COMPARISON of GRACE MASCON and DDK-DERIVED HYDROLOGICAL TRENDS in TURKEY

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Since 2002, GRACE (Gravity Recovery And Climate Experiment) has provided unprecedented information about the temporal variation of the Earth's gravity field. It has been shown that GRACE is very sensitive to the hydrological events and their changes in time. Therefore, generally, the Equivalent Water Thickness (EWT) geopotential function is considered in GRACE-related studies to examine the hydrological events on the land basin by basin or region by region up to the resolution of several hundred kilometers. The EWT can be derived from the original data of GRACE satellites (Level-1 data), from the monthly spherical harmonic models (Level-2 data) provided by some process centers (GFZ, CSRS etc.) and from the time-series of the points or mascons on the physical surface (Level-3 data). The most popular Level-2 data is the so-called DDK models in which the spherical harmonic coefficients are stripped from their some correlations while the most recent Level-3 data is the one dealing with the mascons provided by JPL and NASA-GSFC. An EWT signal from each data type consists of a trend, annual and semi-annual sinusoidal signals. Trend estimation of each point or mascon is realized by considering these periodical signals.

In this study, the EWT trend estimates from the 14-years EWT signals of some DDK models (DDK1, DDK2, DDK3 and DDK4) and mascon solutions of GSFC in Turkey are compared for four hydrological basins, namely Western Blacksea, Sakarya, Konya and Firat-Dicle basins. Although it is shown that the DDK-1 model is the most compatible Level-2 data model with the Mascon solution all over the land of Turkey (most of the differences are less than 0.5 cm/year), the comparisons for each basin show different characteristics: DDK2, DDK4, DDK3 and DDK4 models give the most compatible trend estimates for Western Blacksea, Sakarya, Konya and Firat-Dicle basins, respectively. For the Western Blacksea basin, the difference is about 0.3 cm/year while the differences for the other basins are about 0.01 cm/year. It is obvious that the big difference in the Western Blacksea basin is due to the signal leakage from the Blacksea of which effect is not considered in the DDK solutions. This result also shows that the other basins are not affected by the signal leakage as much as the lands near the Blacksea in Turkey.

Keywords: GRACE, Mascon, DDK, Equivalent Water Thickness, Turkey, Hydrological Signal.