Sensitivity of groundwater depletion rates estimated from different GRACE products and water balance models of different spatial scale

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Abstract. Observations of gravitational field anomalies monitored by the Gravity Recovery and Climate Experiments (GRACE) satellite mission have recently been used to estimate regional-scale groundwater depletion. Different GRACE products are available such as the JPL 1°x1° GRACE Tellus dataset and the University of Colorado (CU) dataset of regional-averages. In order to estimate groundwater depletion rates, GRACE data must be used in conjunction with auxiliary hydrologic and land-use information such as soil moisture, vegetation types, snow storage, etc. These auxiliary datasets are usually estimated using coarse scale (usually 1°x1°) hydrological/land surface observations and models. Therefore, it is important to quantify the sensitivity of estimates of groundwater depletion to different GRACE products, types of auxiliary datasets, and different spatial scales. In this study we present results of an analysis of groundwater depletion trends for the Central Valley aquifer of California using three different GRACE products: i) GRACE Tellus, ii) CU GRACE data and iii) Scaled CU data (filtered CU data optimally scaled to capture peaks in observed water balance). In addition, a sensitivity analysis with respect to the spatial scale of the hydrologic model (*i.e.*, Variable Infiltration Capacity) is presented, which involves using estimates of soil moisture and snow storage at the following three different spatial scales: i) 1 degree, ii) $1/8^{th}$ degree and, iii) $1/16^{th}$ degree. Results of the analysis shows that groundwater depletion estimates are sensitive to GRACE product with estimates of optimally scaled GRACE product significantly higher than the other two products. However, these estimates are found insensitive to the spatial scale of the hydrologic model.