Towards the estimation of reach-averaged discharge from SWOT data using a Manning's equation derived algorithm. Application to the Garonne River between Tonneins-La Reole

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The future NASA-CNES-CSA Surface Water and Ocean Topograpraphy (SWOT) satellite mission will be launched in 2020 and will deliver maps of water surface elevation, slope and extent with an un-precedented resolution of 100m. A river discharge algorithm was proposed by Durand et al. 2013, based on Manning's equation to estimate reach-averaged discharge from SWOT data. In the present study, this algorithm was applied to a 50-km reach on the Garonne River with an averaged slope of 2.8m per 10000m, averaged width of 180m between Tonneins and La Reole. The dynamics of this reach is satisfyingly represented by the 1D model MASCARET and validated against in-situ water level observations in Marmande.

Major assumptions of permanent flow and uniform conditions lie under the Manning's equation choice. Here, we aim at highlighting the limits of validity of these assumptions for the Garonne River during a typical flood event in order to estimate the applicability of the discharge algorithm over averaged reach.

Manning-estimated and MASCARET discharges are compared for non-permanent and permanent flow for different reach averaging (100m to 10 km). It was shown that the Manning equation increasingly over-estimates the MASCARET discharge as the reach averaging length increases. It is shown that the Manning overestimate is due to the effect of the sub-reach parameter covariances. In order to further explain these results, this comparison was carried out for a simplified case study with a parametric bathymetry described either by a flat bottom ; constant slope or local slope variations.