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The OS LISFLOOD hydrological model provides global, high-resolution simulations of terrestrial water storage (TWS) for use in hydrological and geodetic studies. While its consistency with GRACE and GRACE-FO data has been explored, a systematic evaluation extending into the pre-GRACE era has not yet been carried out. Independent gravimetric datasets from Satellite Laser Ranging (SLR), together with combined SLR+GRACE and SLR+DORIS gravity field solutions, enable such an assessment over nearly three decades, reaching back to 1995.

In this study, we validate OS LISFLOOD results against these observation-based datasets and benchmark its performance against the established Land Surface Discharge Model (LSDM). The evaluation is conducted for the world’s largest river basins, focusing on both long-term variability and seasonal signals. By harmonizing SLR with GRACE- and DORIS-based fields, we are able to provide a continuous record and extend model validation into the period before the GRACE era.

The comparison shows that OS LISFLOOD captures large-scale TWS variability in many major basins, with particularly good consistency in low-latitude regions such as the Amazon, Congo, Orinoco, and Ganges–Brahmaputra. Agreement is weaker at high latitudes and in arid zones, reflecting challenges in simulating snow, ice, and human impacts. Compared to LSDM, OS LISFLOOD generally performs better in low-latitude regions, though both models show limitations for interannual variability. Some discrepancies may also arise from SLR-based solutions themselves, which face difficulties in resolving smaller basins, complicating model evaluation in such areas.

Our findings demonstrate the potential of SLR-derived gravity fields to extend hydrological model evaluation beyond the GRACE period. They also confirm that OS LISFLOOD provides a useful tool for investigating multi-decadal water storage variability, offering complementary perspectives to other global models and supporting applications in large-scale hydrology and geodesy.
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galdyn-filip.pdf
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