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River discharge estimation from multi-mission altimetry with optimized spatial coverage and temporal resolution

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One of the main challenges of hydrological modeling is the poor spatio-temporal coverage of in situ discharge databases. The global network of in situ gauges is declining steadily over the past few decades. It has been demonstrated that altimetry-derived water height over rivers can sensibly be used to deal with the growing lack of in situ discharge data. However, the altimetric discharge is often estimated from a single virtual station with a coarse temporal resolution, dictated by the satellite repeat period (10 or 35 days).
In this study, we implement an assimilation scheme that connects all virtual stations of several satellite altimeters along the main stream and tributaries distributed over a catchment. This helps to generate densified water level time series with temporal resolution of less than $\sim$3 days at any given location in the catchment. We then propose a scheme that extends the current one-on-one relationship between a discharge gauge and a nearby (densified) virtual station towards a methodology which links multiple virtual stations to all available gauges. We assess our method over the Amazon river/basin/catchment, where we have access to in situ discharge data from GRDC, and where multiple altimetric water level time series from different missions are available.