

Altimetry of Lakes for Orbit Evaluation and Measurement of Lake Level Variation

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Although satellite radar altimeter are designed for measuring sea level over the open ocean, an altimeter will establish lock and track over moderate-sized lakes. The ability to establish lock over inland waters depends on the characteristics of the altimeter. Temporal changes in the altimeter-derived lake levels are actually a combination of real lake-level variation and altimeter (primarily orbit) error. If the change in lake level is known, the temporal variation of the orbit error for a given pass over the lake can be evaluated.

Collinear analysis of altimeter data over short groundtracks, such as lakes, present different problems than those encountered when analyzing ocean data. We will present a technique developed to overcome these difficulties, which, for each pass over a lake, returns accurate estimates of the average lake surface and the temporal lake level/orbit error variation.

We have applied this technique to data collected over the Great Lakes by both GEOSAT and TOPEX/POSEIDON (Interim GDRs). Lake levels, obtained from the Great Lakes Division, NOAA/National Ocean Service, were used to eliminate the change due to the variation of the lakes. The resulting orbit error for GEOSAT is not random, but is correlated to the 11-month synodic period of the satellite (i.e., the local time of day of the overflight). Our analyses have also demonstrated that, with the improvement in orbits for current and future altimetry satellites, routine monitoring of lake levels for hydrological purposes is feasible.

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