



Continental hydrology retrieval from GPS timeseries and GRACE gravity solutions

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Monitoring of continental hydrology by measuring gravity variations is one of the primary aims of the Gravity Recovery and Climate Experiment (GRACE) mission. We proposed to combine the GRACE measurements with International GPS Service (IGS) time series to strengthen the long wavelengths of the hydrology solution. This strategy is necessary because GRACE monthly gravity solutions not (yet) match the targeted baseline accuracies at the lower spherical harmonic degrees. New in our approach is the introduction of a physically motivated regularization method that guarantees stable inversions up to higher degrees, while seeking to avoid spatial aliasing. Previous studies with GPS data have used least squares estimators, and impose constraints through low-degree spherical harmonic series truncation. We will demonstrate that the new proposed estimator outperforms existing inversion methods in the presence of realistic load distributions. Essential is the removal of known geophysical effects such as the atmospheric pressure loading which are necessary to estimate annual variations of continental scale mass redistributions. Our hydrology solutions are compared to those observed with GRACE and solutions provided via a hydrology models, although it must be mentioned that systematic differences appear. We estimate the individual contributions of GRACE and GPS data in a joint inversion. In this we estimate that GPS contributes up to 60% to degree 2 till 4 spherical harmonic coefficients, and up to 30% for higher-degree tesseral coefficients.