



Current topic for a Master's Thesis

Inland water levels from Sentinel-3: How can SAR altimetry improve the height estimation of river and lakes?



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sentinel-3

Satellite altimetry was designed to provide highly accurate measurements of sea surface heights over open ocean areas. However, it can also be used for inland water level monitoring of lakes and rivers when dedicated processing techniques are applied. Classical altimetry missions such as Jason-3 or Envisat yield decimetre-accuracies for water level time series of medium sized water bodies.

In contrast to the missions using classical pulse-limited altimeters, the satellites of the Copernicus Sentinel-3 mission are equipped with innovative instruments operating in Delay-Doppler mode (so-called SAR altimetry). Due to the better along-track resolution and multiple observations under different observation angles (so-called stack data) these missions are expected to provide improved inland water level heights.

In this thesis, the potential of Sentinel-3 data for inland water applications shall be investigated. The application of full stack data in comparison with pre-processed radar echoes shall be studied, and the improvement with respect to classical missions (e.g. Jason-3) shall be quantified. The analysis shall be performed for different types of inland water bodies (larger lakes, smaller lakes, rivers of different widths). The results shall be validated by a comparison with in-situ gauging data.

Main tasks:

- Understanding the measurement principles of classical satellite altimetry and SAR altimetry as well as their technical differences
- Development and implementation of different processing strategies to estimate water level time series for Sentinel-3 (based on waveforms, radargrams, full stack information)
- Computation of water level time series for different lakes and rivers
- Investigation of precision and accuracy of different water level time series with respect to in-situ data from gauging stations
- Comparison of the results with water level time series from DGFI-TUM's inland altimetry data base DAHITI (from Sentinel-3 and Jason-3)

References:

- Boergens E., Schwatke C., Dettmering D.: Performance of Sentinel-3A for the Observation of Water Level Variations of Rivers and Lakes. OSTST Meeting, Ponta Delgada, Azores, Portugal, 2018-09-27 (Poster)
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- Schwatke C., Dettmering D., Bosch W., Seitz F.: DAHITI – an innovative approach for estimating water level time series over inland waters using multi-mission satellite altimetry. Hydrology and Earth System Sciences 19(10): 4345-4364, 10.5194/hess-19-4345-2015, 2015

Institute Deutsches Geodätisches Forschungsinstitut der TUM (DGFI-TUM)
Supervisors Dr. Denise Dettmering / Christian Schwatke / Prof. Dr. Florian Seitz
Contact denise.dettmering@tum.de; phone: 089/23031-1198