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Observed Climate Change Over Indo-Gangetic Basin

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Many of the recent studies have explored the possibility of climate change over Indo-Gangetic Basin (IGB) in recent past. But the lack of agreement in magnitude, and even direction, of climate change in those studies prevents us from getting a clear picture of possibility and characteristics of the climate change over IGB. This lack of agreement comes from many a sources e.g. exact extent of study domain (for spatial averaging), analysis method (parametric or non-parametric) etc. Our analysis showed that the trend analysis strongly depends on the source of the gridded data also. In this study we analyze the precipitation data from APHRODITE, CRU, GPCC, IMD, PREC/L and UDEL; and temperature data from APHRODITE, CRU and UDEL to show that the spatial trend characteristics are strongly heterogeneous between different dataset.

We combine the seasonal mean precipitation and temperature from all the datasets considered in this study into a Bayesian framework using Multi variable Bayesian Merging (MBaM) to derive a unified conclusion on the trend over IGB. A major assumption of this technique is the consideration of a dataset as a sample of the underlying climate space. Next, we combine the time series produced by the Bayesian method into a Multi variable Trend Principal Component (MTPC) setup to derive the equivalent trend principal components. These MTPCs, if significant, can be taken as the equivalent climate change signal. Further, we used these PCs to estimate the importance of different regional and global drivers in study of the climate change over IGB.

We show that the climate over IGB is significantly (>90%) changing during pre-monsoon and monsoon seasons. During post-monsoon the change is with slightly lesser significance ($\sim$85%). During winter season indication of any climate change is absent. We used the equivalent climate change signal to analyze the importance of different climatic driver in the IGB's climate change. We found the global tele-connection has negligible importance in inducing the climate change and conclude that the numerical investigation of the characteristics of climate change can be carried out with the help of RCMs rather than GCMs. On the other hand the concentrations of GHGs and aerosols have very strong correlation to the climate change signal indicating their prime importance as drivers in the study of the climate change over IGB.