

An assessment of terrestrial water storage, rainfall and river discharge over Northern India from satellite data

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Terrestrial water storage (TWS) plays a key role in the global water cycle and is highly influenced by climate variability and human activities. In this study, monthly TWS, rainfall and Ganga–Brahmaputra river discharge (GBRD) are analysed over India for the period of 2003–12 using remote sensing satellite data. The spatial pattern of mean TWS shows a decrease over a large and populous region of Northern India comprising the foothills of the Himalayas, the Indo-Gangetic Plains and North East India. Over this region, the mean monthly TWS exhibits a pronounced seasonal cycle and a large interannual variability, highly correlated with rainfall and GBRD variations ($r > 0.8$) with a lag time of 2 months and 1 month respectively. The time series of monthly TWS shows a consistent and statistically significant decrease of about 1 cm year^{-1} over Northern India, which is not associated with changes in rainfall and GBRD. This recent change in TWS suggests a possible impact of rapid industrialization, urbanization and increase in population on land water resources. Our analysis highlights the potential of the Earth-observation satellite data for hydrological applications.