Assessment of Spatiotemporal Trends of Winter Warming in India using Global Climate Models

Netrananda SAHU
Department of Geography, Delhi School of Economics, University of Delhi, Delhi

Background

The magnitude of the rate of climatic warming varies between the day and the night but is seen mostly among seasons. Since the 1990s, the warmer winters have drawn much attention worldwide. At mid and high latitudes, winter temperatures have risen faster than summer temperatures, which has decreased the seasonal temperature variations.

Objects

To investigate spatiotemporal characteristics of winter warming in India using remotely sensed data and numerical model (WRF).
To quantify the role of aerosols, green house gases, cloud cover, and sea surface temperatures (SST) on winter warming using statistical methods and model data.
To assess the adaptive techniques for winter warming after quantification of above factors in future scenario using CMIP5/CMIP6.

Expectation from a future partner

Scientific collaborations, sharing of the data and Equal contributions from the foreign partners to work on the proposal in a time bound manner.

Seeds and Needs

In Northern Hemisphere, the temperate zone is particularly sensitive to winter climate change due to the probable loss of longer-lasting permafrost, which might have consequences for various plant-related climatic factors. Also, it reduces the snow cover by accelerating the process of soil freezing at high latitudes [Xia et. al., 2014]. Despite being a tropical country, India has also been facing an increasing trend in temperatures during winter for the last three decades. Anthropogenic activities (like an increase in green house gases concentration, generation of particles and aerosols, etc.) are the causes of human-induced climate change [Redlin and Gries, 2021]. According to some studies [Dash and Hunt, 2007, Jaswal, 2010], winters are getting shorter in India as a result of rising winter temperatures. Despite being covered with clouds and aerosols also, different regions of India experience different kinds of temperature variation. Therefore, there is a need for a better understanding of the relationship between anthropogenic emissions and temperature variations, which is quite complicated. The overall workflow of this research can be divided into three main parts according to three objectives. After collecting data from both satellites and observations, statistical techniques can be applied to the physical drivers like aerosols, green house gases, SST to quantify their contributions in winter warming. For simulation and linkage between the drivers WRF model with sensitivity experiments can be used. In the third part, for future scenario CMIP5/CMIP6 can be used in different RCP scenarios where we can get the results for both near and far futures. Like other seasons, winter season is also important in India, especially for agriculture. Winter temperature plays a critical role in maintaining the chilling hours (temperature below 7^0C) for the cultivation of apple, apricot, peach, almond, pear etc. at higher altitudes. For Rabi crops like wheat, winter precipitation and temperature is required for their growth. By providing a clearer understanding of winter warming, my research will help people take the essential actions to combat climate change and advance sustainable development.