A Wet Tropospheric Correction dedicated to hydrological and coastal applications

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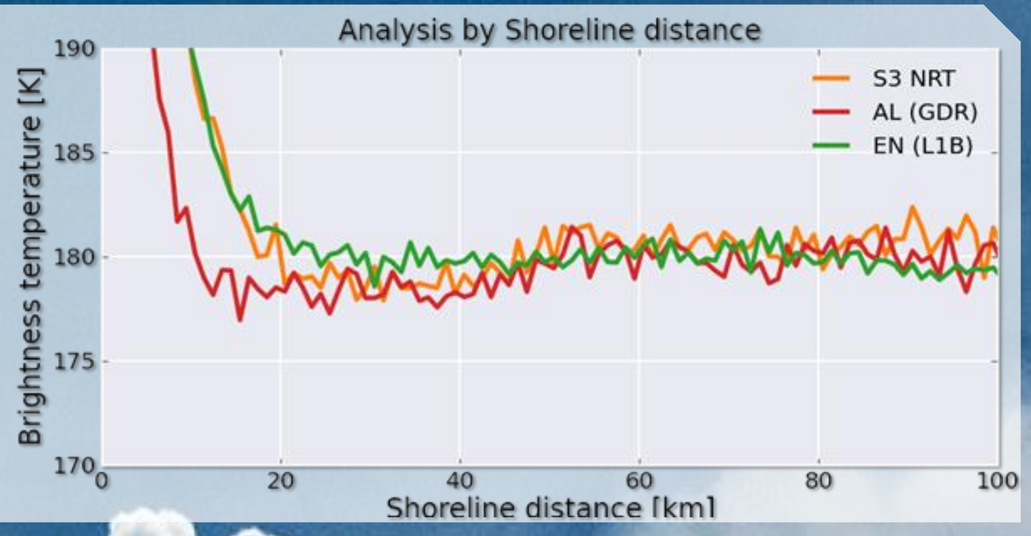
The **Wet Tropospheric Correction (WTC)** retrieval algorithm developed since years in collaboration between IPSL and CLS is based on a semi-empirical approach. Based on simulated parameters **(brightness temperatures (TB)** and **altimeter backscattering coefficient (sigma0)**) and neural networks, it proved to estimate a WTC with an optimal performance with respect to the quality of the altimetry system. For coastal areas, due to the land contamination on TB pixels, the wet tropospheric correction is impacted from 25 km up to the shoreline. A new empirical approach based on measurements instead of simulations and using additional information on land proportion in the Field Of View has been developed.

The Land Contamination

Land contamination in the main lobe is the 1st order source of WTC retrieval error over inland water and coastal areas.
TB over land areas are much larger than over water: ~280 K vs ~180 K.
MWR radiometers have a main lobe diameter **(FOV for Field Of View)** from 10 km (AltiKa) to 30 km (Envisat).
Contamination usually occurs between 2.0 and 2.5 times the radius from coastline
Right, averaged 23.8 GHz TB over ocean against distance to coast for AltiKa (01/2017), Sentinel-3 (01/2017) and Envisat (08/2006)



A new empirical solution

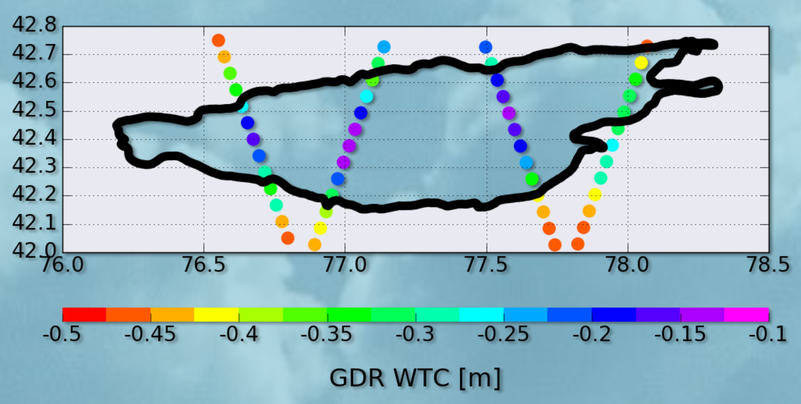
Contamination by land and impact of the FOV are difficult to simulate then so is the semi-empirical solution.
Solutions yet exist for coastal areas.
The GNSS-derived Path Delay (GPD) solution developed by J. Fernandes combines MWR WTC to more than 800 coastal/island GNSS [Fernandes 2010, 2013, 2017].
Our solution is closer to S. Brown mixed-pixel algorithm developed for Jason's radiometer applied at the retrieval level and accounting for the **land fraction (LF)** inside the FOV [Brown 2010].
A neural network is trained from ECMWF WTC and measured TB and sigma0 (instead of simulations), land fraction computed from measured antenna pattern and high-resolution land/sea map (1/120°). Over ocean, SST from Reynolds model is also added.

Two learning databases have been established for the current study, using **6 months of Sentinel-3 measurements […]**

- **[…] over Great Lakes + Issyk-Kul Lake**
- **TBx2, sigma0, LFx2**

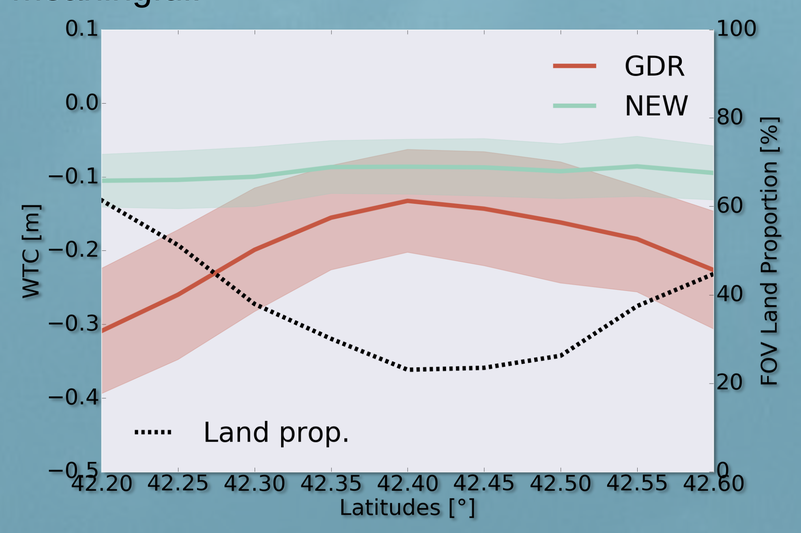
- **[…] over Mediterranean Sea**
- **TBx2, sigma0, LFx2, SST**

Inland Water: Issyk-Kul Lake

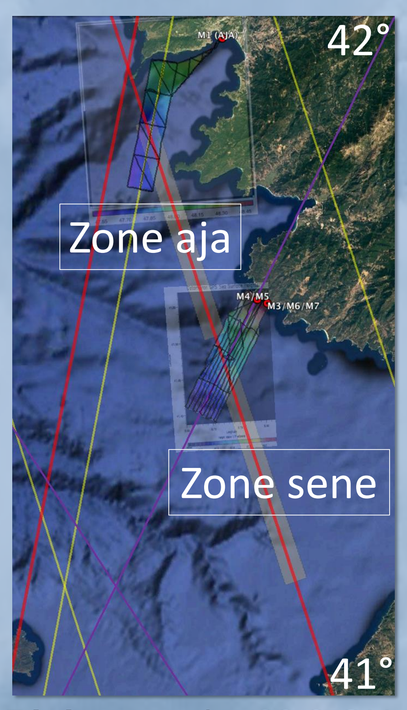


Above, the current WTC (GDR) is contaminated by land and thus correlated to the LF. Even in the middle of the lake, the closest coastline is at about 25 km, at the limit of the land contamination.

Below, averaging over all the tracks against latitudes from June 2016 to April 2017,.
The dedicated WTC is not impacted by the land contamination. Even the measurements near the coastlines are now physically meaningful.



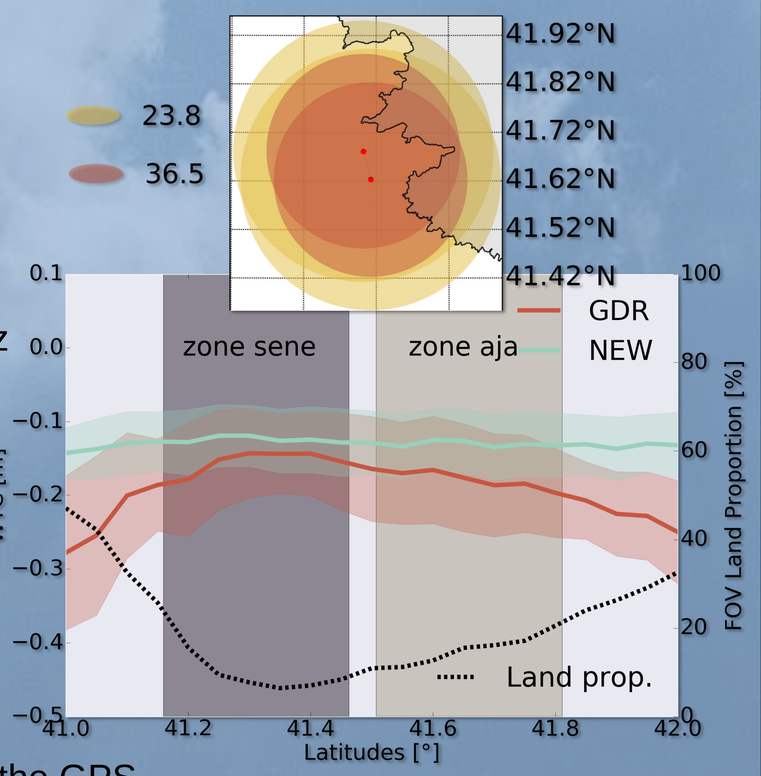
Coastal area: Ajaccio, Corsica



Validation against Ajaccio GPS (Bonnefond & Laurain)

Left, the « aja » and « sene » zones for validation are defined.

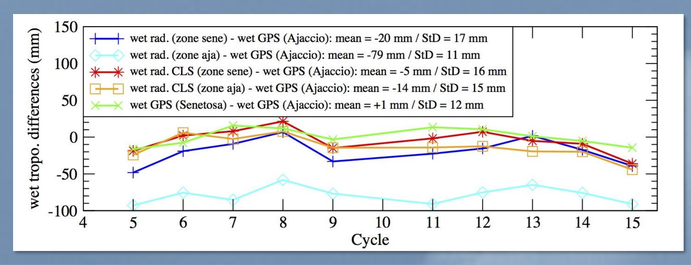
The GPS is located by the red dot M1 (AJA) on the top of the figure



Right, top, the 23.8 GHz and 36.5 GHz 2.5xFOV used for LF computation
Right, bottom, averaging track 741
The shaded patches are the regions used to interpolate the WTC used on resp. zones

Below, the comparison to the GPS

- **the bias is reduced with the new solution**
- the stdev is similar with the new solution over sene zone
  the stdev is larger with the new solution over aja zone



Conclusion

The dedicated solution removes the land contamination. Further validation against in-situ measurements and through the impact on height timeseries are needed. For instance, the factor on FOV width (between 2 and 2.5) could be refined.

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