Trend Analysis of Weather Extremes in Idaho

Mohammad Sohrabi (1), Jae Ryu (2), John Tracy (3)

(1) Graduate Research Assistant, Department of Biological and Agricultural Engineering, University of Idaho, Moscow , ID (sohrabi@uidaho.edu); (2) Assistant Professor, Department of Biological and Agricultural Engineering, University of Idaho, Boise , ID (jryu@uidaho.edu); (3) Director, Idaho Water Resources Research Institute, University of Idaho, Boise, ID (tracy@uidaho.edu)

Introduction

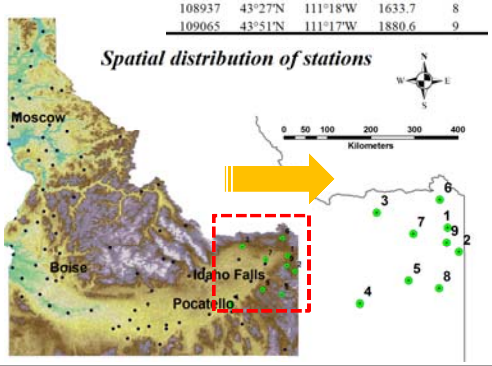
During the late 20th century changes in weather extremes have resulted in grave damages to rural communities. Since then, many studies have concentrated on weather extremes rather than state of mean climate because changing in the frequency and intensity of climatic extreme events would lead to severe impacts on the nature and societies. Trend analyses of weather extremes using daily data is an important avenue in climate change research, little applications related to daily precipitation and temperature have been made in western watersheds, including in Idaho. In this study, a total of 27 climate indices defined and developed by Expert Team on Climate Change, Detection, Monitoring and Indices (ETCCDMI) has been applied to identify spatial and temporal variability of temperature and precipitation-based extremes over mountainous region of the eastern Idaho. The 9 stations are initially selected and investigate to capture any probable changes in climatic extreme events and the preliminary results indicate that overall higher increase trends in minimum temperature and decreasing trends in annual precipitation.

Study area

A total of 9 stations located in mountainous region of the eastern Idaho were initially investigated to detect any probable changes in climatic extreme events.

Table.1- Stations' Detailed Information

Coop-ID	LAT	LONG	ELV	ST-NO.
100470	44°03'N	111°16'W	1588.6	1
102676	43°44'N	111°07'W	1865.4	2
102707	44°15'N	112°12'W	1661.2	3
103297	43°03'N	112°25'W	1360.9	4
104456	43°21'N	111°47'W	1776.4	5
104598	44°25'N	111°22'W	1917.2	6
108022	43°58'N	111°43'W	1508.8	7
108937	43°27'N	111°18'W	1633.7	8
109065	43°51'N	111°17'W	1880.6	9



Method

After data quality control, a total of 27 indices listed in the table 2 and 3 are used to identify spatial and temporal domains of temperature and precipitation-based extremes.

Table.2- Summary information of the used precipitation Indices

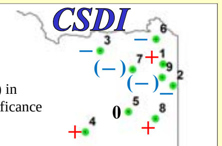
Index	Descriptive Name	Definition	Units
PRCPTOT	Wet day precipitation	annual total precipitation from wet days	mm
SDII	Simple daily intensity index	average precipitation on wet days	mm/d
CDD	Consecutive dry days	maximum number of consecutive dry days	days
CWD	Consecutive wet days	maximum number of consecutive wet days	days
R10mm	Heavy precipitation Days	annual count of days when RR >= 10	days
R20mm	Very heavy precipitation days	annual count of days when RR >= 20	days
R50mm	Number of days have precipitation above50 mm	Annual count of days when PRCP >=50 mm	days
R95p	Very wet day precipitation	annual total precipitation when RR > 95th percentile of 1962-2008 daily rainfall	mm
R99p	Extremely wet day precipitation	annual total precipitation when RR > 99th percentile of 1962-2008 daily rainfall	mm
RX1day	Maximum 1-day precipitation	annual maximum 1-day precipitation	mm
RX5day	Maximum 5-day precipitation	annual maximum consecutive 5-day precipitation	mm

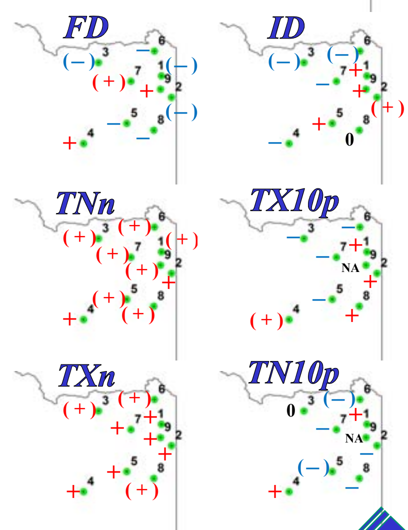
Table.3- Summary information of the used Temperature Indices

Index	Descriptive Name	Definition	Units
SU	Hot days	annual count when TX > 27°C	days
FD	Frost days	annual count when TN < 0°C	days
ID	Cold days	annual count when TX < 2°C	days
DTR	Diurnal temperature range	monthly mean difference between TX and TN	°C
TR	Warm nights	annual count when TN > 5°C	days
TXx	Hottest day	monthly highest TX	°C
TNx	Hottest night	monthly highest TN	°C
TXn	Coolest day	monthly lowest TX	°C
TNn	Coolest night	monthly lowest TN	°C
TN10p	Cool night frequency	percentage of days when TN < 10th percentile of 1962-2008	%
TX10p	Cool day frequency	percentage of days when TX < 10th percentile of 1962-2008	%
TN90p	Hot night frequency	percentage of days when TN > 90th percentile of 1962-2008	%
TX90p	Hot day frequency	percentage of days when TX > 90th percentile of 1962-2008	%
WSDI	Warm spell	Annual count of days with at least 6 consecutive days when TX > 90th percentile of 1962-2008	days
CSDI	Cold spell	annual count of days with at least 6 consecutive days when TN < 10th percentile of 1962-2008	days
GSL	Growing season length	annual count between first span of at least 6 days with TG > 5°C after winter and first span after summer of 6 days with TG < 5°C	days

Cold Extremes

Note that plus (+) and minus (-) in parenthesis indicates 10% significance level has been achieved.





Hot Extremes

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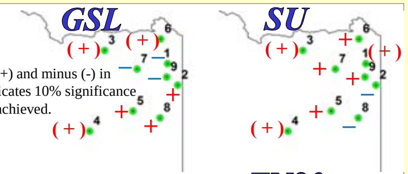
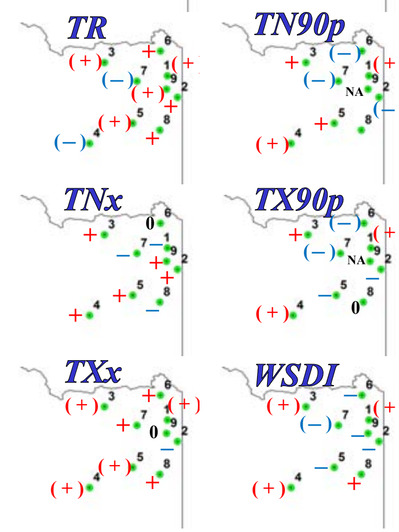
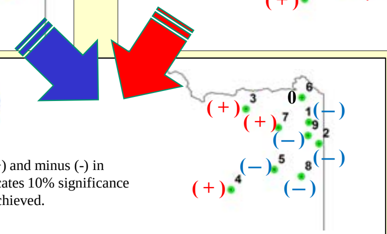




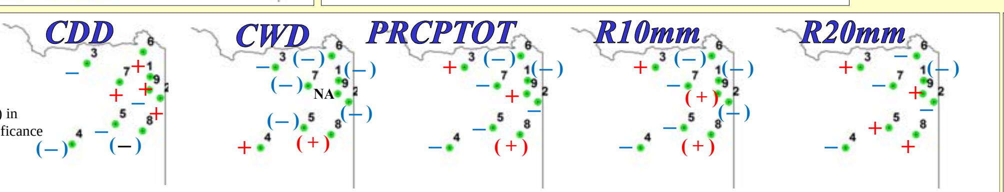
Diurnal Temperature Range

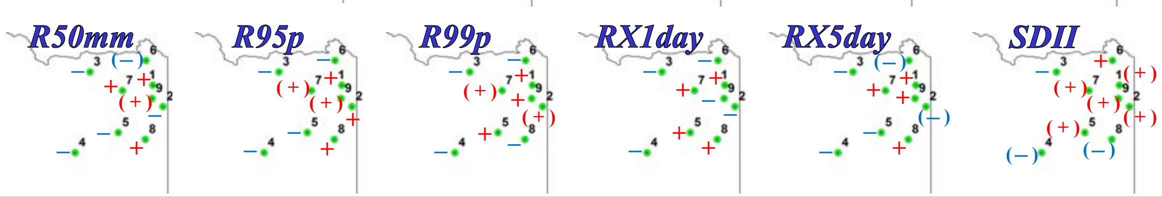
Note that plus (+) and minus (-) in parenthesis indicates 10% significance level has been achieved.



Precipitation Indices

Note that plus (+) and minus (-) in parenthesis indicates 10% significance level has been achieved.





Summary and Future Work

The results show that significant increase in SDII is evidence of wet days decrease. This indicates that increase trends of precipitation intensity and decrease trends of precipitation frequency. TNn and TXx both show considerable increases, which means warming trends are noticeable. Overall, in most of the stations, SU, TR and GSL show increasing trends, while ID and FD indicate decreasing trends. Since TN and other indices related to TN have higher increase rate than that of TX, it is appeared that DTR decreases in most of the stations. This study on weather extreme will be continued to capture the temporal and spatial variability possibly affected by climate change. Consequently, this research activity helps us evaluate the impact of climate change on regional water resources and agricultural management exercises.

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