

# Satellite Radar Altimetry to Measure Water Heights in Coastal and Inland Waters

Stefano Vignudelli

Consiglio Nazionale delle Ricerche (CNR), Pisa, Italy

doi: <https://doi.org/10.21467/abstracts.93.64>

## ABSTRACT

Radar altimetry is a remote sensing technique to measure water height changes from space. It was originally designed to monitor deep oceans, however, it showed the possibility to extend observations to coastal zones and over land. The archive of almost two decades (since 1993) of altimeter data and the seven missions now flying together provide a unique global data set of water surface elevations. It has been used to complement in situ networks and provide measurements where no data exist or are not accessible. However, the retrieval of accurate water heights has been challenging in areas where land and water surface inhomogeneity can contaminate the radar signal and complicate the algorithms for their estimation.

One of the advantages of satellite radar altimetry is that measurements are collected globally in any weather conditions. The coastal zone is affected by several local ocean processes, all impacting the sea surface elevation at different scales. Coastal dynamics has smaller spatial and temporal scales than open ocean and requires a monitoring at finer-scale that is difficult to satisfy with only sparse tide gauges. The usage of altimeter data over inland waters was initially restricted to a limited number of large water targets, due to the large native footprint size of the radar altimeter. Altimeter data are essential in poorly gauged areas to help flood mapping/modeling or water security/resources.

In recent years, adapted reprocessing of the data using new dedicated algorithms (e.g., re-tracking) and improved methods of correction and editing made available coastal and inland altimetry data sets. Moreover, new technological solutions promised improved capabilities over water targets near land, with the CryoSat-2/Sentinel-3 A/B missions equipped with an altimeter operating in Synthetic Aperture Radar (SAR) mode and the SARAL mission carrying onboard the first Ka band altimeter (AltiKa) with its smaller radar footprint. All these missions are demonstrating that a finer along-track spatial resolution and a better precision on retrieved water heights can be achieved. The coming SWOT mission, expected to be launched in 2021, will provide for the first time global imagery of water heights.

A review of recent advances in developing and exploiting altimetry for measuring water heights in the coastal zone and over land is provided, with an overview of the various experimental coastal and inland altimetry products now available and validated in some regions, thus being used in research studies. The quality of these products is constantly improved. Examples of applications emerge through a synergy with in-situ observations, other satellite data sources and modelling in understanding and forecasting of important environmental events. A catalogue of champion case-studies will be showed.

## Reference

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