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Links between global terrestrial water storage and large-scale modes of climatic variability

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Large-scale modes of climatic variability, or teleconnections, influence global patterns of climate variability and provide a framework for understanding complex responses of the global water cycle to global climate. Here, we examine how Terrestrial Water Storage (TWS) responds to 14 major teleconnections (TCs) during the 2003–2016 period based on data obtained from the Gravity Recovery and Climate Experiment (GRACE). By examining correlations between the teleconnections and TWS anomalies (TWSA) data, we find these teleconnections significantly influence TWSA over more than 80.8% of the global land surface. The El Niño-Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), and the Atlantic Multidecadal Oscillation (AMO) are significantly correlated with TWSA variations in 55.8%□56.2% and 60% the global land surface, while other teleconnections affect TWSA at regional scales. We also explore the TCs' effect on three key hydrological components, including precipitation (P), evapotranspiration (ET) and runoff (R), and their contribution to TWSA variations in 225 river basins. It's found the TCs generally exert the comprehensive but not equally impact on all three components (P, ET and R). Our findings demonstrate a significant and varying effect of multiple TCs in terrestrial hydrological balance.