



Groundwater storage variations in Madrid (Central Spain) from InSAR data

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Groundwater resources are decreasing in many regions of the world and the future water supply for many populations is threatened. Future climatic conditions and population growth are expected to intensify the problem. Identifying where groundwater storage loss is occurring and understanding the factors that control this process is crucial to mitigate its adverse consequences. In this work, we apply satellite-based measurements of ground deformation over the Tertiary detritic aquifer of Madrid (TDAM), Central Spain, to infer the spatio-temporal evolution of water levels and identify areas vulnerable to groundwater storage loss. Using Interferometric Synthetic Aperture Radar (InSAR) data during the period 1992-2010 and piezometric time series on 19 well sites covering the period 1997-2010, we model groundwater levels and estimate reservoir capacity variations during the study period. This information is used to quantify groundwater storage loss and identify vulnerable areas. Our results reveal a region of ~ 200 km² where groundwater storage loss occurred in two different periods, 1991-1999 and 2005-2010. A combination of factors including the occurrence of two severe droughts and the existence of multiple private wells exploited by local entities and individuals for water supply, are probably controlling the inferred groundwater storage loss. This study illustrates how InSAR data can be used to detect vulnerable areas with a tendency to loss storage so that measures can be implemented to mitigate its adverse consequences in future drought periods.