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An Improved Genesis and Evolution Parameter for Subseasonal Prediction of the North Indian Ocean Tropical Cyclones

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Tropical storms that develop over the North Indian Ocean basin pose a major threat to the extensive peninsular coastlines teeming with overpopulated cities and vast areas of low-lying farmlands. With each year, the economic and property losses due to storm-induced gales, landslides and flash floods over the coastlines are becoming more frequent. Reliable subseasonal prediction of tropical cyclogenesis over the landlocked North Indian Ocean basin has extreme demand and requires accurate rendition of the crucial parameters that influence the storm development. While several genesis potential indices are used for climatological monitoring and prediction of cyclogenesis globally, their skill in subseasonal prediction of individual storm development is limited, especially near coastlines. This study reviews an improved genesis potential parameter, namely IGPP, that can detect cyclogenesis, evolution and storm tracks from post-processed Multi-model ensemble outputs. The IGPP is a revised version of Kotal Genesis Potential Parameter (KGPP) introduced by the India Meteorological Department for short and medium□range operational cyclogenesis prediction over the North Indian Ocean. We analyzed and compared the cyclogenesis prediction systems when multiple storm systems of different intensities develop simultaneously. Results show that false alarms and overestimation of values present in KGPP are remarkably reduced by using IGPP for all the cases. Moreover, IGPP outperforms KGPP in distinguishing between developing and non-developing storms by accurately representing the cyclogenesis and intensity variations. The mean IGPP shows better correlation with maximum wind speeds of selected storms, with an improvement of almost 34 % compared to KGPP, which we attribute to the changes in thermodynamic and shear terms. The thermodynamic term is modified as the mean equivalent potential temperature of the surface and middle troposphere to include the effect of warm sea surface and tropospheric latent heat release whereas the vertical wind shear between 850 and 200 hPa levels is averaged over an annular region between 100 and 200 km radii from the storm centres and rescaled. IGPP has replaced KGPP operationally and is successfully implemented as one of the indices for the extended range probabilistic prediction of cyclogenesis by the India Meteorological Department. Probabilistic predictions using IGPP has been instrumental in providing early guidance on storm formation and

weekly forecasts are available at https://www.tropmet.res.in/erpas/.

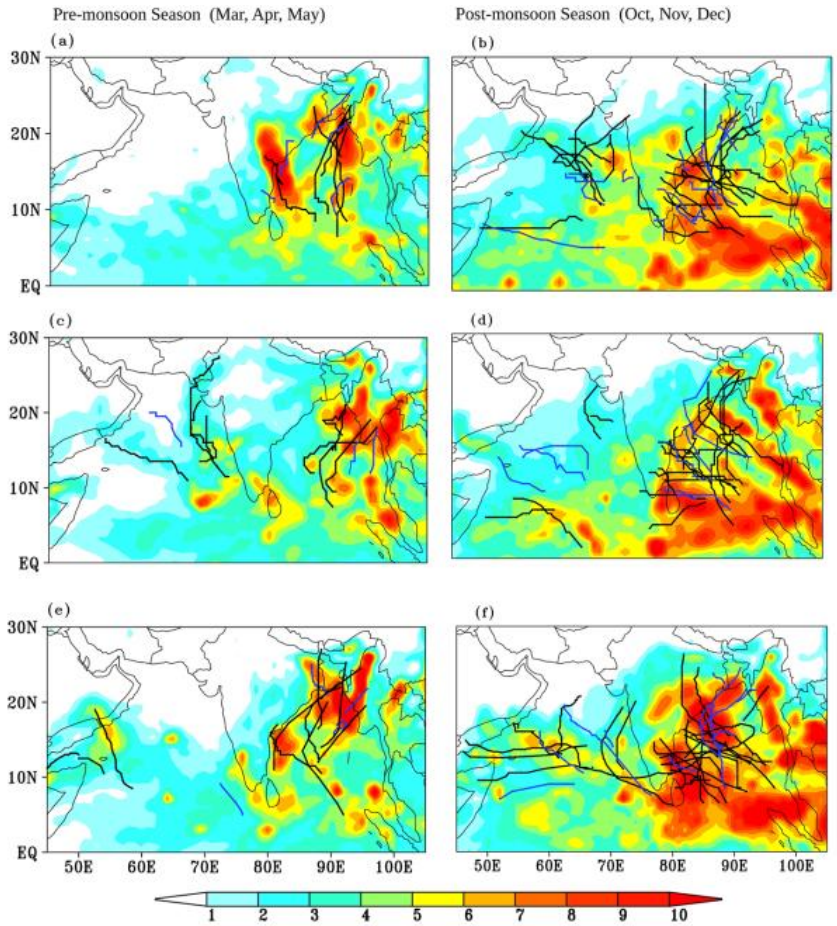

Figure 1. Seasonal climatology for IGPP (shaded) over NIO during premonsoon and postmonsoon seasons of past three decades: (a and)1989–1998, (c and d) 1999–2008, and (e and f) 2009–2018 years. IGPP analyses is overlaid with corresponding observed best tracks of developing (black) and nondeveloping (blue) storms during the periods.