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1 Filter design for GRACE monthly gravity field models

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The estimation of terrestrial water storage variations at river basin scale is one of the many valuable applications of the Gravity and Climate Experiment (GRACE). When computing mean storage variations from GRACE monthly gravity field models, spatial filtering is mandatory to reduce random and systematic errors. The choice of the filter has a strong influence on the estimated amplitude of the mean water storage variations, which makes the design of optimal filters an important issue. A broad range of filters and filter parameters have been proposed so far ranging from simple Gaussian isotropic filters to more sophisticated non-isotropic filters such as Wiener optimal filters and regularization-type filters. The choice of the filter parameters is done in different ways, ranging from a trial-and-error approach to statistically optimal filters exploiting a-priori information about expected water storage variations and noise in monthly GRACE gravity field models.

The objective of this presentation is to compare different filters and to assess their performance. Among the filters to be compared are the Gaussian isotropic filter, the isotropic Gauss-Weierstrass filter, various implementations of Wiener optimal filters, regularization-type filters, and the destriping technique.

We use RL04 GRACE monthly gravity field models to estimate mean water storage

variations over the Zambezi river basin using the different filters. The performance of the filters is assessed by a comparison with the output of the TU Delft Lumped Elementary Watershed (LEW) model, a high-quality regional hydrological model of the Zambezi river basin. We also analyze the sensitivity of the filter output with respect to variations of the filter parameters and uncertainties in the a-priori information used to design the filters. Finally, we quantify the errors introduced when applying filtering to monthly GRACE models.