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## Assessment of Meteorological and Hydrological Droughts and Floods over mainland Australia based on Drought Indices

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Climate change has led to increased droughts and floods over mainland Australia, resulting in water scarcity, excessive surplus and socioeconomic losses. Therefore, it is of great significance to comprehensively evaluate droughts and floods from the meteorological and hydrological perspective. Firstly, we determine the Standard Precipitation and Evapotranspiration Index (SPEI) by correlation analysis to represent the meteorological conditions. To characterize the hydrological conditions, we calculate the hydrological drought indices including Standard Runoff Index (SRI), Soil Moisture Deficit Index (SMDI), and Total Storage Deficit Index (TSDI), using the runoff and soil moisture data from the Global Land Data Assimilation System (GLDAS) and the Terrestrial Water Storage Change (TWSC) data from Gravity Recovery And Climate Experiment (GRACE) respectively. Results show that the most severe hydrological drought over mainland Australia during the study period occurred from May 2006 to Jan. 2009 with the drought severity of -58.28 (cm months) and the most severe flood from Jun. 2010 to Jan. 2013 is with the severity of 151.36 (cm months). The comprehensive analysis of both meteorological and hydrological drought indices shows that both meteorological and hydrological drought indices can effectively detect the droughts and floods over mainland Australia. Moreover, the meteorological drought and flood are of higher frequency, while hydrological drought and flood have a relatively longer duration. Based on the cross-correlation analysis, we find that the SPEI can firstly reflect the droughts or floods over mainland Australia, and then the SRI, SMDI and TSDI reflect with the time lags of one, three and six months respectively. Furthermore, we calculate the frequency of drought and flood at the basin scale and find that SPEI and SMDI are equally sensitive to drought and flood, while TSDI is more sensitive to flood than drought. This study reveals the relationship between meteorological and hydrological conditions in mainland Australia in the last two decades and highlights its intensifying extreme climate conditions under the circumstances of the increasing temperature and complex changing precipitation.