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Surface waters monitoring by satellite altimetry

M-C. Gennero, J-F. Crétaux, C. Maheu, K. Do Minh, S. Calmant, A. Cazenave

LEGOS, Toulouse, France (marie-claude.gennero@cnes.fr / Fax: (+33) (0)5 61 25 32 05 / Phone: (+33) (0)5 61 33 29 35)

Water level measurement by satellite altimetry has been developed and optimized for open oceans. Nevertheless, the technique is now applied to obtain water levels of extensive inland seas, lakes, rivers, floodplains and wetlands. Several satellite altimetry missions have been launched since the early 1990s : ERS-1 (1991-1996), Topex/Poseidon (1992-), ERS-2 (1995-), GFO (2000-), Jason-1 (2001-) and ENVISAT (2002-). We have developed a global data base of water level time series over lakes and rivers based on satellite altimetry. Most of the water level time series of the data base are constructed using the Topex/Poseidon GDRs data, but a number of lakes water levels are based on ERS, GFO and Envisat data.

To construct water level time series on rivers, we need to define virtual stations corresponding to the intersection of the satellite track with the river. For that purpose, we select a rectangular 'window' taking in all available along track 10Hz (for T/P) altimetry data over the river area corresponding to at least one orbital cycle. The coordinate of the virtual station is defined as the barycenter of the selected data within the 'window'. After rigourous data editing, all available 10 Hz data of a given cycle are combined into a single measurement through simple numerical averaging. At the time of writing, about 50 lakes and 50 virtual stations on rivers worldwide are available. In addition to revealing the spatial and temporal signature of climate variability on water levels, systematic use of satellite altimetry in large river basins might support initialization and verification of models used in forecasts of hydrological variability, and, possibly, estimates of river discharge where rating curves can be established by surface-based methods. Another important application of altimetry in hydrographic basins is the determination of vertical references linked to the terrestrial reference system in which in situ hydrographic measurements can be expressed.