The Gravity Recovery and Climate Experiment (GRACE) satellites provide valuable information on water variations over the globe. This variation is a climatic change indicator and exhibits nonlinear and complex interactions requiring that the hydrological signals be separated into their original sources. Such separation is vital for proper interpretation of GRACE-hydrological signals in regions such as Australia, where such signals have been statistically shown to be non-Gaussian. The principal component analysis (PCA) separation method, which has been widely used suffer from the inability to separate Australian GRACE-hydrological signals into their statistically independent sources. This is due to the fact that PCA uses only the second order statistical information contained in the correlation matrix of data to explain the maximum amount of variance in the dataset, which is unfavourable for analysing the weaker Australian signals. Independent component analysis (ICA) method that uses higher order statistics is here analysed for its suitability to process Australia's hydrological-signals from GRACE gravity data obtained from the four sources: GFZ, CSR, JPL, and ITG2010 (from Bonn University). To validate the results, WaterGAP Global Hydrology Model and Tropical Rainfall Measuring Mission (TRMM) rainfall dataset are employed. Compared to the PCA, the ICA results show a remarkable improvement in separating the hydrological signals into their regional sources, what so far was unachievable by PCA. The impact of the 2006-2007 droughts on Australian water resource is clearly identified in the southern Australia, Murray Darling Basin and the Western Australia regions, while the recent 2010-2011 floods are also visible in eastern Australia.

Keywords: PCA, ICA, GRACE, Australian hydrological signal