Minimizing filtering induced changes to GRACE signal at catchment scale

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Filtering is essential to extract meaningful information from the noisy gravity fields produced by the Gravity Recovery And Climate Experiment (GRACE) satellites. Filtering suppresses noise, but also changes the signal, which increases the uncertainty in GRACE results. In order to minimize the signal change, various approaches have been developed. For example, the additive approach, the multiplicative approach, the scaling approach and many more. These methods use a hydro-geophysical model to compute mathematical quantities such as bias, leakage, or scale factors, which are used to correct the amplitude of filtered GRACE products. Since GRACE should ideally improve the hydrological models, we do not want to use models to improve GRACE. These hydro-geophysical models have uncertainty that varies spatially and temporally, therefore using them to correct GRACE would propagate uncertainty to the corrected GRACE products. In addition to this, these approaches assumed that filtering affects only the amplitude of the signal, but we show that the phase is also affected.

We propose a data driven method to minimize effects of filtering at catchment scale. We validate our approach in a closed-loop environment, and show that it is performing better than other popular approaches. We apply our method to GRACE products and validate the results by closing the water balance equation for more than 25 catchments. The components of water balance equation are selected from a permutation and combination of various precipitation data sources, evapotranspiration models and GRDC observed runoff.

Keywords: GRACE, filtering, water balance

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