Global inland water monitoring from satellite radar altimetry – a glimpse into the future

P.A.M. Berry¹, M.K. Salloway¹, R.G. Smith¹, J. Benveniste²
¹EAPRS Lab, De Montfort University, Leicester, UK
²ESA ESRIN, Via Galileo Galilei, Frascati, Roma, Italy

Satellite Altimetry has been used to monitor the heights of the Earth’s largest lakes for many years; however, river systems present far more challenging targets. Although they contain only a small proportion of the total inland water budget, these ‘river corridors’ are vital for human life, transporting and distributing fresh water throughout the continents. Over these surfaces fewer echoes are returned, and these are frequently contaminated by responses from surrounding land, irrigation and wetlands. However, using an expert system approach, echoes from smaller lakes and river systems can be successfully retracked to yield height measurements. As the network of in-situ gauges declines, this remote measurement technique gives a unique insight into the Earth’s changing inland water resources.

This paper presents a global analysis of the capability of the current generation of satellite radar altimeters to monitor inland water, including ERS2, EnviSat, TOPEX, Jason1 and Jason2. The results are analysed using an automated grading technique validated using in-situ gauge data over the Amazon basin; the results demonstrate that EnviSat is the most successful altimeter to date, with 25636 targets acquired of which 3512 now produce viable height time series.

A glimpse into the potential of future altimeters is gained from the EnviSat altimeter (RA-2) Individual Echoes, with 1800Hz along-track sampling rate. This paper also presents results from a global analysis of these echoes, and hence demonstrates the substantial enhancement in monitoring capability afforded by the next generation of satellite altimeter missions.