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On the impact of reducing global geophysical fluid model deformations in SLR data processing

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Mass redistributions in the atmosphere, oceans and the continental hydrology cause elastic loading deformations of the Earth's crust and thus systematically influence Earth-bound observation systems such as VLBI, GNSS or SLR. Causing non-linear station variations, these loading deformations have a direct impact on the estimated station coordinates and an indirect impact on other parameters of global space-geodetic solutions, e.g. Earth orientation parameters, geocenter coordinates, satellite orbits or troposphere parameters. Generally, the impact can be mitigated by co-parameterisation or by reducing deformations derived from global geophysical fluid models. Here, we focus on the latter approach.

A number of data sets modelling the (non-tidal) loading deformations are generated by various groups. They show regionally and locally significant differences and consequently the impact on the space-geodetic solutions heavily depends on the available network geometry. We present and discuss the differences between these models and choose SLR as the speace-geodetic technique of interest in order to discuss the impact of atmospheric, oceanic and hydrological loading on the parameters of space-geodetic solutions when correcting for the global geophysical fluid models at the observation level. Special emphasis is given to a consistent usage of models for geometric and gravimetric corrections during the data processing. We quantify the impact of the different deformation models on the station coordinates and discuss the improvement in the Earth orientation parameters and the geocenter motion. We also show that a significant reduction in the RMS of the station coordinates can be achieved depending on the model of choice.