



Quantifying the contribution of land use land cover changes (LULC) and climate change on hydrological processes over India

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Assessing the impact of land use land cover change (LULC) and climate change (CC) on global and regional hydrology has been a topic of significant interest in the recent times. For a reliable and realistic assessment of hydrological changes, the proper representation of climate and land surface processes in Earth system models is crucial. An associated significant aspect in the study of hydrologic processes is the assessment of the individual impacts of LULC and CC. Such studies are of special importance in regions such as India, which has experienced extensive deforestation and urbanization over the past half century. The diverse geography and varied climate of India combined with the large-scale LULC have resulted in significant changes in the hydrological cycle. In this study, we quantified the individual contributions of LULC and CC on hydrological changes over the Indian subcontinent using the Community Land Model version 4.5 (CLM4.5), which is a state-of-the-art land surface model. CLM4.5 has been widely utilized for studying interaction between land surface and atmospheric processes, and employs advanced land surface parameterization schemes. We setup CLM4.5 over India using high resolution surface and atmospheric forcing datasets as input for a simulation period of three decades starting from 1979. In order to quantify the individual impacts of LULC and CC, two model scenarios were designed to highlight the specific roles. The first scenario included constantly changing atmospheric forcing with fixed LULC over the entire simulation period, while the second scenario involved a fixed repeated atmospheric forcing with LULC changing every 5 years. The results for the scenarios were analysed for various homogeneous regions of India, as defined by the Indian Meteorological Department (IMD). The outcome of this study is helpful in providing an in-depth understanding of the distinct contributions of LULC and CC on the hydrological processes in the tropical regions.

Keywords: Climate change, LULC, CLM4.5, India.