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Emerging instability in global terrestrial water storage since 2010

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Global terrestrial water storage (TWS) is an indicator of the integrated impact of climate variability on the environment. Accurate assessments of global TWS also facilitate the understanding of disturbances in global sea level rise. Gravity satellite GRACE has proved to be an effective tool in monitoring global TWS changes. With the latest observations of GRACE and GRACE Follow-on, we estimated the global TWS from April 2002 to October 2019, and found contrasting variations in global TWS before and after 2010. Before 2010, the global TWS was almost stable with variations that contribute only a few millimeters of sea level change; while the stability is ceased after the 2010/11 La Nina and three drastic fluctuations of up to 10 millimeters sea level contribution have occurred since then. We find these TWS changes have a good linear relationship with the global precipitation trend, rather than the accumulation of net precipitation, indicating that the precipitation trend is the main driving force of the recent global TWS instability. We further investigate the sensitivities of TWS to precipitation in basins.