Heat Events in the Indian subcontinent under a warming climate scenario: Detection and its drivers

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Introduction

Global temperatures have shown a warming trend over the last century, mainly as a result of anthropogenic activities. Rising temperatures are a potential cause for increase of extreme climate events, such as heat waves, both in severity and frequency. Heat waves are anomalous episodes, characterized by extremely high surface air temperatures that usually last up to several days and have serious consequences. Over India, the most impacting heat waves occur during the months of March to June and can affect various sectors including health, agriculture, ecosystems and the national economy.

In May 2015, a severe heat wave due to the delayed onset of southwest monsoon affected parts of south-eastern India, which claimed more than 2500 lives.

Objectives

1. To identify the heat stress conditions with the help of suitable heat indices for different regions.
2. Understanding the physical mechanisms and drivers behind the onset, duration and severity of heat events.

Data and Methods

Maximum Temperature at 2 metres (MX2T & Relative Humidity (RH) from ERA-Interim
1979-2017, 0.5degx0.5deg [European Centre for Medium-Range Weather Forecasts]

Methods:

Heat Stress 
Indicators

Patterns

Selecting 
Values

K Means Clustering tries to cluster data into clusters based on their similarity. The optimal number of clusters was ascertained to be 7 using the Elbow and Silhouette method.

Following are the Tmax clusters for 1979-2017

Clusters (MAM)

- 2 out of 8 clusters were selected based on high population density and differences in index.
- Heat events selected by taking temperature values exceeding 5th percentile for >= 3 days consecutively
- HI Category 4 days

Heat Events and Physical Drivers

Maximum Temperature anomalies for the season MAM shows a positive correlation of 0.6 with Nino 3.4 region in east Pacific Ocean. There is a high correlation with central, west and east coast region of India. The east Indian region correlation is in agreement with Ratnam et al (2016).

Temperature Anomalies and Atlantic Regimes

Maximum Temperature Anomalies with the 4 Atlantic Regimes, Blocking, NAO+, Atlantic Ridge and NAO+ was done. Positive & Negative anomalies are seen in central India for MAM.

Conclusions

1. The index to identify heat events in India are different for each region in India, since the regions respond differently during the pre-monsoon(MAM) and transitional period (MJJ).
2. Further investigation into the physical drivers of the clusters is needed.

References