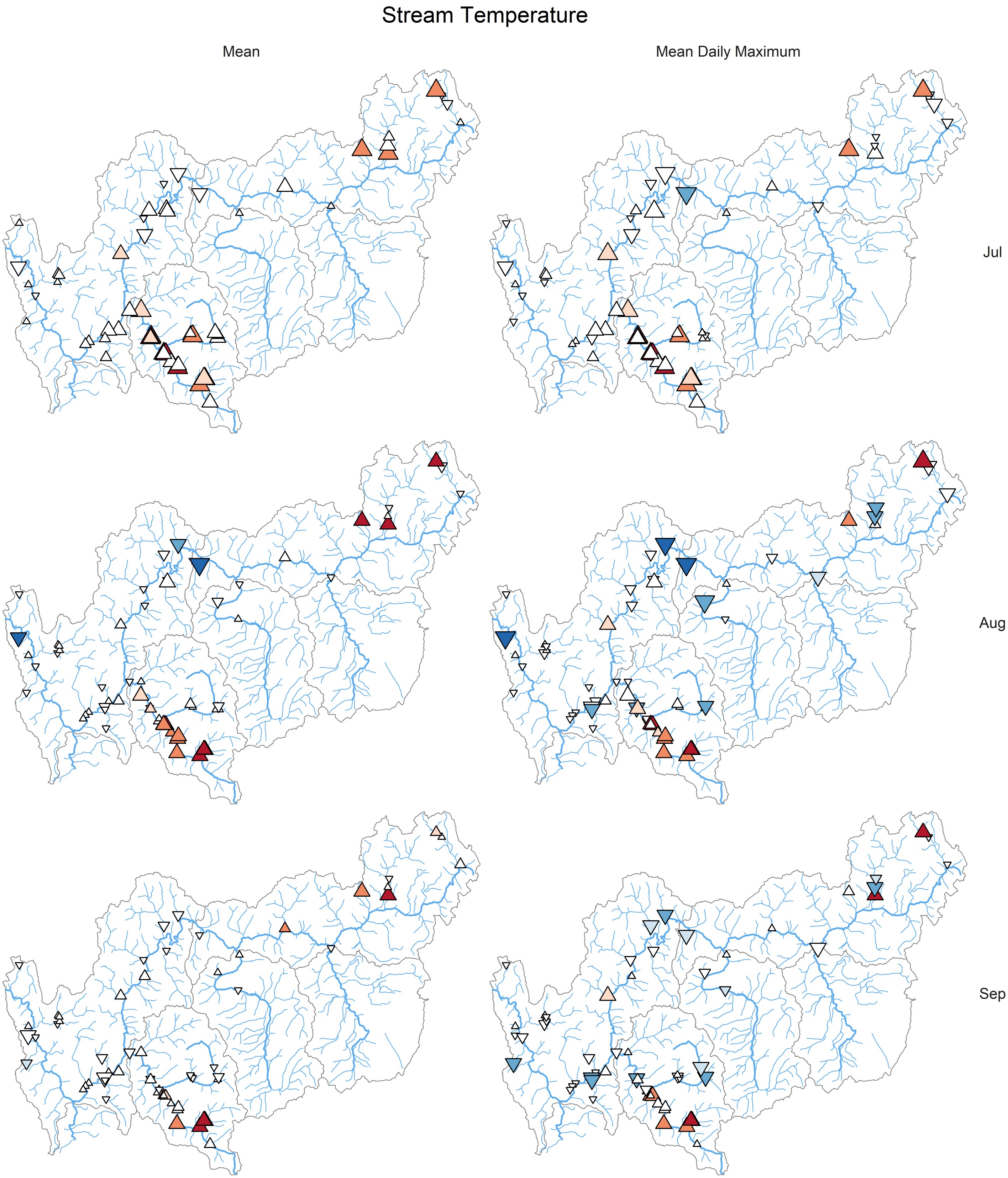


Figure 21. Map of site-specific results of statistical trend tests at 68 long-term sites in the study area for monthly mean (left panels) and monthly mean daily maximum (right panels) stream temperature for July (top panels), August (middle panels), and September (bottom panels). Symbol shape shows direction (increasing/decreasing), size shows magnitude (°C/decade), and shading shows strength of evidence (darker means stronger evidence). See Figure 20 for legend.

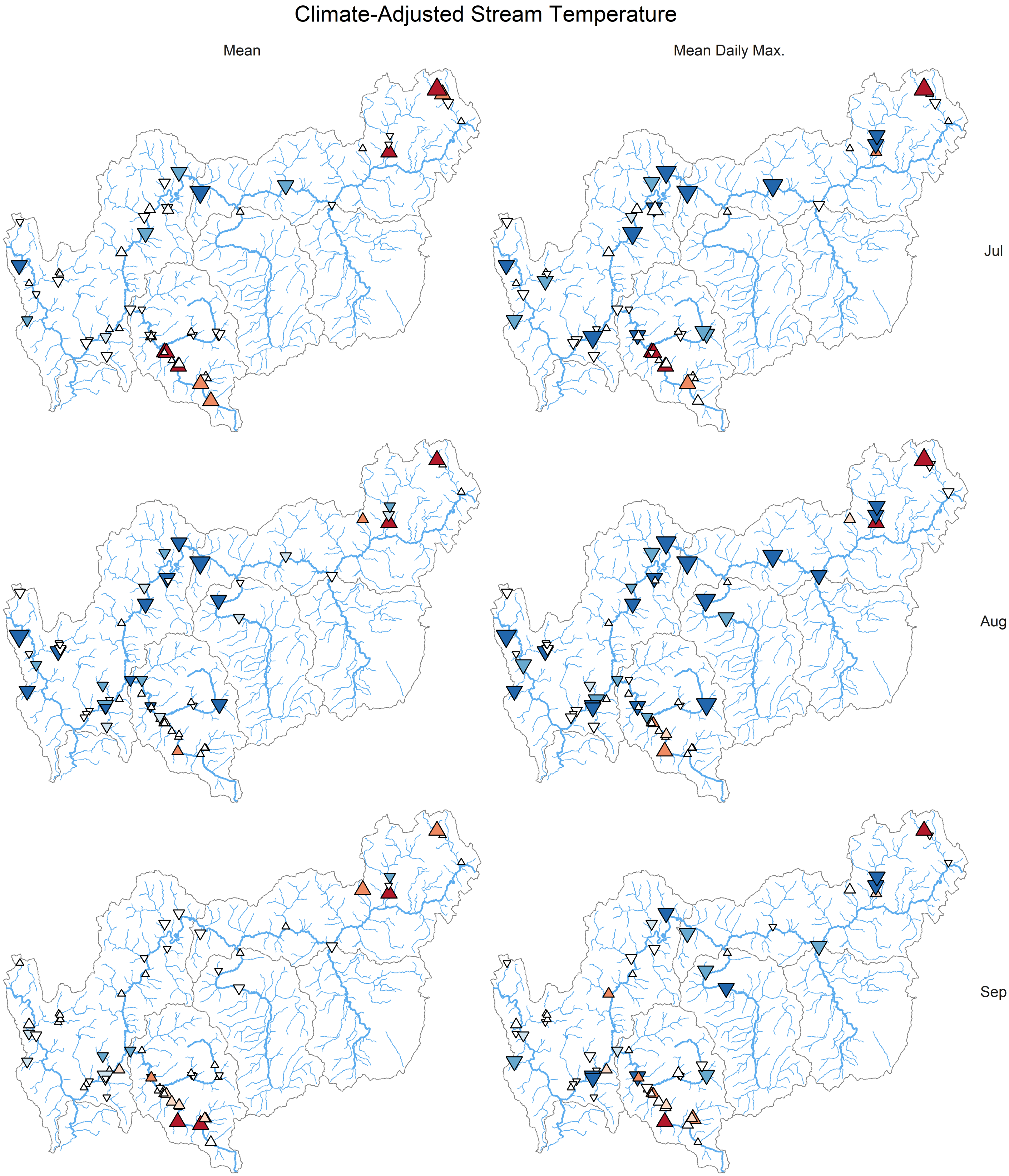


Figure 22. Map of site-specific results of statistical trend tests at 68 long-term sites in the study area for climate-adjusted monthly mean (left panels) and monthly mean daily maximum (right panels) stream temperature for July (top panels), August (middle panels), and September (bottom panels). Symbol shape shows direction (increasing/decreasing), size shows magnitude (°C/decade), and shading shows strength of evidence (darker means stronger evidence). See Figure 20 for legend.

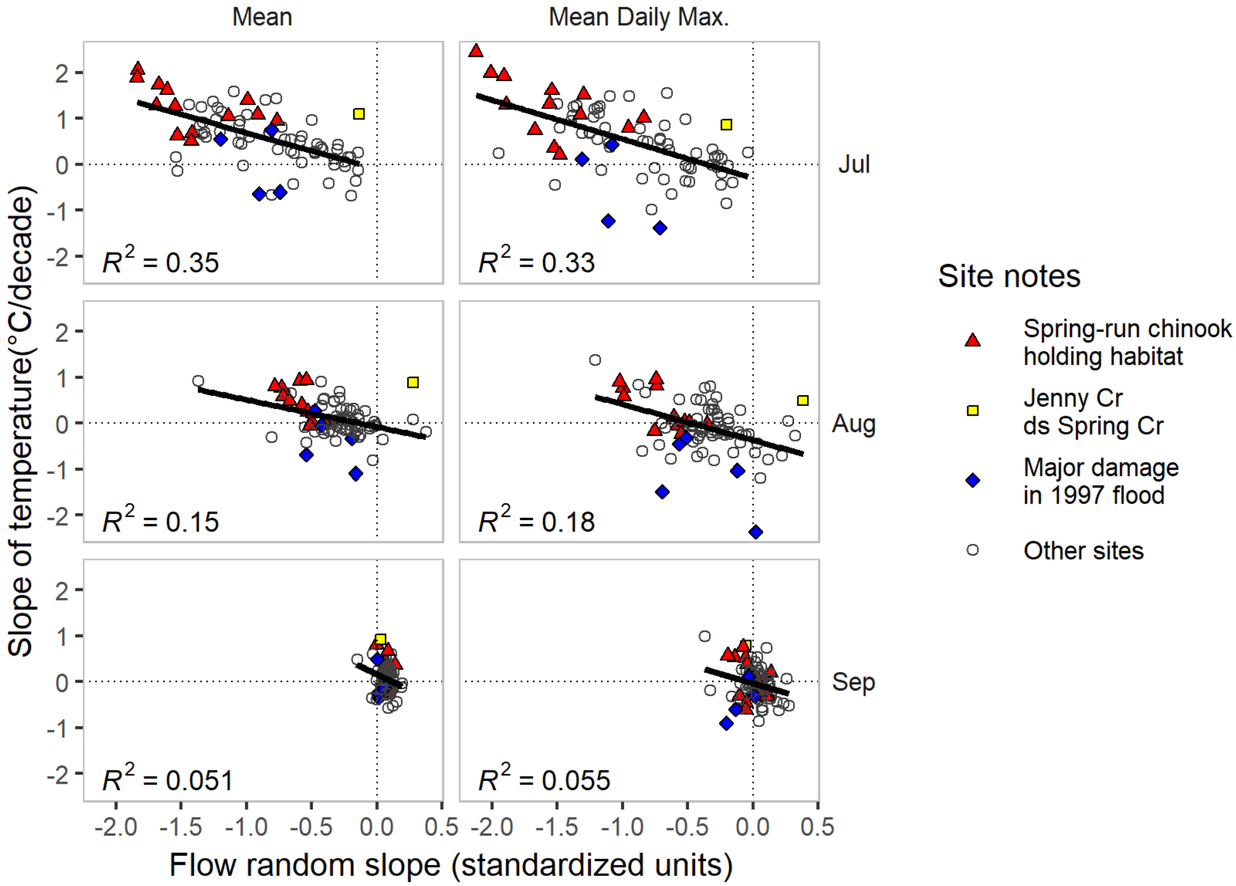


Figure 23. Scatterplot of the decadal slope of 1995–2017 trends in stream temperatures versus flow random effect at 87 long-term monitoring sites. Sites are grouped in categories for discussion purposes (see text). Decadal slopes shown here are the same as those shown in Figure 18a (tributaries), Figure 19a (mainstem), and Figure 21 (tributaries), and flow random slopes are the same as shown in Figure 13 (tributaries) and Figure 15 (mainstem). Sites in the Salmon River, North Fork Salmon River, South Fork of the Salmon River, East Fork South Fork of the Salmon River, and Wooley Creek are denoted here as core holding habitat for spring-run chinook salmon because those reaches are where annual snorkel surveys are conducted.

4 ACKNOWLEDGMENTS

Countless people from many different entities have contributed to collection and compilation of the stream temperature data included in this report. The reports cited in the methods section list some of the persons who collected and organized data. Special thanks to Nicholas Cusick who assisted with compiling and cleaning of the many of the datasets. Nicholas Som (USFWS) provided invaluable statistical advice. Sarah Beesley (YTFP) and Robin Welling (USFS) provided comments on a draft of this report. The Klamath Tribal Water Quality Consortium supported Riverbend Sciences' participation in this project using funds provided by USEPA Region 9.

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APPENDIX A: DESCRIPTION OF ADDITIONAL TEMPERATURE DATASETS NOT ACQUIRED OR NOT COMPILED

As noted in section 2.3 above, during the outreach and research over the course of this project, we became aware of many datasets that we were either not able to obtain the original electronic data, or did not have time to compile and quality check the data. This appendix describes those datasets. Some (but not all) of these data, particularly those in the Trinity River and Lower Klamath River, are currently being compiled and analyzed by Riverbend Sciences and the Yurok Tribe as part of a separate Trinity River project scheduled for completion in 2020.

5.1 DATASETS SPANNING MULTIPLE SUB-BASINS

The U.S. Geological Survey's (USGS) National Water Information System (NWIS) contains archival stream temperature data collected during the years 1959-1985 at many streamflow gages in the Klamath and Trinity Basins (Bartholow 2005).

Additional water temperature (as well as dissolved oxygen, pH, and specific conductivity) data were compiled by Tetra Tech (2004) in preparation for the Klamath River TMDL (NCRWQCB 2010). Kier Associates compiled and added additional data through 2005, as part of projects funded by the Klamath Basin Tribal Water Quality Work Group. Our review of this compilation (it is available upon request from Riverbend Sciences), found that substantial portions of it overlap with (and are now superseded by) other datasets as USFS NRIS AqS, SRRC, and UFSWS. Time and budget constraints precluded utilization of this compilation which include the following unique datasets: 1) North Coast Regional Water Quality Control Board data, 2) Watercourse Engineering (2003) data for the year 2000 sponsored by the US Bureau of Reclamation and PacifiCorp, 3) USGS data for Klamath River at Walker Bridge and Klamath River above Shovel Creek, and 4) potentially some additional data from the Yurok Tribe.

A few unique (i.e., not overlapping with other datasets) temperature datasets are available in the Klamath Resource Information System (KRIS). These include: 1) hourly data from the Karuk Tribe for eight sites Klamath River between Keno and the Klamath Estuary for the years 1995–1996[25] (Karuk Tribe of California 1999), 2) Daily summaries of data collected by multiple entities and compiled by the North Coast Regional Water Quality Control Board from around the Klamath Basin in the years 1989–1995[26], including: Klamath River from Link Dam to Big Bar; Shasta, Scott, and Salmon rivers; and various creeks and canals. Some of these data overlap with USFS NRIS AqS but some are unique. Reports by Rohde and Hillman (1994, 1995) and the Karuk Tribe of California (1999) describe some of the data and methods. The Karuk Tribe of California (1999) report also includes tables of all daily average data from the years 1993–1997, some of which (especially 1997) are likely not included in the 1989–1995 or 1995–1996 KRIS data files. We downloaded the 1989–1996 data but did not compile them due to time and budget constraints.

The U.S. Bureau of Reclamation (USBR) operated continuous multi-parameters probes at various sites in the Klamath River (from Miller Island to Wautek/Johnson's) and tributaries (Shasta, Scott, Salmon, Trinity) in September and October of 1998 and 1999. As described above in a preceding paragraph, USBR's 2000 river-wide temperature data (Watercourse Engineering 2003) were compiled by TetraTech (2004). USBR's fall 2001 and 2002 monitoring focused on the area around

[25] http://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/mk_cst28.htm,
[26] https://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/mk_cst27.htm

Keno Reservoir, upstream of our study area. We obtained all these 1998-2002 data but did not compile them due to time and budget constraints.

The Michigan-California Timber Company (an affiliate of Timber Products) has substantial land holdings in tributaries to the Middle Klamath River and Scott River. The company declined requests to share data for this project.

5.2 SHASTA RIVER SUB-BASIN

We did acquire and begin compiling a large quantity of temperature data from the Shasta Valley Resource Conservation District (SVRCD) but did not have time to complete data screening and review, so did not include those data in our final compilation nor use this in this report.

The North Coast Regional Water Quality Control Board compiled a substantial temperature database for the Shasta River sub-basin as part of the Shasta River Stewardship Report (Mallory et al. 2018). We obtained these data but time and budget constraints precluded use from using them in this report.

The Nature Conservancy (TNC) monitored stream temperature for at least several years at sites on Big Springs Creek, the Shasta River, and Parks Creek on its Big Springs Ranch. TNC provided us with access to download these data[27], but time and budget constraints precluded us from doing so. The property has now been sold to the CDFW, and we are unclear what the current status of the temperature monitoring is.

CDFW's Yreka office (section 2.2.3) monitors many additional stations beyond what we compiled and utilized in this report.

The California Department of Water Resources monitors temperature at flow gages on Parks Creek and Shasta River. These data are available online[28] but we did not have time/budget to download or compile them.

A few unique (i.e., not overlapping with other datasets) Shasta River temperature datasets are available in the Klamath Resource Information System (KRIS). These include: 1) North Coast Regional Water Quality Control Board (NCRWQCB) data for five sites in 1991-1992[29], 2) a multi-agency dataset for the years 1994–2002[30] compiled by KRIS and the Shasta River Coordinated Resource and Monitoring Program (CRMP), 3) Karuk Tribe data at the mouth of the Shasta River 1994[31], 4) California Department of Fish and Game data for 12 sites in 1995[32] and 1996[33] which may overlap with the CRMP dataset), and 5) 1998[34] data collected at Anderson Grade Road in 1998 by Siskiyou County Schools.

University of California Davis collects temperature data associated with research projects (e.g., Nichols et al. 2017, Willis et al. 2017, Willis and Holmes 2019), but we have not attempted to acquire those data.

5.3 SCOTT RIVER SUB-BASIN

[27] https://www.grabdata.com/DB/SiteHawk.aspx
[28] http://cdec.water.ca.gov/dynamicapp/staMeta?station_id=SRG,
http://cdec.water.ca.gov/dynamicapp/staMeta?station_id=PBS
[29] https://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/sh_cst26.htm
[30] https://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/sh_cst18.htm
[31] http://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/mk_cst46.htm
[32] https://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/sh_cst21.htm
[33] https://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/sh_cst22.htm
[34] http://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/sh_cst17.htm

The Siskiyou Resource Conservation District monitored stream temperatures for many years at various sites in the Scott River and its tributaries. Some of these data are available in KRIS[35] as hourly measurements or daily summaries, and a table of annual MWAT values for many sites is available in Quigley (2001) and NCRWQCB (2005), but to our knowledge these data have not been systematically compiled.

The Scott River Watershed Council monitors water temperatures associated with its restoration projects (e.g., Yokel et al. 2018) but we were not able to acquire these data.

CDFW monitors stream temperatures at its downstream migrant trap near the mouth of the Scott River (e.g., Chesney et al. 2007) but we have not attempted to acquire or compile these data.

5.4 SALMON RIVER SUB-BASIN

A few unique (i.e., not overlapping with other datasets) Salmon River temperature datasets are available in the Klamath Resource Information System (KRIS[36]). For details, see Asarian et al. (2019).

5.5 MIDDLE KLAMATH RIVER SUB-BASIN

The Bartholomew Lab at Oregon State University has monitored year-round temperatures in the Klamath River as part of fish health research since 2008. Sites include Klamath River at Interstate 5, Beaver Creek, Seiad Valley, Orleans, and Tully Creek. We acquired the 2008–2014 data from Julie Alexander, but did not have time/budget to compile them.

The Michigan-California Timber Company (an affiliate of Timber Products) has substantial land holdings in tributaries to the Middle Klamath River and Scott River. The company declined requests to share data for this project.

As part of the Klamath Hydroelectric Project Settlement Agreement, PacifiCorp monitors temperatures at several sites in the Klamath River between J.C. Boyle Dam and Iron Gate Dam (Watercourse Engineering 2015). We did not have time to request those data.

U.S. Fish and Wildlife Service (USFWS) annual reports note that temperatures were monitored at the downstream migrant trap in the Klamath River at Big Bar in 1989 and 1990 (Craig 1991, 1992), and 1991 (Goldsmith 1994), but we have not been able to locate electronic copes of these data. Those reports include daily average graphs for 1990 and 1991. We were able to acquire USFWS temperature data at the Big Bar trap for 1991 to 2004, but did not have time/budget to compile them.

Data collected by Siskiyou County Schools in Bogus Creek in 1998 are available in KRIS[37] but did not have time/budget to compile them.

5.6 LOWER KLAMATH RIVER SUB-BASIN

Green Diamond Resource Company (GDRC) monitors stream temperatures data at large number of streams on its timber lands along the Lower Klamath River as part of their Aquatic Habitat Conservation Plan (AHCP) (GDRC 2006). The company declined requests to share the data, but some portions of older data (1990-1998) might be included in the HSU FSP compilation (section 2.2.9 above). Tables with annual summaries (MWMT, MWAT, annual maximum) of all of GDRC's stream temperature monitoring results for 1994-2000 are available in Appendix C5 of

[35] http://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/selecttopic_scott_river.htm
[36] http://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/selecttopic_temperature.htm
[37] http://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/md_cst53.htm

the AHCP (GDRC 2006) but no maps or coordinates are provided. The annual AHCP monitoring reports (GDRC 2017) do not contain any tables that would allow extraction of annual temperature summaries for sites. Fortunately, the Yurok Tribe (sections 2.2.7 and 2.2.8) has sites in some of the same tributaries that GDRC monitors.

YTEP has long-term year-round temperature datasets (primarily year-round) at its streamflow gaging stations on Turwar, McGarvey, and Tully Creeks (YTEP 2005). In addition, YTEP has long-term summer temperature data from multi-parameter datasondes at the mouth of the Trinity River, and the Klamath River at Weitchpec, Tully Creek, and Turwar (YTEP 2012), but these data were not utilized due to time/budget restraints.

Humboldt State University student Alexander Wick monitored stream temperatures in 2014 and 2015 at several sites in South Fork Ah Pah Creek in as part of the riparian thinning experiment (Wick 2016, GDRC 2017). The data have been incorporated into Green Diamond Resource Company's database.

Oregon State University doctoral student David Roon is intensively monitoring temperatures (tens of probes per creek) associated with a riparian thinning experiment in the West Forks Tectah Creek and East Forks Tectah Creek on Green Diamond Resource Company Land (Roon 2017, GDRC 2017). The project runs for at least the years 2016-2017.

Additional data from USFWS Arcata office (note: it is possible that these data may be compiled during a Trinity River temperature report currently being developed by Riverbend Sciences and scheduled for completion in 2020):

- *Tributaries of the Lower Klamath River and Trinity River 1977-1978*: USFWS (1979) includes graphs of water temperatures in the Hoopa Valley Indian Reservation (prior to the Yurok Indian Reservation being split from the Hoopa Valley Indian Reservation. Some of these data may be in the USGS NWIS database.
- *Blue Creek 1988-1992*: Gale (1998) noted that USFWS monitored temperatures data in lower Blue Creek in 1988–1992. These data are shown in graphs in Chan and Longenbaugh (1994), Gilroy et al. (1992), and Stern and Noble (1990) but we have not yet been able to acquire electronic versions of these data.
- *Lower Klamath River 1995 and 1996*: Gale (1998) noted that USFWS deployed multi-parameter Hydrolab water quality sensors in the lower mainstem Klamath River in 1996 which we have not been able to obtain the data for. The Klamath Resource Information System (KRIS) contains USFWS Hydrolab data for the lower Klamath River above Blue Creek and Klamath River above Coon Creek in 1995[38]. We are unclear if the Gale (1998) memo is incorrect (i.e., no data were collected in 1996) or if the 1996 data are additional to the 1995 data.
- *1997-2005 Klamath/Trinity data no longer included in Microsoft Access database:* Riverbend Sciences has an old archived 2007 version of the USFWS Arcata's Microsoft Access database that contains additional data for the years 1997-2005 that has been removed from the current version of the database. These include a variety of Klamath/Trinity mainstem and tributary sites. It is unclear why these data were deleted.
- *Klamath River above Weitchpec* 1991: these data are available in KRIS[39] but we did not have time/budget to compile them.

[38] http://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/lk_cst9.htm
[39] http://www.krisweb.com/krisklamathtrinity/krisdb/webbuilder/mt_cst19.htm

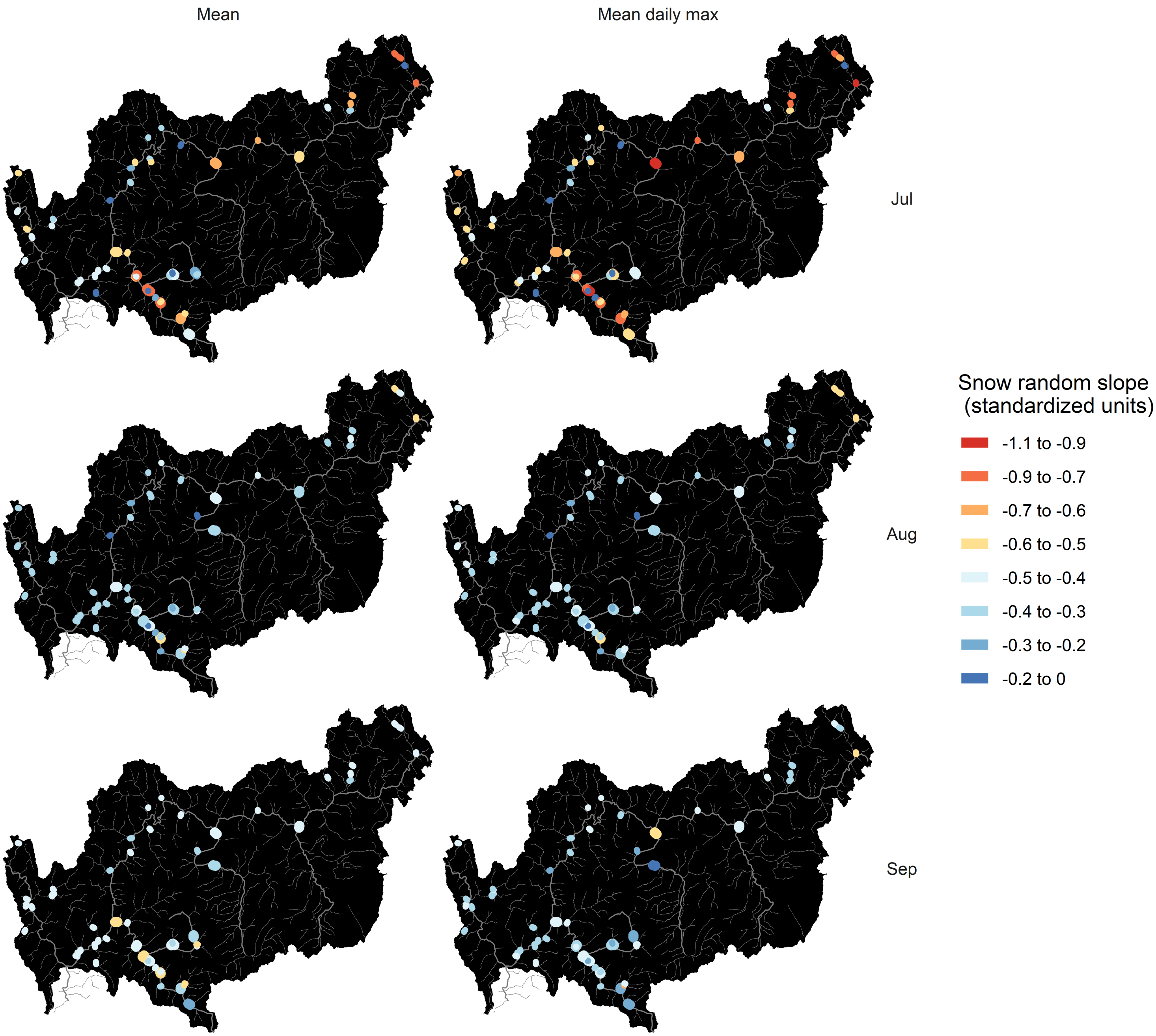


Figure B24. Maps showing April 1 snowpack random slopes for monthly mean (left panels) and monthly mean daily maximum (right panels) stream temperature for July (top panels), August (middle panels), and September (bottom panels) at 68 long-term tributary monitoring sites (for legibility, mainstem Klamath and Trinity river sites are shown in Figure 15 instead of here). Highly negative slopes indicate cooler stream temperatures when snowpack was high; slopes closer to zero indicate that a lesser cooling effect of snowpack. Sites are displayed as 1-km long reaches, with thick lines for sites in Shasta River, Salmon River, SF Salmon River, and NF Salmon River, and thin lines for sites on other streams. Only streams with drainage area ≥10 km2 are shown.

Table B3. Root mean squared error (RMSE) for the final linear mixed effects models (Table 2).

Month	Root mean squared error (°C) Mean daily maximum temperature	Mean temperature
July	0.58	0.50
Aug	0.54	0.41
Sept	0.49	0.43

Table B4. Overall slopes of 1995–2017 trends for A) nine stream temperature metrics [MDMT, MWMT, MWAT, and monthly mean and monthly mean daily maximum temperature for July, August, and September], and B) six climate-adjusted temperature metrics. Positive slopes indicate metrics that increased during the study period while negative slopes indicate metrics that decreased during the study period. Data are plotted in Figure 16.

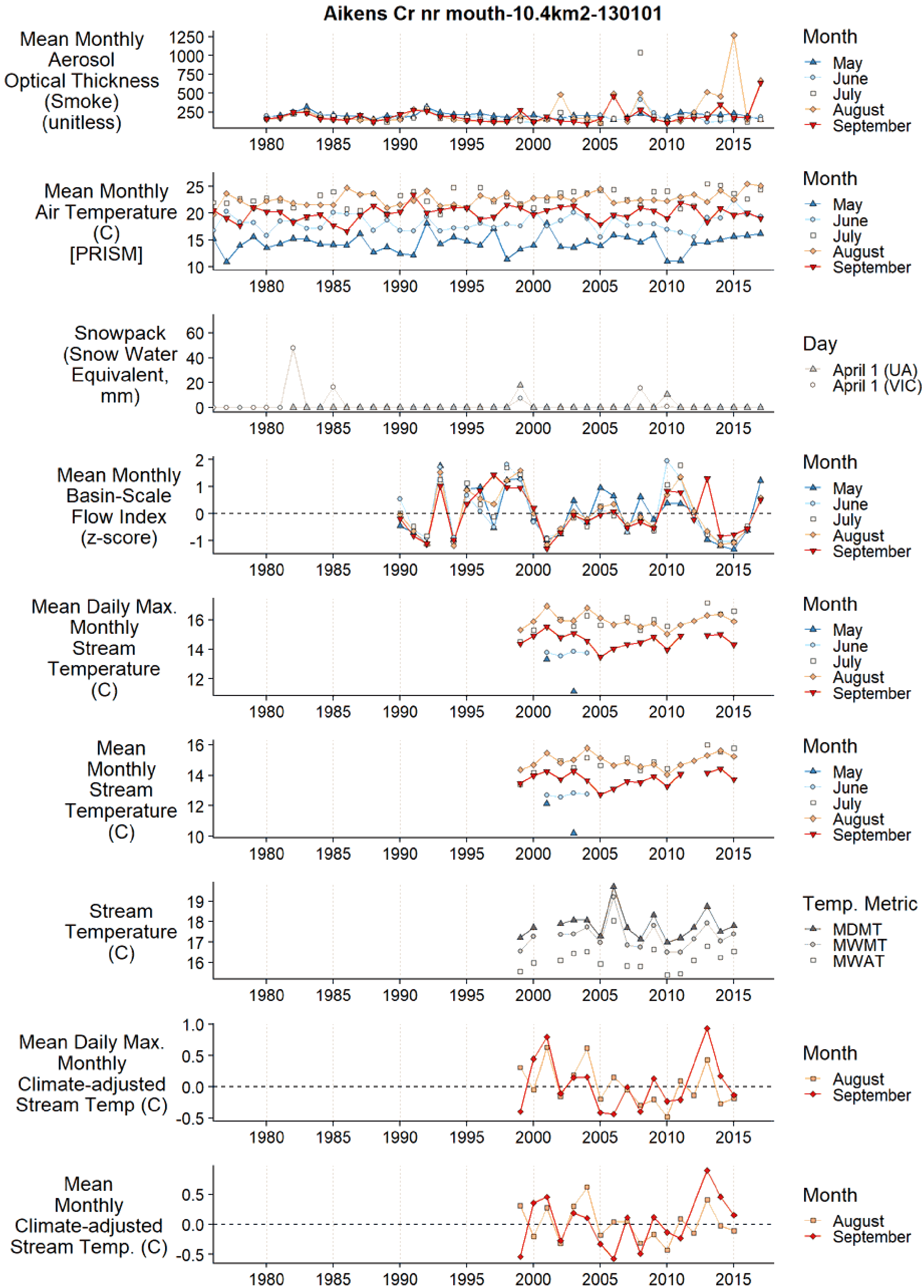
Type	Metric	Slope (°C/decade)	95% Confidence interval Low	High	P value
Stream Temperature	MDMT	0.24	0.18	0.29	<0.001
	MWMT	0.27	0.21	0.32	<0.001
	MWAT	0.41	0.36	0.45	<0.001
	Jul Mean Daily Max.	0.56	0.49	0.63	<0.001
	Jul Mean	0.65	0.59	0.72	<0.001
	Aug Mean Daily Max.	-0.05	-0.08	-0.01	0.239
	Aug Mean	0.14	0.10	0.17	<0.001
	Sep Mean Daily Max.	-0.03	-0.06	0.00	0.384
	Sep Mean	0.08	0.05	0.11	0.005
Climate-Adjusted Stream Temperature	Jul Mean Daily Max.	-0.17	-0.21	-0.14	<0.001
	Jul Mean	-0.04	-0.07	-0.01	0.253
	Aug Mean Daily Max.	-0.28	-0.32	-0.25	<0.001
	Aug Mean	-0.16	-0.18	-0.13	<0.001
	Sep Mean Daily Max.	-0.06	-0.09	-0.04	0.019
	Sep Mean	0.03	0.01	0.05	0.192

APPENDIX C: Annual Time Series of Climate and Stream Temperature at Long-Term Monitoring Sites

This appendix is a series of graphs. There is one page for each site long-term temperature monitoring site (stream temperatures monitored for at least eight years). Graphs are titled by a combination of site name, drainage area, and 1-km reach ID code.

Caption for all graphs:

In top to bottom order, the graph panels show: Annual time series 1990–2017 of: A) mean monthly aerosol optical thickness (a proxy for wildfire smoke) estimated from satellites, B) mean monthly air temperature for site (from PRISM model), C) April 1 modeled snowpack for site drainage area, D) basin-wide hydrologic index (average of several USGS gages), E) measured mean daily maximum monthly stream temperature, F) measured seasonal stream temperature metrics (MDMT, MWMT, and MWAT), G) climate-adjusted mean daily maximum monthly stream temperature, H) climate-adjusted mean monthly stream temperature. Climate-adjusted temperature is only shown for the 87 sites with at least 14 years of monthly stream temperature data.


Aikens Cr nr mouth-10.4km2-130101
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
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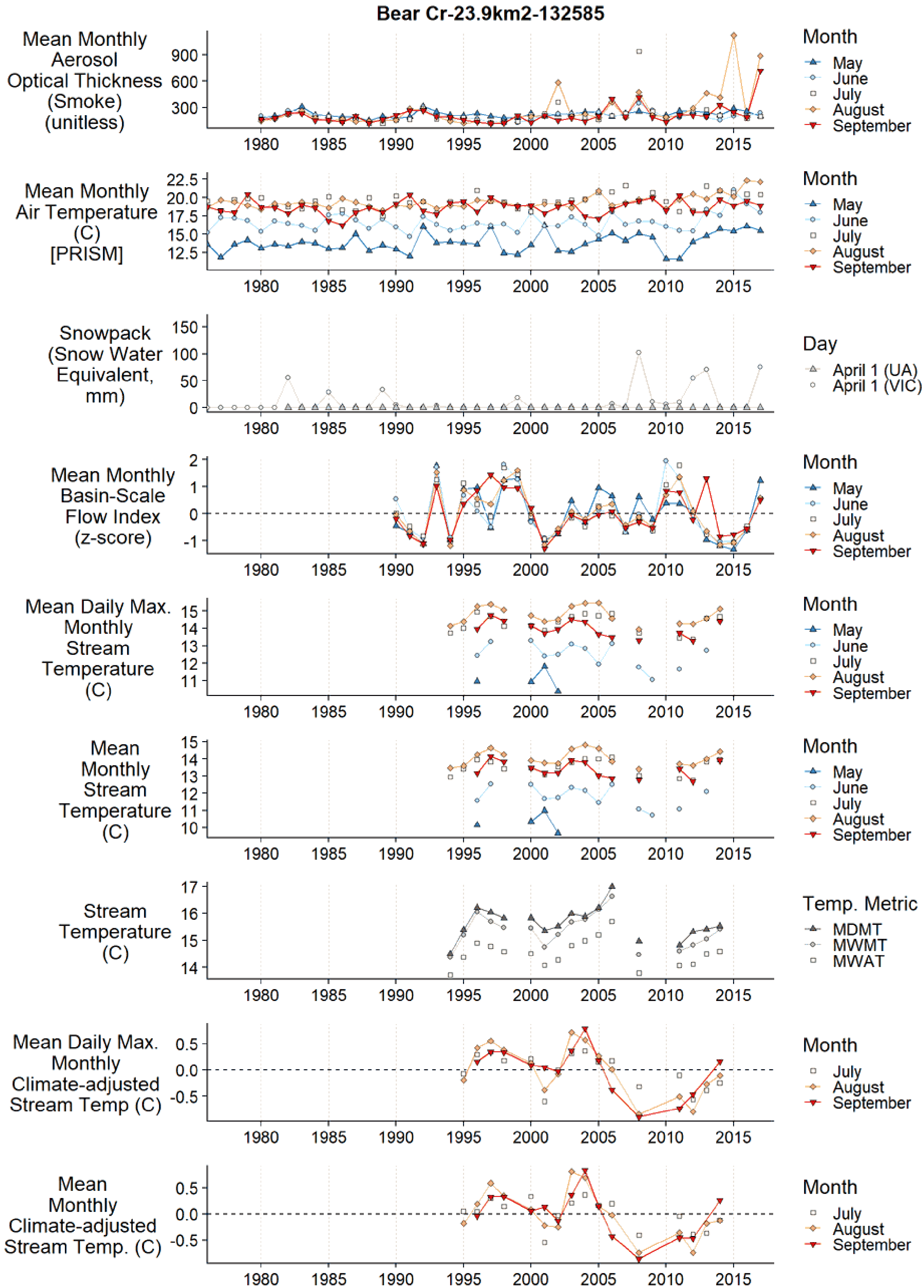
Bear Cr-23.9km2-132585
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
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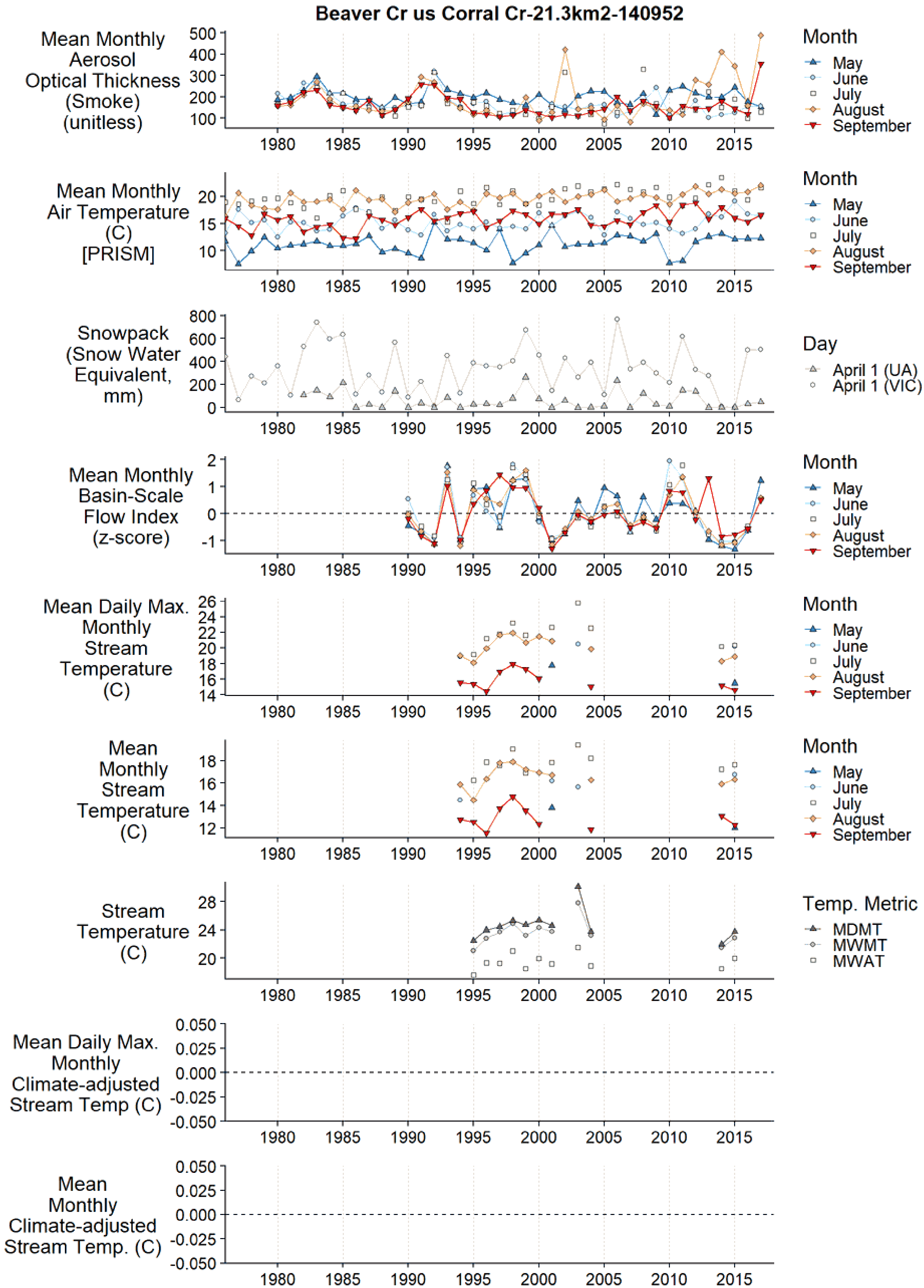
Beaver Cr us Corral Cr-21.3km2-140952
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
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Mean Monthly Basin-Scale Flow Index (z-score)
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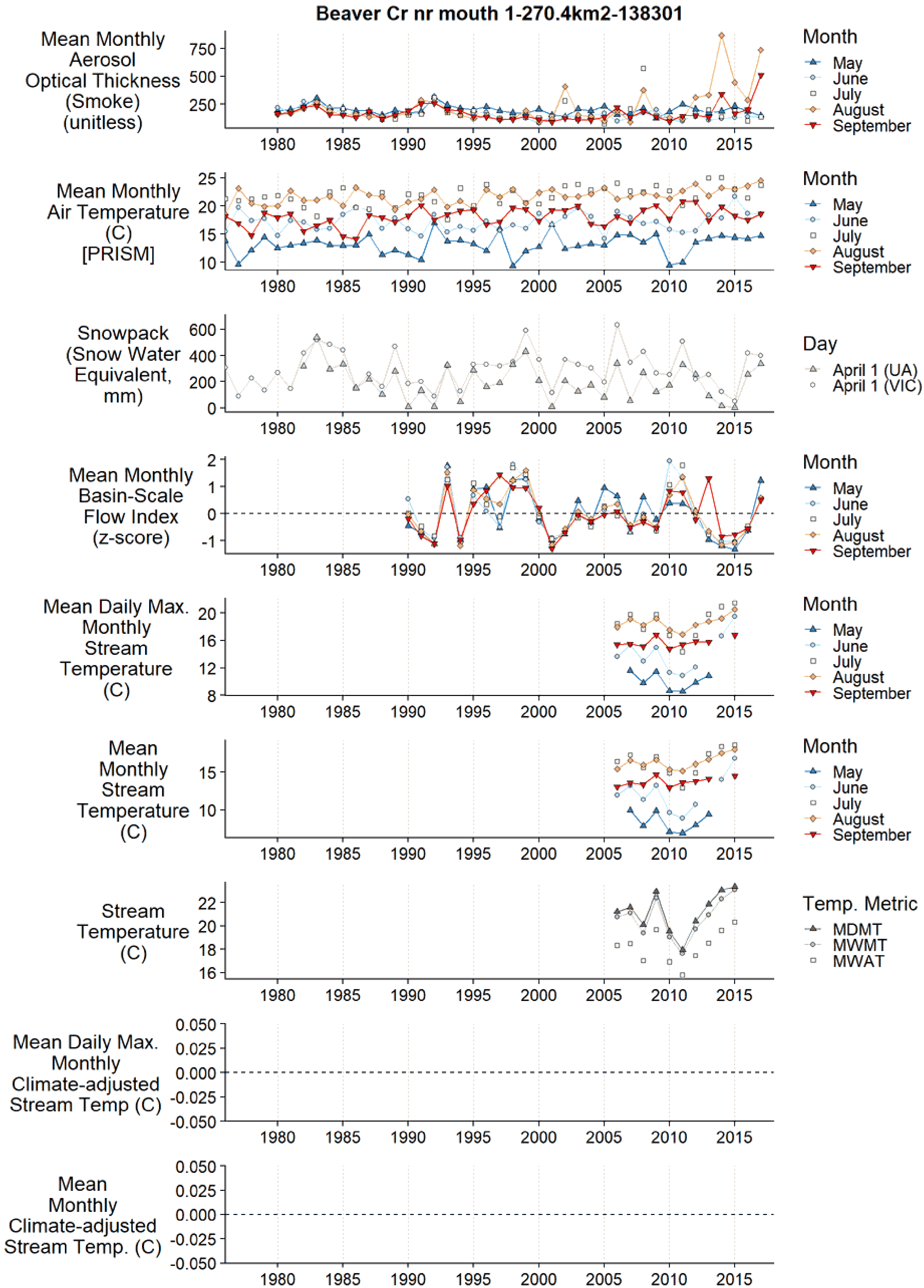

Beaver Cr nr mouth 1-270.4km2-138301
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
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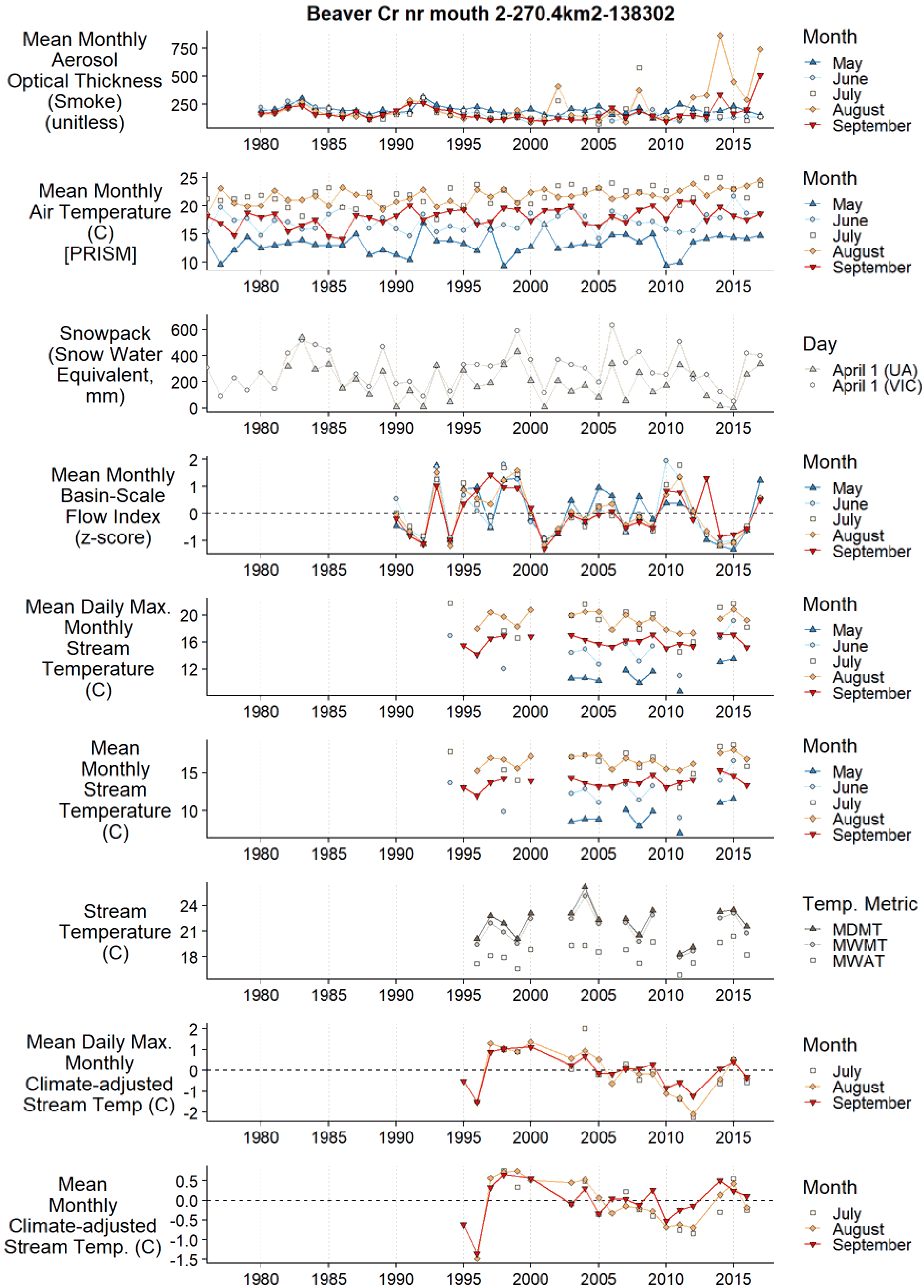
Beaver Cr nr mouth 2-270.4km2-138302
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
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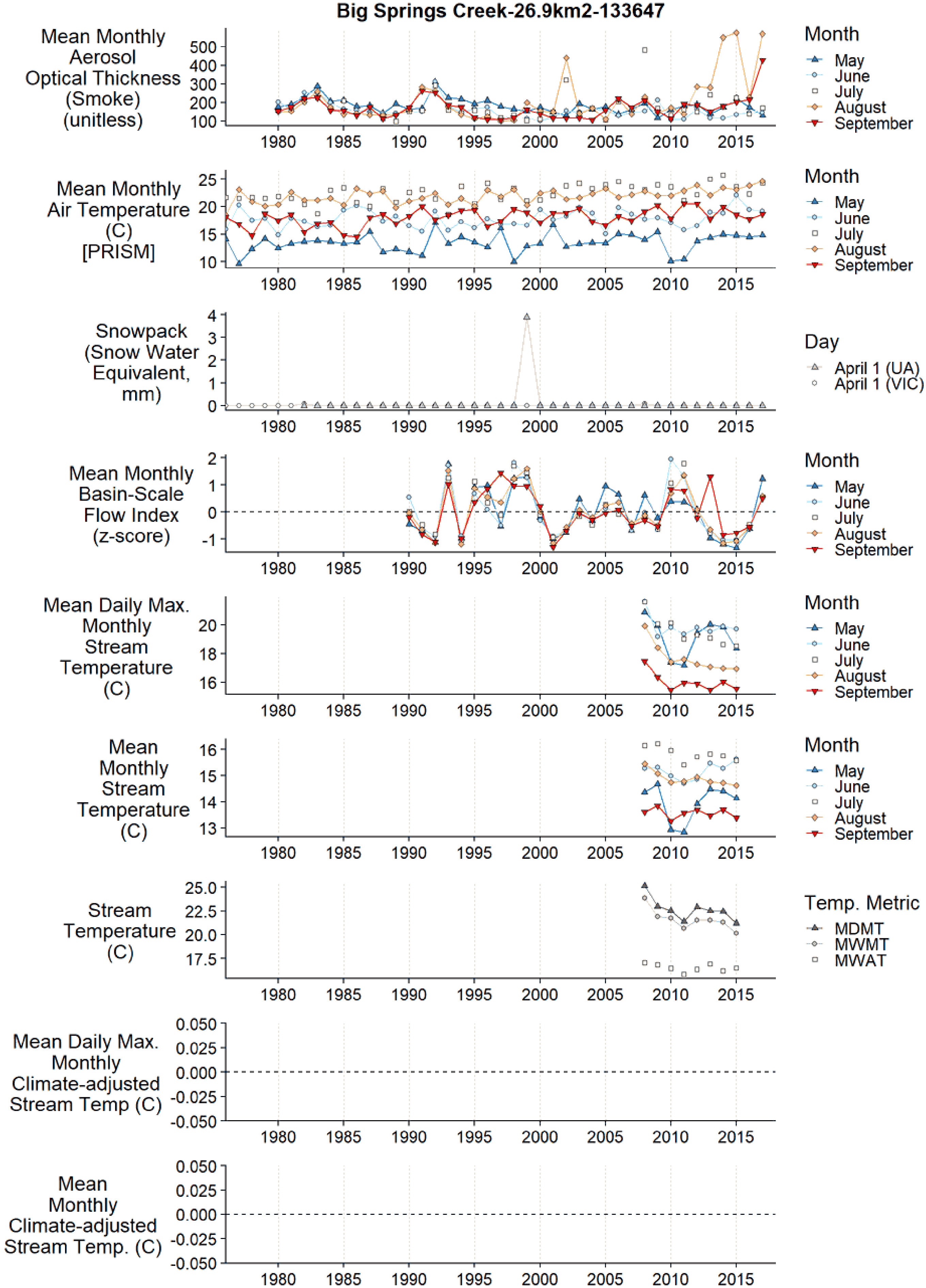
Big Springs Creek-26.9km2-133647
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
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Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
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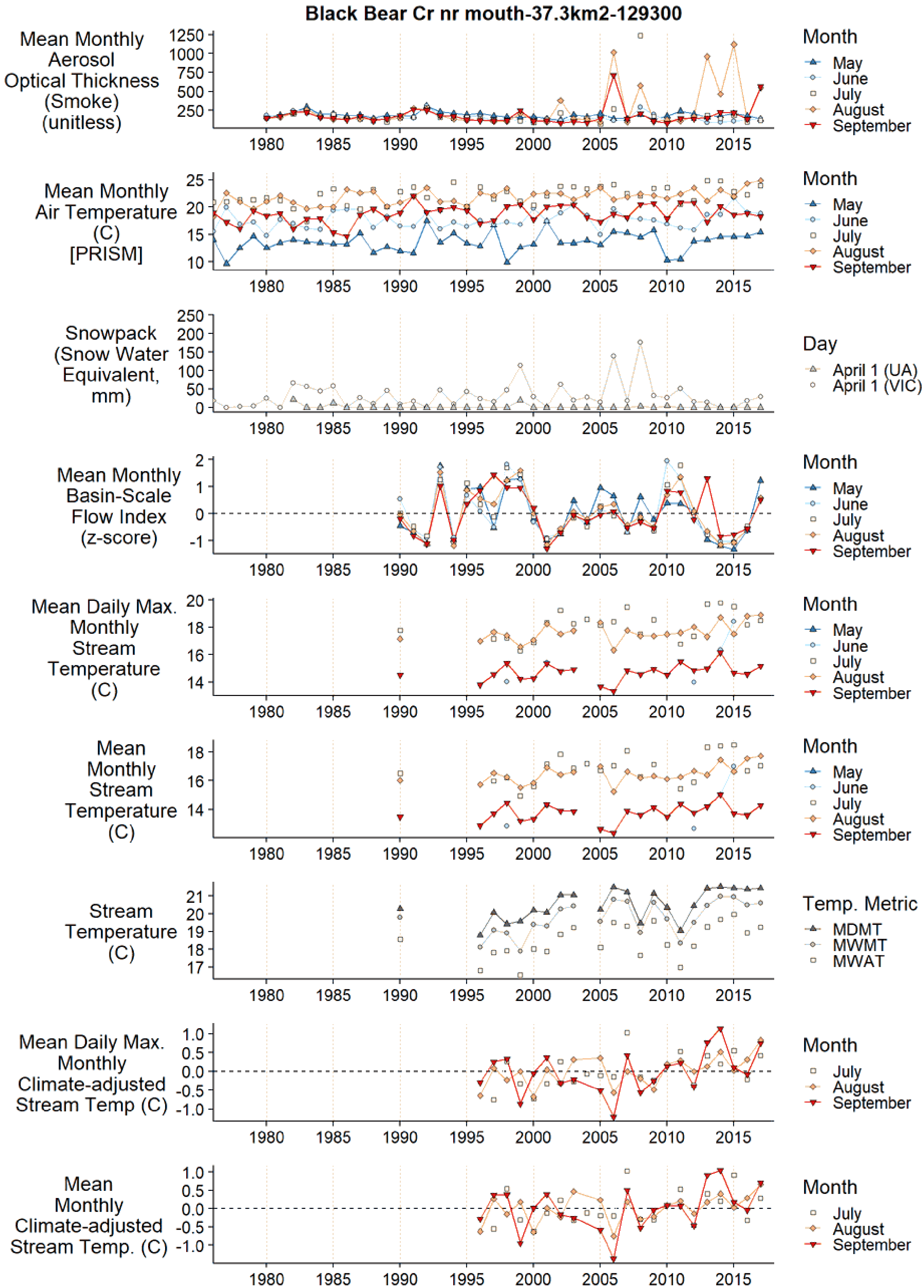

Black Bear Cr nr mouth-37.3km2-129300
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
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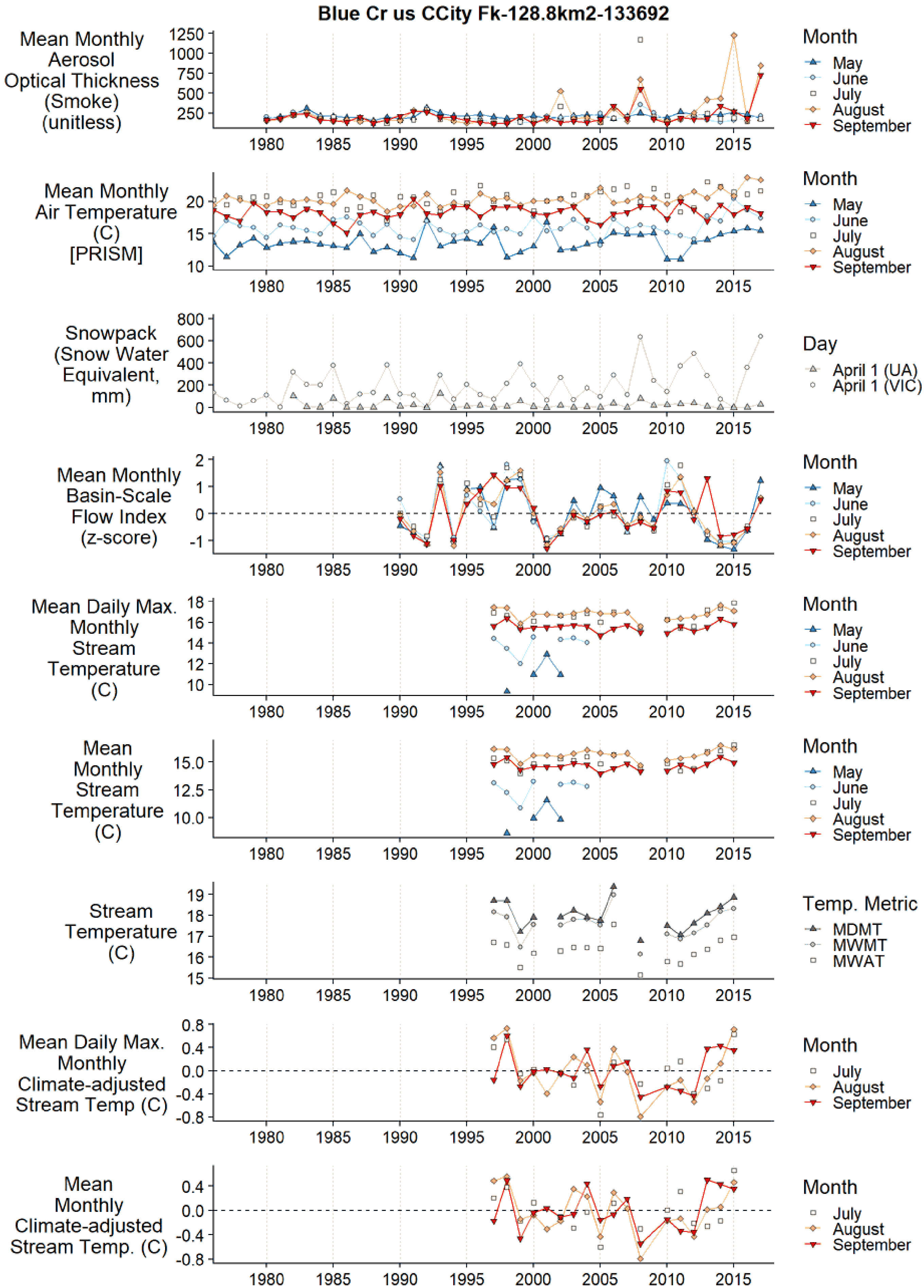
Blue Cr us CCity Fk-128.8km2-133692
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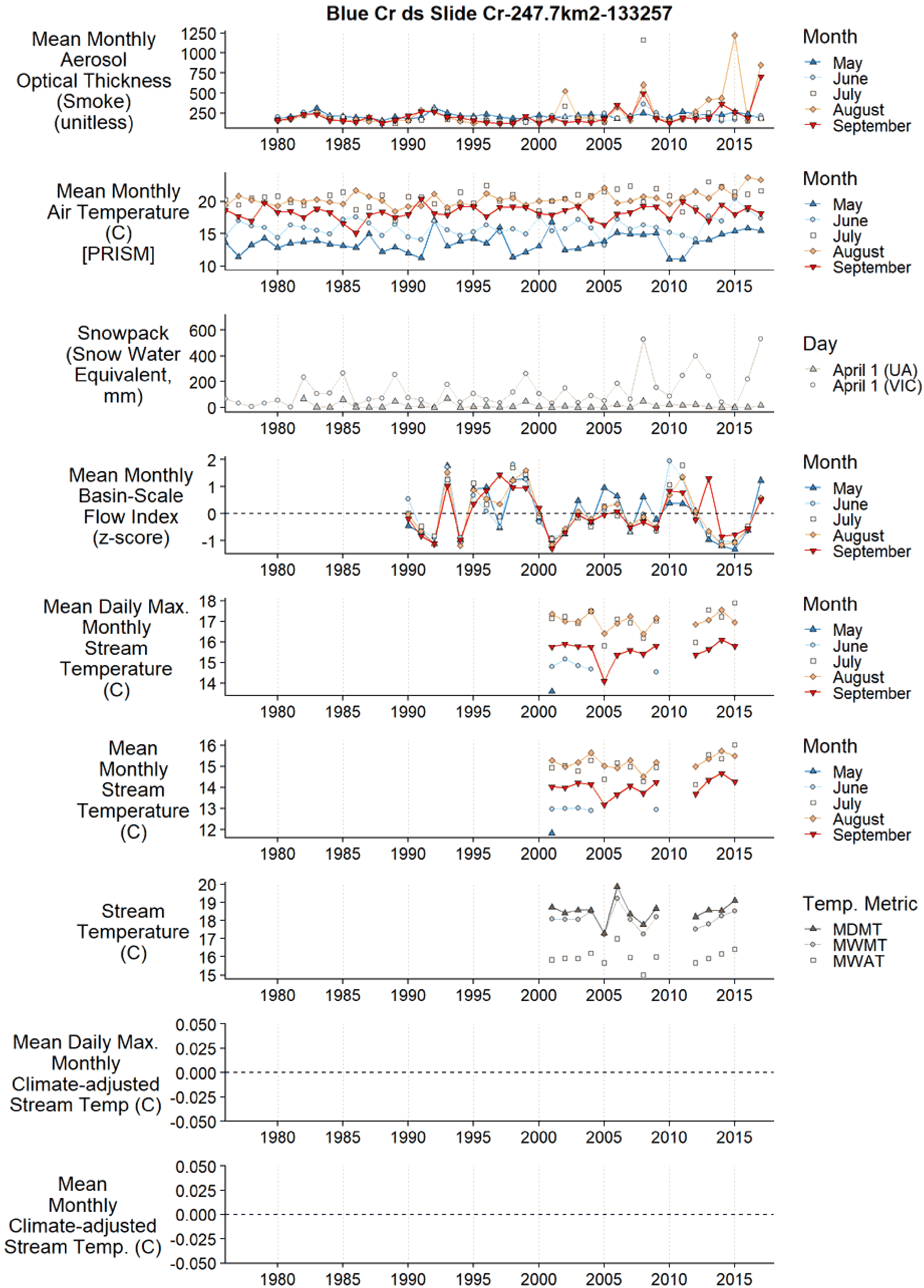

Blue Cr ds Slide Cr-247.7km2-133257
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
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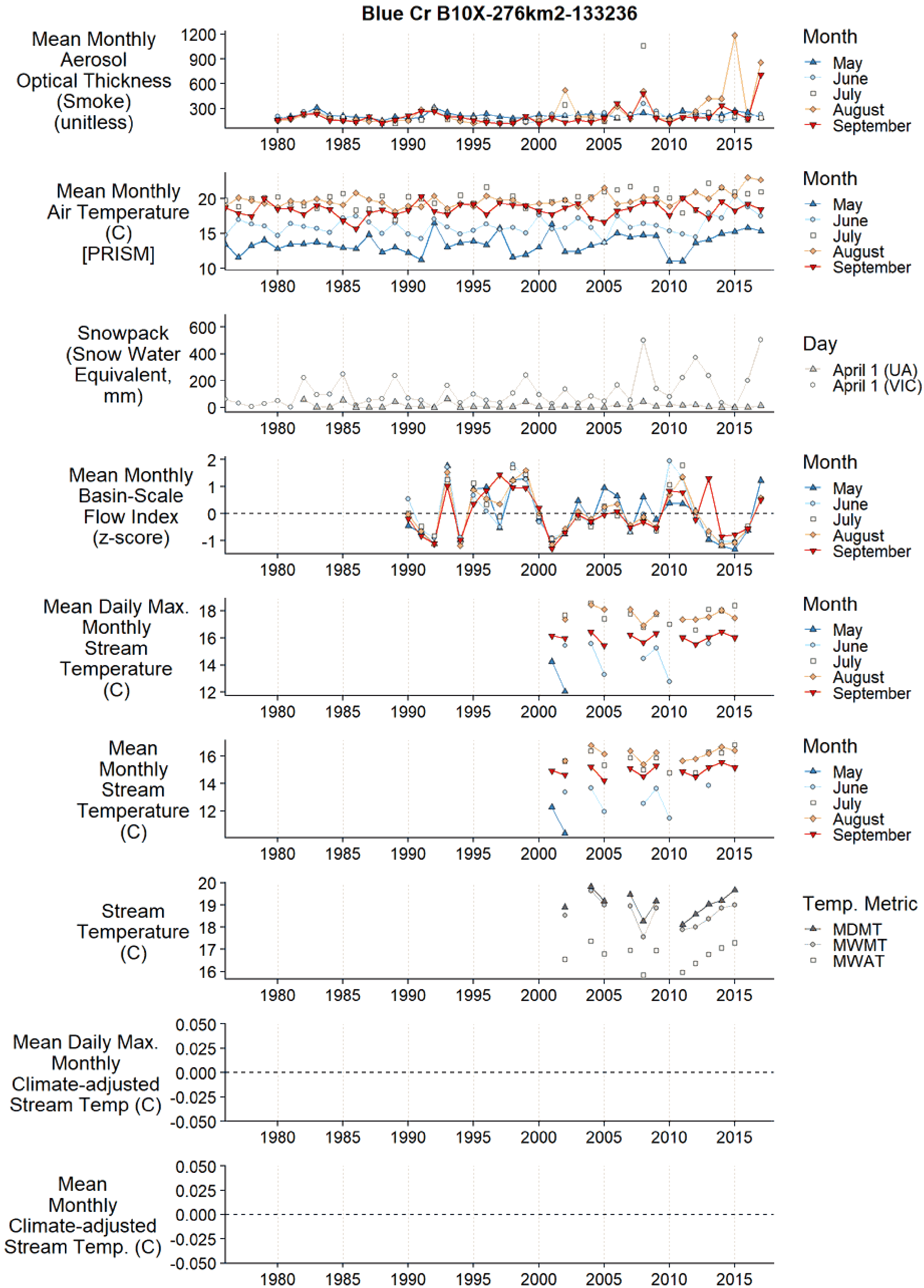

Blue Cr B10X-276km2-133236
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Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
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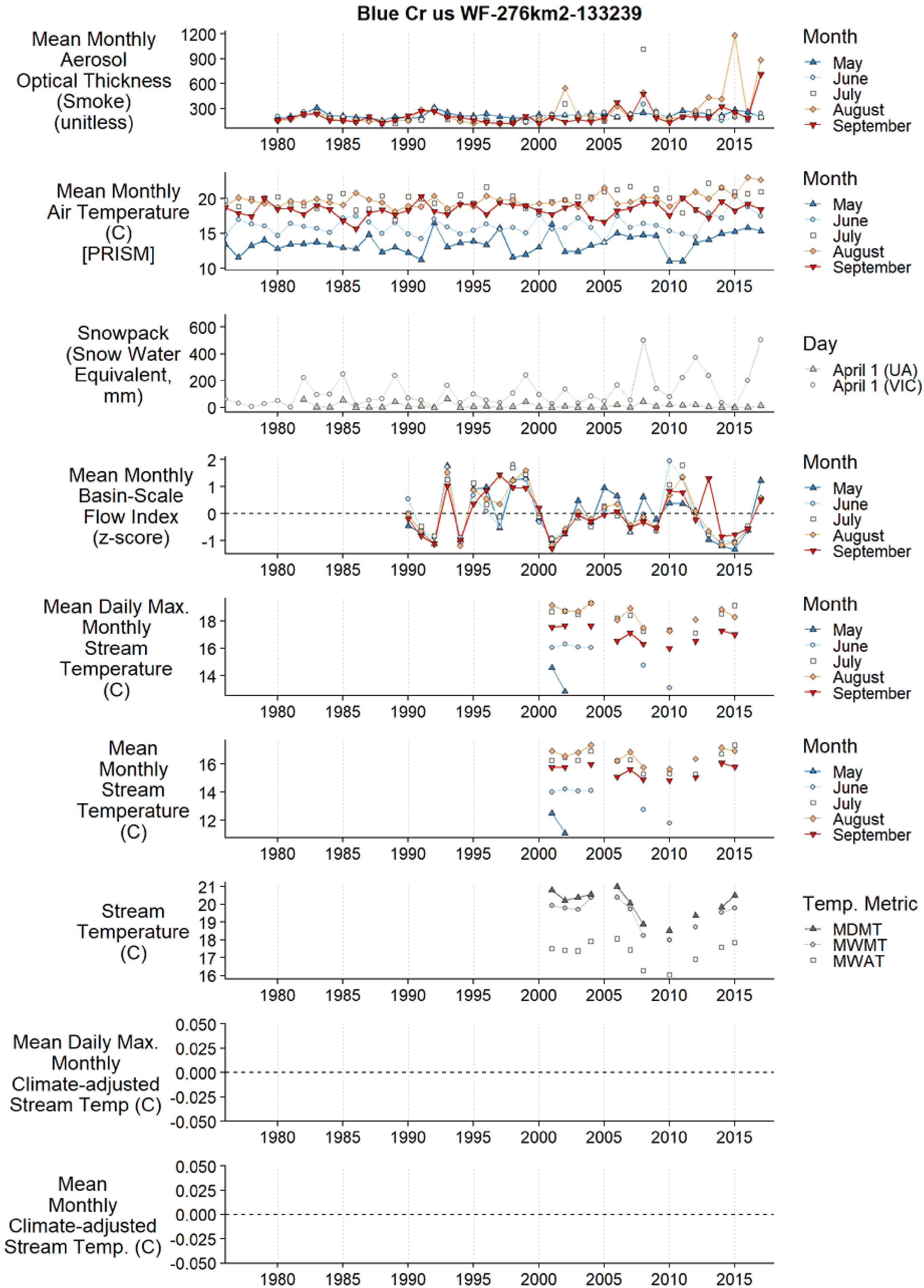
Blue Cr us WF-276km2-133239
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Snowpack (Snow Water Equivalent, mm)
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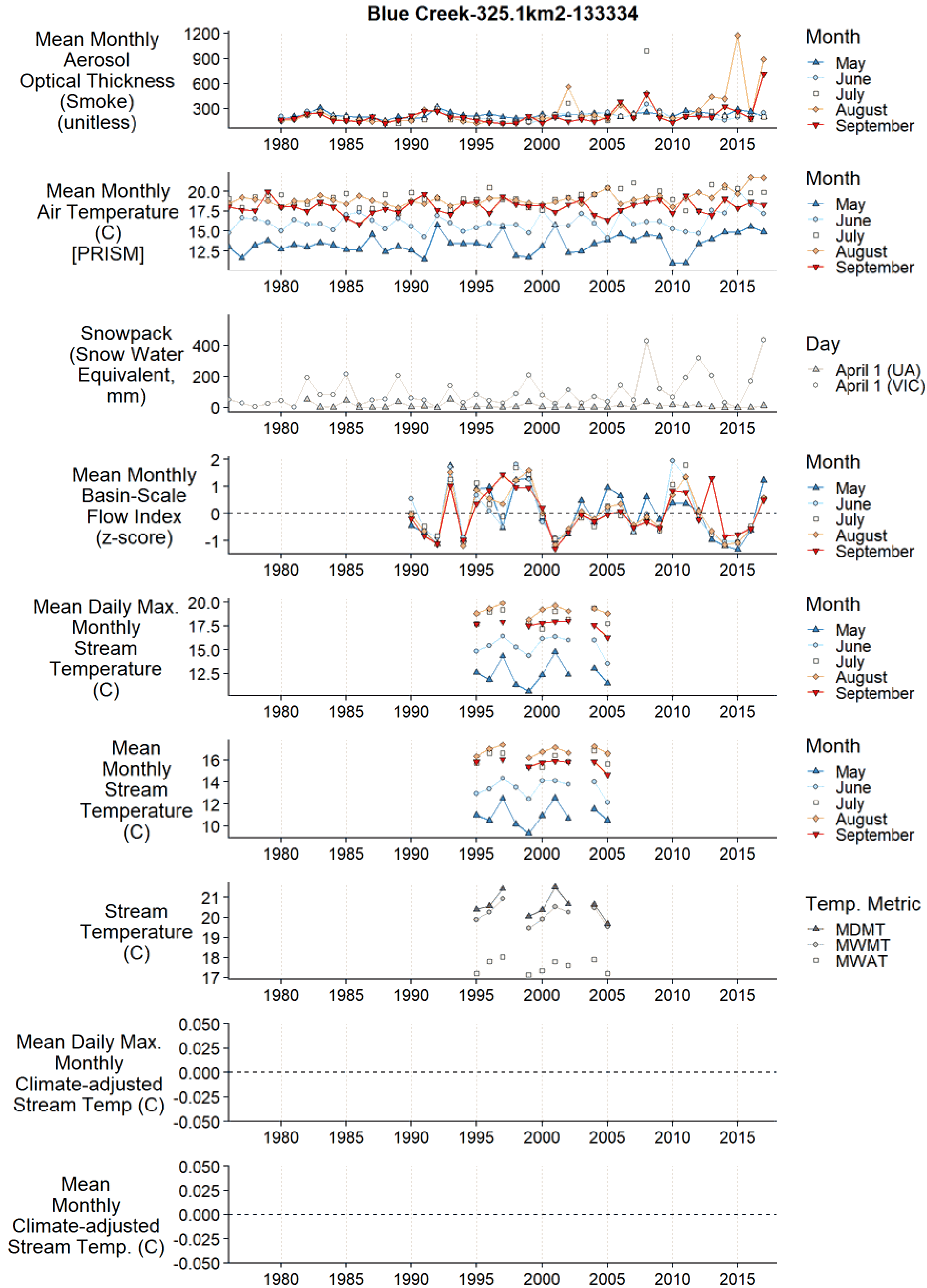

Blue Creek-325.1km2-133334
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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September
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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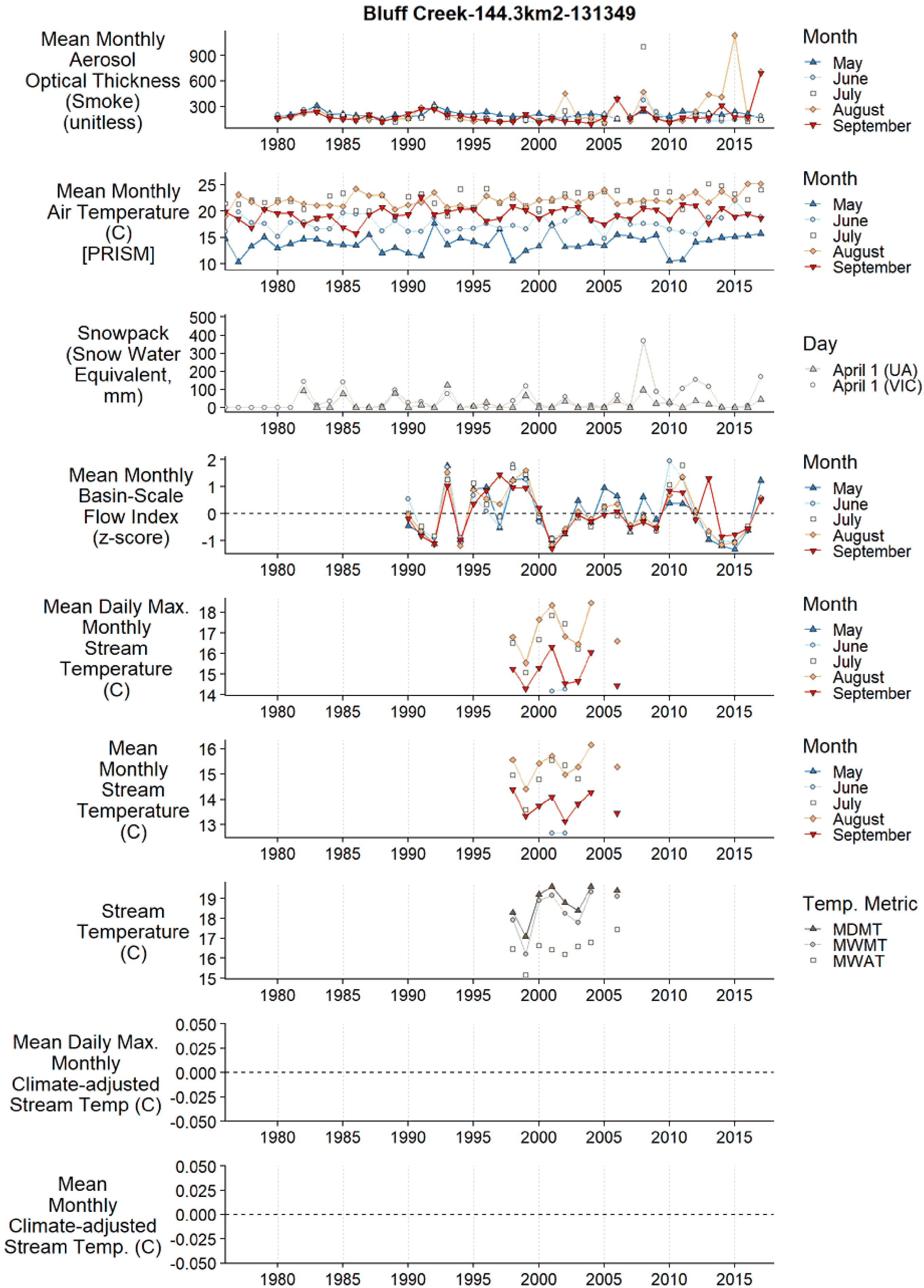
Bluff Creek-144.3km2-131349
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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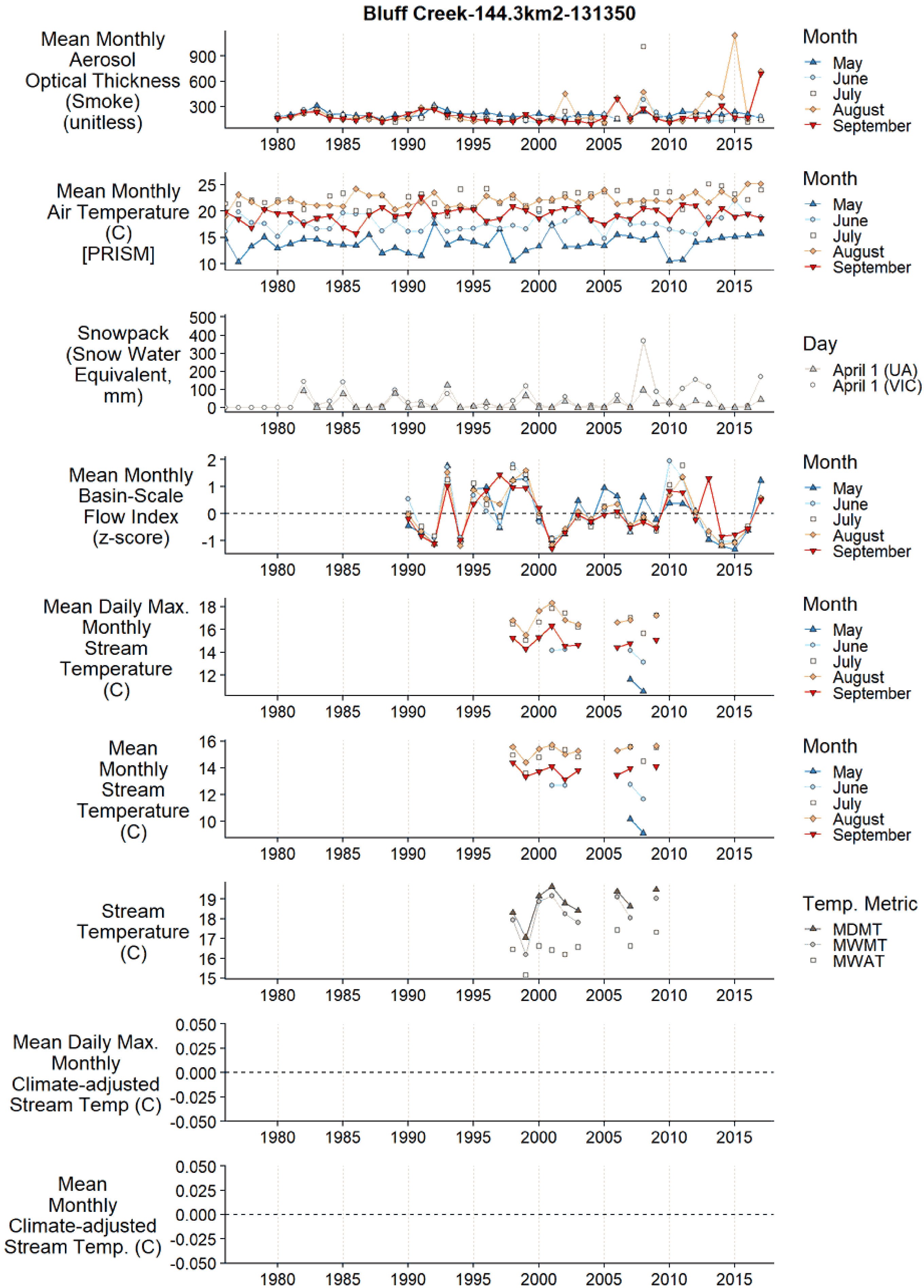
Bluff Creek-144.3km2-131350
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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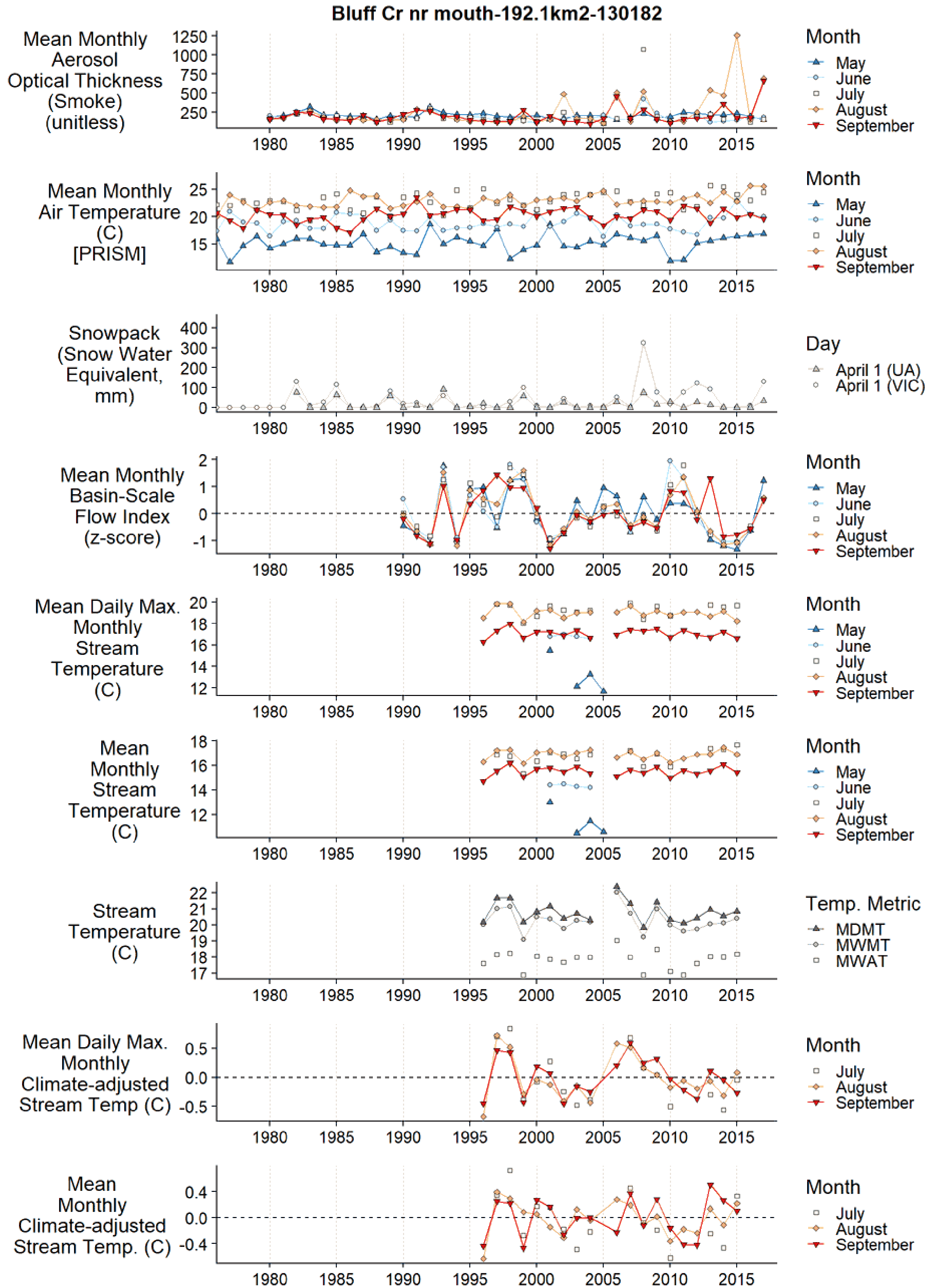
Bluff Cr nr mouth-192.1km2-130182
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
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Temp. Metric
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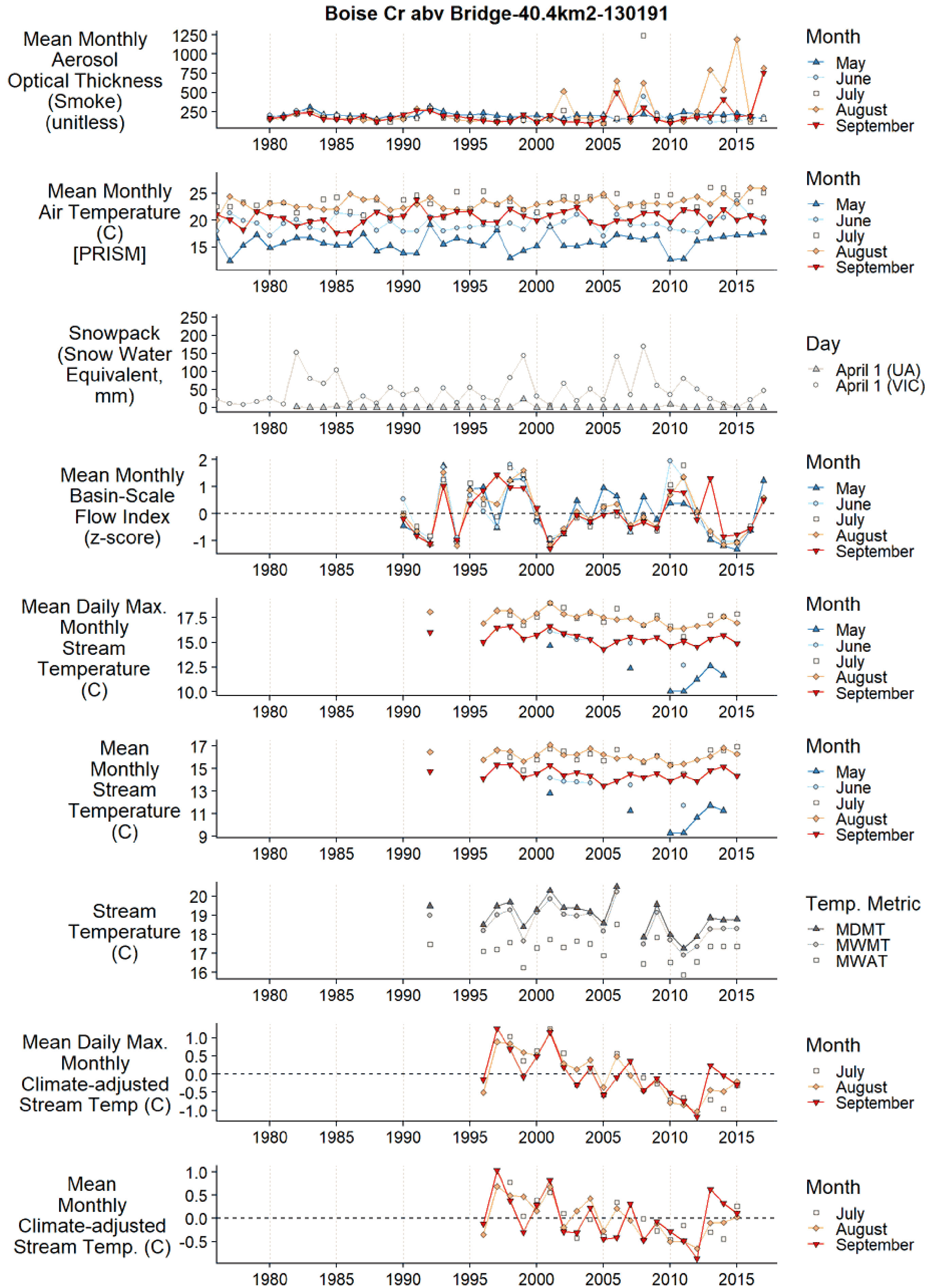
Boise Cr abv Bridge-40.4km2-130191
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (UA)
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Temp. Metric
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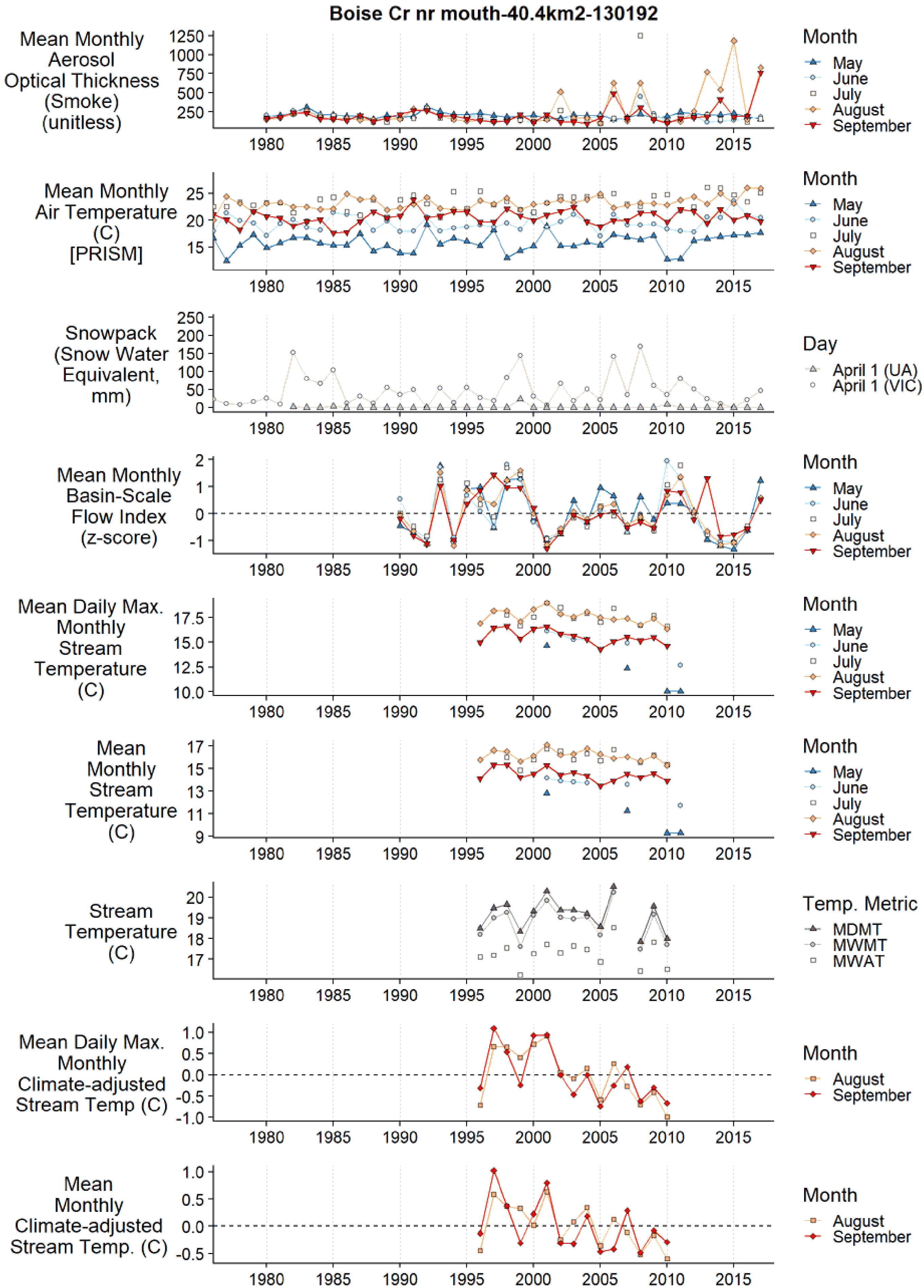
Boise Cr nr mouth-40.4km2-130192
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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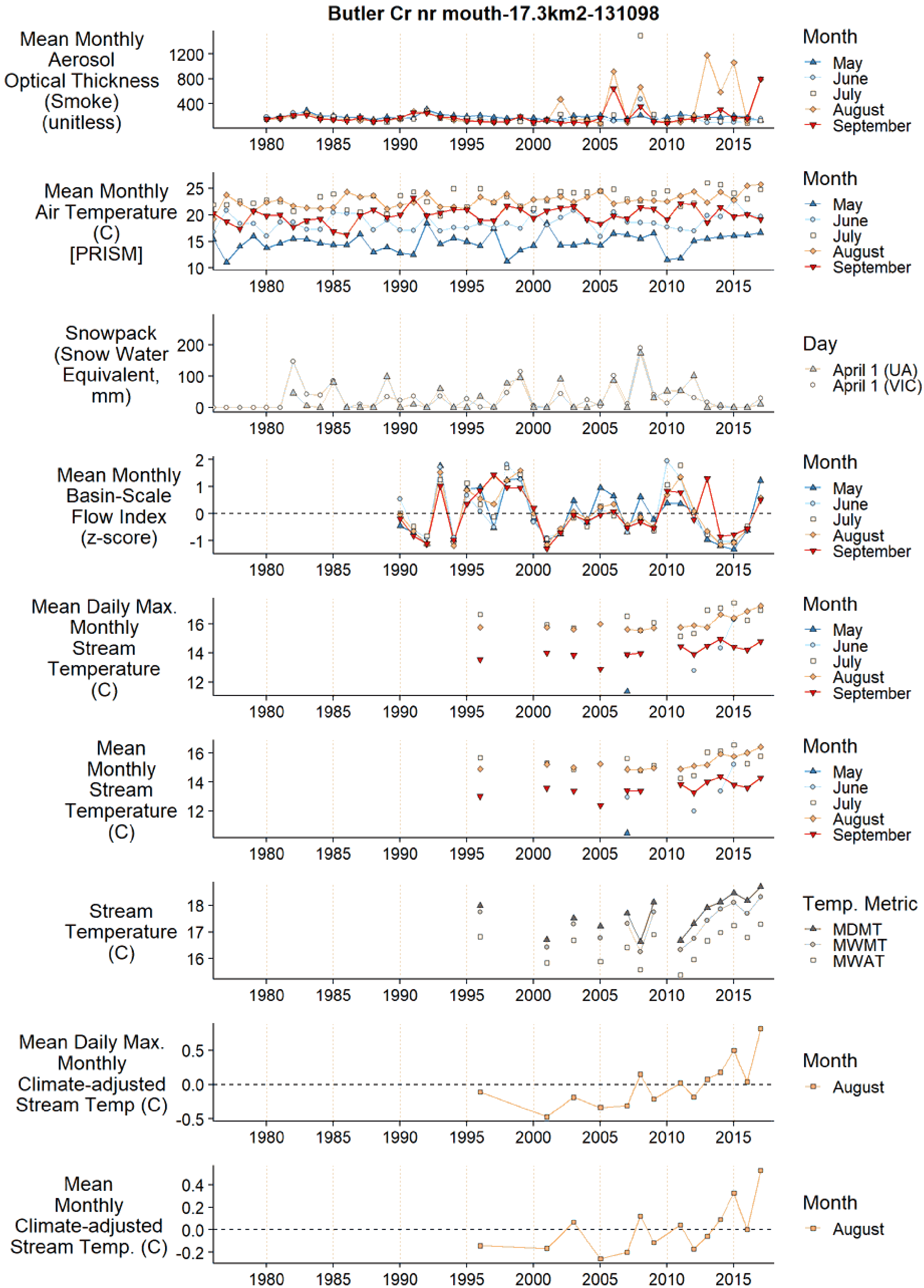
Butler Cr nr mouth-17.3km2-131098
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
1980
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Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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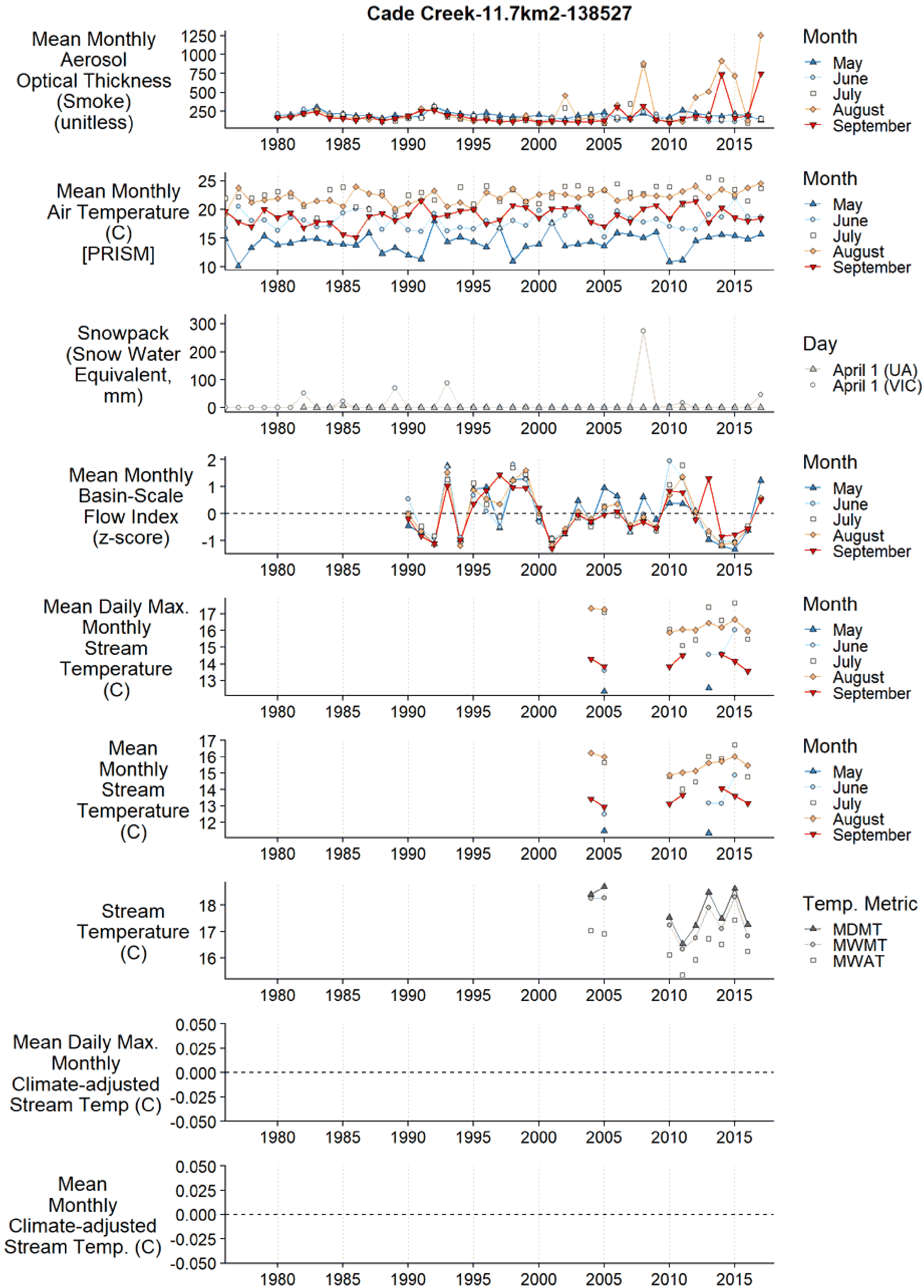
Cade Creek-11.7km2-138527
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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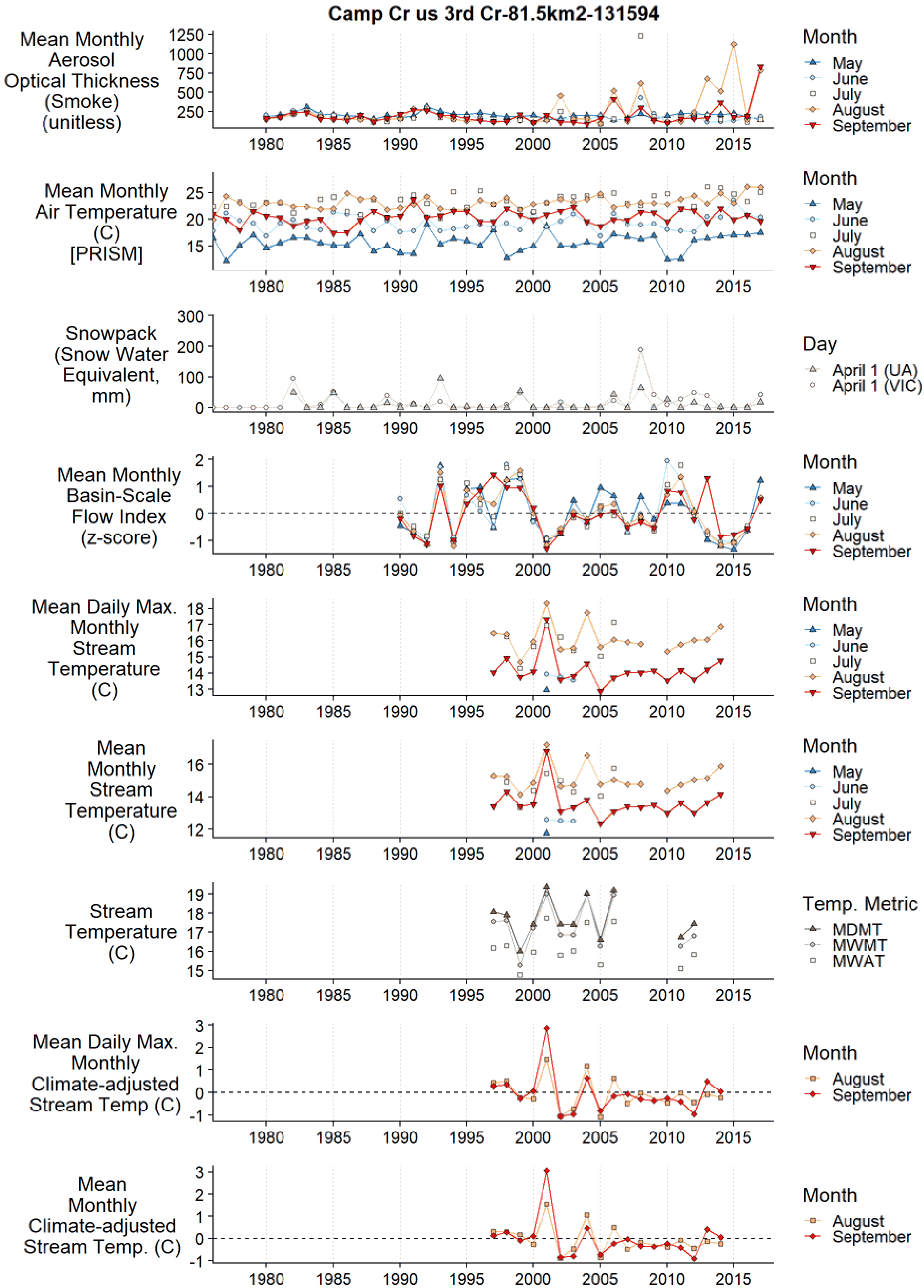
Camp Cr us 3rd Cr-81.5km2-131594
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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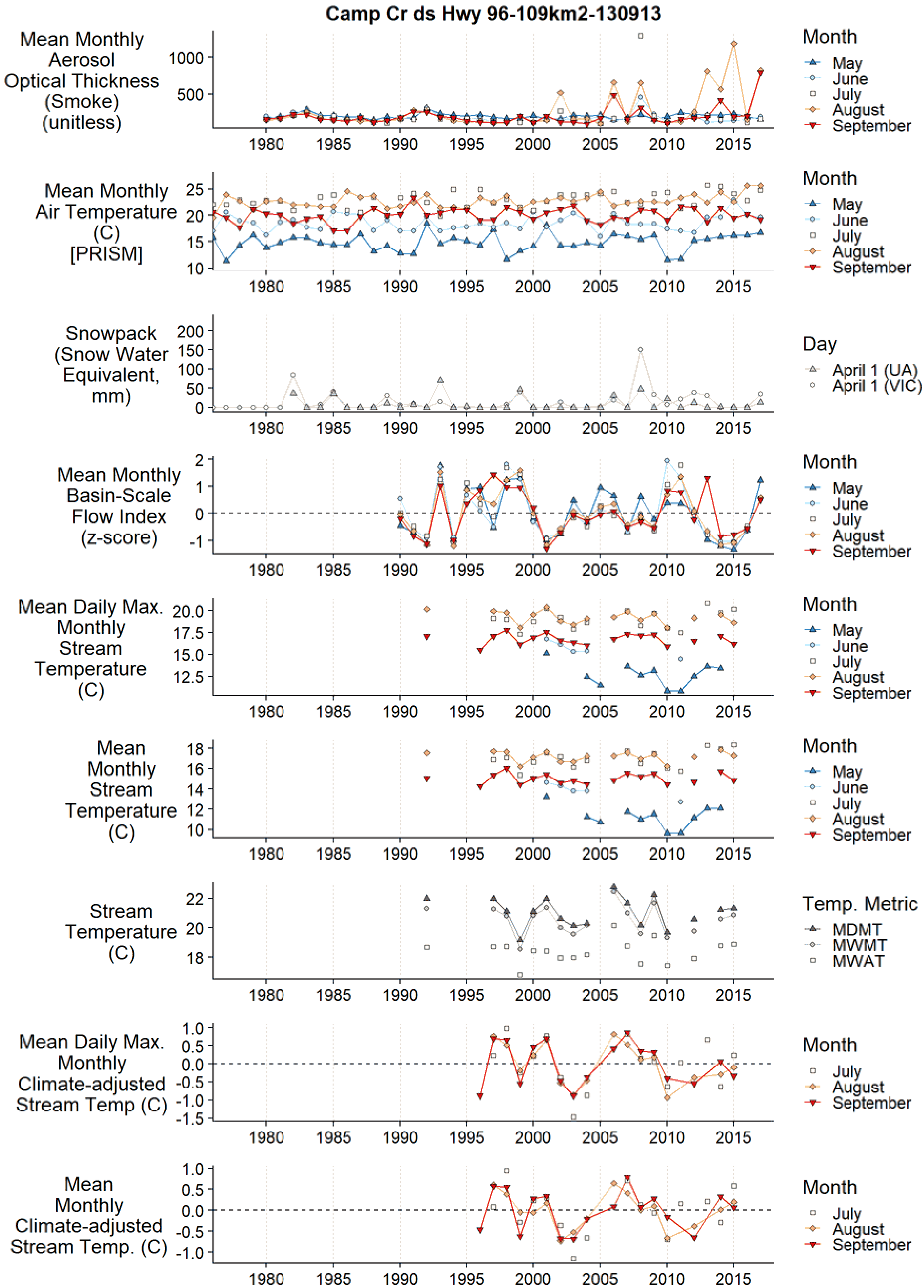

Camp Cr ds Hwy 96-109km2-130913
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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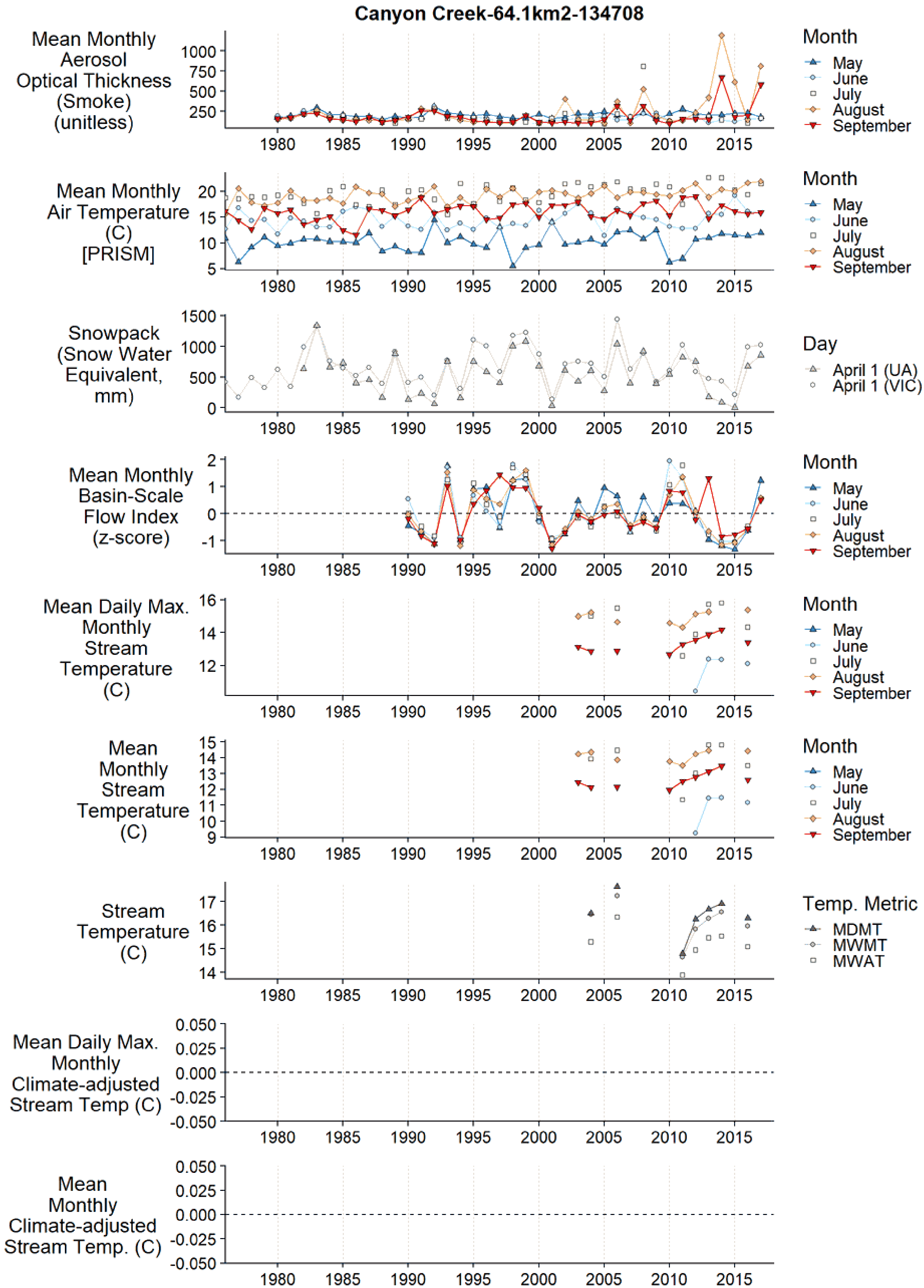

Canyon Creek-64.1km2-134708
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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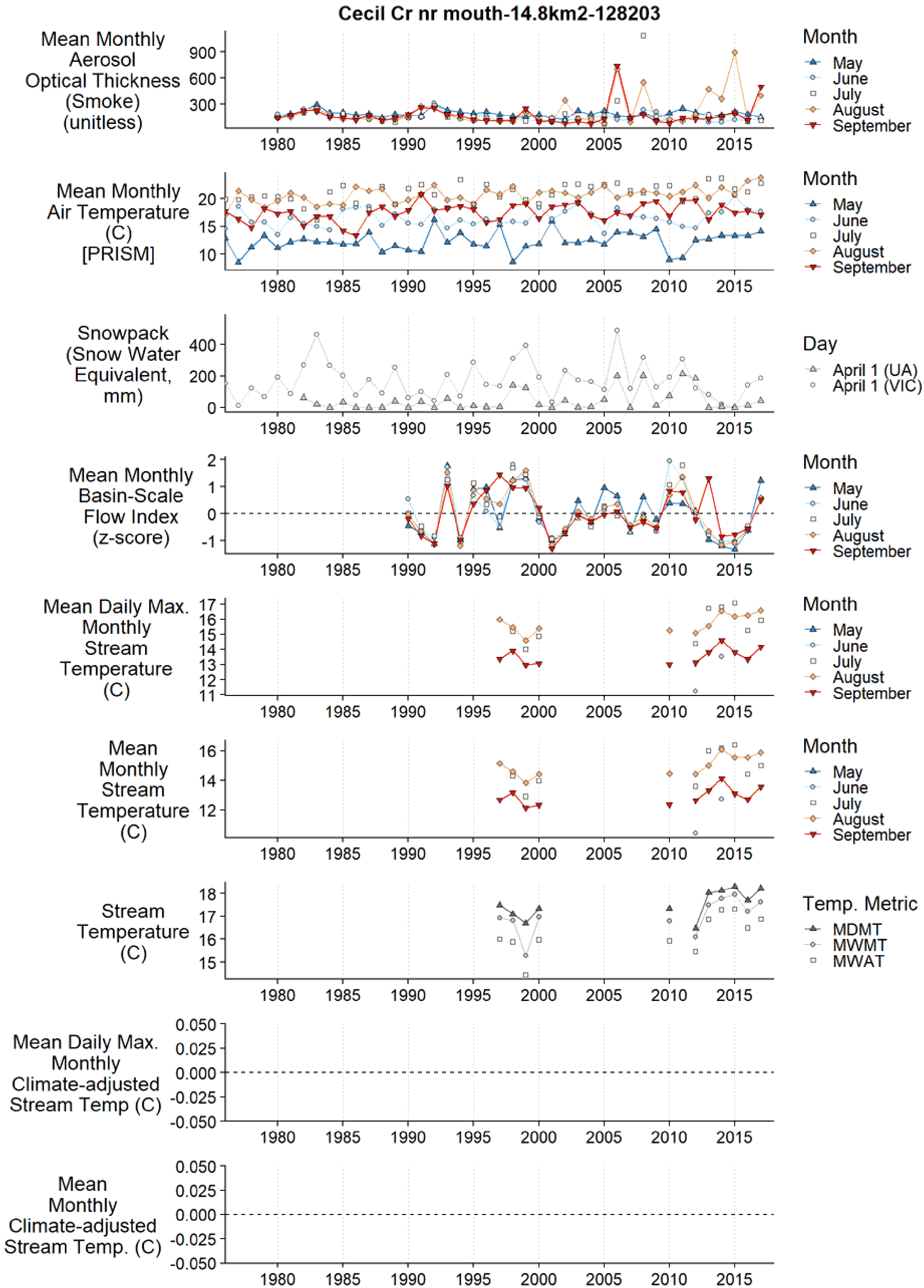
Cecil Cr nr mouth-14.8km2-128203
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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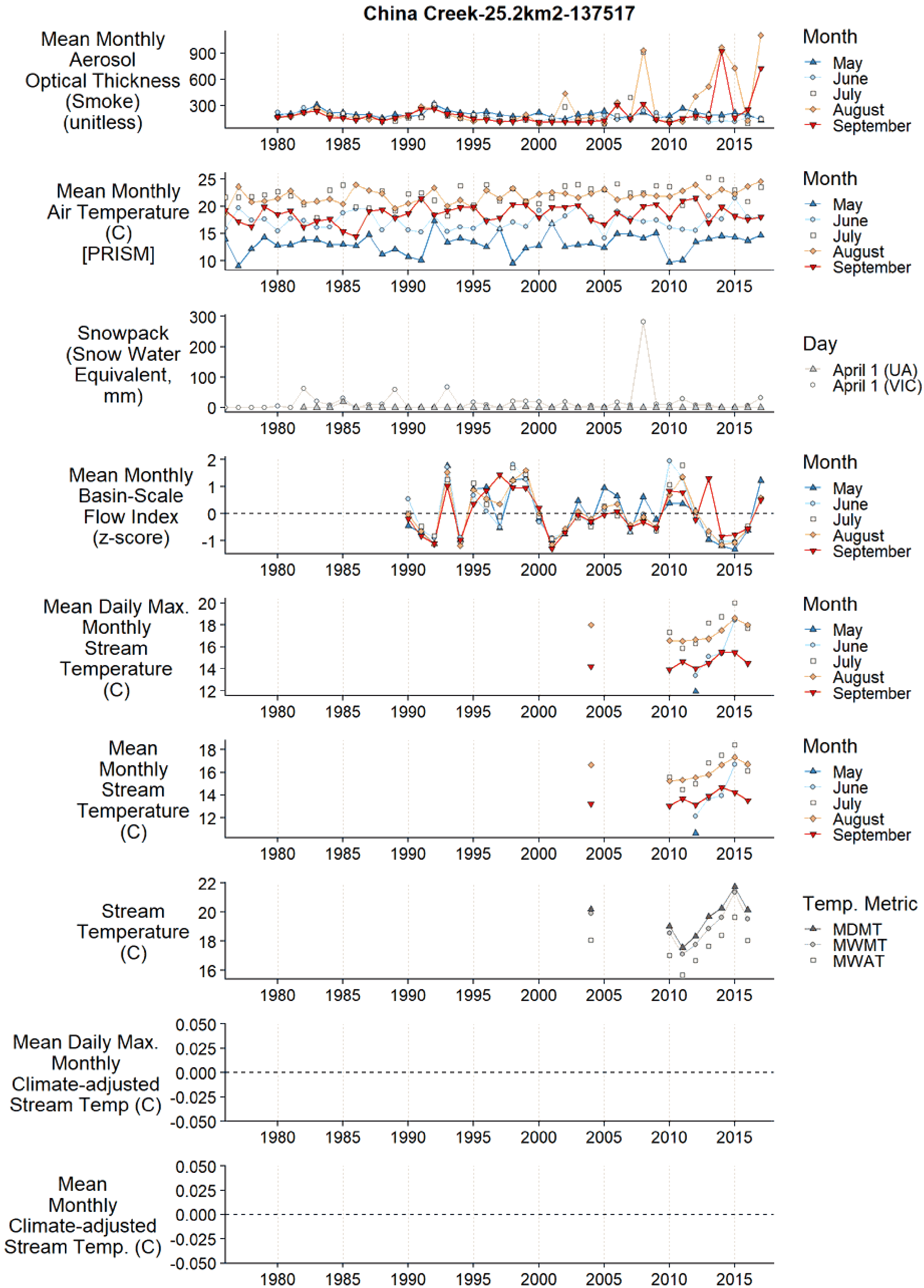
China Creek-25.2km2-137517
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
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Temp. Metric
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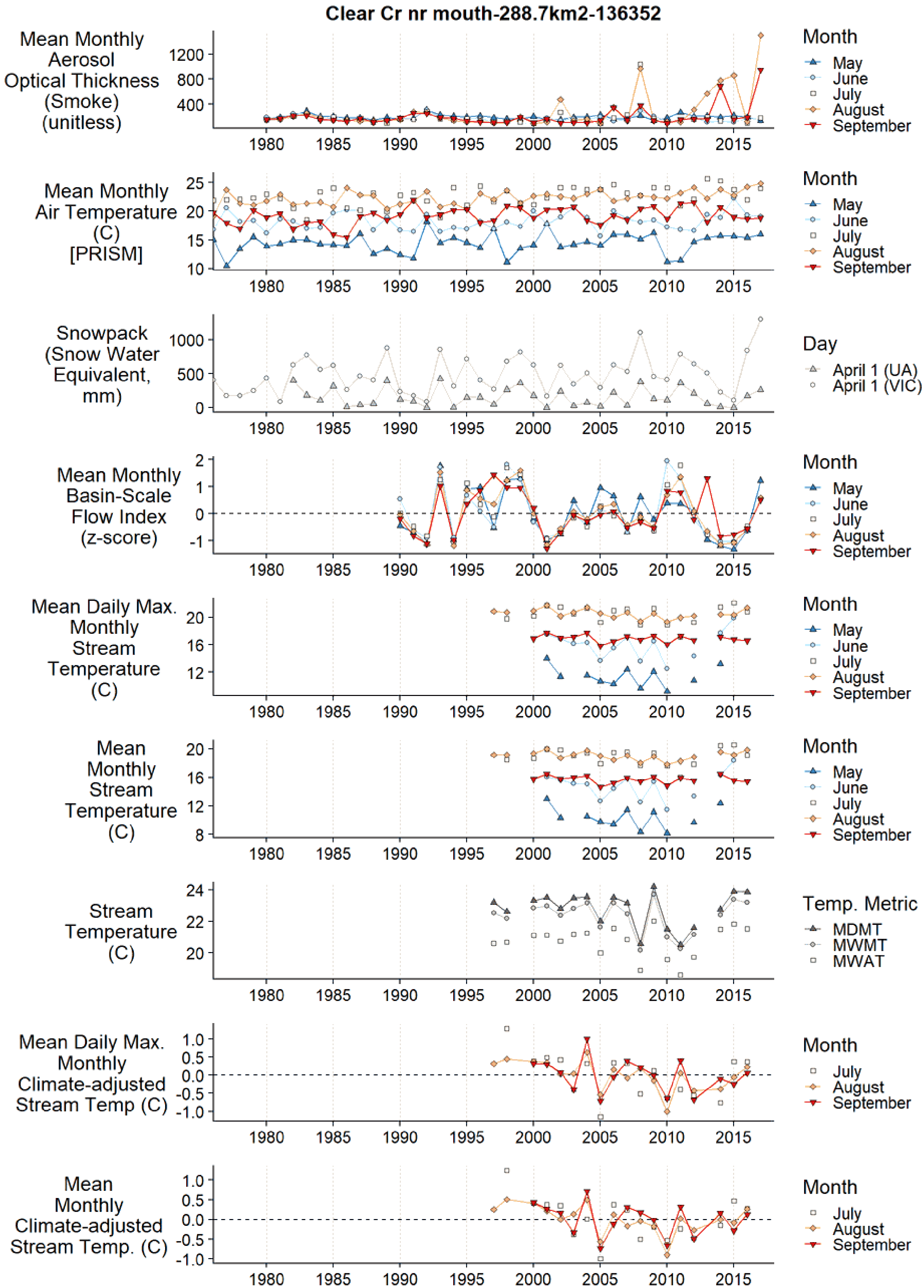
Clear Cr nr mouth-288.7km2-136352
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Temp. Metric
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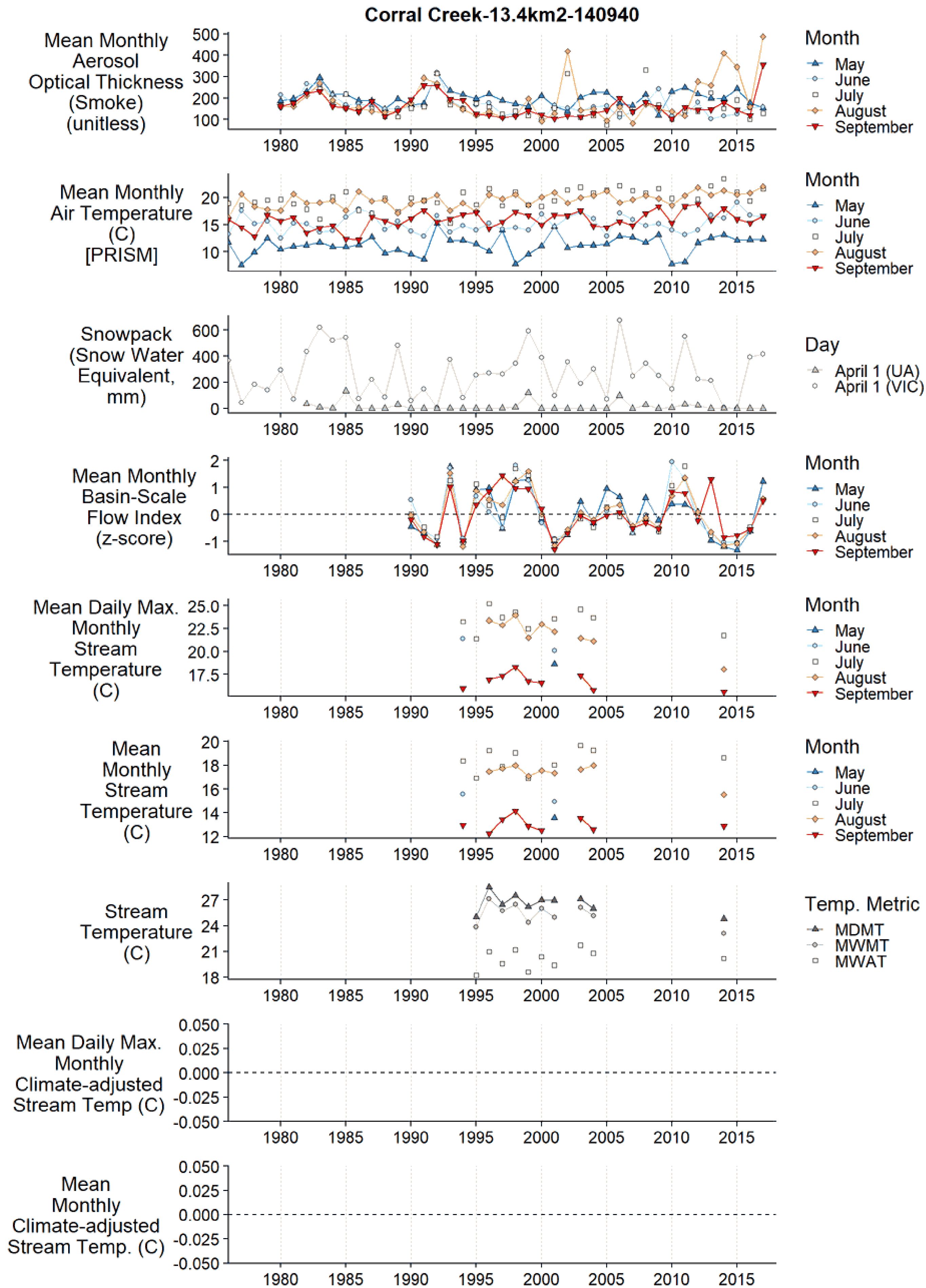
Corral Creek-13.4km2-140940
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
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Temp. Metric
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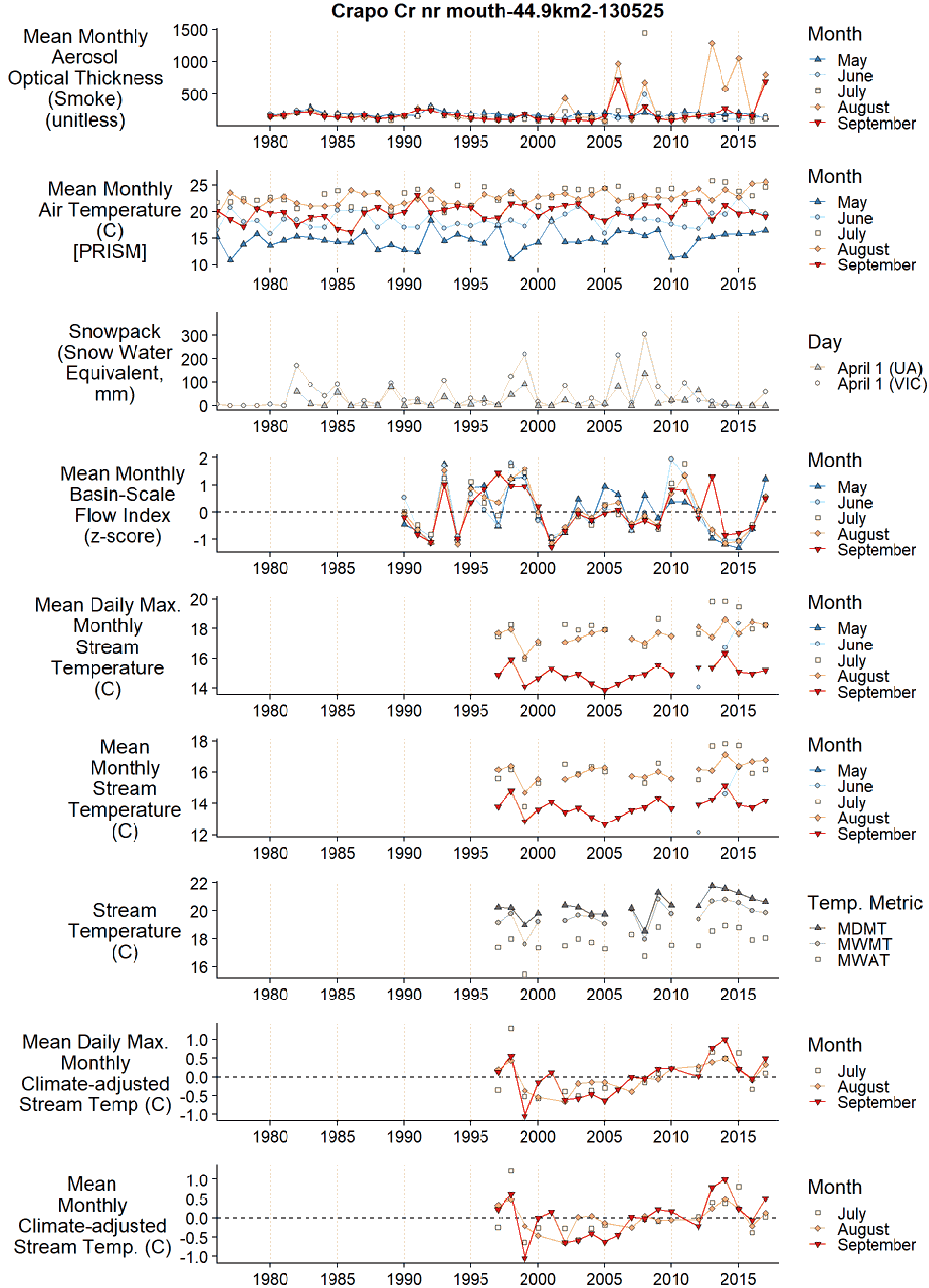
Crapo Cr nr mouth-44.9km2-130525
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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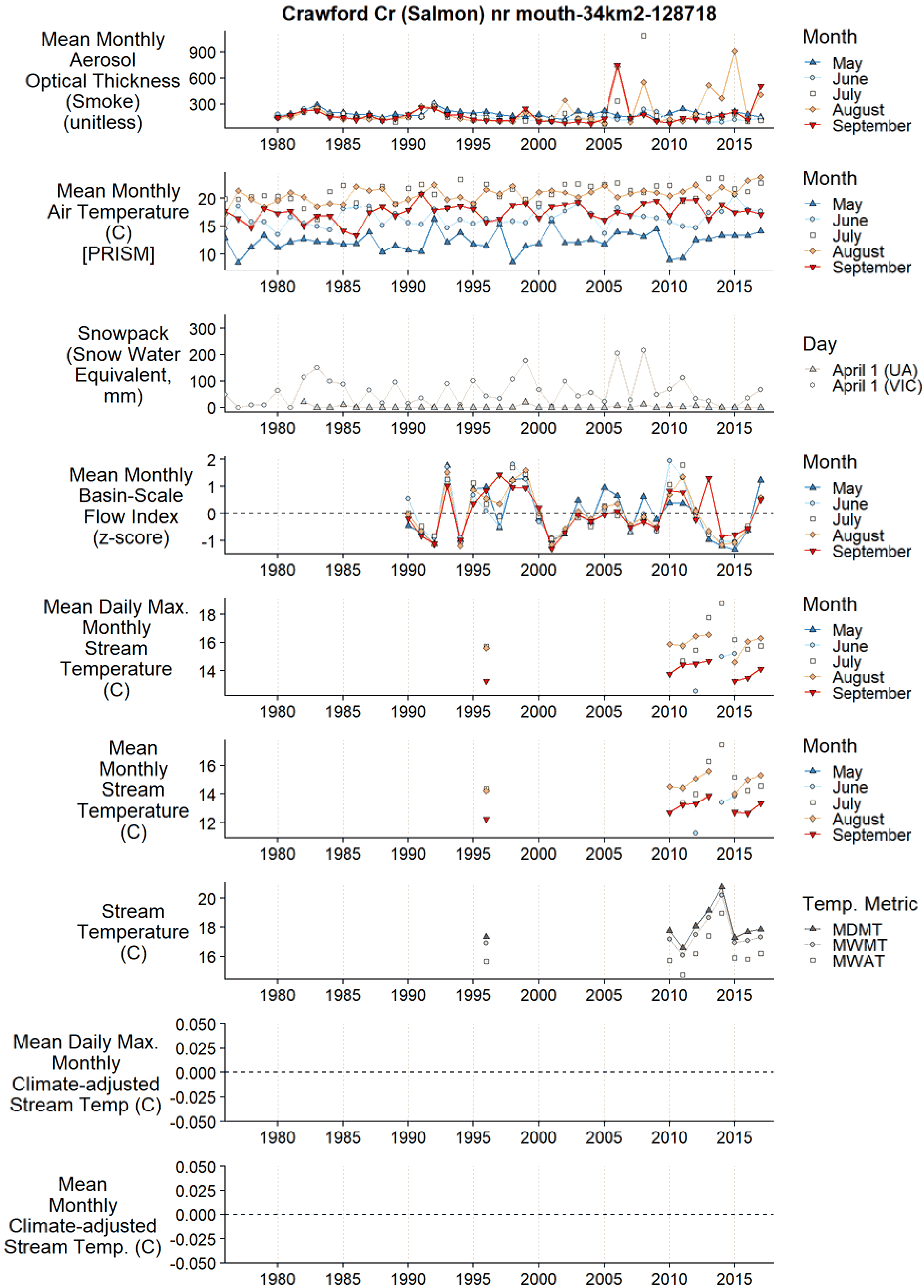

Crawford Cr (Salmon) nr mouth-34km2-128718
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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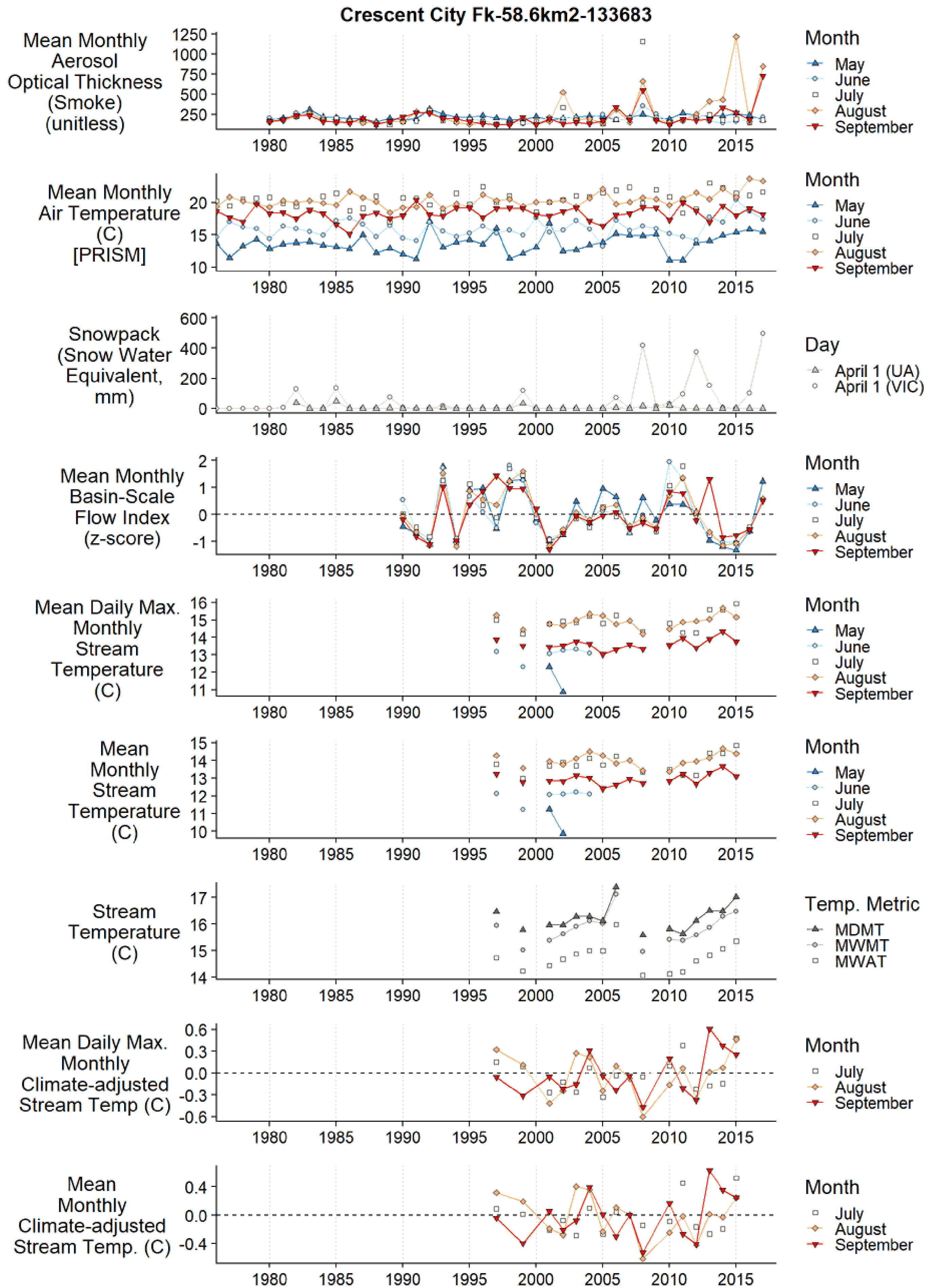
Crescent City Fk-58.6km2-133683
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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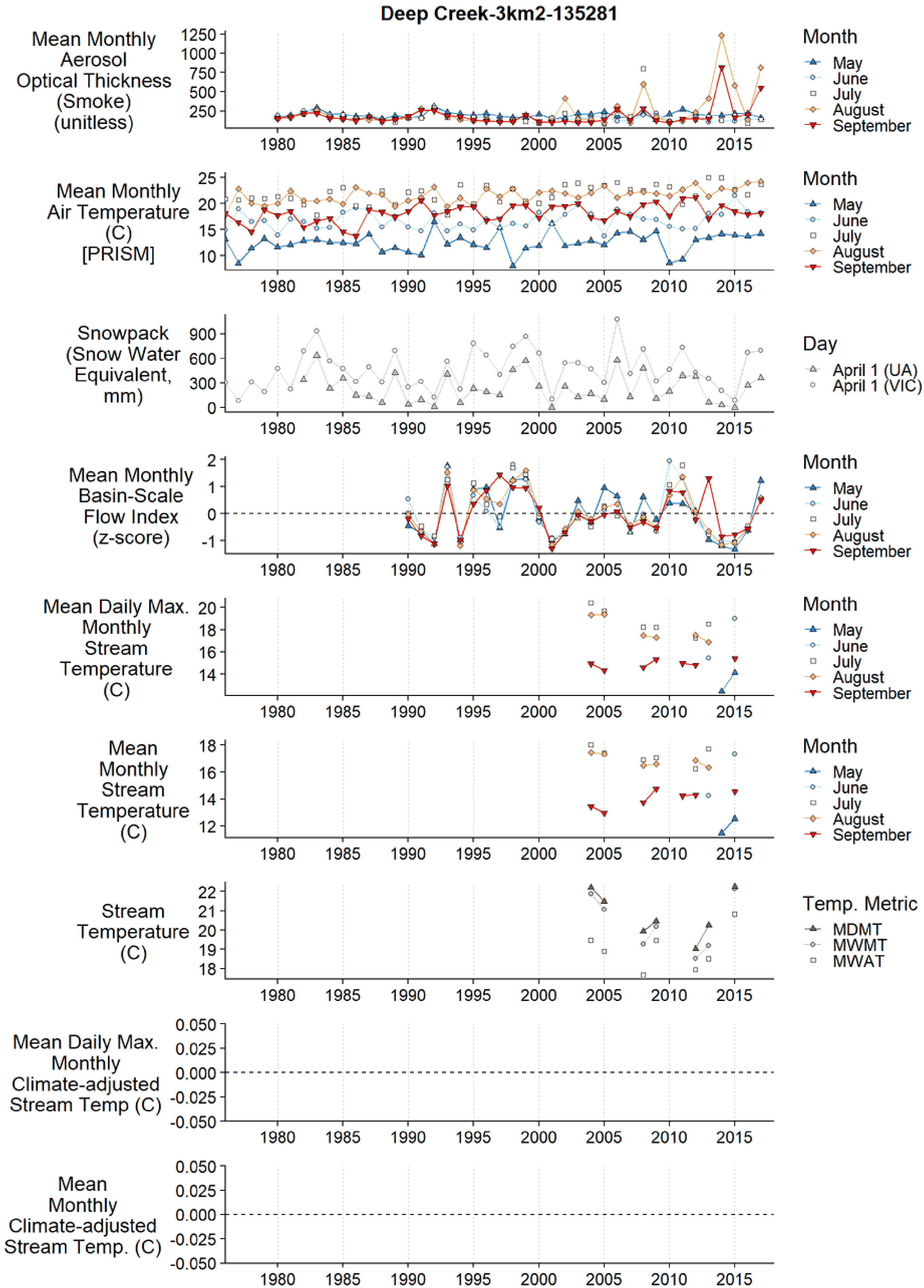
Deep Creek-3km2-135281
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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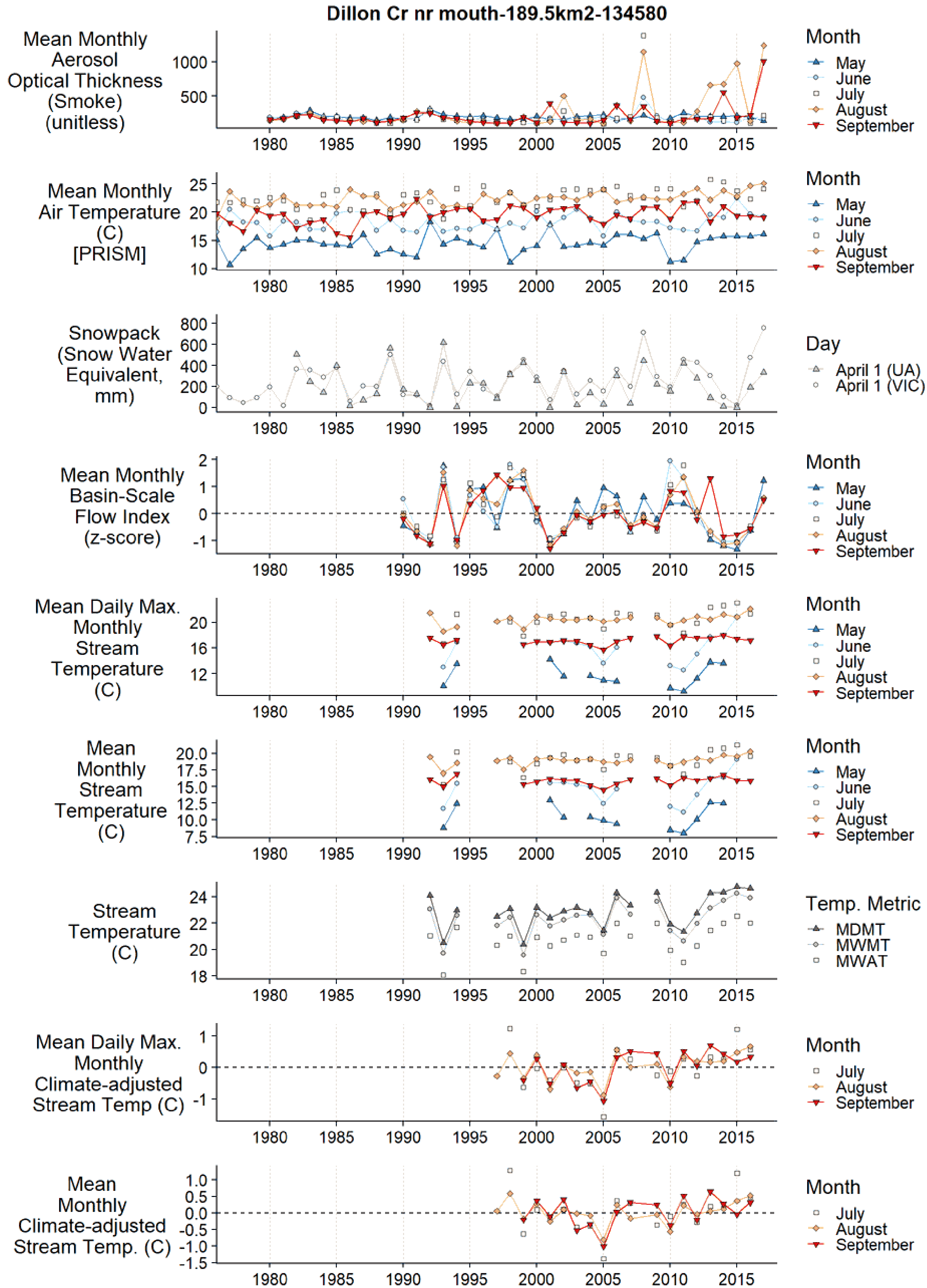
Dillon Cr nr mouth-189.5km2-134580
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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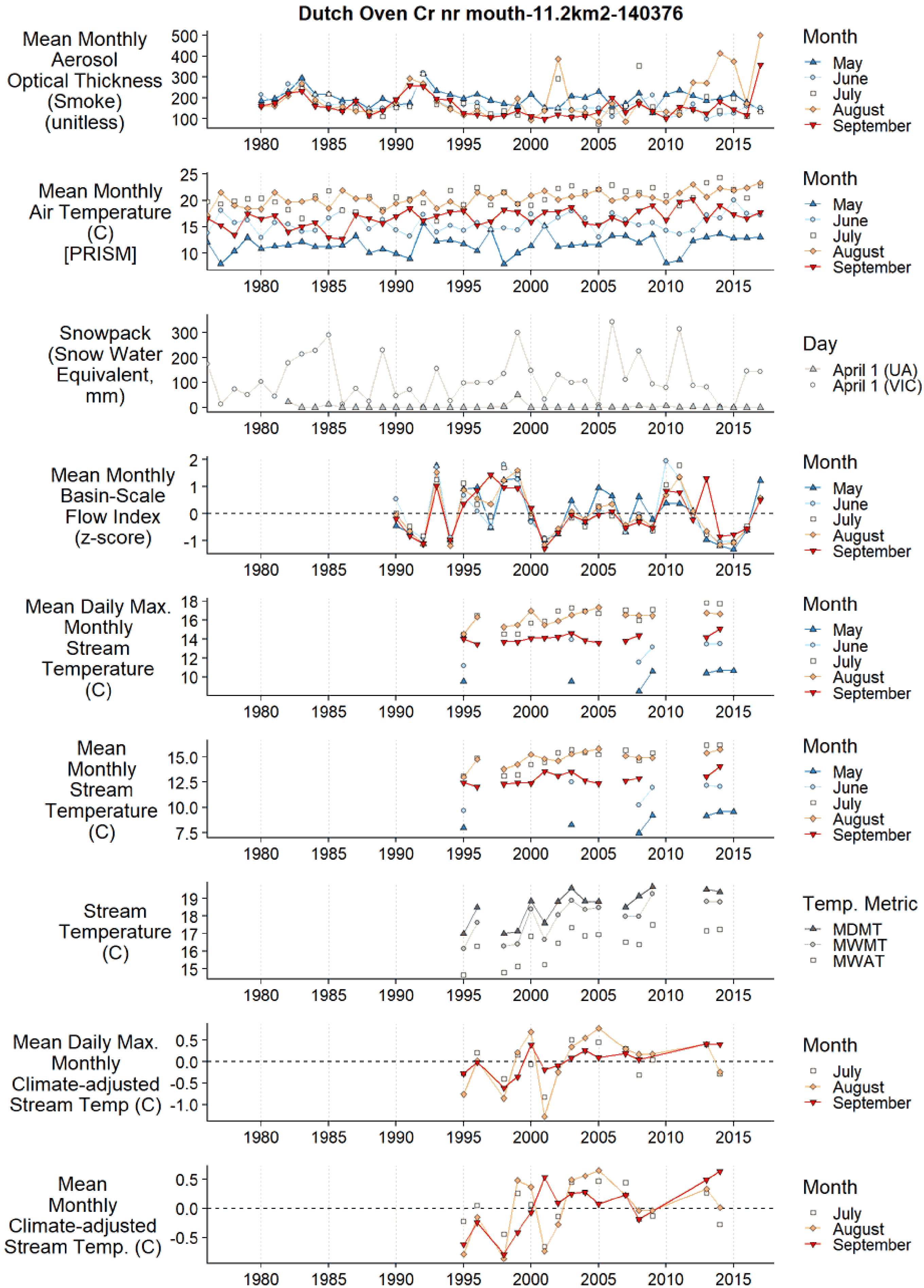

Dutch Oven Cr nr mouth-11.2km2-140376
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
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August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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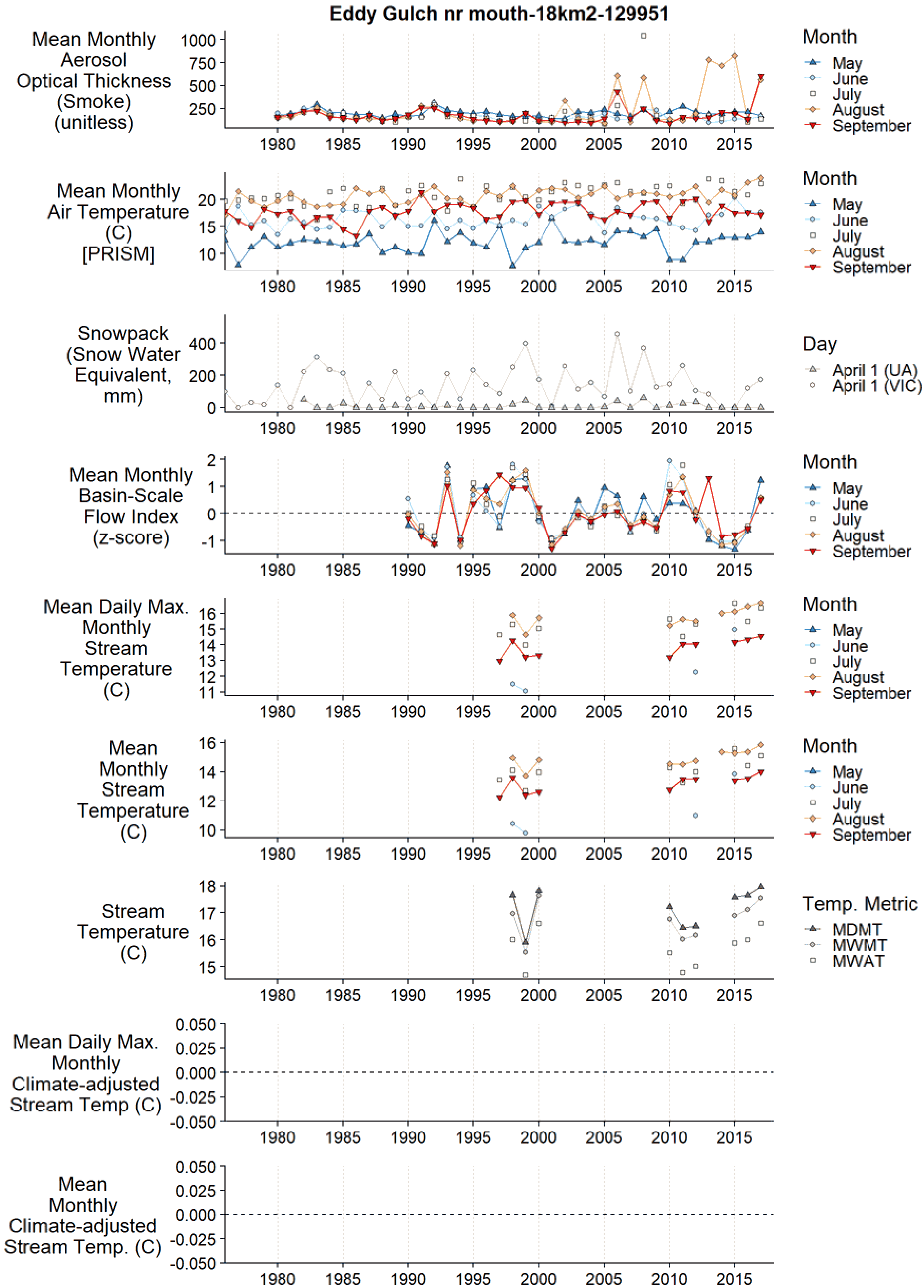
Eddy Gulch nr mouth-18km2-129951
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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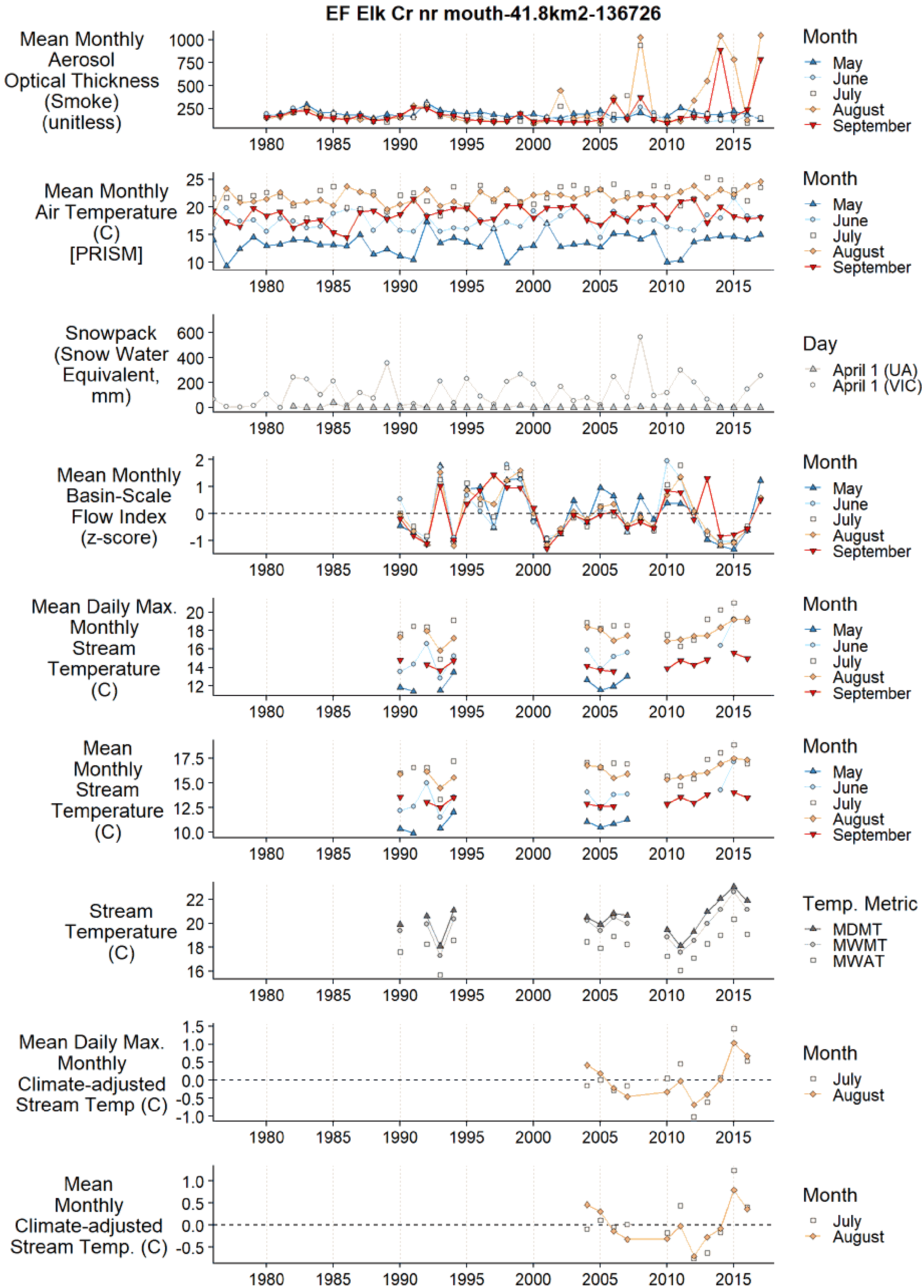
EF Elk Cr nr mouth-41.8km2-136726
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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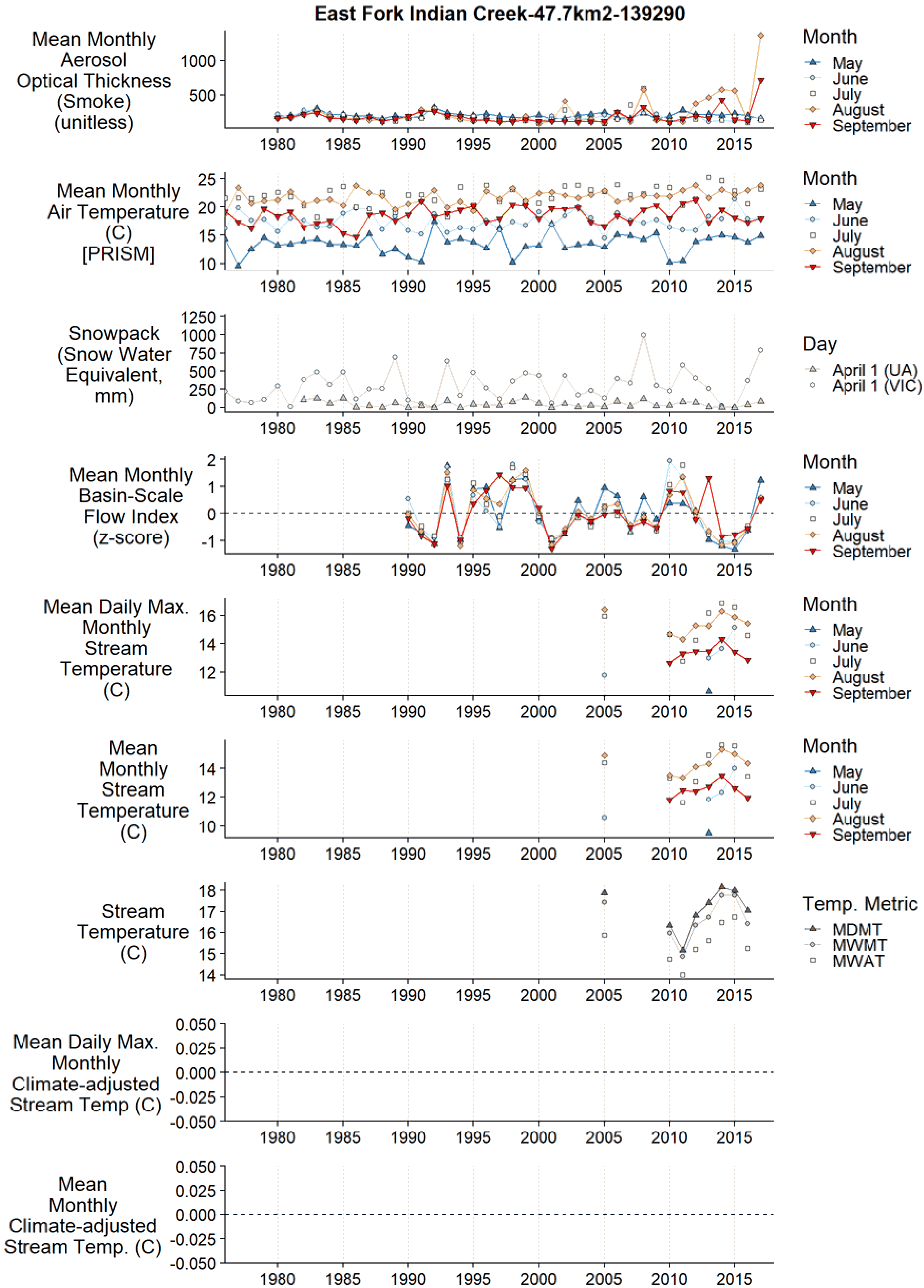

East Fork Indian Creek-47.7km2-139290
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
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August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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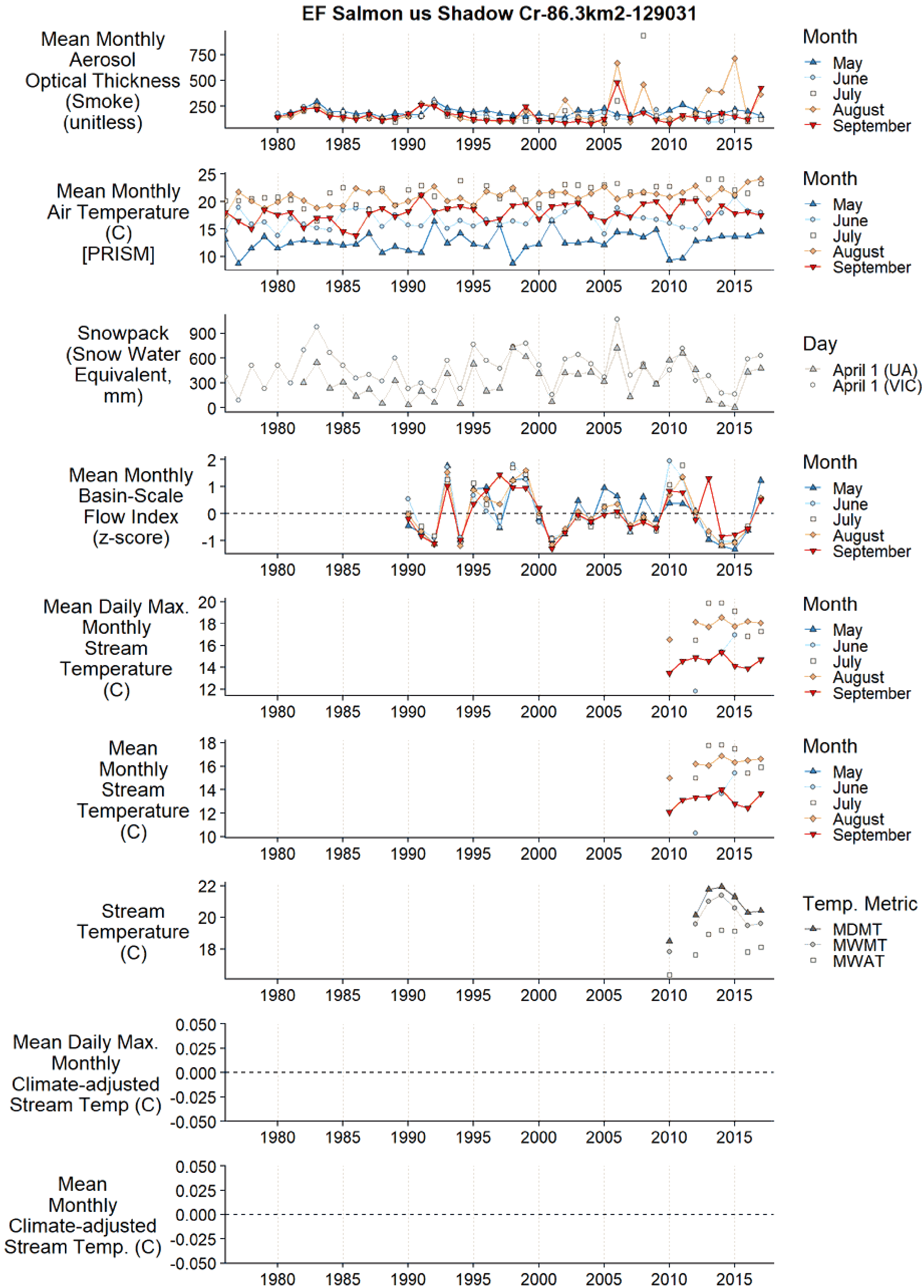
EF Salmon us Shadow Cr-86.3km2-129031
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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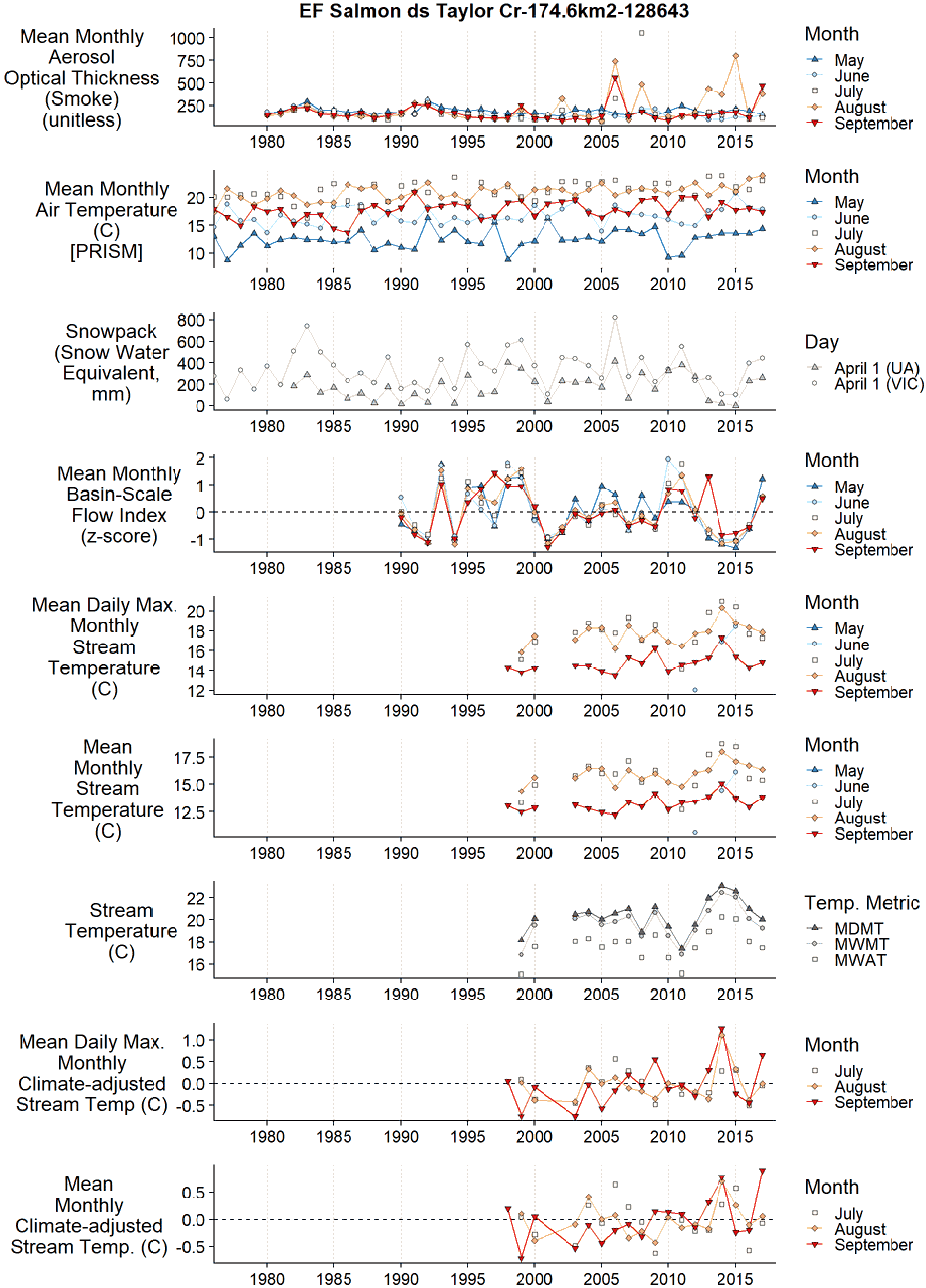
EF Salmon ds Taylor Cr-174.6km2-128643
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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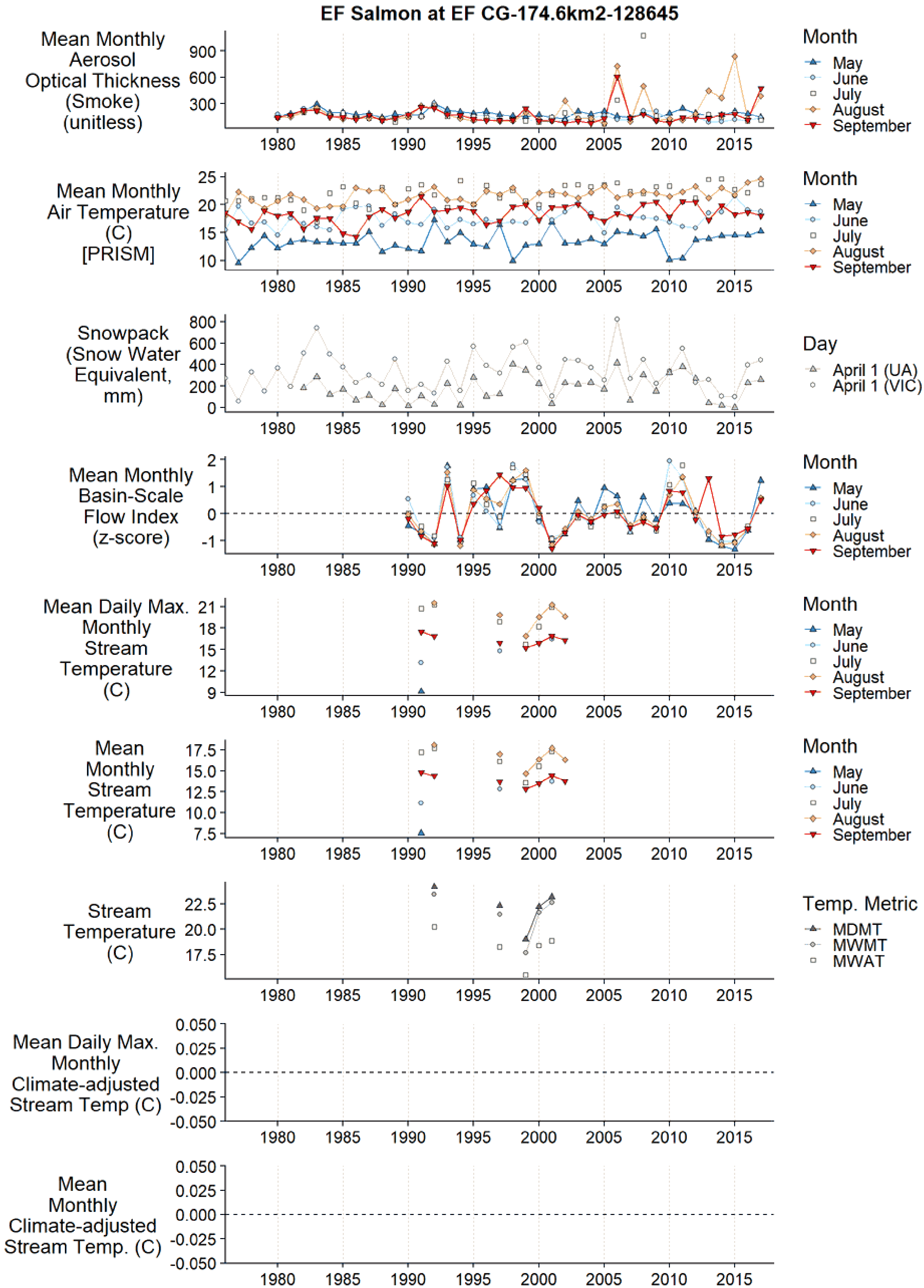

EF Salmon at EF CG-174.6km2-128645
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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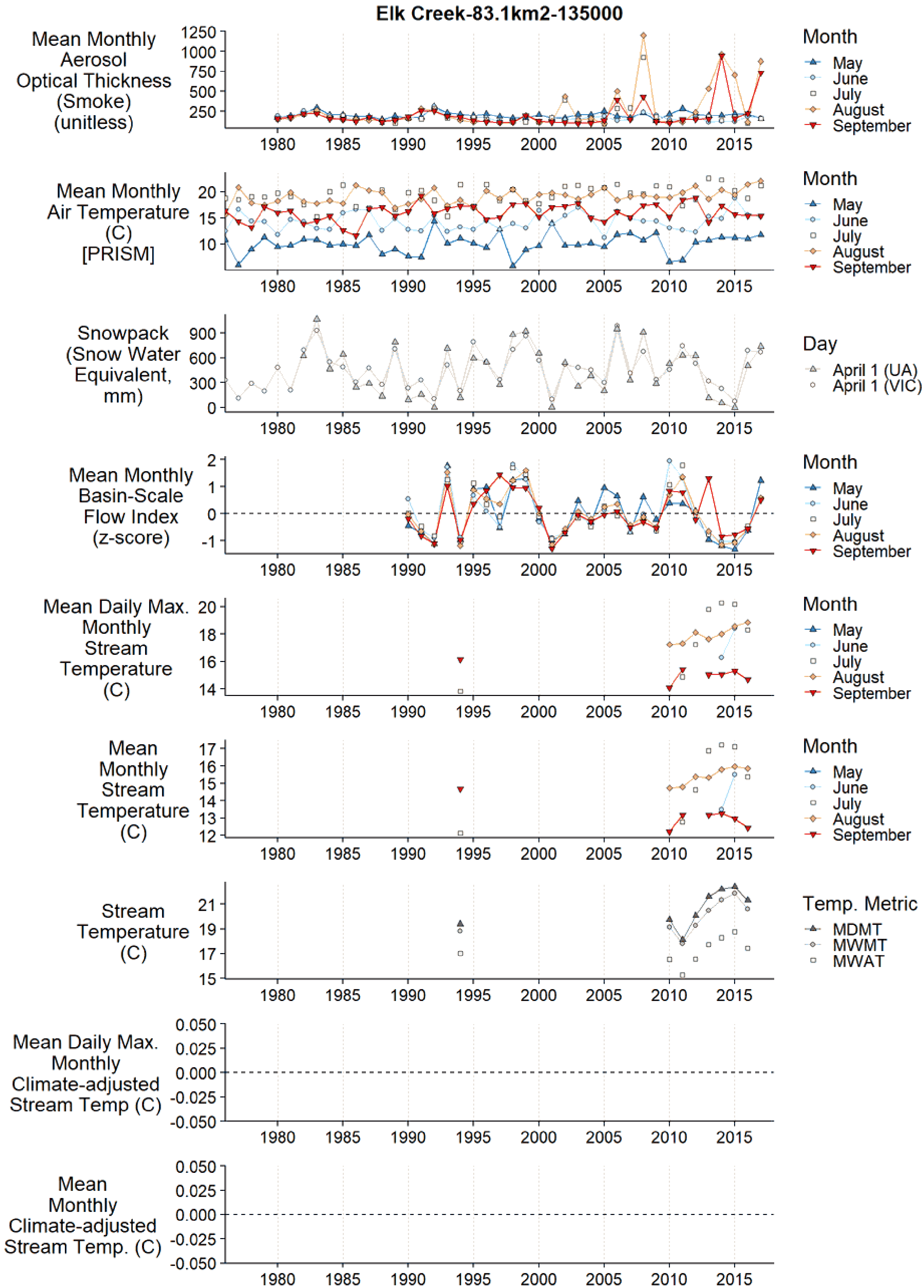
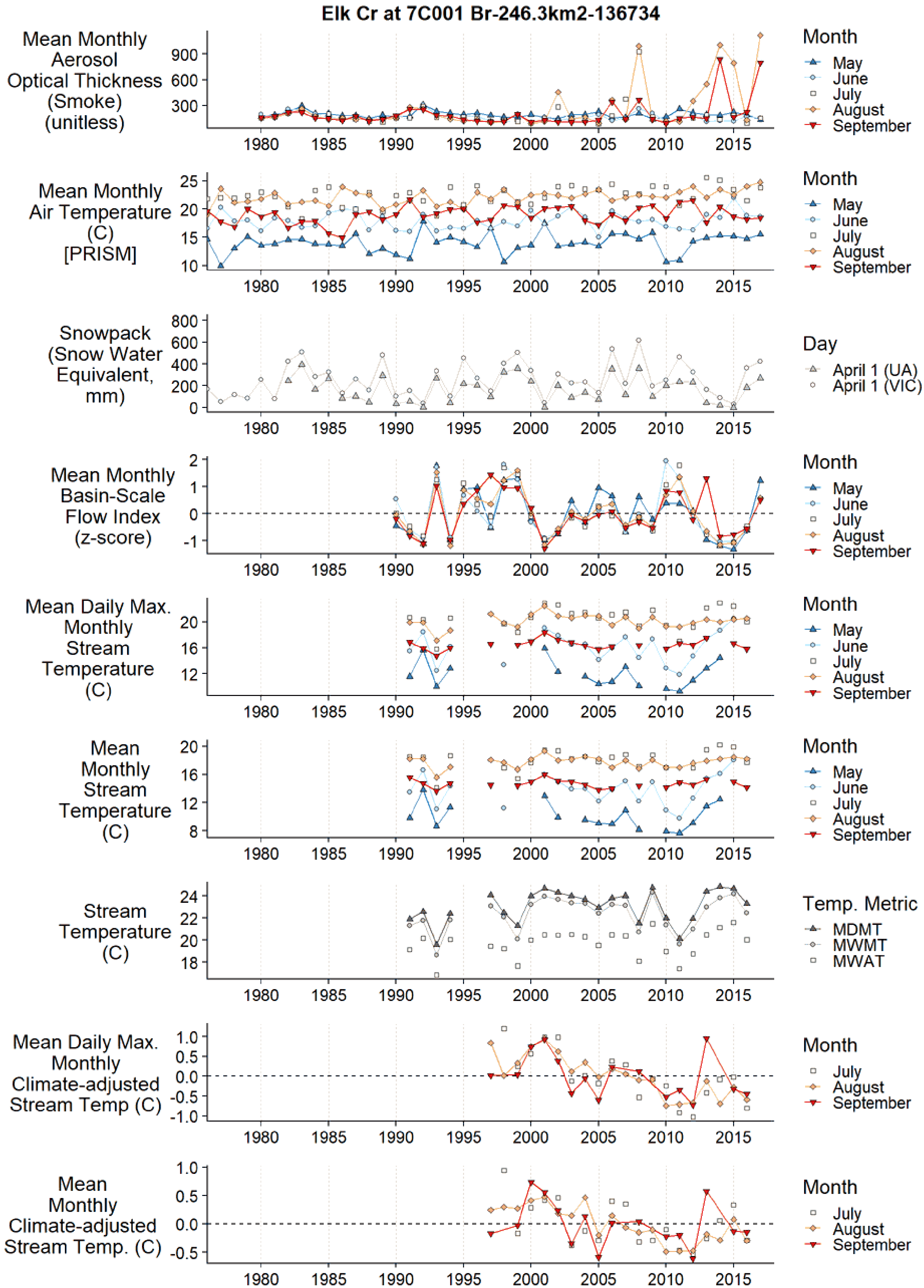


Elk Creek-83.1km2-135000
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT


Elk Cr at 7C001 Br-246.3km2-136734
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Month
May
June
July
August
September
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Month
May
June
July
August
September
Mean Daily Max. Monthly Stream Temperature (C)
Month
May
June
July
August
September
Mean Monthly Stream Temperature (C)
Month
May
June
July
August
September
Stream Temperature (C)
Temp. Metric
MDMT
MWMT
MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Month
July
August
September
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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August
September
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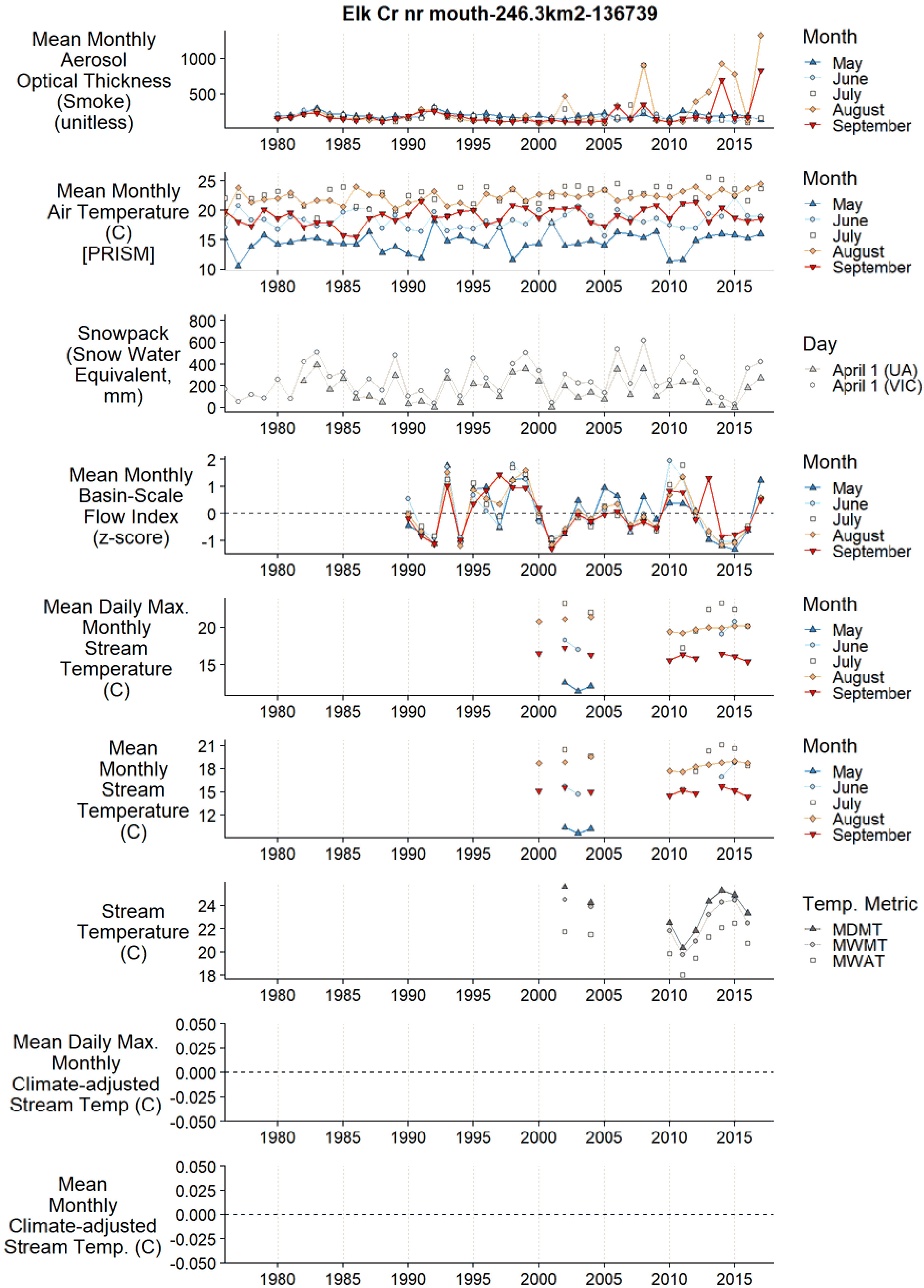
2015


Elk Cr nr mouth-246.3km2-136739
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
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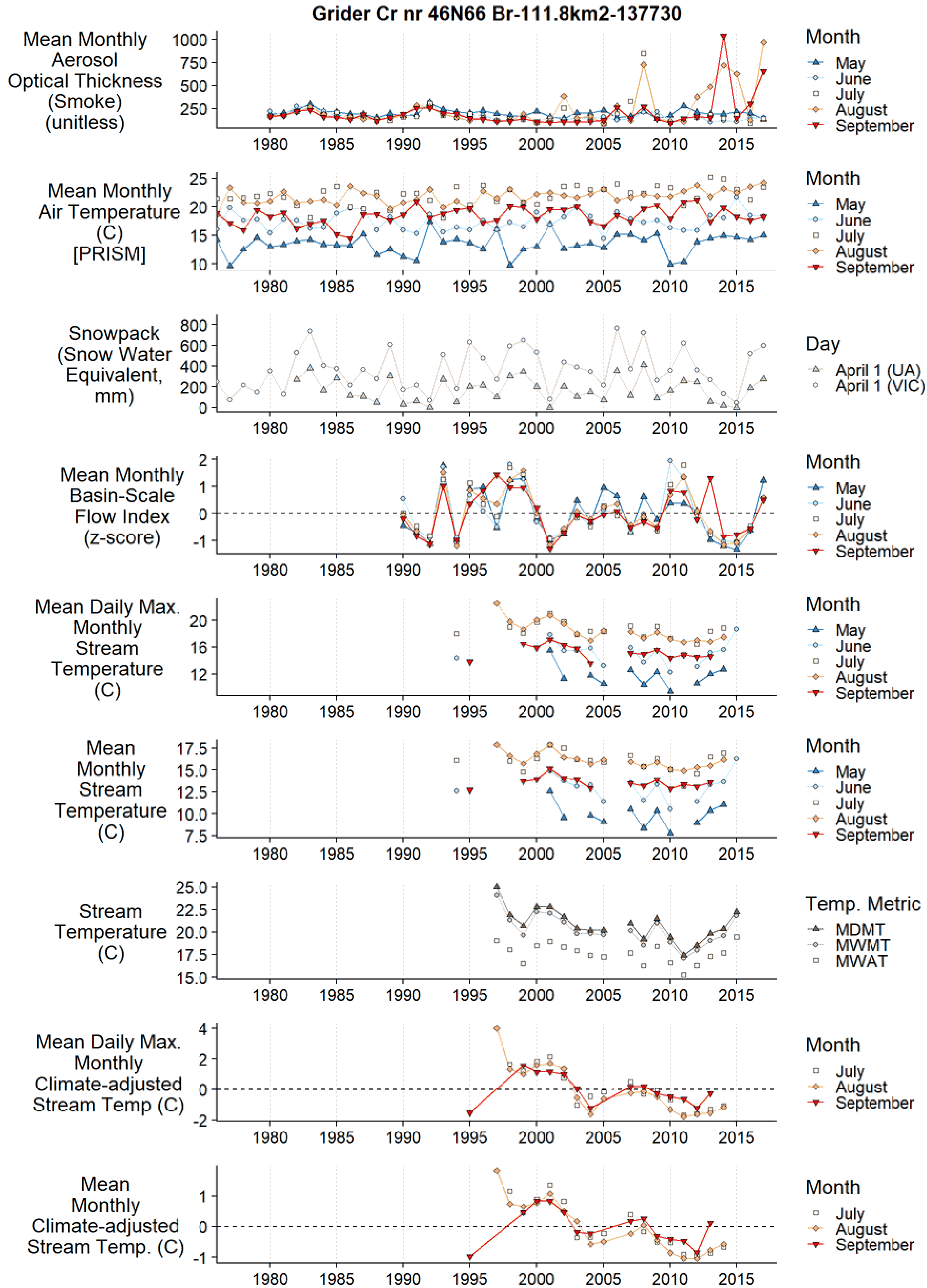

Grider Cr nr 46N66 Br-111.8km2-137730
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
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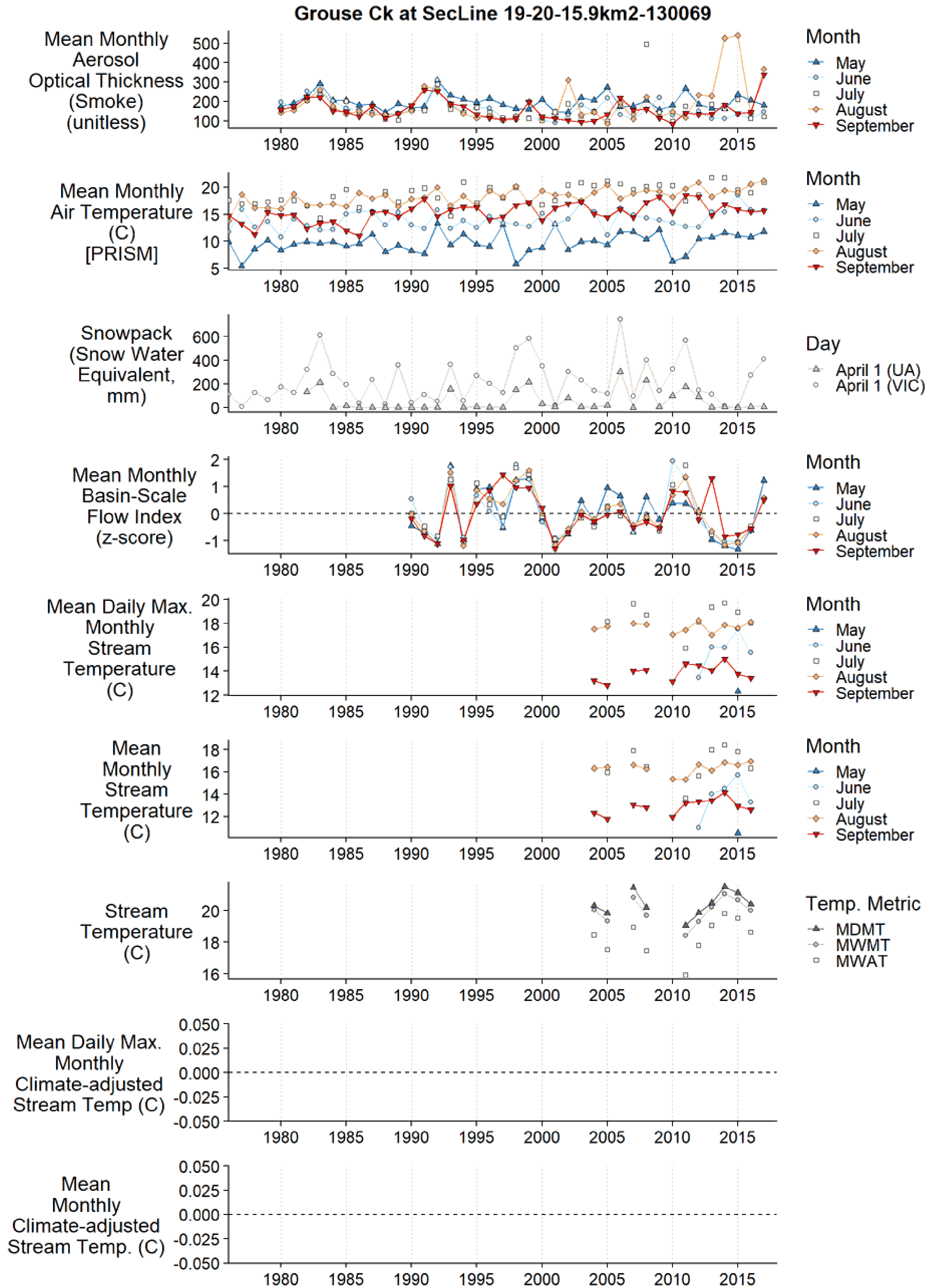
Grouse Ck at SecLine 19-20-15.9km2-130069
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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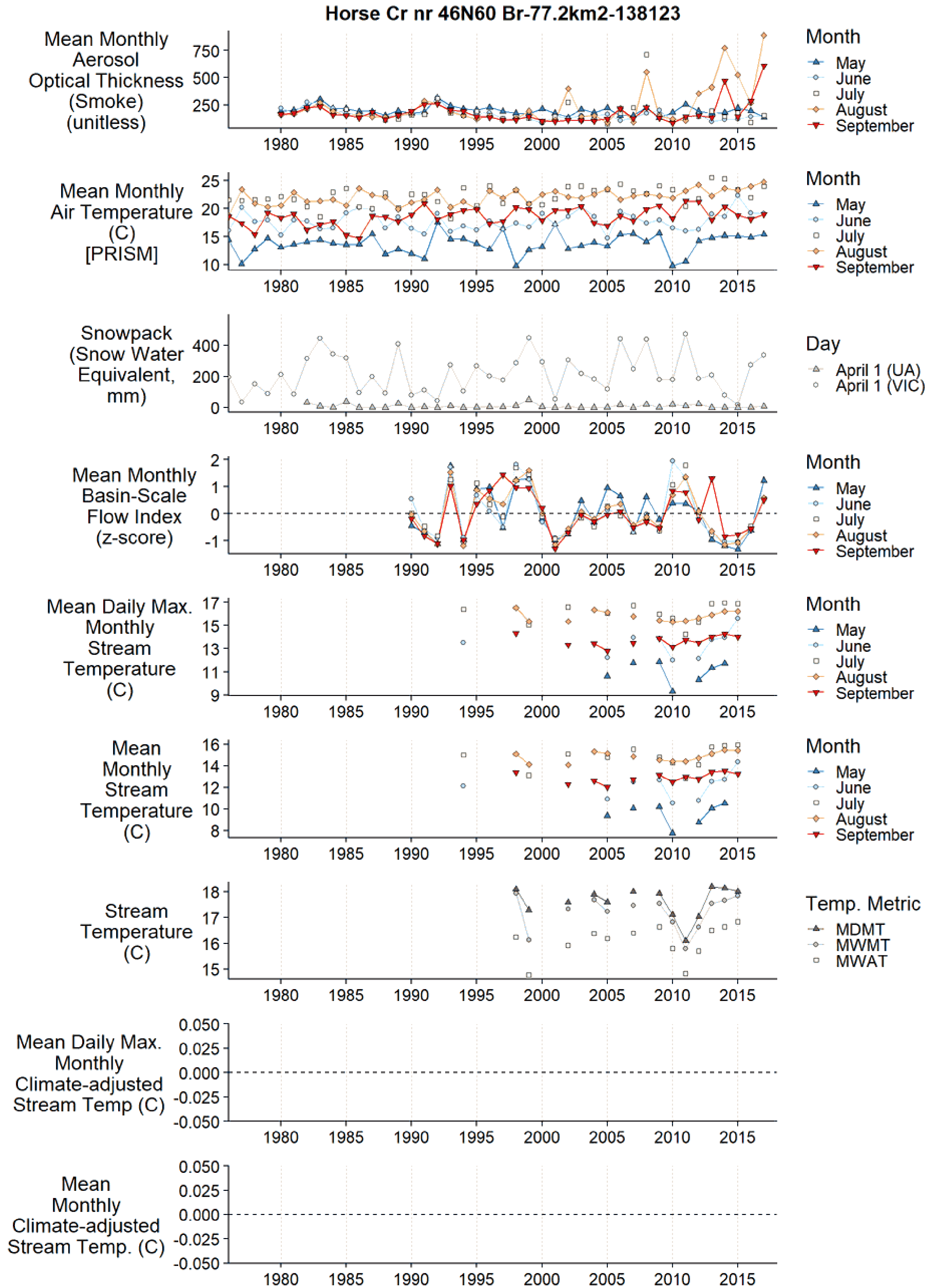
Horse Cr nr 46N60 Br-77.2km2-138123
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
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1980
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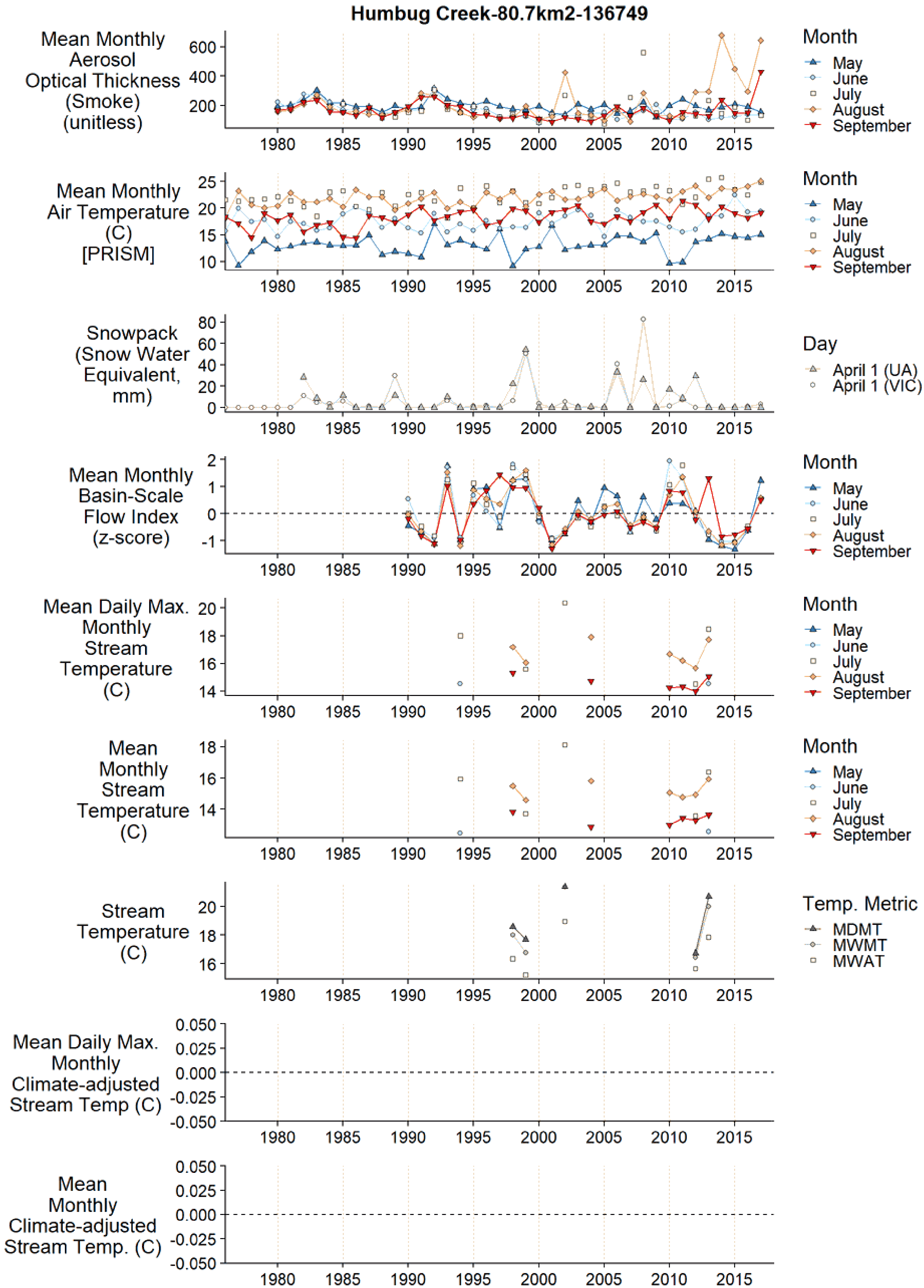

Humbug Creek-80.7km2-136749
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
MDMT
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MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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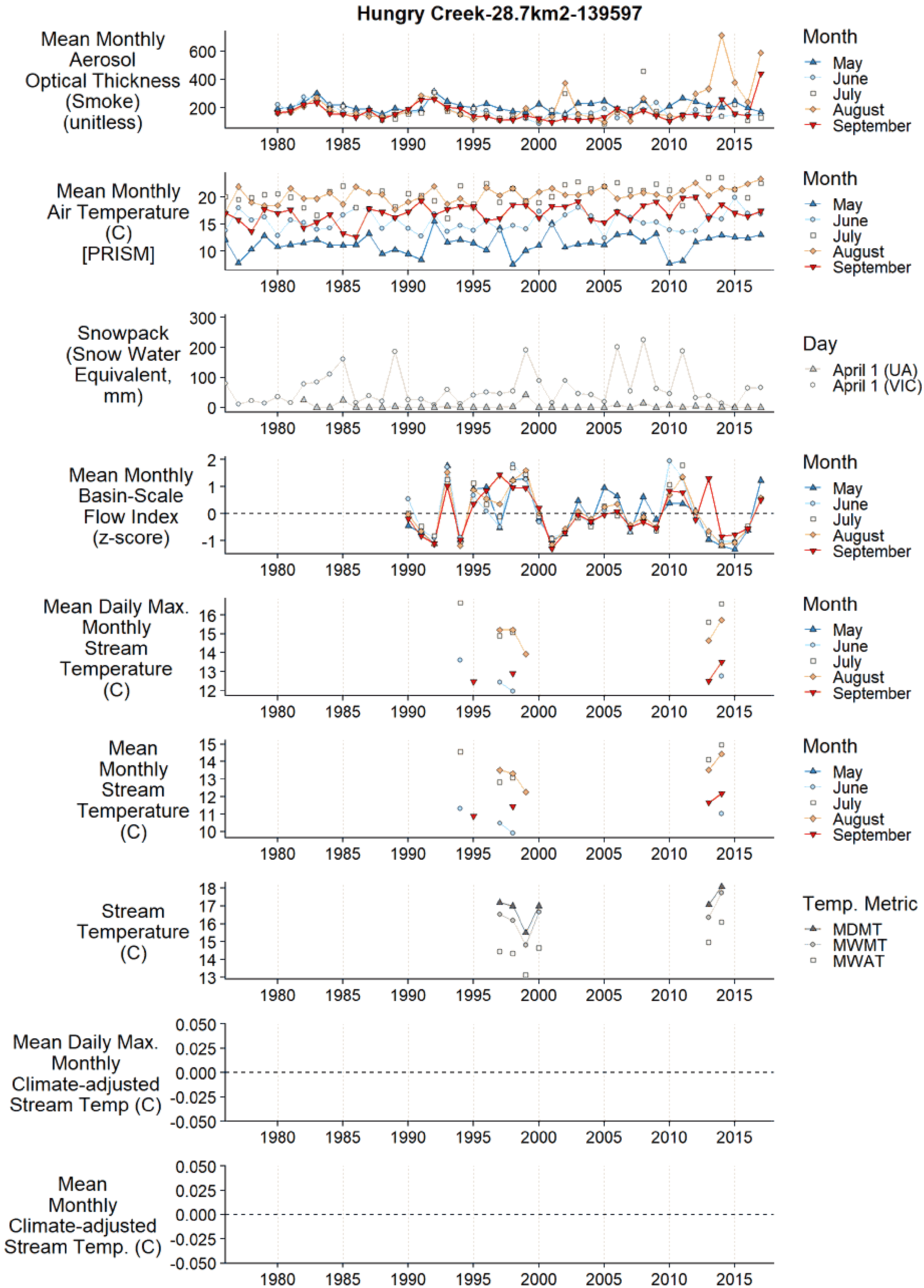
Hungry Creek-28.7km2-139597
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
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July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
MDMT
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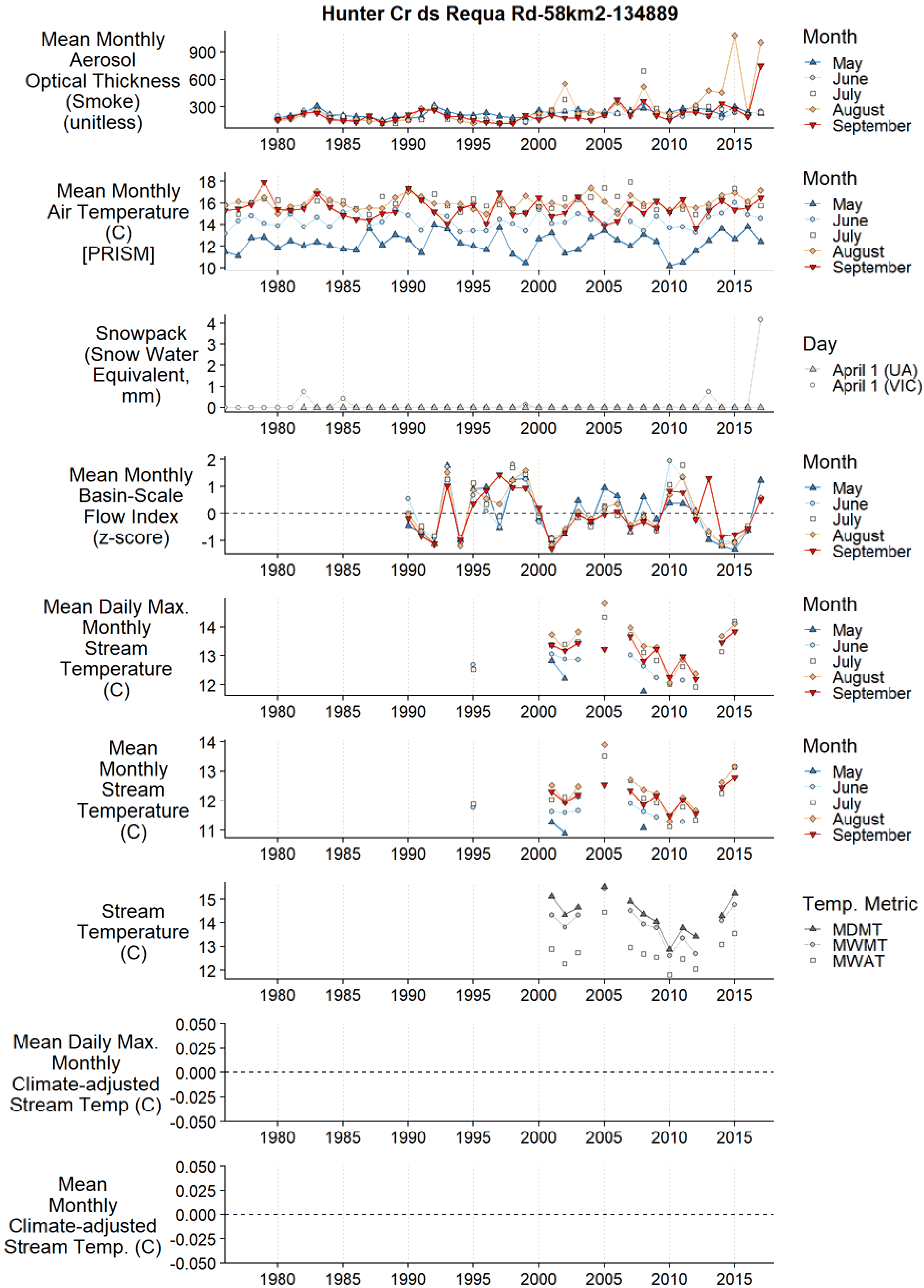
MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)


Hunter Cr ds Requa Rd-58km2-134889
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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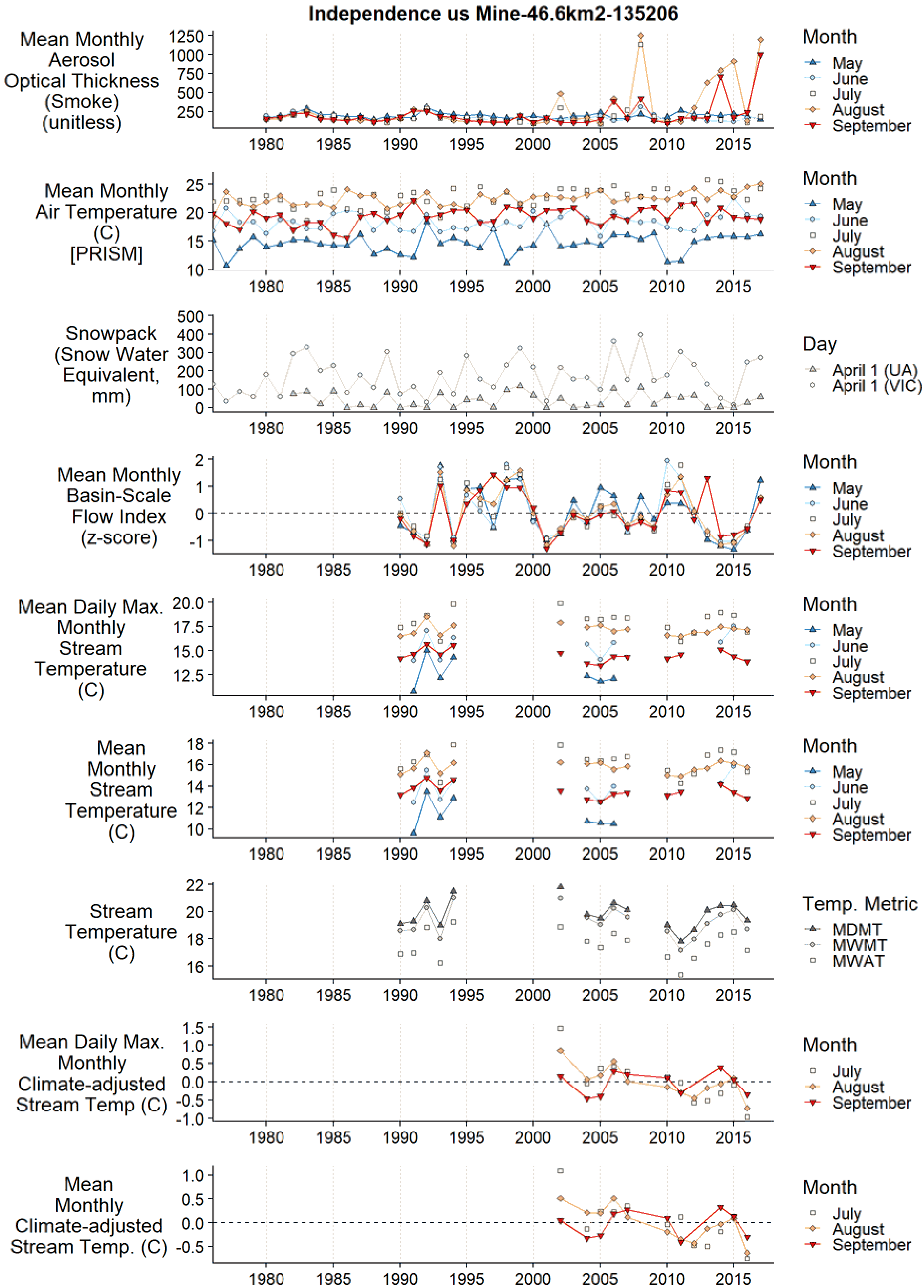
Independence us Mine-46.6km2-135206
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
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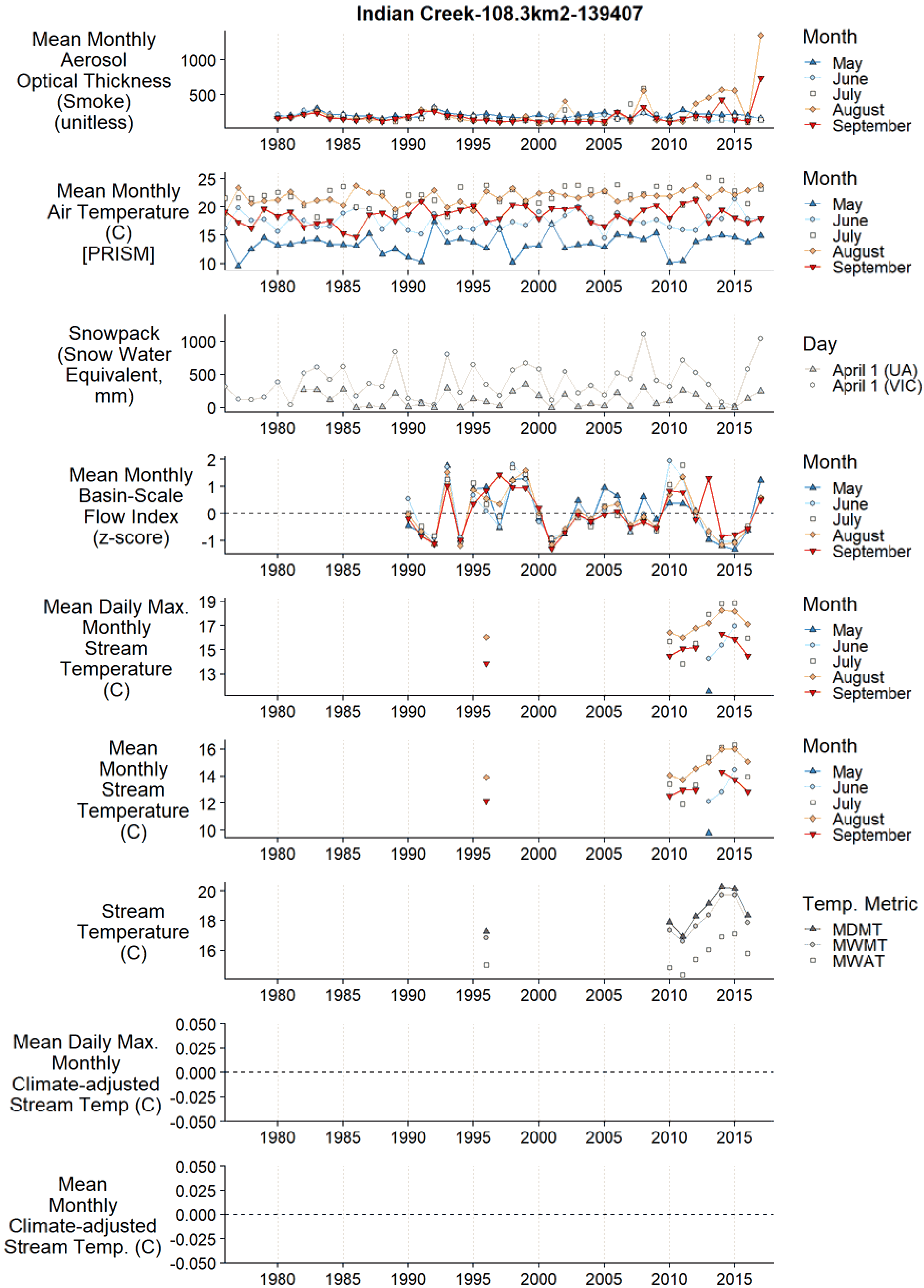
Indian Creek-108.3km2-139407
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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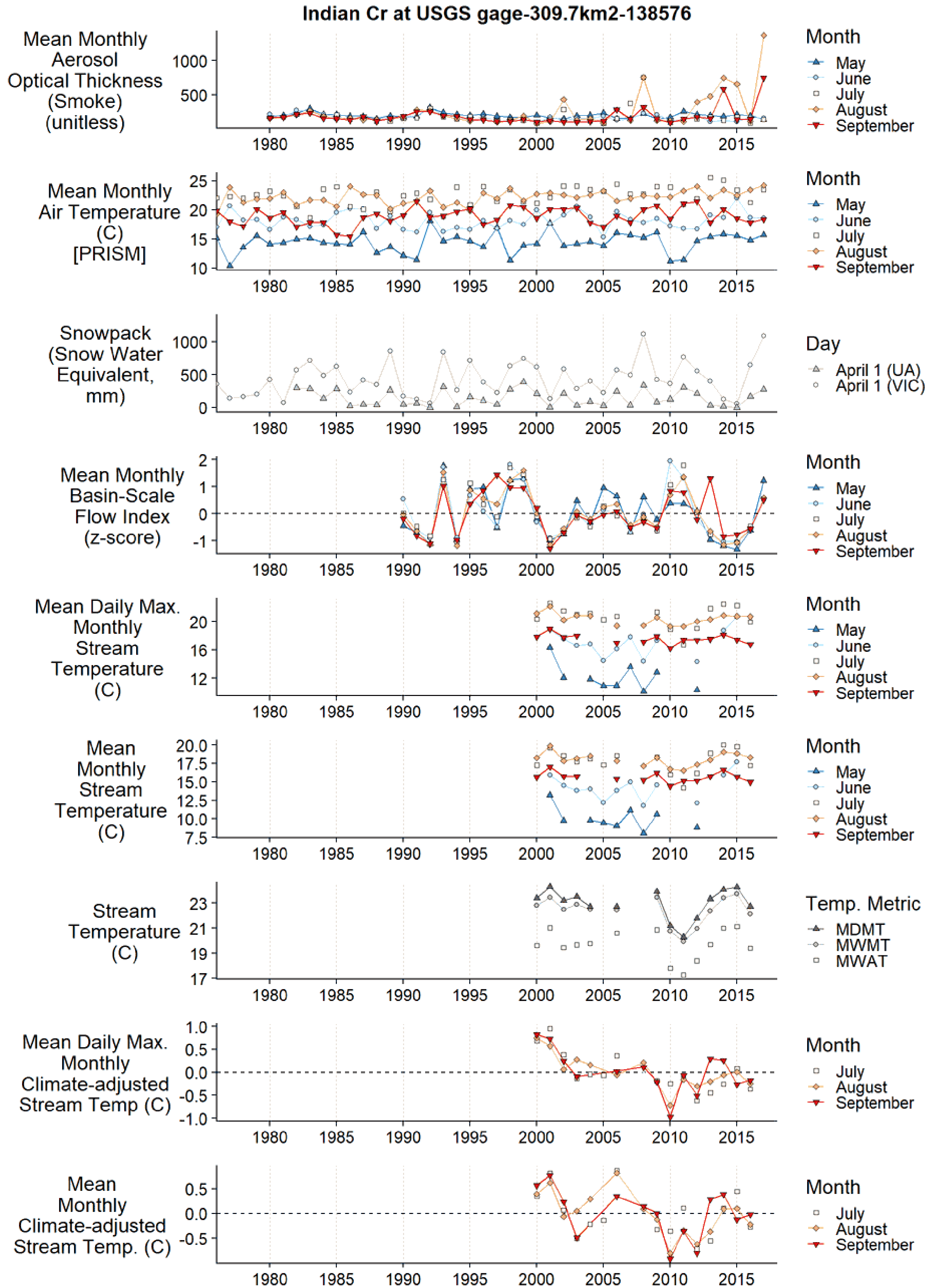
Indian Cr at USGS gage-309.7km2-138576
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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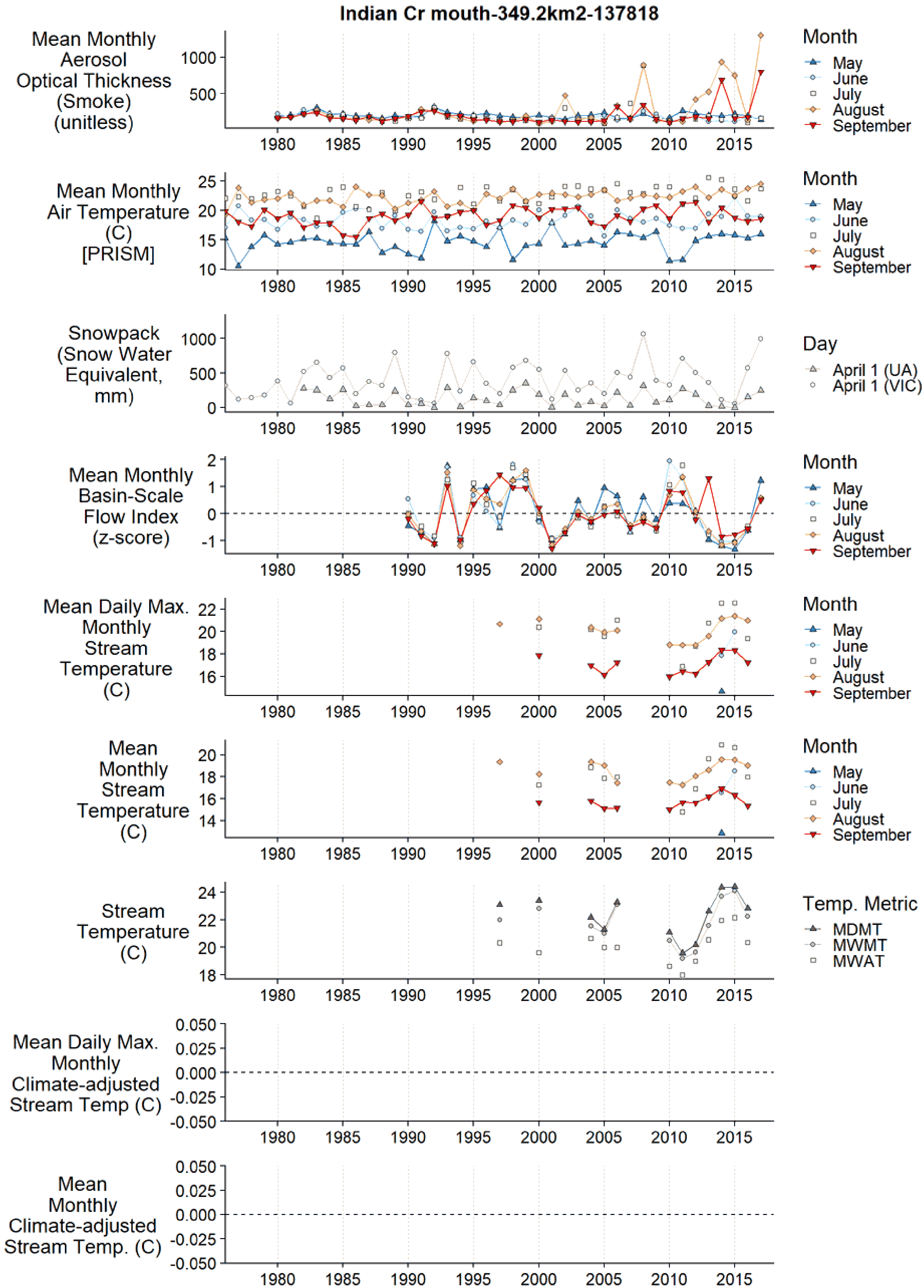
Indian Cr mouth-349.2km2-137818
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
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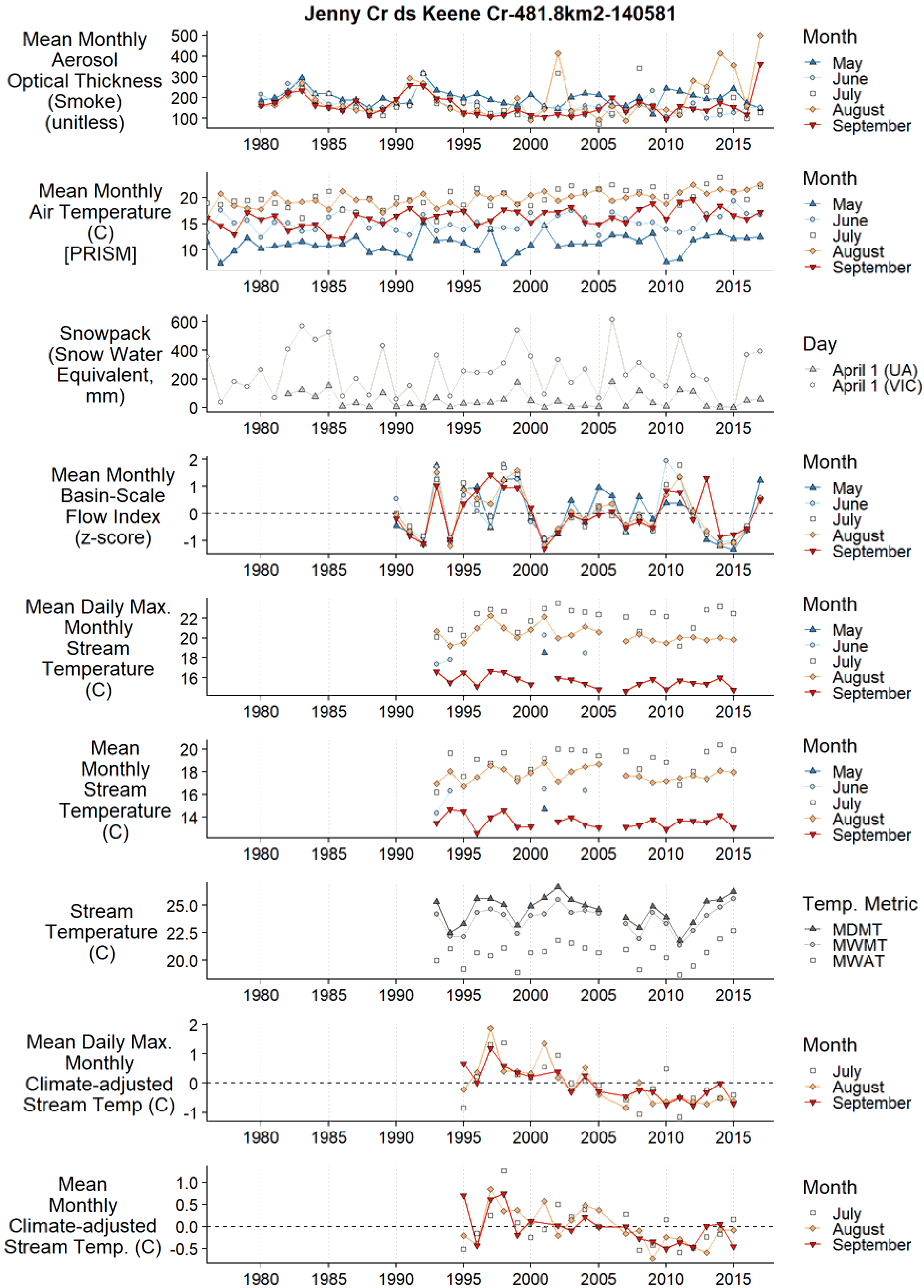
Jenny Cr ds Keene Cr-481.8km2-140581
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
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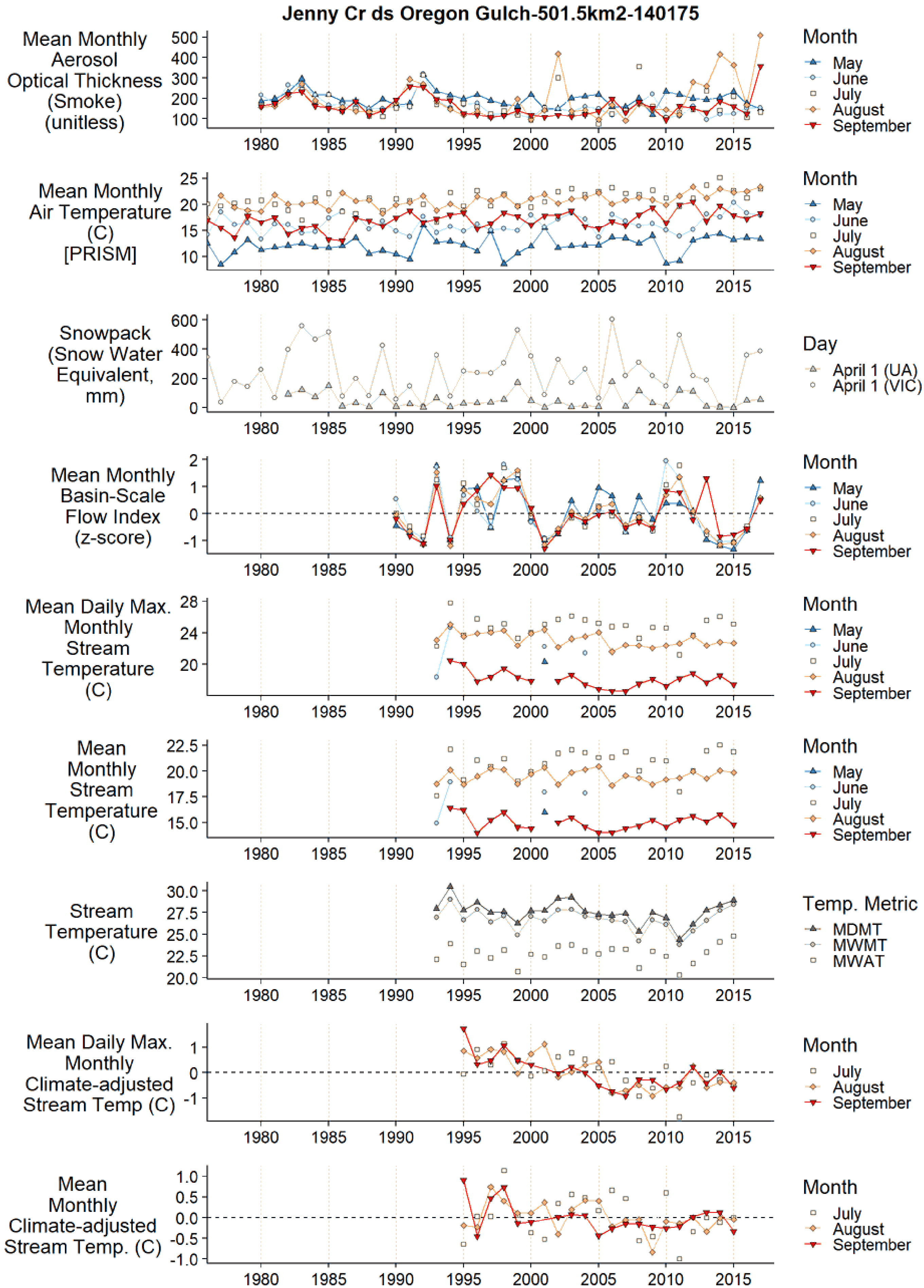

Jenny Cr ds Oregon Gulch-501.5km2-140175
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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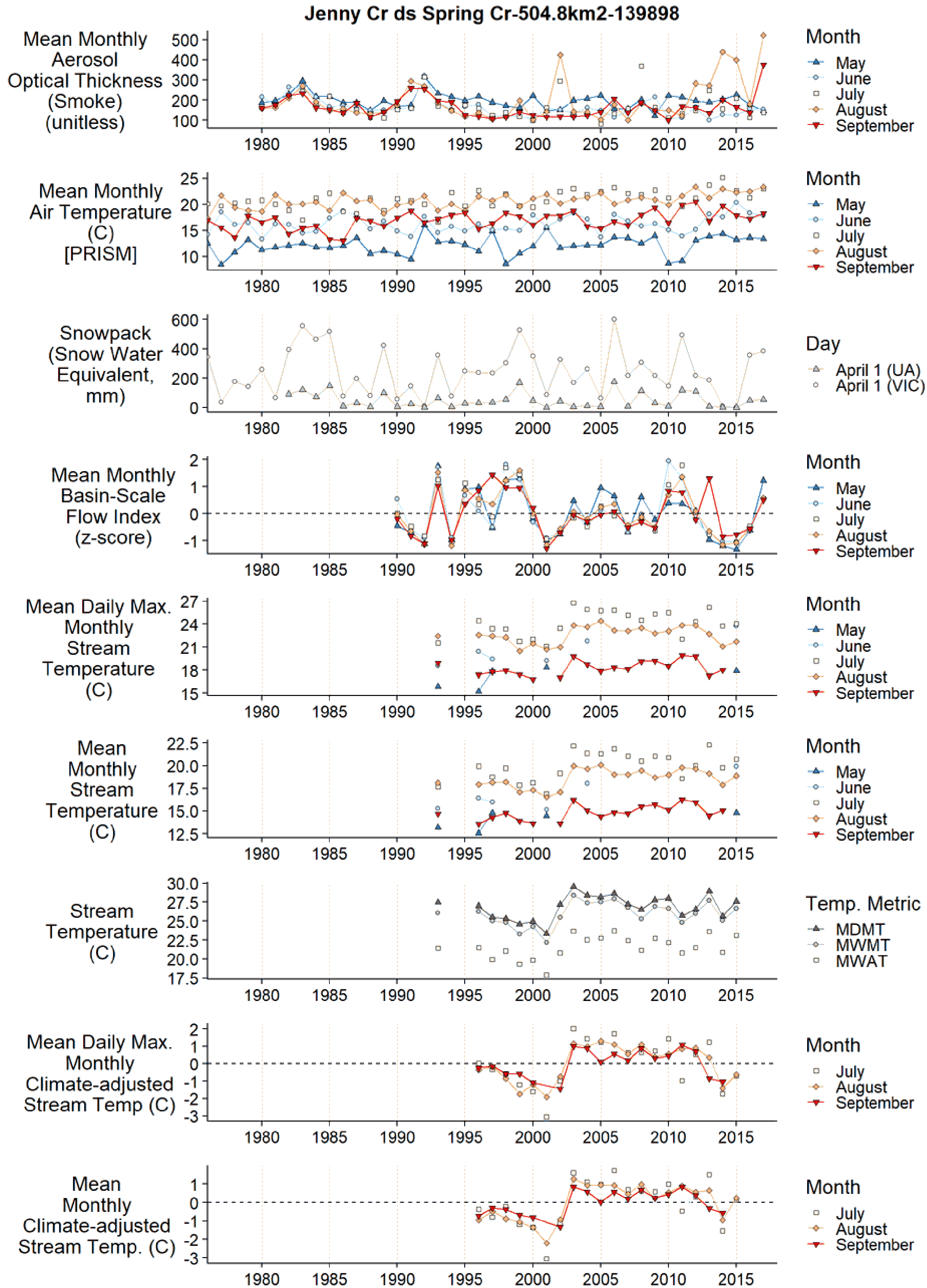
Jenny Cr ds Spring Cr-504.8km2-139898
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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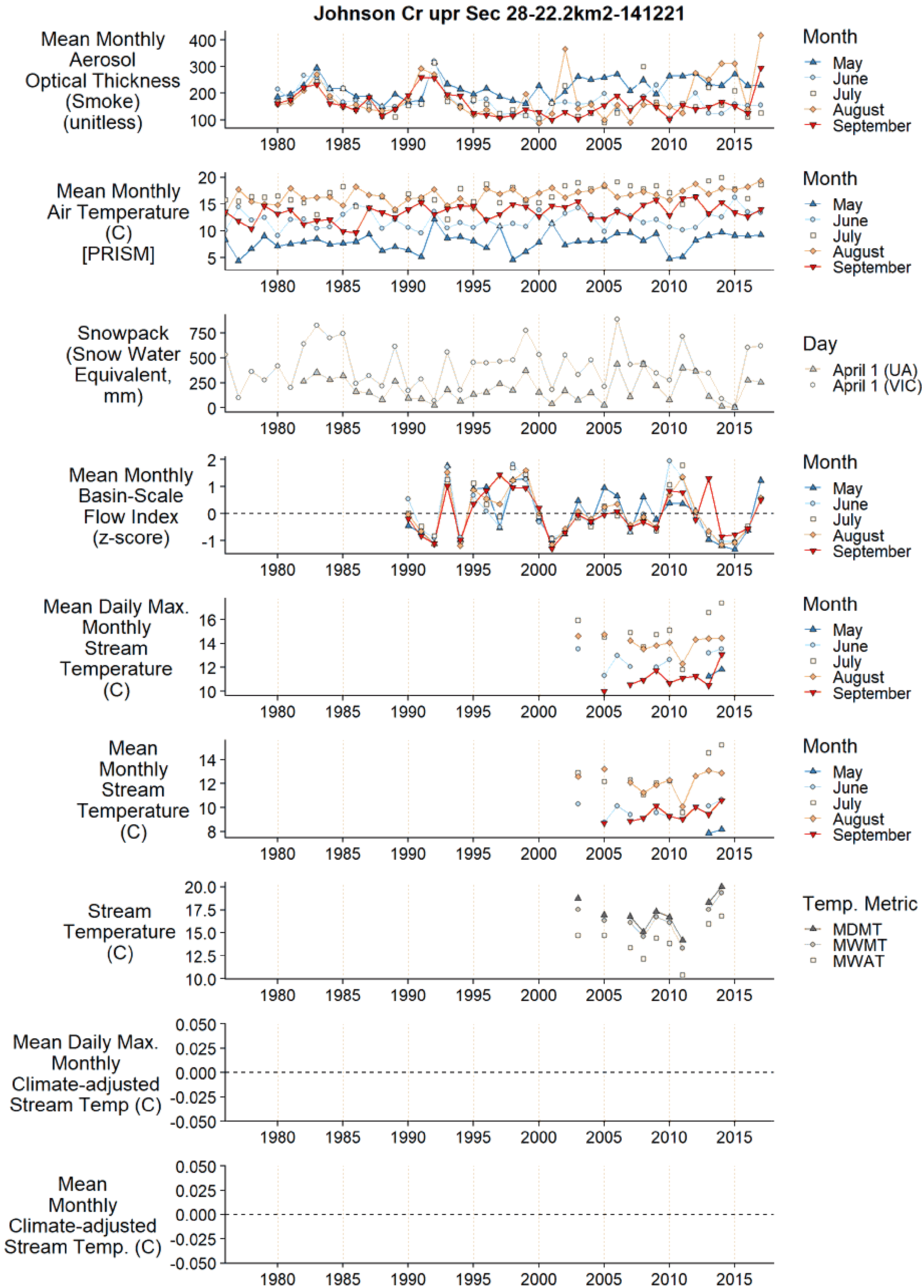

Johnson Cr upr Sec 28-22.2km2-141221
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
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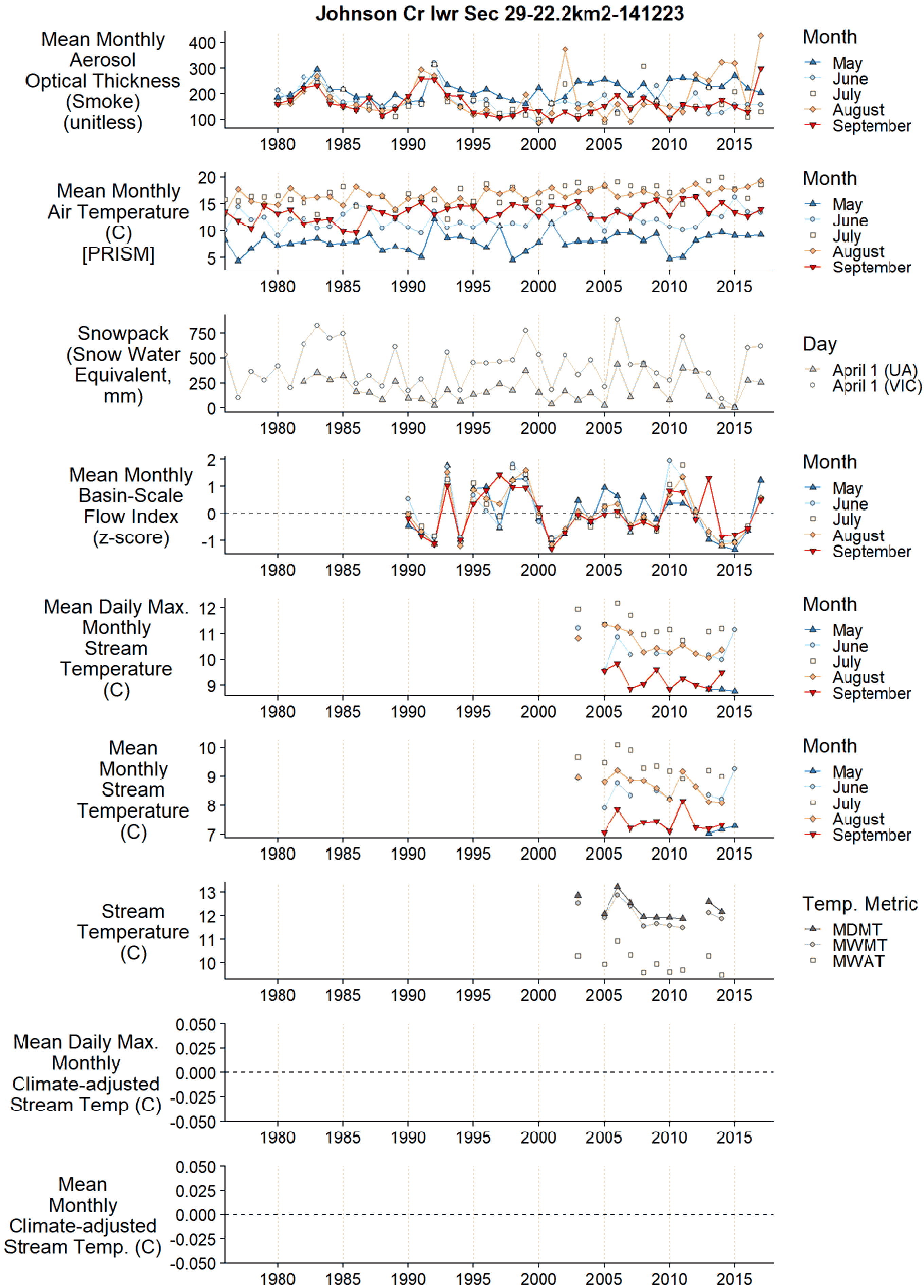

Johnson Cr lwr Sec 29-22.2km2-141223
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
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1980
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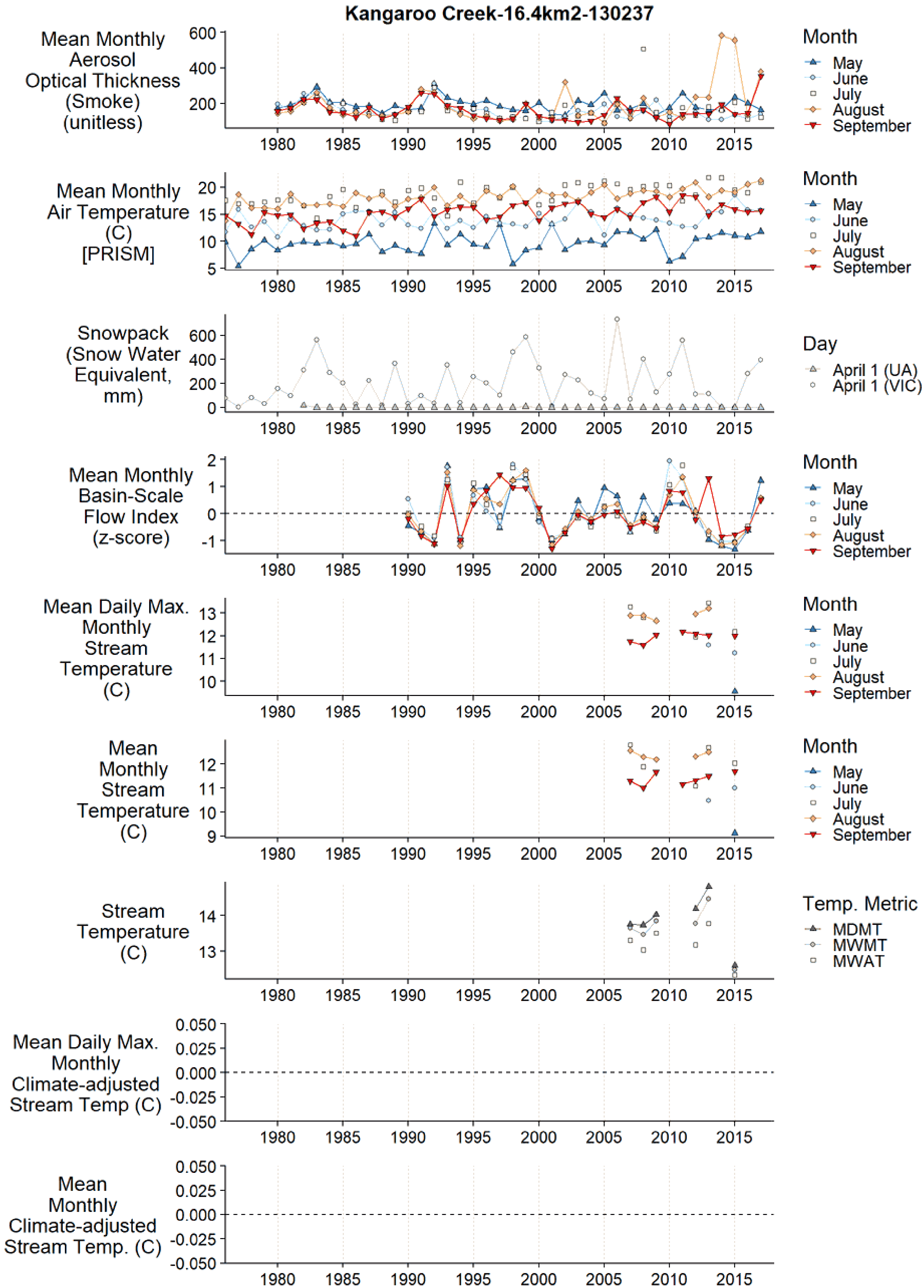
Kangaroo Creek-16.4km2-130237
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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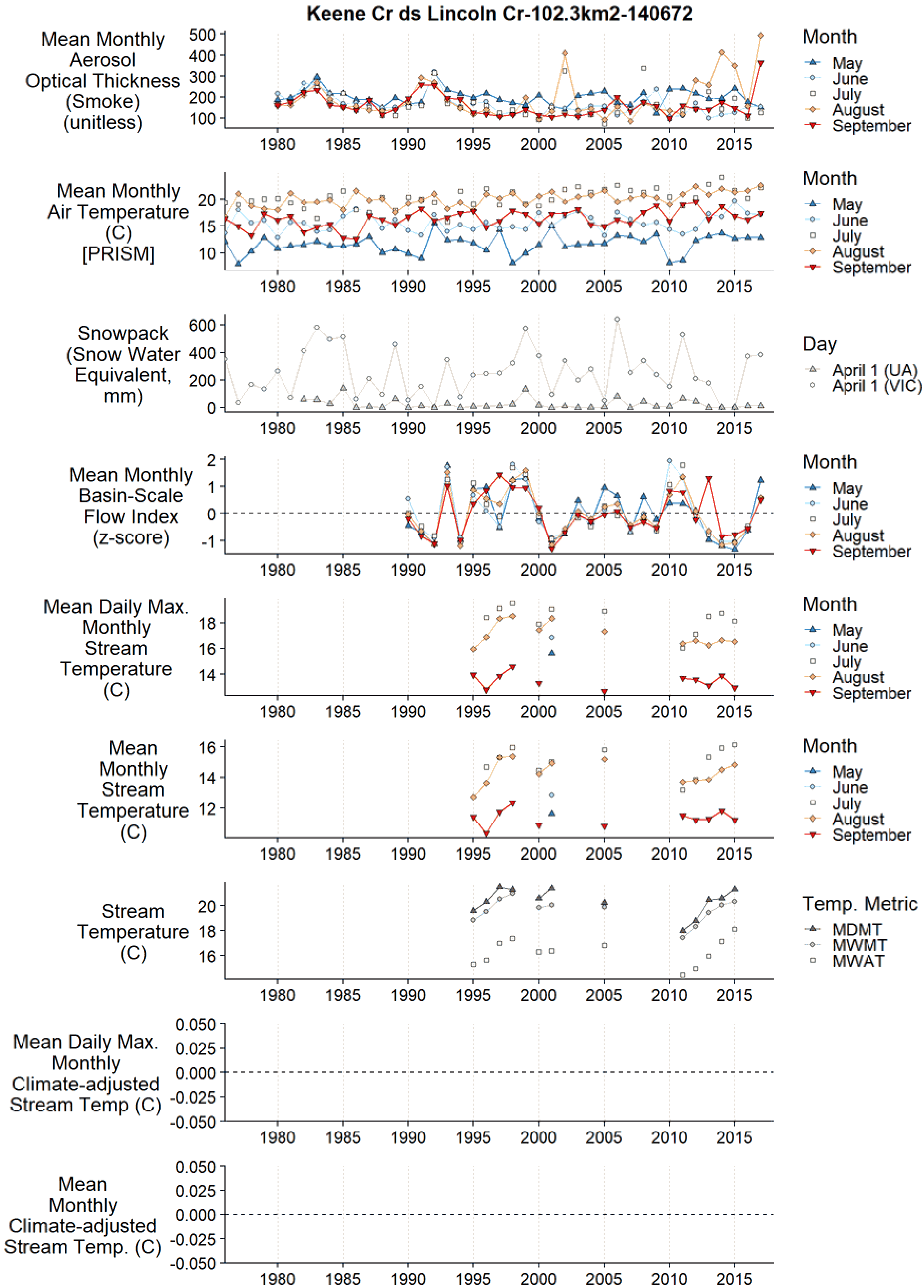

Keene Cr ds Lincoln Cr-102.3km2-140672
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
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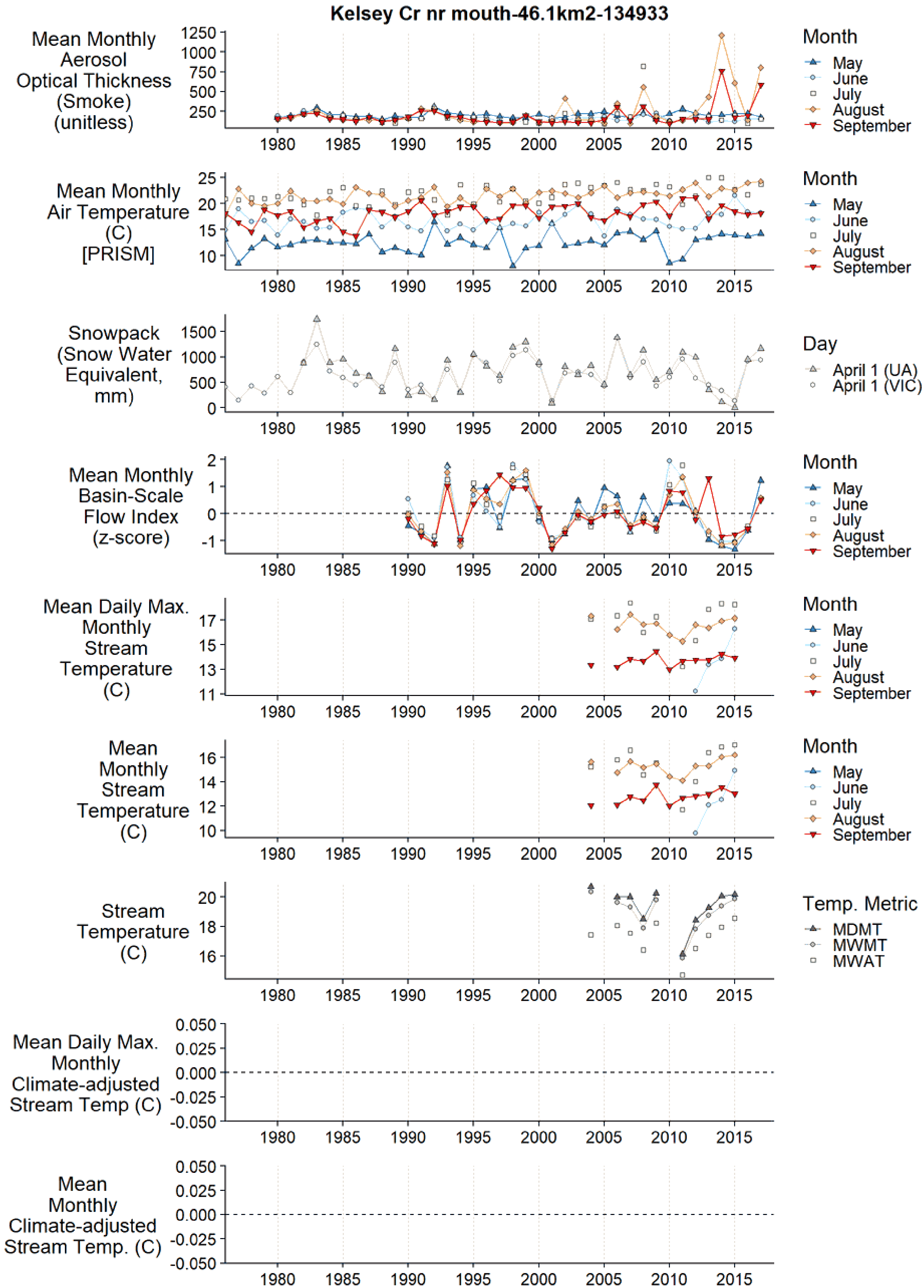
Kelsey Cr nr mouth-46.1km2-134933
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
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September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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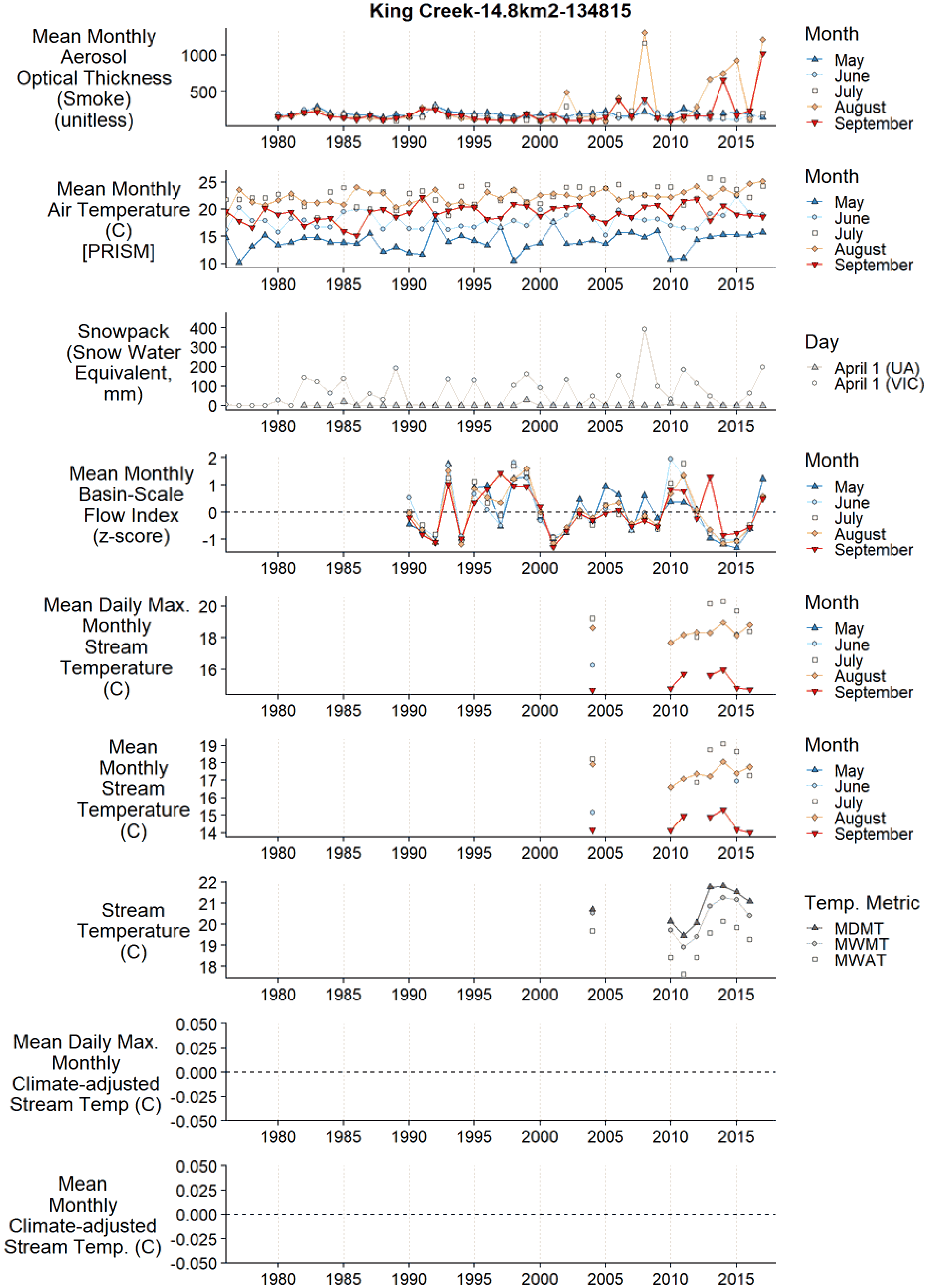
King Creek-14.8km2-134815
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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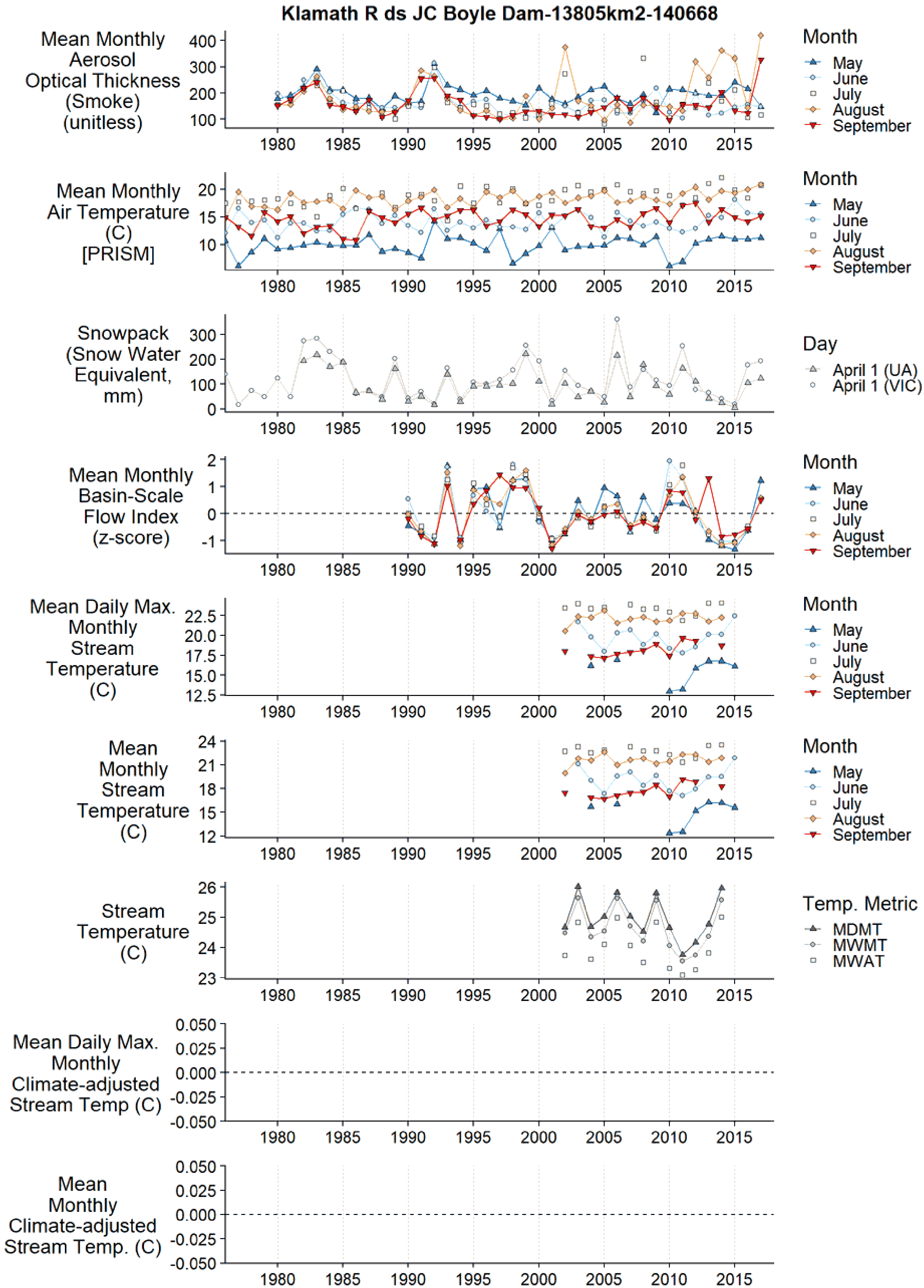
Klamath R ds JC Boyle Dam-13805km2-140668
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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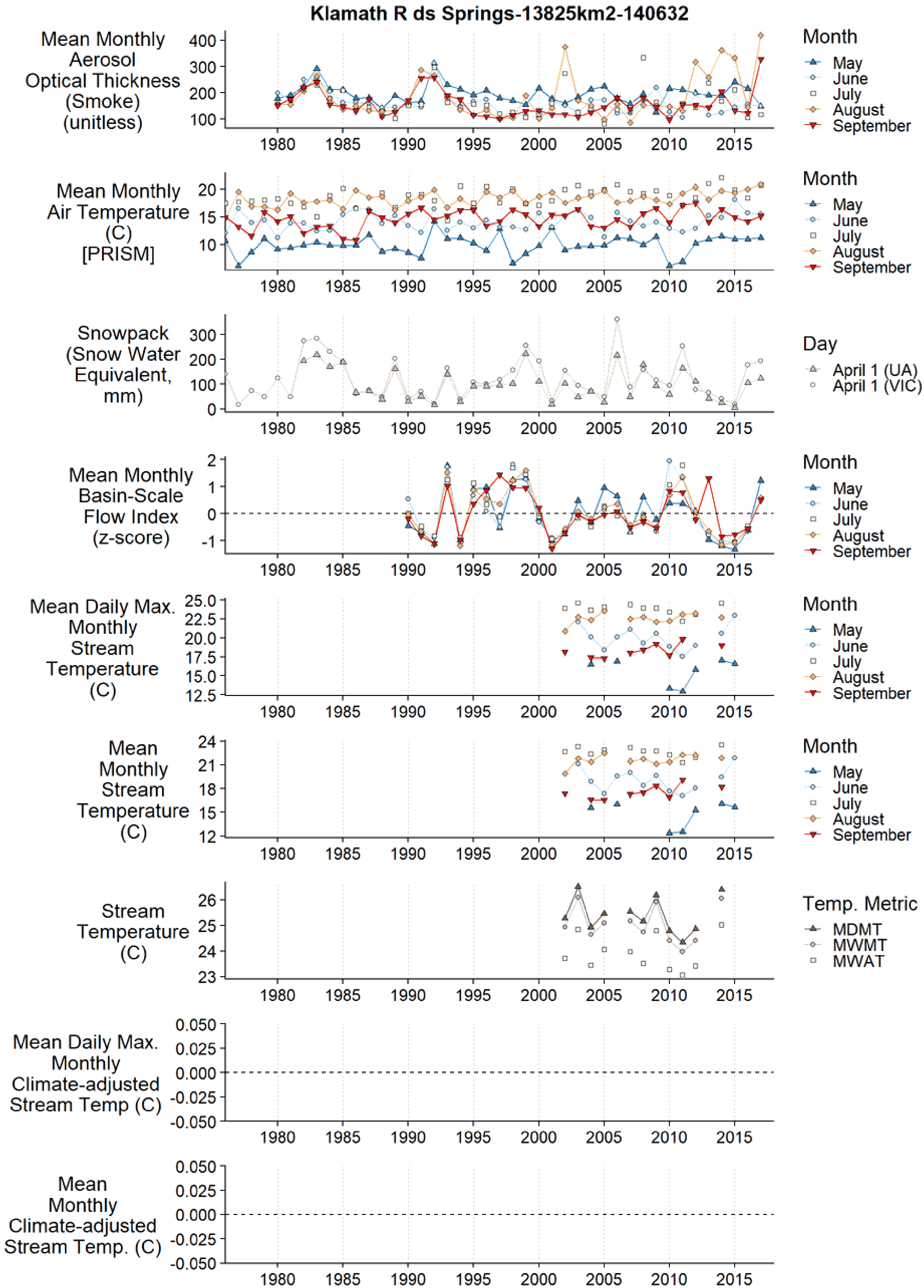
Klamath R ds Springs-13825km2-140632
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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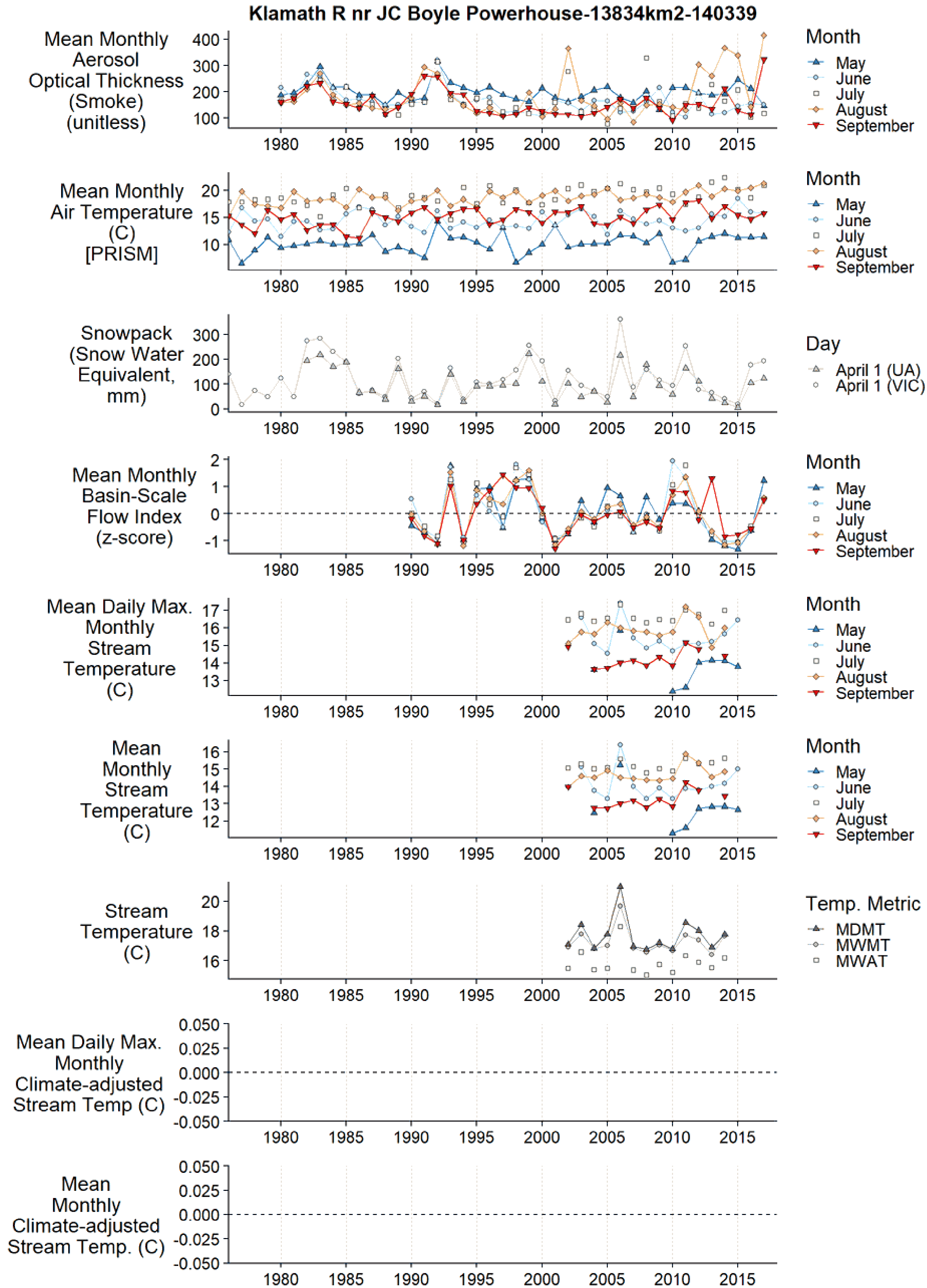
Klamath R nr JC Boyle Powerhouse-13834km2-140339
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
1980 1985 1990 1995 2000 2005 2010 2015
Month
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April 1 (UA)
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Temp. Metric
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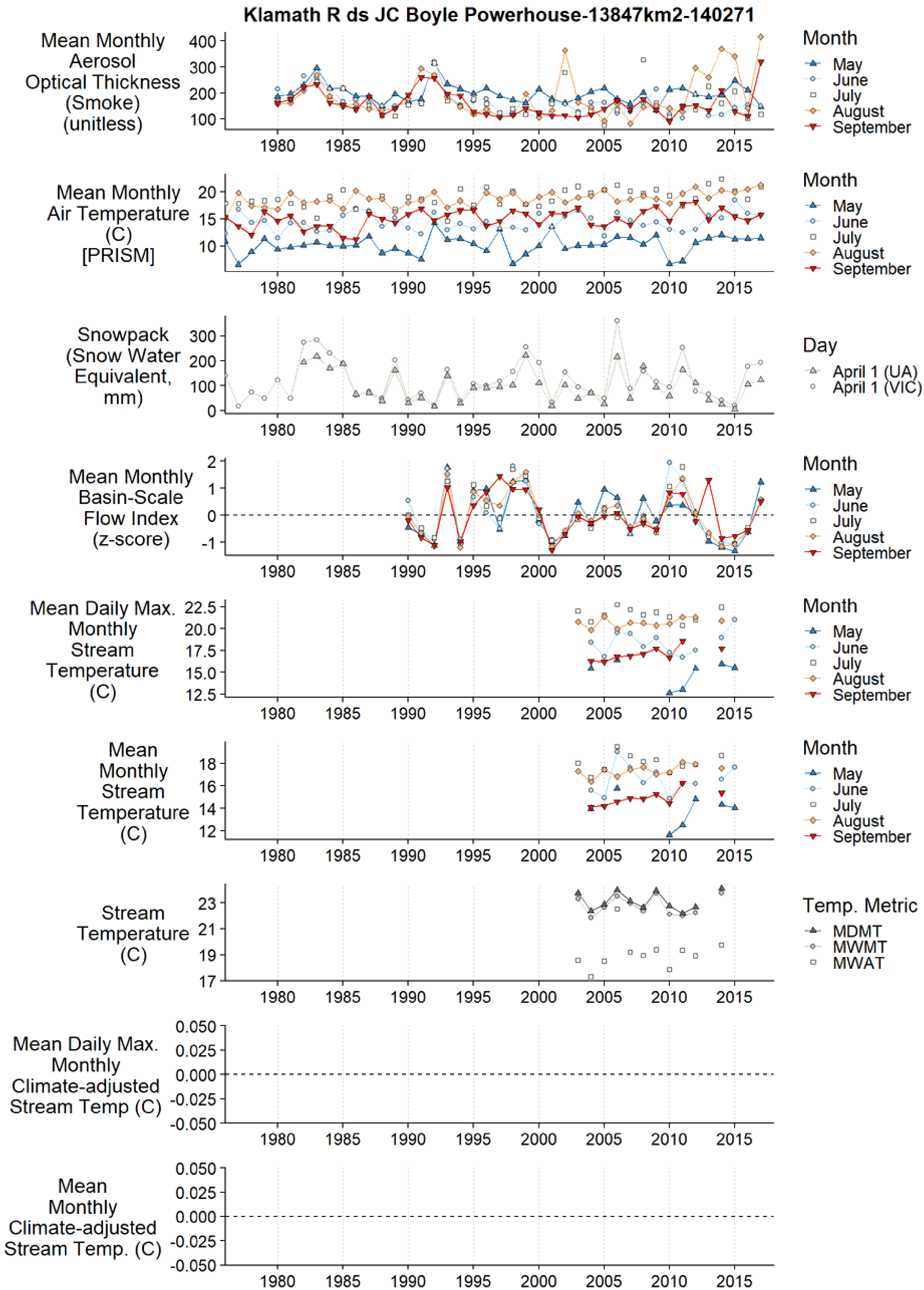
Klamath R ds JC Boyle Powerhouse-13847km2-140271
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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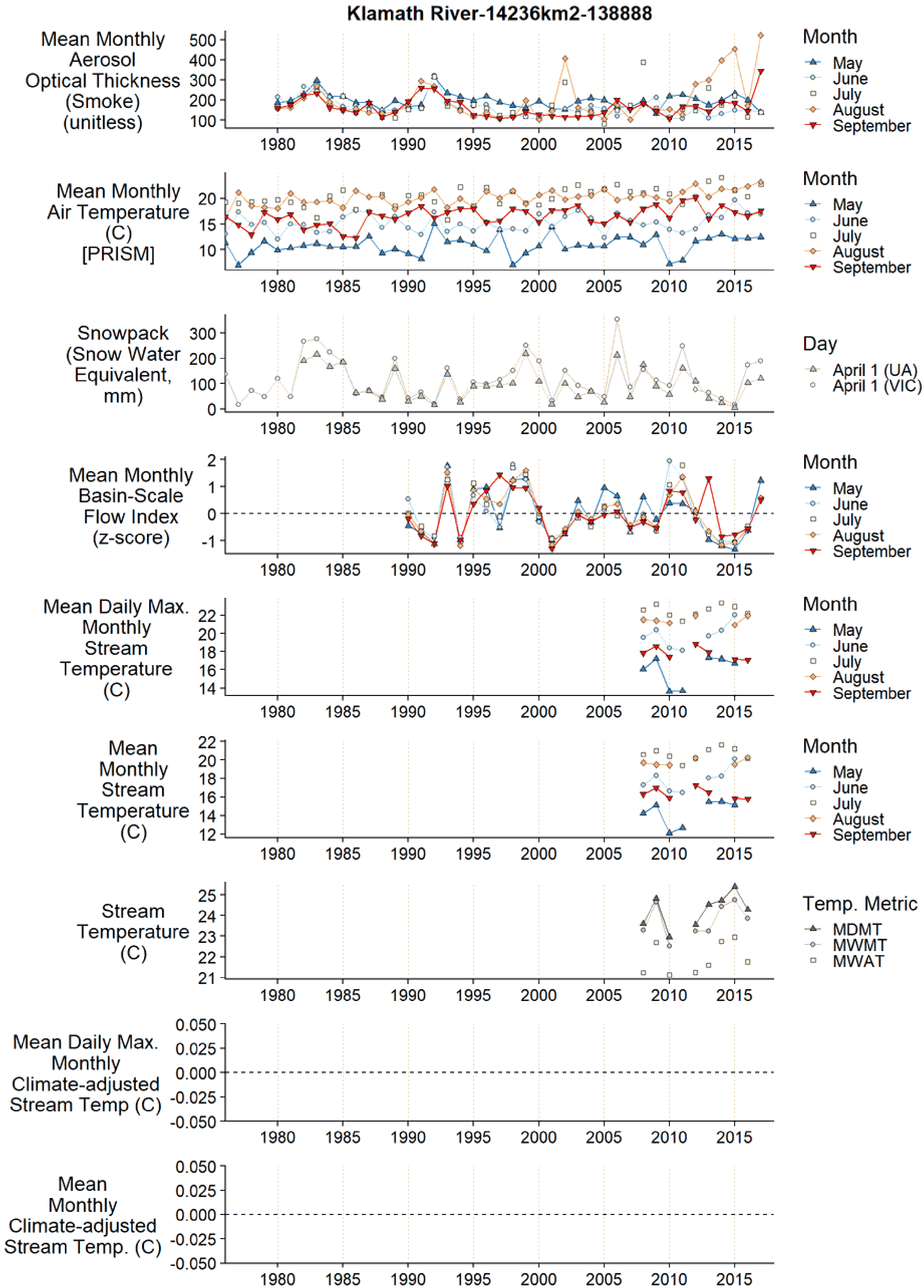
Klamath River-14236km2-138888
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
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Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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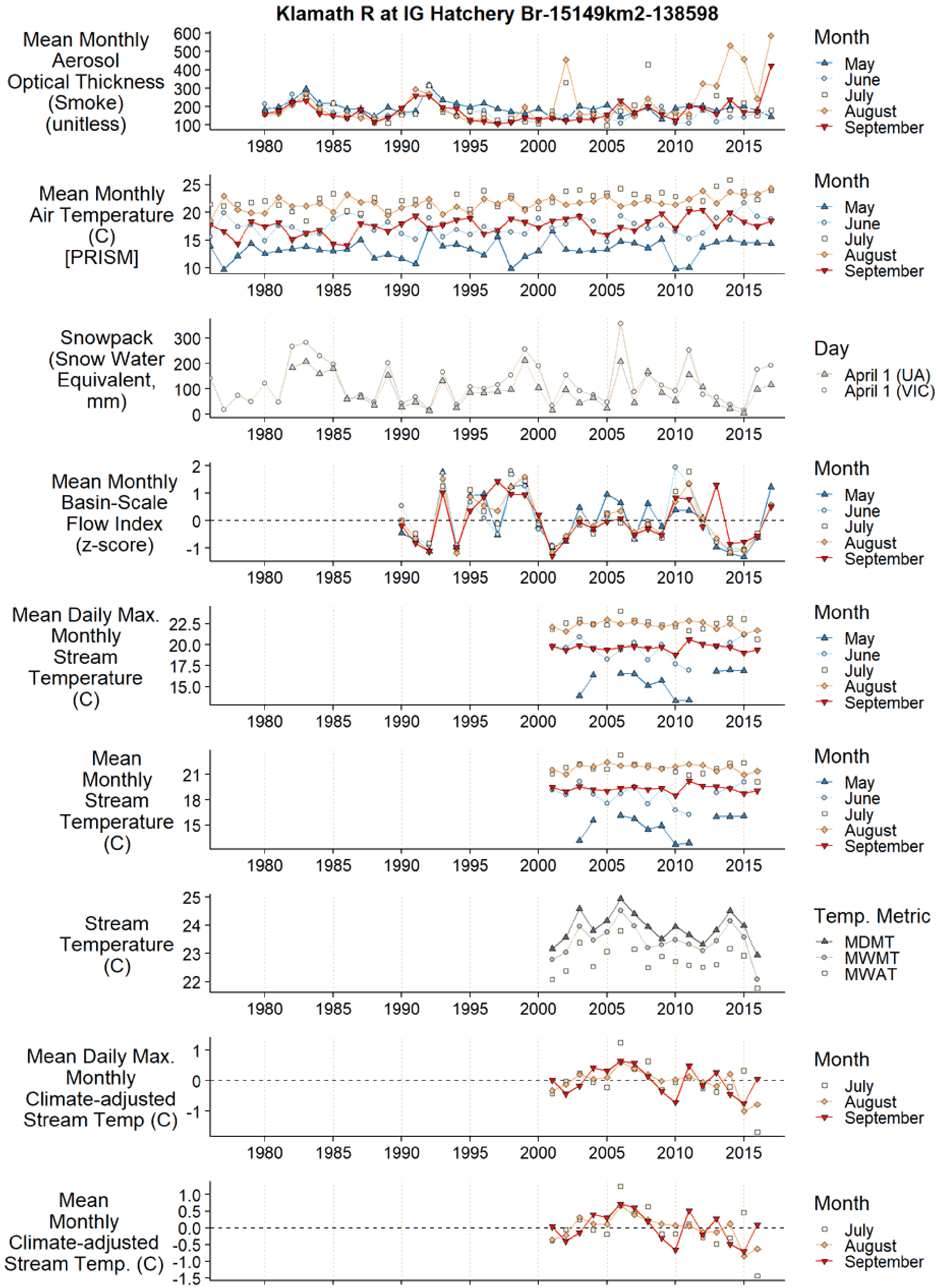
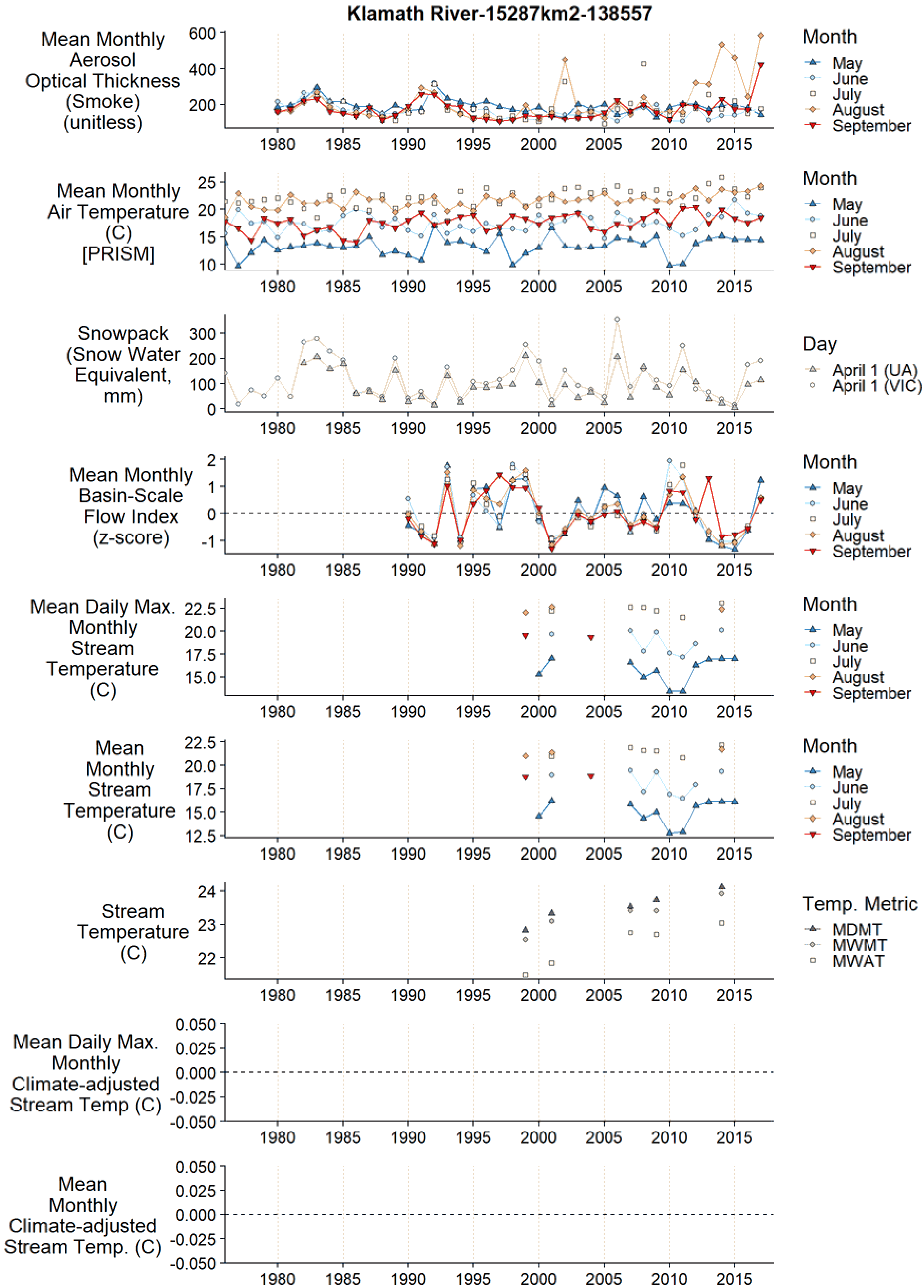
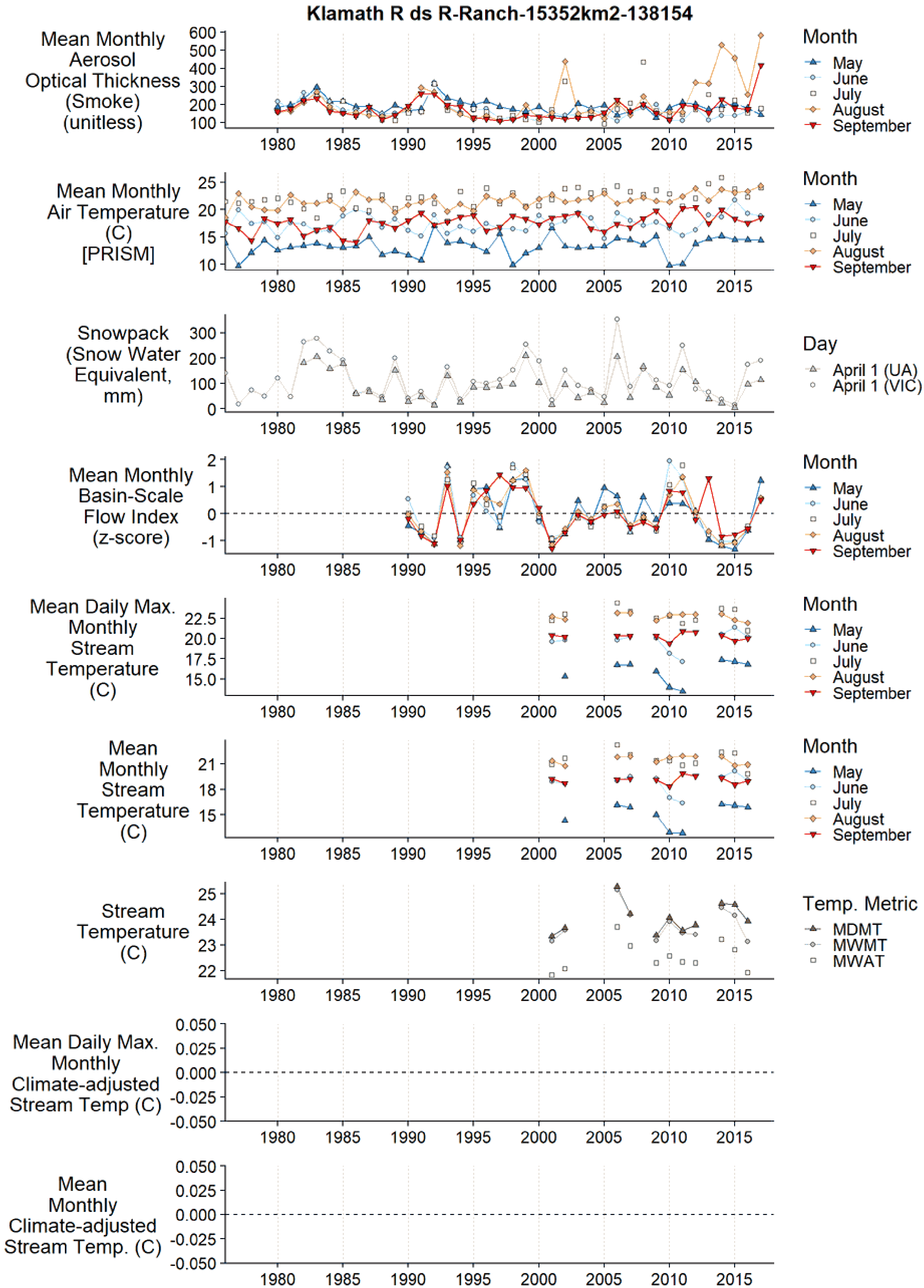
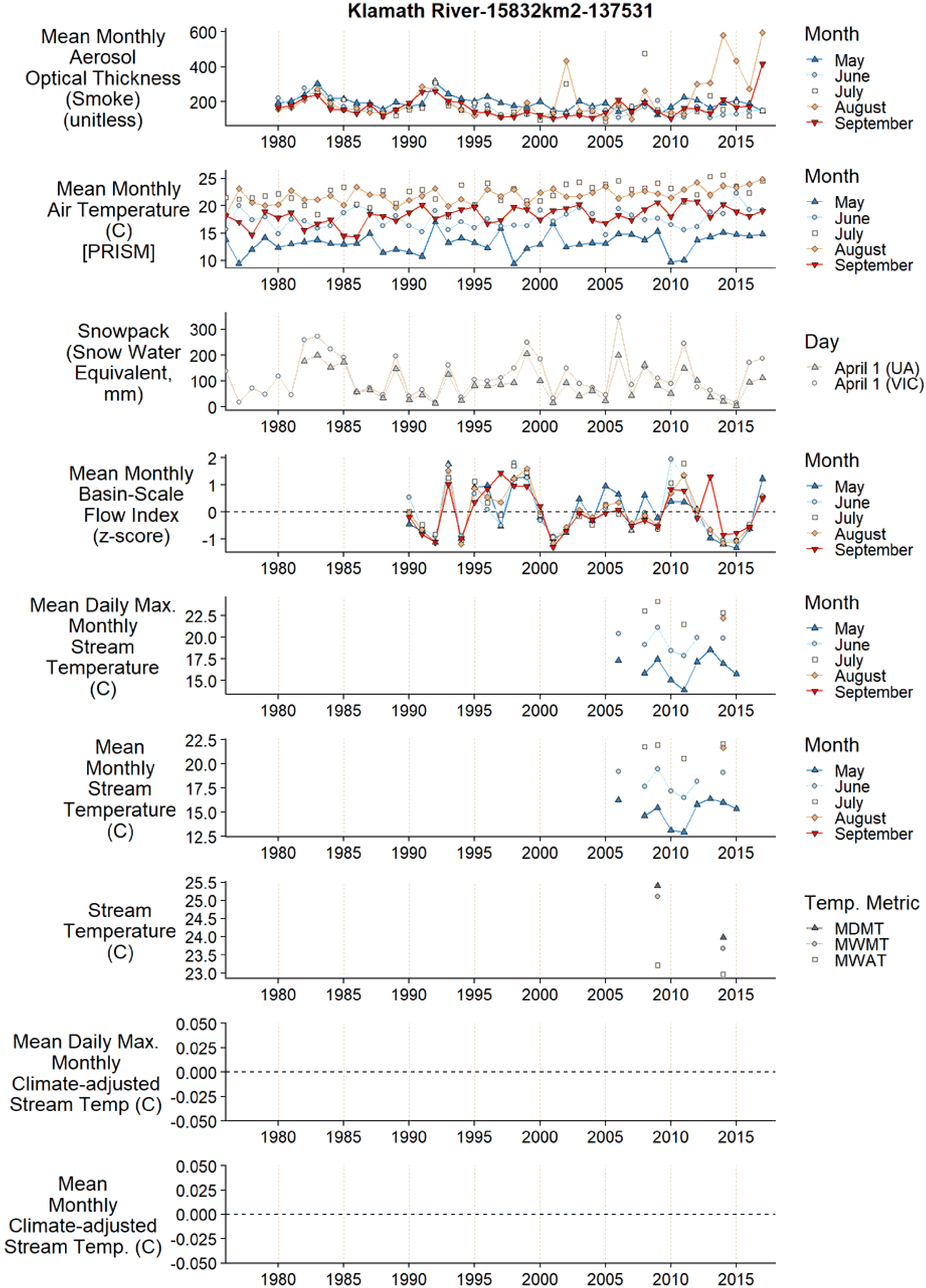
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
1980
1985
1990
1995
2000
2005
2010
2015

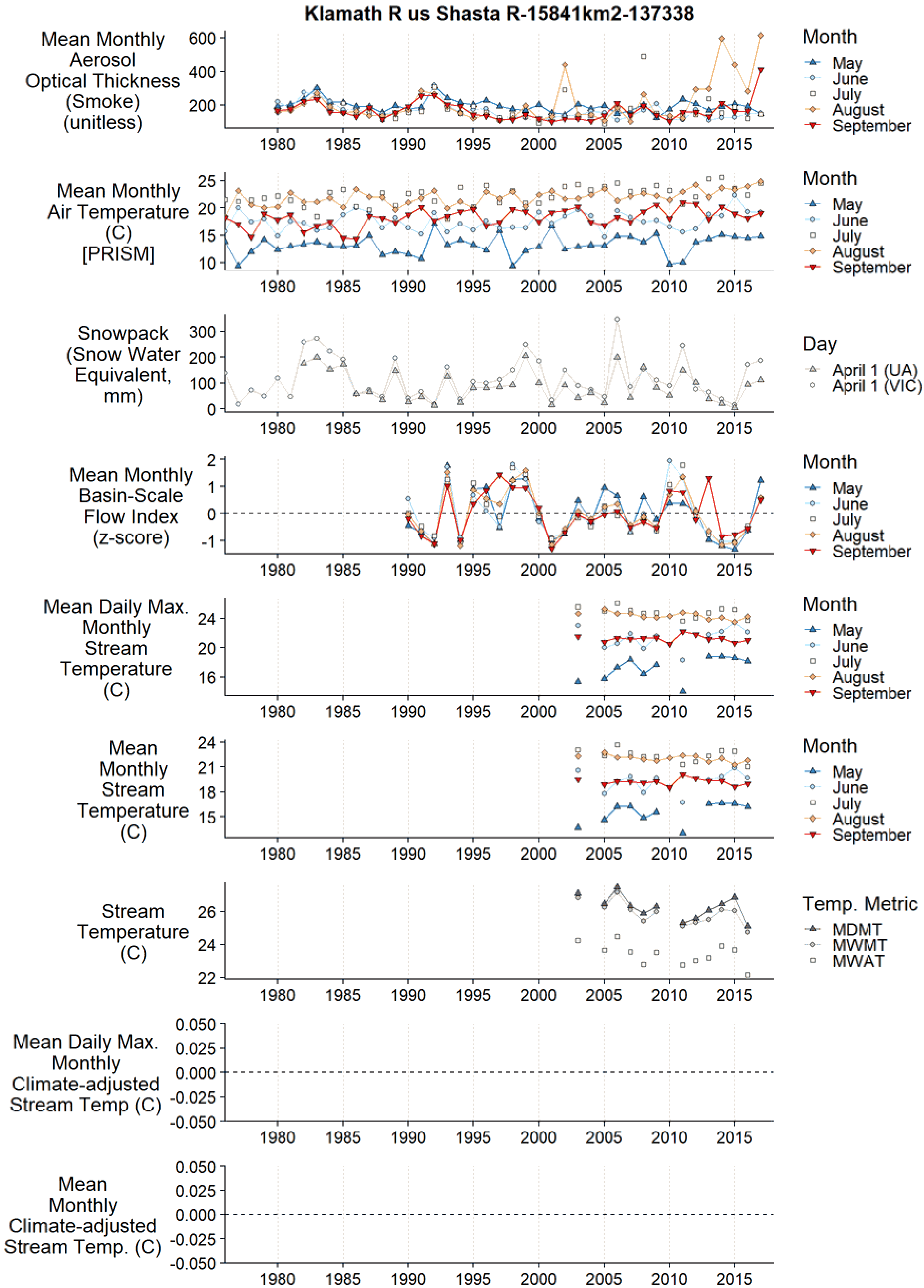

Klamath R at IG Hatchery Br-15149km2-138598
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015

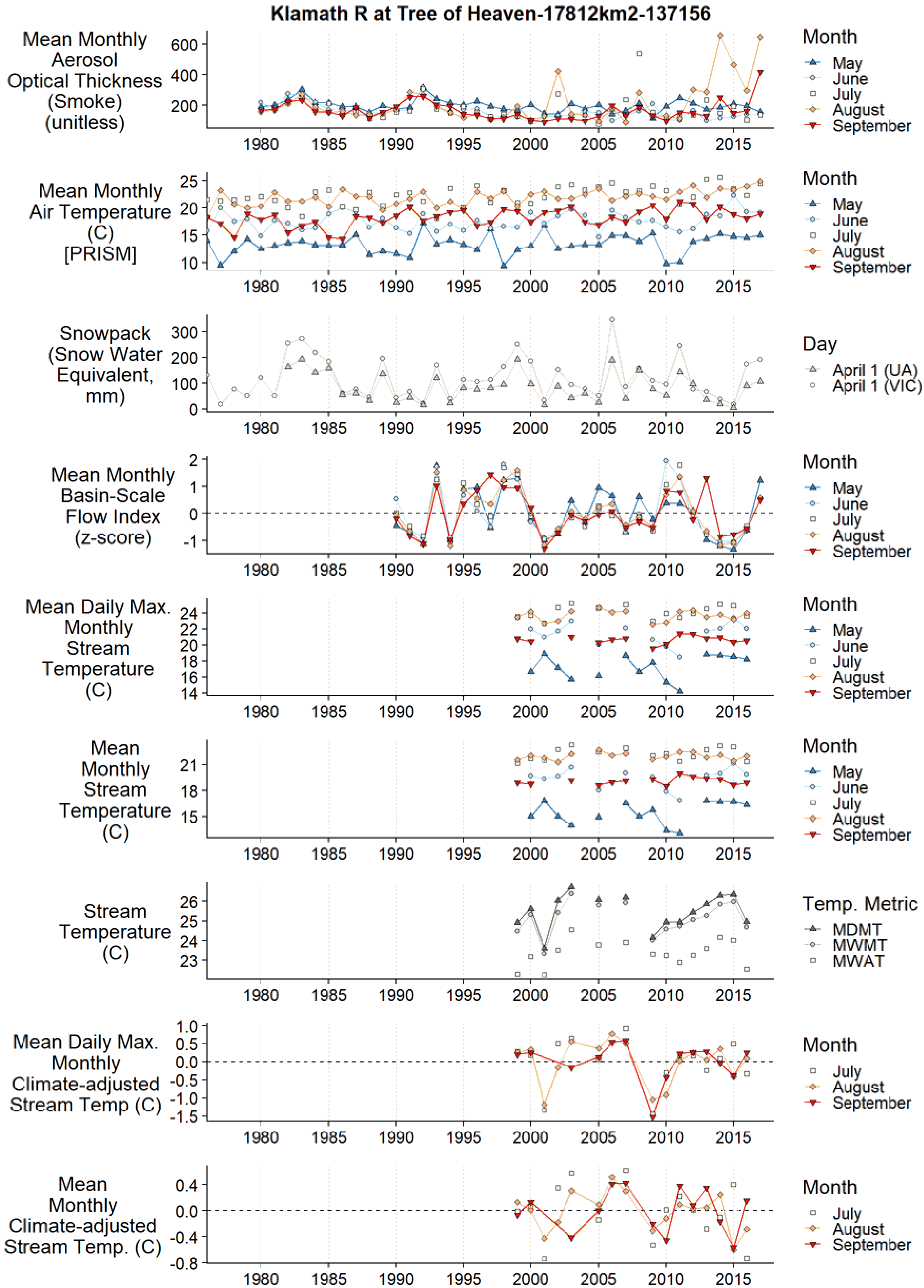

Klamath River-15287km2-138557
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
MDMT
MWMT
MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)

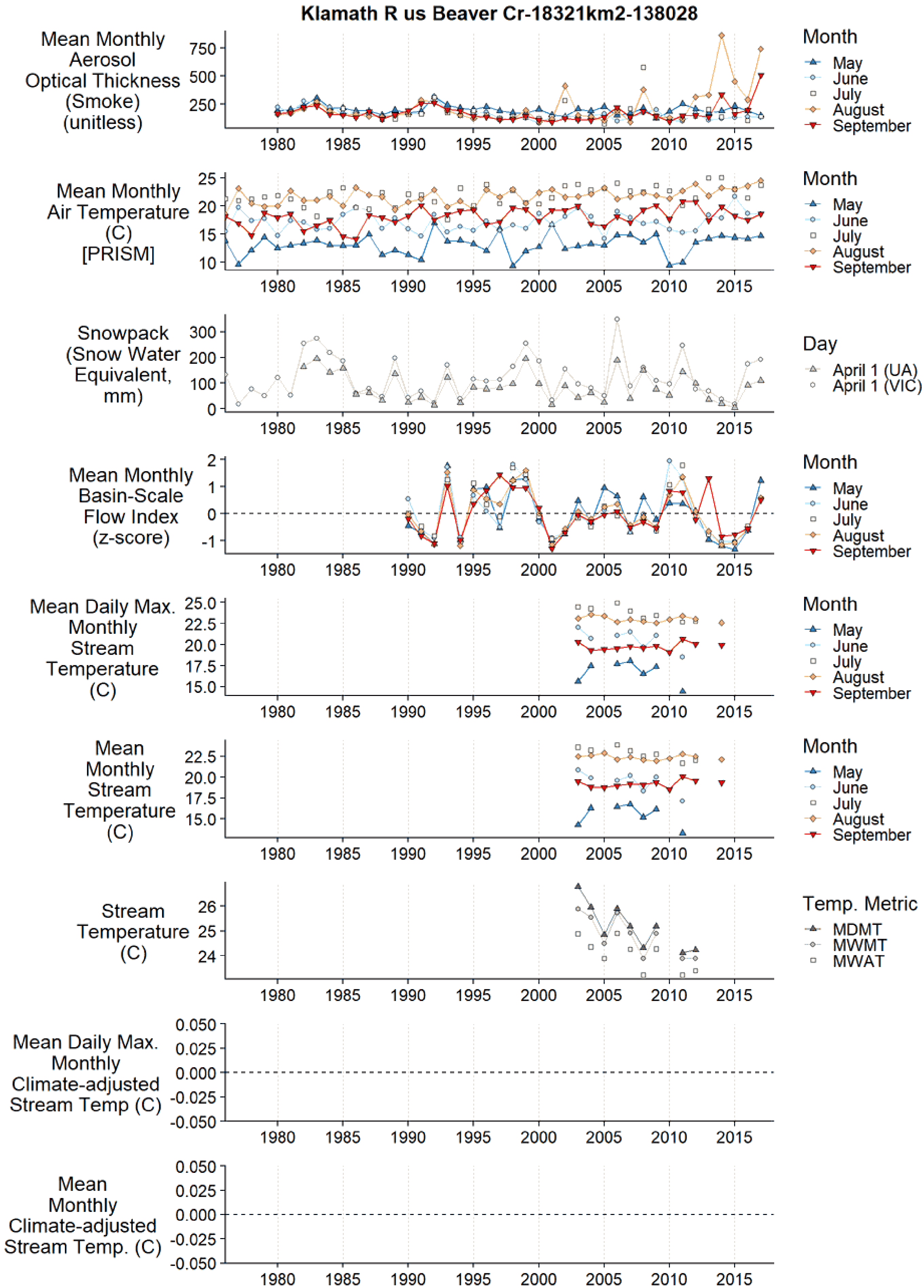

Klamath R ds R-Ranch-15352km2-138154
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT

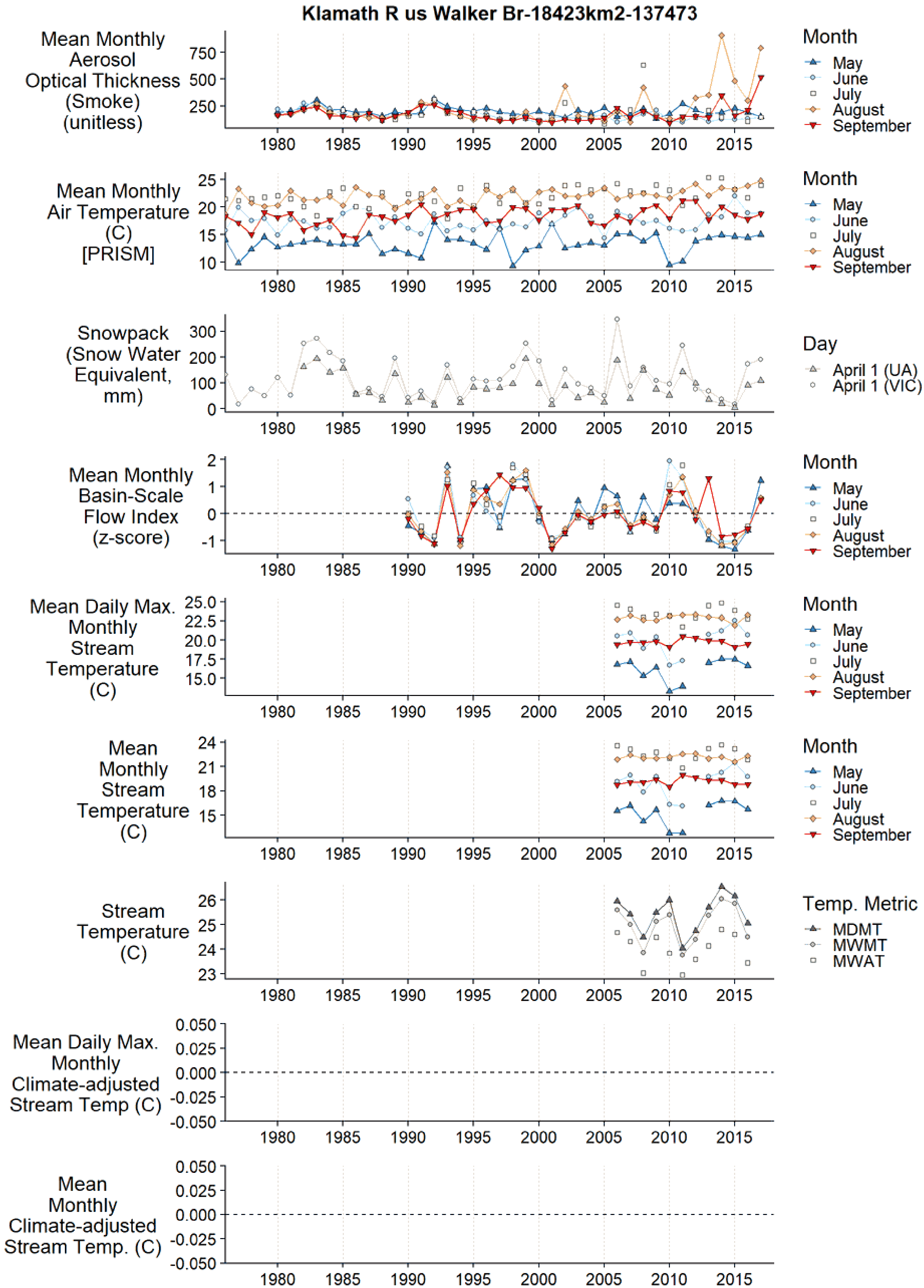


Klamath River-15832km2-137531
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015

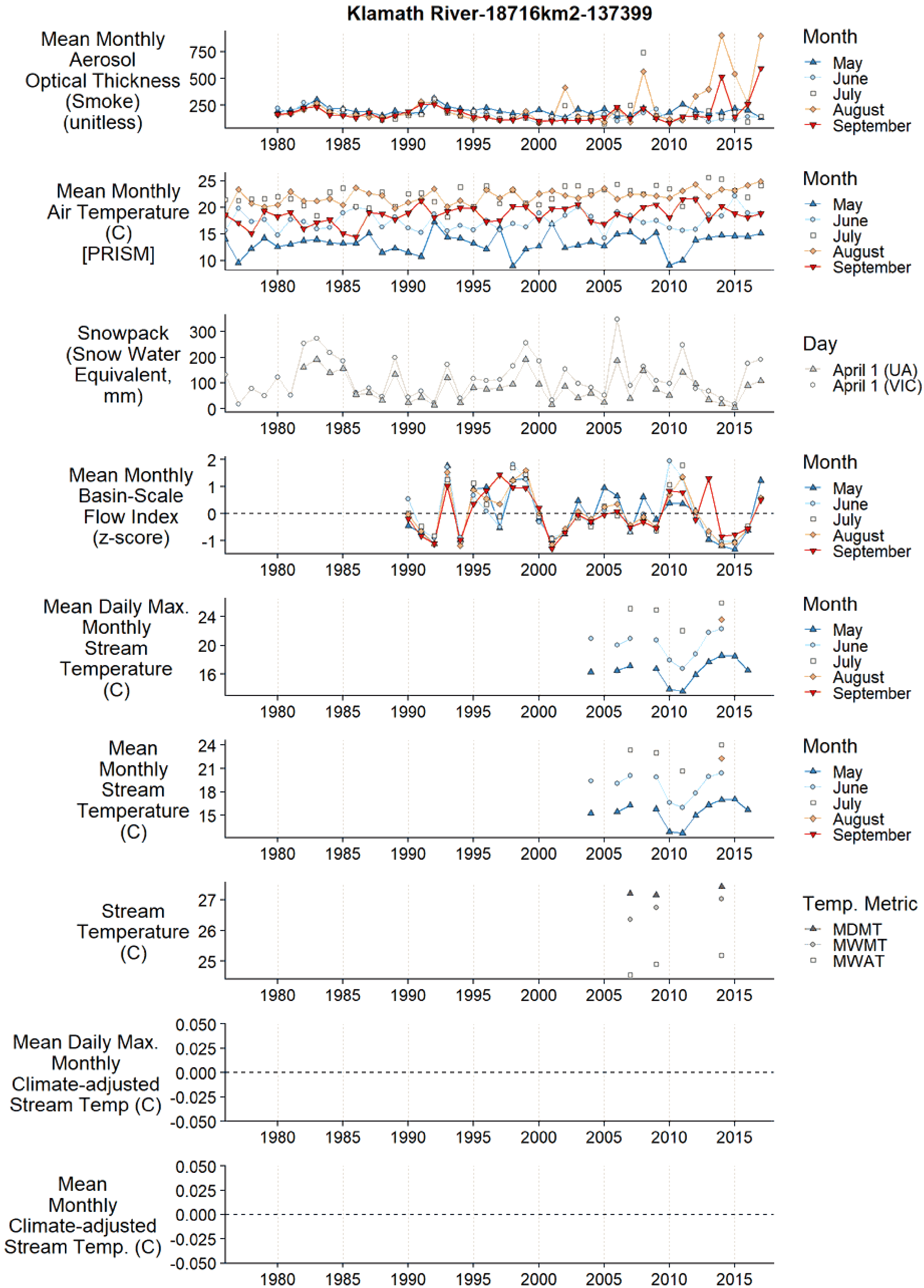

Klamath R us Shasta R-15841km2-137338
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT

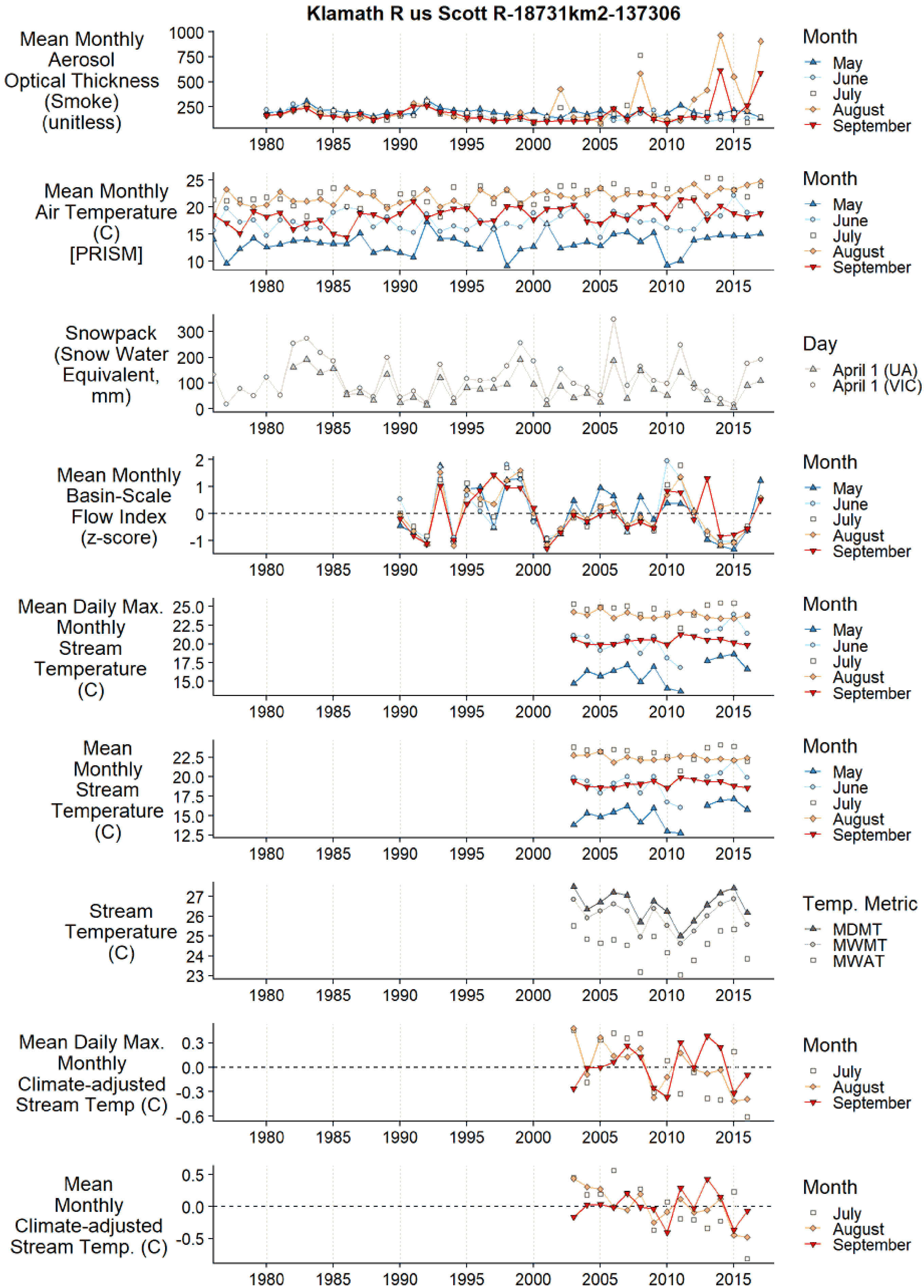

Klamath R at Tree of Heaven-17812km2-137156
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015


Klamath R us Beaver Cr-18321km2-138028
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015

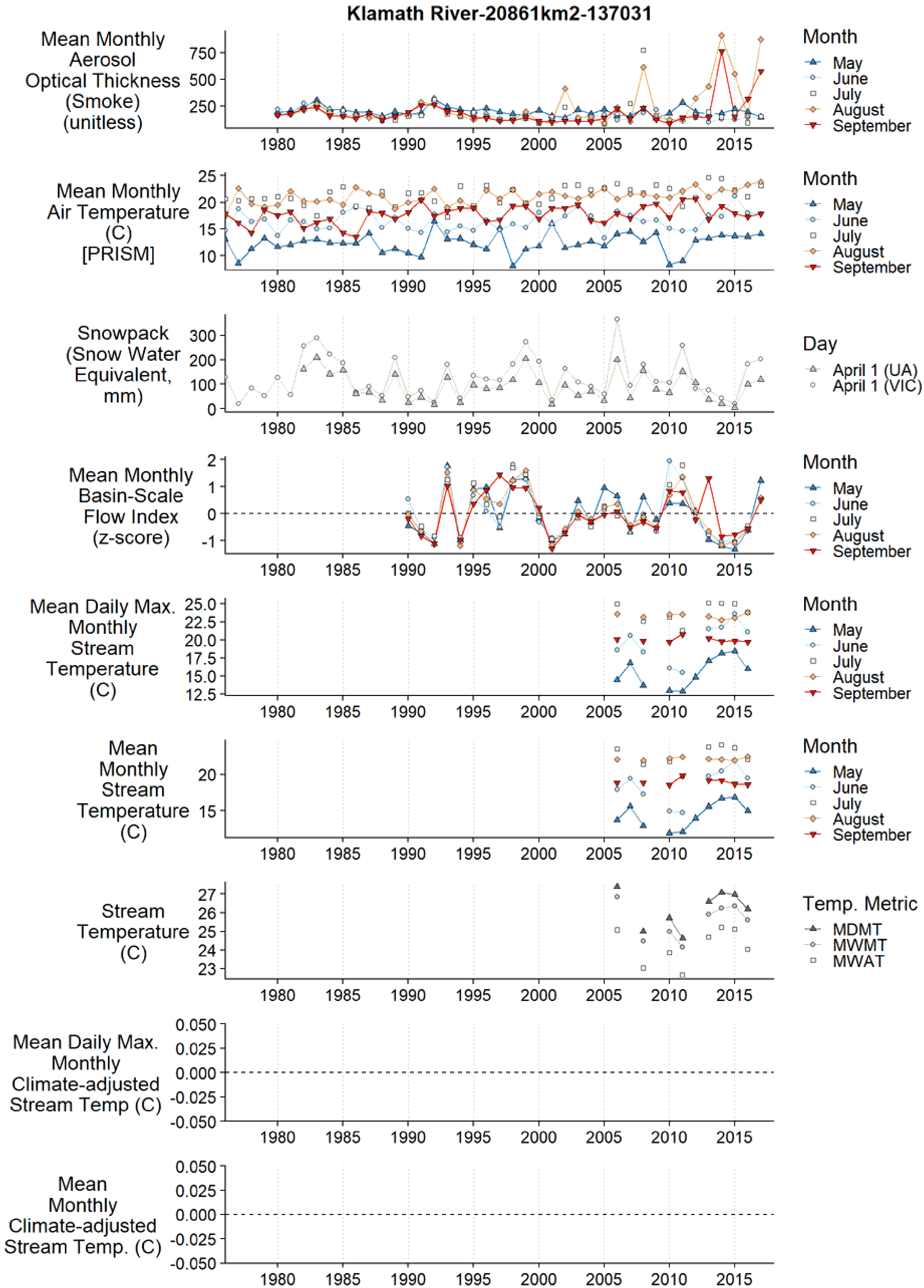


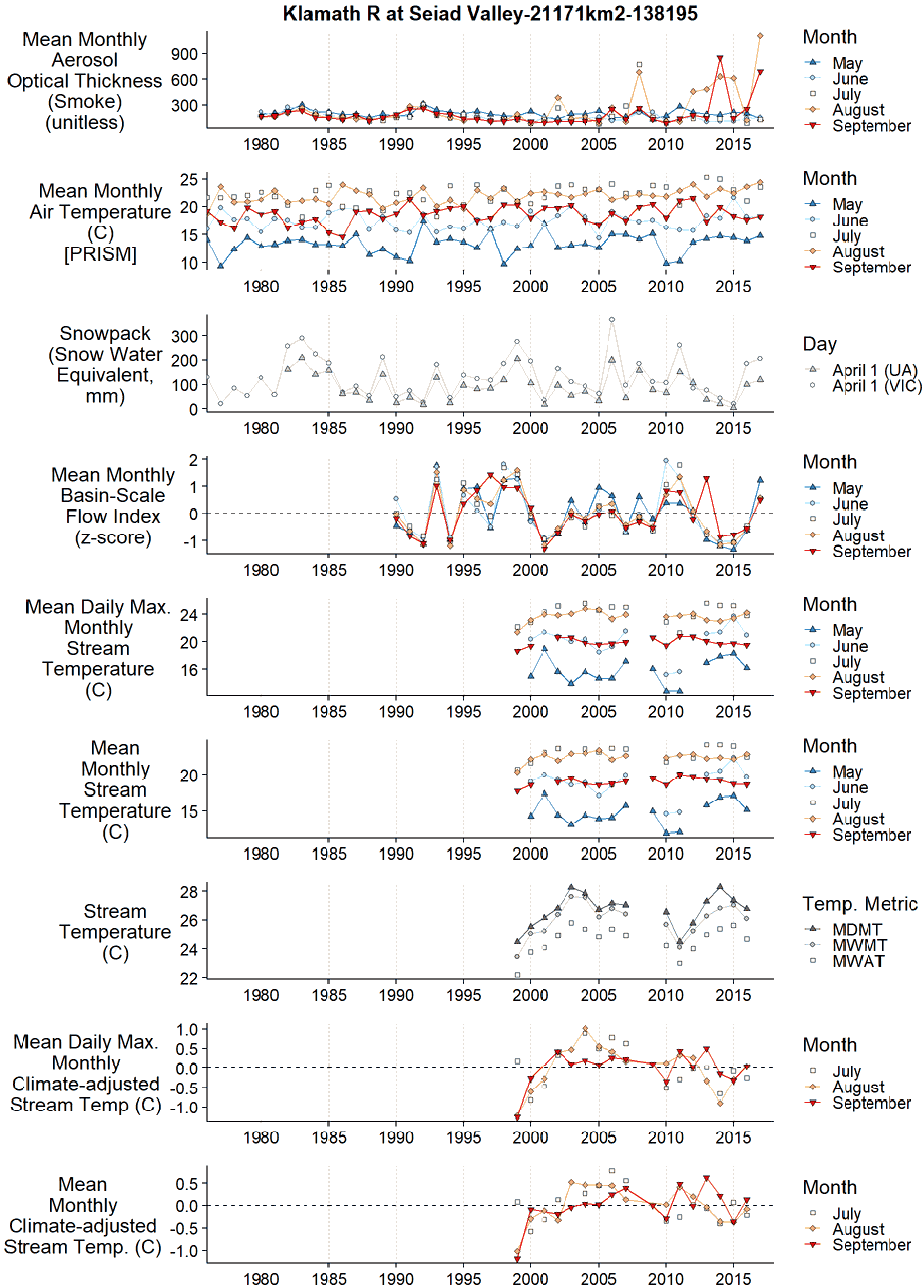
Klamath R us Walker Br-18423km2-137473
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT


Klamath River-18716km2-137399
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
MDMT
MWMT
MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
1980
1985
1990
1995
2000
2005
2010
2015

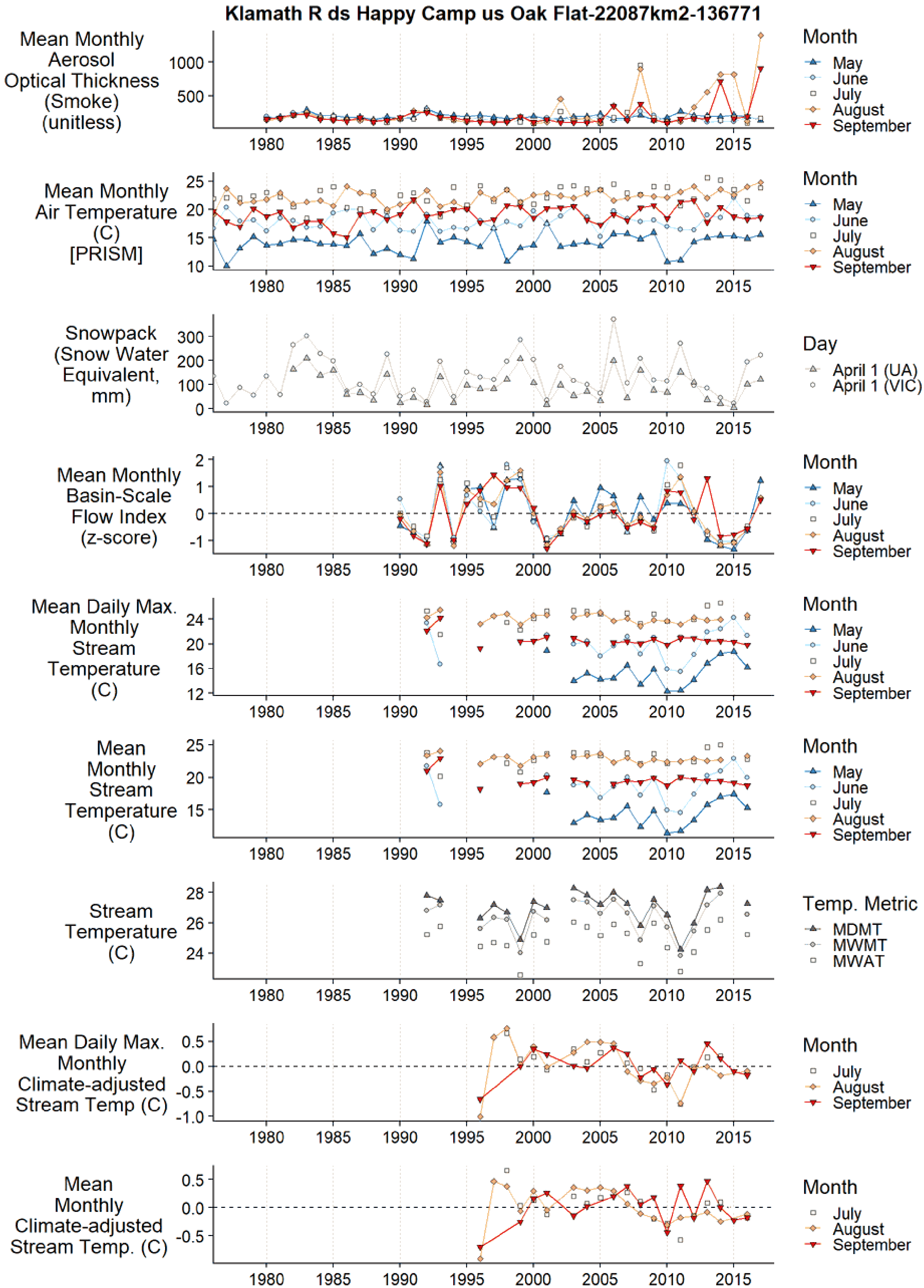


Klamath R us Scott R-18731km2-137306
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015

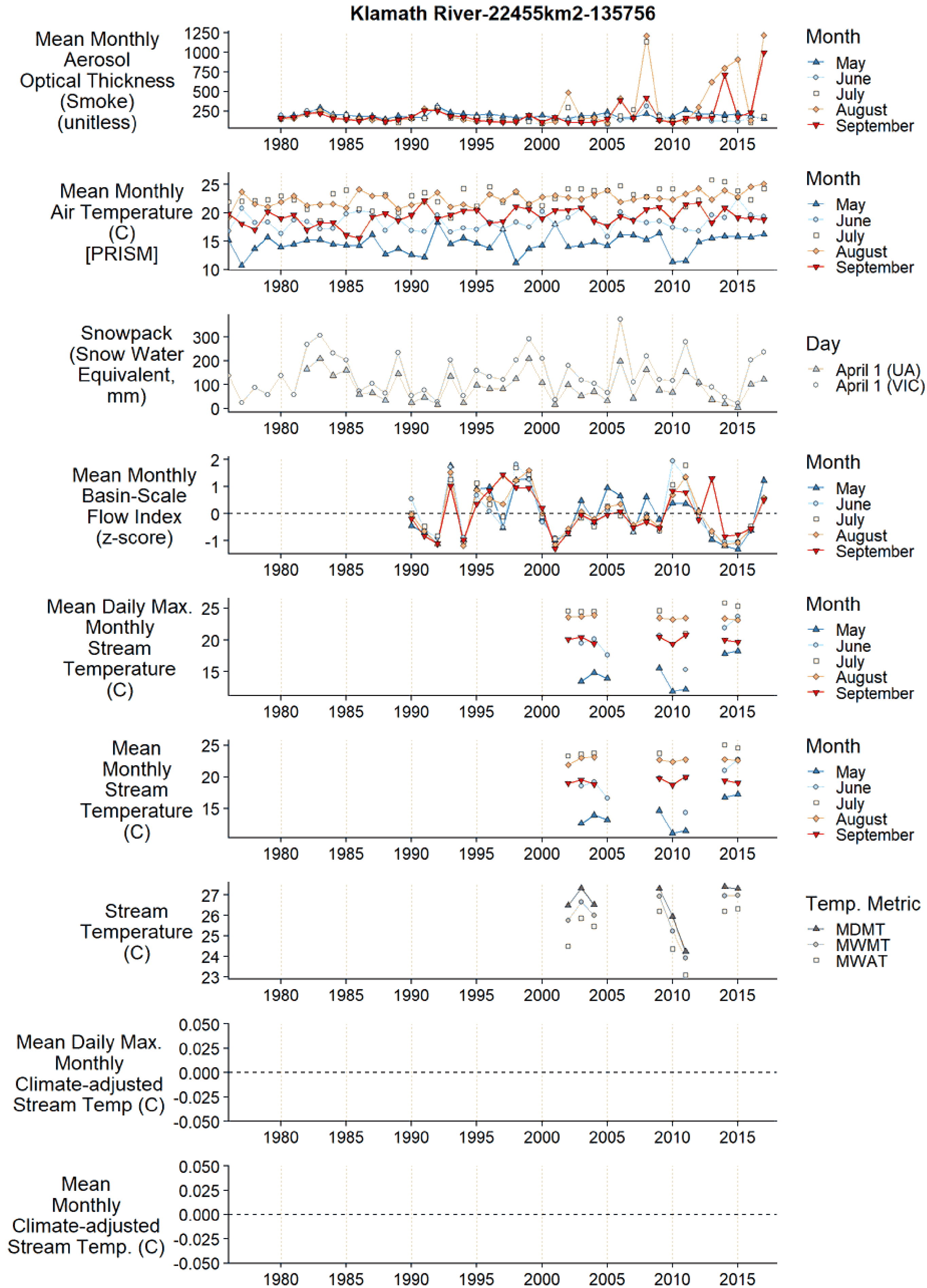

Klamath River-20861km2-137031
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015



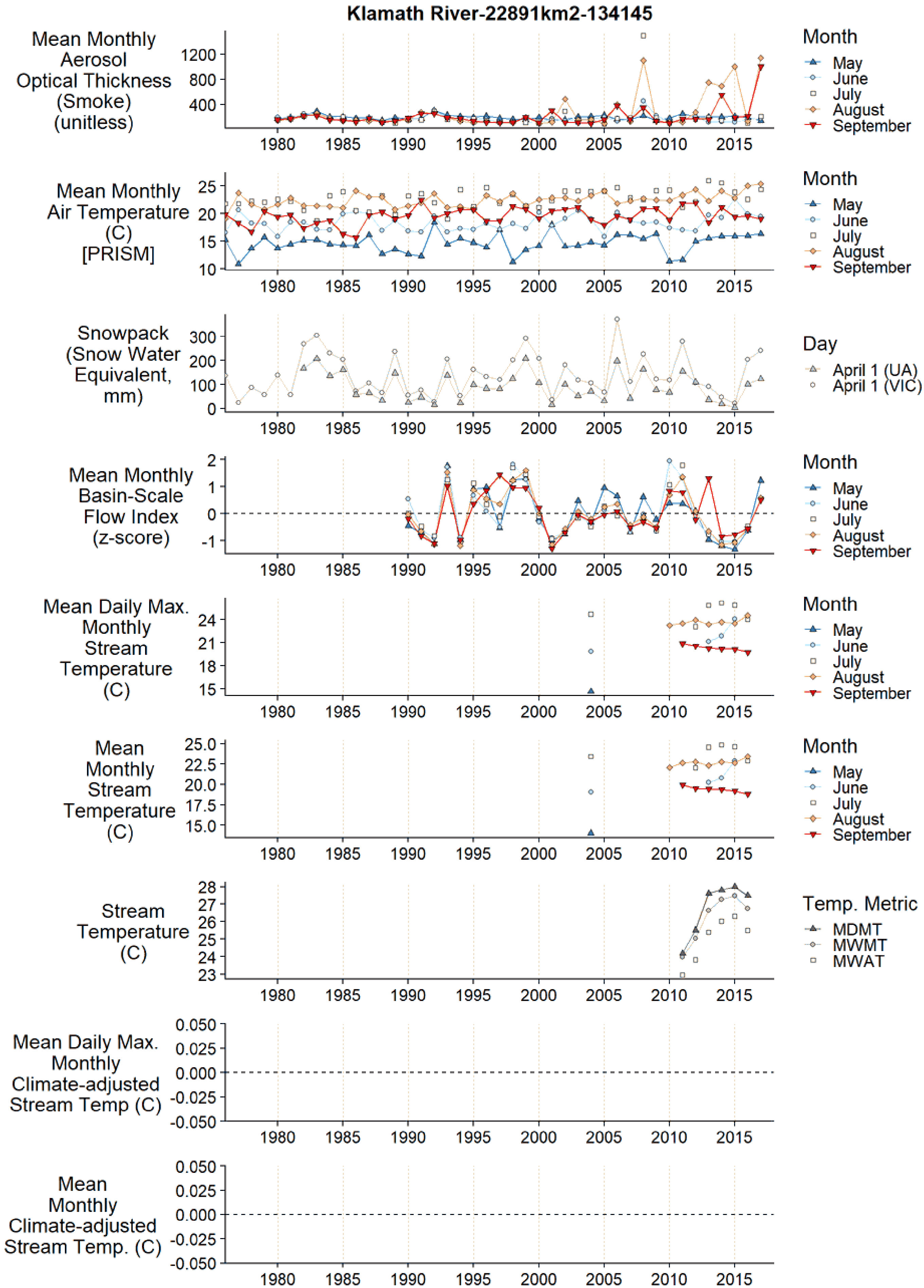
Klamath R at Seiad Valley-21171km2-138195
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015

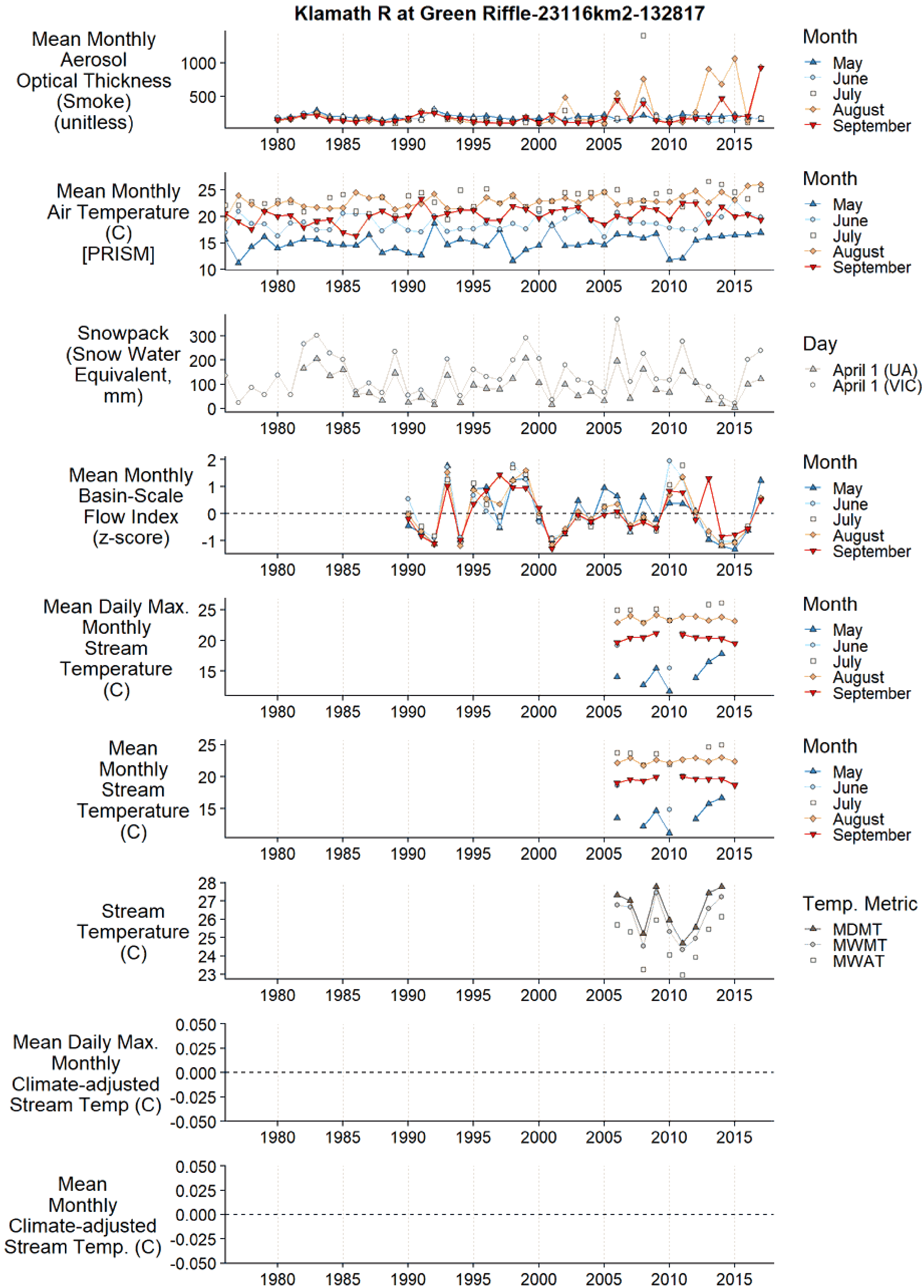


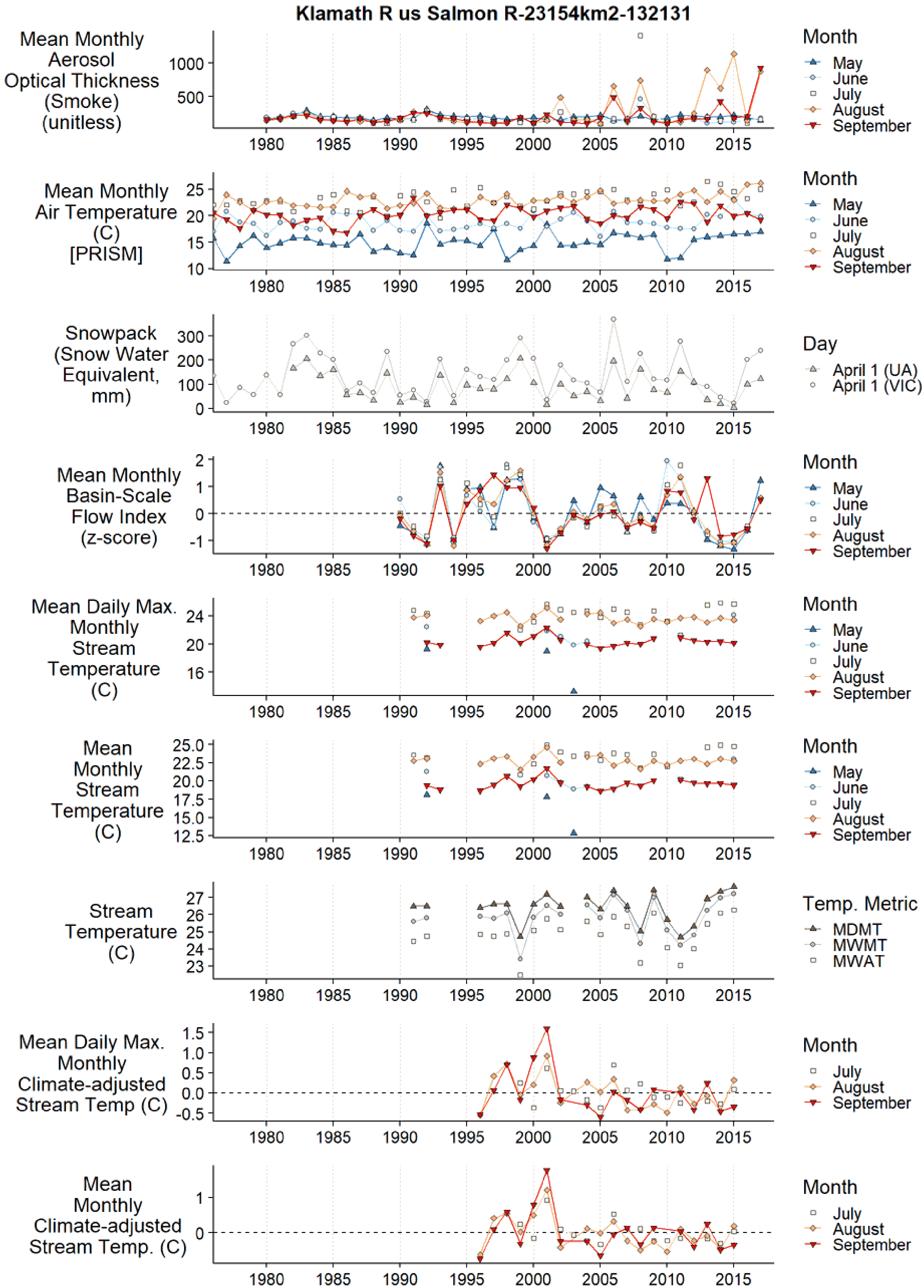
Klamath R ds Happy Camp us Oak Flat-22087km2-136771
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT



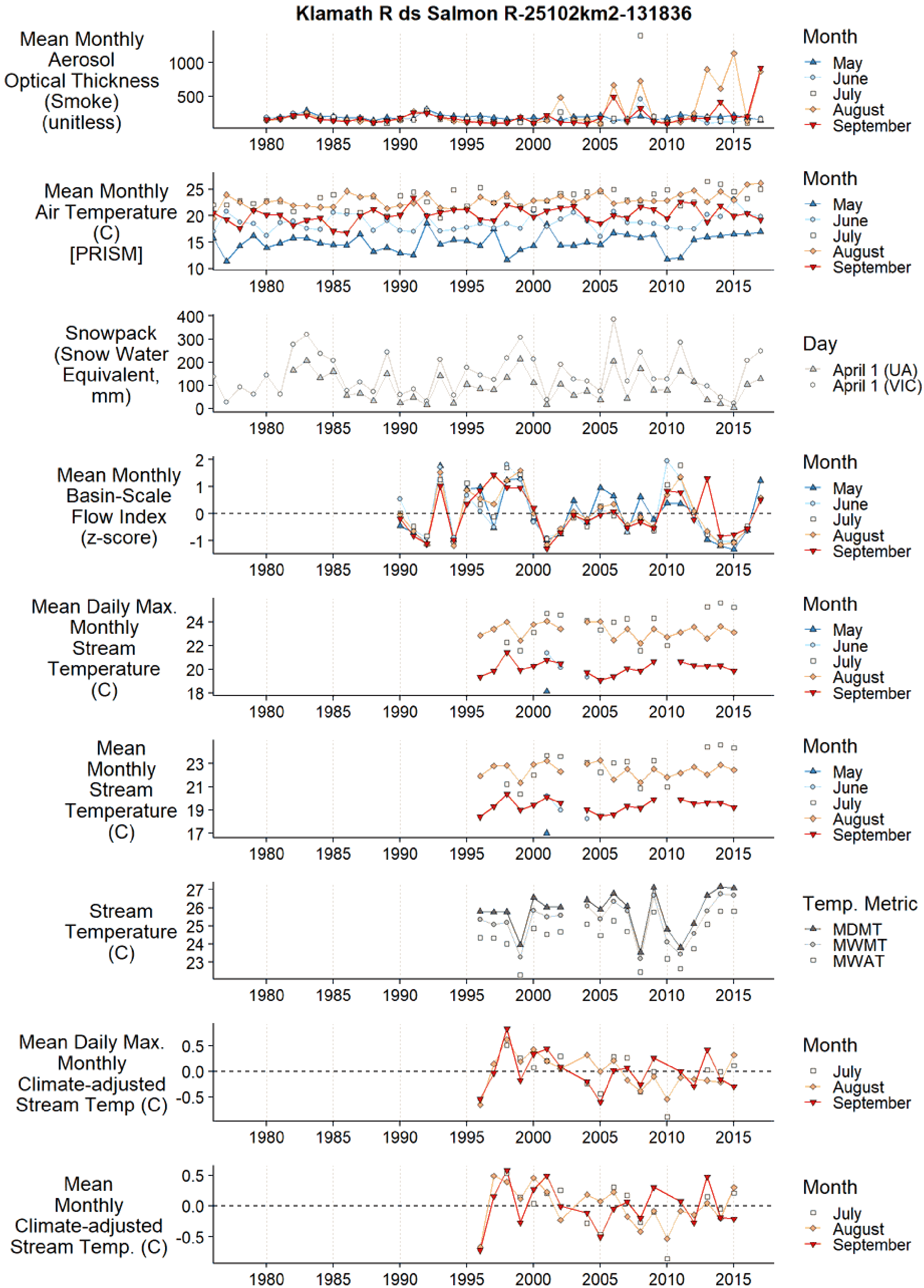
Klamath River-22455km2-135756
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
MDMT
MWMT
MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)


Klamath River-22891km2-134145
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
400
800
1200
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
10
15
20
25
Month
May
June
July
August
September
Snowpack (Snow Water Equivalent, mm)
0
100
200
300
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
-1
0
1
2
Month
May
June
July
August
September
Mean Daily Max. Monthly Stream Temperature (C)
15
18
21
24
Month
May
June
July
August
September
Mean Monthly Stream Temperature (C)
15.0
17.5
20.0
22.5
25.0
Month
May
June
July
August
September
Stream Temperature (C)
23
24
25
26
27
28
Temp. Metric
MDMT
MWMT
MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
-0.050
-0.025
0.000
0.025
0.050
Mean Monthly Climate-adjusted Stream Temp. (C)
-0.050
-0.025
0.000
0.025
0.050
1980
1985
1990
1995
2000
2005
2010
2015


Klamath R at Green Riffle-23116km2-132817
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Month
May
June
July
August
September
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Month
May
June
July
August
September
Mean Daily Max. Monthly Stream Temperature (C)
Month
May
June
July
August
September
Mean Monthly Stream Temperature (C)
Month
May
June
July
August
September
Stream Temperature (C)
Temp. Metric
MDMT
MWMT
MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
1980
1985
1990
1995
2000
2005
2010
2015



Klamath R us Salmon R-23154km2-132131
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT


Klamath R ds Salmon R-25102km2-131836
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
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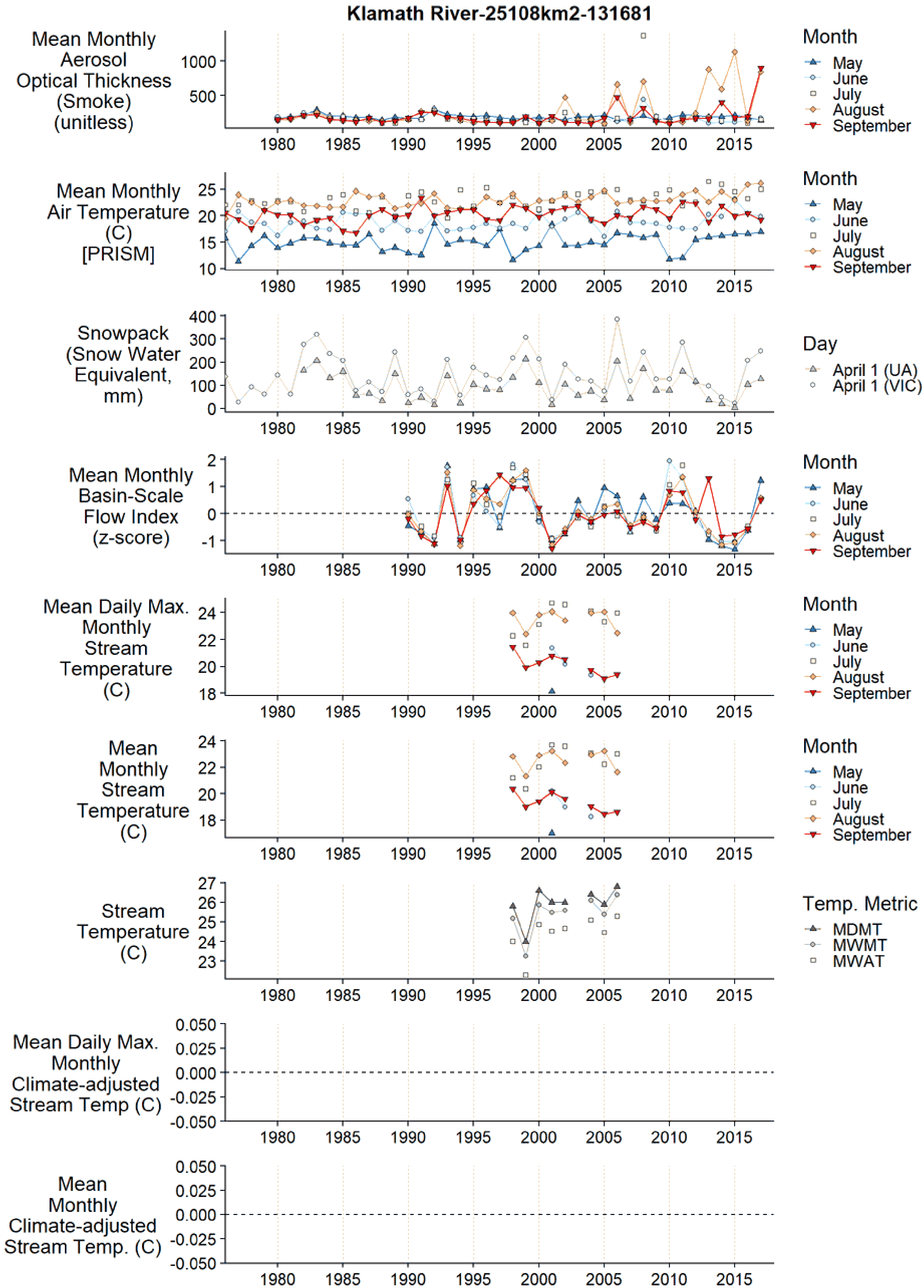
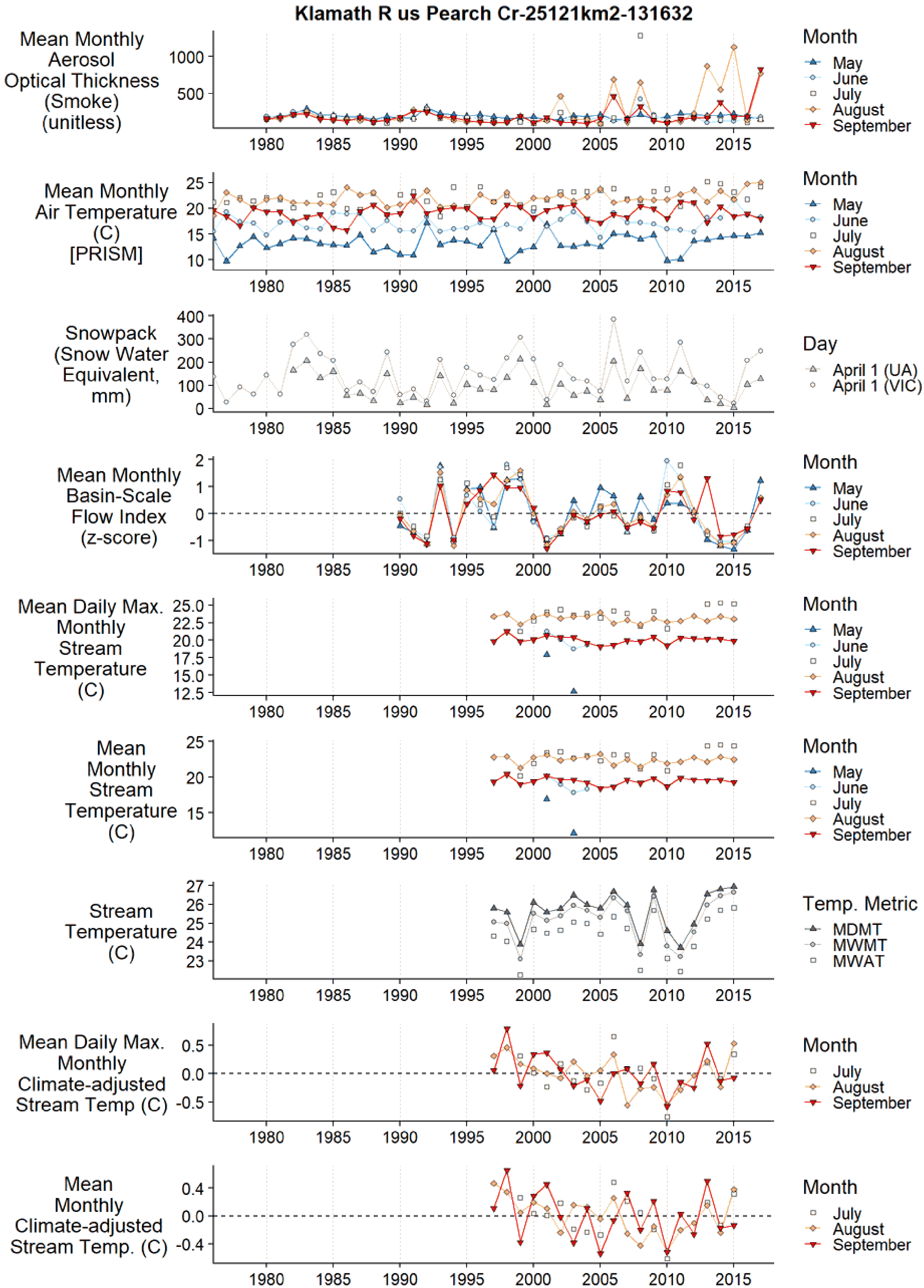
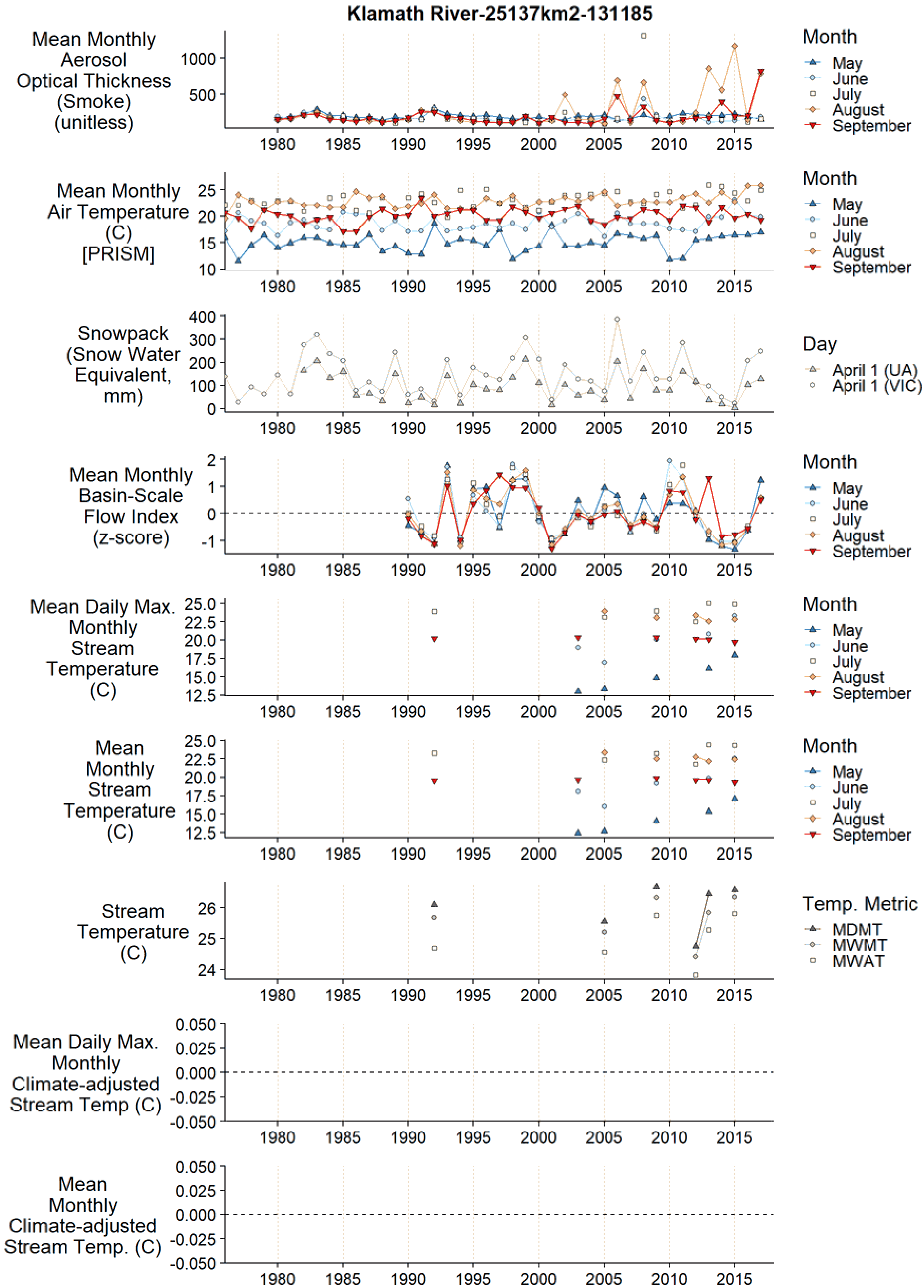
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT

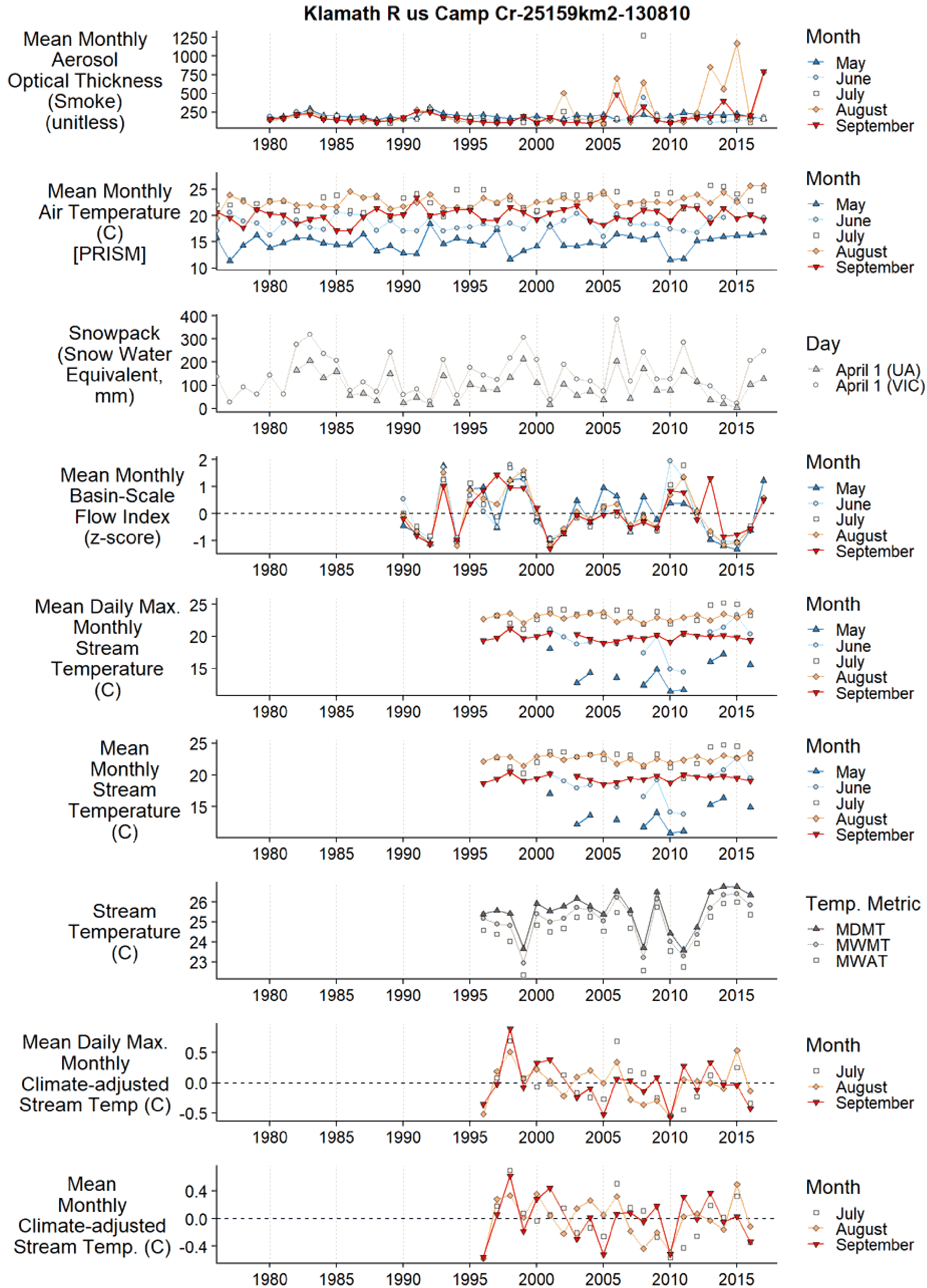


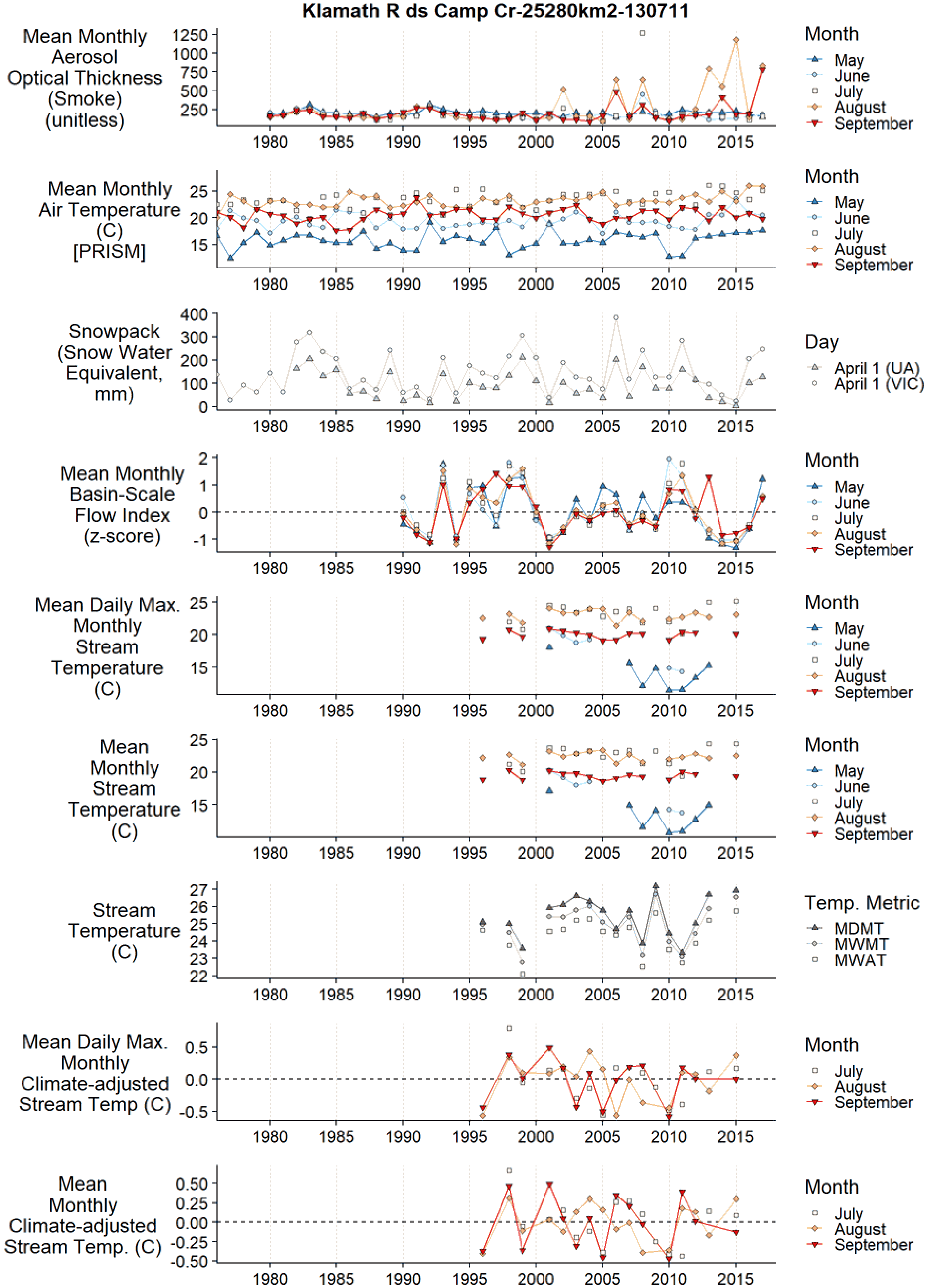
Klamath River-25108km2-131681
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015



Klamath R us Pearch Cr-25121km2-131632
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT


Klamath River-25137km2-131185
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015


Klamath R us Camp Cr-25159km2-130810
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015


Klamath R ds Camp Cr-25280km2-130711
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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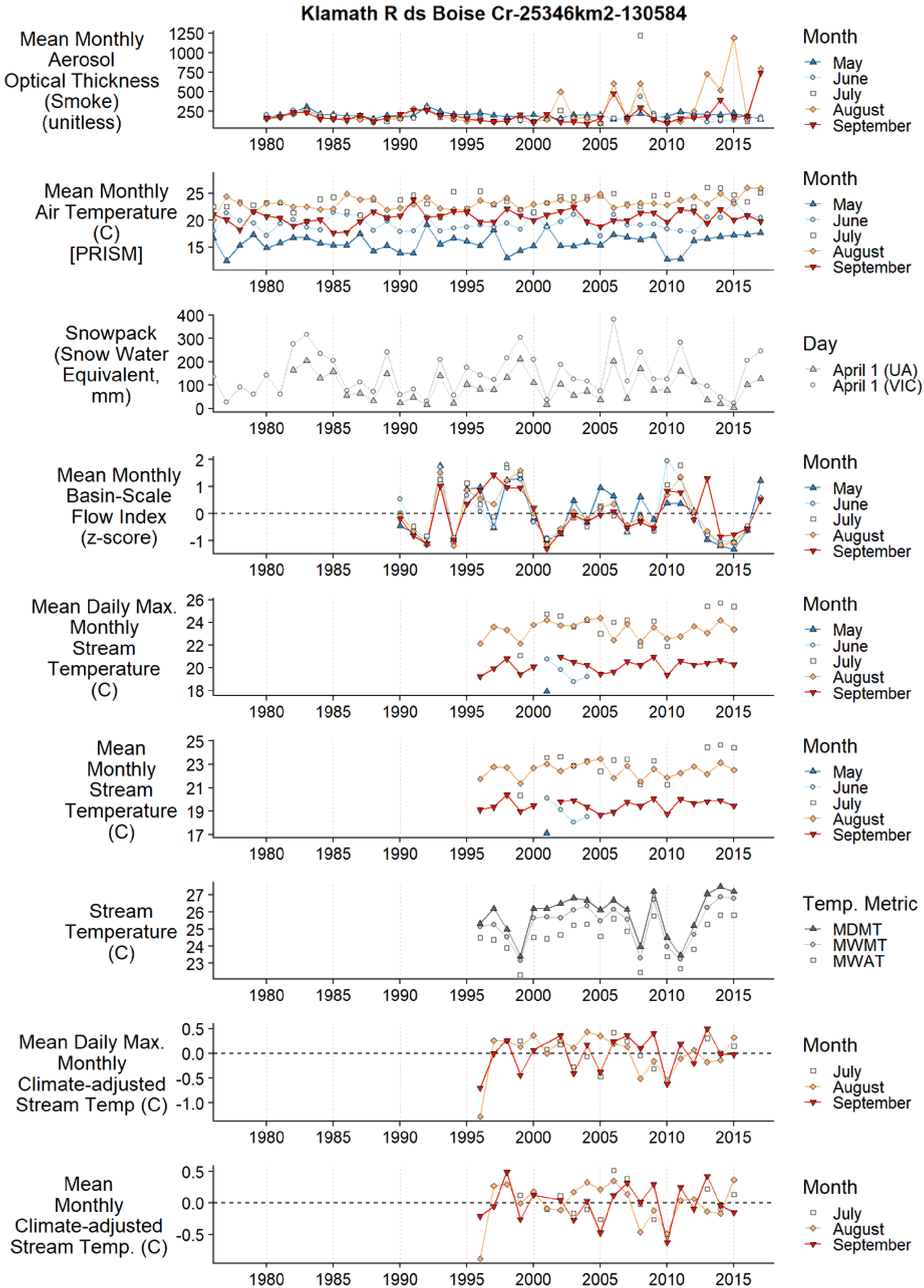
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT


Klamath R ds Boise Cr-25346km2-130584
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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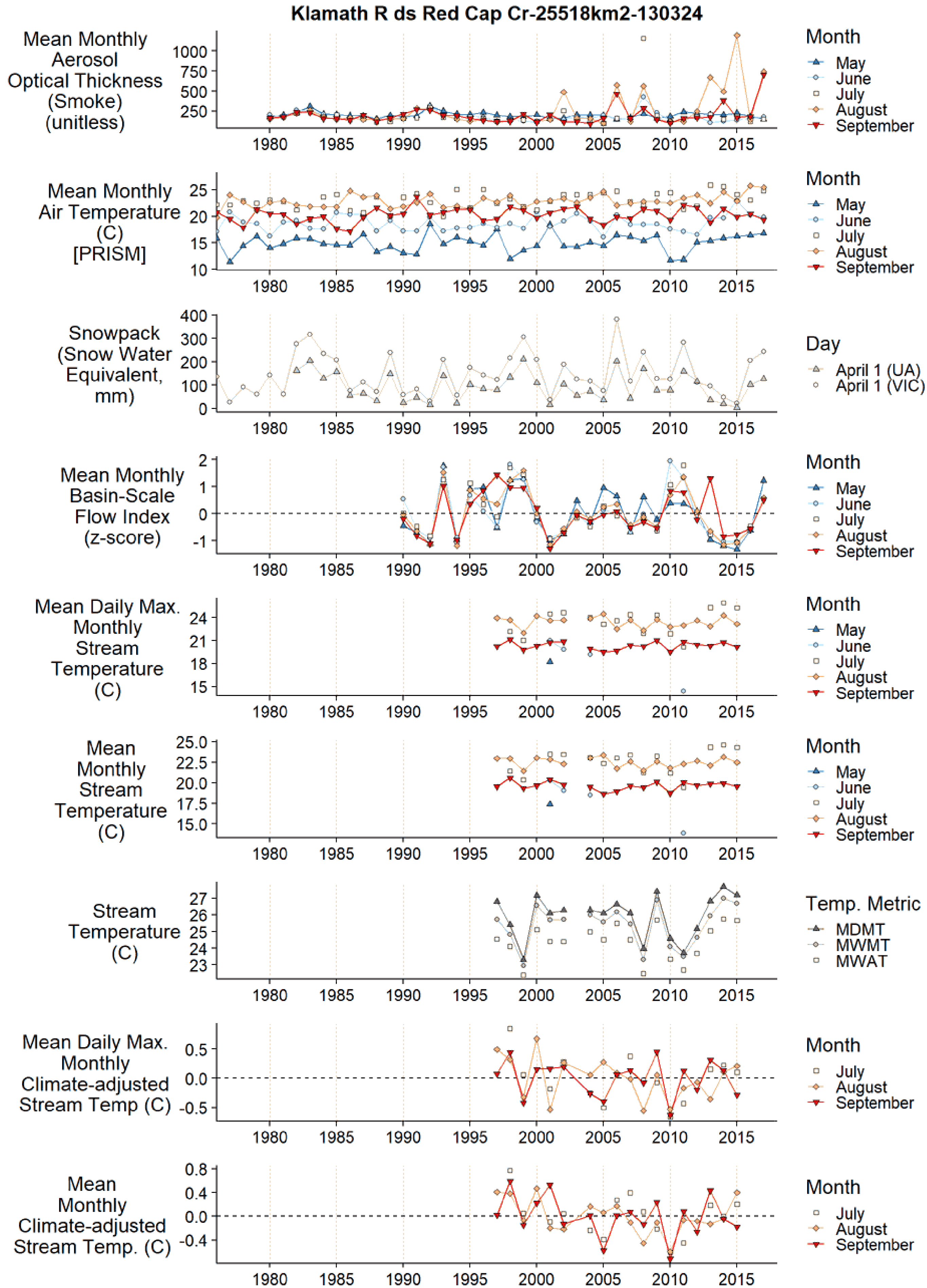
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT



Klamath R ds Red Cap Cr-25518km2-130324
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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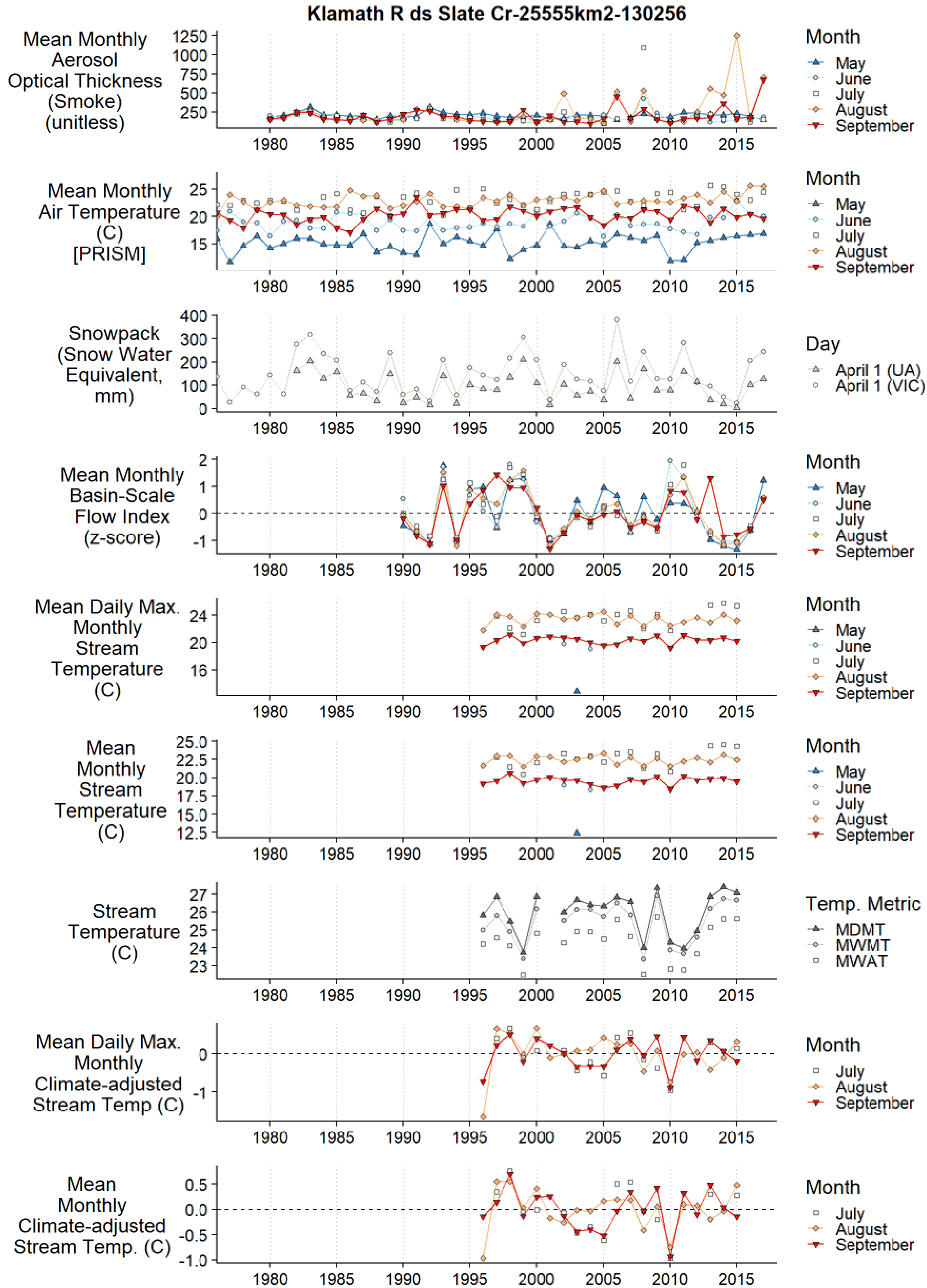
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT


Klamath R ds Slate Cr-25555km2-130256
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
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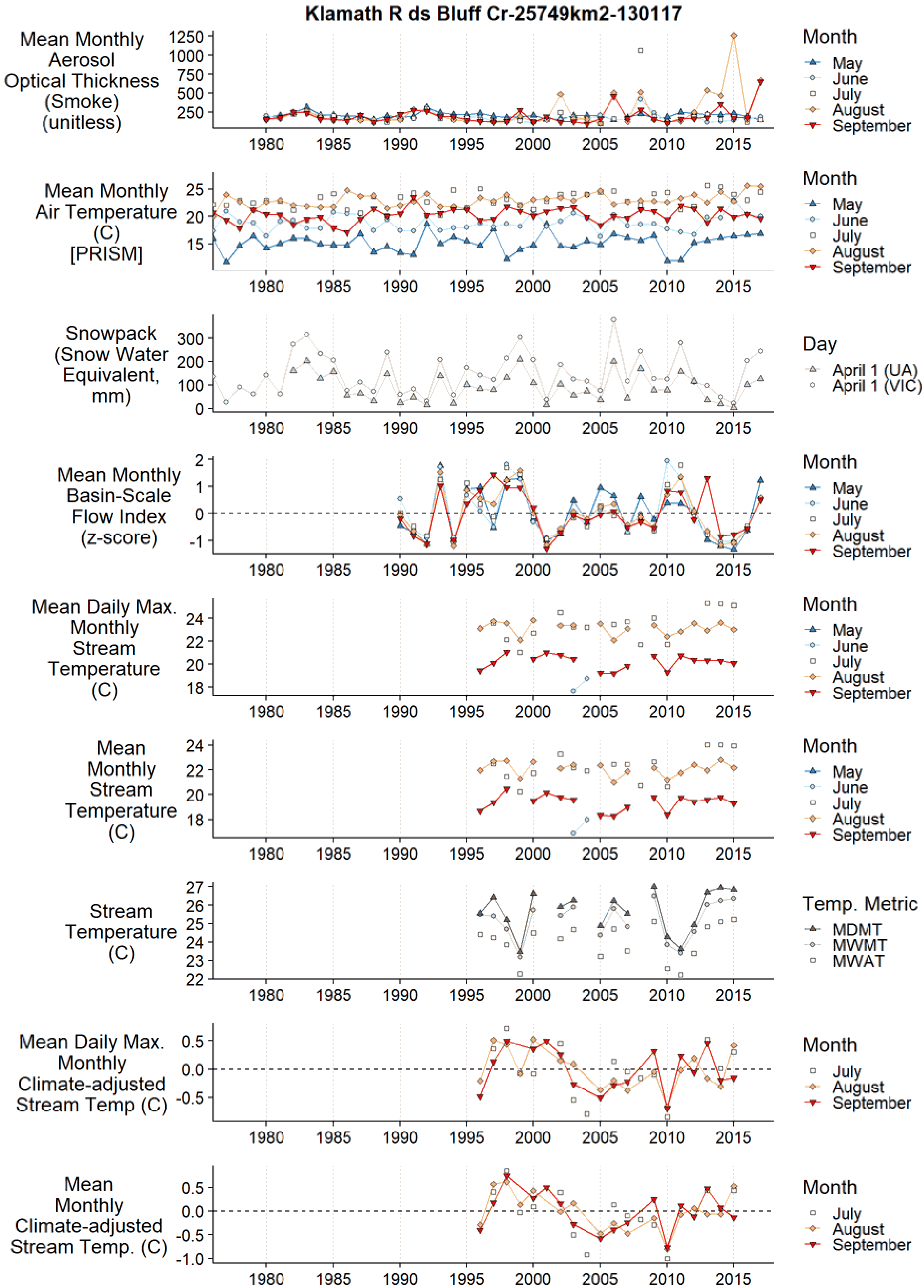
2015



Klamath R ds Bluff Cr-25749km2-130117
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
MDMT
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MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
1980
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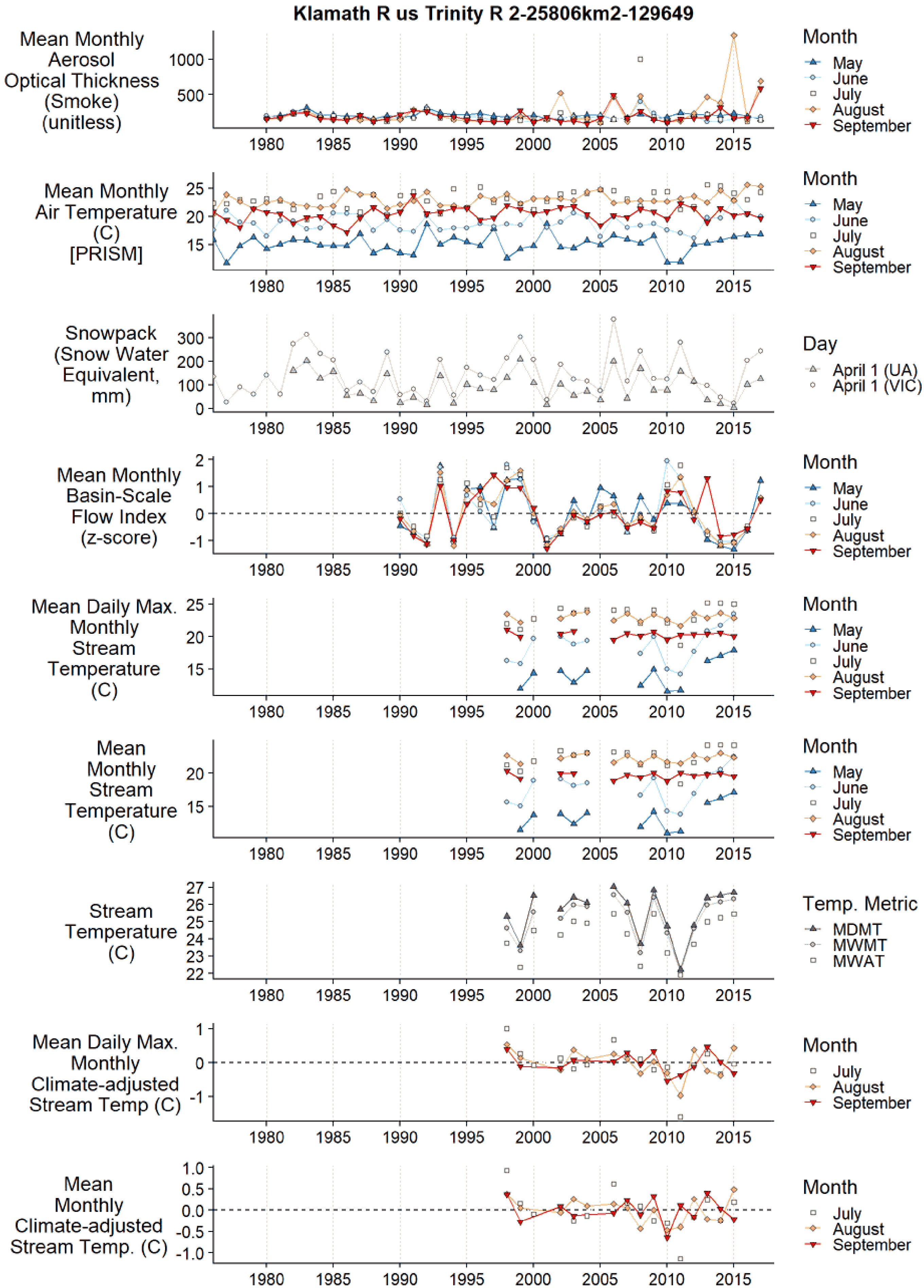
2015


Klamath R us Trinity R 2-25806km2-129649
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
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September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
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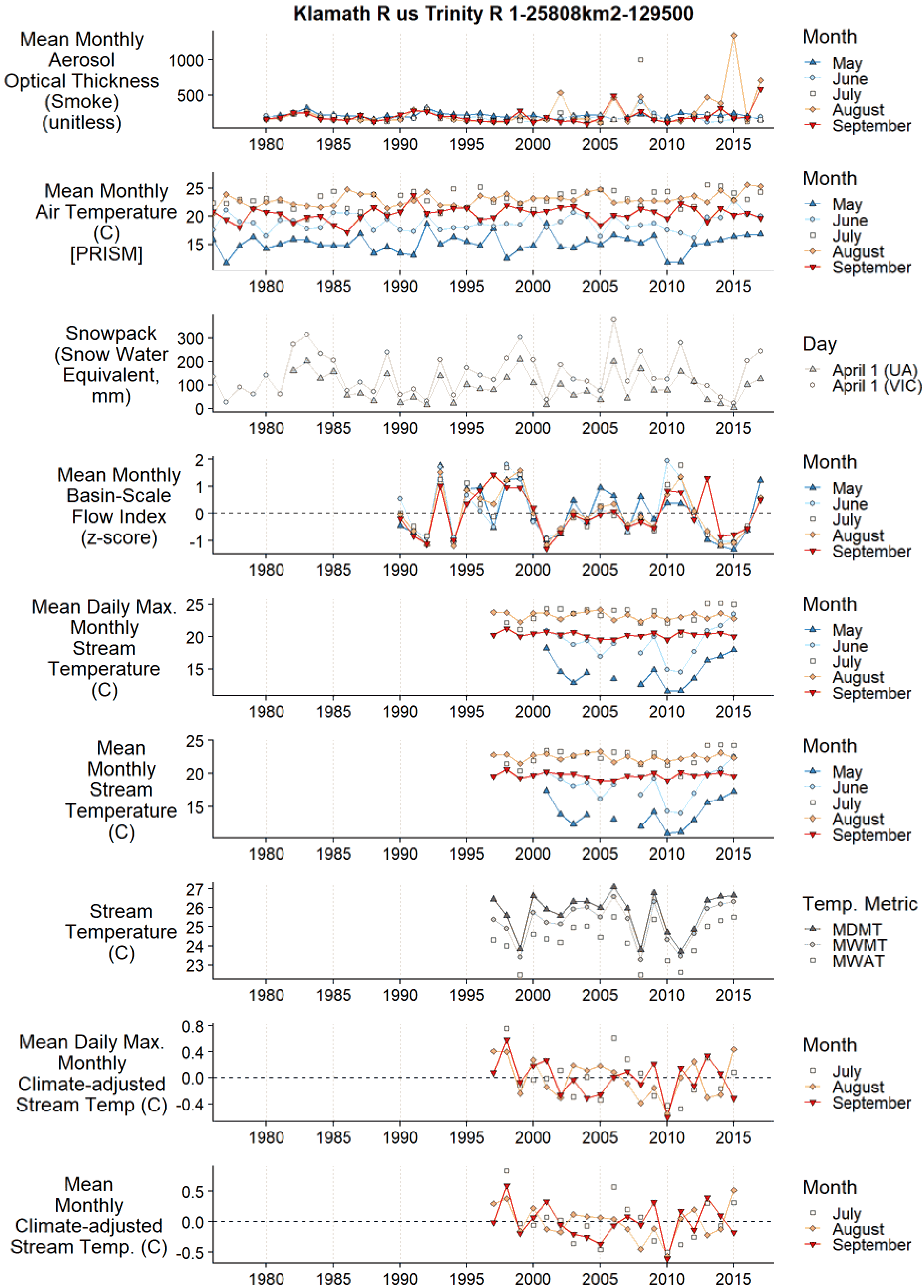
2015


Klamath R us Trinity R 1-25808km2-129500
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
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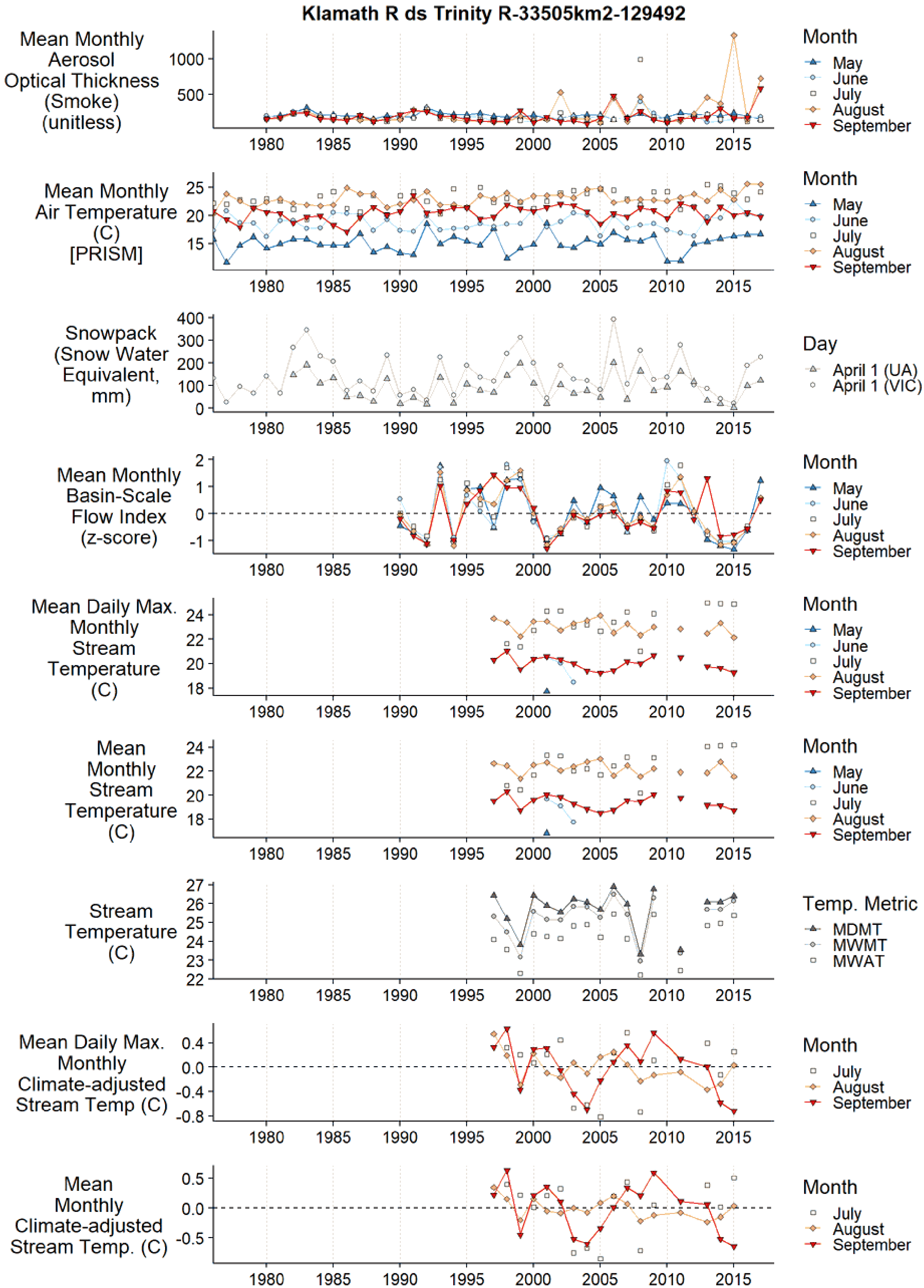
Klamath R ds Trinity R-33505km2-129492
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
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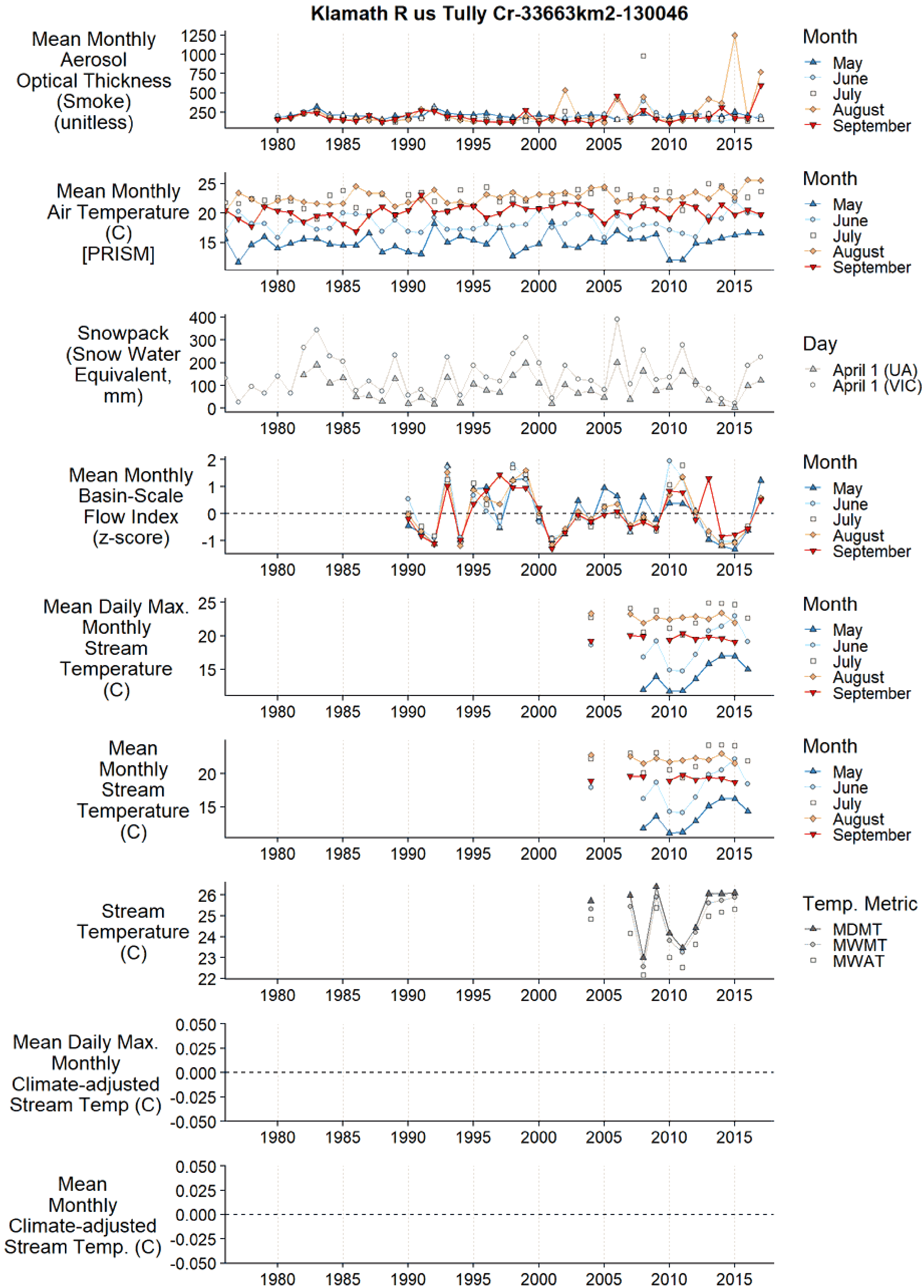
Klamath R us Tully Cr-33663km2-130046
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
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September
Mean Monthly Air Temperature (C) [PRISM]
Month
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August
September
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Month
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Mean Daily Max. Monthly Stream Temperature (C)
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Mean Monthly Stream Temperature (C)
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Stream Temperature (C)
Temp. Metric
MDMT
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MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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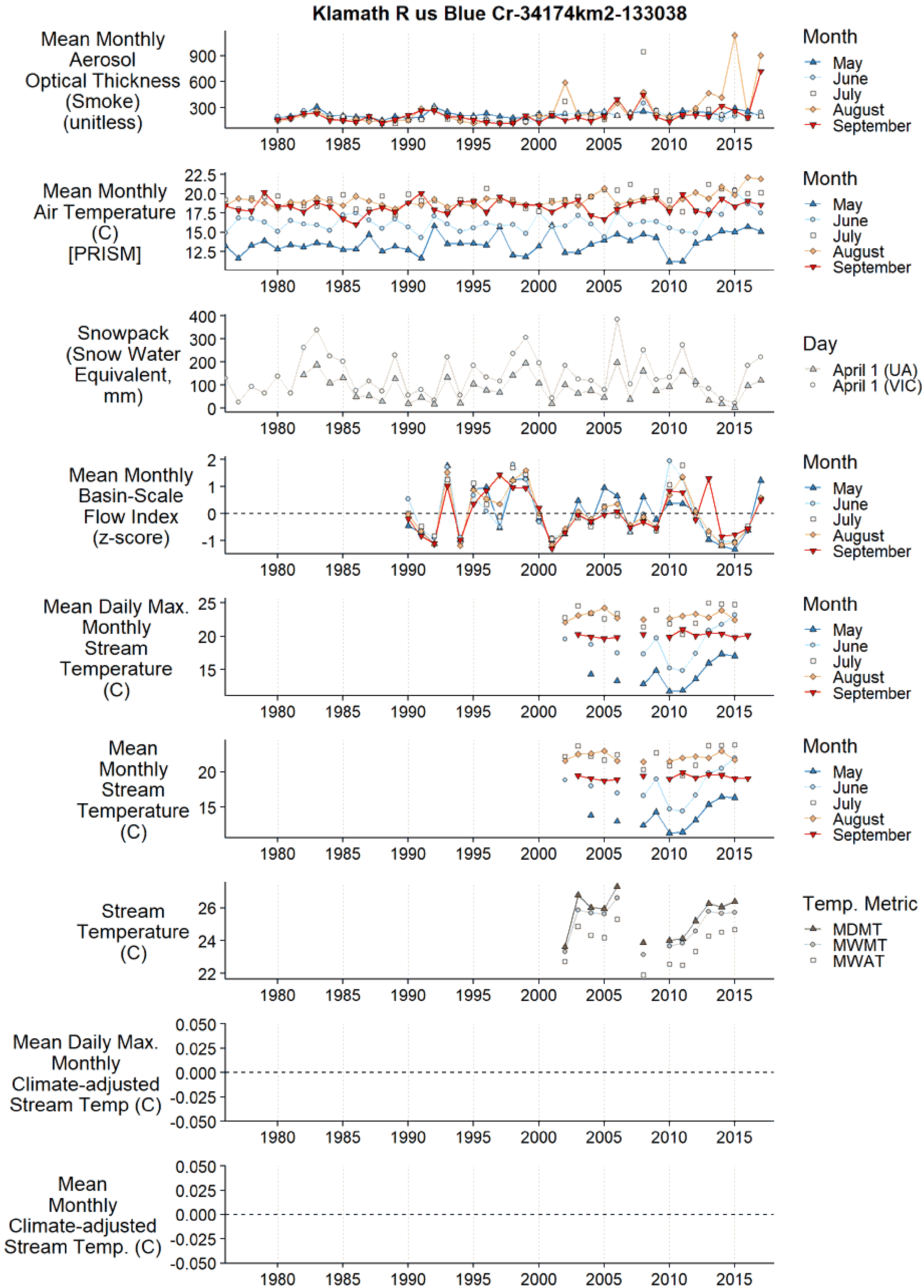
Klamath R us Blue Cr-34174km2-133038
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (VIC)
Temp. Metric
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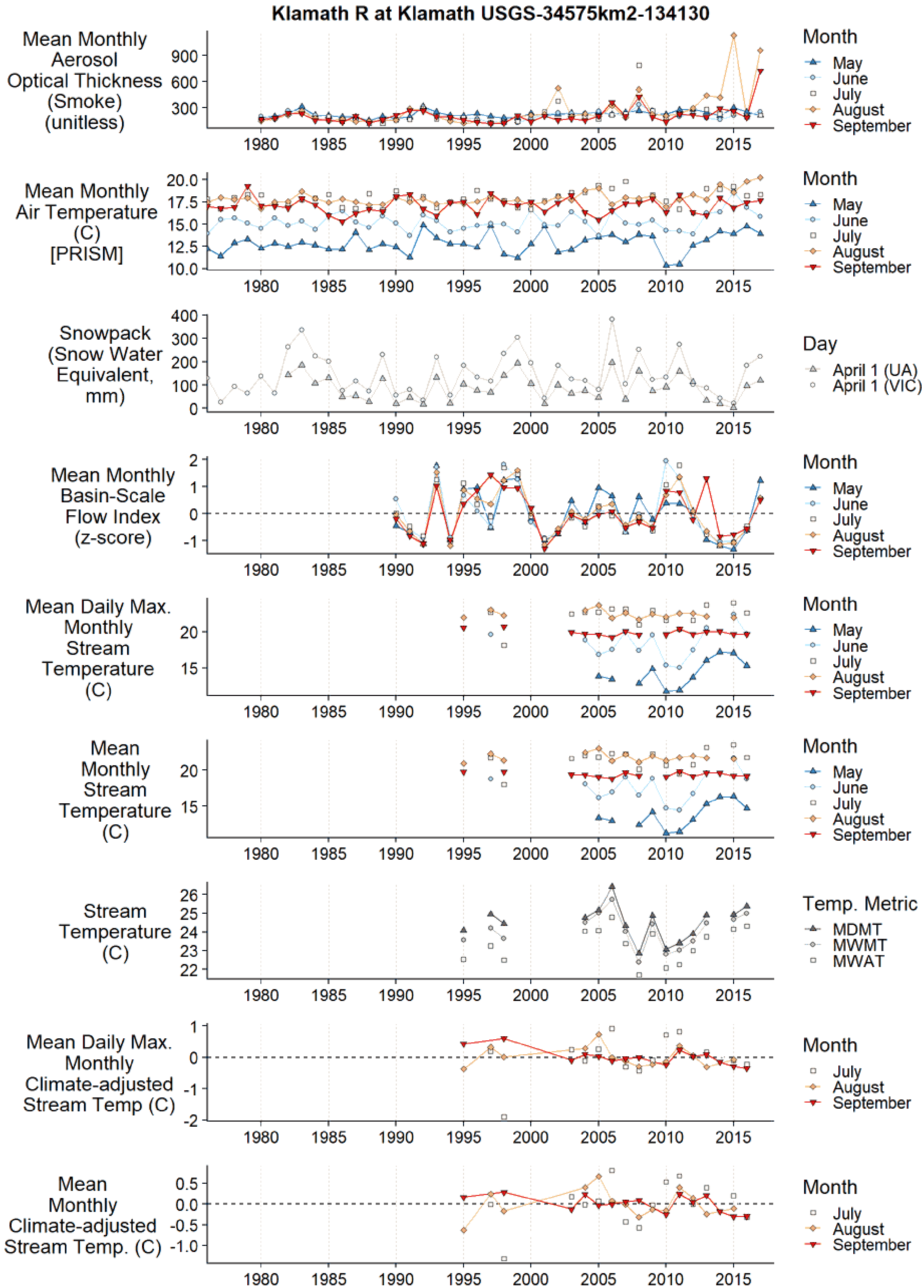
Klamath R at Klamath USGS-34575km2-134130
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
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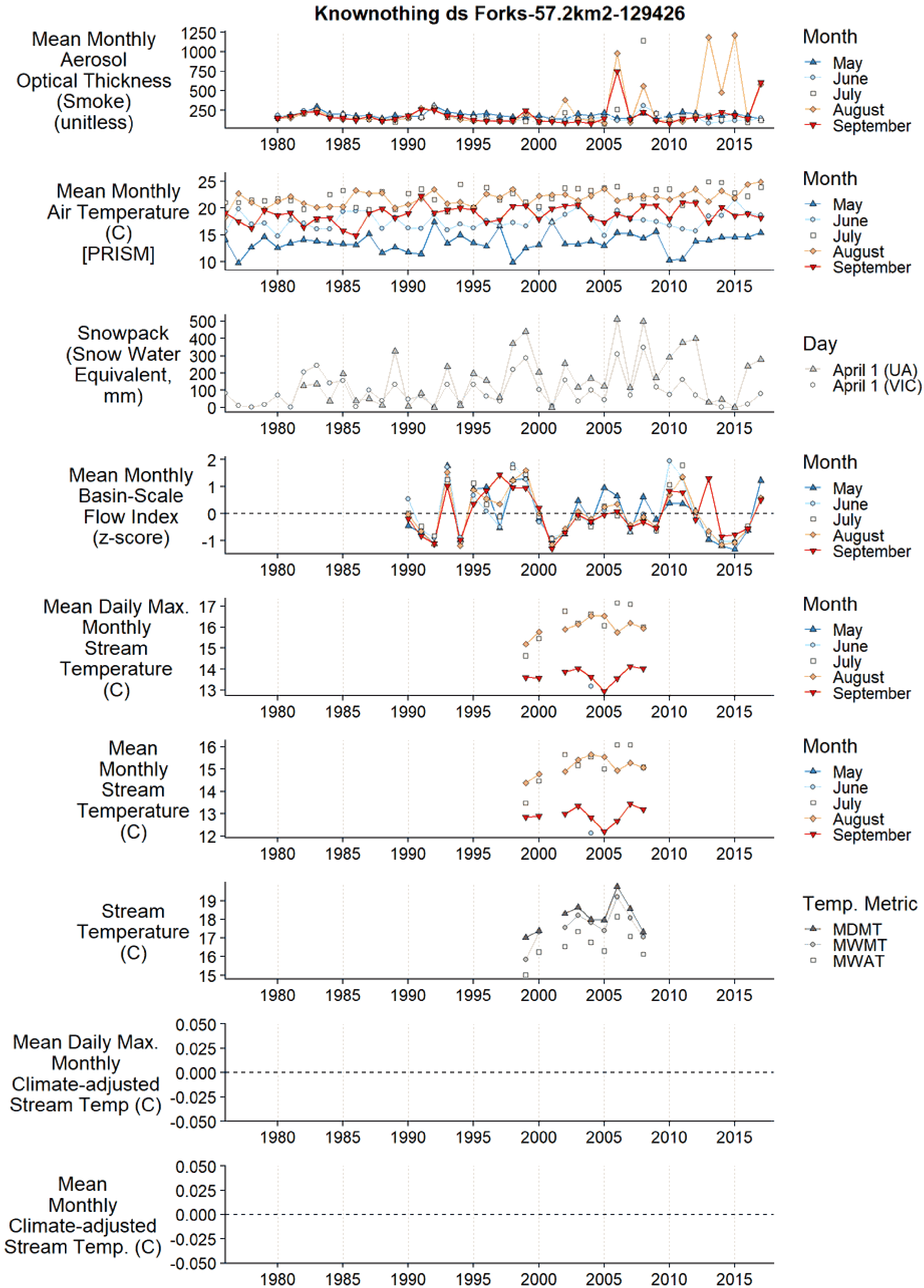

Knownothing ds Forks-57.2km2-129426
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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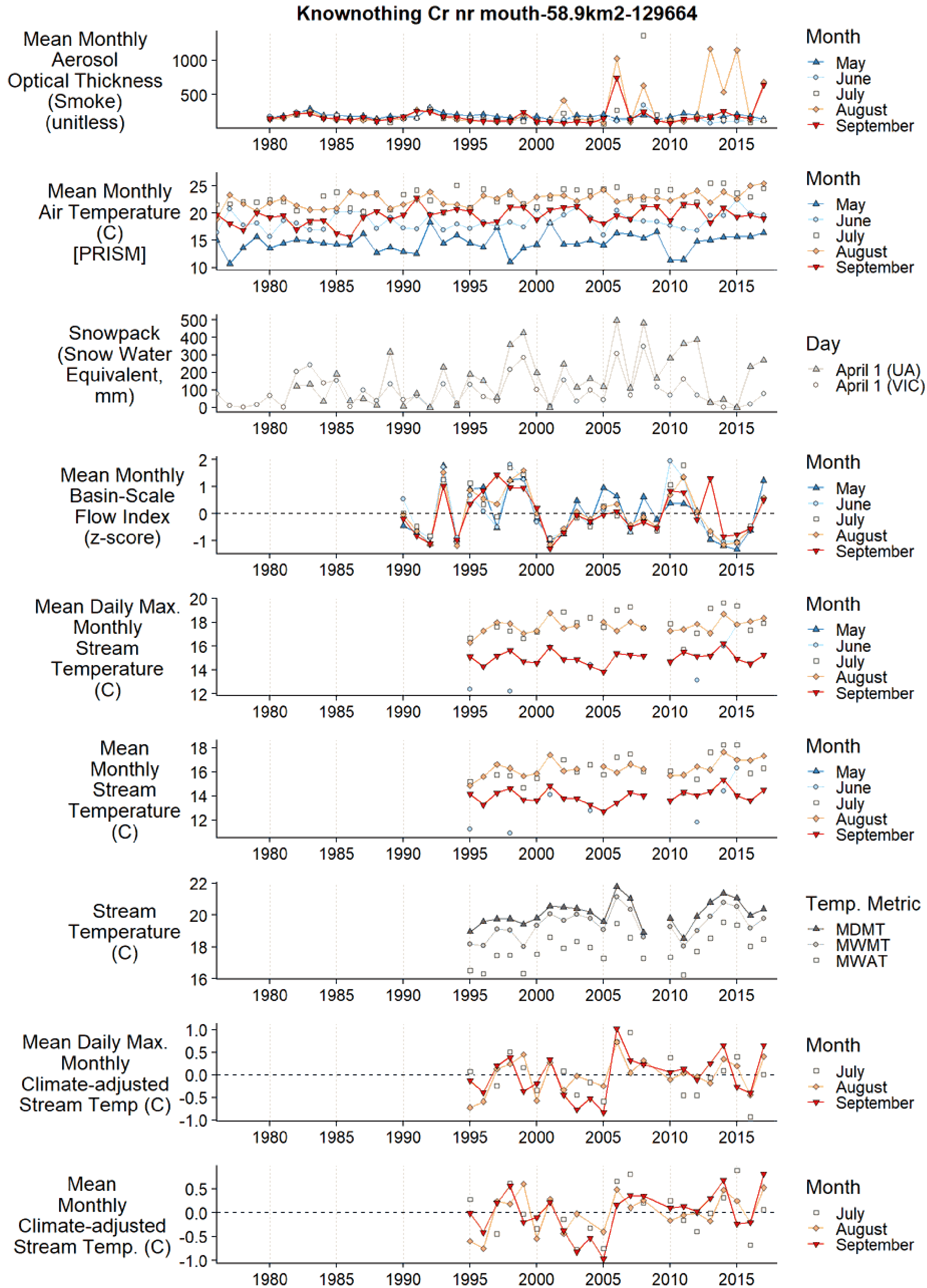
Knownothing Cr nr mouth-58.9km2-129664
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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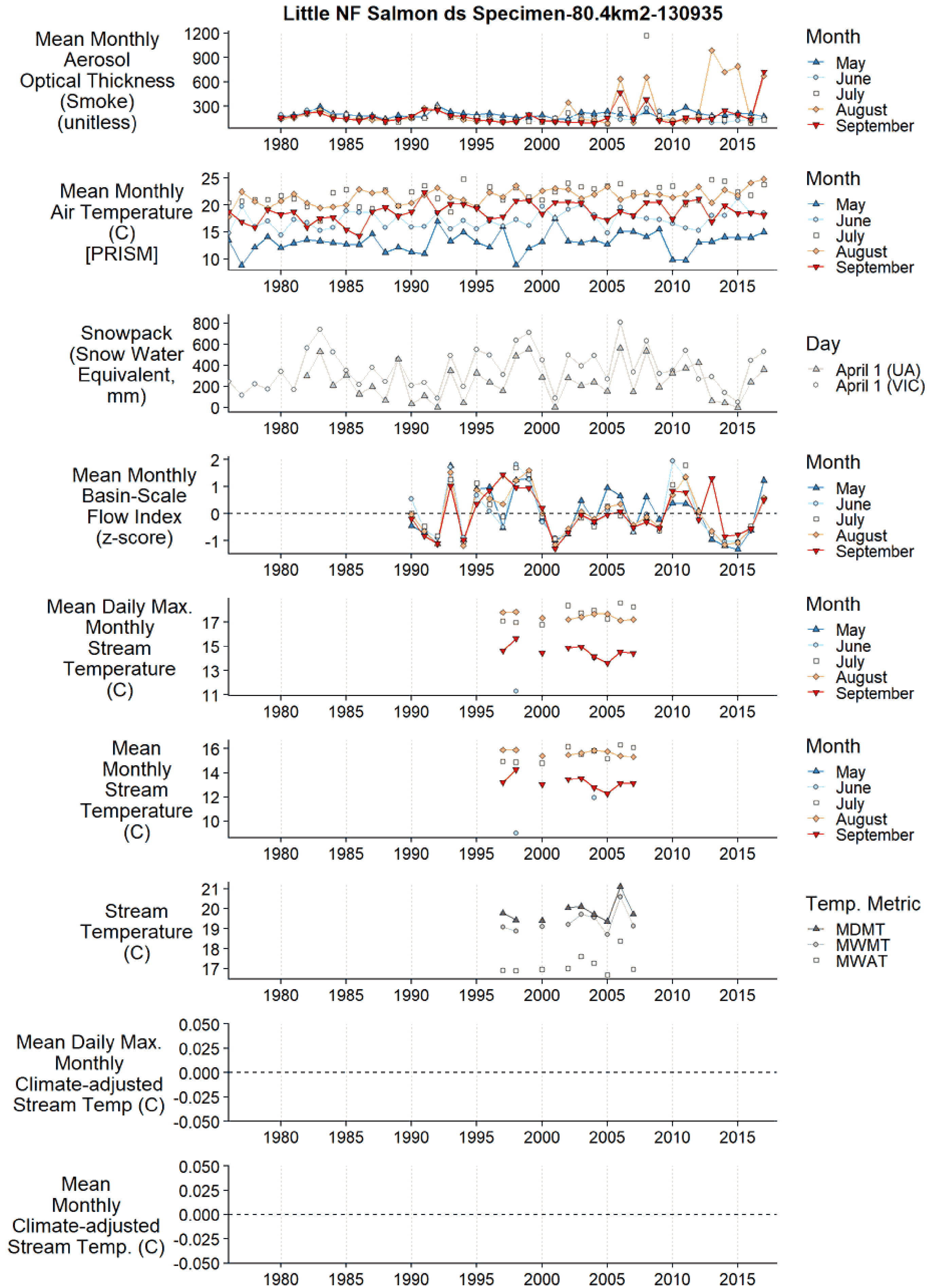
Little NF Salmon ds Specimen-80.4km2-130935
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (VIC)
Temp. Metric
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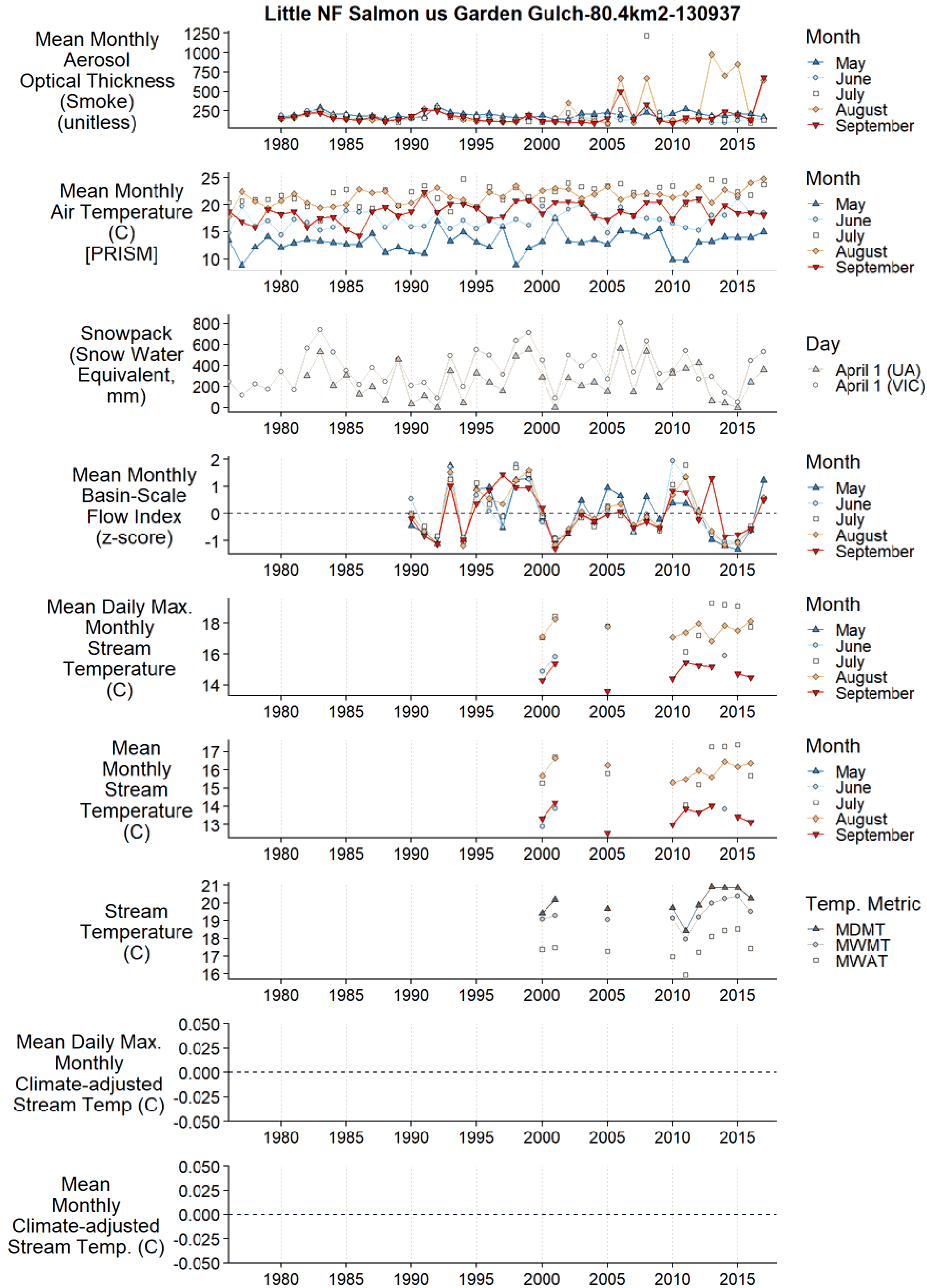
Little NF Salmon us Garden Gulch-80.4km2-130937
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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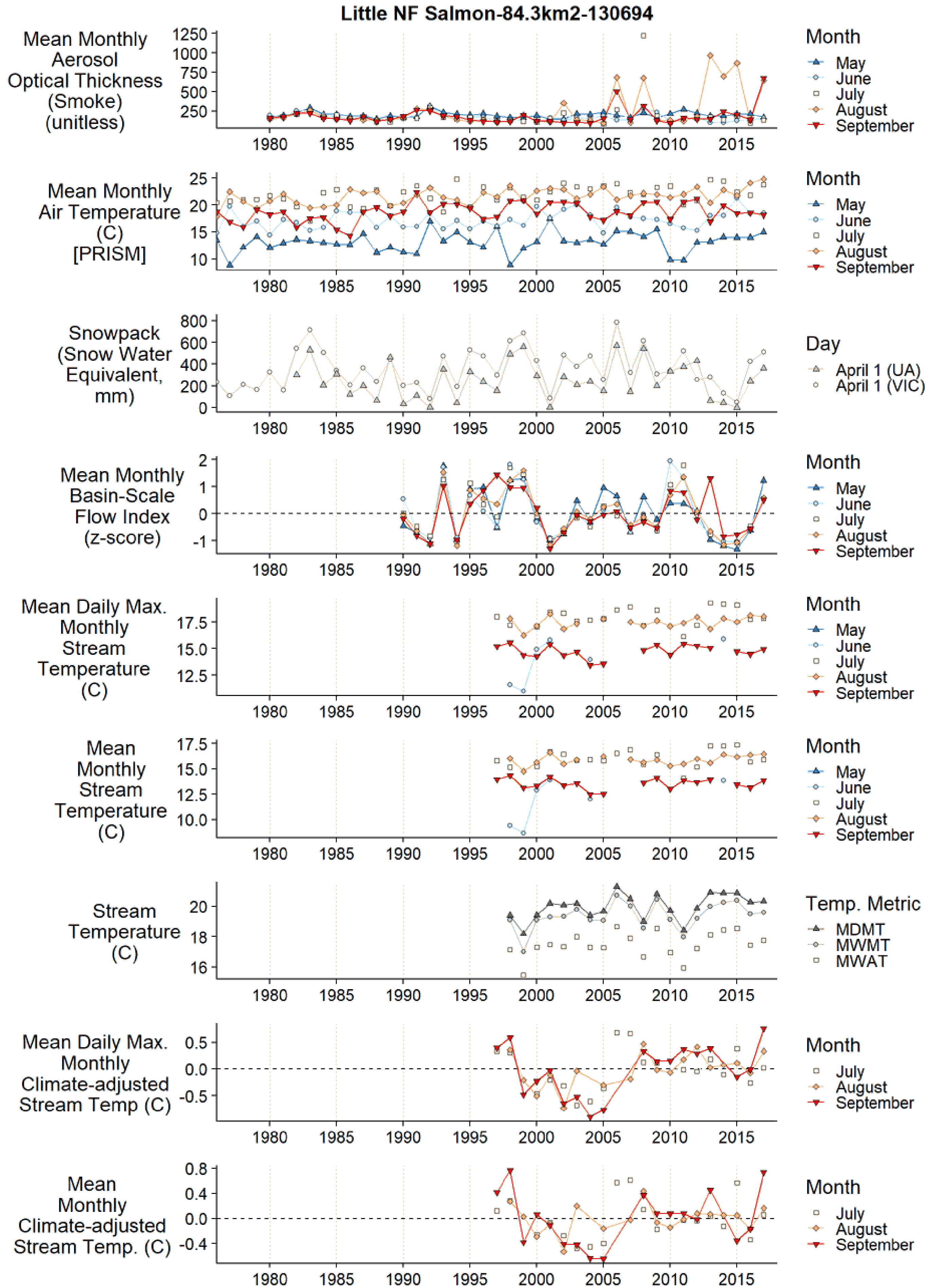

Little NF Salmon-84.3km2-130694
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (UA)
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Temp. Metric
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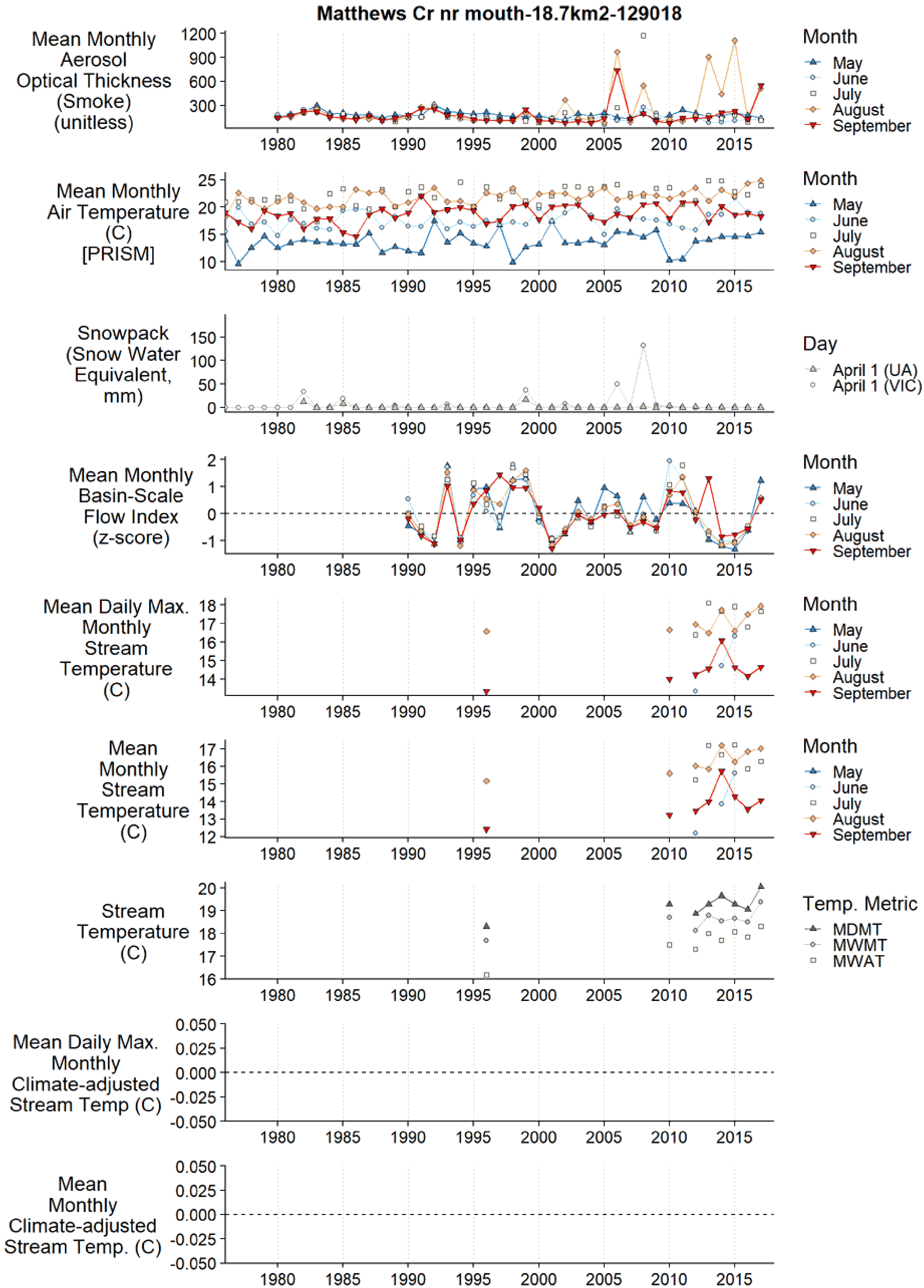
Matthews Cr nr mouth-18.7km2-129018
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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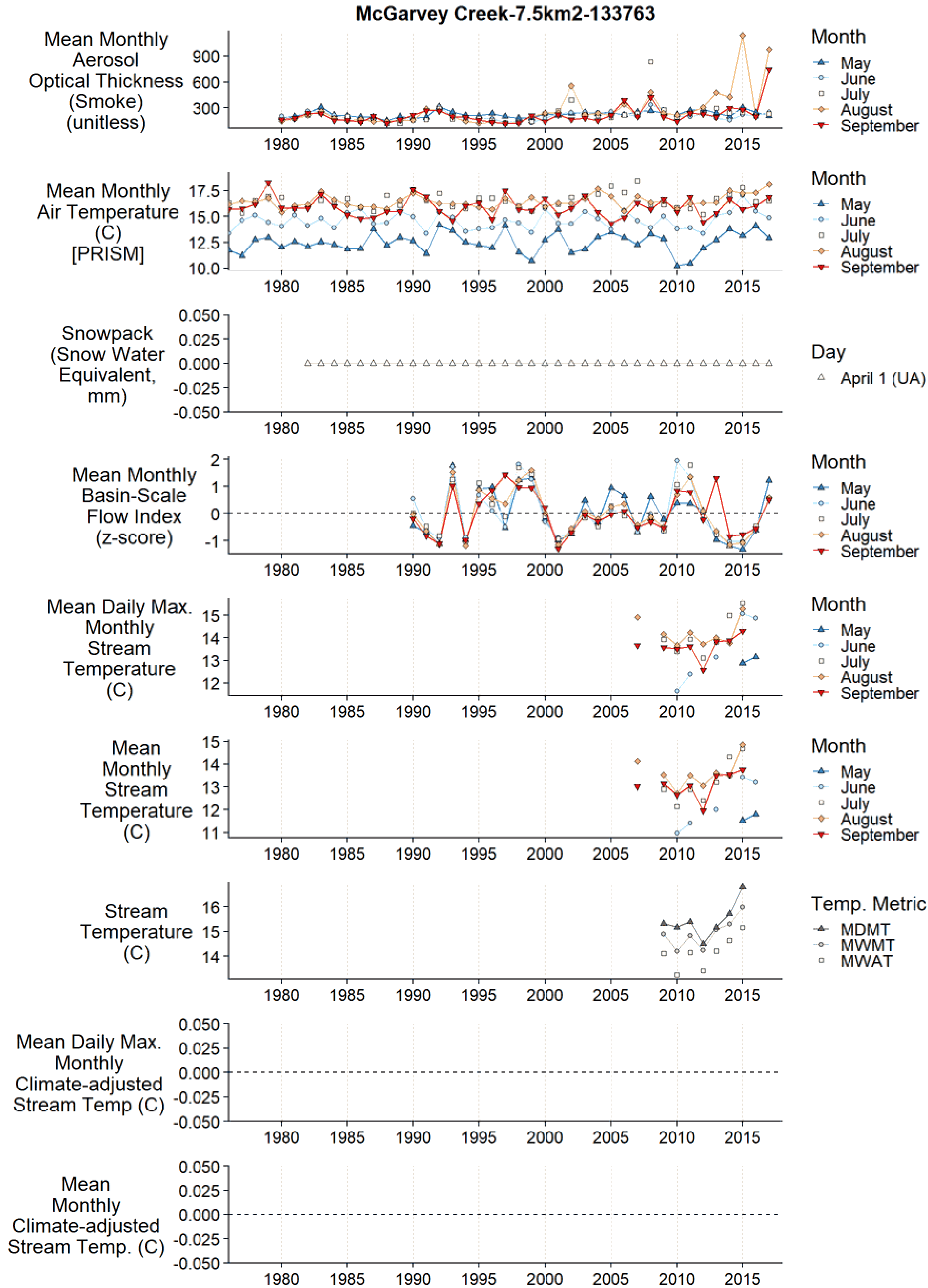
McGarvey Creek-7.5km2-133763
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
Temp. Metric
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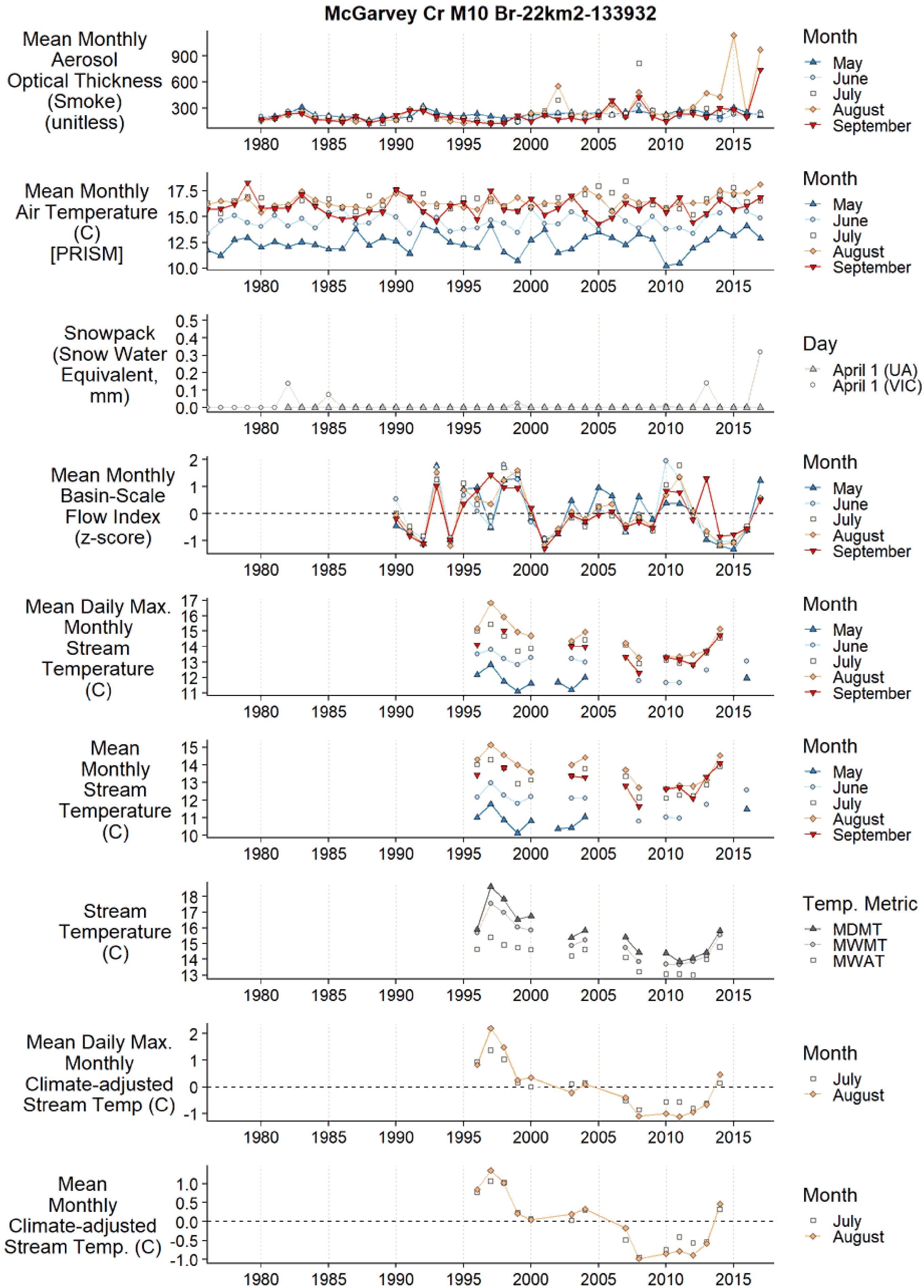
McGarvey Cr M10 Br-22km2-133932
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Temp. Metric
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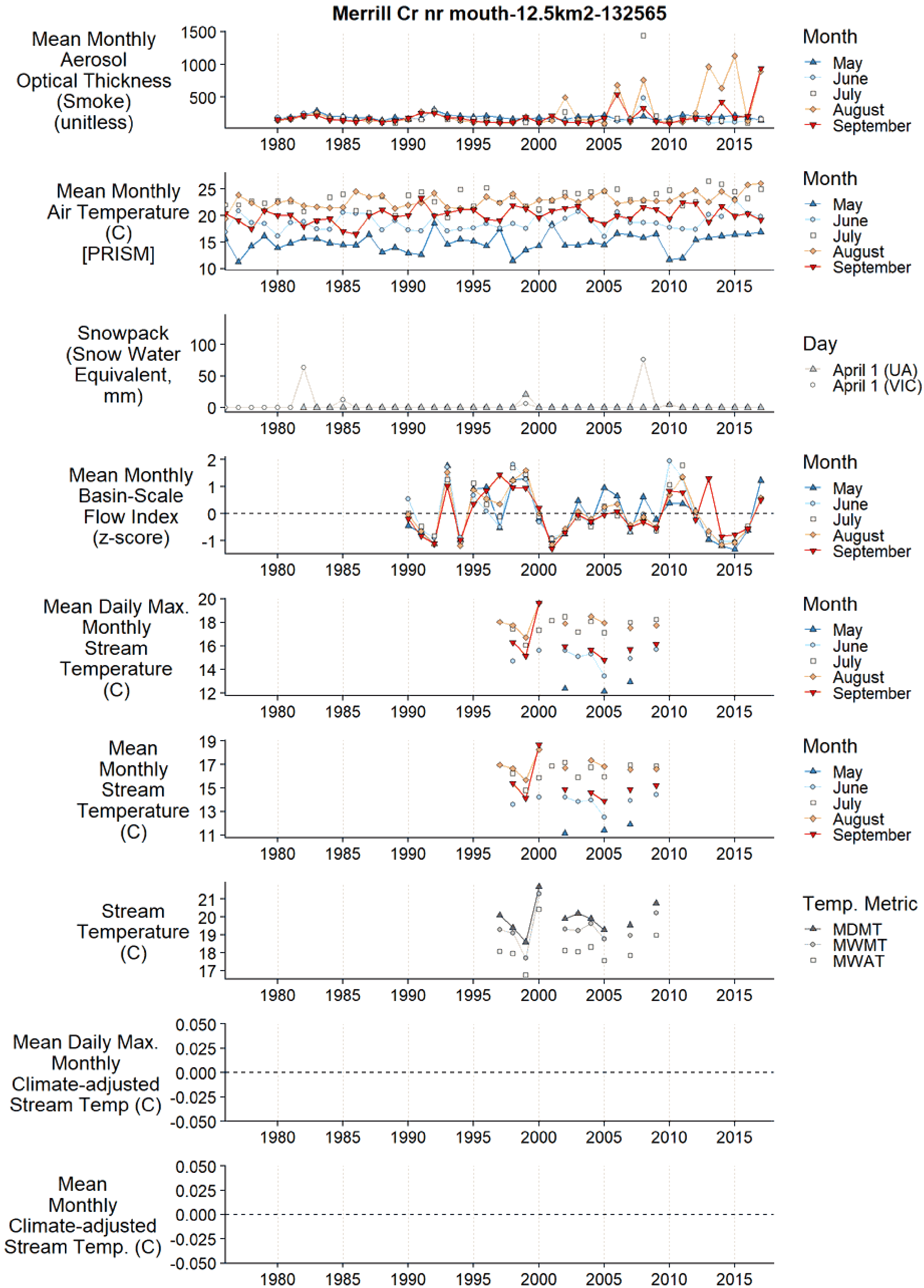
Merrill Cr nr mouth-12.5km2-132565
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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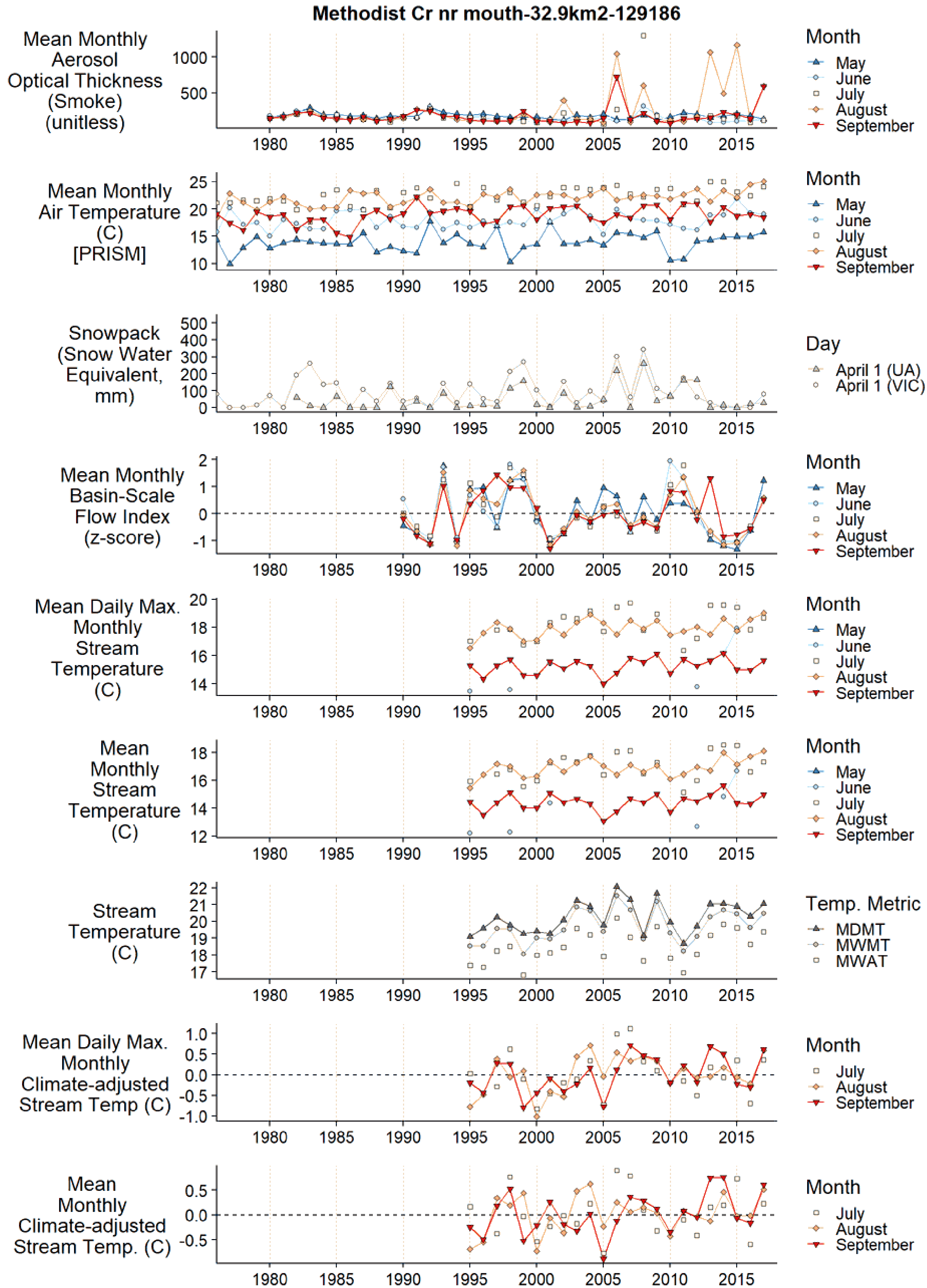
Methodist Cr nr mouth-32.9km2-129186
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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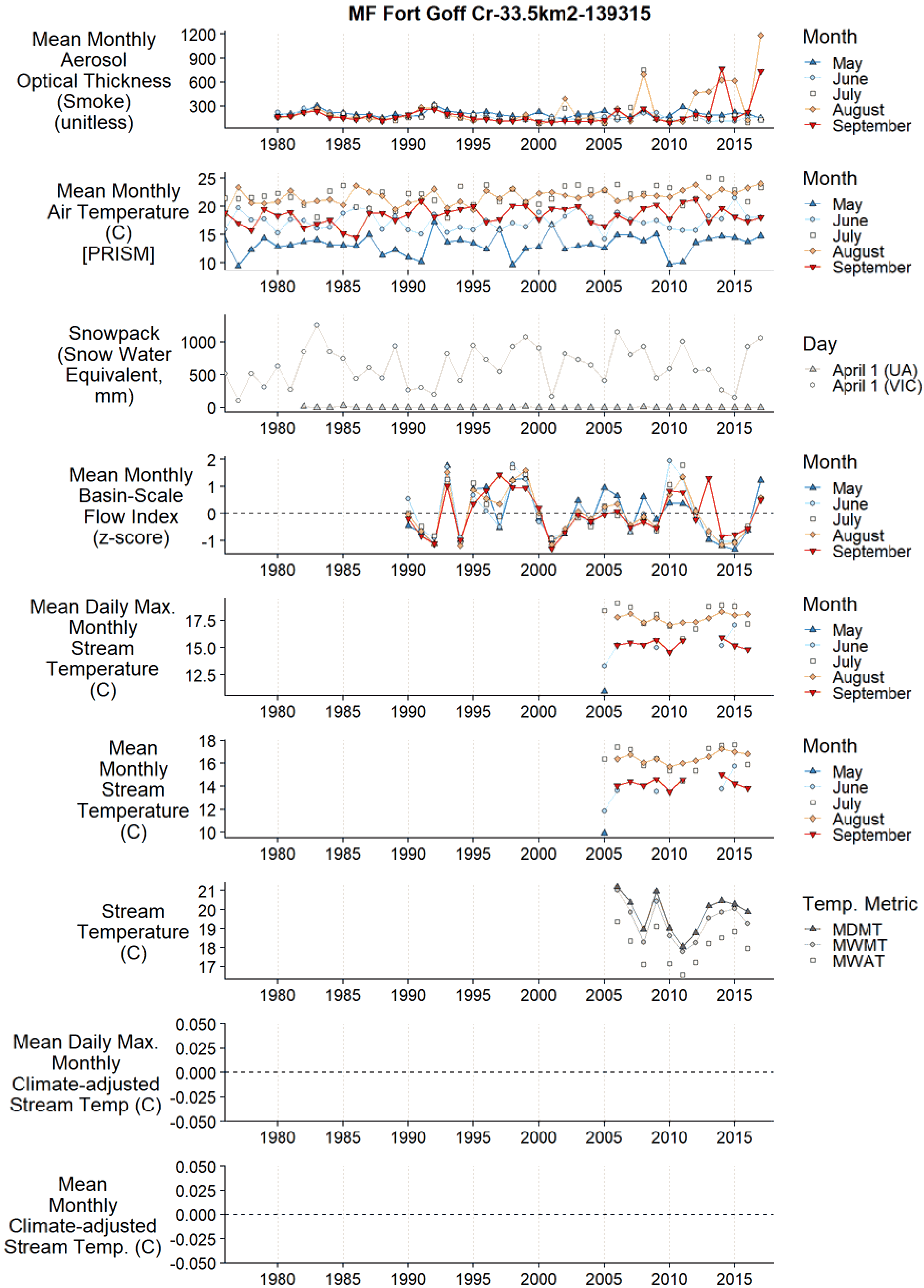
MF Fort Goff Cr-33.5km2-139315
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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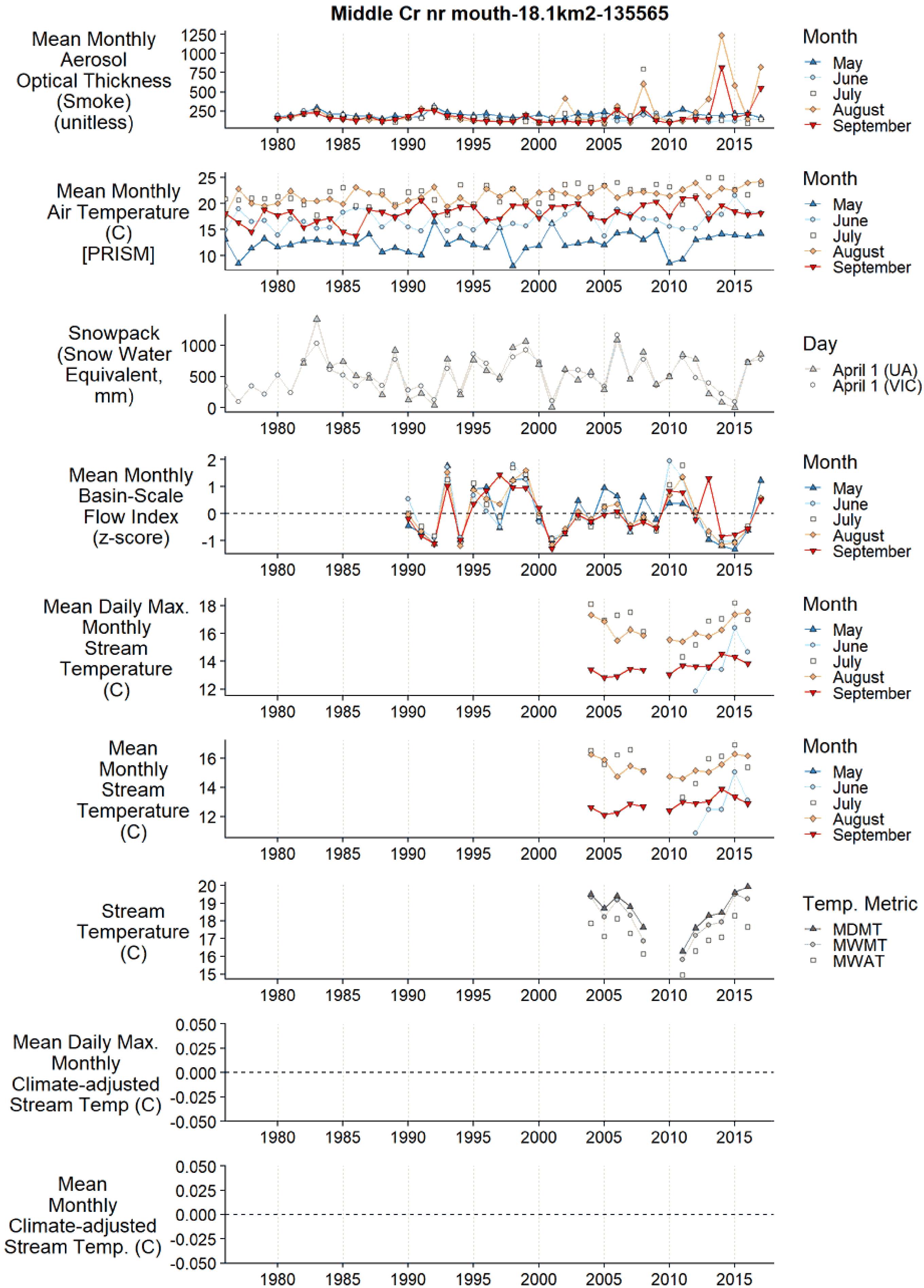
Middle Cr nr mouth-18.1km2-135565
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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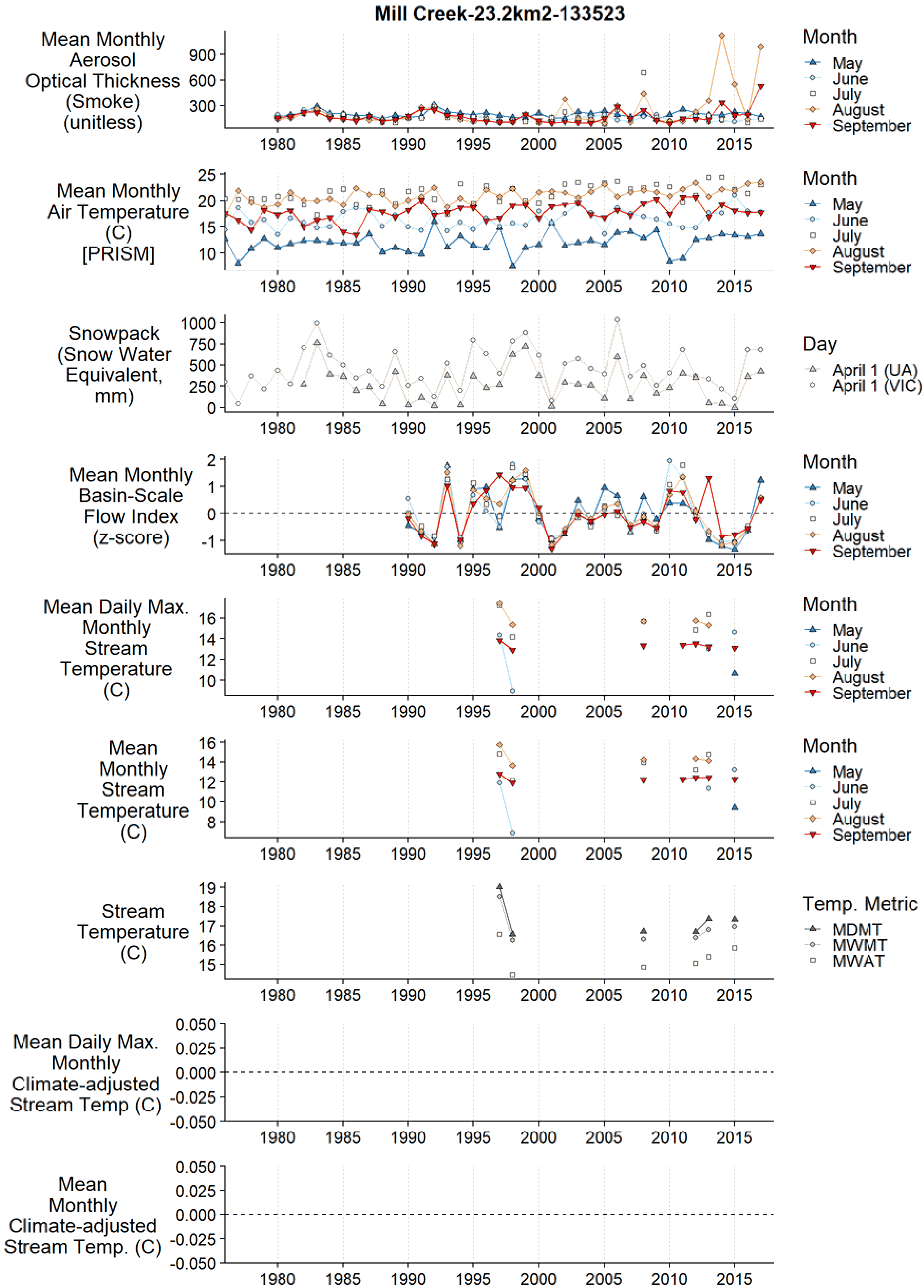
Mill Creek-23.2km2-133523
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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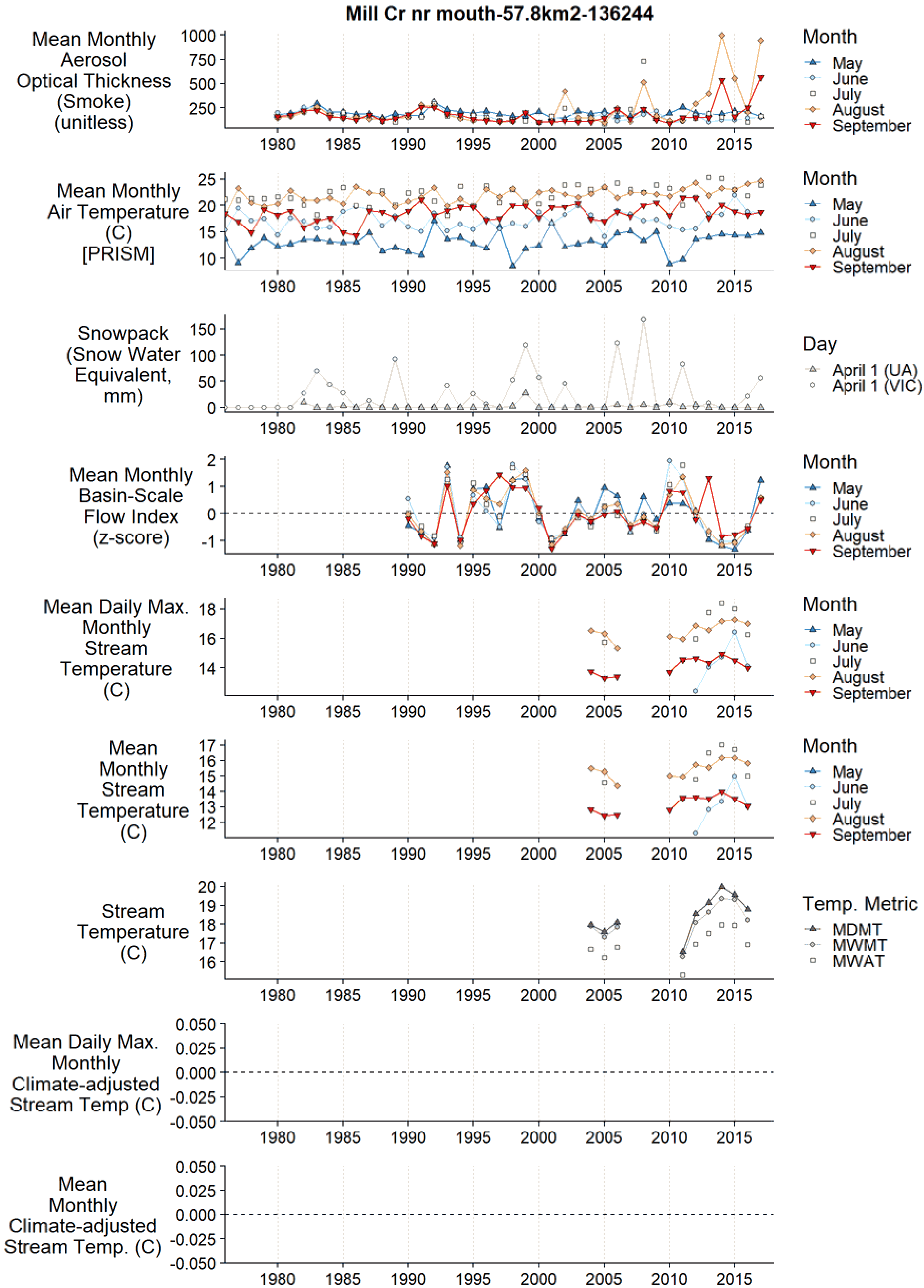
Mill Cr nr mouth-57.8km2-136244
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (VIC)
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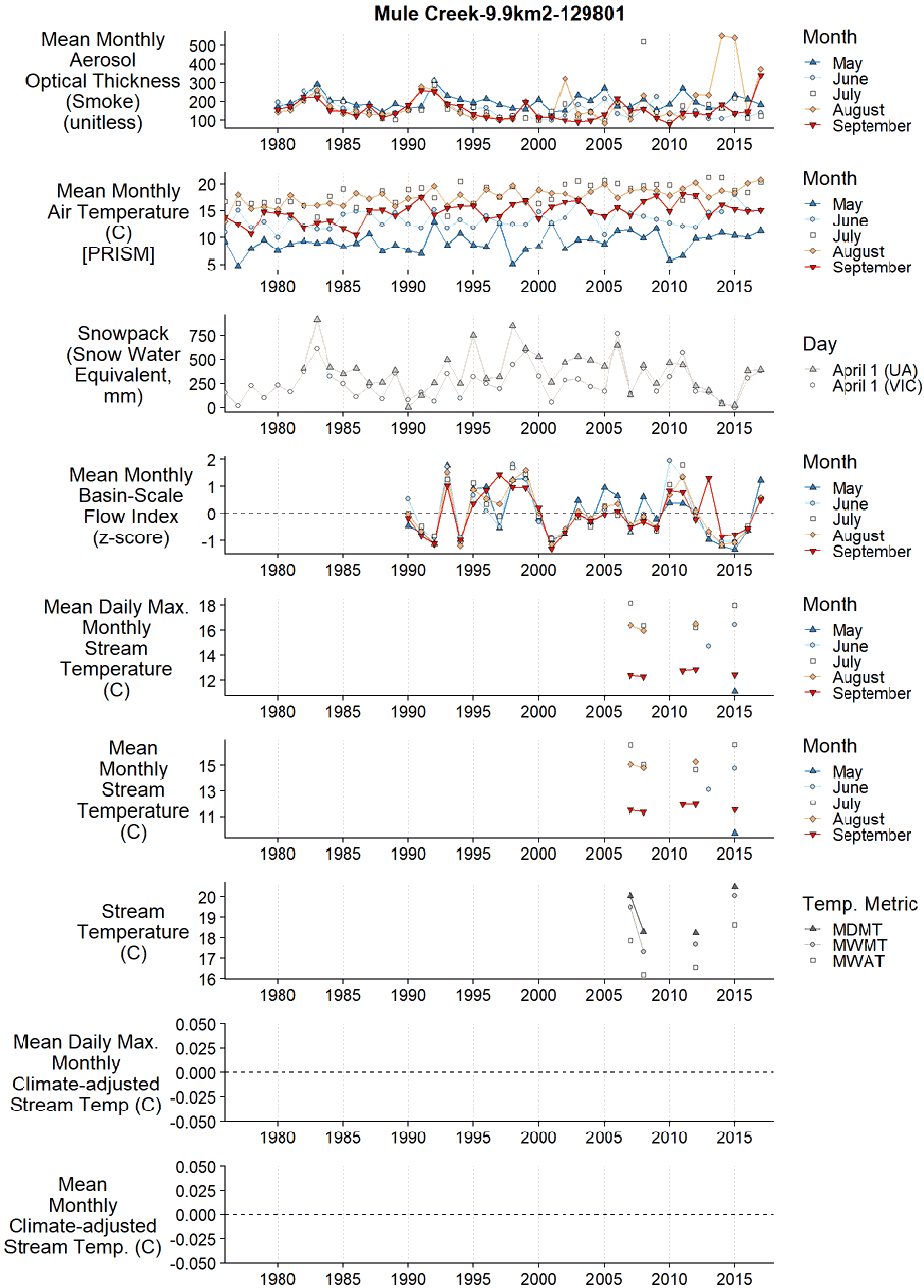
Mule Creek-9.9km2-129801
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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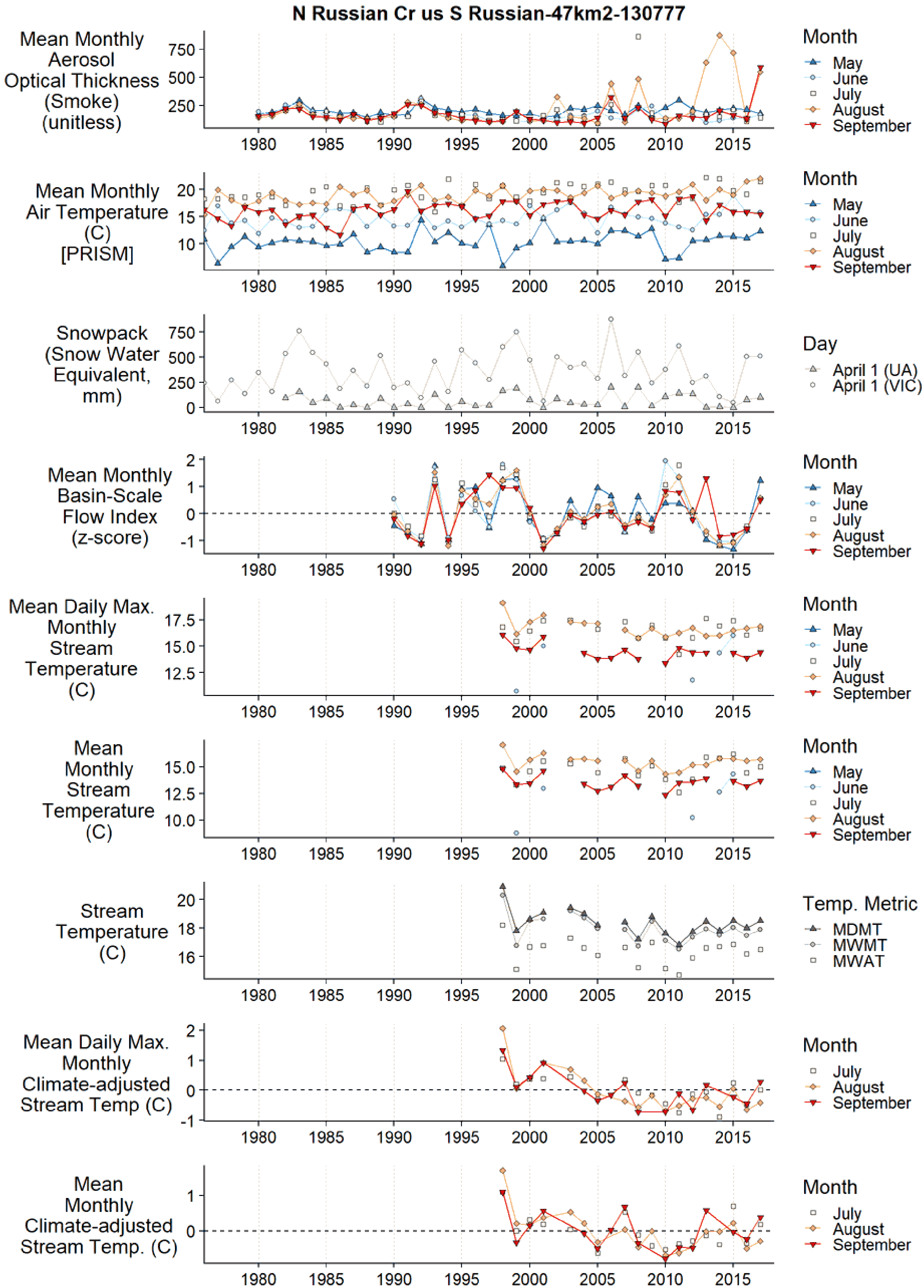
N Russian Cr us S Russian-47km2-130777
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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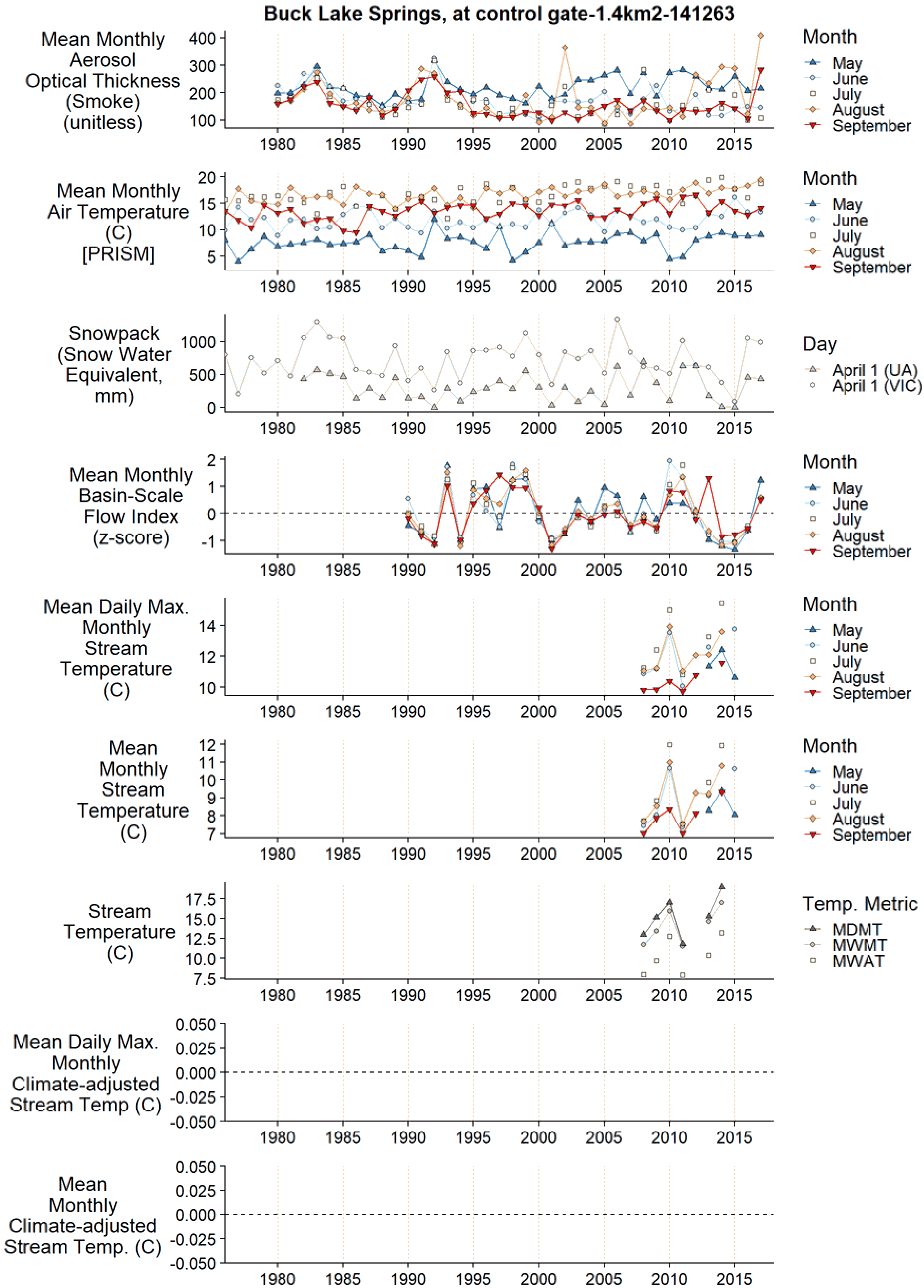
Buck Lake Springs, at control gate-1.4km2-141263
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
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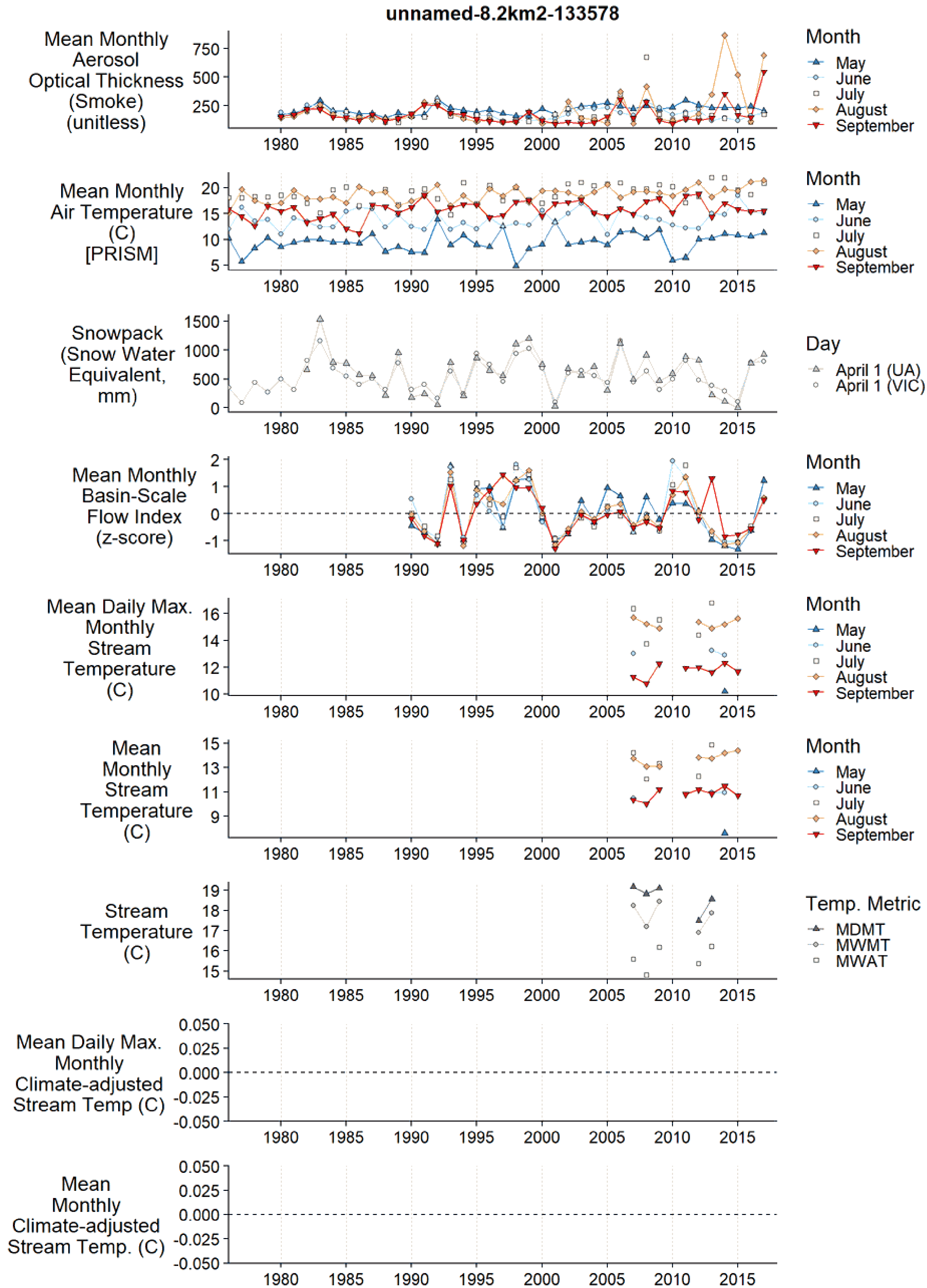
unnamed-8.2km2-133578
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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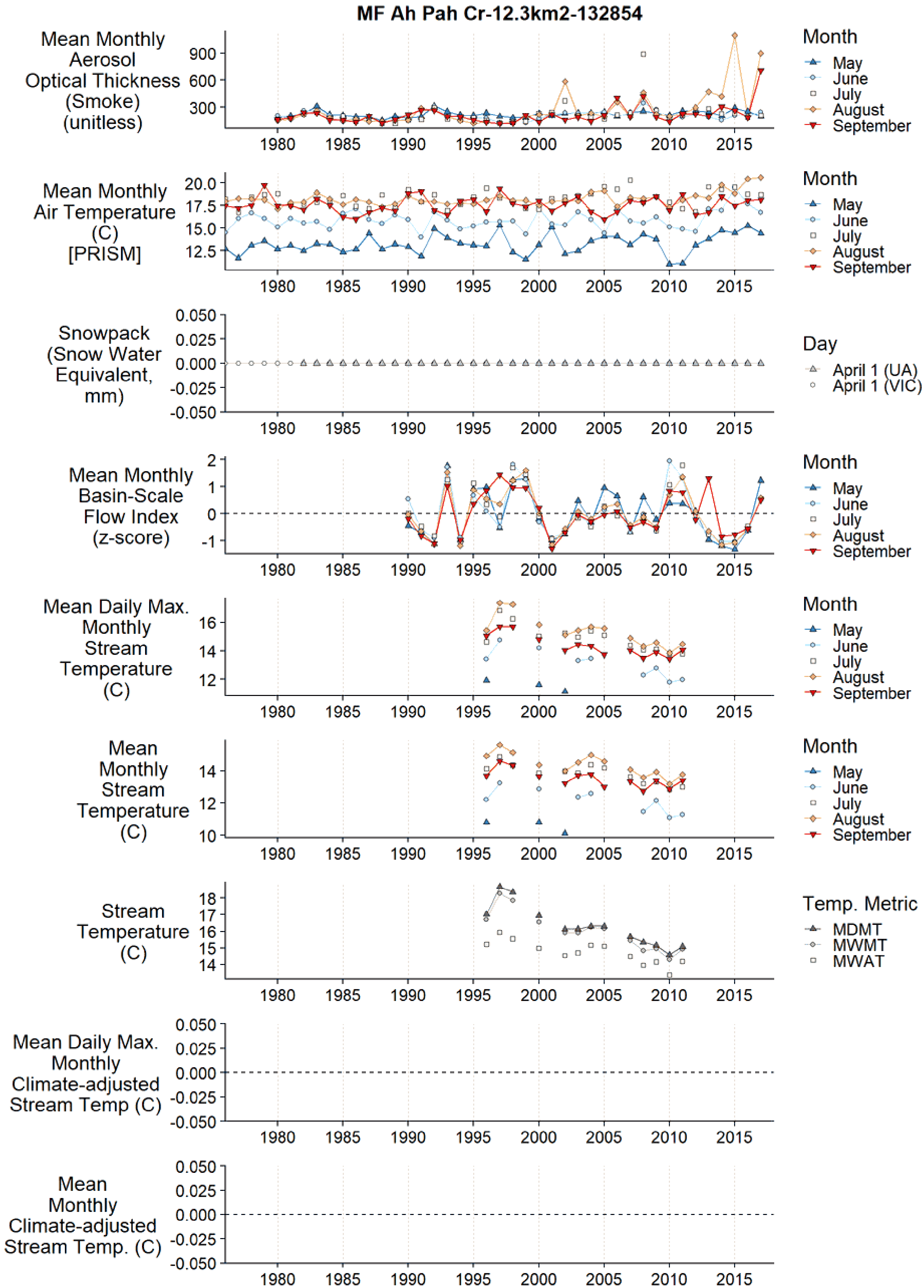
MF Ah Pah Cr-12.3km2-132854
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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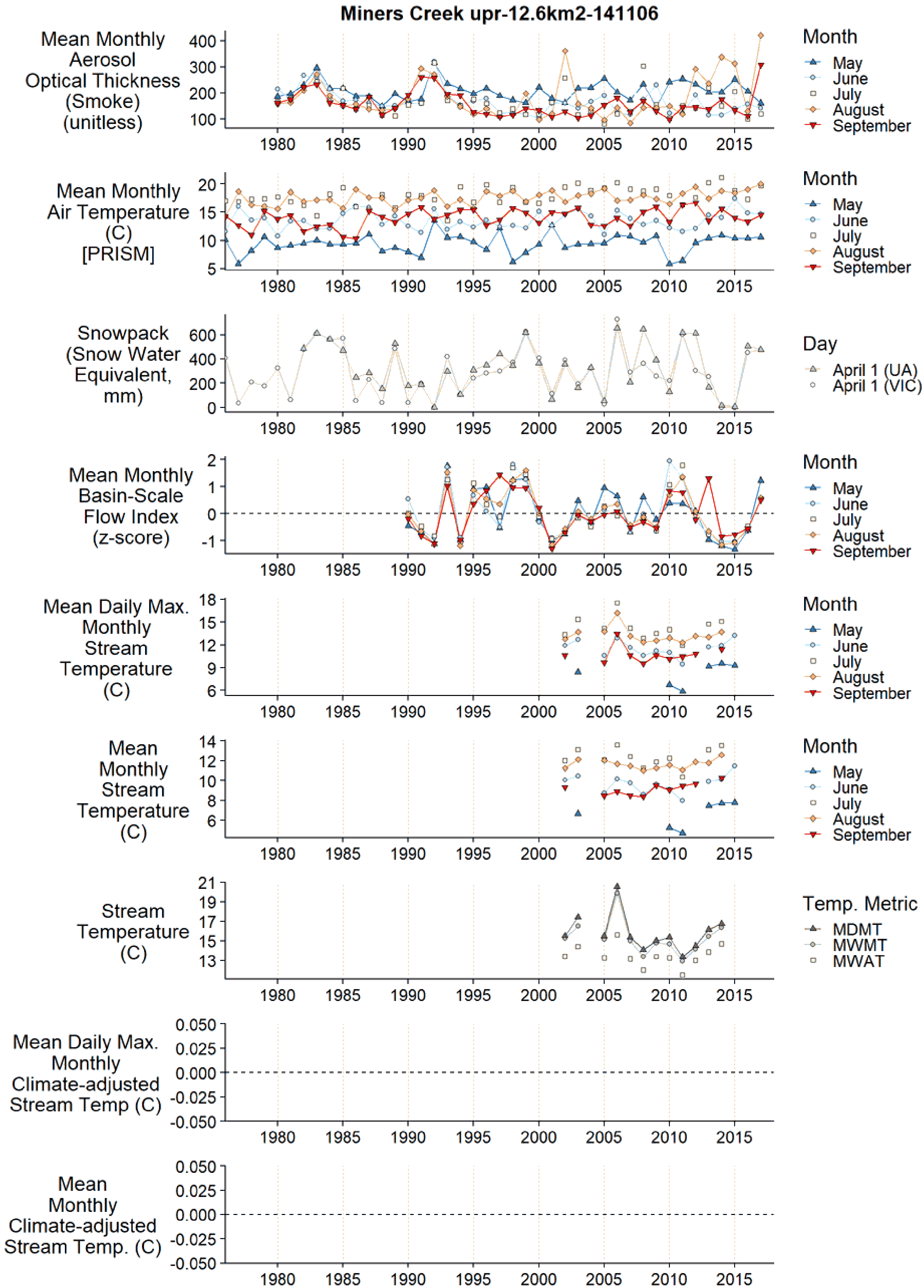
Miners Creek upr-12.6km2-141106
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
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April 1 (VIC)
Temp. Metric
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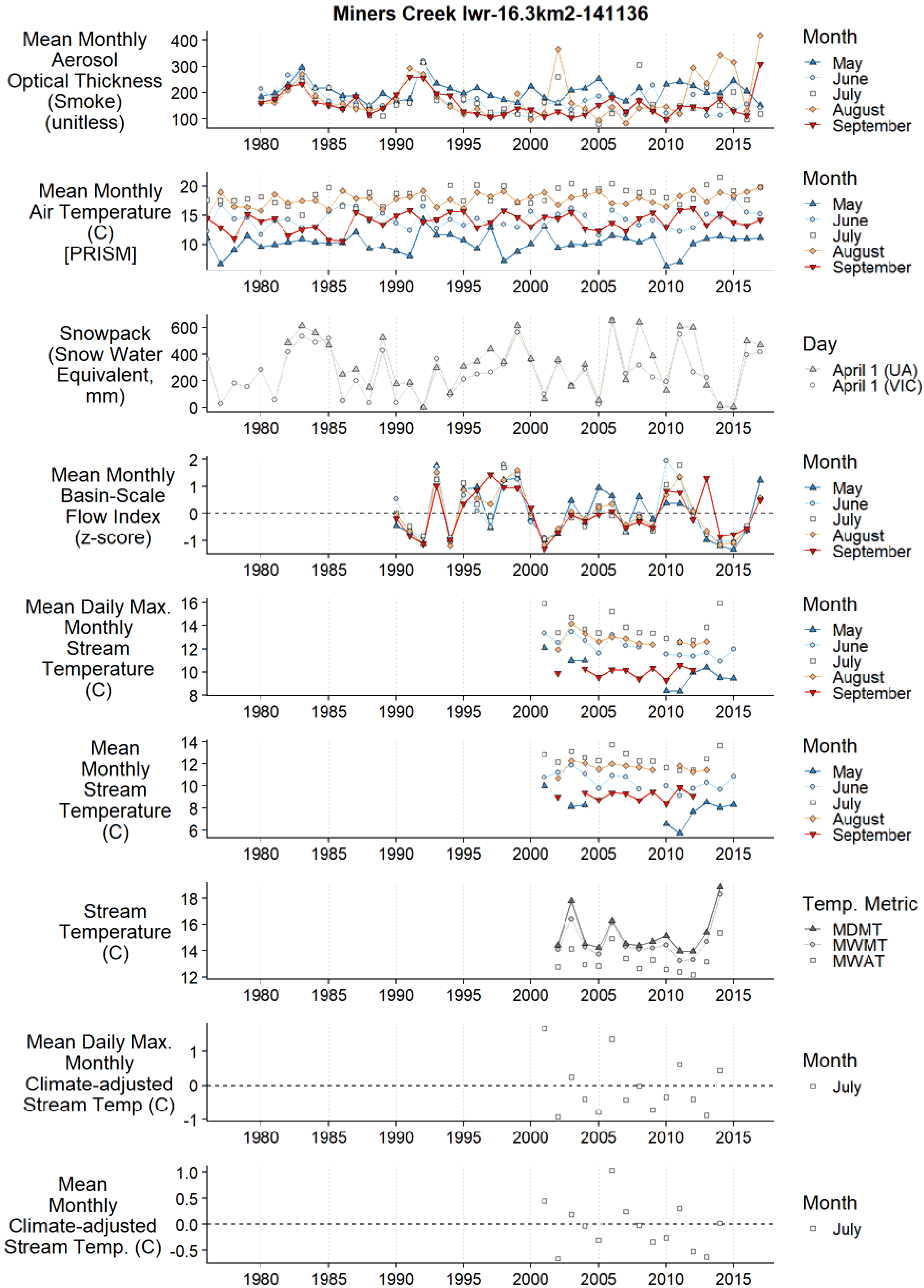

Miners Creek lwr-16.3km2-141136
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (VIC)
Temp. Metric
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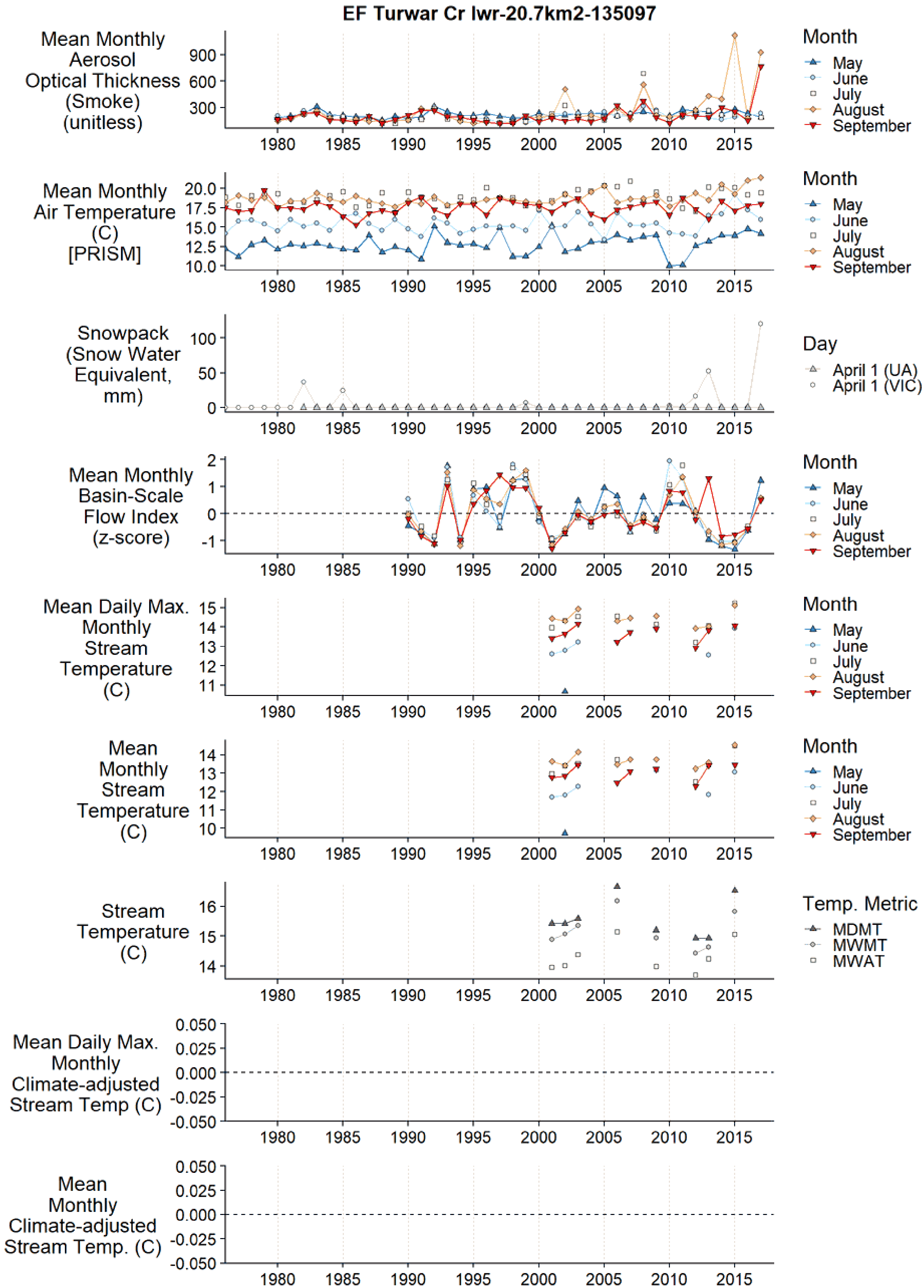

EF Turwar Cr lwr-20.7km2-135097
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (VIC)
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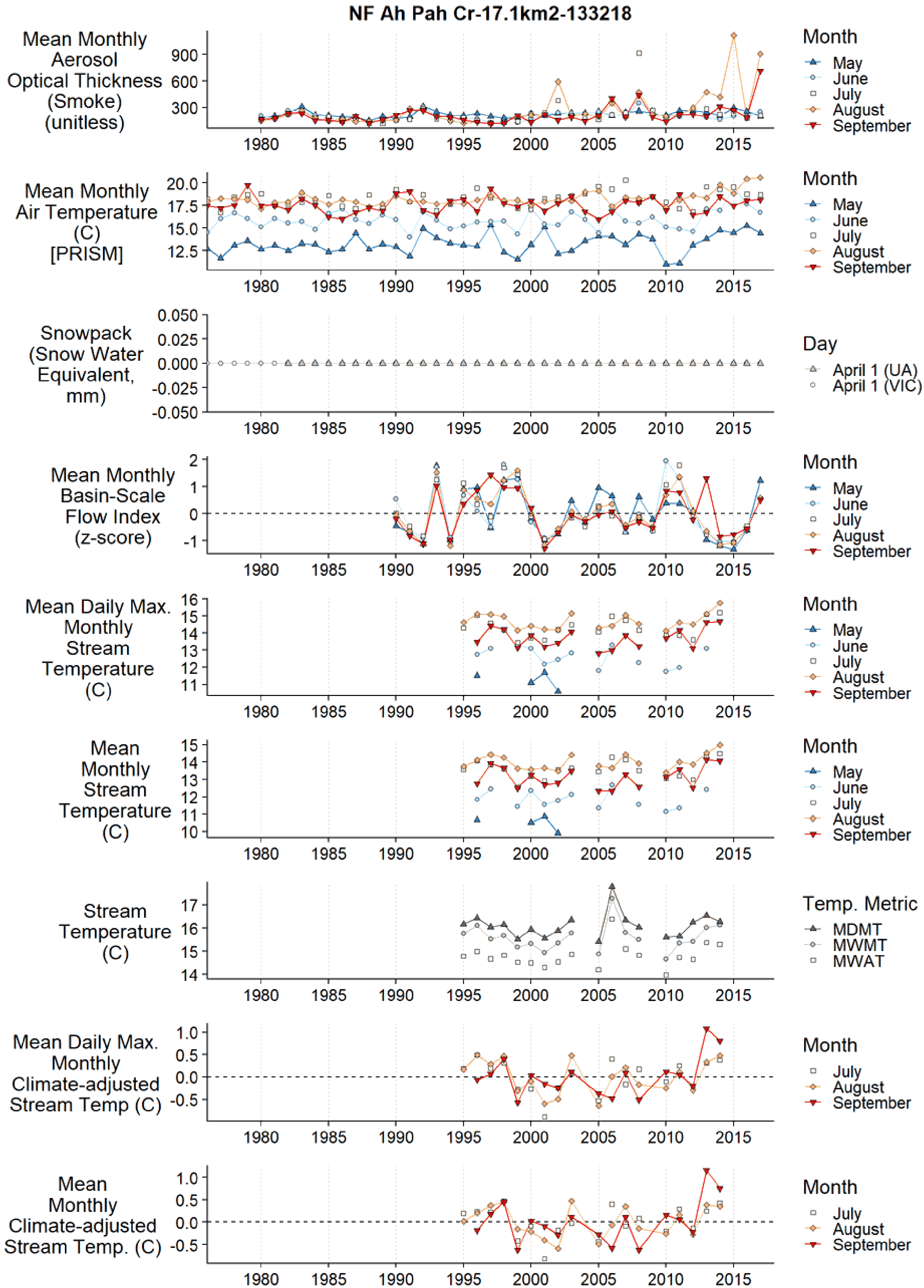
NF Ah Pah Cr-17.1km2-133218
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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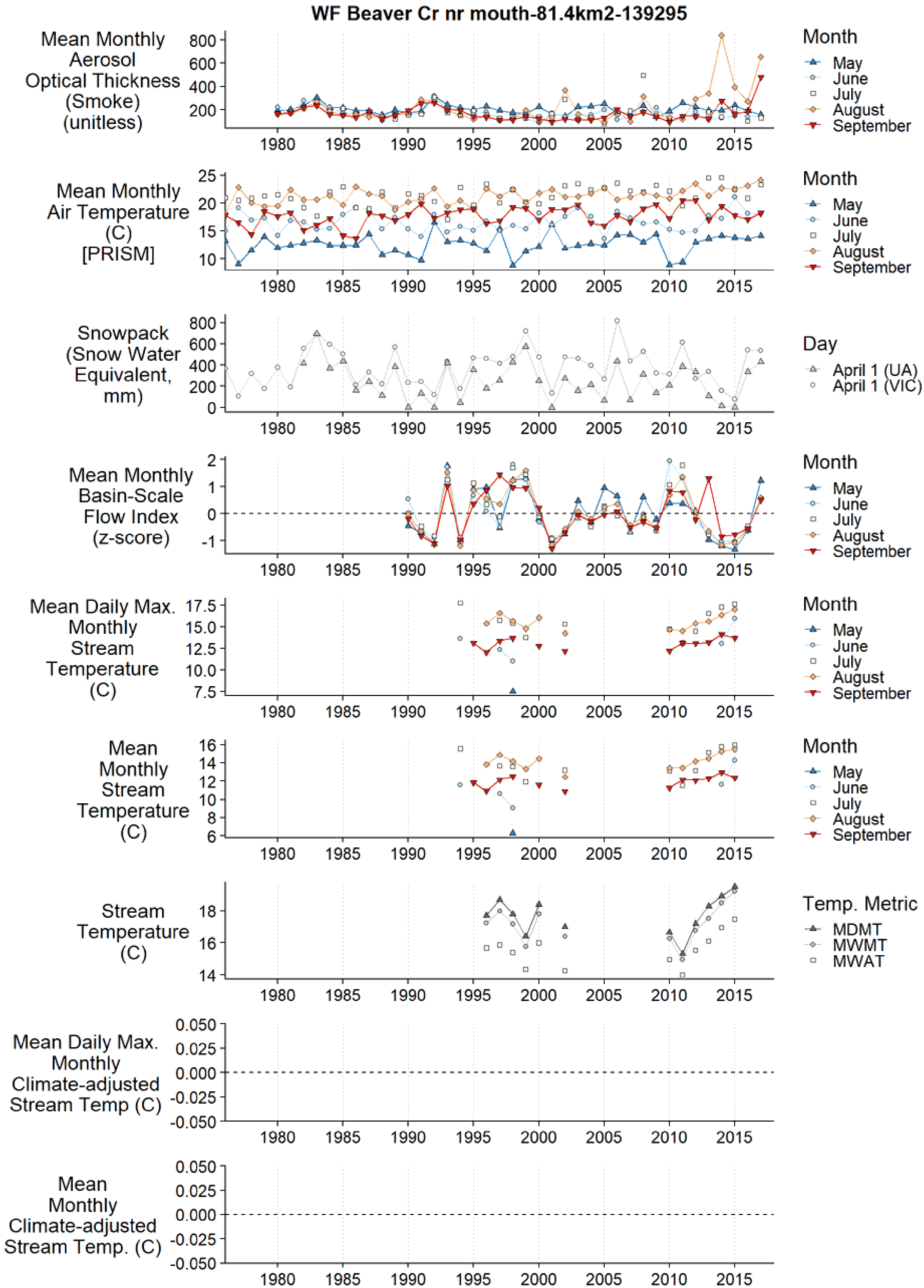
WF Beaver Cr nr mouth-81.4km2-139295
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
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August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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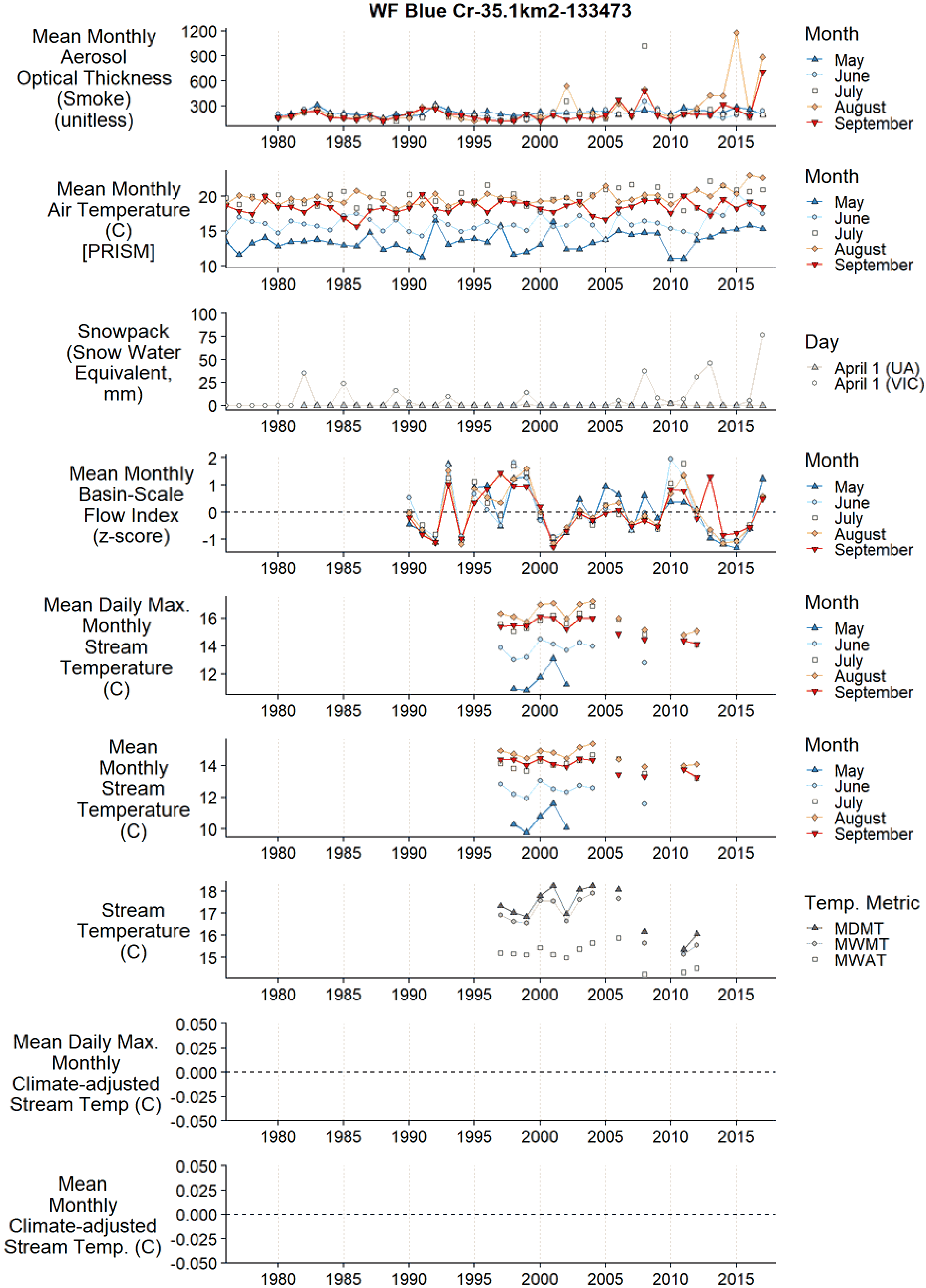
WF Blue Cr-35.1km2-133473
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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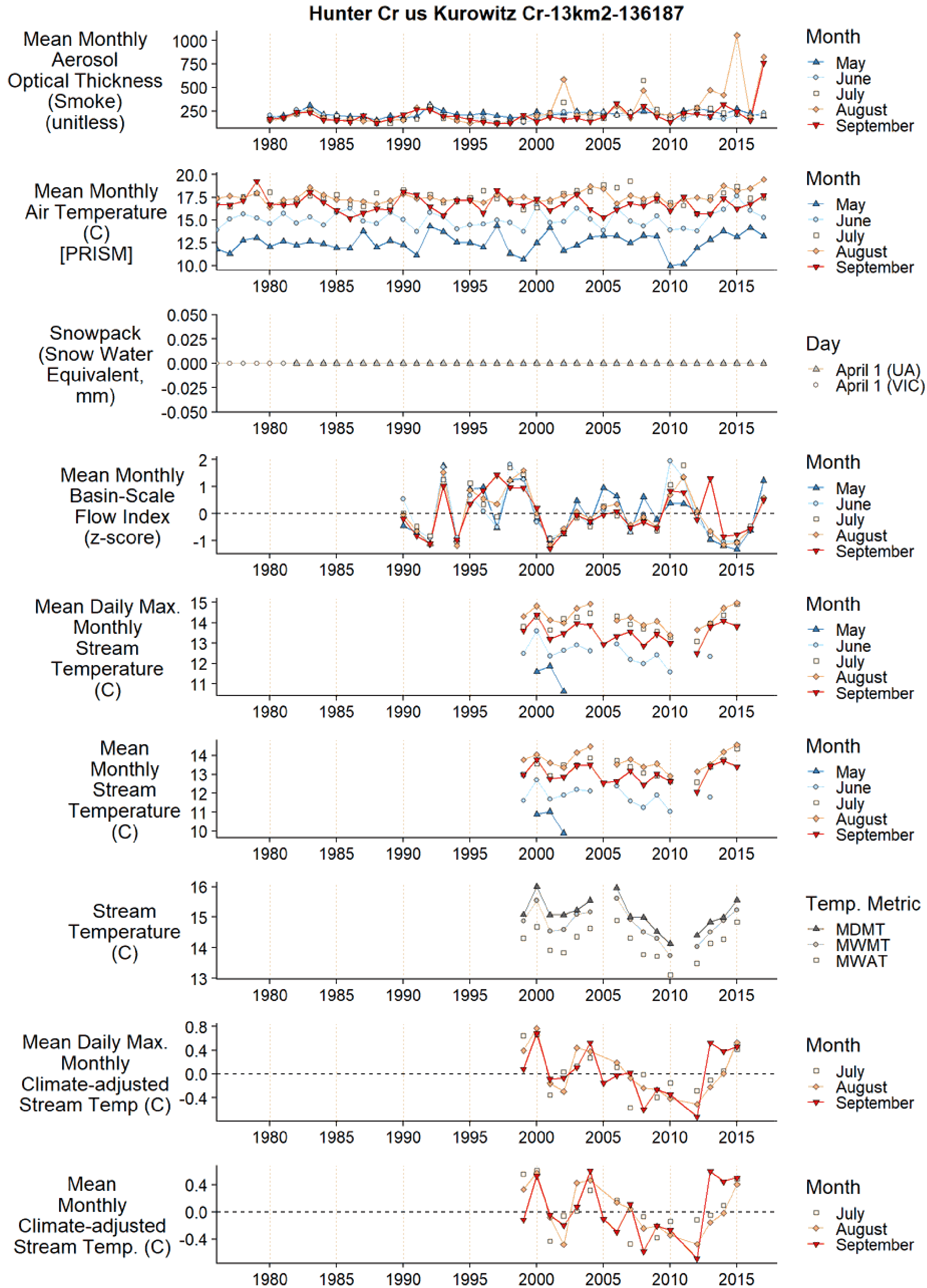
Hunter Cr us Kurowitz Cr-13km2-136187
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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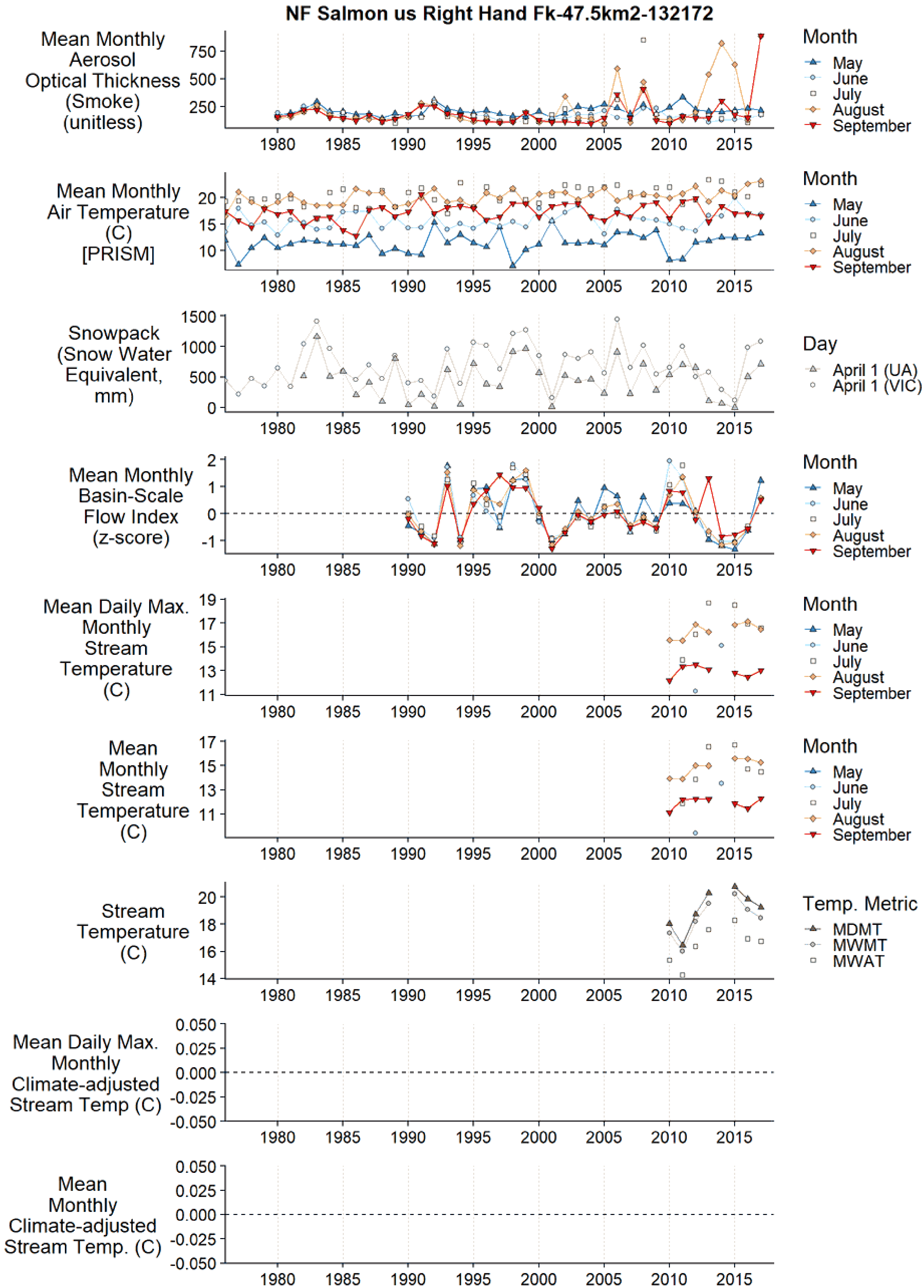

NF Salmon us Right Hand Fk-47.5km2-132172
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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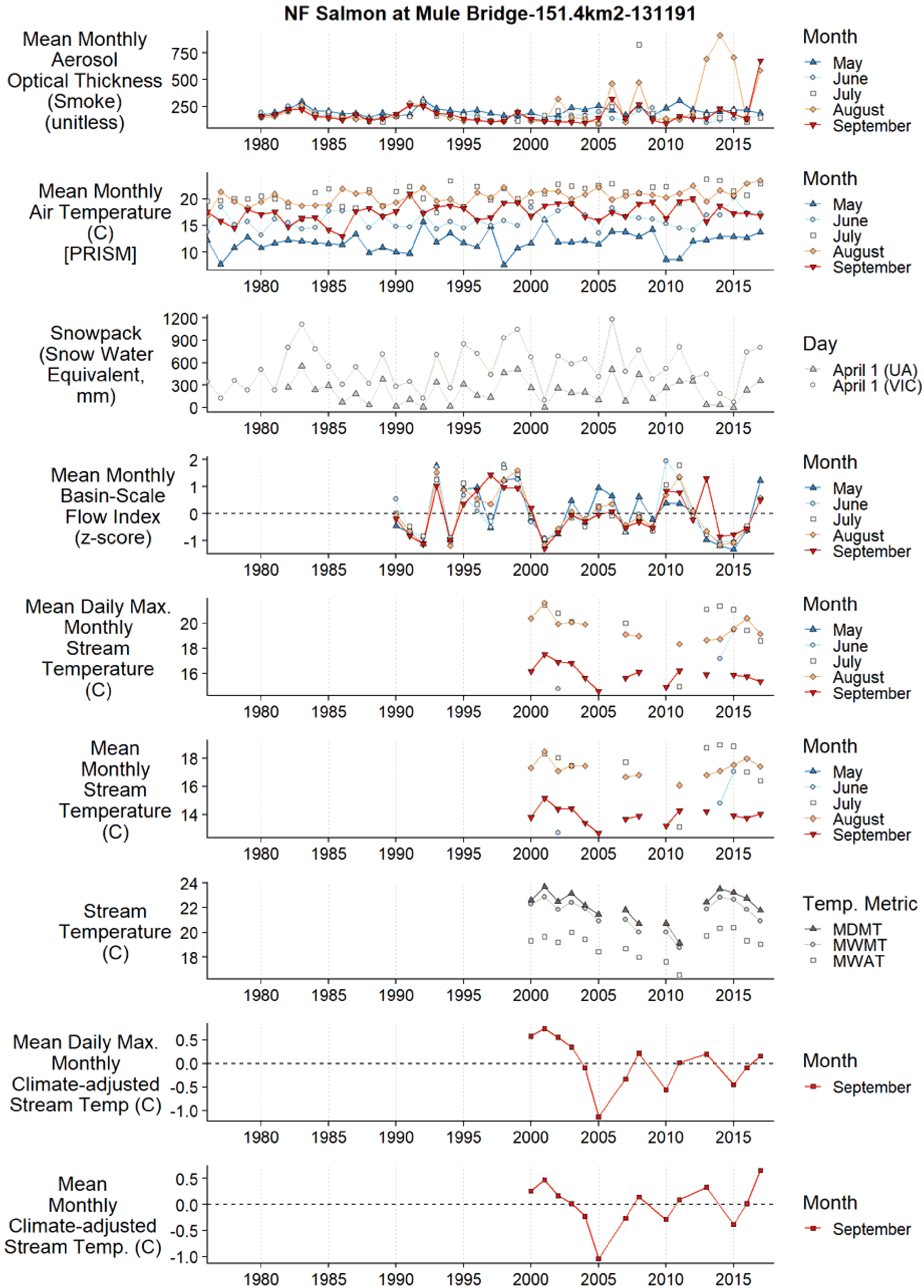
NF Salmon at Mule Bridge-151.4km2-131191
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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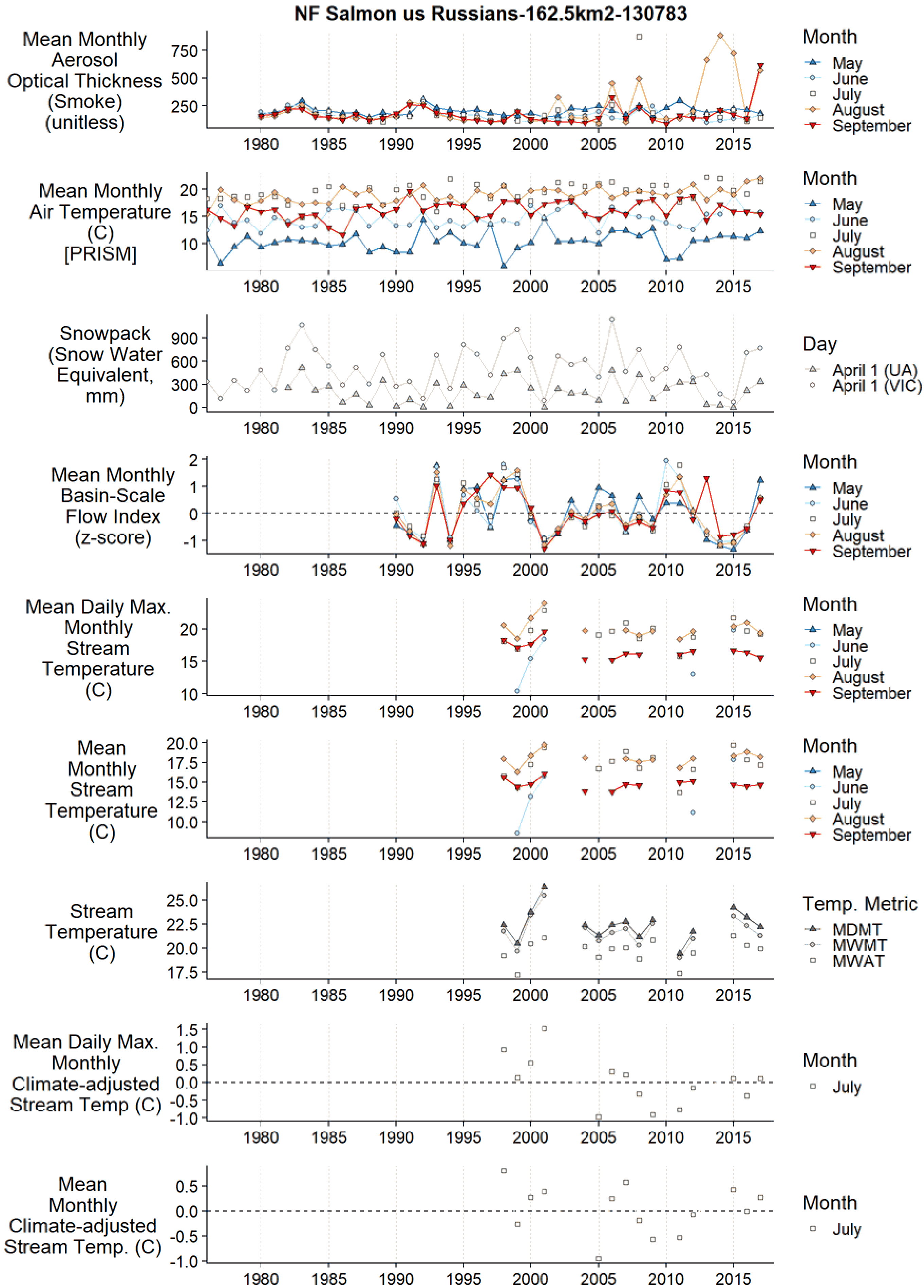
NF Salmon us Russians-162.5km2-130783
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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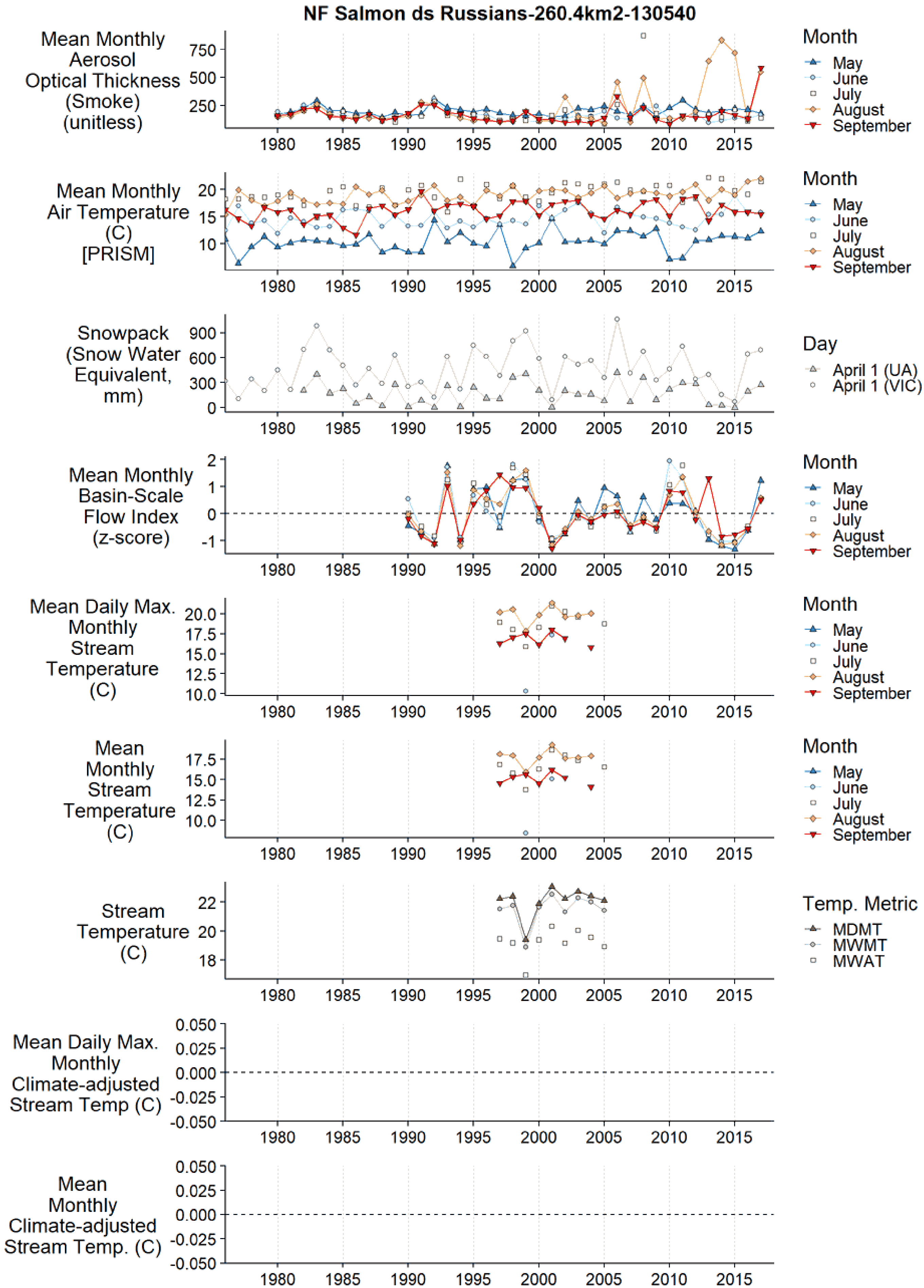

NF Salmon ds Russians-260.4km2-130540
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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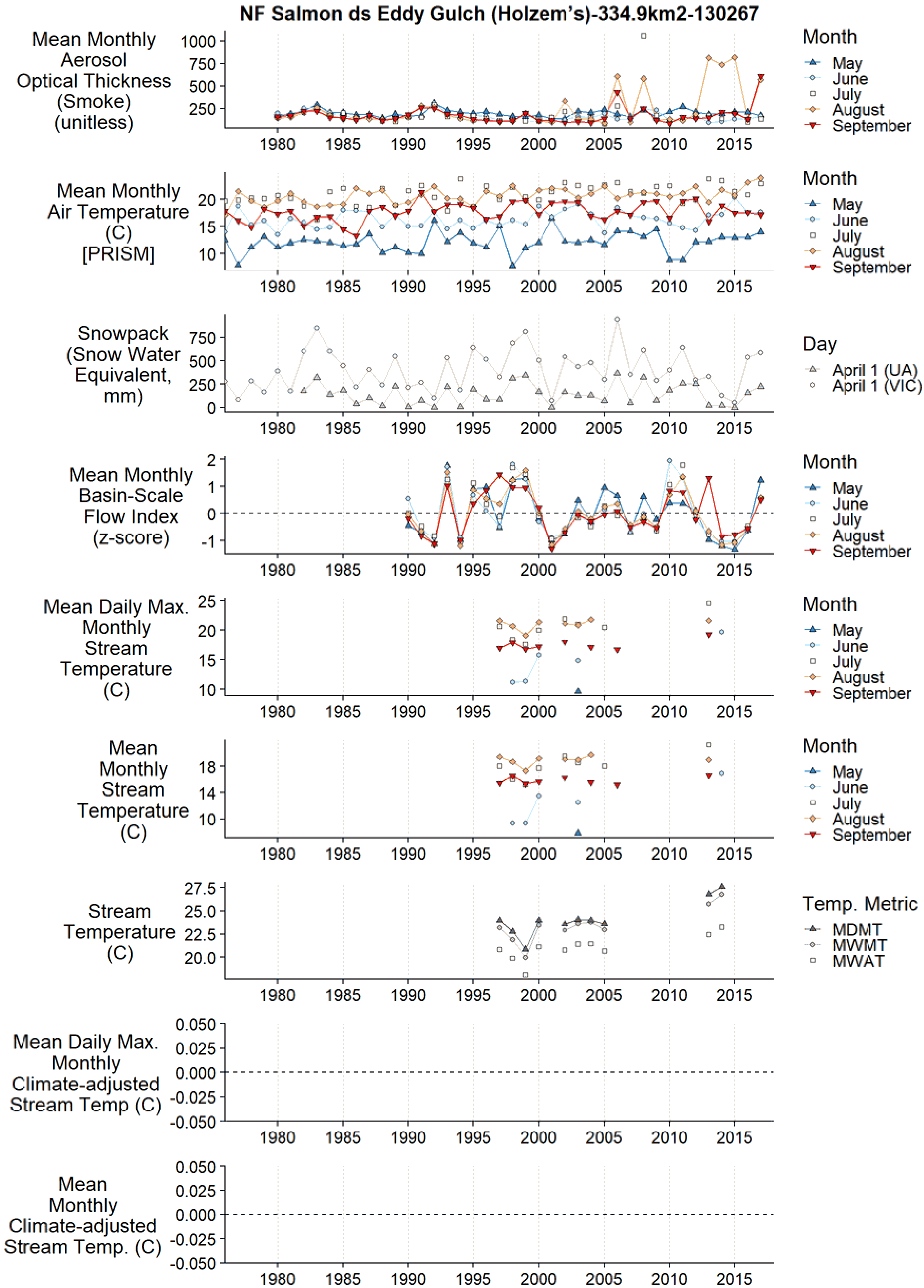
NF Salmon ds Eddy Gulch (Holzem's)-334.9km2-130267
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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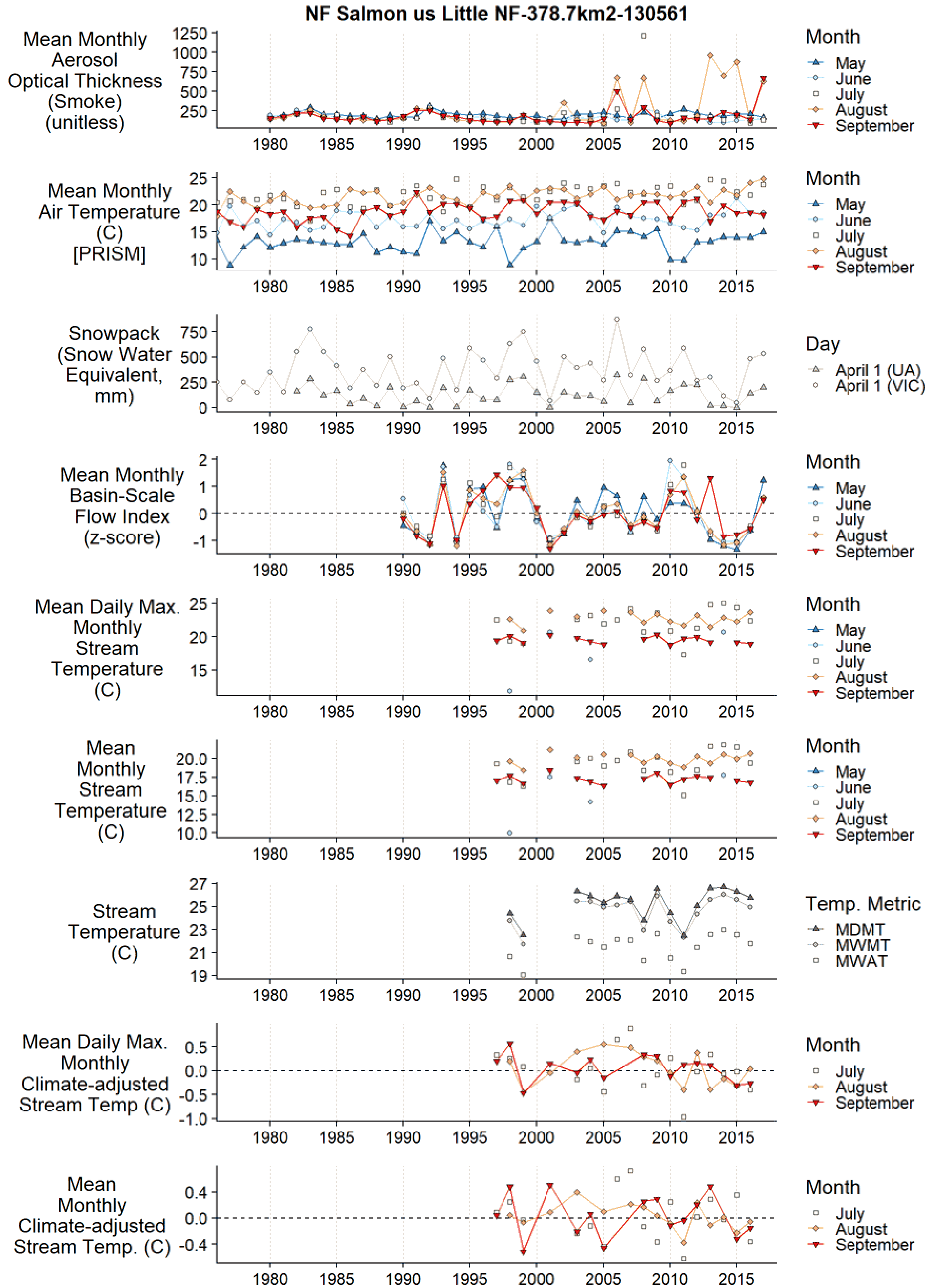
NF Salmon us Little NF-378.7km2-130561
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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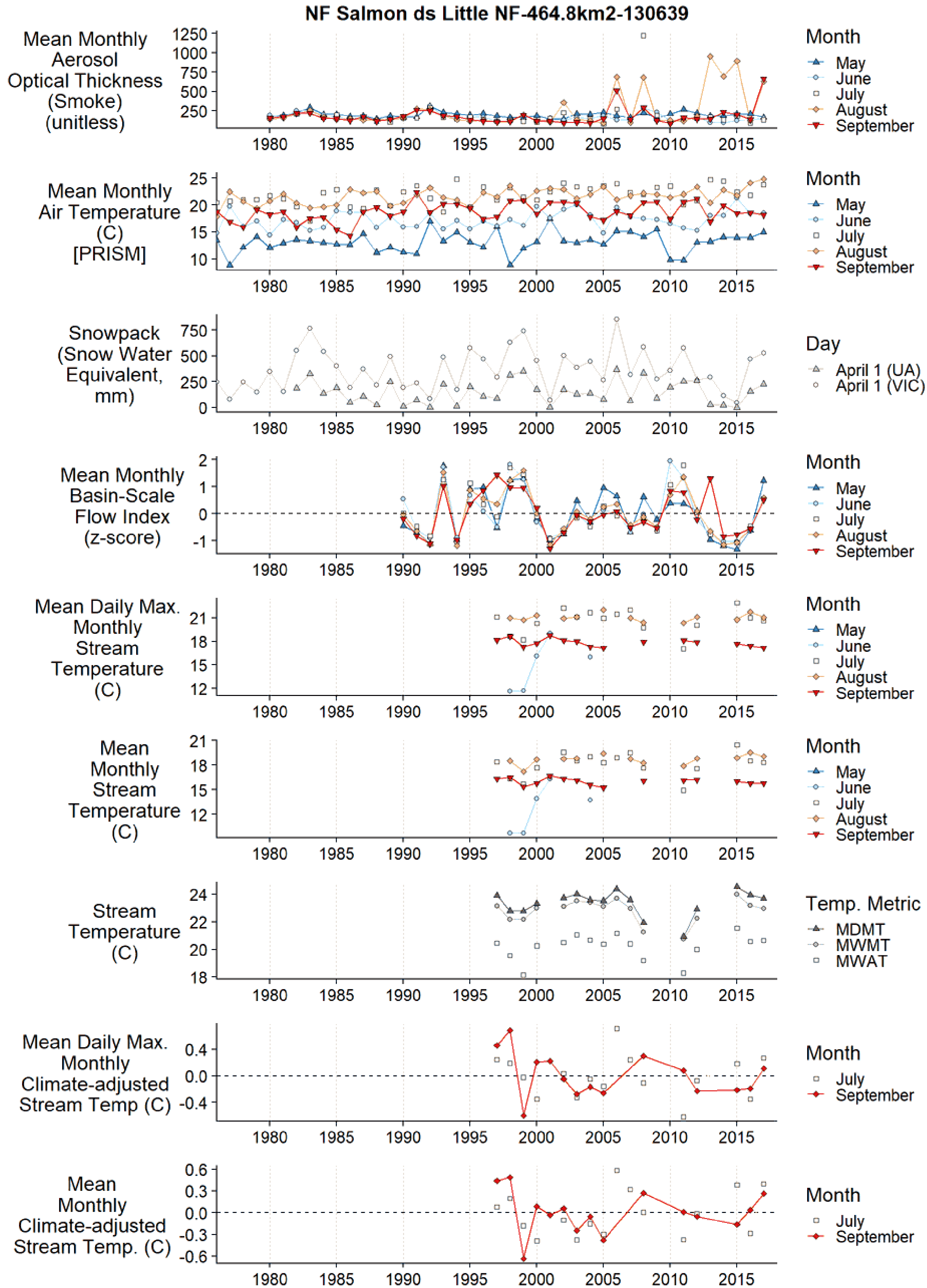
NF Salmon ds Little NF-464.8km2-130639
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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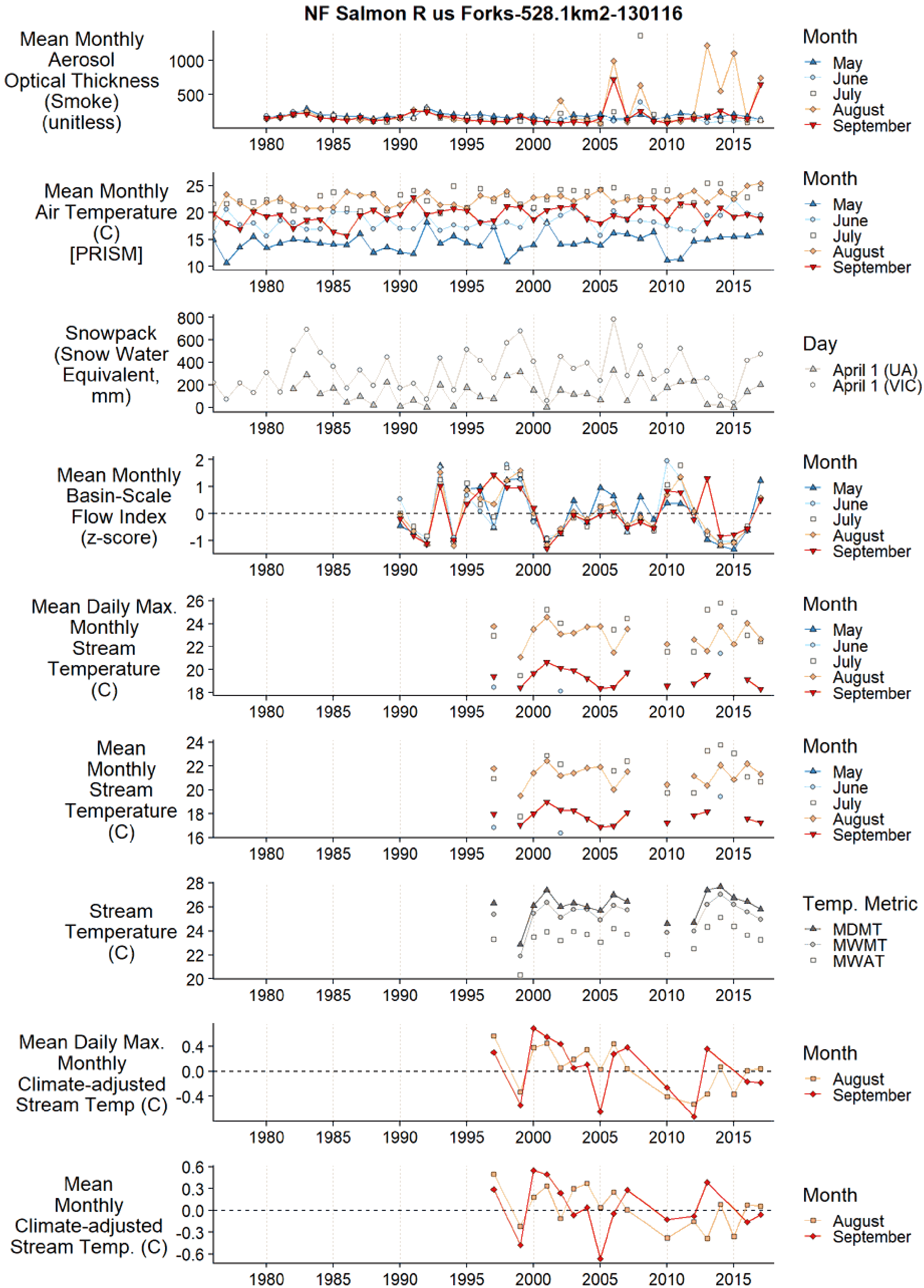
NF Salmon R us Forks-528.1km2-130116
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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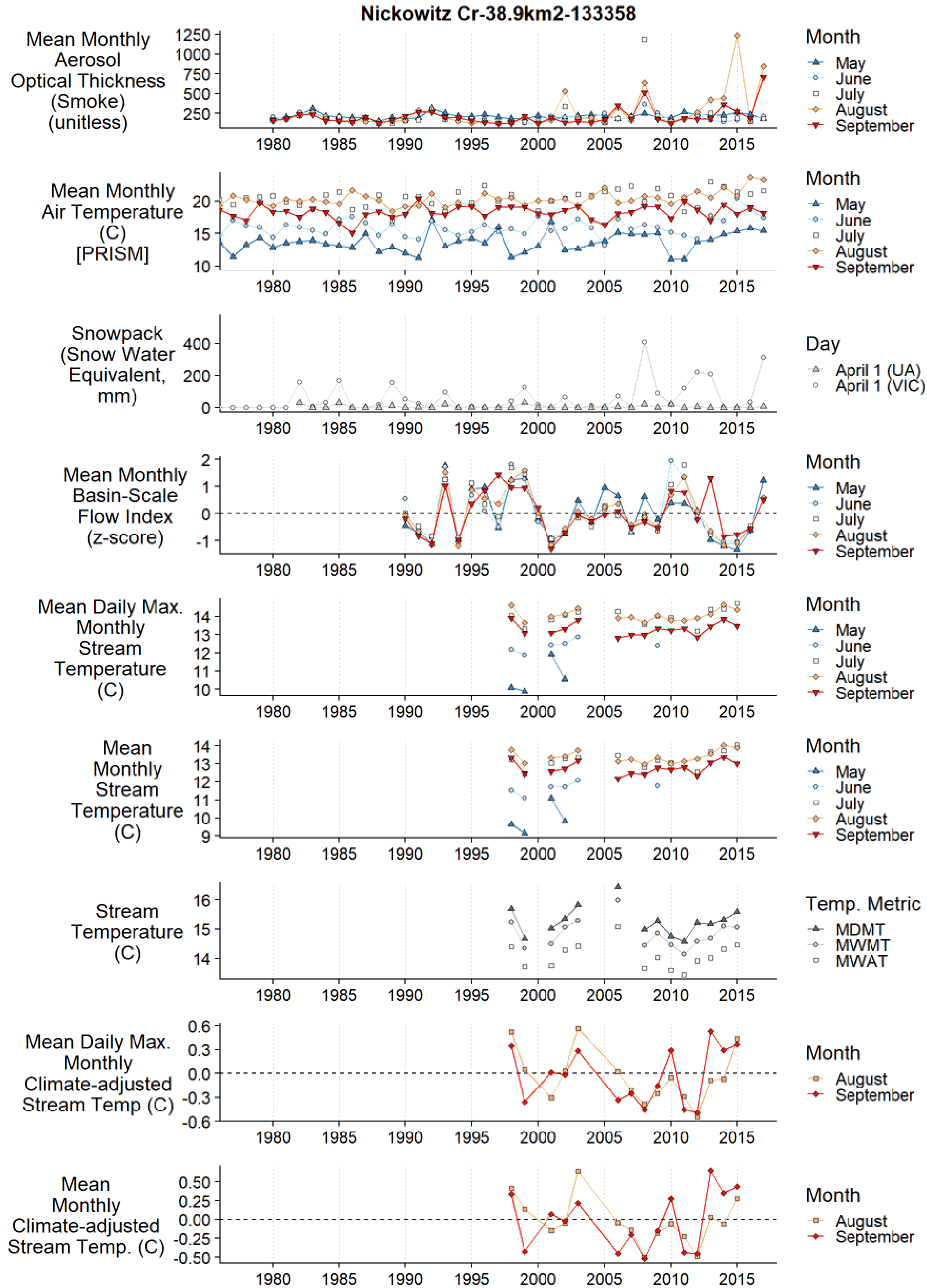

Nickowitz Cr-38.9km2-133358
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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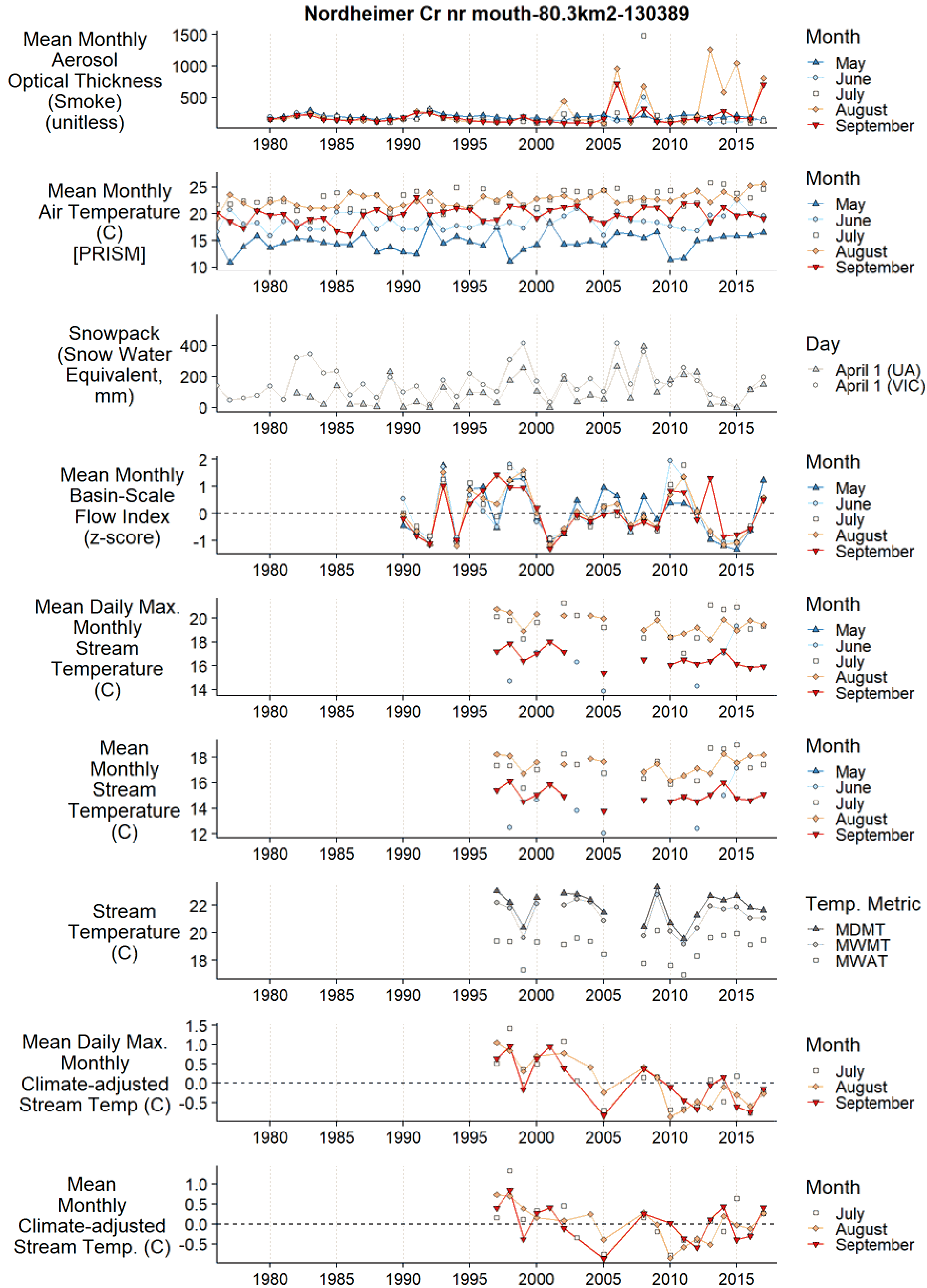
Nordheimer Cr nr mouth-80.3km2-130389
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
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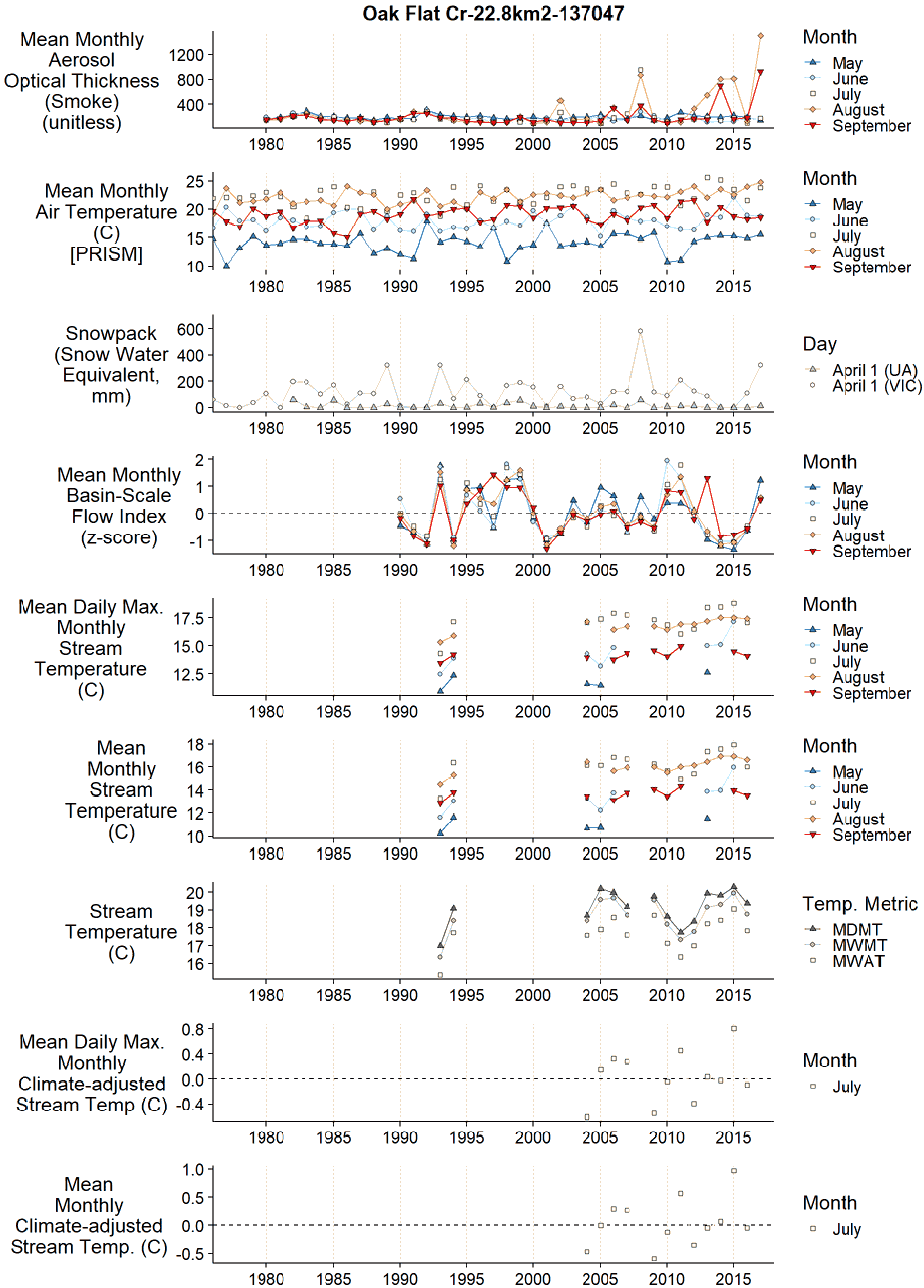
Oak Flat Cr-22.8km2-137047
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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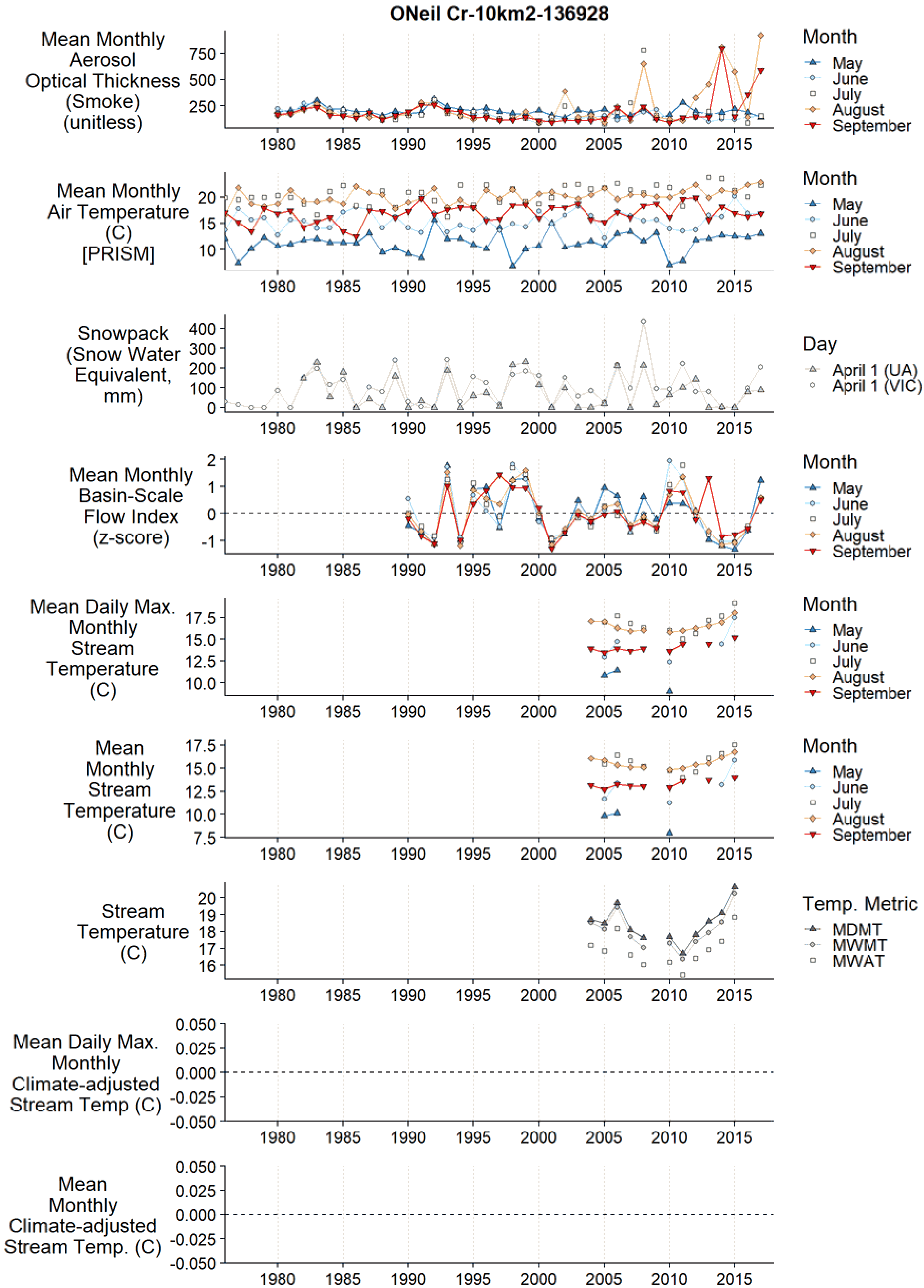
ONeil Cr-10km2-136928
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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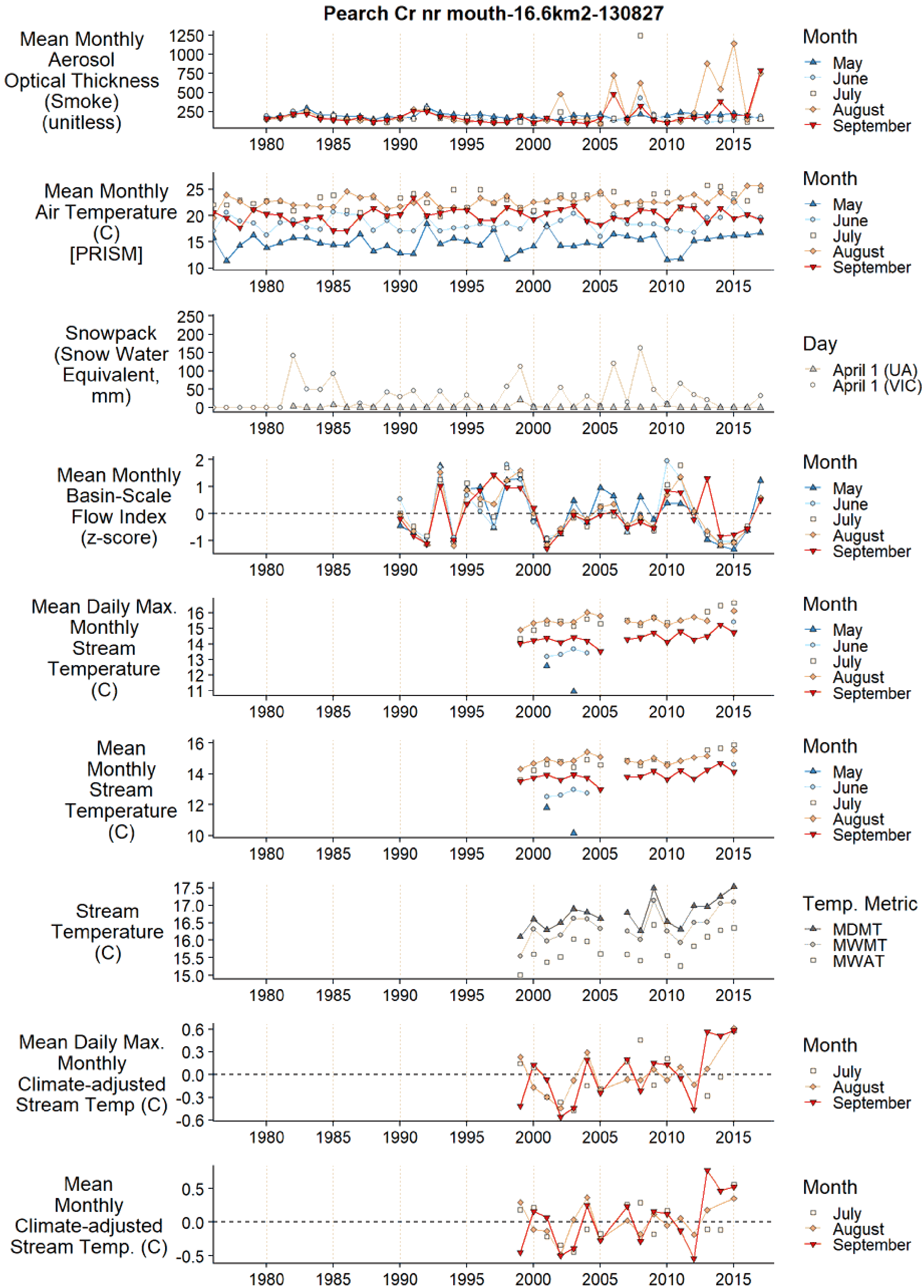
Pearch Cr nr mouth-16.6km2-130827
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
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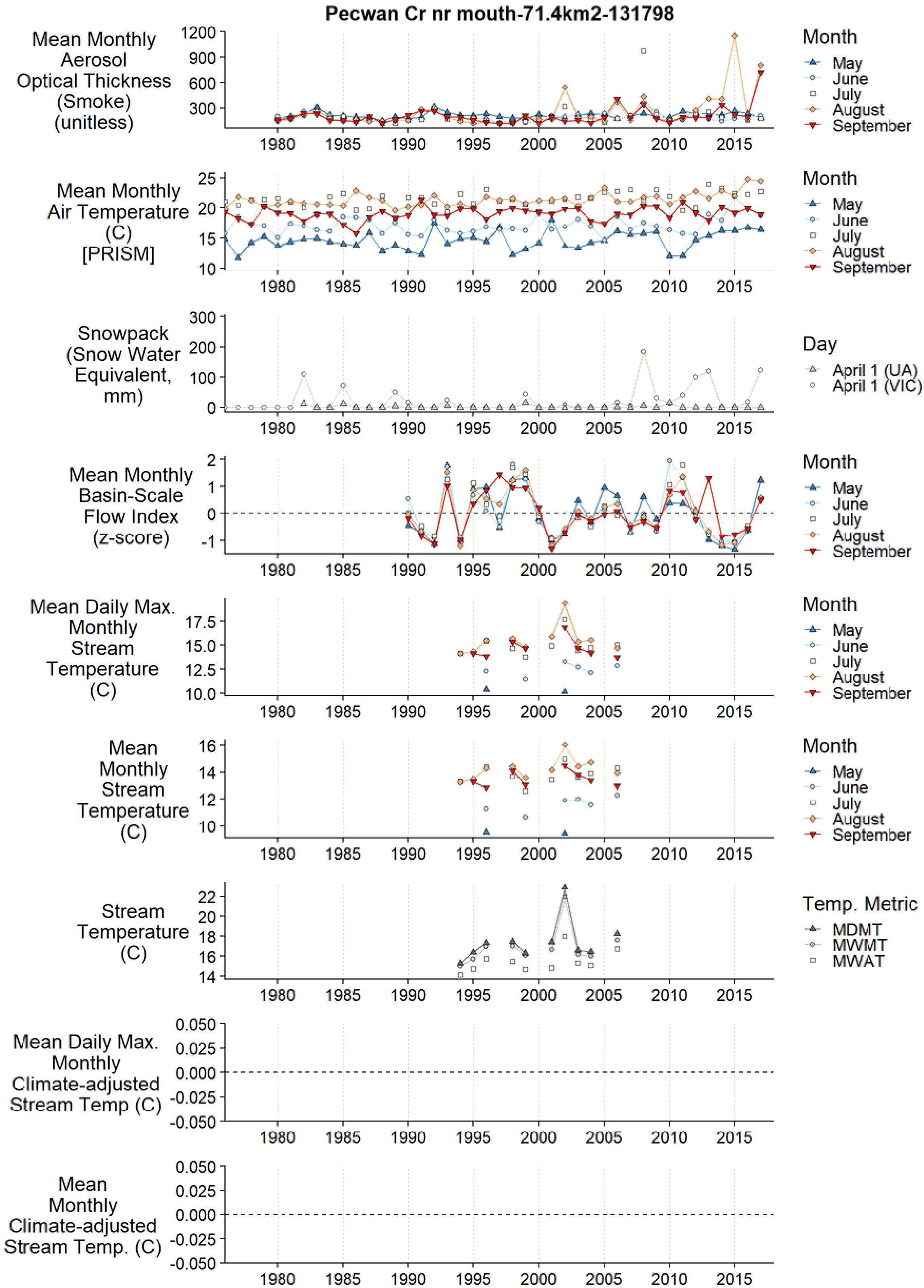
Pecwan Cr nr mouth-71.4km2-131798
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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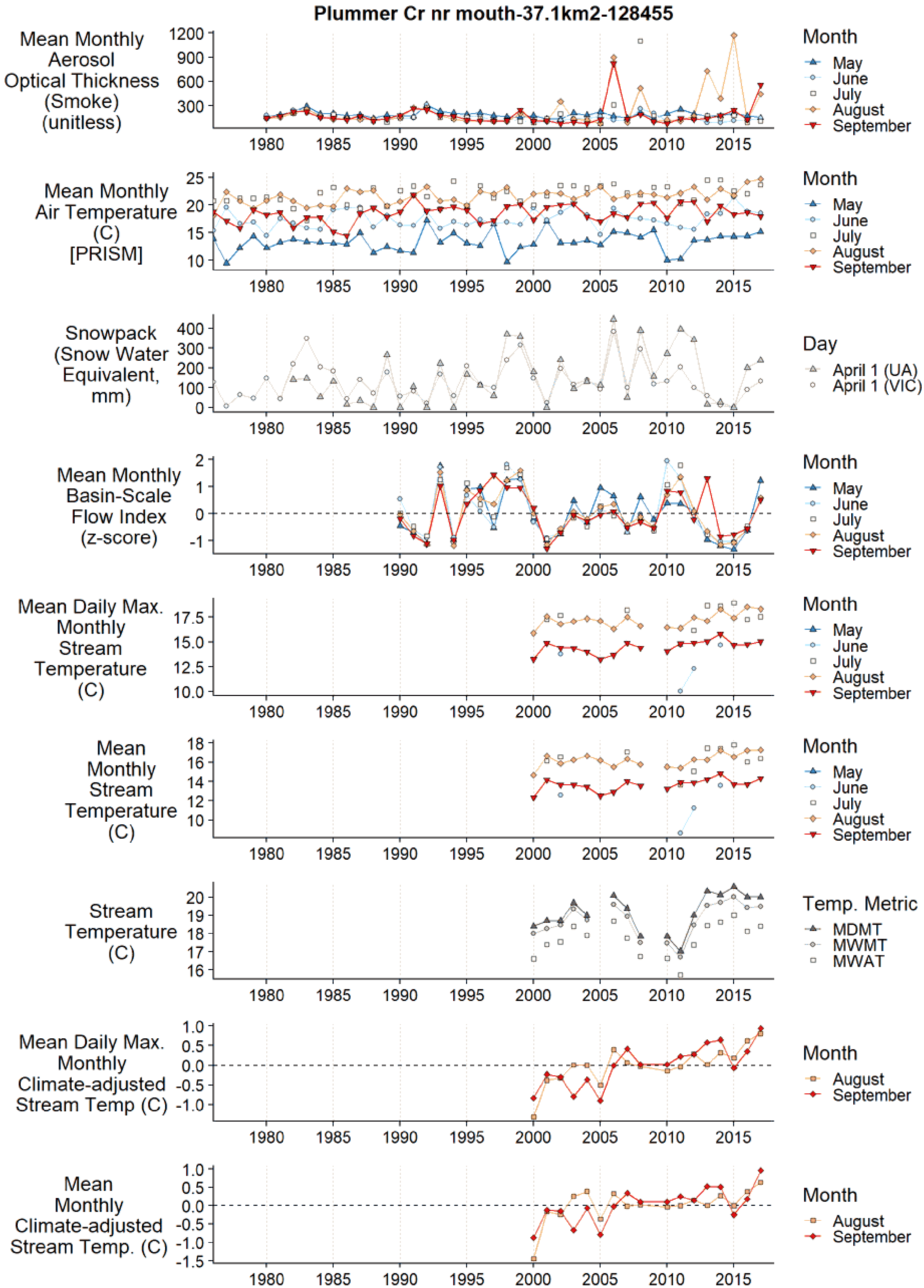

Plummer Cr nr mouth-37.1km2-128455
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
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Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
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April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
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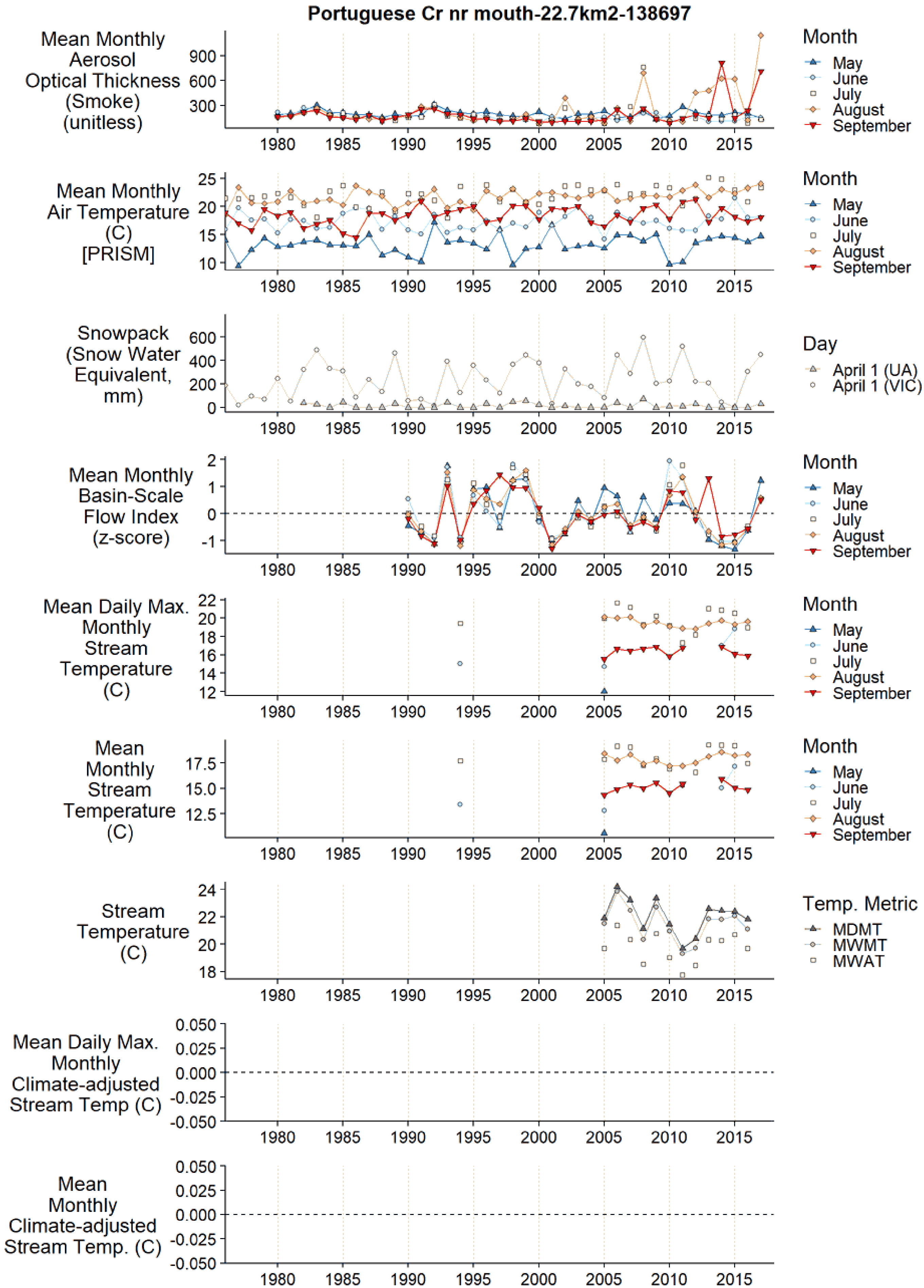
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)


Portuguese Cr nr mouth-22.7km2-138697
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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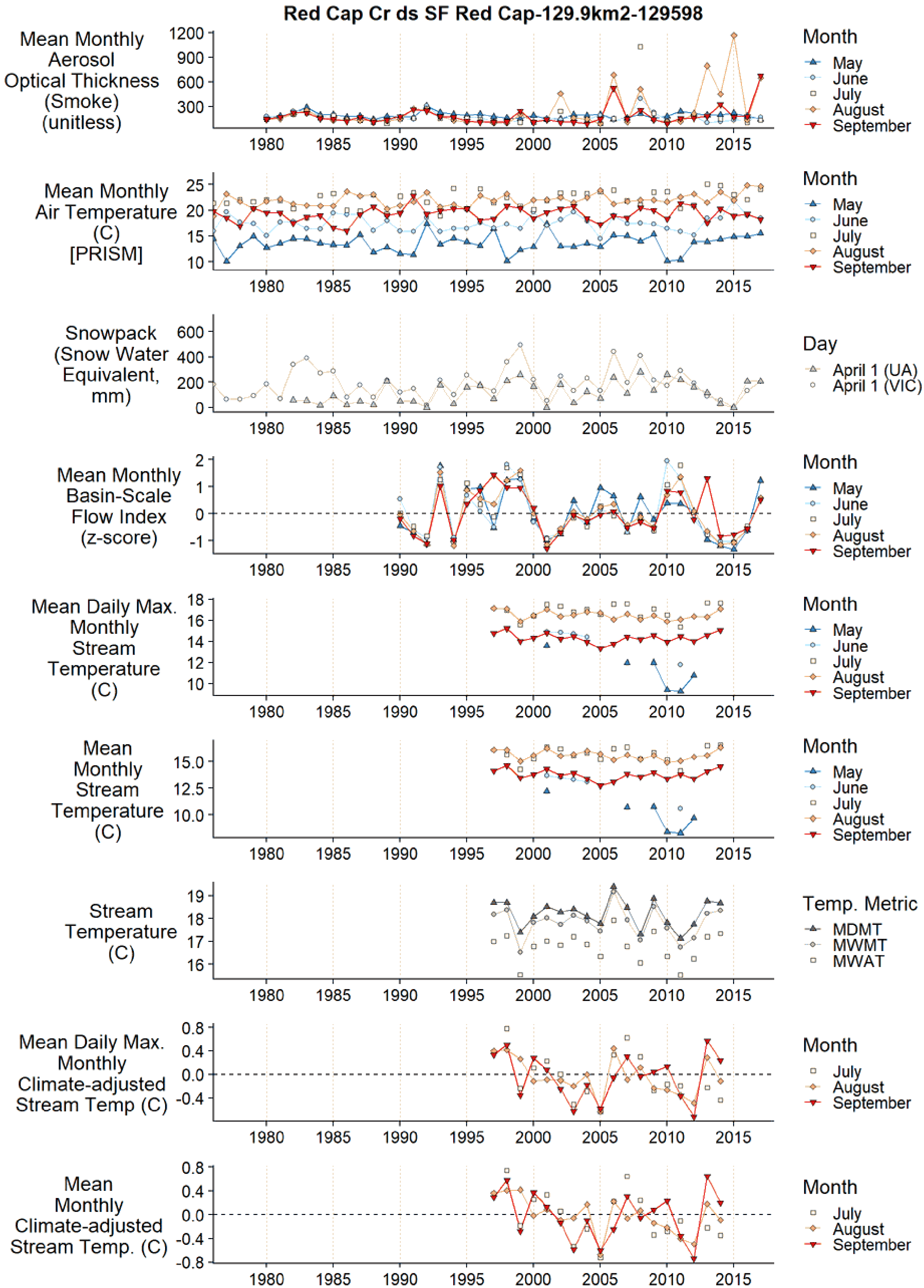
Red Cap Cr ds SF Red Cap-129.9km2-129598
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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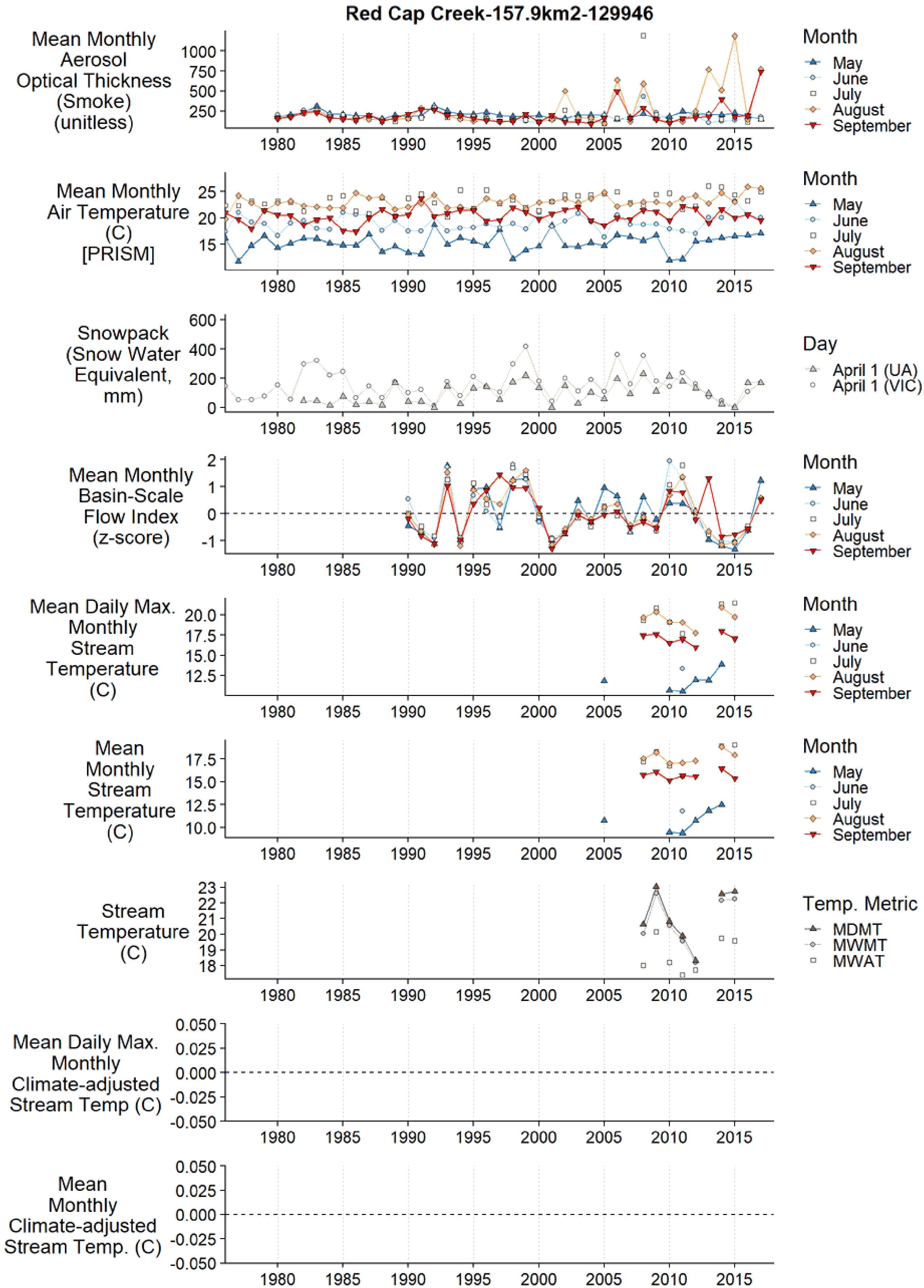
Red Cap Creek-157.9km2-129946
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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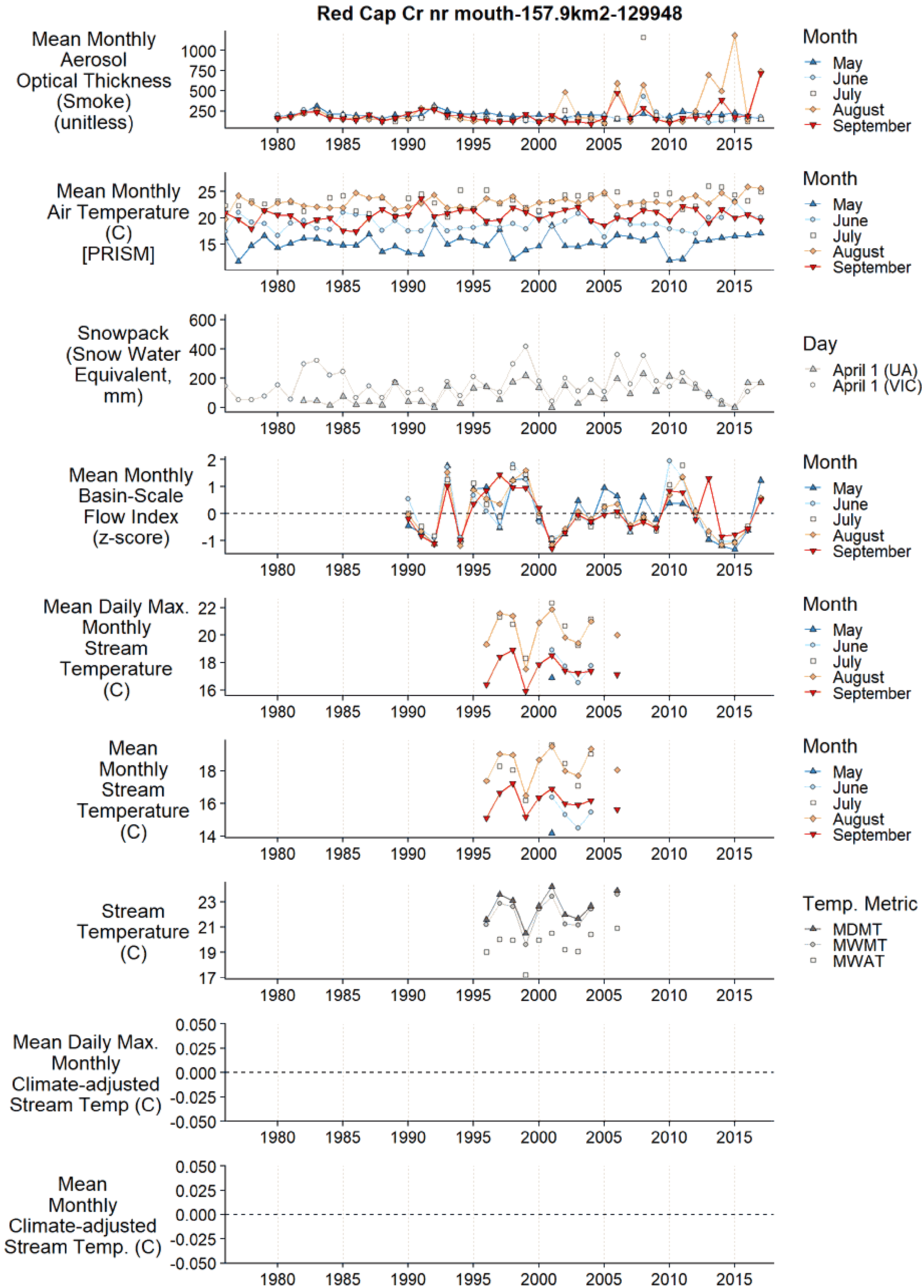
Red Cap Cr nr mouth-157.9km2-129948
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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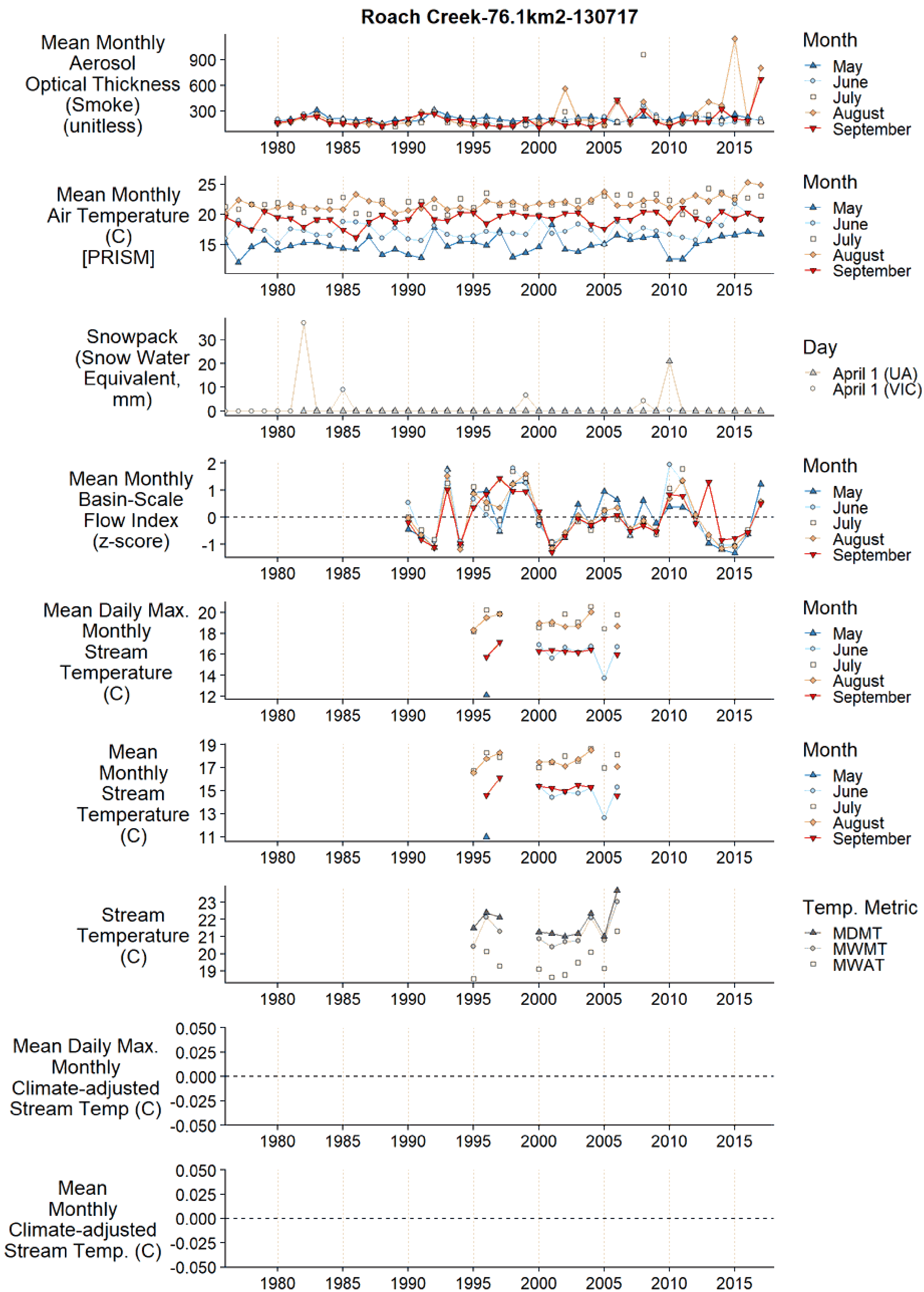
Roach Creek-76.1km2-130717
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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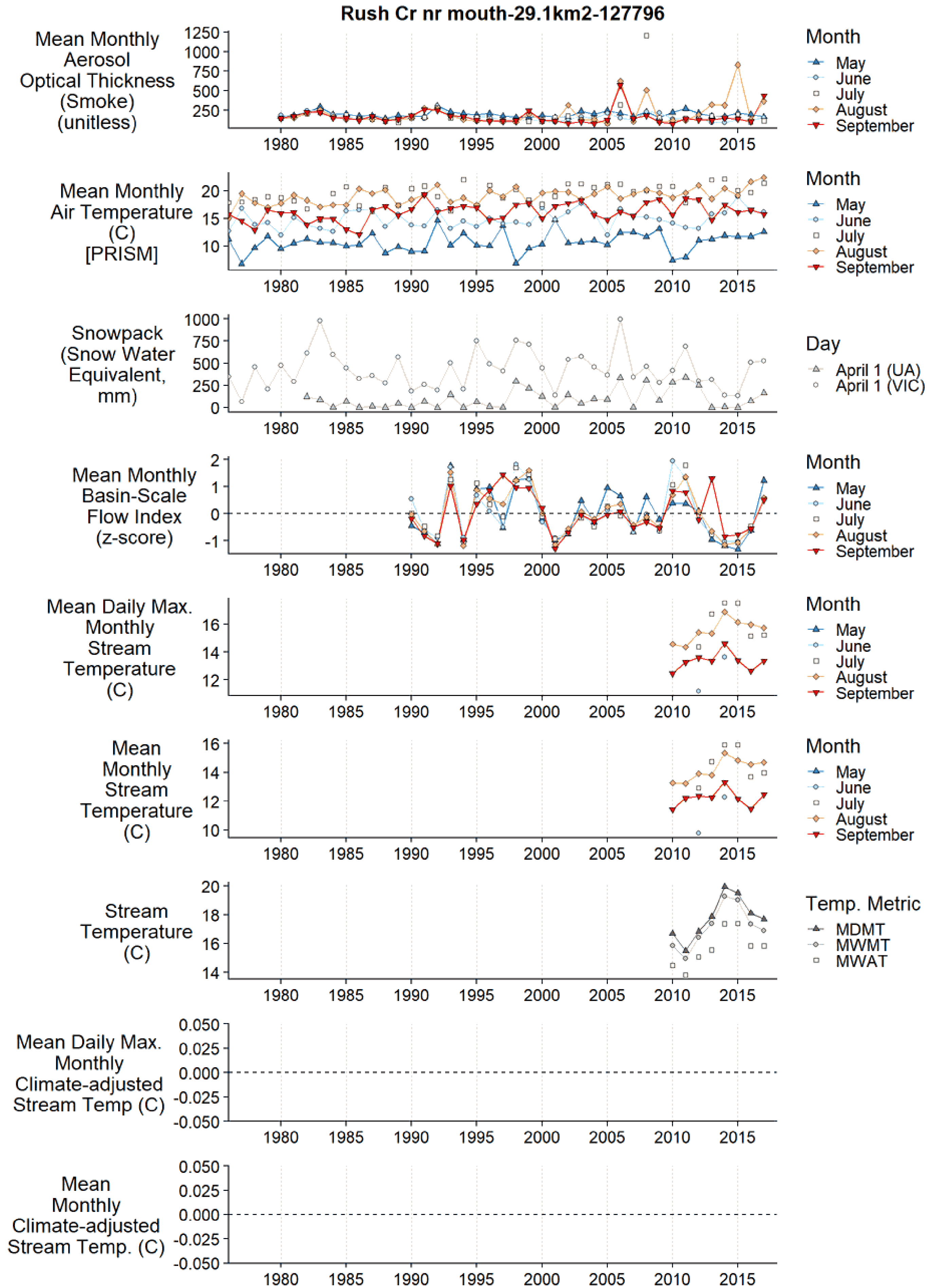
Rush Cr nr mouth-29.1km2-127796
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
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1980
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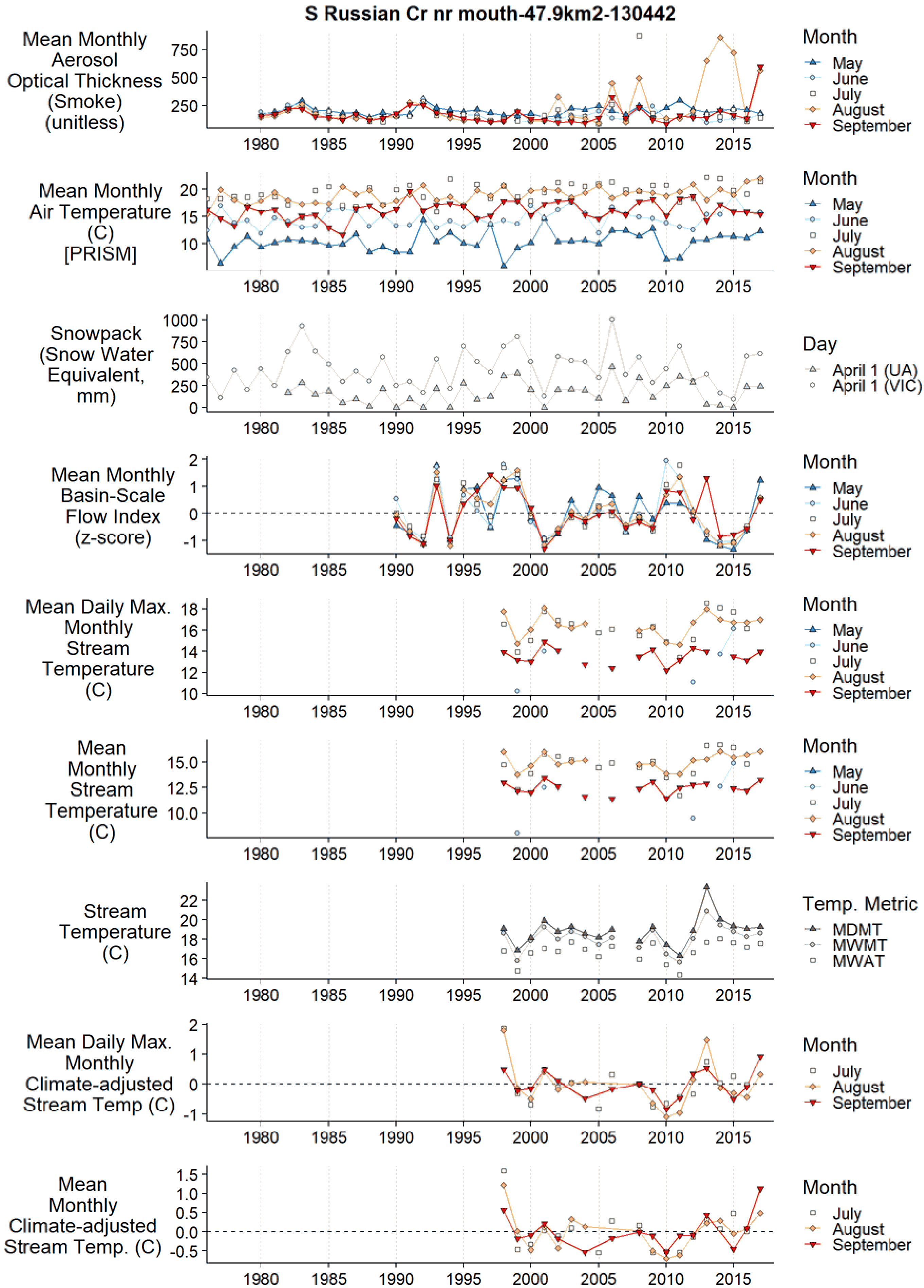

S Russian Cr nr mouth-47.9km2-130442
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
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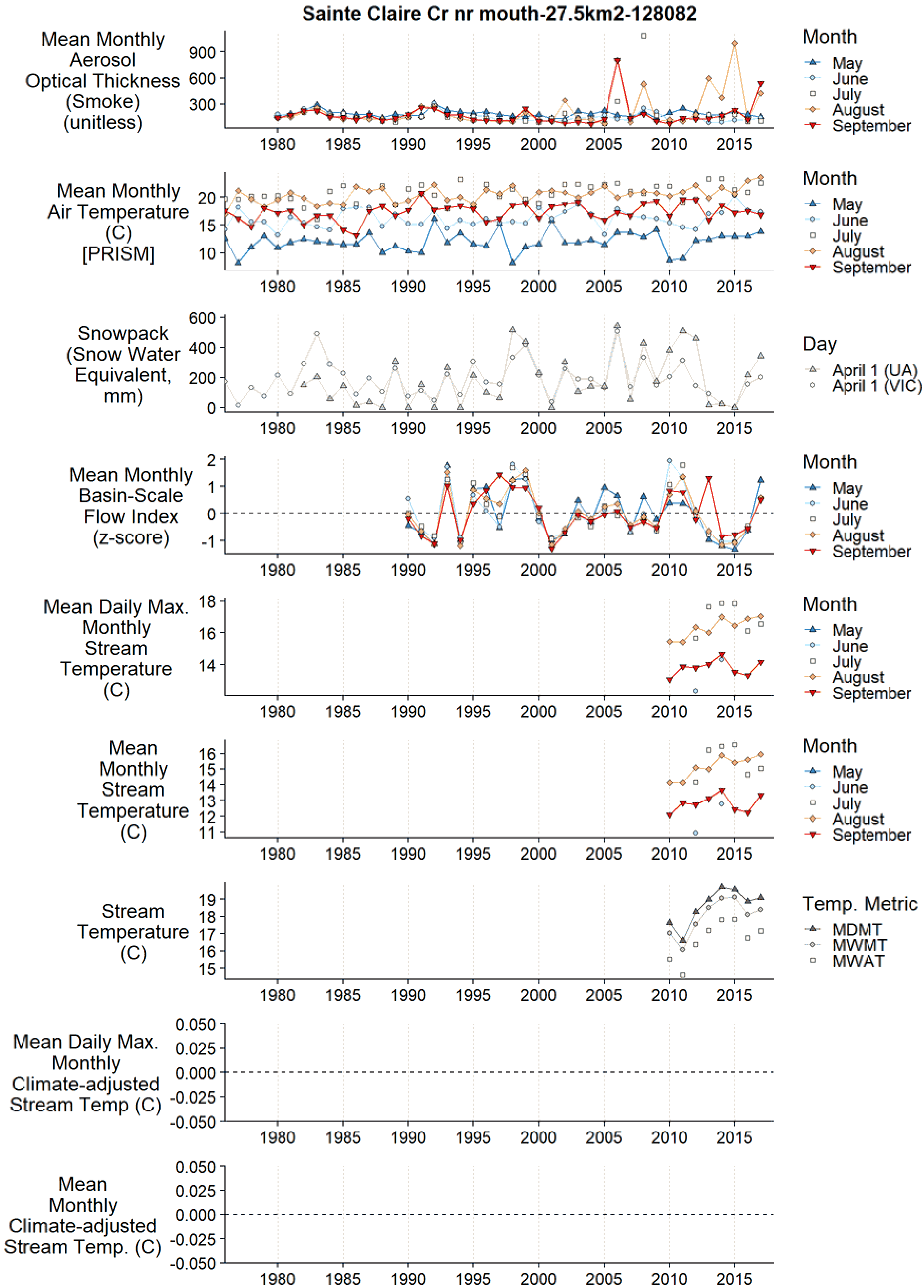
Sainte Claire Cr nr mouth-27.5km2-128082
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
1980 1985 1990 1995 2000 2005 2010 2015
Month
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Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
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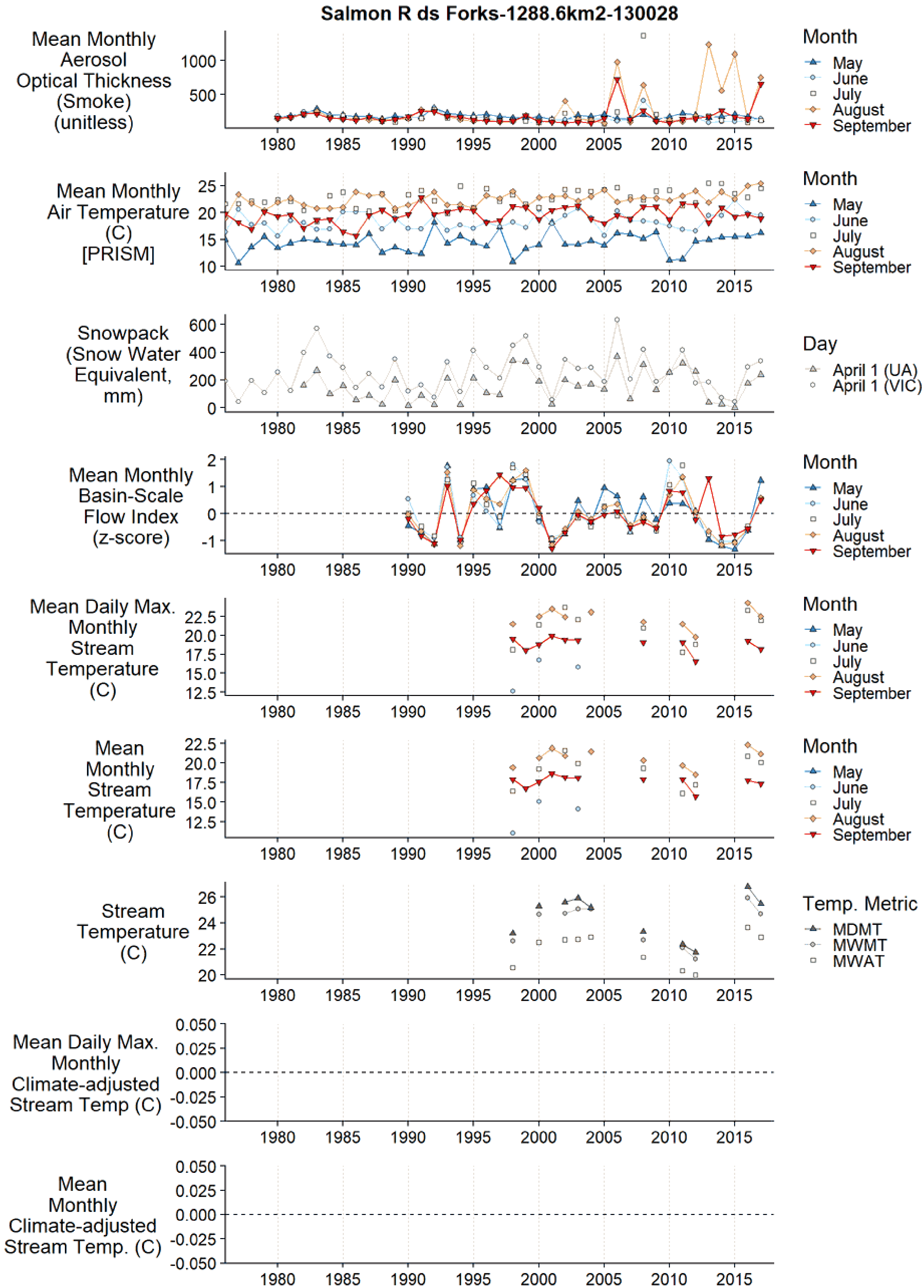
Salmon R ds Forks-1288.6km2-130028
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Temp. Metric
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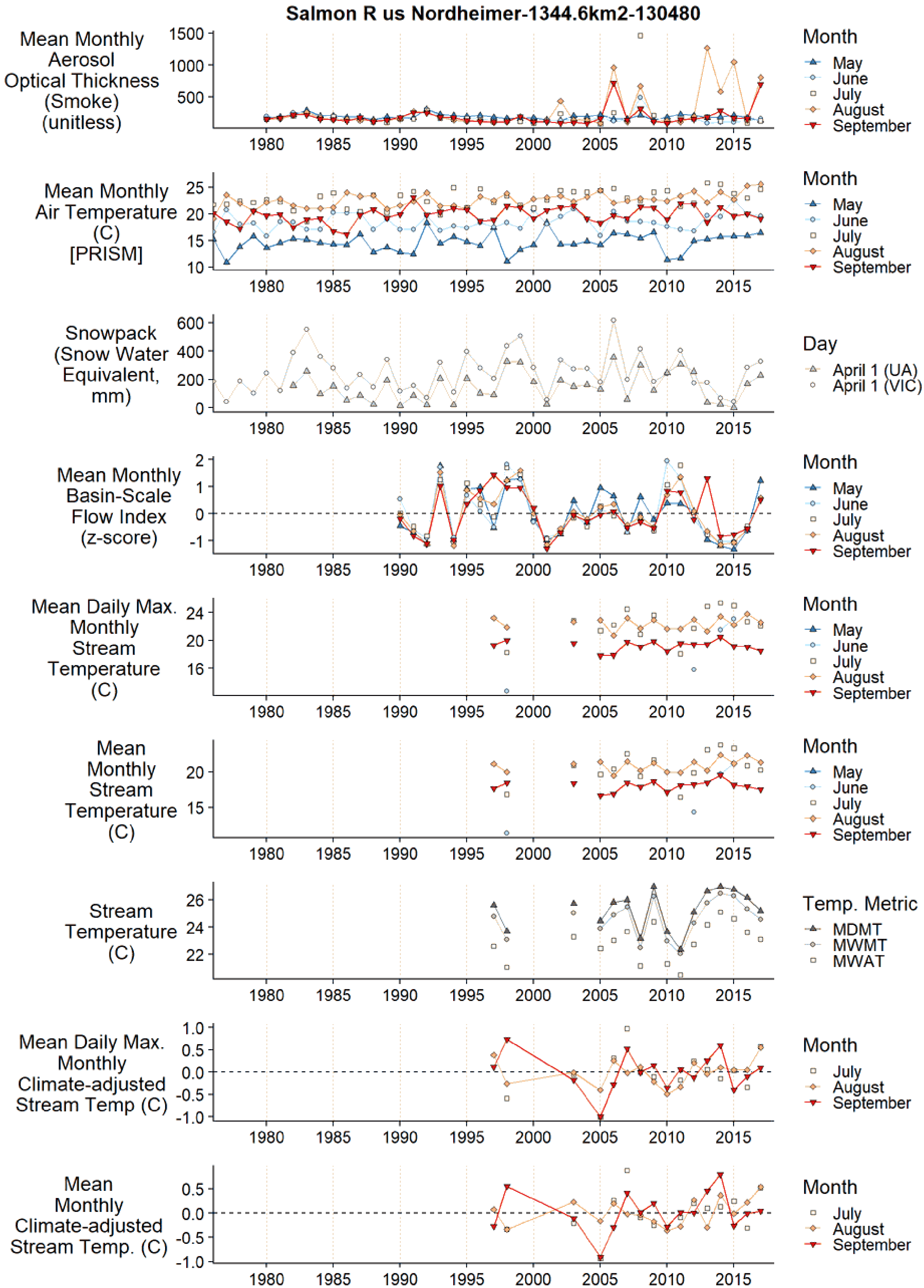
Salmon R us Nordheimer-1344.6km2-130480
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
June
July
August
September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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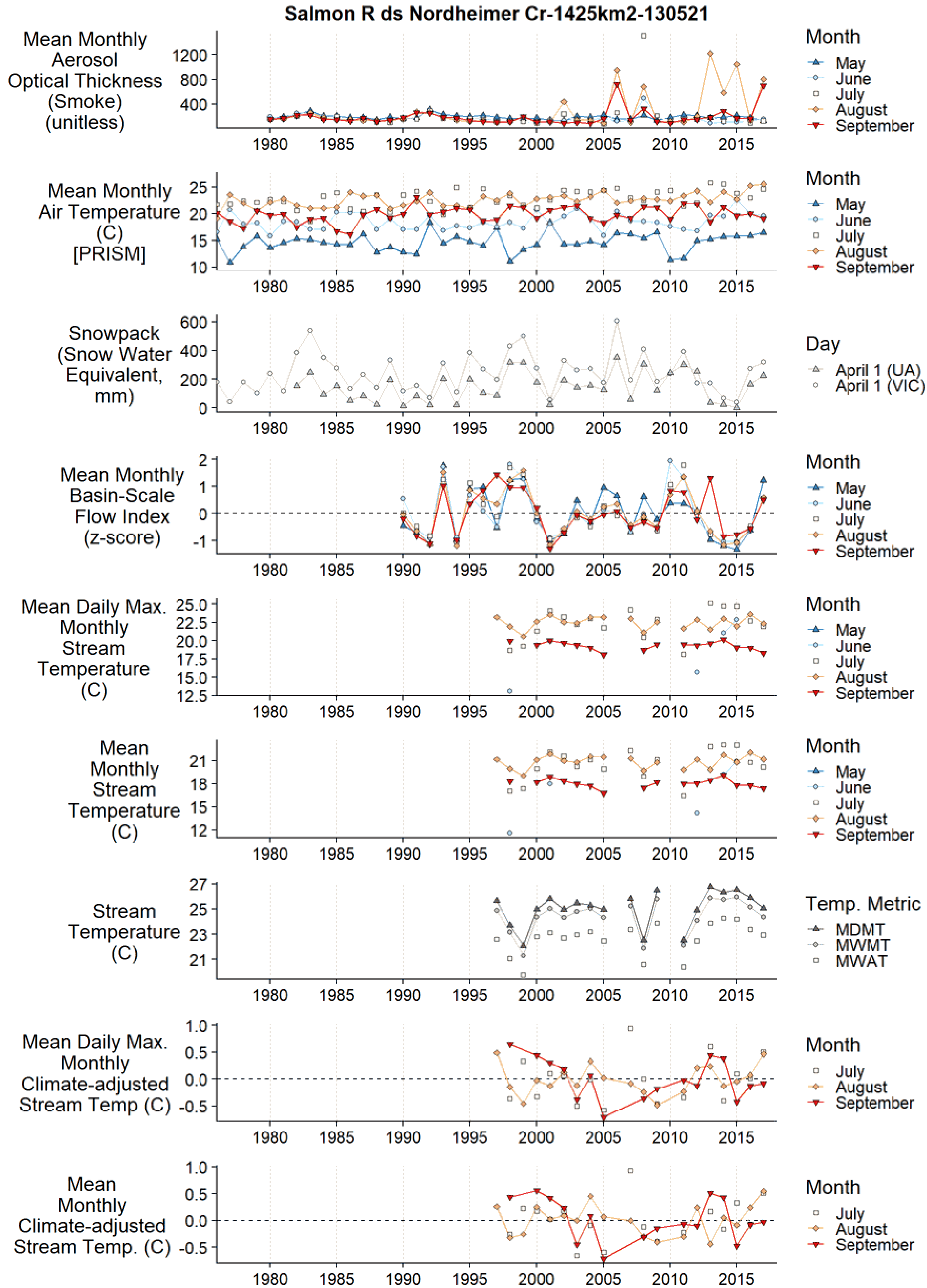
MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)


Salmon R ds Nordheimer Cr-1425km2-130521
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (VIC)
Temp. Metric
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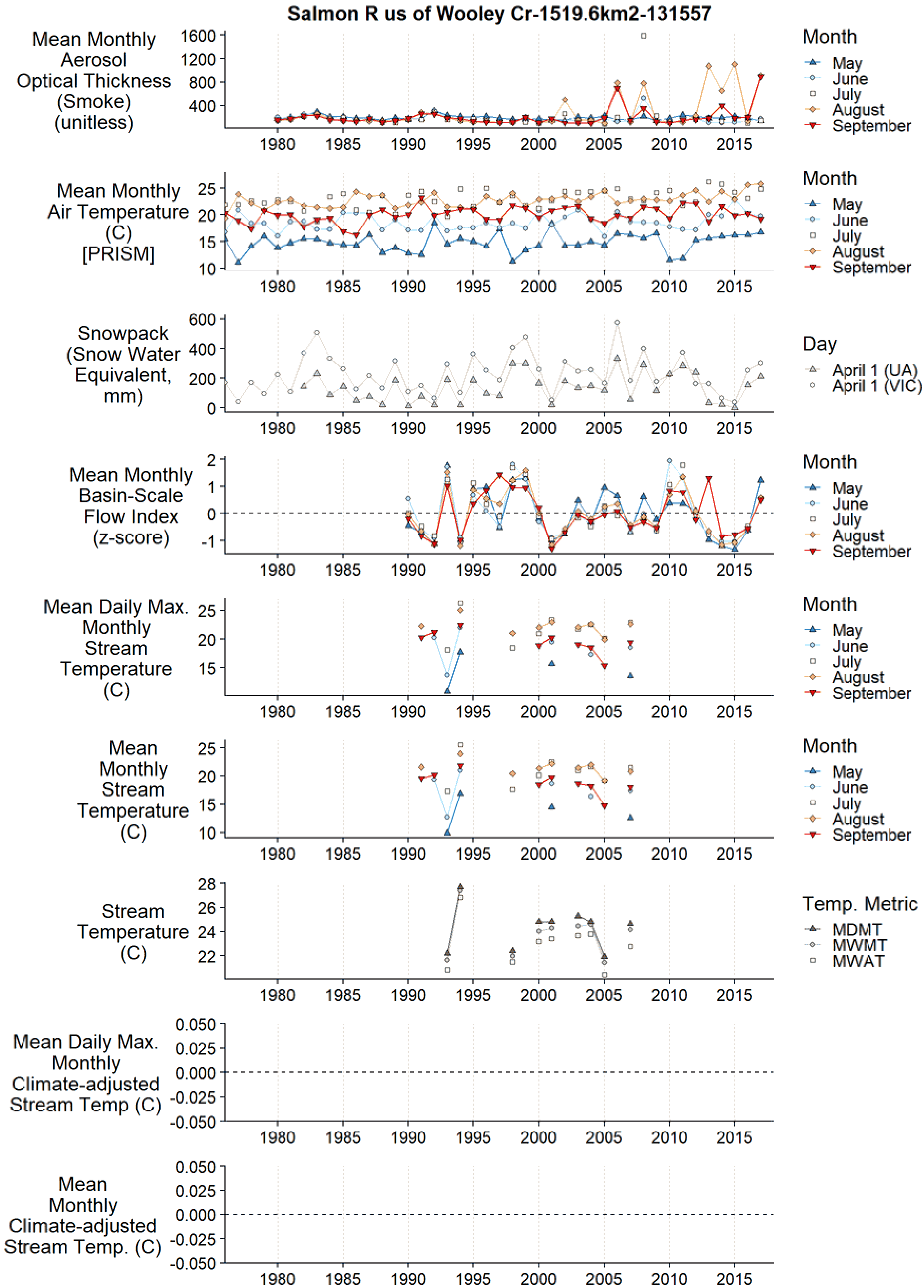

Salmon R us of Wooley Cr-1519.6km2-131557
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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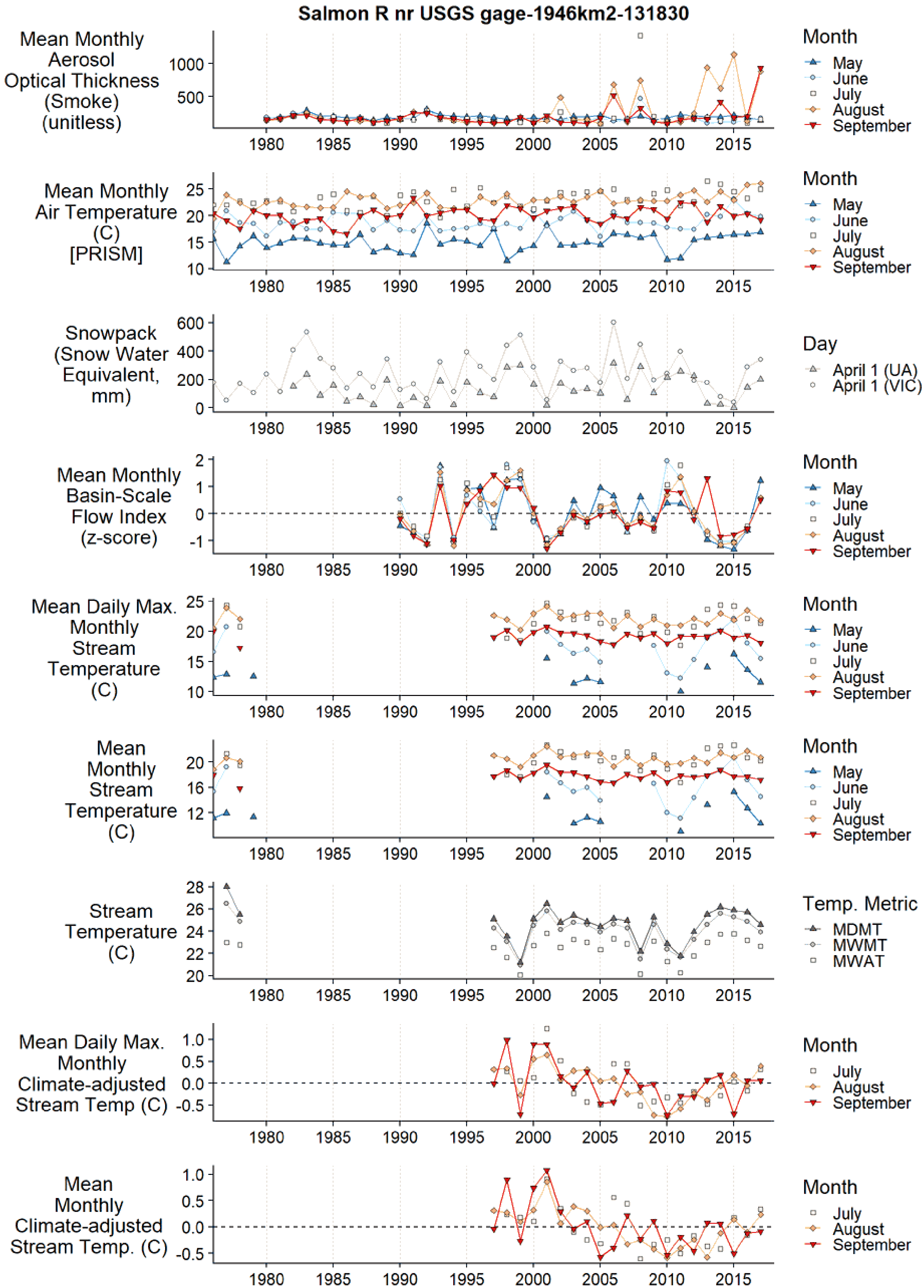
Salmon R nr USGS gage-1946km2-131830
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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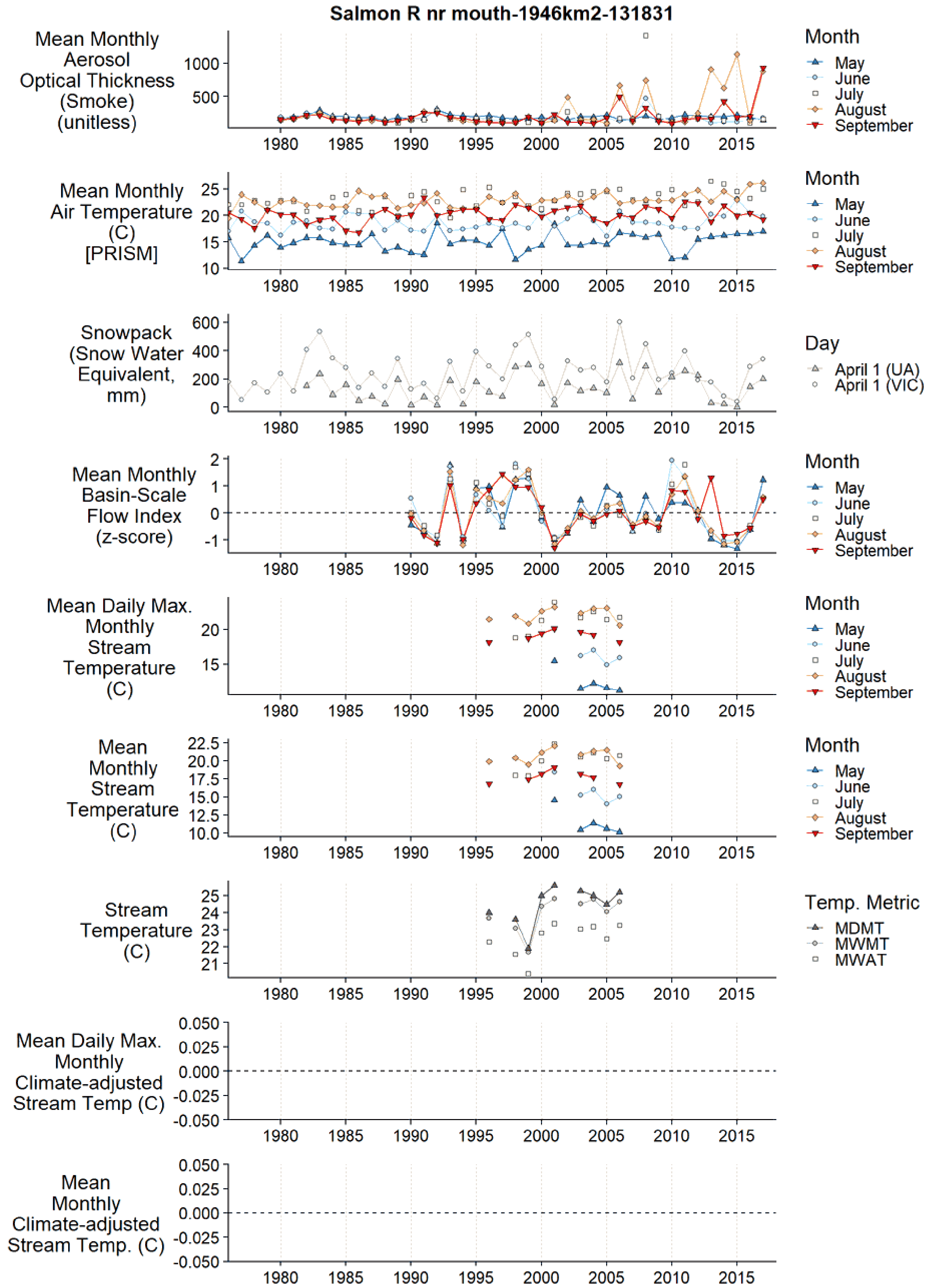
Salmon R nr mouth-1946km2-131831
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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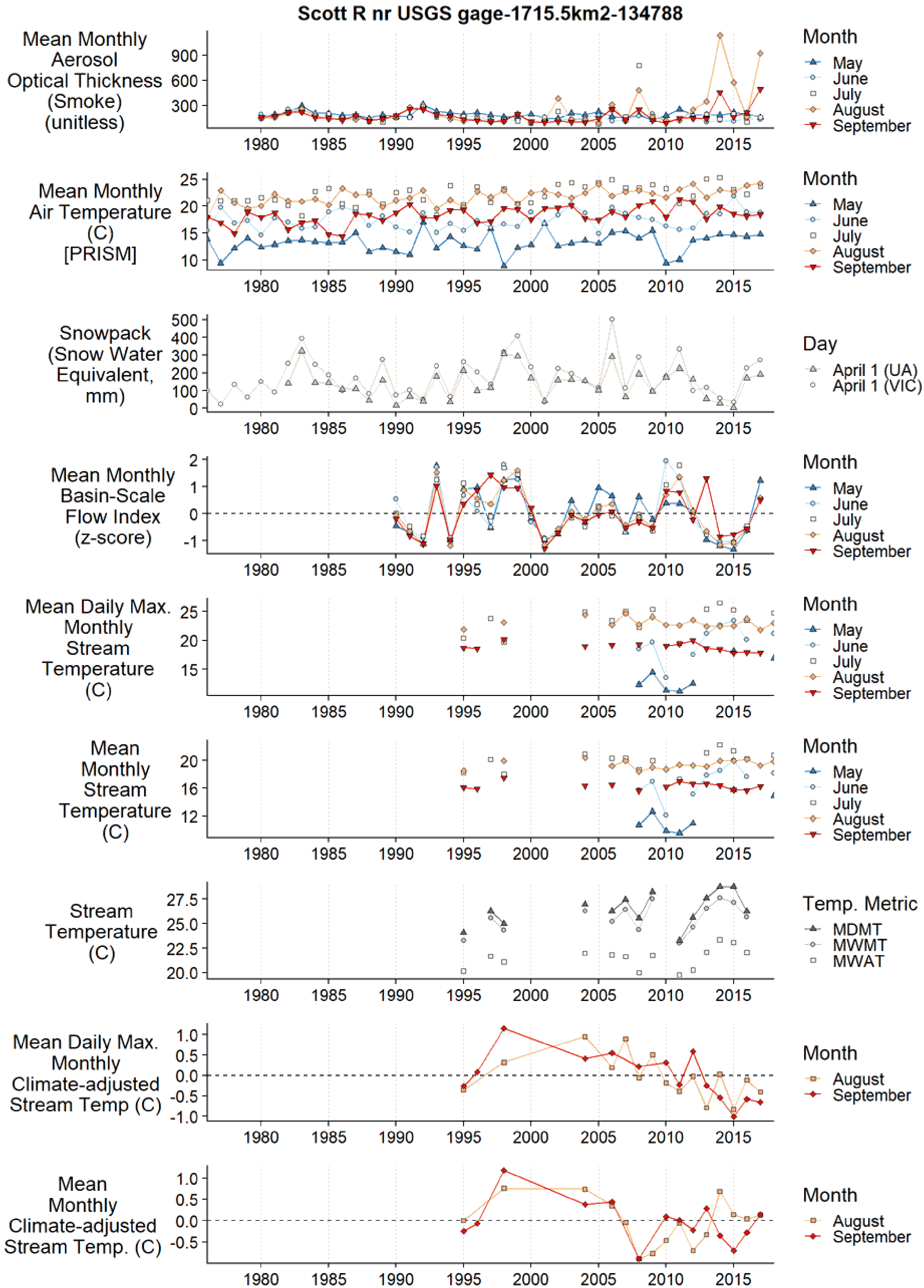

Scott R nr USGS gage-1715.5km2-134788
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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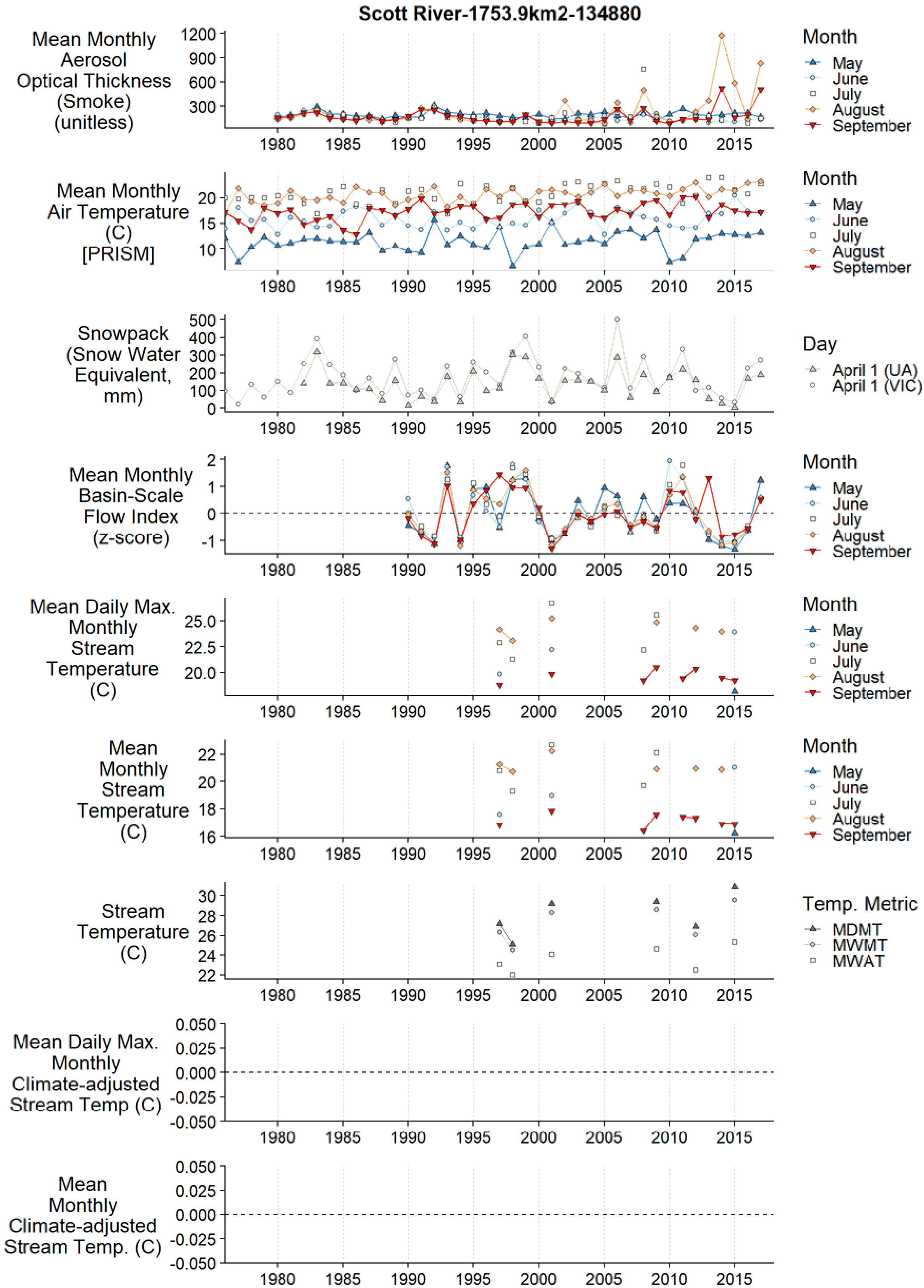
Scott River-1753.9km2-134880
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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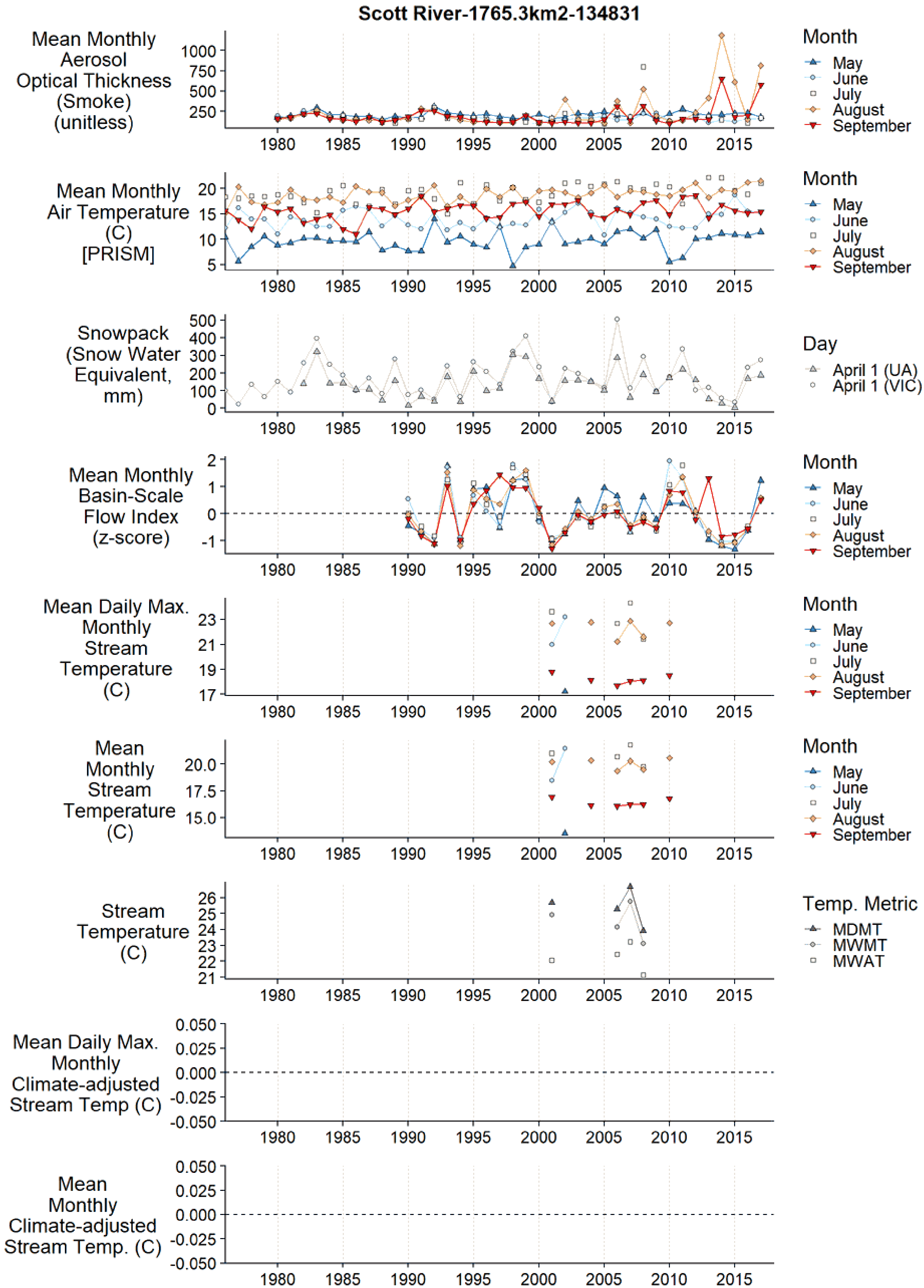

Scott River-1765.3km2-134831
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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Temp. Metric
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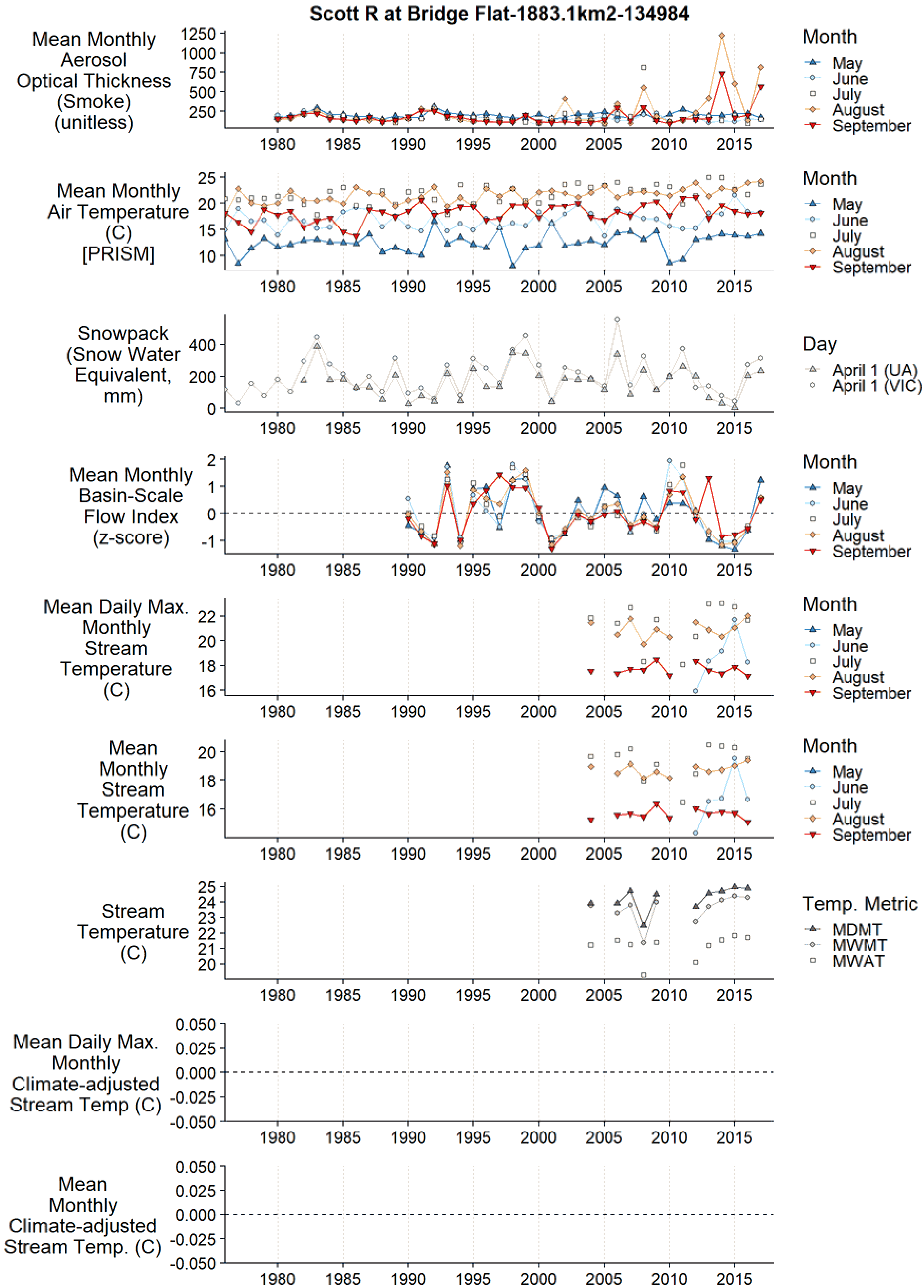
Scott R at Bridge Flat-1883.1km2-134984
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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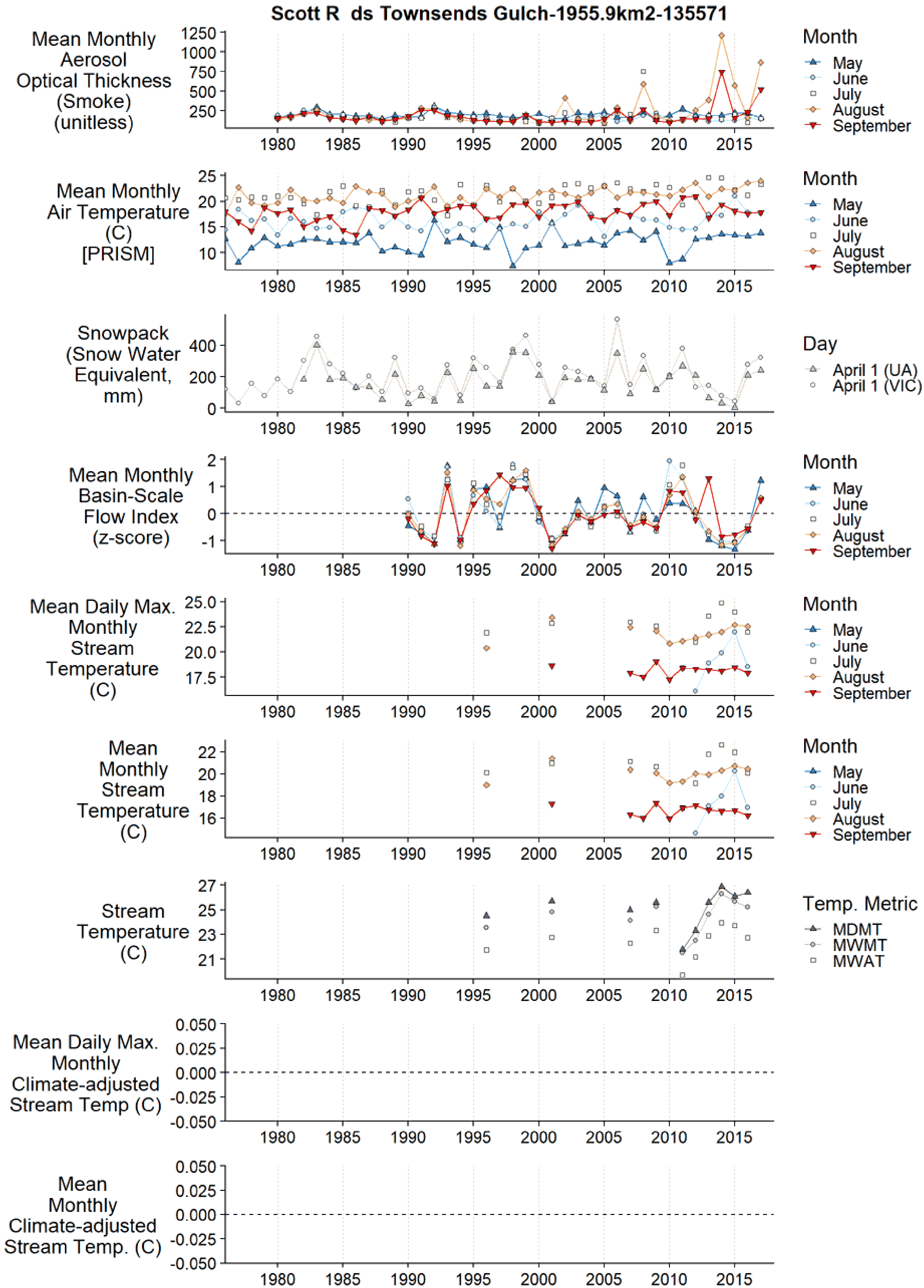
Scott R ds Townsends Gulch-1955.9km2-135571
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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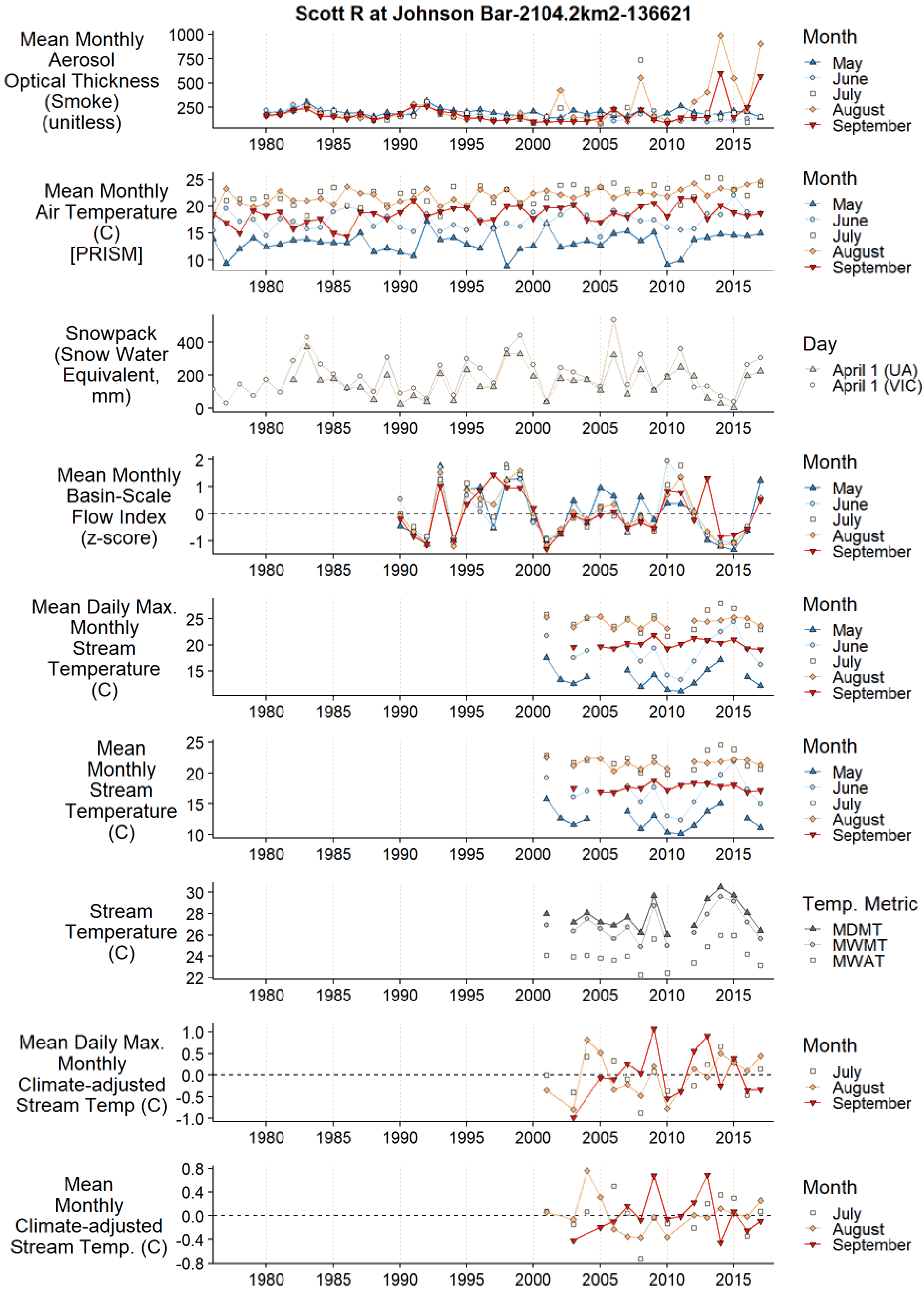
Scott R at Johnson Bar-2104.2km2-136621
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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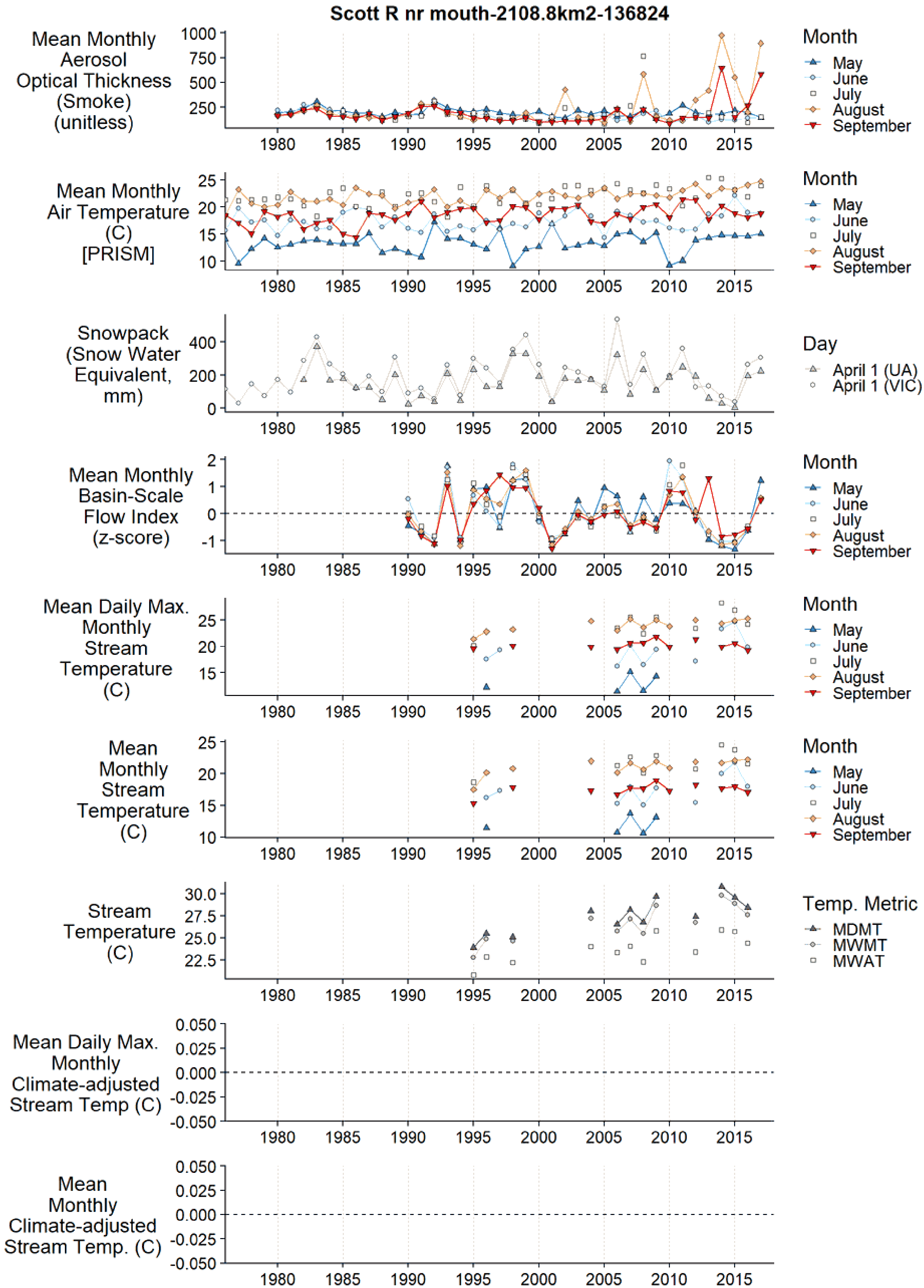
Scott R nr mouth-2108.8km2-136824
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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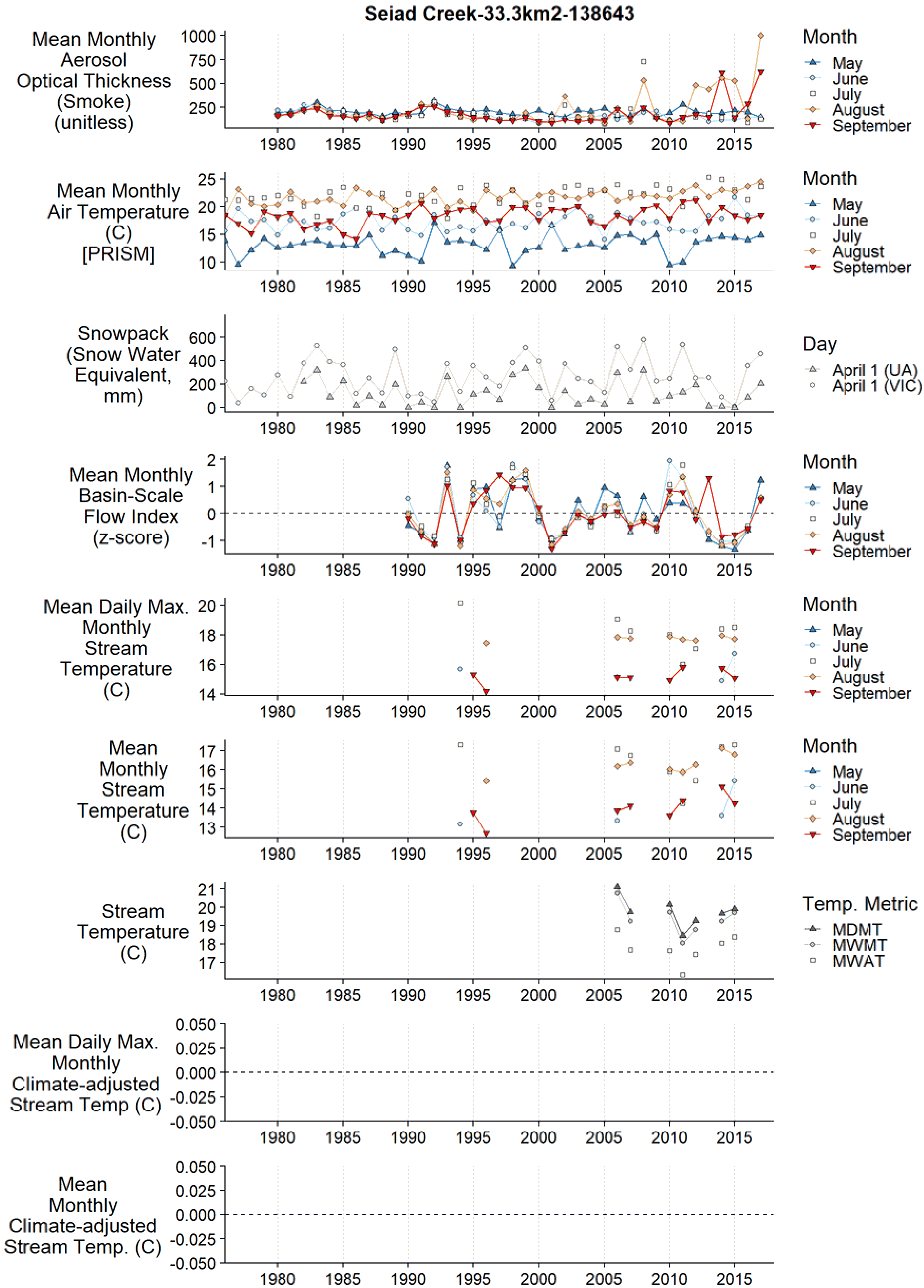

Seiad Creek-33.3km2-138643
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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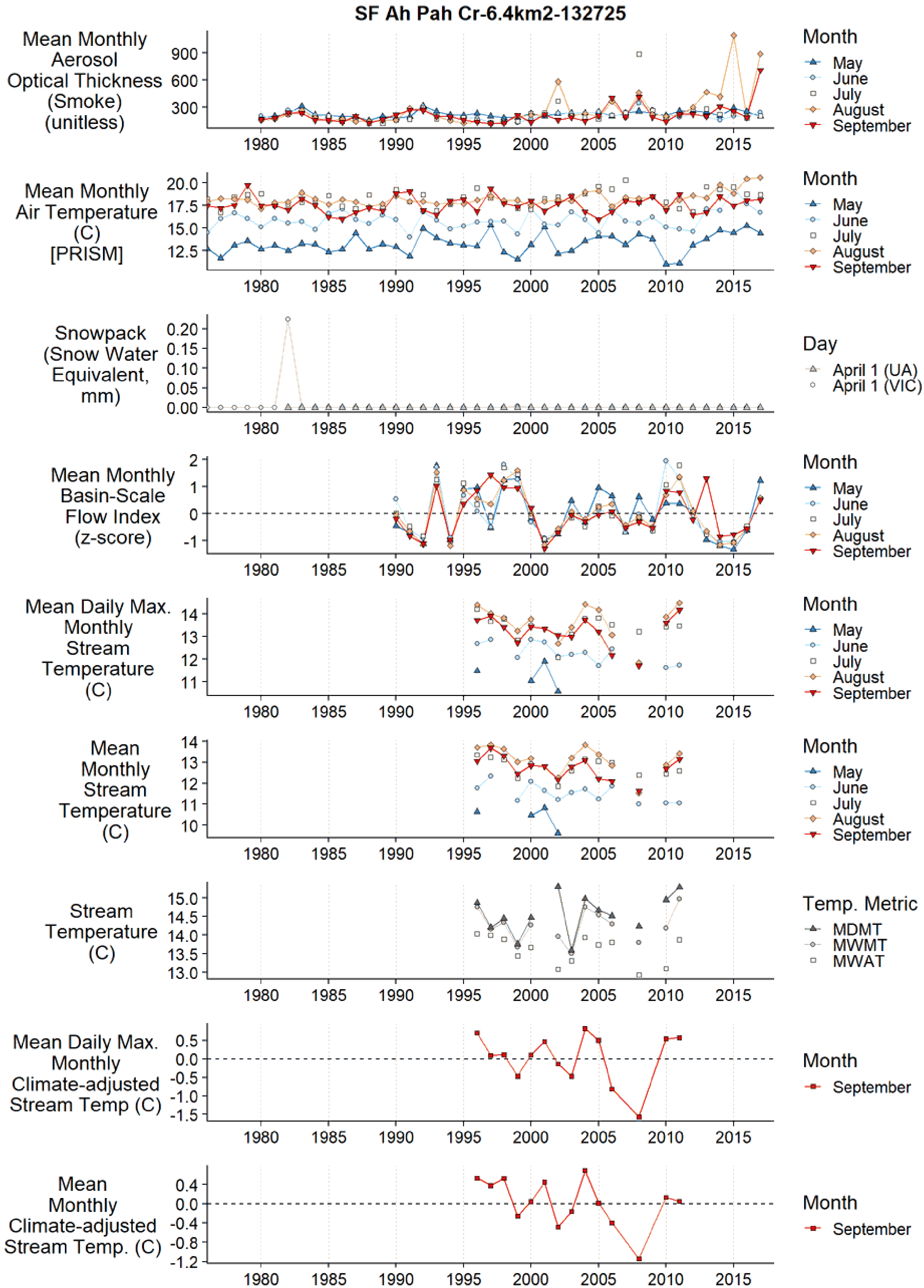

SF Ah Pah Cr-6.4km2-132725
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (VIC)
Temp. Metric
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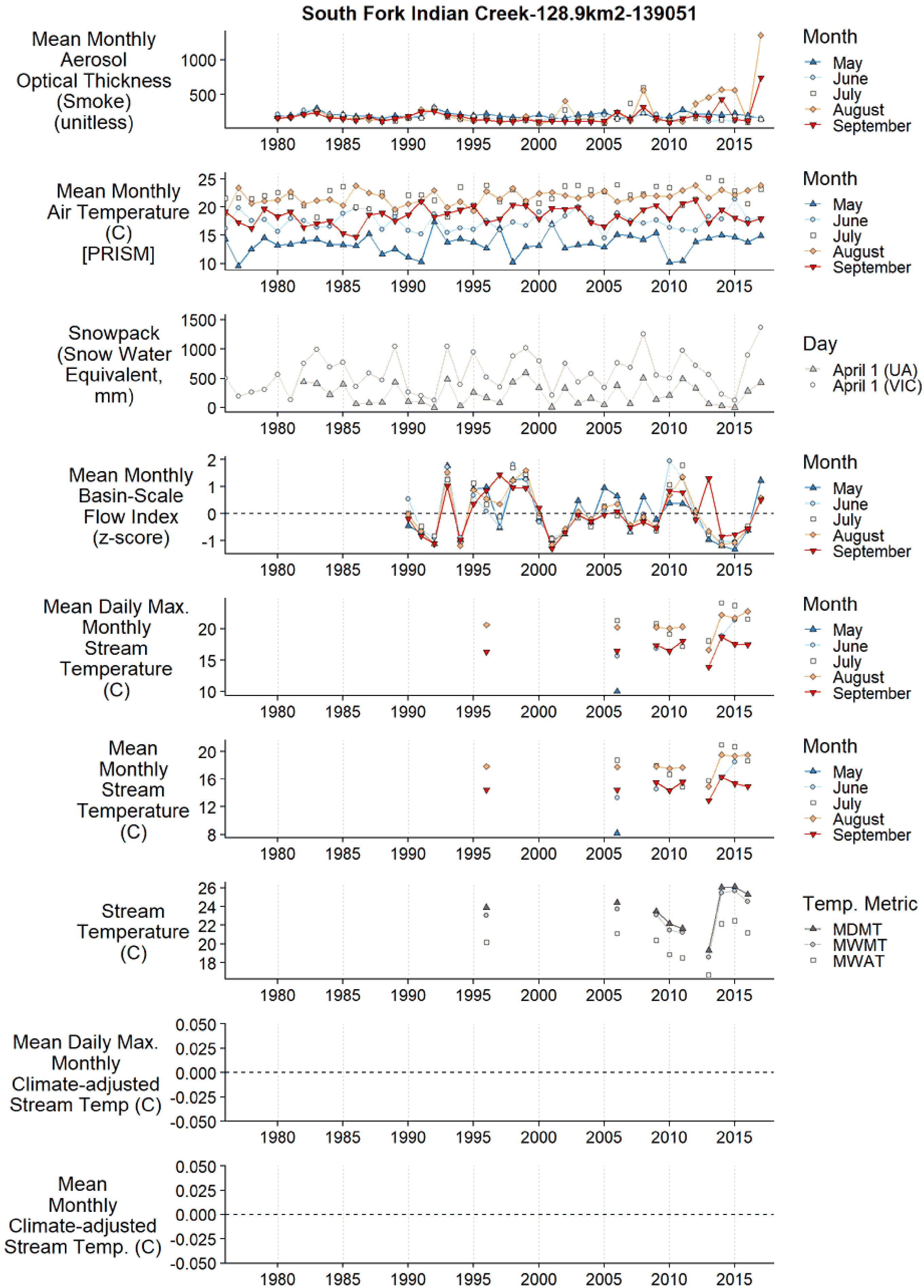
South Fork Indian Creek-128.9km2-139051
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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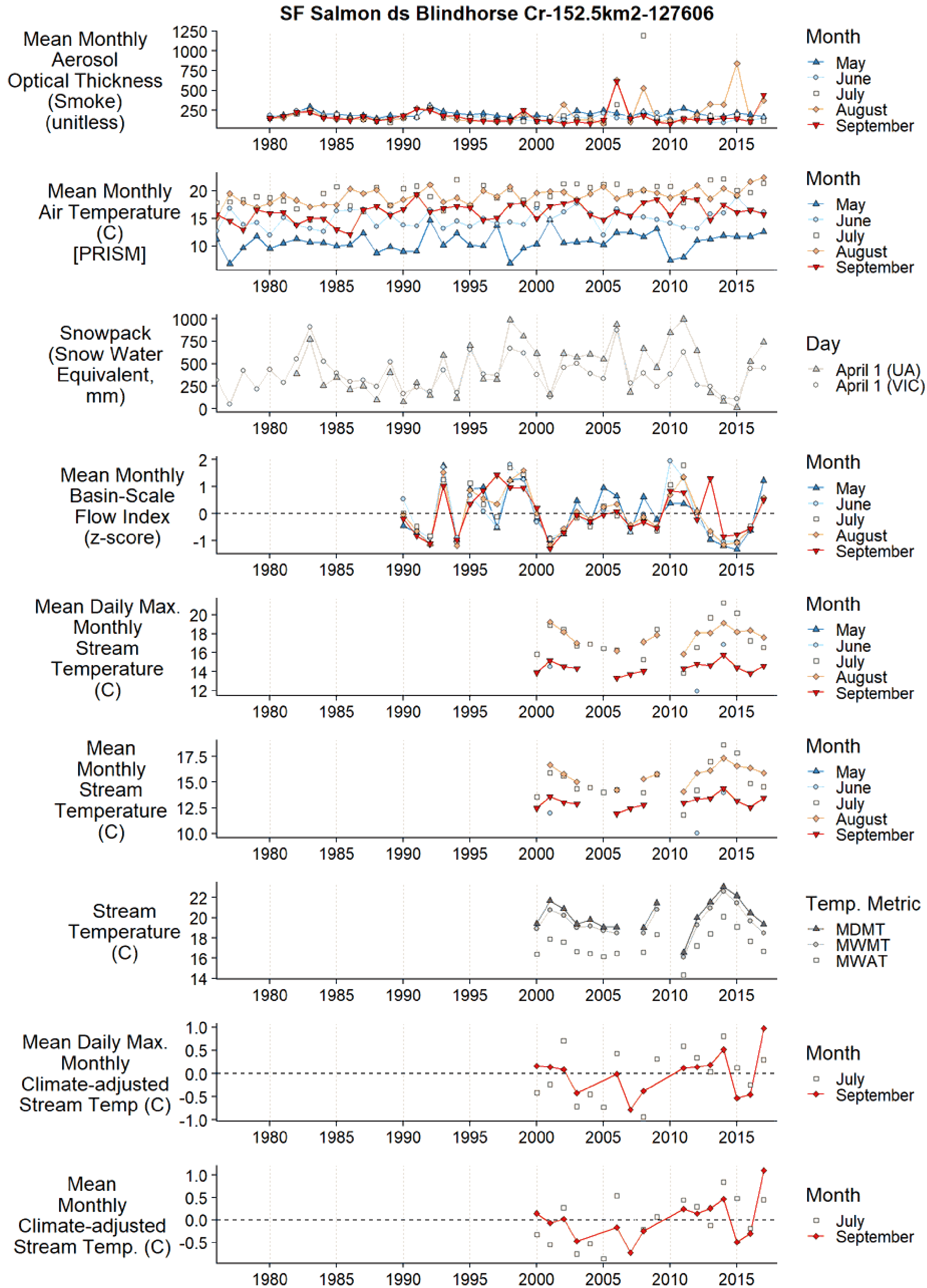
SF Salmon ds Blindhorse Cr-152.5km2-127606
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
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Temp. Metric
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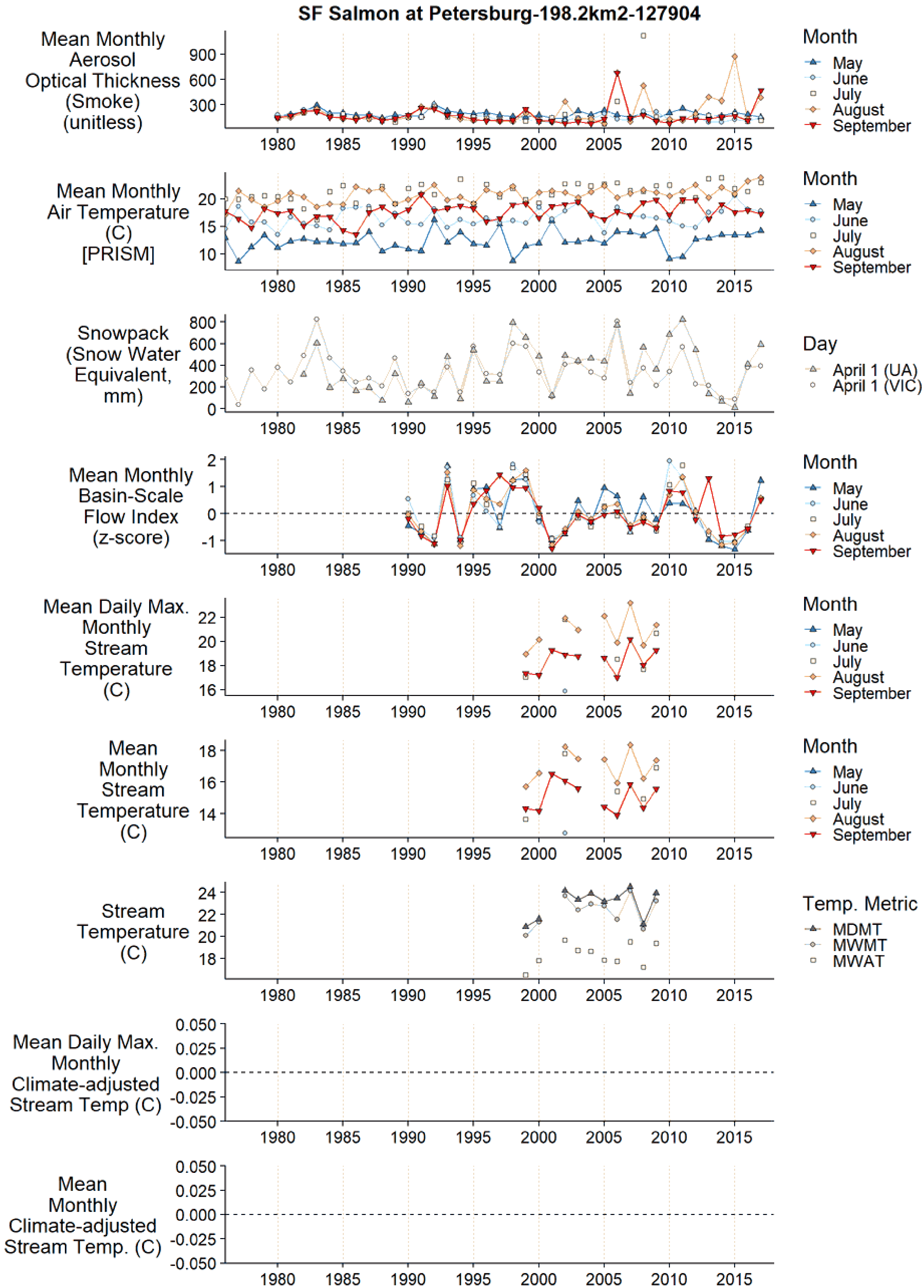
SF Salmon at Petersburg-198.2km2-127904
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
May
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September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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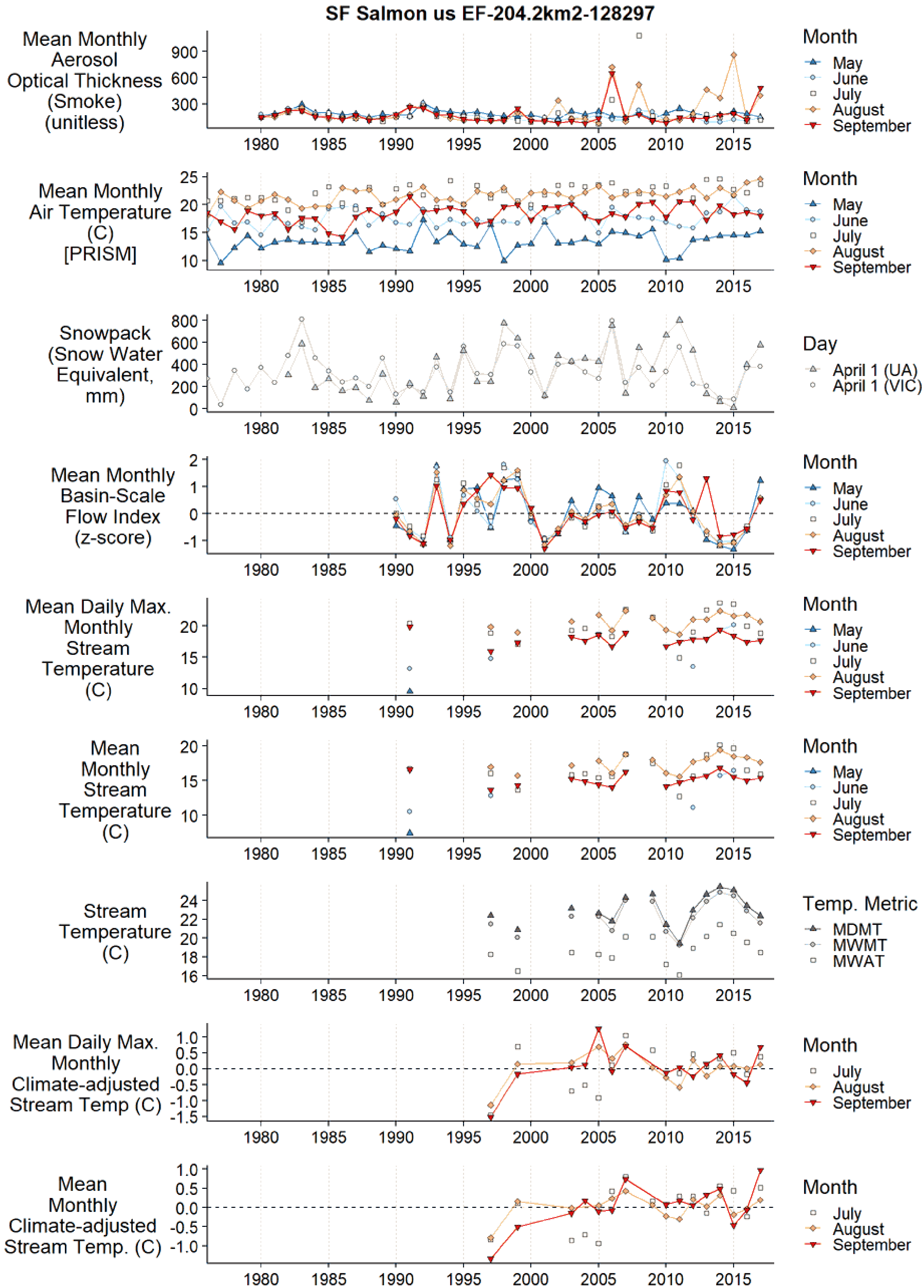
MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)


SF Salmon us EF-204.2km2-128297
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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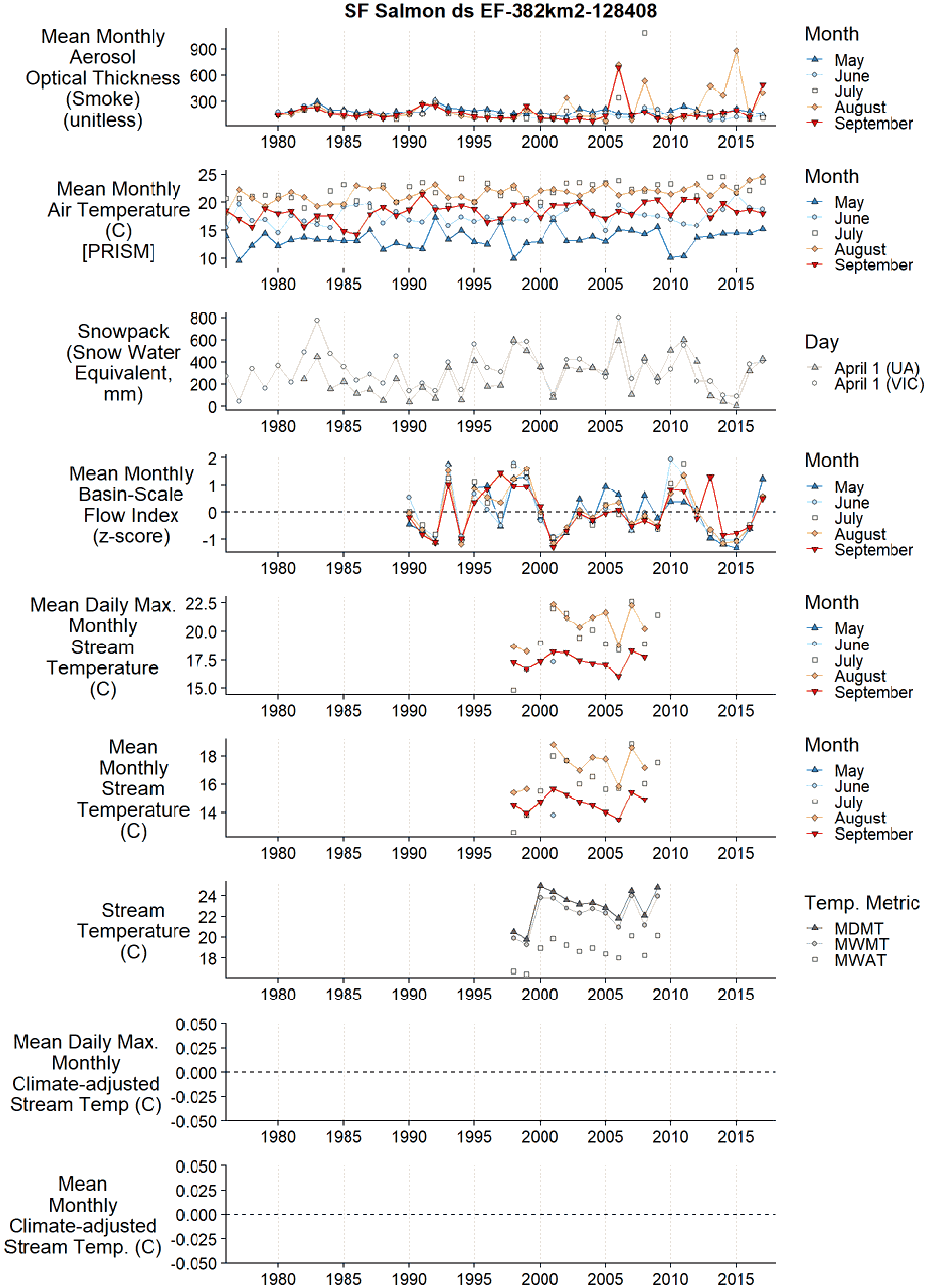

SF Salmon ds EF-382km2-128408
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
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Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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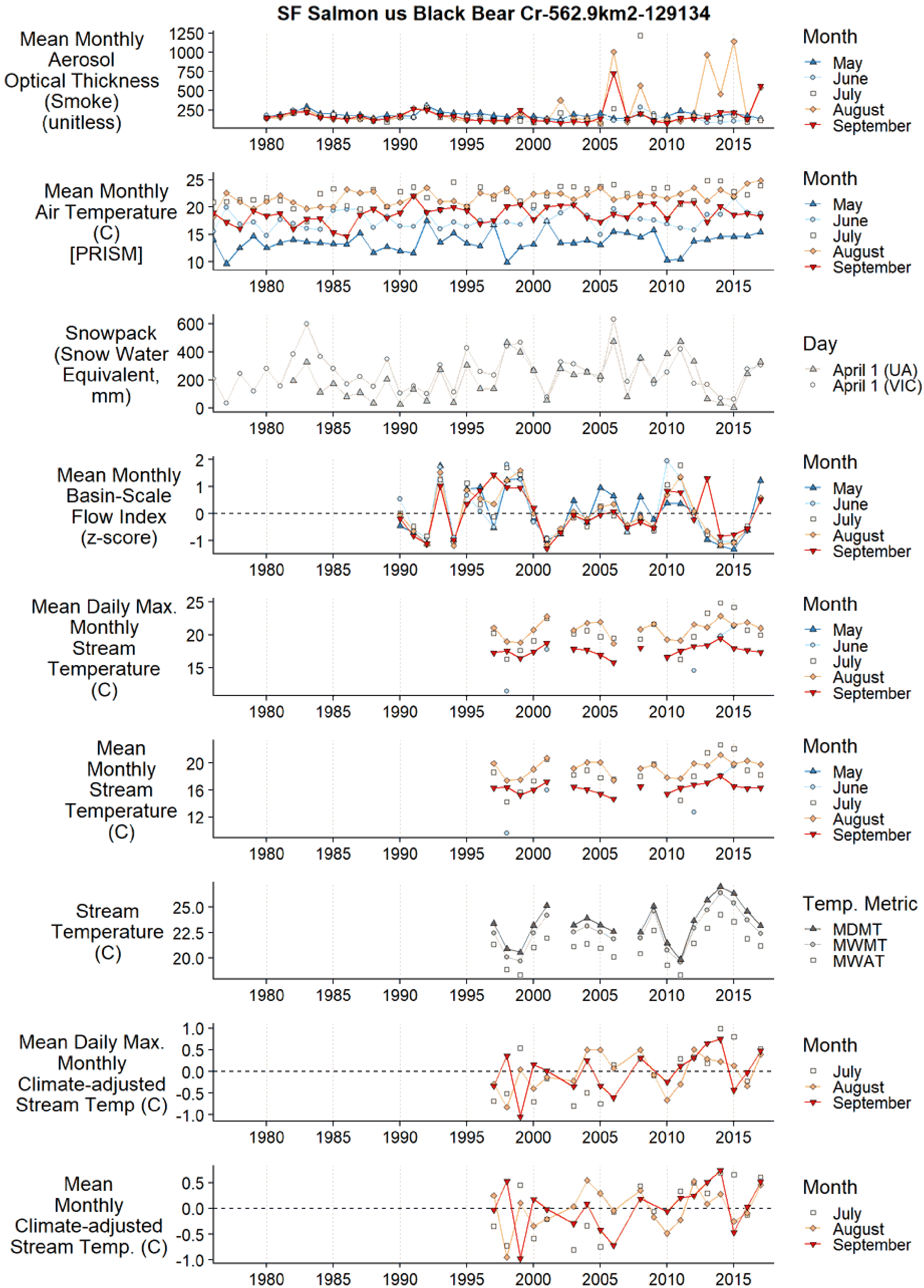
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)


SF Salmon us Black Bear Cr-562.9km2-129134
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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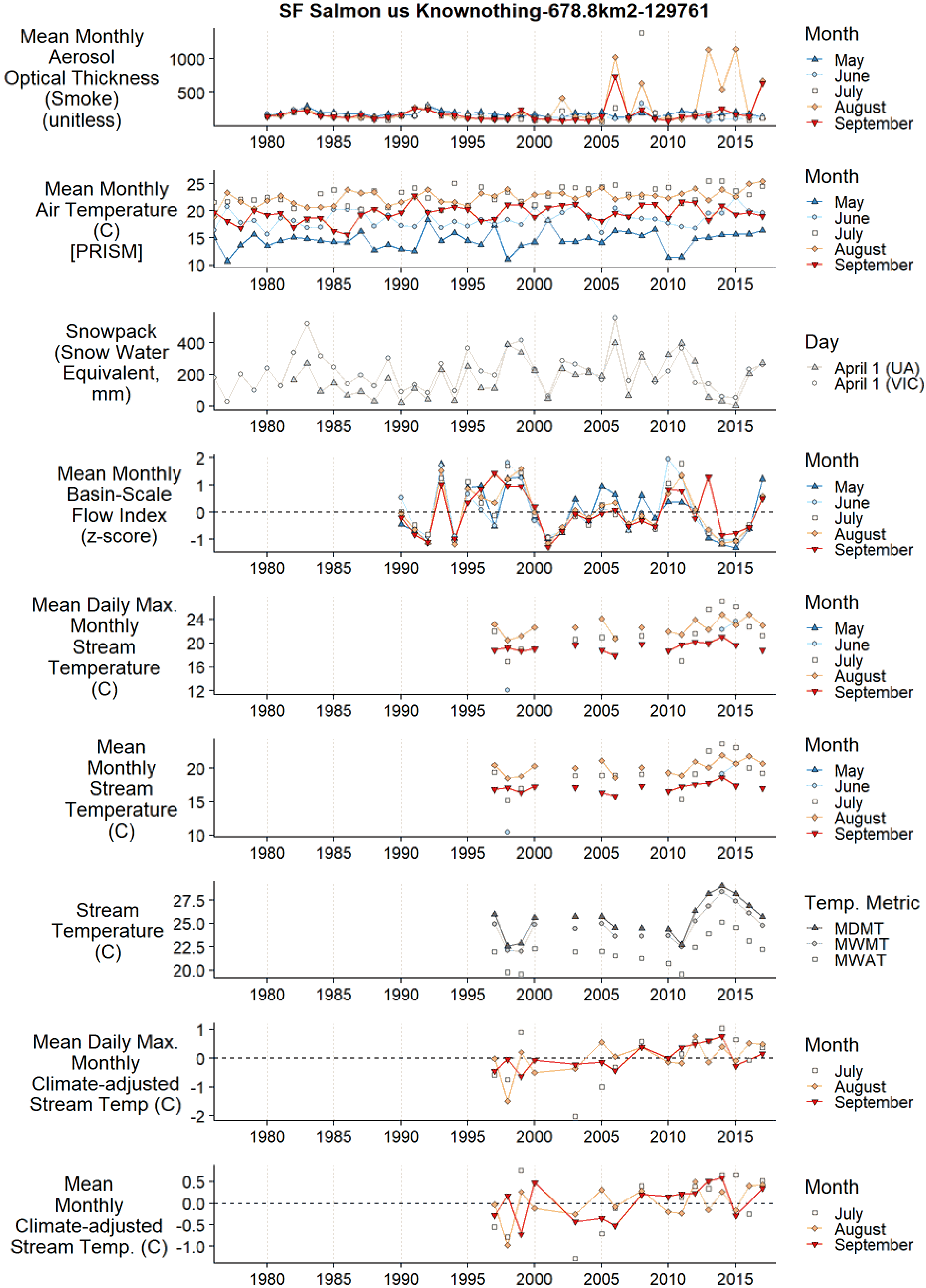
SF Salmon us Knownothing-678.8km2-129761
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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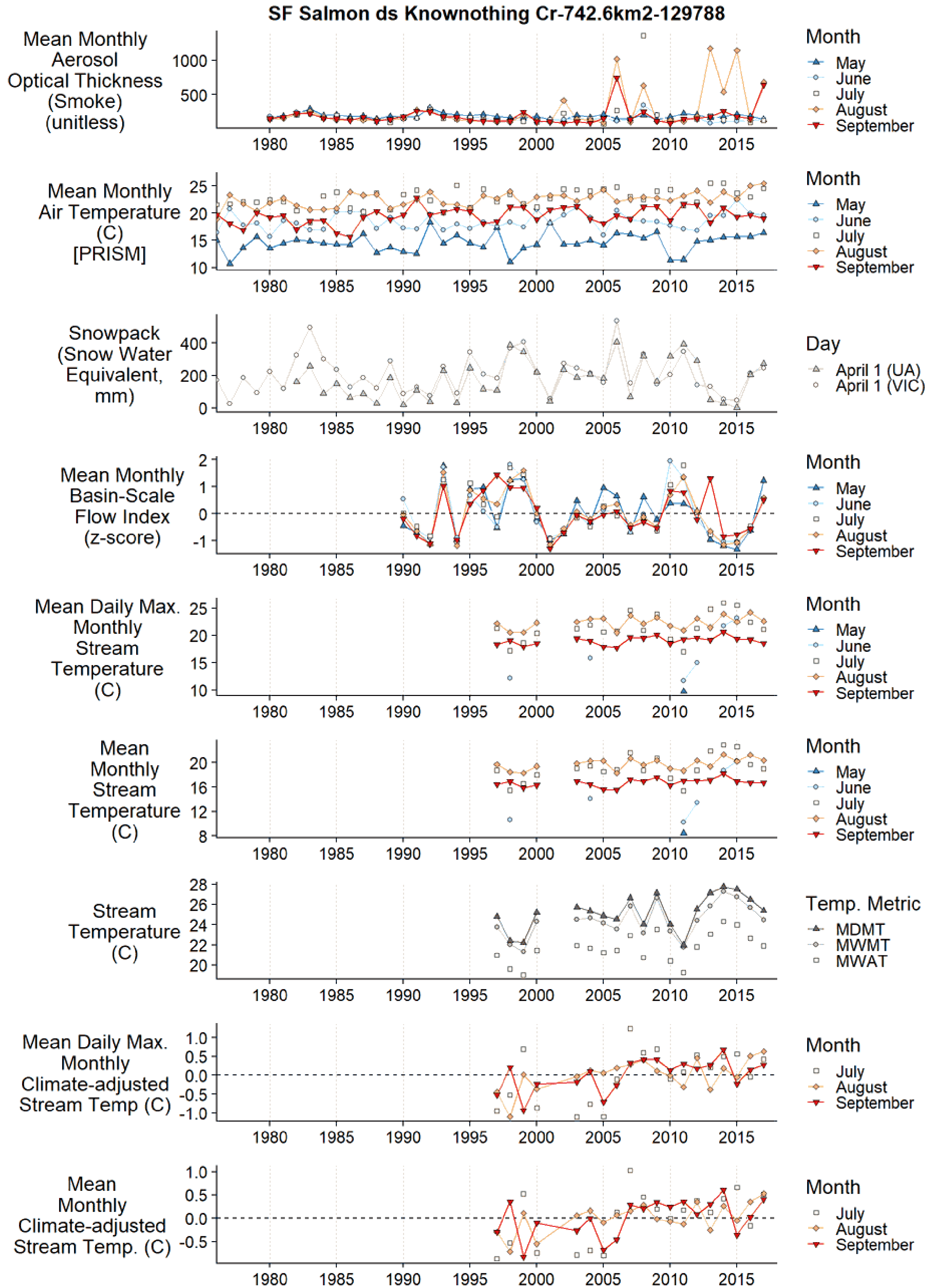
SF Salmon ds Knownothing Cr-742.6km2-129788
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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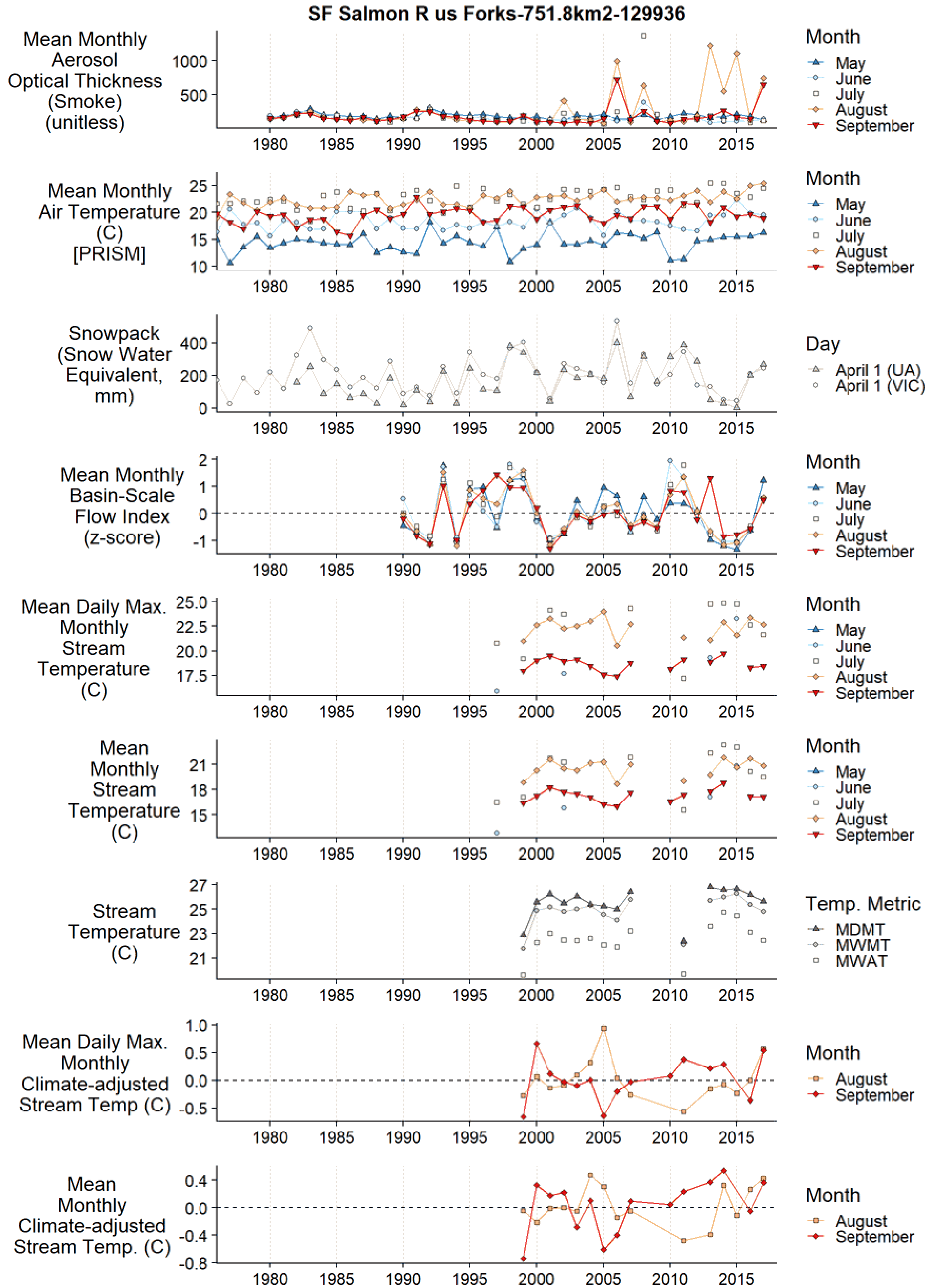

SF Salmon R us Forks-751.8km2-129936
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
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Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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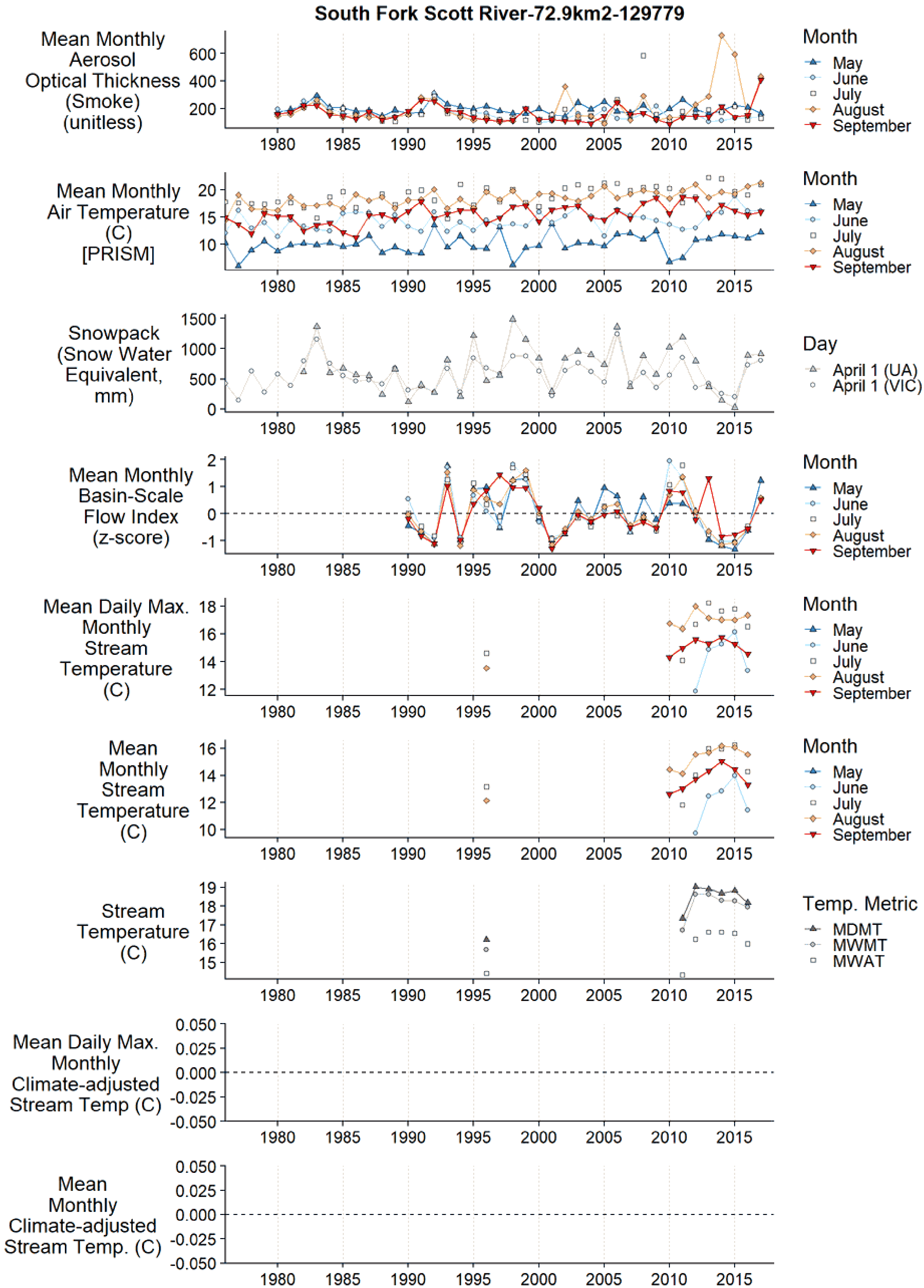
South Fork Scott River-72.9km2-129779
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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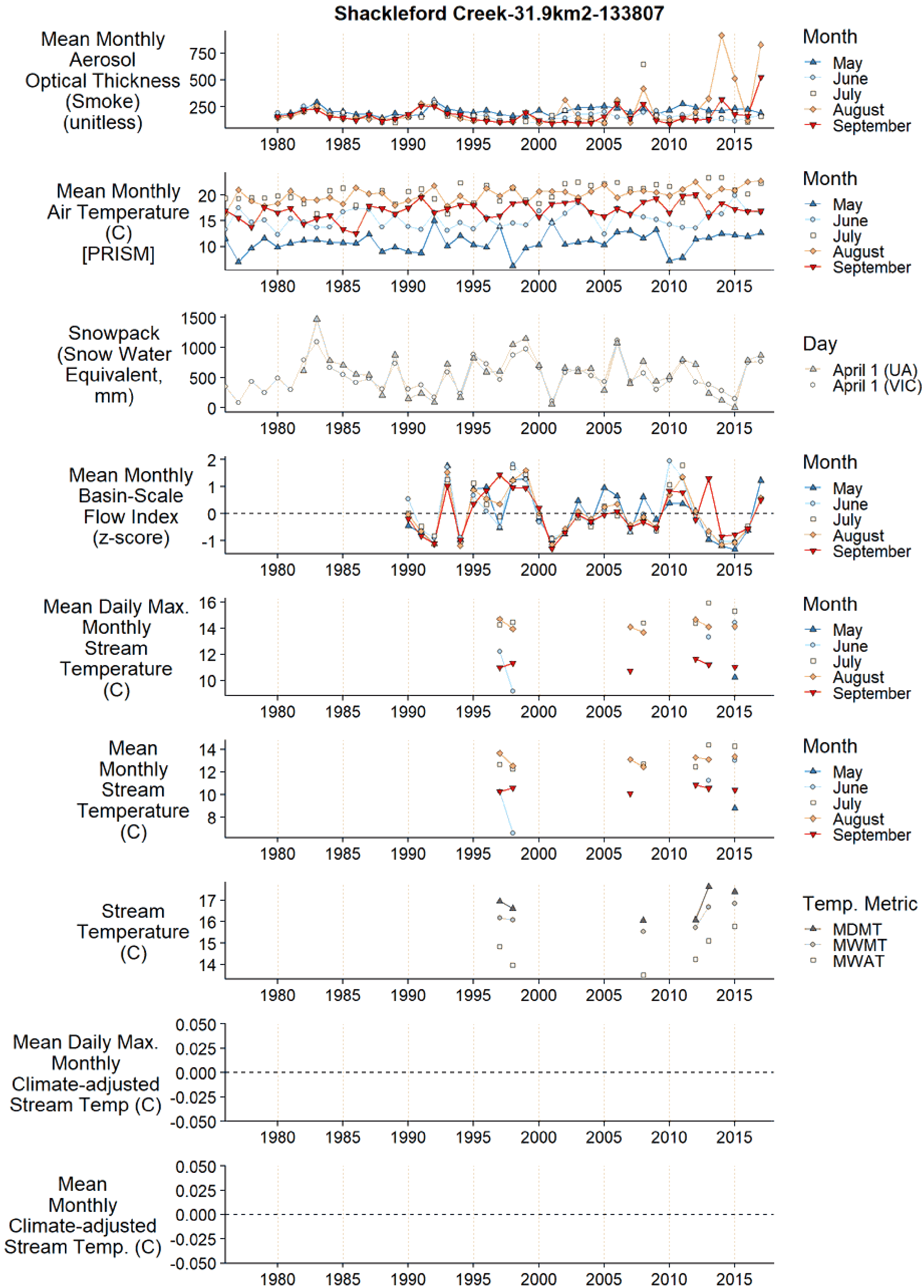

Shackleford Creek-31.9km2-133807
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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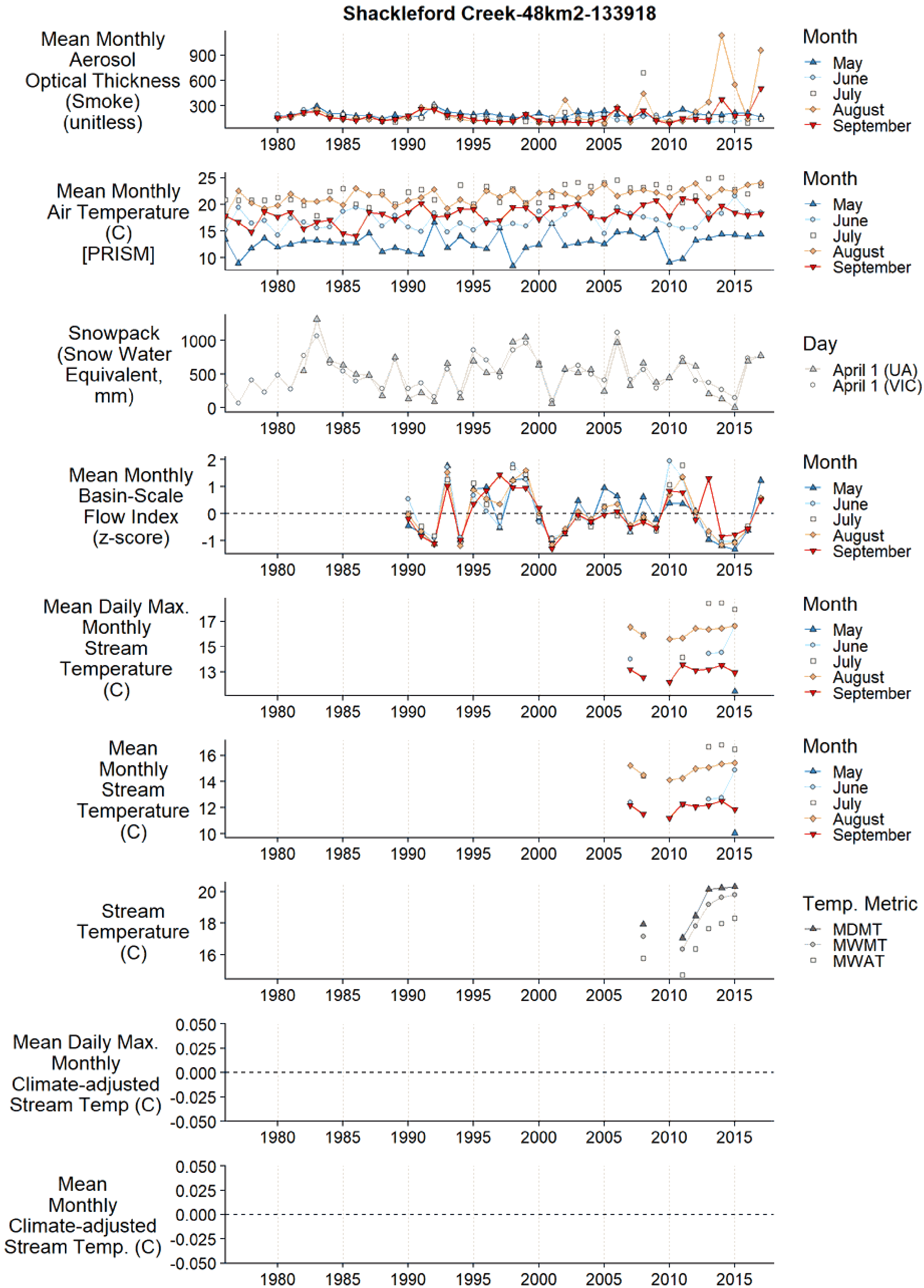
Shackleford Creek-48km2-133918
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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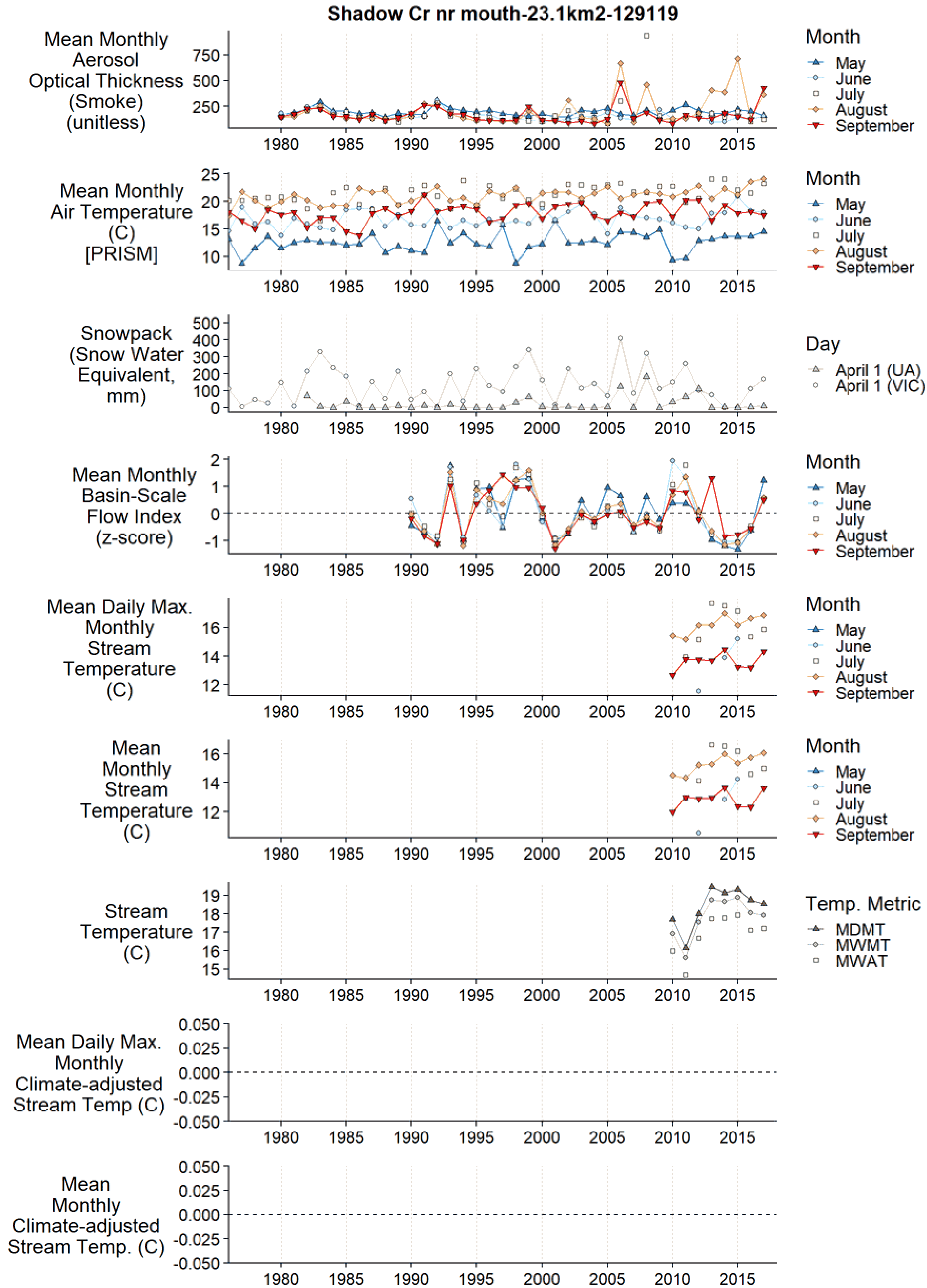

Shadow Cr nr mouth-23.1km2-129119
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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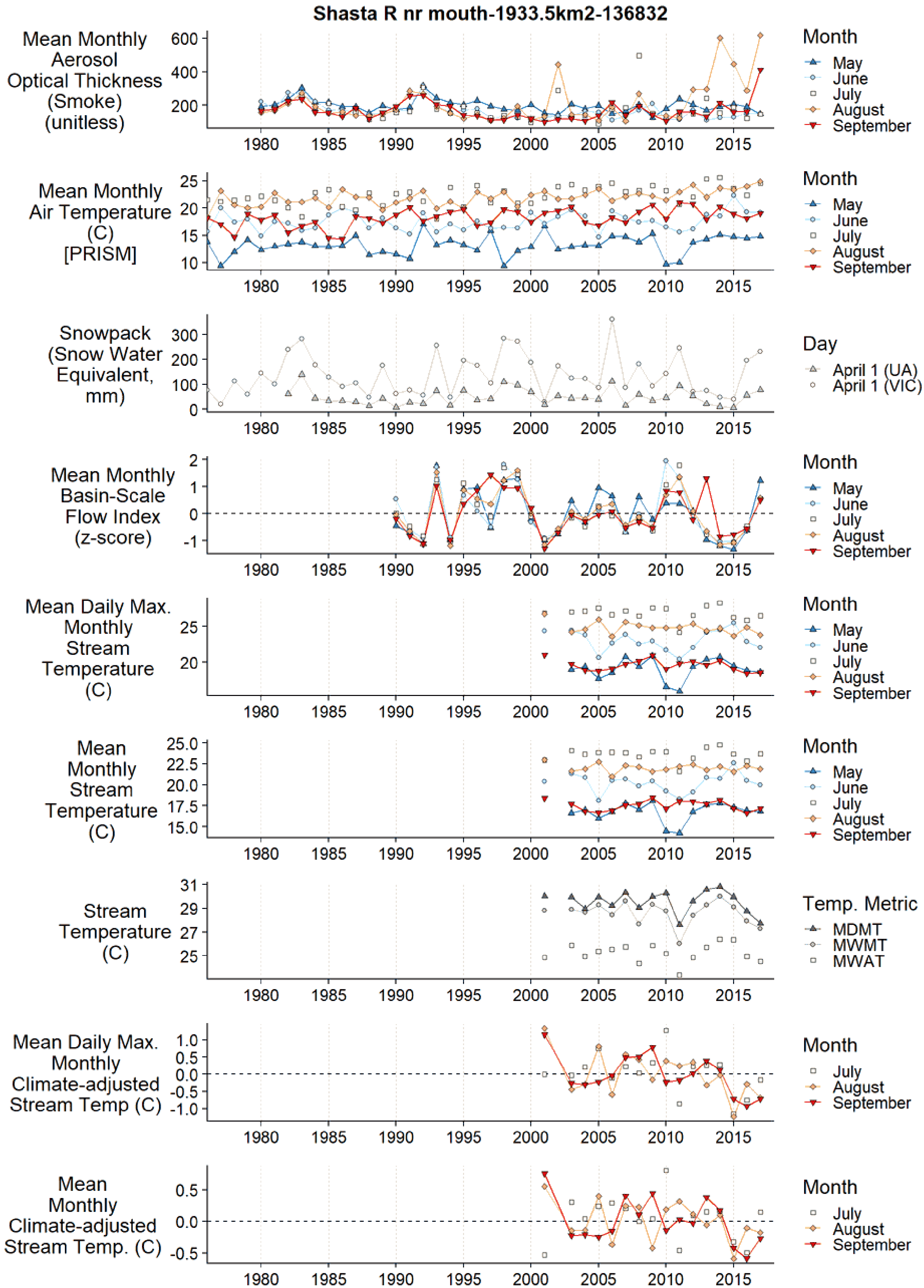
Shasta R nr mouth-1933.5km2-136832
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
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April 1 (UA)
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Temp. Metric
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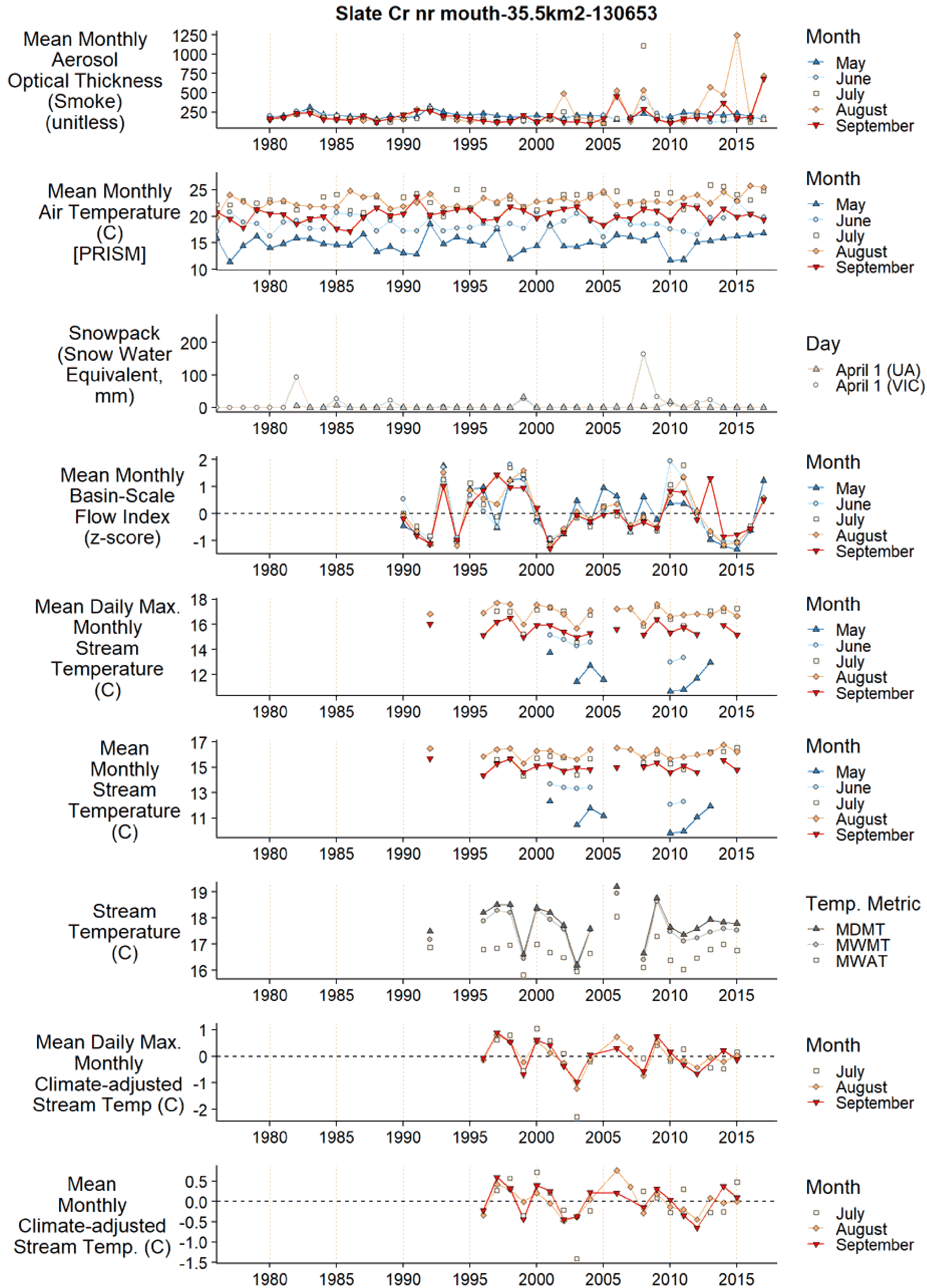

Slate Cr nr mouth-35.5km2-130653
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (VIC)
Temp. Metric
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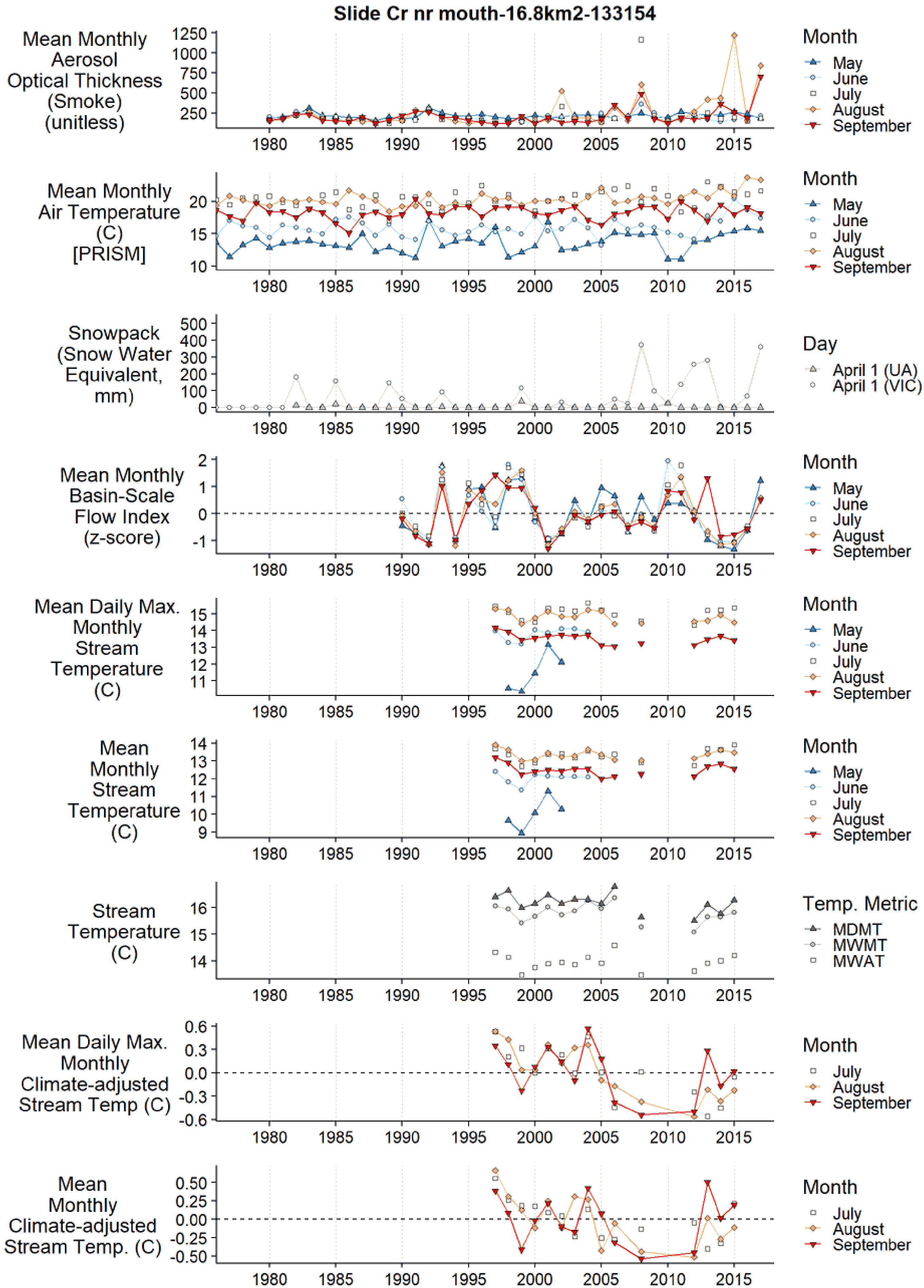

Slide Cr nr mouth-16.8km2-133154
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Month
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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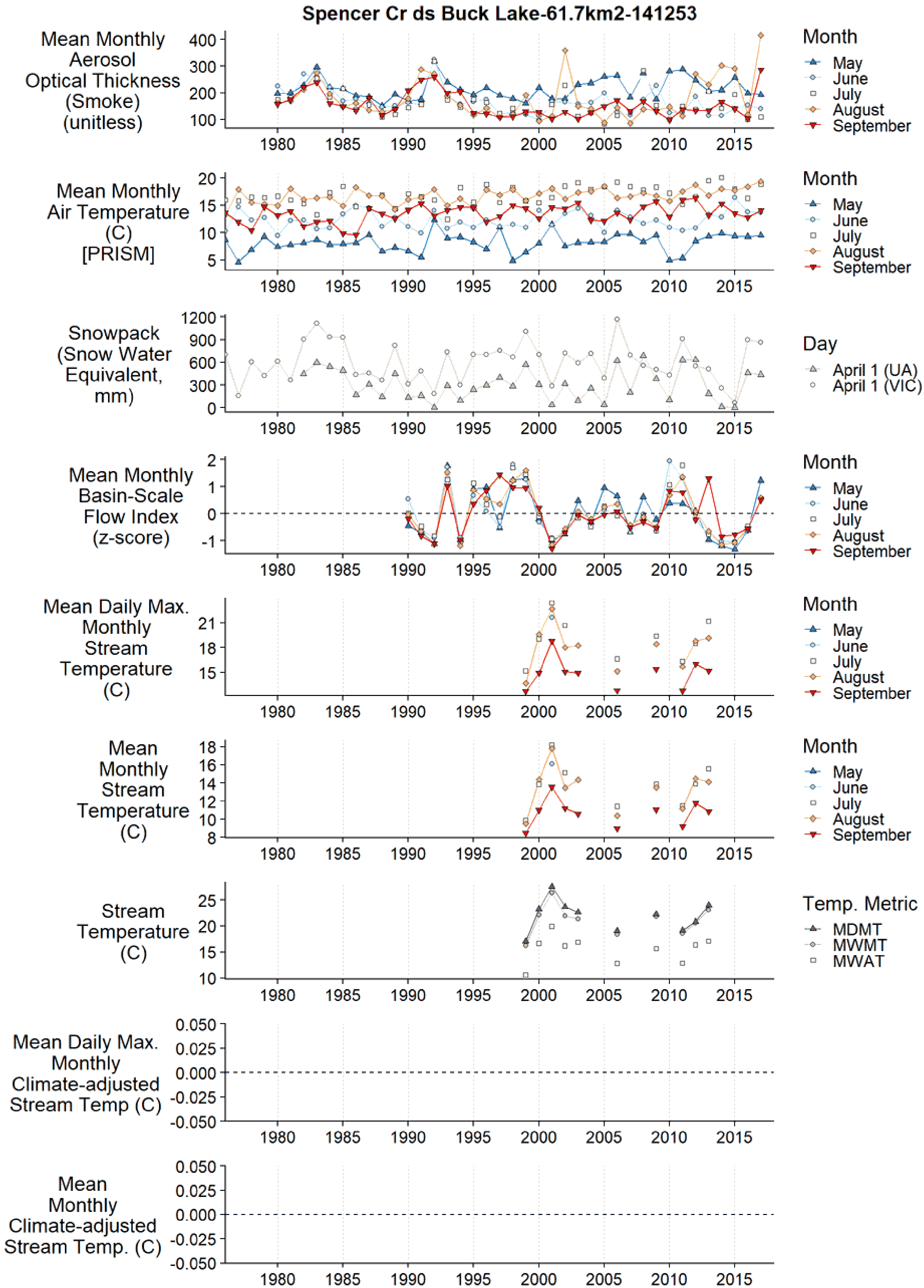
Spencer Cr ds Buck Lake-61.7km2-141253
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (UA)
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Temp. Metric
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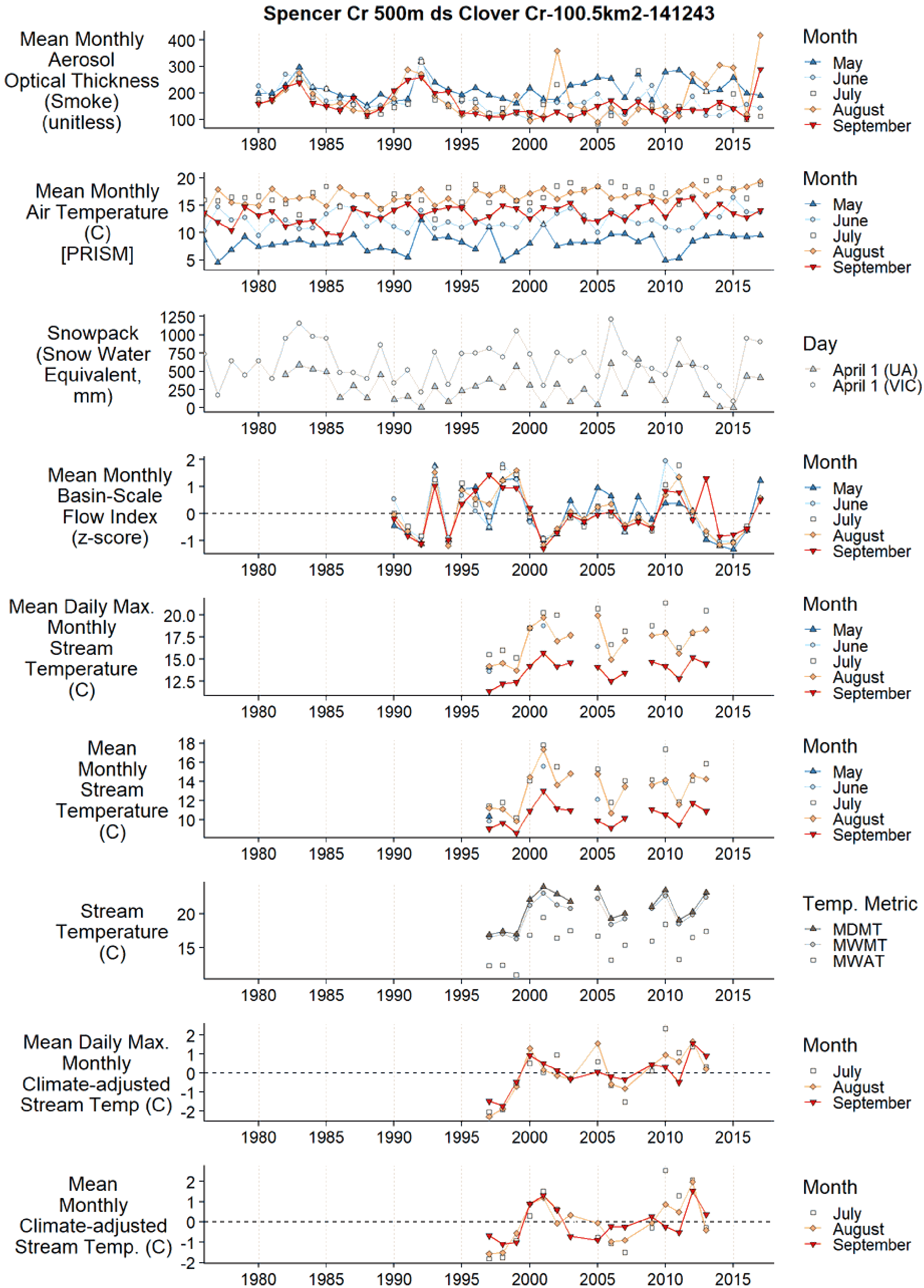
Spencer Cr 500m ds Clover Cr-100.5km2-141243
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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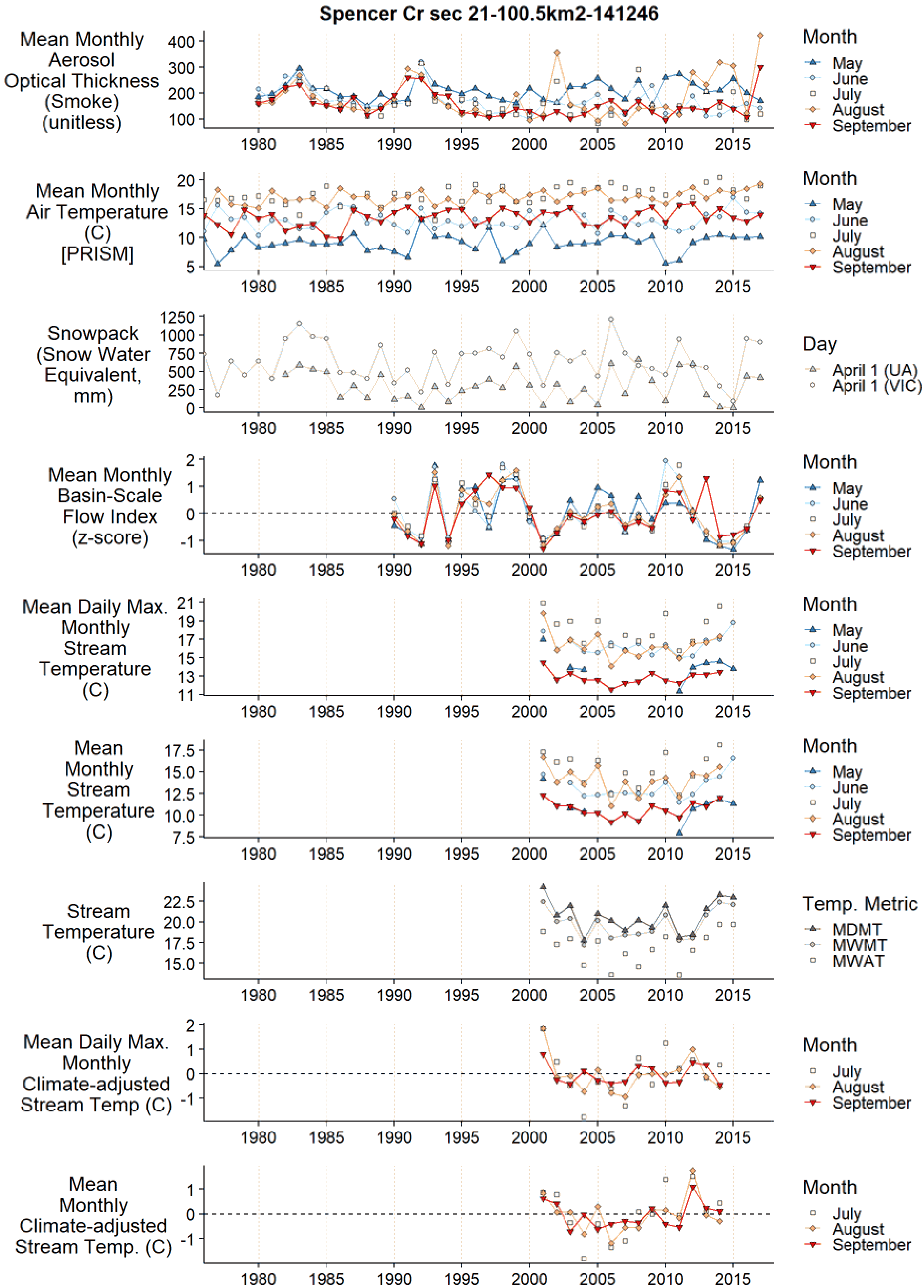
Spencer Cr sec 21-100.5km2-141246
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
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Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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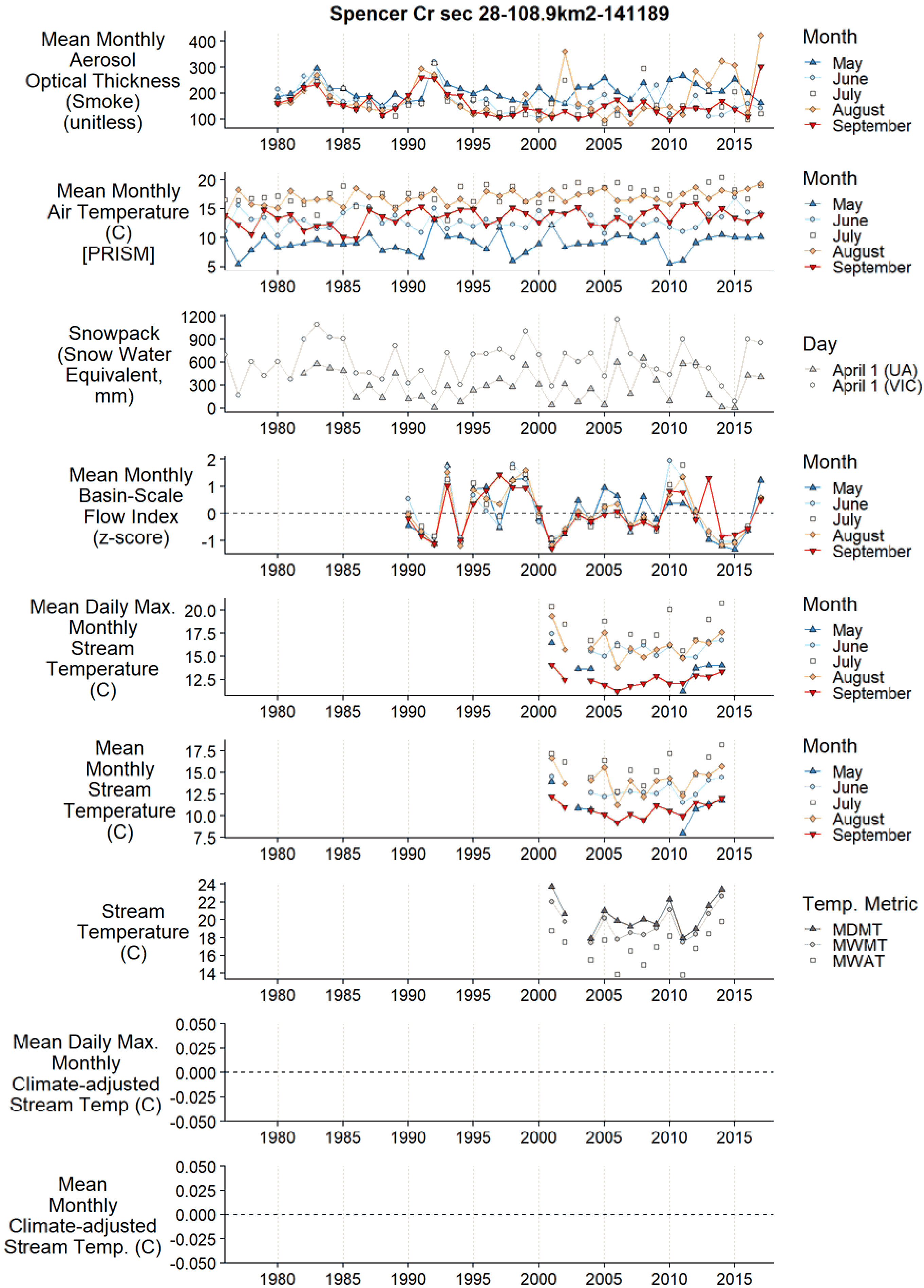
MWAT
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)


Spencer Cr sec 28-108.9km2-141189
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (UA)
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Temp. Metric
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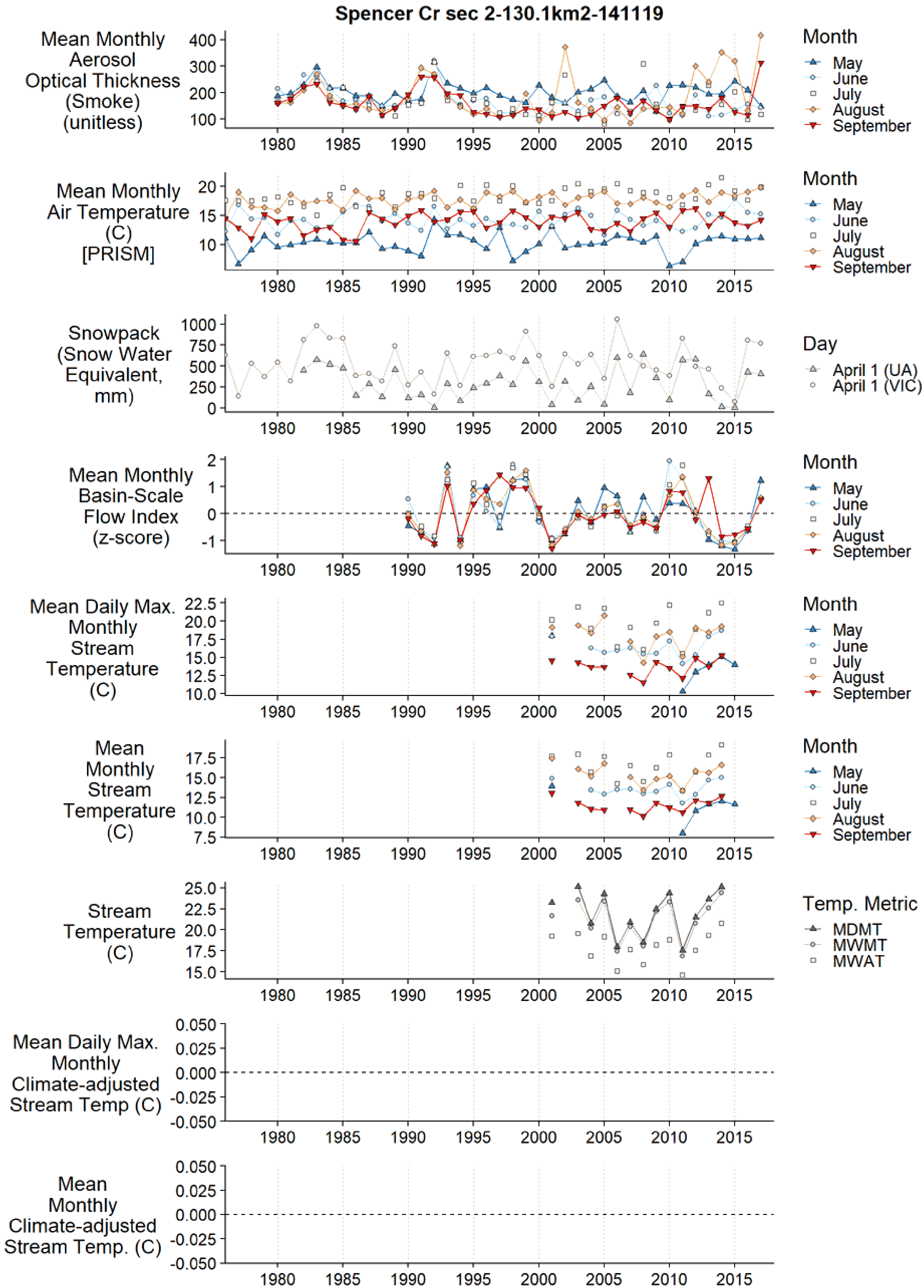

Spencer Cr sec 2-130.1km2-141119
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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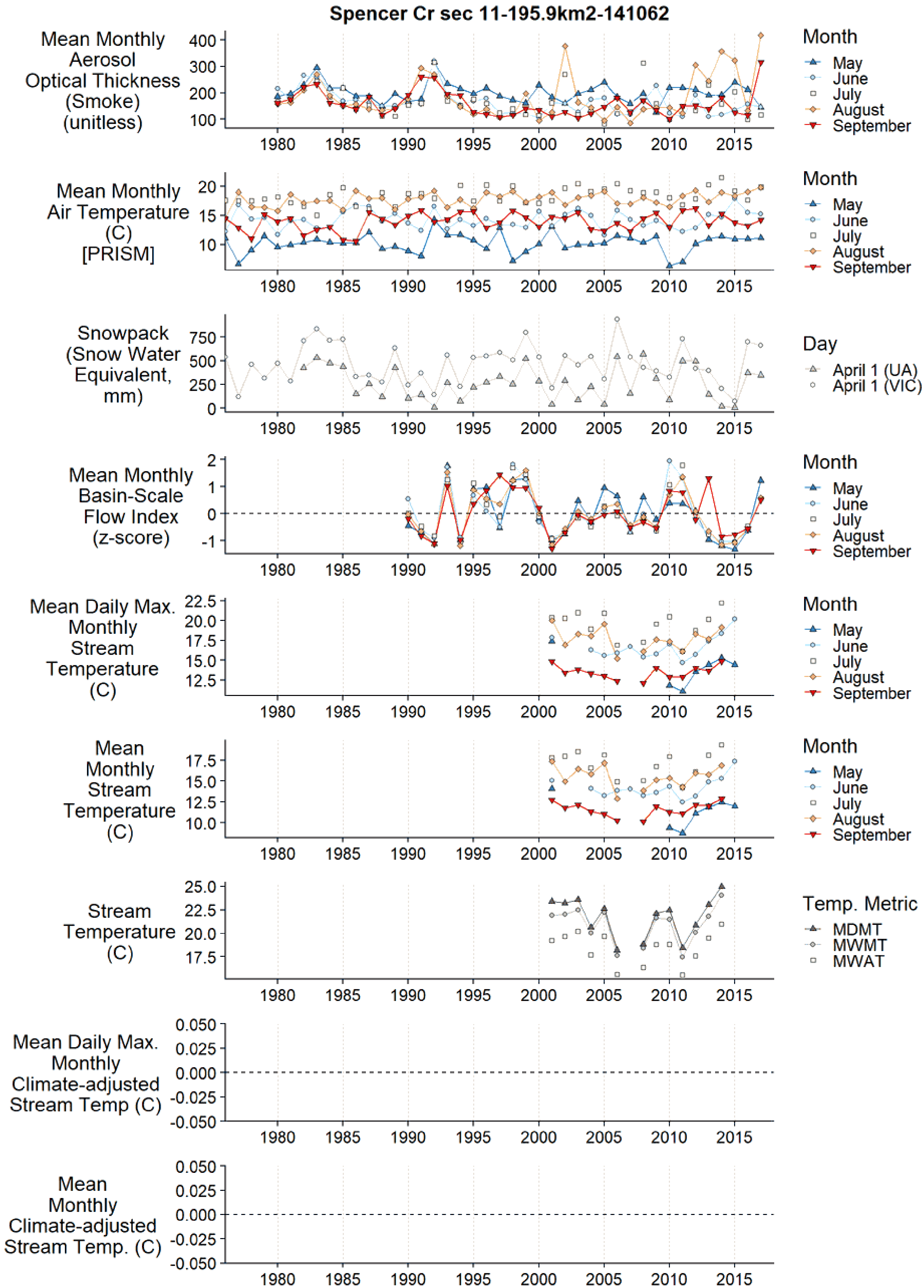

Spencer Cr sec 11-195.9km2-141062
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
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September
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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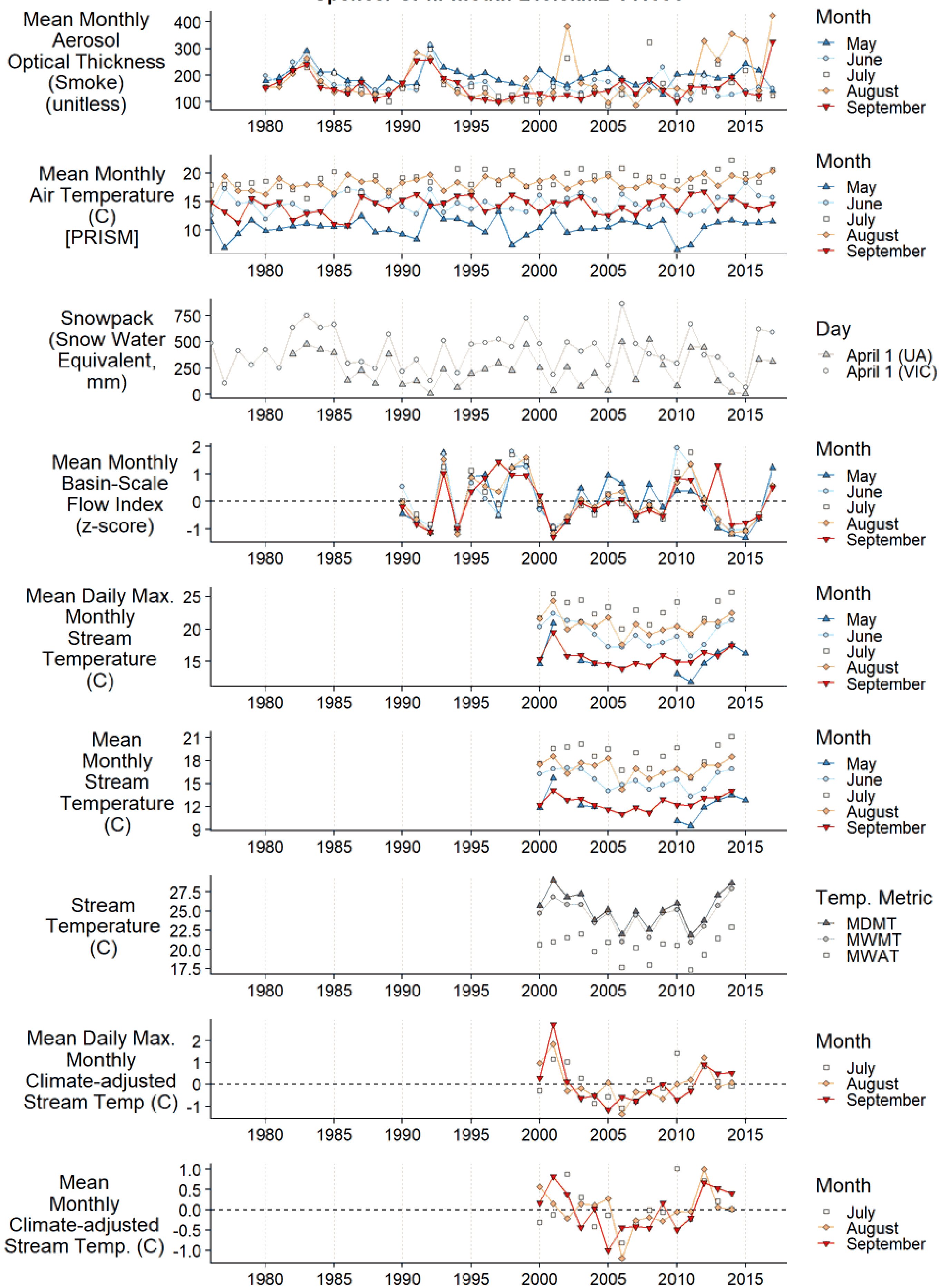
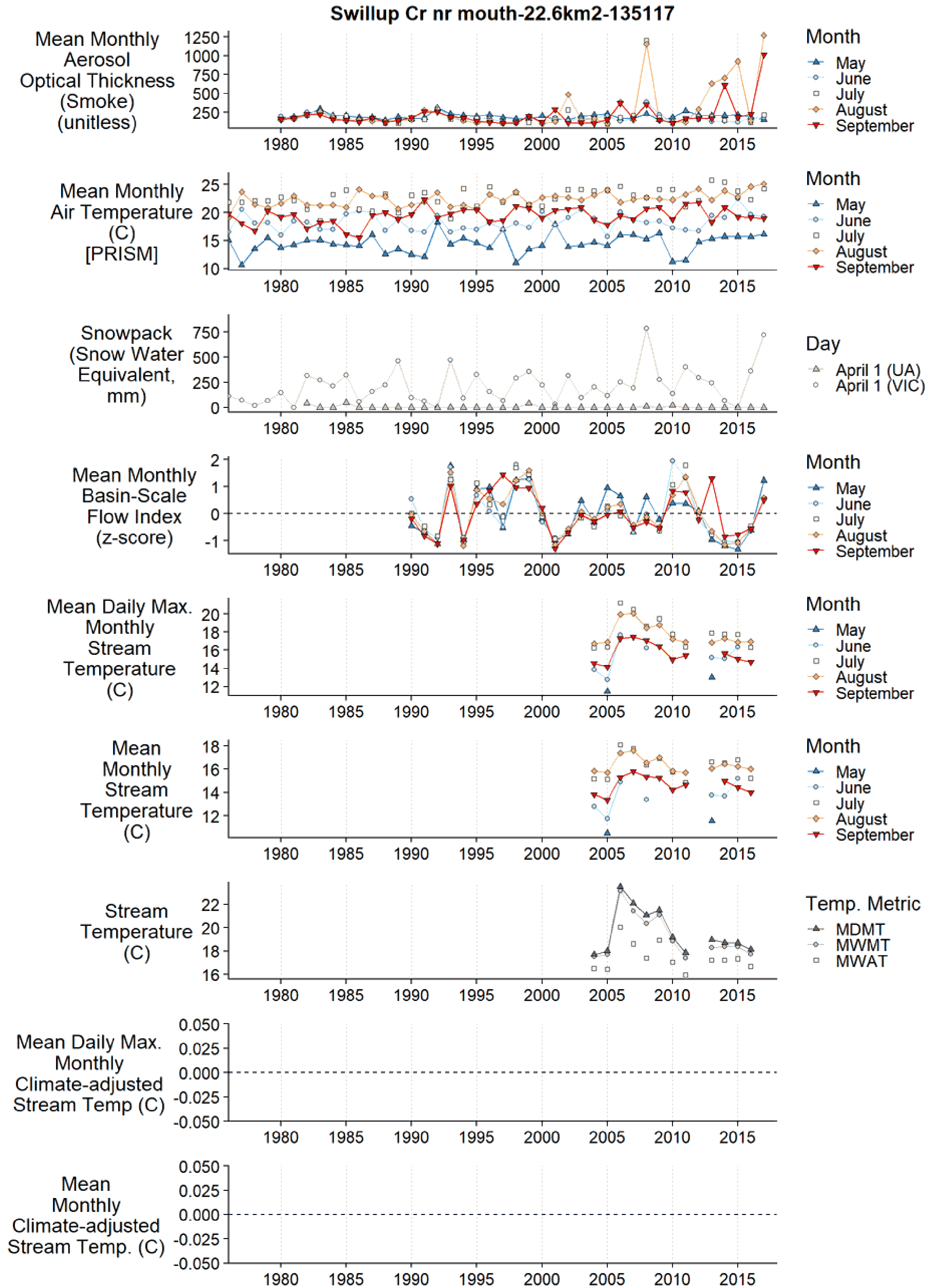
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)

Spencer Cr nr mouth-219.5km2-141006




Swillup Cr nr mouth-22.6km2-135117
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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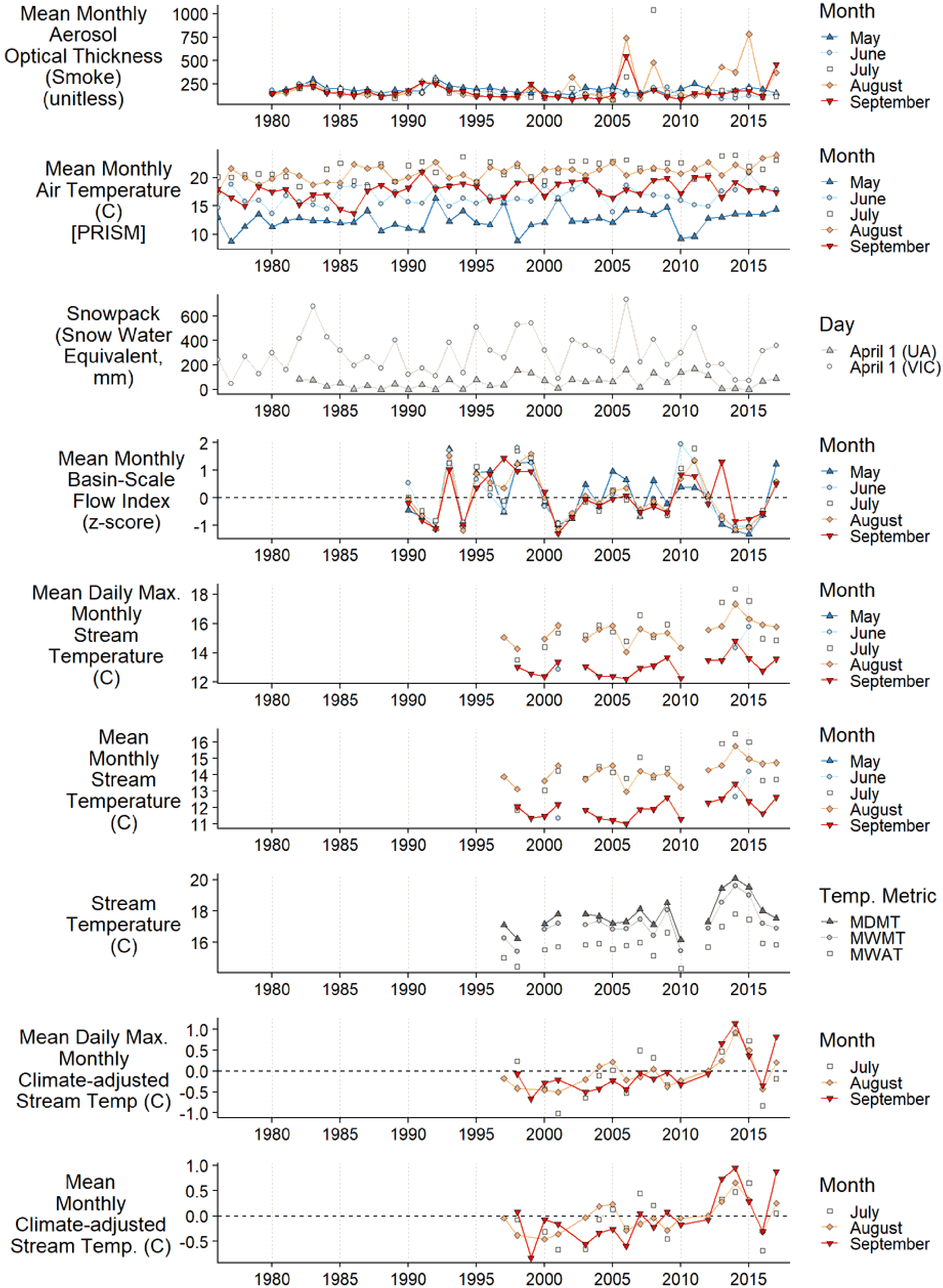
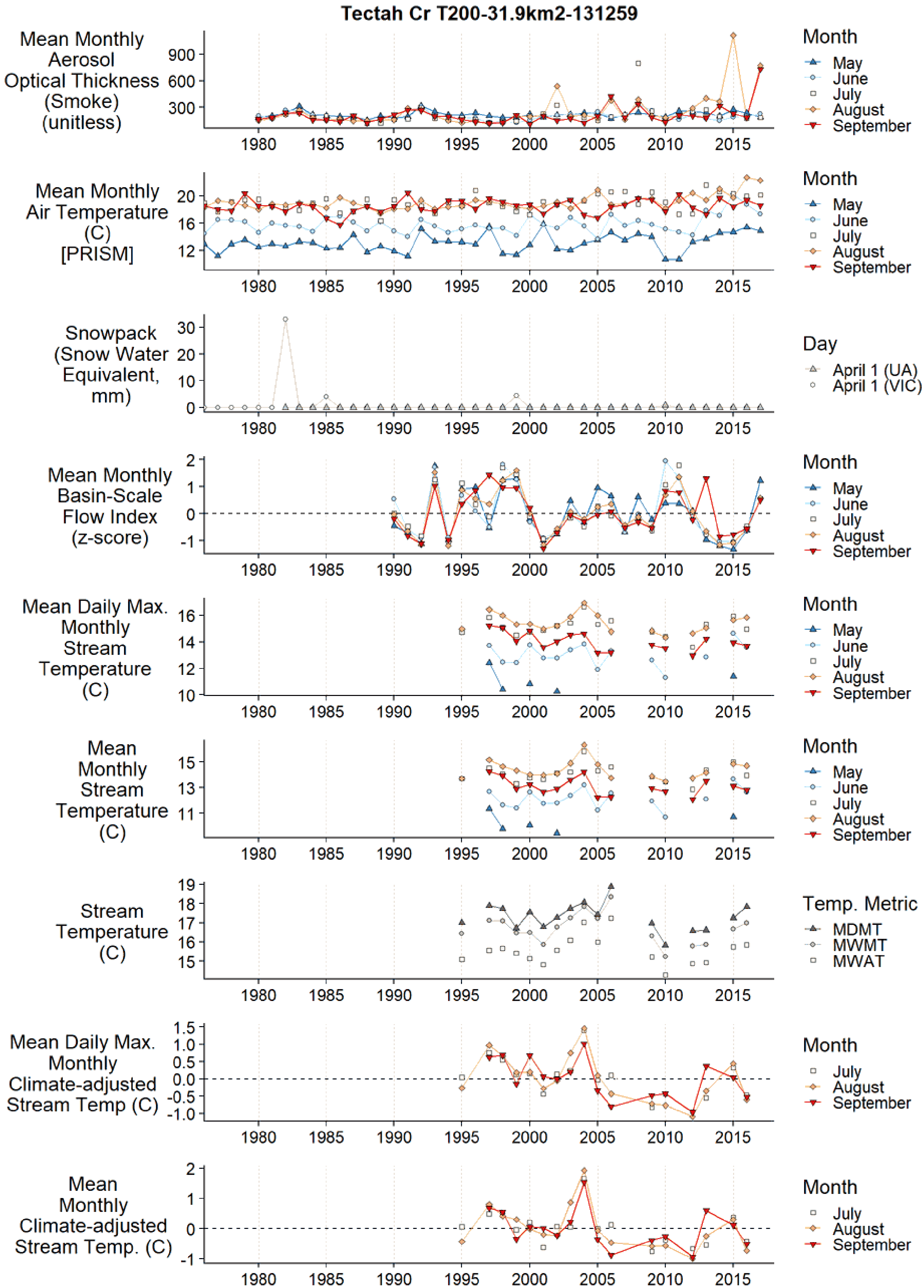
Taylor Cr nr mouth-47.5km2-128562




Tectah Cr T200-31.9km2-131259
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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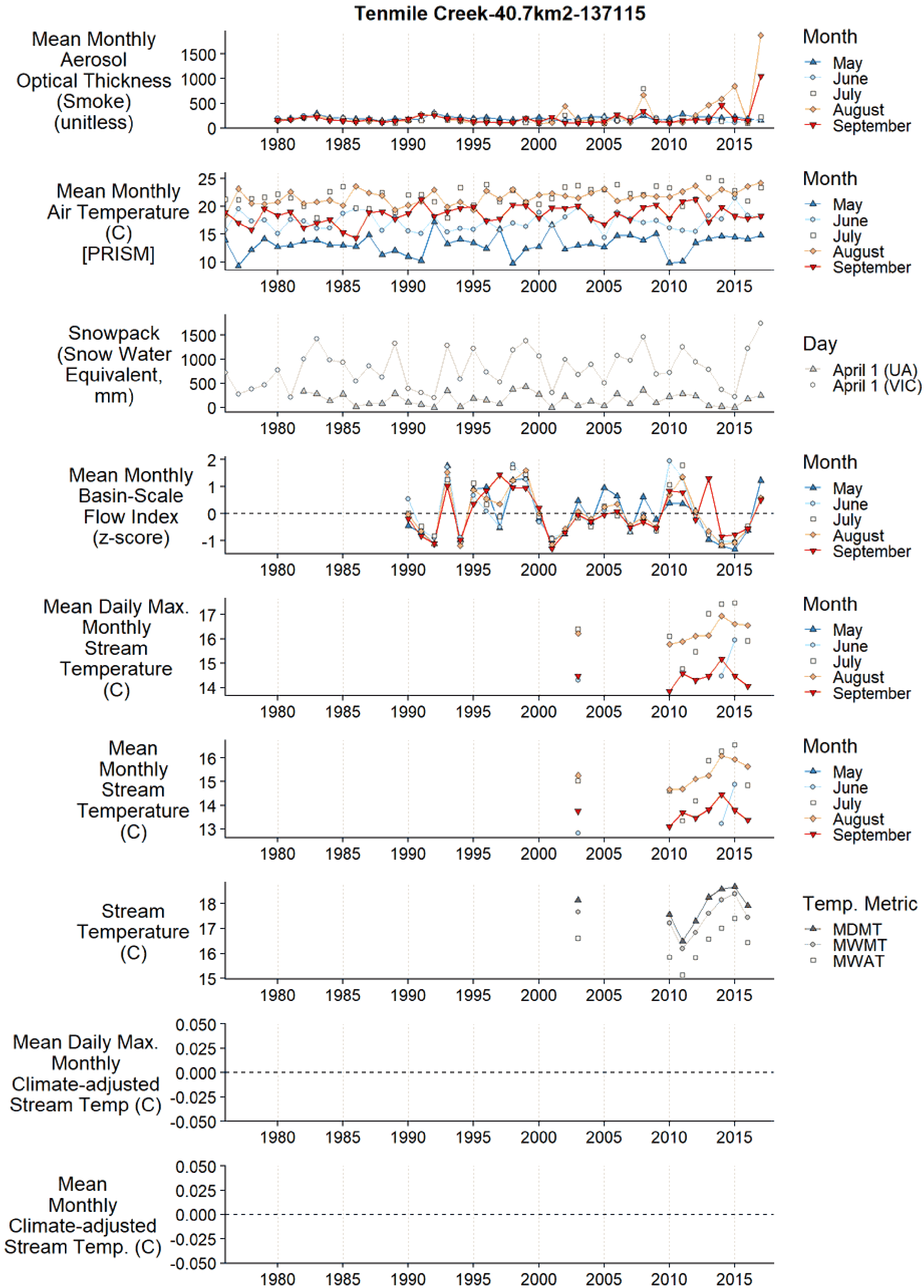
Tenmile Creek-40.7km2-137115
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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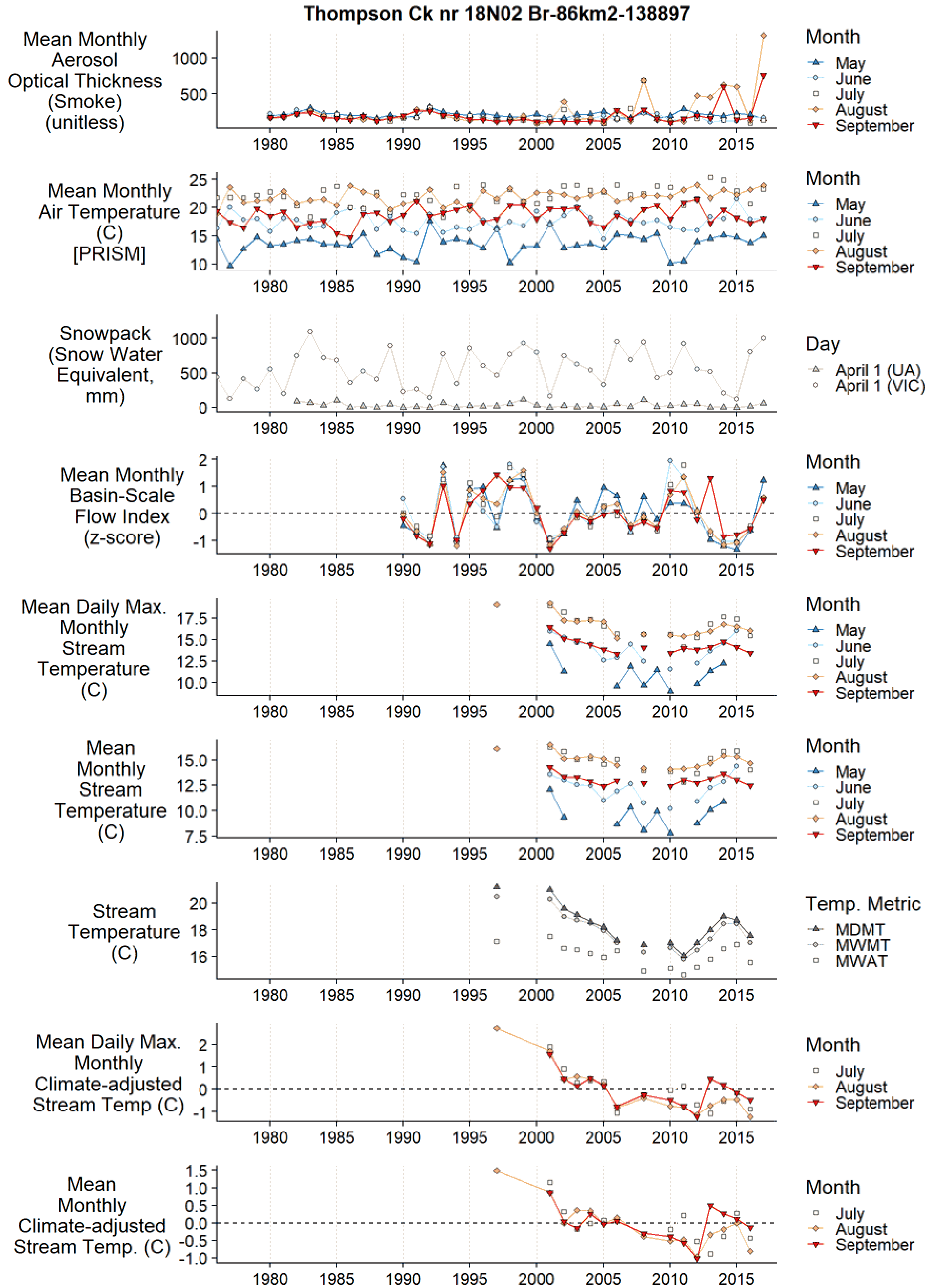
Thompson Ck nr 18N02 Br-86km2-138897
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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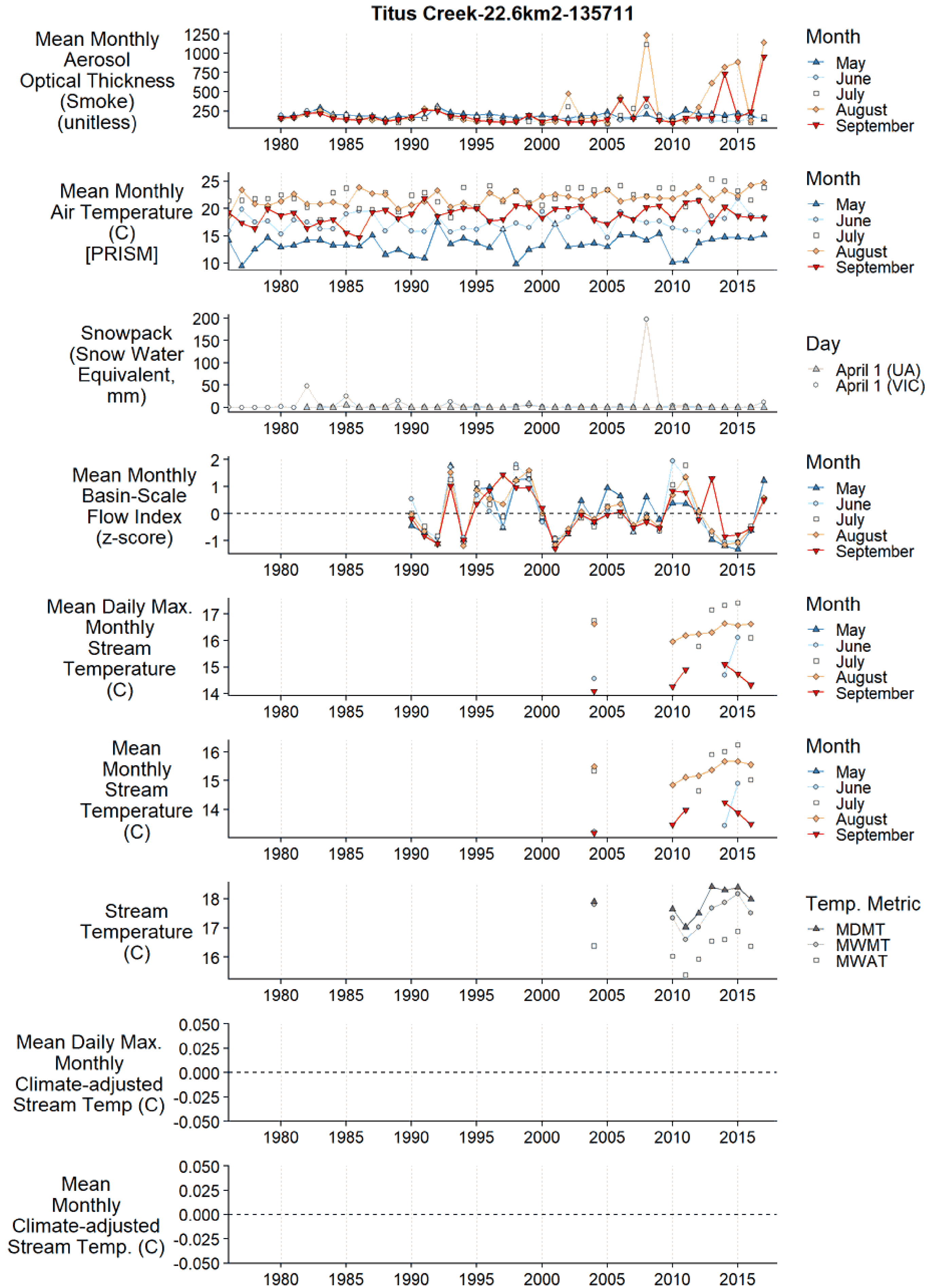
Titus Creek-22.6km2-135711
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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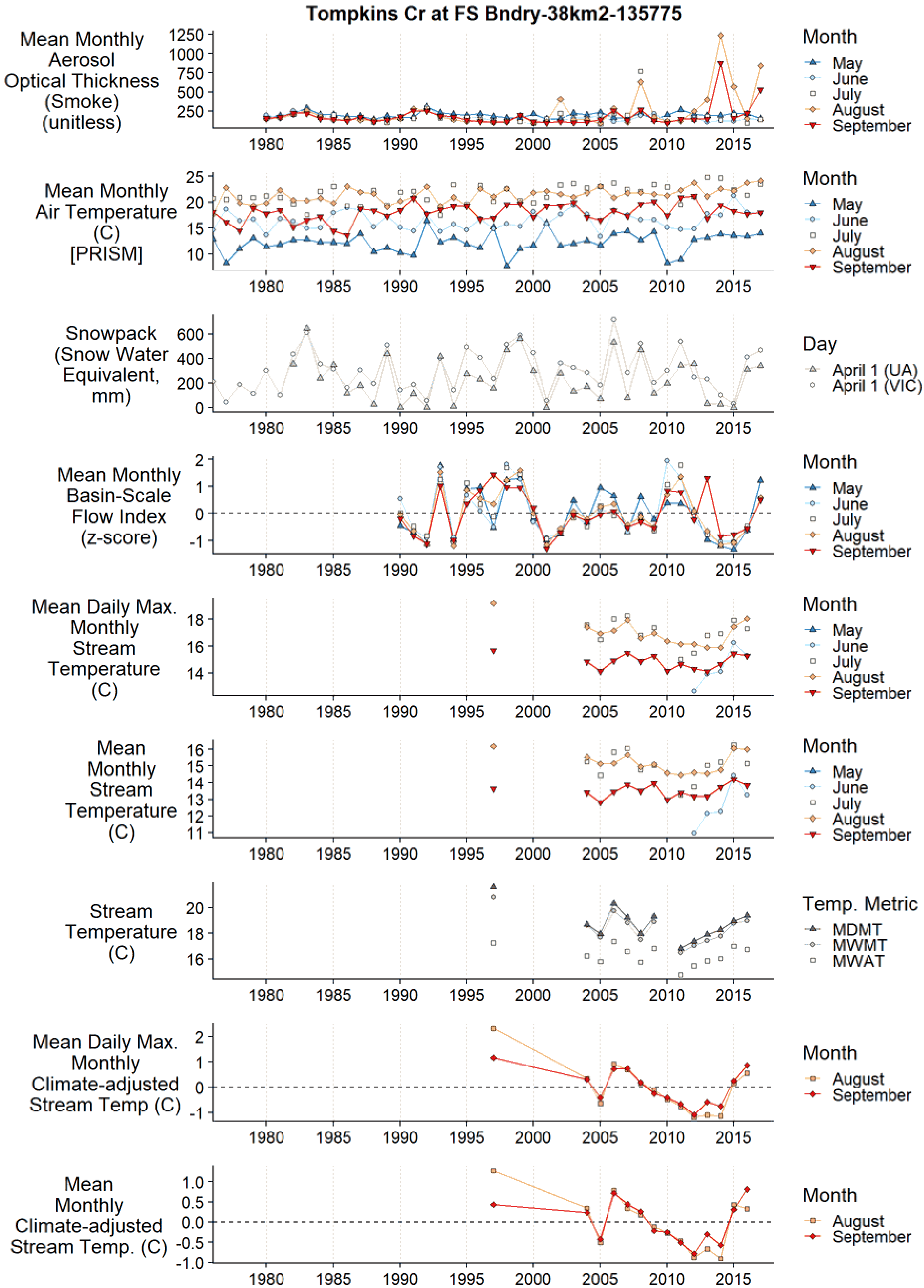
Tompkins Cr at FS Bndry-38km2-135775
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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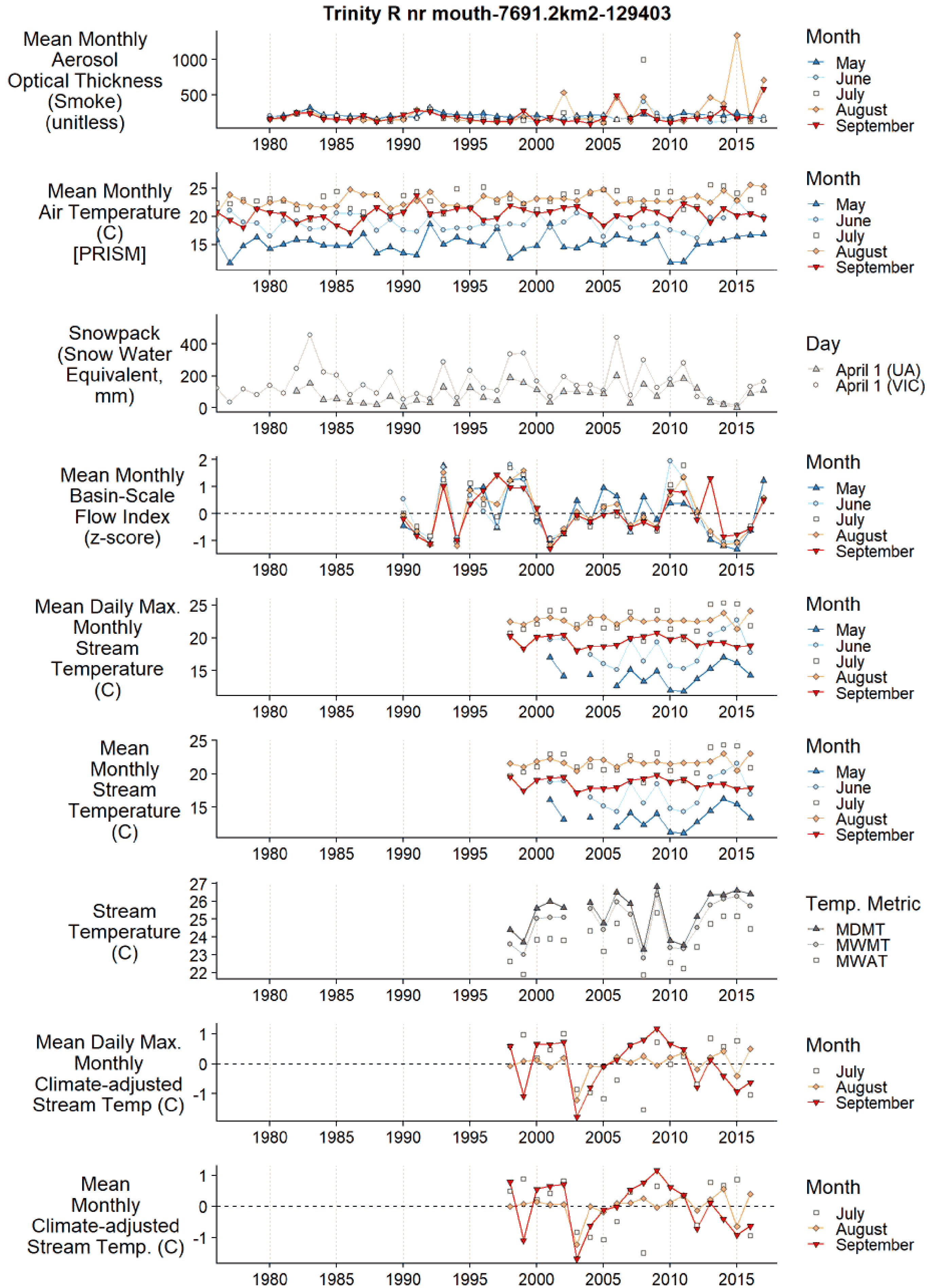
Trinity R nr mouth-7691.2km2-129403
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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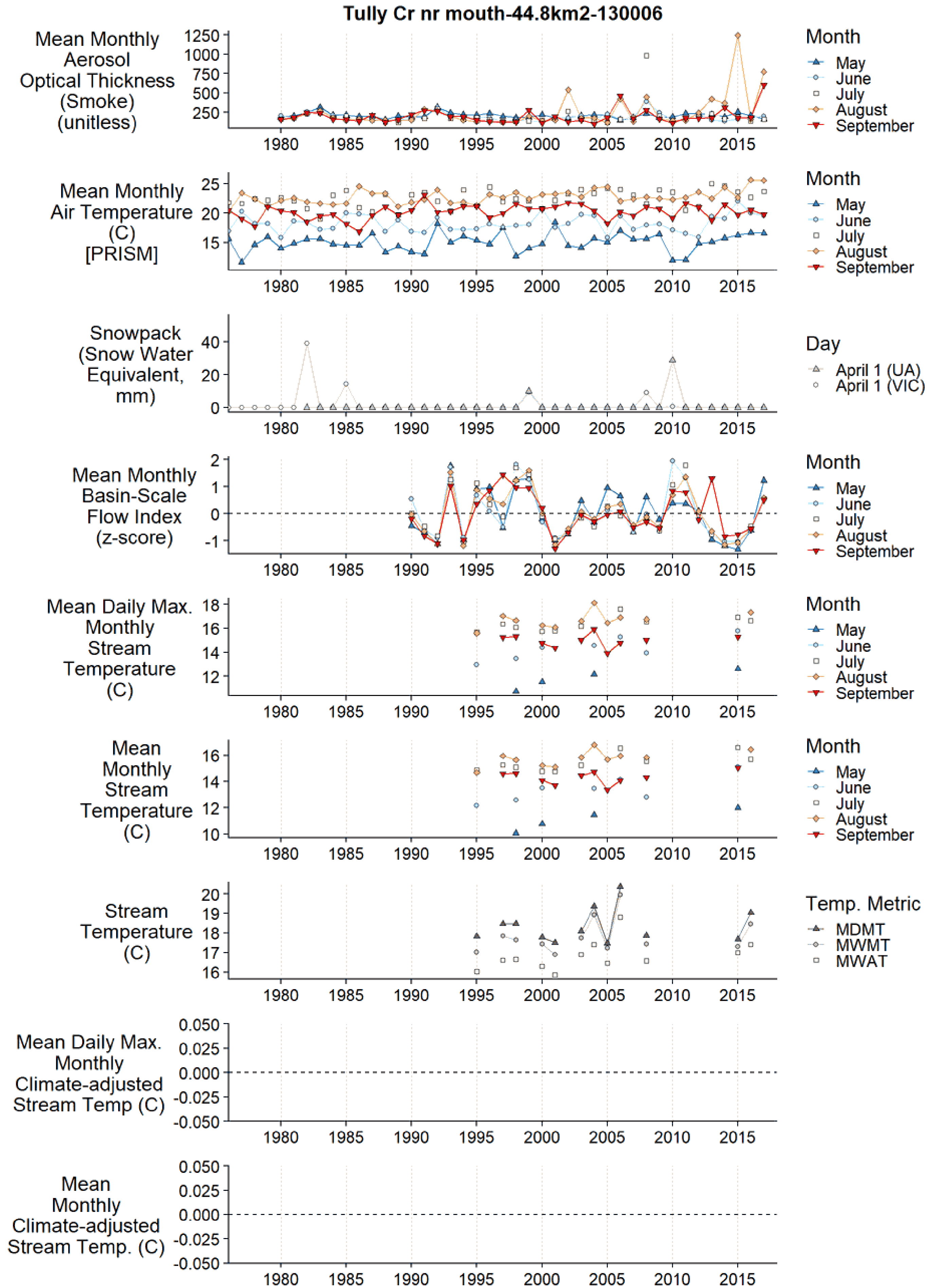
Tully Cr nr mouth-44.8km2-130006
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (VIC)
Temp. Metric
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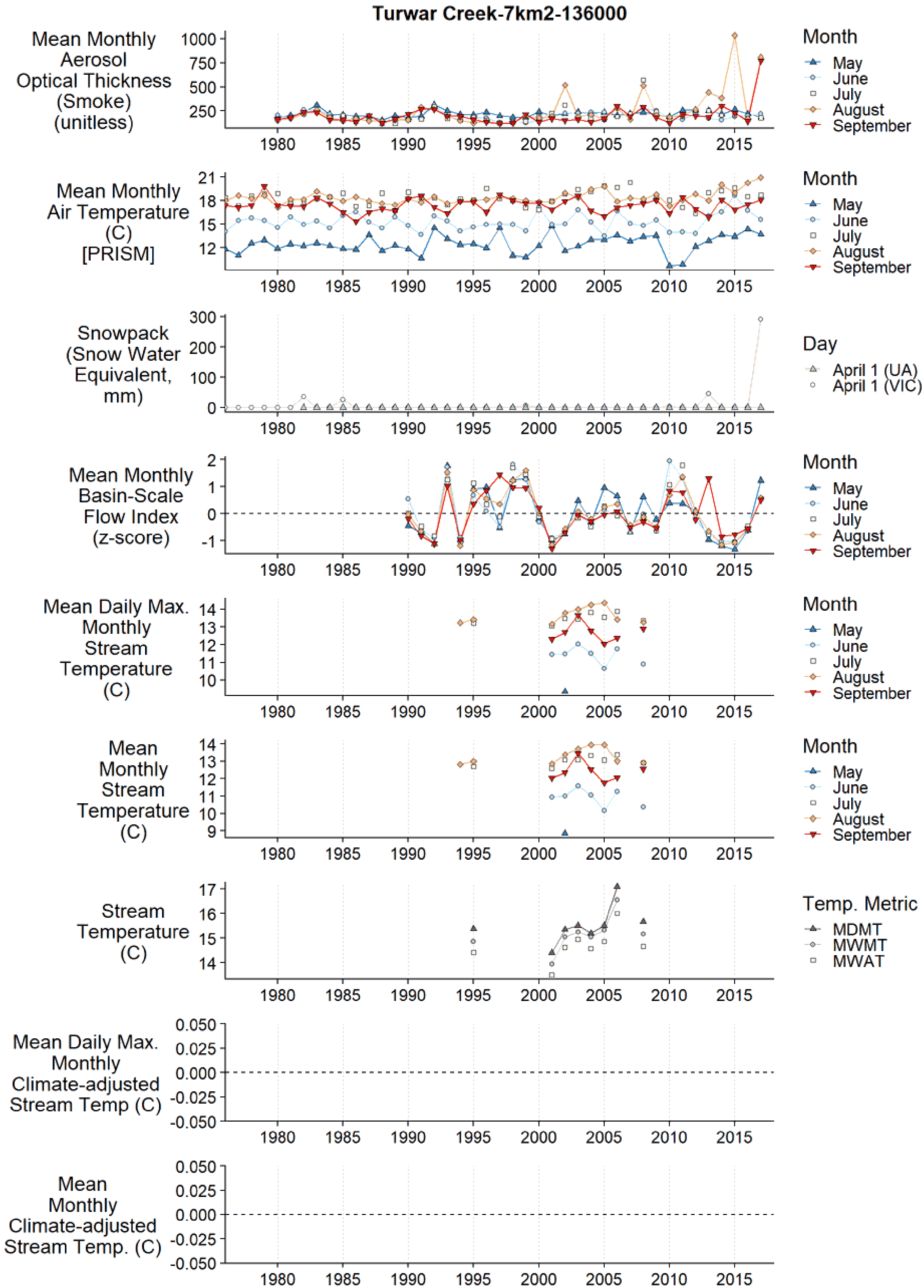
Turwar Creek-7km2-136000
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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Temp. Metric
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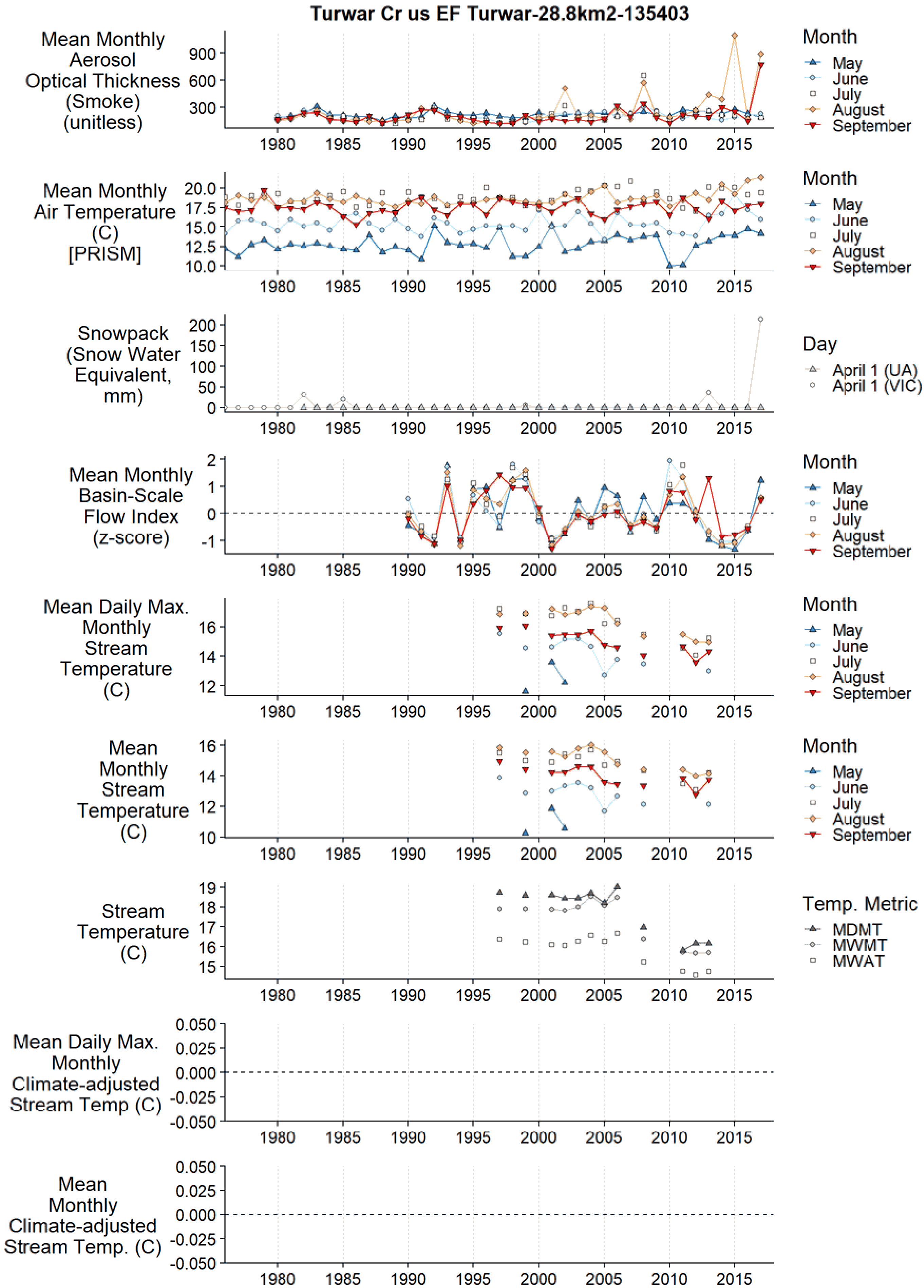

Turwar Cr us EF Turwar-28.8km2-135403
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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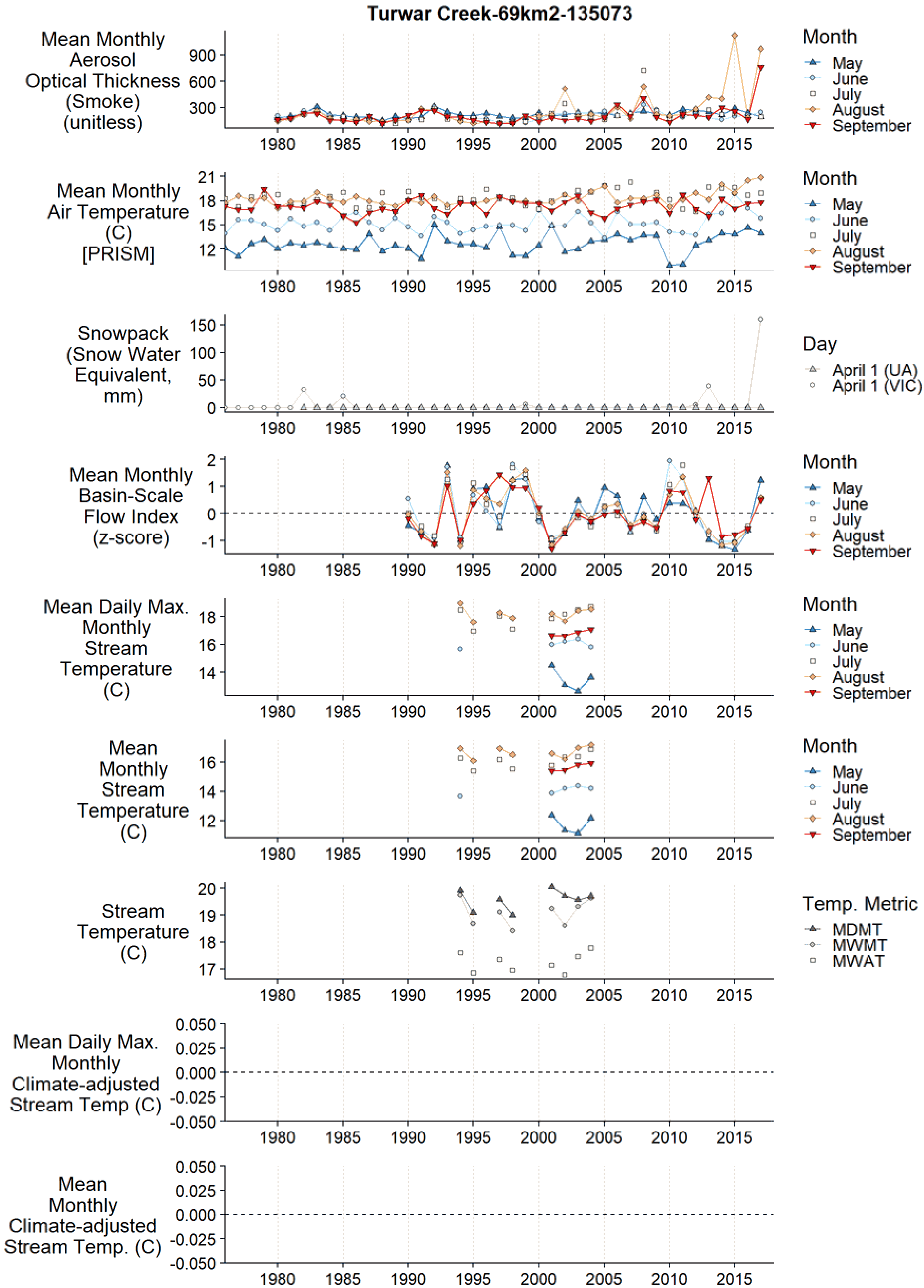

Turwar Creek-69km2-135073
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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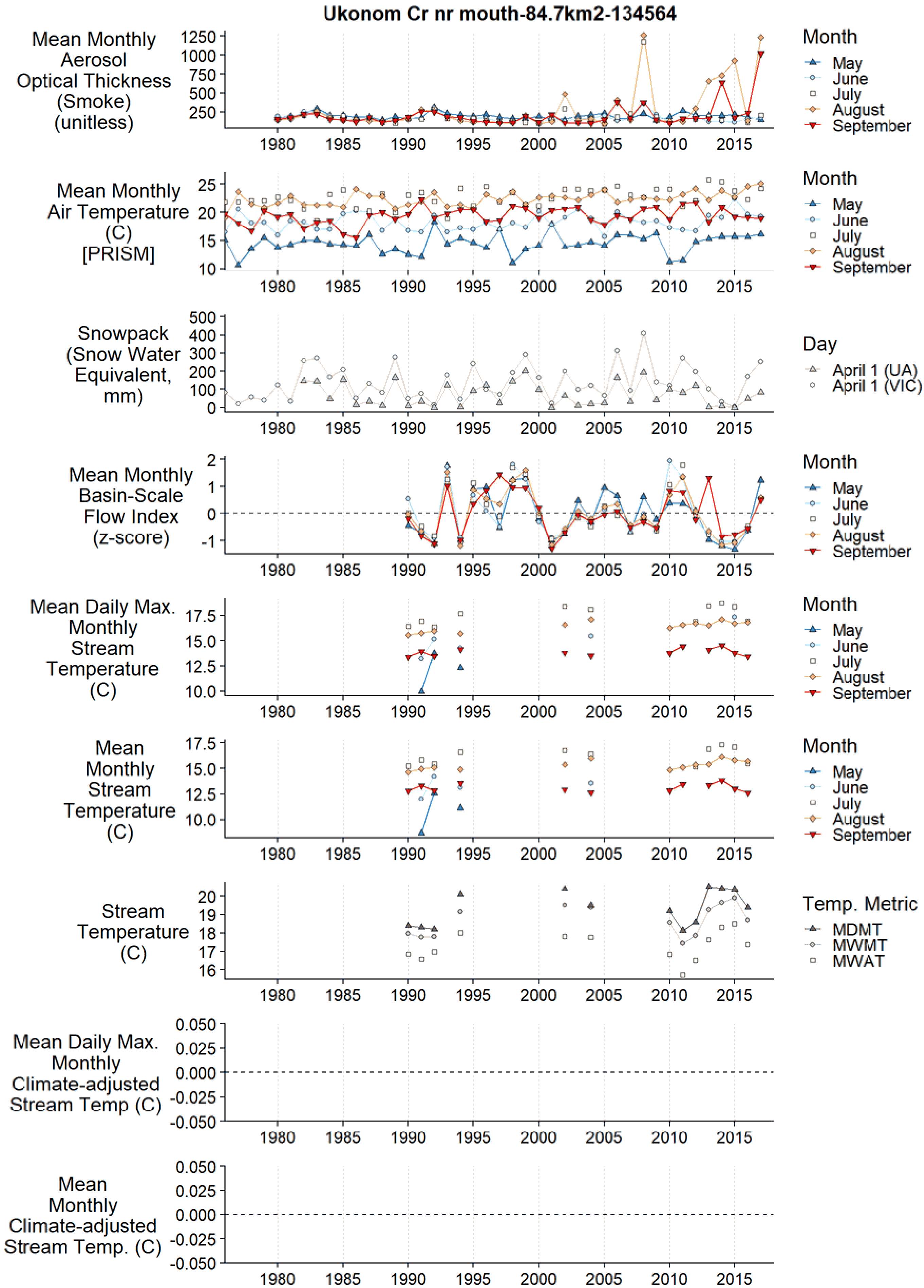
Ukonom Cr nr mouth-84.7km2-134564
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Month
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Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Day
April 1 (UA)
April 1 (VIC)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Temp. Metric
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Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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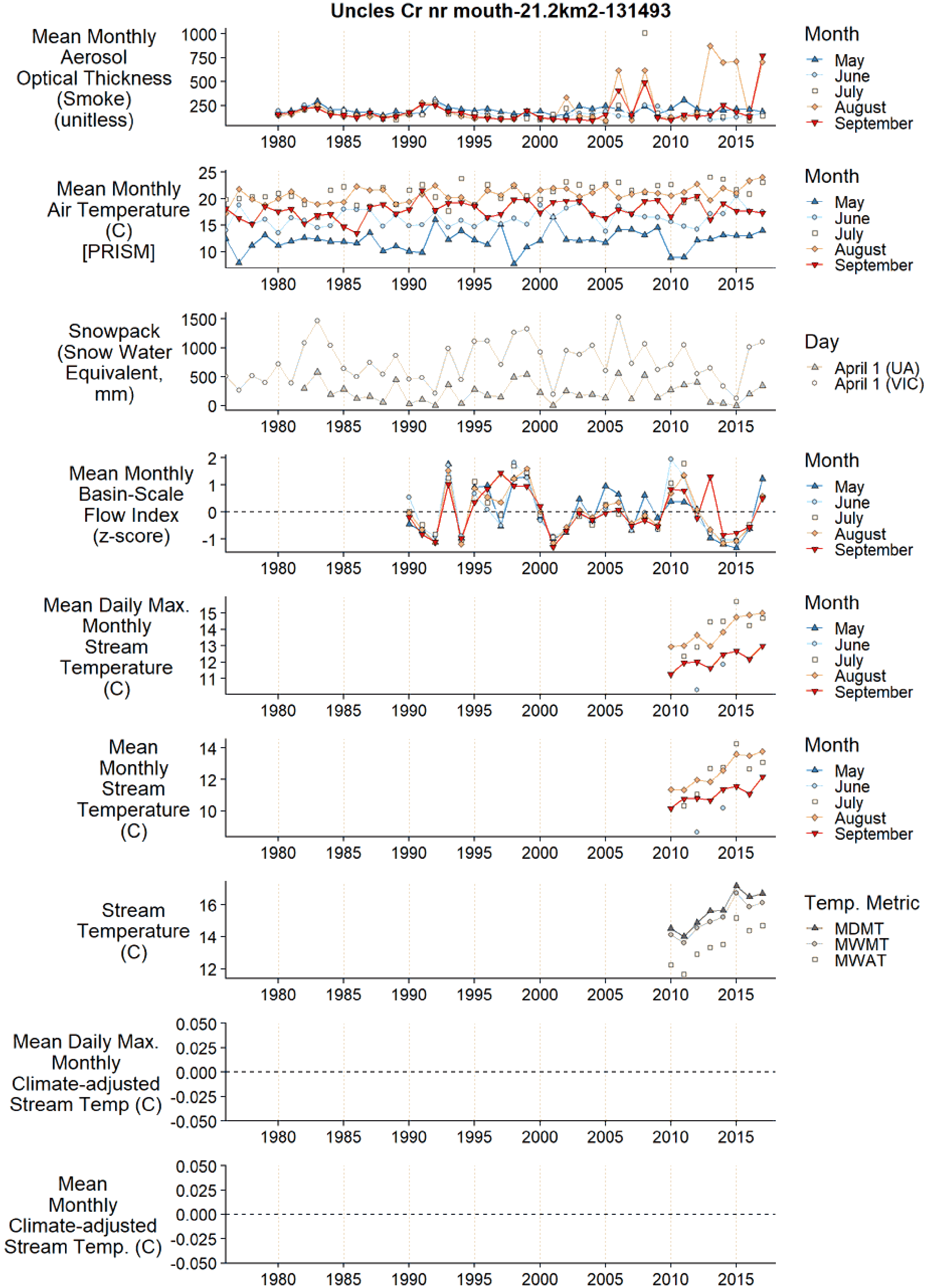

Uncles Cr nr mouth-21.2km2-131493
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (UA)
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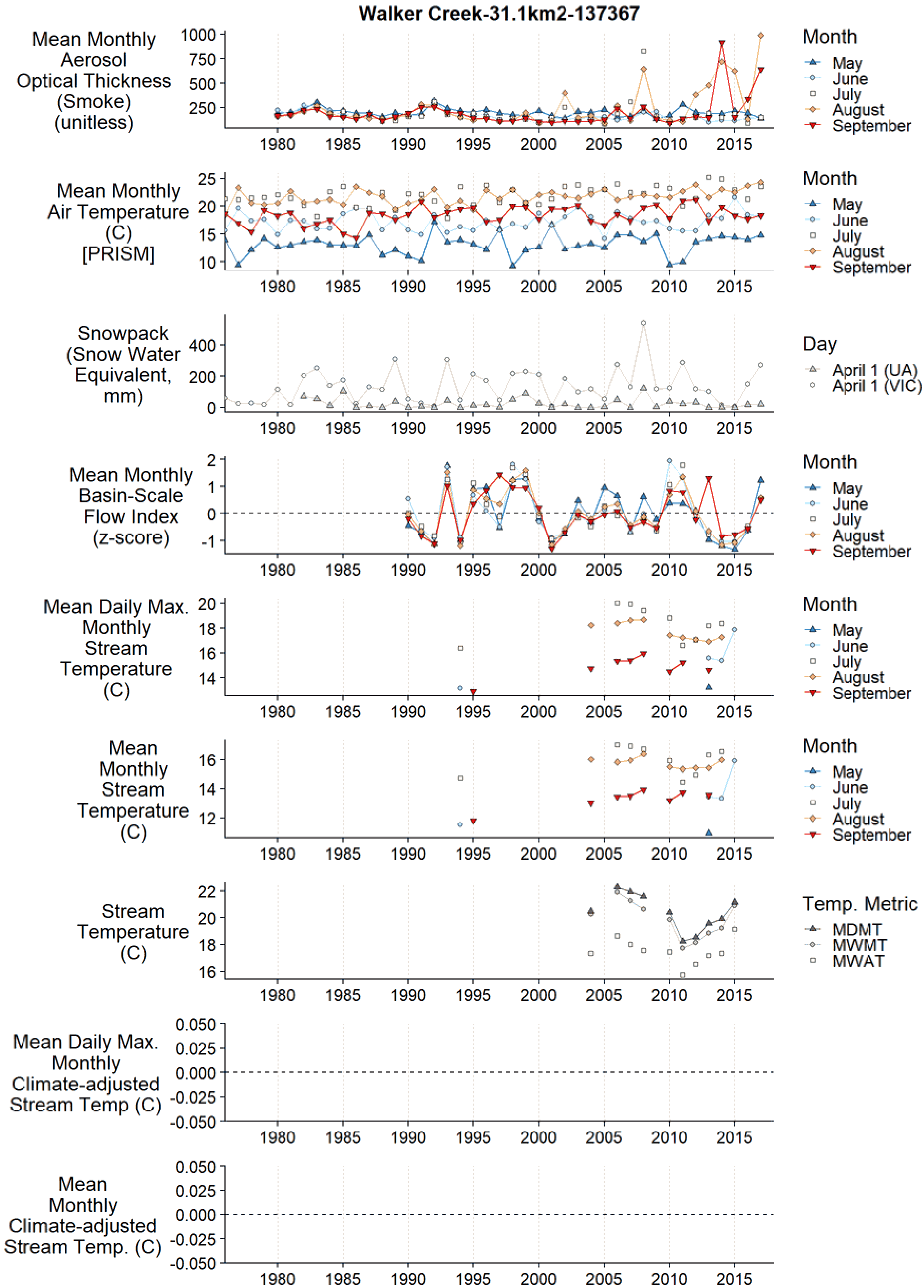
Walker Creek-31.1km2-137367
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
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April 1 (UA)
April 1 (VIC)
Temp. Metric
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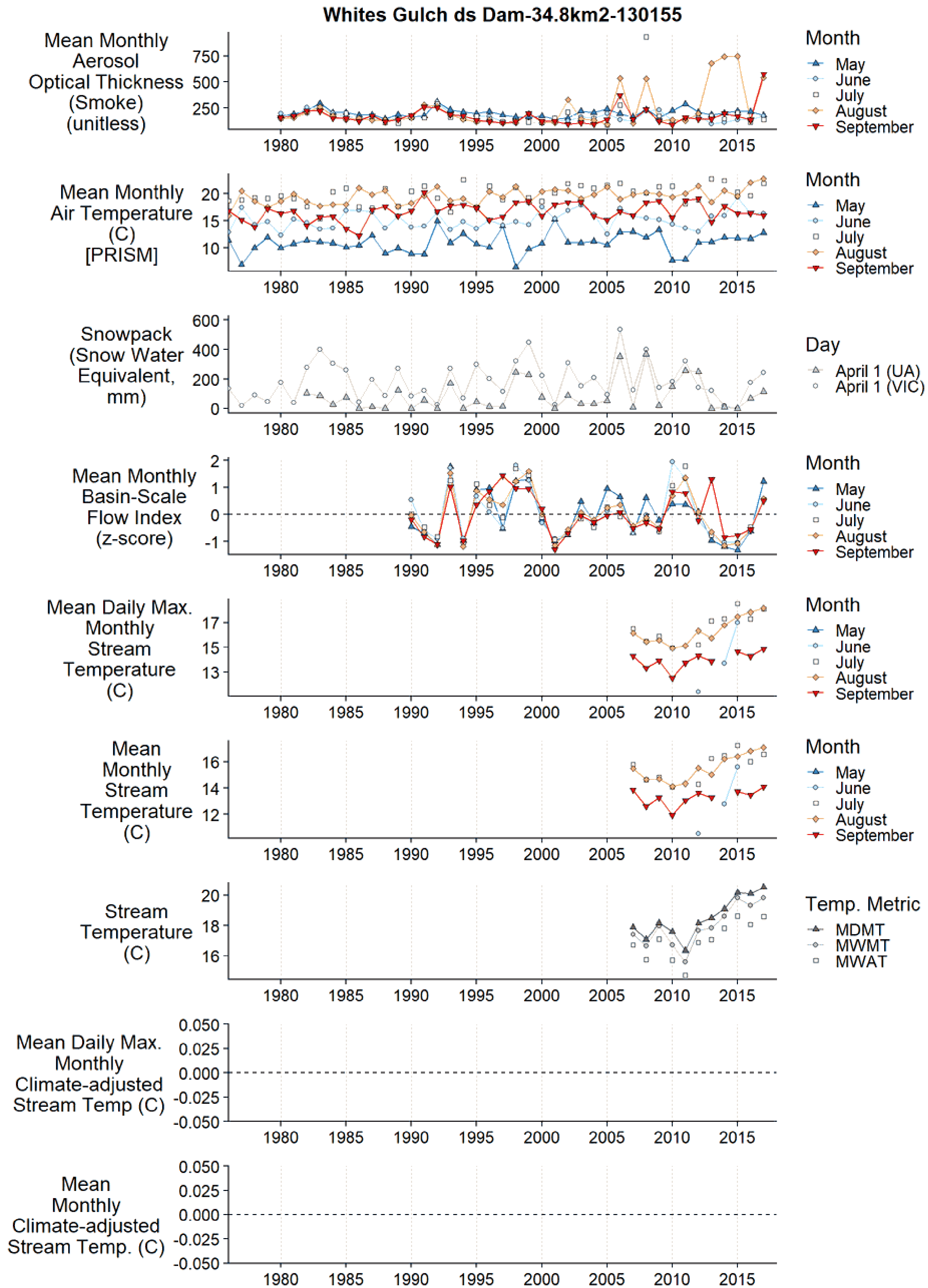
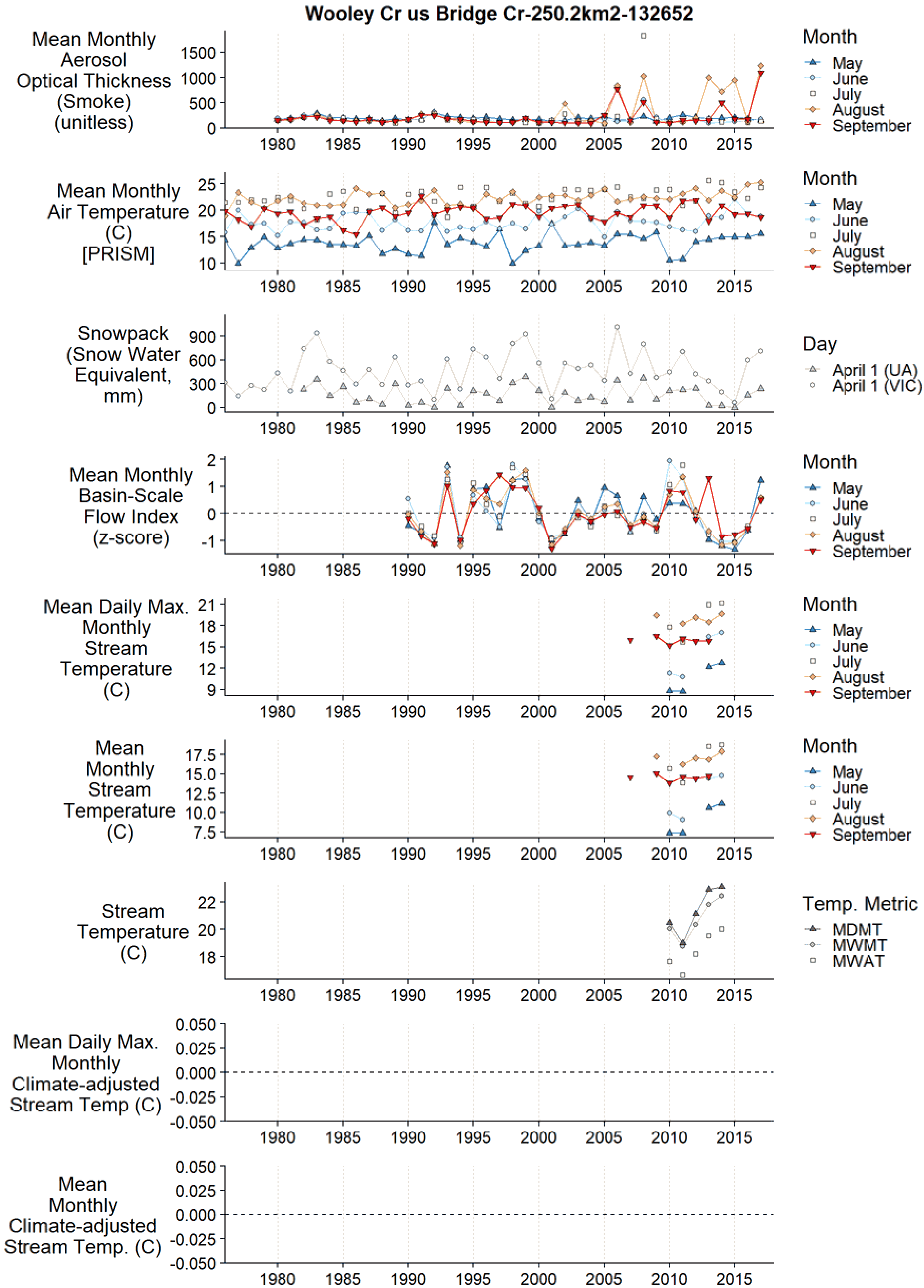
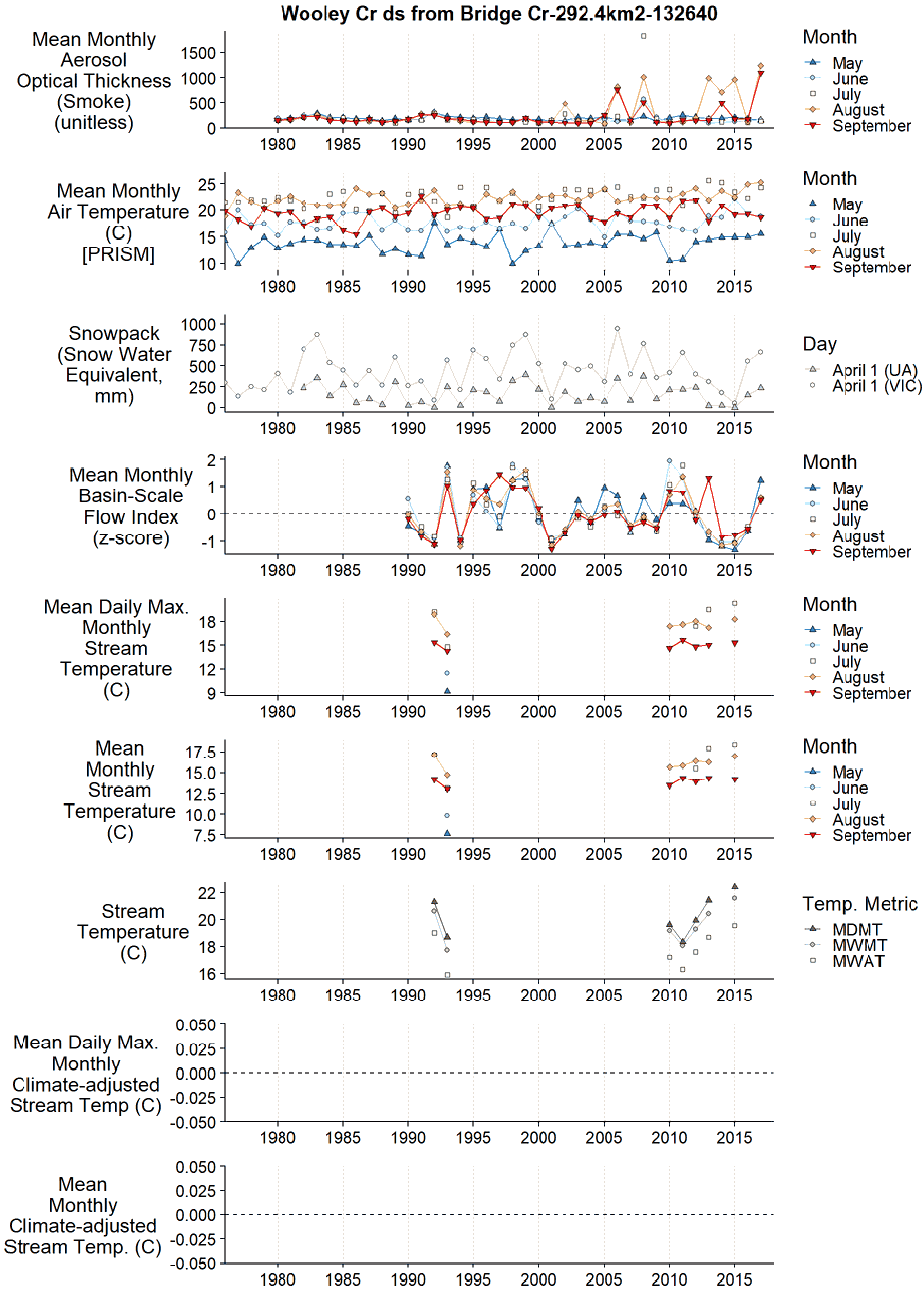
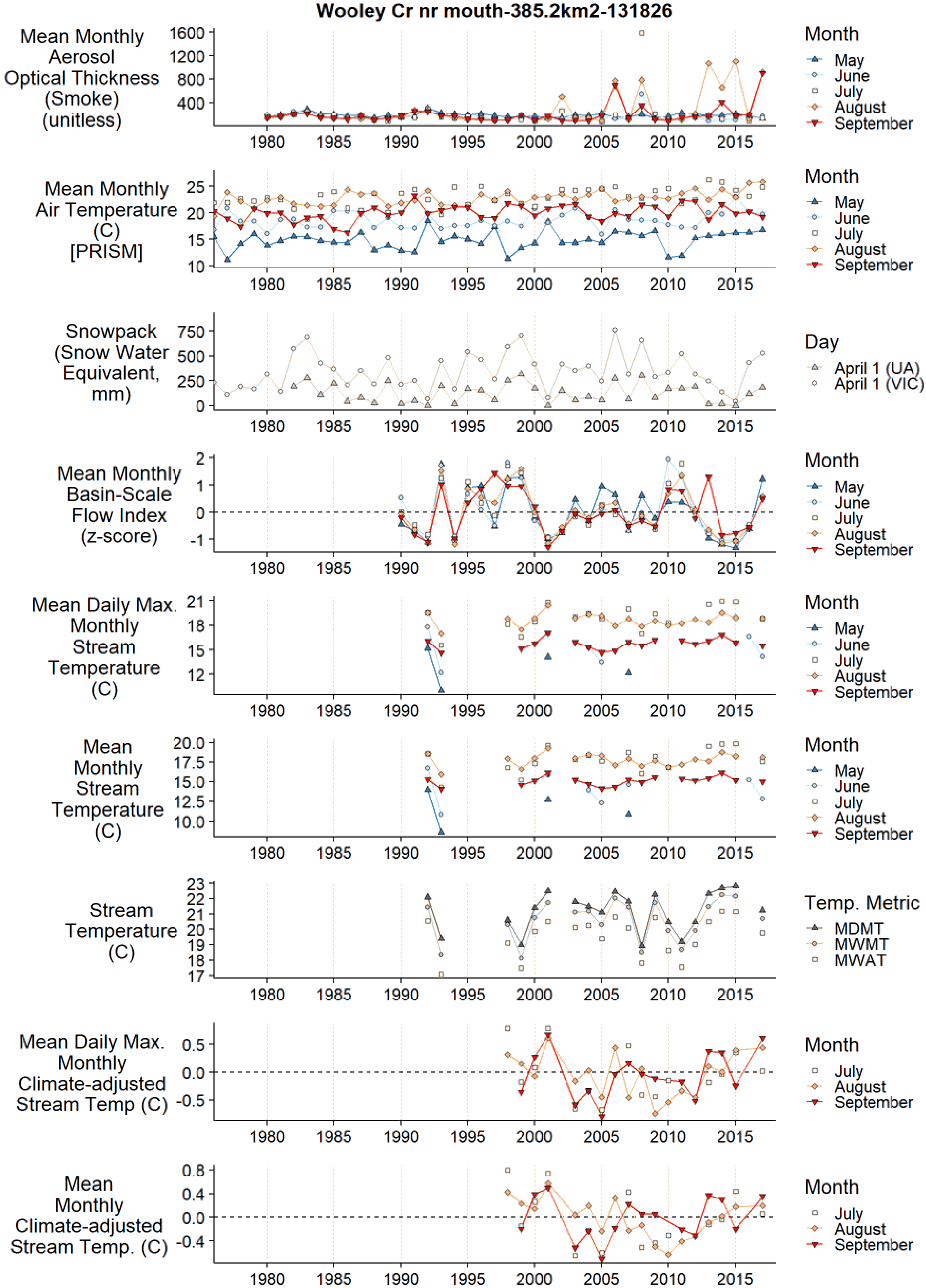
MWMT
MWAT


Whites Gulch ds Dam-34.8km2-130155
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
1980 1985 1990 1995 2000 2005 2010 2015
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT


Wooley Cr us Bridge Cr-250.2km2-132652
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
1980 1985 1990 1995 2000 2005 2010 2015
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT



Wooley Cr ds from Bridge Cr-292.4km2-132640
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT
1980
1985
1990
1995
2000
2005
2010
2015


Wooley Cr nr mouth-385.2km2-131826
Mean Monthly Aerosol Optical Thickness (Smoke) (unitless)
Mean Monthly Air Temperature (C) [PRISM]
Snowpack (Snow Water Equivalent, mm)
Mean Monthly Basin-Scale Flow Index (z-score)
Mean Daily Max. Monthly Stream Temperature (C)
Mean Monthly Stream Temperature (C)
Stream Temperature (C)
Mean Daily Max. Monthly Climate-adjusted Stream Temp (C)
Mean Monthly Climate-adjusted Stream Temp. (C)
Month
May
June
July
August
September
Day
April 1 (UA)
April 1 (VIC)
Temp. Metric
MDMT
MWMT
MWAT