



Anomalies of hydrological cycle components during the 2007 heat wave in Bulgaria

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Heat waves have large adverse social, economic and environmental effects which include increased mortality, transport restrictions and a decreased agricultural production. The estimated economic losses of the 2007 heat wave in South-east Europe exceed 2 billion EUR with 19 000 hospitalisation in Romania only. Understanding the changes of the hydrological cycle components is essential for early forecasting of heat wave occurrence. Valuable insight of two components of the hydrological cycle, namely Integrated Water Vapour (IWV) and Terrestrial Water Storage Anomaly (TWSA), is now possible using observations from Global Navigation Satellite System (GNSS) and Gravity Recovery And Climate Experiment (GRACE) mission. In this study anomalies of temperature, precipitation, IWV and TWS in 2007 are compared to 2003–2013 period for Sofia, Bulgaria. In 2007, positive temperature anomalies are observed in January, February and July. There are negative IWV and precipitation anomalies in July 2007 that coincides with the heat wave in Bulgaria. TWSA in 2007 are negative in January, May and from July to October being largest in August. Long-term trends of: 1) temperatures have a local maximum in March 2007, 2) TWSA has a local minimum in May 2007, 3) IWV has a local minimum in September 2007, and 4) precipitation has a local maximum in July 2007. The TWSA interannual trends in Bulgaria, Hungary and Poland show similar behaviour as indicated by cross correlation coefficients of 0.9 and 0.7 between Bulgaria and Hungary and Bulgaria and Poland respectively. ALADIN-Climate describes the anomalies of temperature and IWV more successfully than those of precipitation and TWS