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Hydrological variability from gauging stations and simulated SWOT data, for major French rivers over the past decades

Laetitia Chevalier (1,2), Benoit Laignel (1), Imen Turki (1), Florent Lyard (2), and Christine Lion (2)

(1) University of Rouen, UMR 6143 M2C, 76821 Mont Saint Aignan, France; CNRS, UMR 6143 M2C, 76821 Mont Saint Aignan, France; SFR SCALE, 76821 Mont Saint Aignan, France, (2) CNES/LEGOS, University of Toulouse, Toulouse, France

This study was carried out in the framework of the program Surface Water and Ocean Topography (SWOT) associated to the National Center of Space Studies (CNES). Basing on discharge measurements, and simulated Surface Water and Ocean Topography (SWOT) data, we have investigated the hydrological variability of the main French rivers (Seine, Loire, Garonne and Rhône) by the use of a minimum, maximum and mean annual discharge analyses, Loess and wavelet approach (continuous wavelet analyses and wavelet coherence analyses). Results show (i) strong coherence between the four watershed discharges, varying between 73% and 92% and (ii) three different periods for hydrological variability: before 1970, between 1970 and 1990, and after 1990. From these results, simulated SWOT data and discharges are compared for these three periods using same analyses. Simulated SWOT data are obtained by re-sampling river discharges from the SWOT crossing time calculated. Simulated SWOT data can reproduce the hydrological variability of rivers despite number of SWOT passages (from two to four). These results are validated by coherence wavelet, which underlines coherence higher than 90% between simulated SWOT data and in-situ discharge. However, the results indicate that simulated SWOT data don't reproduce exactly the minimum and maximum annual discharge: (i) maximum annual SWOT data are underestimated and (ii) minimum annual SWOT data are overestimated