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SWOT Mission Capabilities for the Prediction of Flow-Duration Curves: A Global Scale Assessment

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The Surface Water and Ocean Topography (SWOT) satellite mission will provide high-resolution estimates of riverine water surface characteristics, such as river surface width, elevation and slope. Those parameters will enable a global estimation of river discharges flowing into rivers wider than 100 m, with a temporal resolution varying from 3 to 10 days, in dependence of latitude. Although errors on streamflow estimates are expected to be highly dependent on flow regimes and geomorphic conditions, the mission potential on providing insights on the hydrological regime of inland rivers is still not fully investigated. To this end, in this study we propose a comparison of remotely sensed and empirical period-of-record flow-duration curves (FDCs) on worldwide basis. We used the Global Runoff Data Centre (GRDC) dataset, the world largest and freely available source of streamflow data. We filtered the original dataset by selecting only those sites that matched 2 criteria: river width larger than 100 m and streamflow time series longer than 10 years of continuous daily discharges. Such dataset query resulted in 1200 gauged river cross-sections readily available to be used for our purposes. To simulate SWOT observations, each record has been reduced following 4 different sampling scenarios, i.e. 3, 5, 7, and 10 days interval for a 3-year moving time-frame (i.e., SWOT mission lifetime). We then corrupted gauged data with random errors sampled from a gaussian distribution having zero mean and 30% standard deviation. For each site, we obtained a set of SWOT simulated FDCs to compare with their empirical counterparts. We found that tropical and temperate climates deliver good estimates throughout flow regimes, whereas, mostly arid climates may have higher uncertainties, especially for high- and low-flows.