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Changes in water storage in Australia as resolved using GRACE gravity field solutions

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The GRACE gravity field solutions have been used in several studies to provide some constraint on how terrestrial water storage in Australia is changing, especially given the recent drought that has afflicted much of the country for most of the past decade. In this study we look at four regions of Australia, and compare/contrast how GRACE describes the behaviour of the terrestrial water storage. These areas are the Murray-Darling River Basin (MDRB) in the southeast corner of Australia, one of the primary agricultural regions that have been seriously afflicted by the drought, monsoonal Northern Australia, which has seen an increase in terrestrial water storage, the southwest corner of Western Australia (SWWA), another area of regional agricultural importance and the Lake Eyre district, an area that is usually extremely dry, but experiences occasional flooding.

We make use of the mascon solutions from the Goddard Space Science Laboratory, and apply principle component analysis to identify the most important spatial and temporal trend variability in the GRACE solutions. These are in turn compared to other datasets, namely ground truth data such as groundwater levels and river gauges from various government agencies (e.g. the Western Australian Department of Water), as well as precipitation data from the Tropical Rainfall Measuring Mission. Loss of mass, interpreted as a decrease in stored terrestrial water, is identified from the GRACE time series for the MRDB and SWWA, while an increase is seen in the monsoonal north, with significant mass fluctuations noted around Lake Eyre which are correlated with flooding events in other parts of Australia, e.g. Queensland.