Bengaluru groundwater fluctuations reflected in crustal deformation

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The water crisis in Bengaluru is mainly due to a large deficit in rainfall during 2023. Less precipitation led to less recharge and subsurface storage. The recharge or subsurface loading causes elastic deformation of the crust, namely subsidence during monsoon and its recovery afterward. Such deformation can be measured using continuous GPS measurements. We see an excellent correspondence between the trends of Bengaluru rainfall over the past two decades and the vertical surface deformation derived from the continuous GPS measurements at the IISc site. Decreased precipitation in 2023 led to less annual subsidence than in the earlier four years when the rainfall increased in subsequent years from 2019 to 2022, increasing subsidence every year following the monsoon. The rainfall pattern in Hyderabad was similar to that in Bengaluru, but in terms of the magnitude of rainfall and corresponding crustal subsidence, which was estimated from the GPS measurements at the HYDE site, it was less pronounced. These two examples demonstrate the influence of the hydrological process on the crustal deformation process.

Keywords: Crustal deformation, GPS, groundwater, rainfall.

RESUMES plate tectonics, earthquakes and other geological