



Drought occurrences in mid monsoon period over IGP- a detailed perspective

Rohit Chakraborty^{*(1)}, Shamitaksha Talukdar⁽¹⁾, Bijay Kumar Guha⁽²⁾,
and Madineni Venkat Ratnam⁽¹⁾

(1) National Atmospheric Research Laboratory, India, e-mail: rohite744@gmail.com

(2) National Institute of Technology Raurkella, India.

In the recent past, there have been multiple reports citing the occurrence of abnormal floods and droughts over the Indo-Gangetic plane. Some additional reports have also depicted that atmospheric aerosols from both natural and anthropogenic sources may be responsible for modulating the distribution of rainfall. Hence, in this study an attempt is made to investigate rainfall occurrence and intensity over Lucknow, a typical urban location in Indo-Gangetic Plain (IGP). Daily rainfall accumulation observations from the India Meteorology Department (IMD) station at Lucknow show an increasing number of dry days (having precipitation less than 1mm) and this dry day frequency parameter is now considered to be a proxy element for drought occurrences. To provide justification for the selection of this parameter for drought analysis, drought index values calculated against Potential evapotranspiration (PET) and rainfall are plotted with the dry day frequency values over Lucknow in the last three decades. The analysis reveals a strong inter-relation among all three parameters. Now, when the thirty year trends of dry day frequencies are observed for all months of the monsoon season, then it is observed that the trends are strongest during the mid-monsoon months of August which is otherwise expected to get the maximum rainfall. Next, a further investigation is done employing satellite and reanalysis datasets of cloud liquid water and precipitable water vapor from The Modern-Era Retrospective analysis for Research and Applications database (hereafter referred to as MERRA) which depicts that in-spite of having sufficient amount of cloud liquid water and water vapor content, the dry day frequency still continues to increase during August. This implies the effect of some other natural or anthropogenic factors which may control rain occurrence and intensity. Accordingly, the relationship between the number of dry days in Lucknow with other aspects such as El-Nino, Solar activity are seen which does not provide very good agreement among themselves. However when anthropogenic factors using aerosol parameters from MERRA 2 and MISR Satellite observations has been considered, a much better correlation is noticed. Further investigation also showed that a few anthropogenic components of aerosols have a strong association with dry day frequency increase over Lucknow. However, rural regions surrounding Lucknow does not depict that much prominent agreement between dry day frequency and the anthropogenic emissions thereby indicating the effect of urbanization on the length of monsoon dry spells in a regional scale. This investigation is followed by a further analysis to estimate the future projections of dry day frequency over the IGP from RCP 8.5 scenarios. This analysis reveals an acceleration in the trends in dry day occurrences in the coming decades which is an important aspect of discussion for policy makers of the future.