## ABSTRACT

Flood hazard assessment is important task in making proper management plan for floods in the changing climate. Flood regime changes as a result of changing river discharge in terms of frequency and magnitude. This study aims to answer whether frequent floods in the delta region of Mahanadi basin are due to an increase in rainfall extremes over the basin and subsequently, to assess the flood hazard in the delta region for possible future flood scenarios. In light of frequent floods in delta region of the basin, trends of extreme rainfall and runoff in the upper and middle reaches of Mahanadi basin are analysed. Change in flood regime of the basin is analysed based on flood severity and flood frequency. Four different flood scenarios are considered such as reference scenario, present scenario and two possible future scenario modifying the peak flood series with percentage change approach. Cartosat-1 Digital Elevation Model (DEM) is developed from the stereo image pair and assessed for its quality. Flood hazard is assessed in terms of maximum water level and flood inundation extent for changing flood regime. Trends of extreme rainfall in middle region of the basin is found to be increasing which is linked to increasing trend of peak flow of middle region. Further, flood severity of the Mahanadi delta is also found to be increasing based on the flood estimates of 30-year moving window peak flow series at Naraj (head of delta region). Based of frequency analysis of flood, floods of higher return period such as 61 years happens to be lower return period flood such as 11 years in possible future scenario. For flood modelling, Cartosat-1 DEM showed better representation of river cross-section than that of freely available DEM. Performance of 1D hydrodynamic model, MIKE11 based on cross-section derived from Cartosat-1 DEM is found to be satisfactory in simulating river discharge and water level in different distributaries of the delta region. Coupled 1D/2D hydrodynamic model, MIKEFLOOD based on Cartosat-1 DEM is also found to be satisfactory in simulating flood inundation in delta region of the Mahanadi basin. The maximum water level profile of recent historical high floods is found to be equivalent or higher than 5- and 10-year return period floods of possible future flood scenarios. Flood inundation assessment under different land-uses reveals that the economically significant land-uses in the delta region, such as cropland, built-up land and aquaculture, are likely to be the most affected in possible future flood scenarios. Spatial coverage of 'high' and 'very high' flood depth increases and that of 'low' depth decreases with a higher return period for the delta region of Mahanadi basin. The increasing trend of the inundation area for 'very high' flood depth indicates agricultural vulnerability in the delta region of the basin.

Key Words: Flood hazard assessment, Trend analysis, Cartosat-1 Digital elevation model, Flood scenarios.