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Can the Gravity Recovery and Climate Experiment (GRACE) mission detect hydrological droughts?

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Detecting and characterizing hydrological droughts at the global scale is a difficult task as several thousands of mid-to-large catchments remain ungauged or have limited discharge records. In water-limited regions, research on hydrological drought is even more complex because of the dominant streamflow perennial regime that characterizes small order watersheds.

Over the last decade, the emergence of global remote sensing products has remarkably improved the capability to observe different climate and land surface processes that affect catchment discharge. Among several observational satellites that provide continuous data on terrestrial hydrology, the Gravity Recovery and Climate Experiment (GRACE) is perhaps the only tool able to retrieve information about large-scale water storage variations across the world's terrestrial surface.

This work tests the hypothesis that water storage deficits derived from GRACE are inextricably linked to below-than-average baseflow values extracted from streamflow records. This study case analyzed several regions in Mexico and USA with different hydro-climate regimes. Drought conditions using total water storage variations and observed streamflow records from 2003 until 2013 were computed and compared. Results indicate that although the GRACE mission is moderately/highly correlated to streamflow and baseflow time series, discrepancies in the magnitude of hydrological deficit exist and can be attributed to active versus passive catchment storage issues. Finally, the suitability of creating an improved product to monitor hydrological drought by merging in situ with remote sensed information will be discussed.