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Adaptive Filtering for Deformation Parameter Estimation Considering both of Geometrical Measurements and Geophysical Models

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There are two kinds of methods in researching the crust deformation, that is, geophysical method and geometrical (or observational) method. Big differences usually exist in the two kinds of results, because of the datum differences, geophysical model errors, observational model errors etc. Combining the two kinds of information to pick up the crust deformation information is a reasonable way. To reasonably use the reliable geometrical and geophysical information, we have to control the observational and geophysical model error influences on the estimated deformation parameters, as well as to balance their contributions to the evaluated parameters. A hybrid estimation strategy for evaluating the deformation parameters employing an adaptively robust filtering is proposed in this paper. The effects of measurement outliers on the estimated parameters are controlled by robust equivalent weights. Adaptive factors are introduced to balance the contribution of the geophysical model information and the geometrical measurements to the model parameters. The datum for the local deformation analysis is mainly determined by the high accurate IGS station velocities. The hybrid estimation strategy is applied in an actual GPS monitoring network. It is shown that the hybrid technique employs local repeated geometrical displacements to reduce the displacement errors caused by the mis-modeling of geophysical technique, and improves the precision of the estimated crust deformation parameters.