

Drought Indicators Based on Model Assimilated GRACE Terrestrial Water Storage Observations

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ABSTRACT

The Gravity Recovery and Climate Experiment (GRACE) twin satellites observe time variations in Earth's gravity field which yield valuable information about changes in terrestrial water storage (TWS). GRACE is characterized by low spatial (>500 km) and temporal (> 10 day) resolution but has the unique ability to sense water stored at all levels (including groundwater) systematically and continuously. The GRACE Data Assimilation System (GRACE-DAS), based on the Catchment land surface model (CLSM) enhances the value of the GRACE water storage data by enabling spatial and temporal downscaling and vertical decomposition into moisture components (i.e. groundwater, soil moisture, snow), which individually are more useful for scientific applications. In this study GRACE-DAS was applied to North America and GRACE of a larger effort to demonstrate that drought conditions can be identified more accurately and objectively by integrating spatially, temporally and vertically disaggregated GRACE data into the U.S. and North American Drought Monitors. An extensive dataset of groundwater storage from USGS monitoring wells and soil moisture from the Soil Climate Analysis Network (SCAN) were used to assess improvements in the hydrological modeling skill resulting from the assimilation of GRACE TWS data. The results point toward significant improvements in the hydrological modeling skill across major parts of the United States, highlighting the potential value of GRACE assimilated water storage field for improving drought detection.