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Teleconnection between El Nino-Southern Oscillation and Seasonal Flow of the Surma River and Possibilities of Long Range Flood Forecasting

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Abstract : El Nino-Southern Oscillation (ENSO) is the interaction between atmosphere and ocean in tropical Pacific which causes inconsistent warm/cold weather in tropical central and eastern Pacific Ocean. Due to the impact of climate change, ENSO events are becoming stronger in recent times, and therefore it is very important to study the influence of ENSO in climate studies. Bangladesh, being in the low-lying deltaic floodplain, experiences the worst consequences due to flooding every year. To reduce the catastrophe of severe flooding events, non-structural measures such as flood forecasting can be helpful in taking adequate precautions and steps. Forecasting seasonal flood with a longer lead time of several months is a key component of flood damage control and water management. The objective of this research is to identify the possible strength of teleconnection between ENSO and river flow of Surma and examine the potential possibility of long lead flood forecasting in the wet season. Surma is one of the major rivers of Bangladesh and is a part of the Surma-Meghna river system. In this research, sea surface temperature (SST) has been considered as the ENSO index and the lead time is at least a few months which is greater than the basin response time. The teleconnection has been assessed by the correlation analysis between July-August-September (JAS) flow of Surma and SST of Nino 4 region of the corresponding months. Cumulative frequency distribution of standardized JAS flow of Surma has also been determined as part of assessing the possible teleconnection. Discharge data of Surma river from 1975 to 2015 is used in this analysis, and remarkable increased value of correlation coefficient between flow and ENSO has been observed from 1985. From the cumulative frequency distribution of the standardized JAS flow, it has been marked that in any year the JAS flow has approximately 50% probability of exceeding the long-term average JAS flow. During El Nino year (warm episode of ENSO) this probability of exceedance drops to 23% and while in La Nina year (cold episode of ENSO) it increases to 78%. Discriminant analysis which is known as 'Categoric Prediction' has been performed to identify the possibilities of long lead flood forecasting. It has helped to categorize the flow data (high, average and low) based on the classification of predicted SST (warm, normal and cold). From the discriminant analysis, it has been found that for Surma river, the probability of a high flood in the cold period is 75% and the probability of a low flood in the warm period is 33%. A synoptic parameter, forecasting index (FI) has also been calculated here to judge the forecast skill and to compare different forecasts. This study will help the concerned authorities and the stakeholders to take long-term water resources decisions and formulate policies on river basin management which will reduce possible damage of life, agriculture, and property.

Keywords : El Nino-Southern Oscillation, sea surface temperature, surma river, teleconnection, cumulative frequency distribution, discriminant analysis, forecasting index
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