



Evaluation of Sentinel-3 SRAL SAR Altimetry over Recently Constructed Global Reservoirs

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Satellite radar altimetry is increasingly being used for hydrological studies. However, it is still challenging to deliver high quality data over inland water bodies, i.e. lakes, rivers and reservoirs. One of the reasons is that the positioning of the range window is difficult due to highly variable topography and water surface elevation. To address this issue, Sentinel-3, the first SAR altimeter operating at global scale, is configured with a new on-board tracking system, i.e. open-loop mode. An open-loop tracking system can position the range window very efficiently based on a priori surface elevation stored on-board. In this context, a suitable a priori surface elevation of inland water bodies is very important.

Sentinel-3 is operating based on a pseudo-DEM controlled through the Open-Loop Tracking Command (OLTC). The current OLTC V5 (operated after March 2019) is generated based on an inland water mask and Altimeter corrected Elevations (ACE-2), which is created using multi-mission Satellite Radar Altimetry from 1994-2005 in combination with the Shuttle Radar Topography Mission (SRTM). However, OLTC V5 still misses some inland water bodies and contains some incorrect surface elevations, especially over newly built reservoirs, where the difference between water surface elevation and ACE-2 can exceed 100m.

In this study, a comprehensive evaluation of Sentinel-3A (S3A) is conducted at 26 globally-distributed recently constructed large reservoirs. The results show that S3A fails to deliver useful data over most new reservoirs in open loop due to the incorrect a priori elevations stored in OLTC V5. On the contrary, S3A closed-loop (operated before March 2019) can deliver useful data in many cases.

To improve the OLTC table, we propose two approaches. The first one is to use dam height to correct the a priori surface elevation, which is relevant for very recently completed dams or dams under construction. The other is to use water surface elevation from Cryosat-2 to update the OLTC table. The approaches are demonstrated for reservoirs located on the Lancang and Nu rivers in the Southwest of China. The updated OLTC table will help exploit the Sentinel-3 radar altimetry mission to its full potential, enabling it to correctly track water surface elevation in a larger number

of water bodies.