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A Ground Observation Based Climatology of Winter Fog: Study over the Indo-Gangetic Plains, India

Authors : Sanjay Kumar Srivastava, Anu Rani Sharma, Kamna Sachdeva

Abstract : Every year, fog formation over the Indo-Gangetic Plains (IGPs) of Indian region during the winter months of December and January is believed to create numerous hazards, inconvenience, and economic loss to the inhabitants of this densely populated region of Indian subcontinent. The aim of the paper is to analyze the spatial and temporal variability of winter fog over IGPs. Long term ground observations of visibility and other meteorological parameters (1971-2010) have been analyzed to understand the formation of fog phenomena and its relevance during the peak winter months of January and December over IGP of India. In order to examine the temporal variability, time series and trend analysis were carried out by using the Mann-Kendall Statistical test. Trend analysis performed by using the Mann-Kendall test, accepts the alternate hypothesis with 95% confidence level indicating that there exists a trend. Kendall tau's statistics showed that there exists a positive correlation between time series and fog frequency. Further, the Theil and Sen's median slope estimate showed that the magnitude of trend is positive. Magnitude is higher during January compared to December for the entire IGP except in December when it is high over the western IGP. Decade wise time series analysis revealed that there has been continuous increase in fog days. The net overall increase of 99 % was observed over IGP in last four decades. Diurnal variability and average daily persistence were computed by using descriptive statistical techniques. Geo-statistical analysis of fog was carried out to understand the spatial variability of fog. Geo-statistical analysis of fog revealed that IGP is a high fog prone zone with fog occurrence frequency of more than 66% days during the study period. Diurnal variability indicates the peak occurrence of fog is between 06:00 and 10:00 local time and average daily fog persistence extends to 5 to 7 hours during the peak winter season. The results would offer a new perspective to take proactive measures in reducing the irreparable damage that could be caused due to changing trends of fog.

Keywords : fog, climatology, Mann-Kendall test, trend analysis, spatial variability, temporal variability, visibility
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