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IRIS: Global River Surface Slopes from ICESat-2

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The global reach-scale “ICESat-2 River Surface Slope” (IRIS, <https://doi.org/10.5281/zenodo.7098113>) dataset comprises average and extreme water surface slopes (WSS) derived from ICESat-2 observations between October 2018 and August 2022 as a supplement to 121,583 reaches from the “SWOT Mission River Database” (SWORD, Altenau et al., 2021). WSS is required to calculate river discharge, which is among the Essential Climate Variables as defined by the Global Climate Observing System.

To gain full advantage of ICESat-2’s unique measurement geometry with six parallel lidar beams, the WSS is determined across pairs of beams or along individual beams, depending on the intersection angle of spacecraft orbit and river centerline. The combined results of both approaches are validated against in-situ data in a regional study at 815 reaches in Europe and North America with a median absolute error of 23 mm/km, almost complying with the SWOT science requirements of 17 mm/km (Scherer et al., 2022).

IRIS can be used to research river dynamics, estimate river discharge, and correct water level time series from satellite altimetry for shifting ground tracks. Additionally, by referencing SWORD as a common database, IRIS may be used in combination with observations from the recently launched SWOT mission and could be easily compared against WSS measurements from SWOT’s new wide-swath sensor.