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The analysis of climatic variability/weather trends (past and future) in eastern U.P.

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Abstract
Underneath these trends is that of decadal scale variability in the Pacific basin at least induced by the Interdecadal Pacific Oscillation (IPO), which causes decadal changes in climate averages. On interannnual timescales El Ni˜no/Southern Oscillation (ENSO) causes much variability throughout many tropical and subtropical regions and some mid-latitude areas. During the course of the 21st century global-average surface temperatures are very likely to increase by 2 to 4.5 ^{O}C as greenhouse gas concentrations in the atmosphere increase. By concentrating on changes in climate means, the full impacts of climate change on biological and human systems are probably being seriously underestimated. Here, we briefly review the possible impacts of changes in climate variability and the frequency of extreme events on biological and food systems, with a focus on the developing world. We present new analysis that tentatively links increases in climate variability with increasing food insecurity in the future. Climatic variability & weather trend analysis were made for past and future based on the historical data results reveal that. Future rainfall scenario of eastern U.P. Showed much varying trends in monthly rainfall and was observed that in eastern U.P. rainfall will increase during south west monsoon period up to 2080 but the month of August will face sharp decline in rainfall. Projected trends in temperature and rainfall over eastern U.P. reveal that rainfall will not significantly affect the yield of rice crop as compared to temperature. The rate of increase of maximum temperature in eastern U.P. will be higher during 2050 to 2080 (2-4 ^{0}C) as compared to 2020-2050 (1-2 ^{0}C).

Keywords: Climatic Variability, Weather Trends, Past and Future, Eastern U.P

Introduction
Climate change has many elements, affecting biological and human systems in different ways. The considerable spatial heterogeneity of climate change impacts has been widely studied; global average temperature increases mask considerable differences in temperature rise between land and sea and between high latitudes and low; precipitation increases are very likely in high latitudes, while decreases are likely in most of the tropics and subtropical land regions (IPCC, 2007).

It is widely projected that as the planet warms, climate and weather variability will increase. Changes in the frequency and severity of extreme climate events and in the variability of weather patterns will have significant consequences for human and natural systems. Increasing frequencies of heat stress, drought and flooding events are projected for the rest of this century, and these are expected to have many adverse effects over and above the impacts due to changes in mean variables alone (IPCC, 2012). The cooler period of climate in the 19th century and rapid global warming during the late 20th century. Over the last millennium climate has varied by as much as 1 ^{O}C globally. Key questions of any future impacts of global warming are the effects on human society and economics, and in particular, on agriculture and forestry. History can provide very valuable lessons on effects of climatic variability on the human dimensions. The multidecadal cooling of the late 16th century in Europe resulted in one of the peak cooling excursions of the so called Little Ice Age epoch of Europe. This example of climate variability provides impacts of a mere 0.5 ^{O}C cooling in annual mean temperature on society. Increases were observed in surface global temperatures during the 20th century, and interannual climate variability has been observed in many regions of the globe. The 1982/83 and 1997/98 El Ni˜nos and the 1991 Mt. Pinatubo volcanic eruption. Caused considerable variability in the interannual climate of tropical regions in the late 20th century.

Climate variability and trends have significant environmental and socioeconomic impacts. Global challenges such as food security, biodiversity loss, water scarcity and human health are affected by reference evapotranspiration, temperature, solar radiation, and precipitation together, but nonlinear dynamics of these four climatic factors have not been assessed simultaneously at the national scale.

Climate variability and trends have enormous influences on the environment and social development on which a growing human population relies (Mishra *et al* 2010). Understanding climatic patterns is of great significance when many global challenges such as food insecurity, water crisis, biodiversity loss, and health issues are tied to the changing climate.

Many studies have assessed climate trends at different spatial and temporal scales, explored the drivers that led to climate trends, or tracked the impacts of climate trends on nature and society (Spencer. and Christy 1990). For example (Haines *et al*. 2006) analyzed the trend of global temperature change and suggested that the increasing temperature may influence sea level and the extermination of species. (Sinha *et al*. 2015)

In other words, the analyses of climate trends could only reflect the overall change of climatic factors over one period of time, but have ignored the variability of climatic dynamics to which human health, crop production and plant growth are sensitive (New lands *et al* 2012). Variability indicates the degree of fluctuation and uncertainty of the climate change process (Pelletier *et al* 1999). It has great impacts on human health because the reproduction and survival rates of bacteria and viruses, which are devoid of thermostatic mechanisms, are significantly affected by temperature variability (Patz *et al* 2005). Also, climate variability has enormous influences on agricultural and economic development. Basic elements of farming – soil moisture, heat and sunlight – are affected by variability of temperature, rainfall, solar radiation, and the frequency and amplitude of extreme climate events like droughts and floods (Alexandrov and Hoogenboom, 2000).

Materials and methods

The weather data of last 30 years (1986-2015) of Eastern Uttar Pradesh were collected from IMD., Lucknow Land Revenaue department and crop data from Department of Agriculture Statistics, Directorate of Agriculture Uttar Pradesh, Lucknow.

Demography of eastern Uttar Pradesh

General description

It should include general description of weather / soil /topography /cropping pattern etc of Eastern U.P. state in India. It is situated at 26°.77 N Latitude & 82°. 14E Longitude.

Weather during winter

Winter in Eastern Uttar Pradesh is a lot cooler with day temperature pleasant around 24 °C. and nights are chilly with temperature getting as low as 2 to 4 °C across the entire Eastern U.P. Earlier Eastern regions were comparatively warmer but due to change in the weather trends, even these areas fall under intense cold wave. Cities like Varanasi are continuously seeing mercury dipping to freezing point. The winter falls around Mid-November and continue till February end. Dew is very common in all the parts of Eastern Uttar Pradesh.

Weather during monsoon

As Eastern Uttar Pradesh stretches from North India towards Eastern, the rainfall of eastern U.P is about 900 mm. The climate of Eastern Uttar Pradesh is generally defined to be tropical monsoon type. It is primarily classified as *humid subtropical with dry winter* type with parts of Eastern U.P. as *semi-arid* type. Variations do exist in different parts of the large state, however the uniformity of the vast Indo-Gangetic Plain forming bulk this regions. State gives a predominantly single climatic pattern with minor regional variations. Eastern U.P. has a climate of extremes. With temperatures fluctuating from 0 °C to 47 °C in several parts of the Eastern Uttar Pradesh and cyclic droughts and floods due to unpredictable rains, the summers are extremely hot, winters cold and rainy season can be either very wet or very dry.

Climate Trend

The year to year variability of climatic conditions may conceal gradual trends from one type of regime to another. Statistical methods such as moving average, frequency distribution and stepwise regressions were employed to study climatic trends.

The historical data of soil, major crops and weather parameters especially rainfall and temperature of districts of Eastern region were collected for study depending upon the availability of the data from the period of 1986-2015. Climatic variability & weather trend analysis were made for past and future based on the historical data.

Result and discussion

Annual variation of Minimum temperature during November month in the region

Trend analysis of annual variation of minimum temperature during 1st fortnight of November and 2nd fortnight of November have been presented in Fig-1 (a). Results reveal that minimum temperature during 2nd fortnight of November. Was highly correlated over 1st fortnight of November temperature. Fig-1 (b).

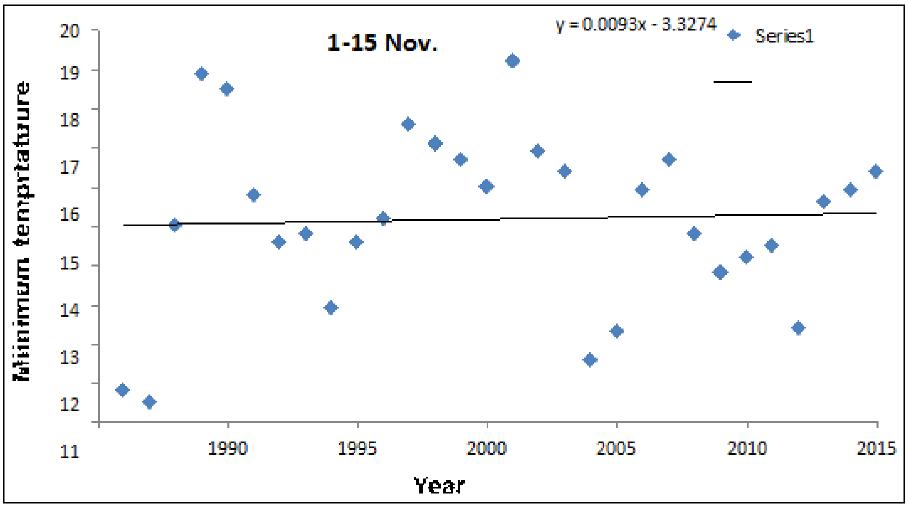

Fig 1(a)

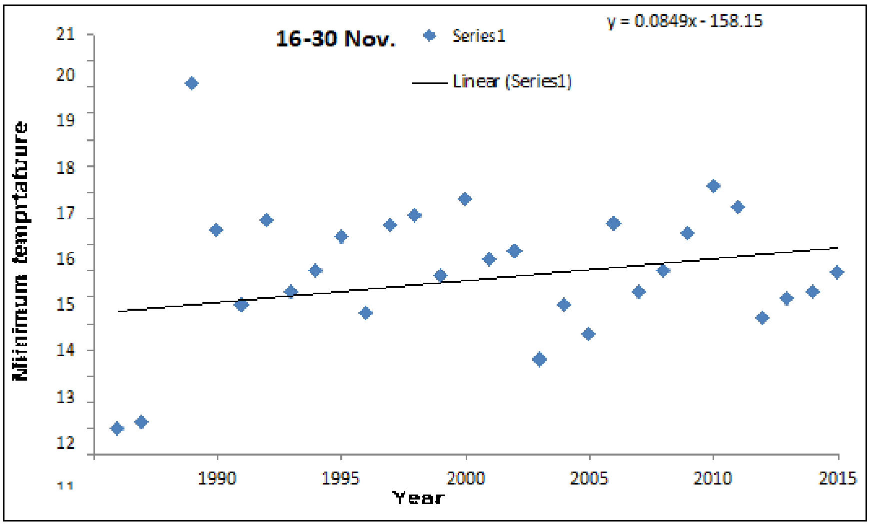

Fig 1(b): Annual variation of Minimum temperature during November

Annual variation of minimum temperature during February month in the region

Trend analysis of annual variation of minimum temperature during 1st fortnight and 2nd fort night of February month have been presented in Fig-2 (a). Results reveal that minimum temperature during 1st fortnight of February. Was highly correlated over 2nd fortnight of February month. Fig-2(b).

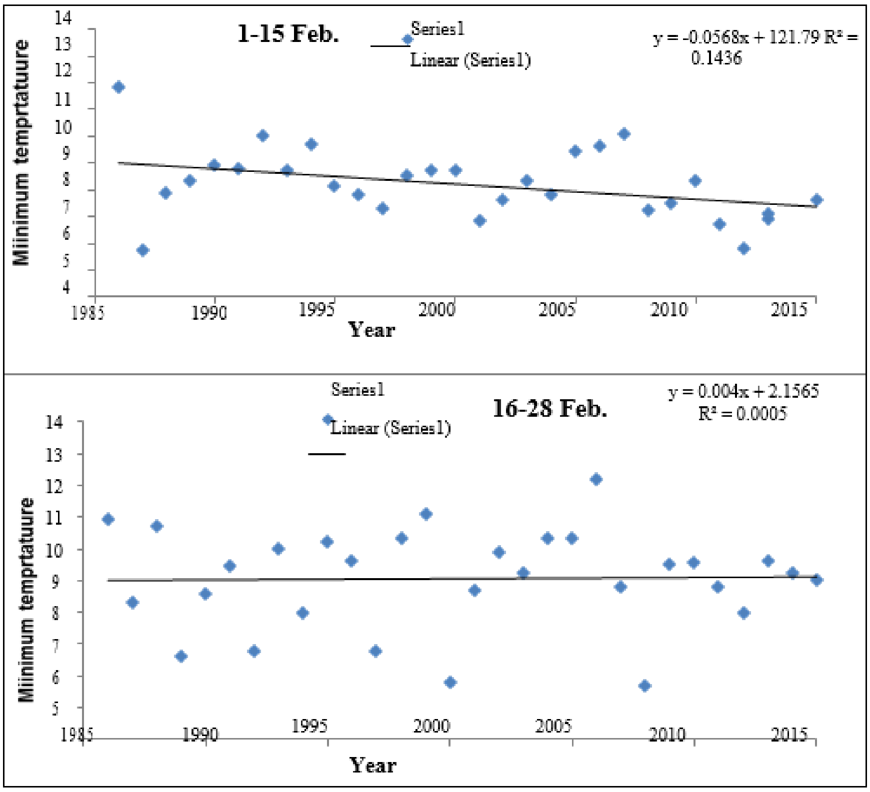

Fig 2(a, b): Annual variation of Minimum Temperature during February month

Projected trends in future of Temperature and rainfall over eastern U.P

Climate change is one of the most important global environmental challenges with implications for food production. Future rainfall scenario of eastern U.P. showed much varying trends in monthly rainfall and was observed that in eastern U.P. rainfall will increase during south west monsoon period up to 2080 but the month of August will face sharp decline in rainfall Fig-3 (a, b and c). Projected trends in temperature and rainfall over eastern U.P. reveal that rainfall will not significantly affect the yield of rice crop as compared to temperature.

In general the rate of increase of maximum temperature in eastern U.P. will be higher during 2050 to 2080 (2-4 °C) as compared to 2020-2050 (1-2 °C). Similar observations were recorded for variations in minimum temperature too with greater magnitude ranging between 3-5 °C in later part of century as compared to early part (2-3 °C).

Future prediction of maximum temperature and minimum temperature scenario on monthly basis predicts that month of December and January will be hotter as compared to November' contrary to the normal trend. Trend analysis of temperature (maximum and minimum) shows the increasing trend. The model predicts that rice yield may decrease 1.5-2% due to increase in maximum temperature alone by the end of 2080. Similarly' the range of sensitiveness of minimum

temperature in yield prediction is 1-2% with respect to average yield in eastern U.P.
The maximum temperature is likely to increase between 0.5 °C and 3.0 °C in eastern U.P while minimum temperature between 1.0 and 4.5 °C during ensuing decades by 2080. A slight increase in rainfall is likely over eastern U.P by 2080.

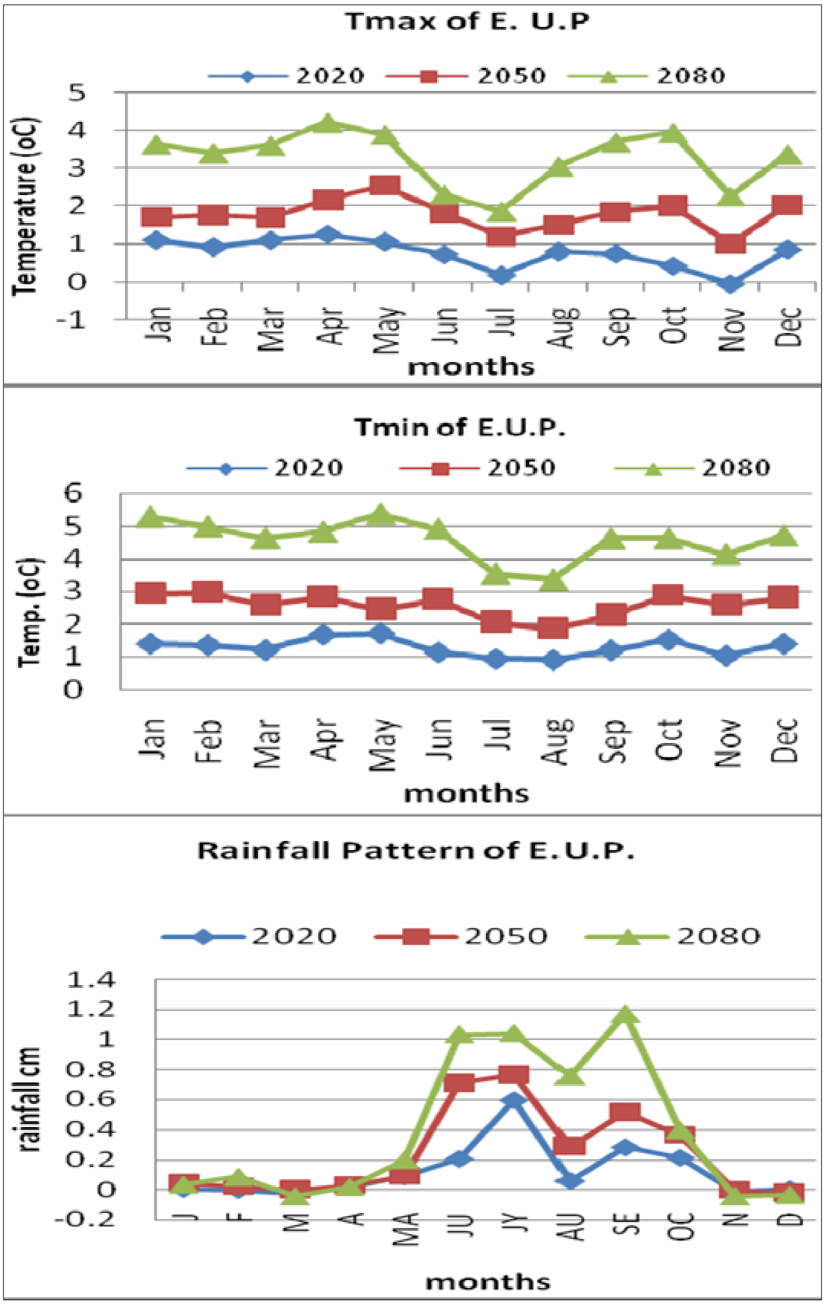

Fig 3(a, b and c): Projected trends in future of Temperature and rainfall over eastern U.P.

Conclusion

In general, the rate of increase of maximum temperature in eastern U.P. will be higher during 2050 to 2080 (2-4 ^{0}C) as compared to 2020-2050 (1-2 ^{0}C). Similar observations were recorded for variations in minimum temperature too with greater magnitude ranging between 3-5 ^{0}C in later part of century as compared to early part (2-3 ºC). Future prediction of maximum temperature and minimum temperature scenario on monthly basis predicts that month of December and January will be hotter as compared to November contrary to the normal trend. Trend analysis of temperature (maximum and minimum) shows the increasing trend. The model predicts that rice yield may decrease 1.5-2% due to increase in maximum temperature alone by the end of 2080. Similarly' the range of sensitiveness of minimum temperature in yield prediction is 1-2% with respect to average yield in eastern U.P. The maximum temperature is likely to increase between 0.5 ^{0}C and 3.0 ^{0}C in eastern U.P while minimum temperature between 1.0 and 4.5 ^{0}C during ensuing decades by 2080. A slight increase in rainfall is likely over eastern U.P by 2080.

References

1. Alexandrov V, Hoogenboom G. The impact of climate variability and change on crop yield in Bulgaria. Agricultural and forest meteorology, 2000; 104:315-327.
2. Haines A, Kovats RS, Campbell-Lendrum D, Corvalán C. Climate change and human health: impacts, vulnerability and public health. Public Health, 2006; 120:585-596.
3. IPCC Intergovernmental Panel on Climate Change Climate Change impacts, adaptation and vulnerability. Summary for policy makers, 2007.
4. IPCC. Managing the risks of extreme events and disasters to advance climate change adaptation. In: A Special Report of Working Groups I and II of the

Intergovernmental Panel on Climate Change, 2012.
5. Mishra AK, Singh VP, Jain SK. Impact of global warming and climate change on social development. Journal of Comparative Social Welfare. 2010; 26:239-260.
6. Newlands NK, Espino-Hernández G, Erickson RS. Understanding Crop Response to Climate Variability with Complex Agroecosystem Models. International Journal of Ecology, 2012, 1-13.
7. Patz JA, Campbell-Lendrum D, Holloway T, Foley JA. Impact of regional climate change on human health. Nature, 2005; 438:310-317.
8. Pelletier JD, Turcotte DL. Self-affine time series: II. Applications and models. Advances in Geophysics, 1999; 40:91-166.
9. Sinha A, Kathayat G, Cheng H, Breitenbach SFM, Berkelhammer M, Mudelsee M *et al*. Trends and oscillations in the Indian summer monsoon rainfall over the last two millennia, 2015.
10. Spencer RW, Christy JR. Precise monitoring of global temperature trends. Science, 1990; 247:1558-1558.