A method for land correction based on SMAP TB measurements

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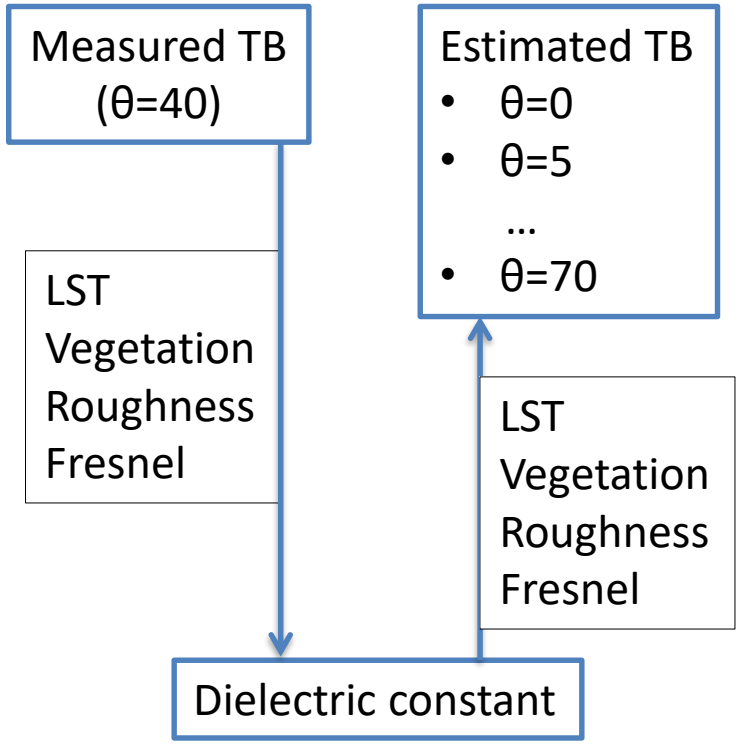
Outline

1) Land TB at different incidence angles
2) Retrieve new SSS (plan)
3) Validation (plan)
4) Conclusions

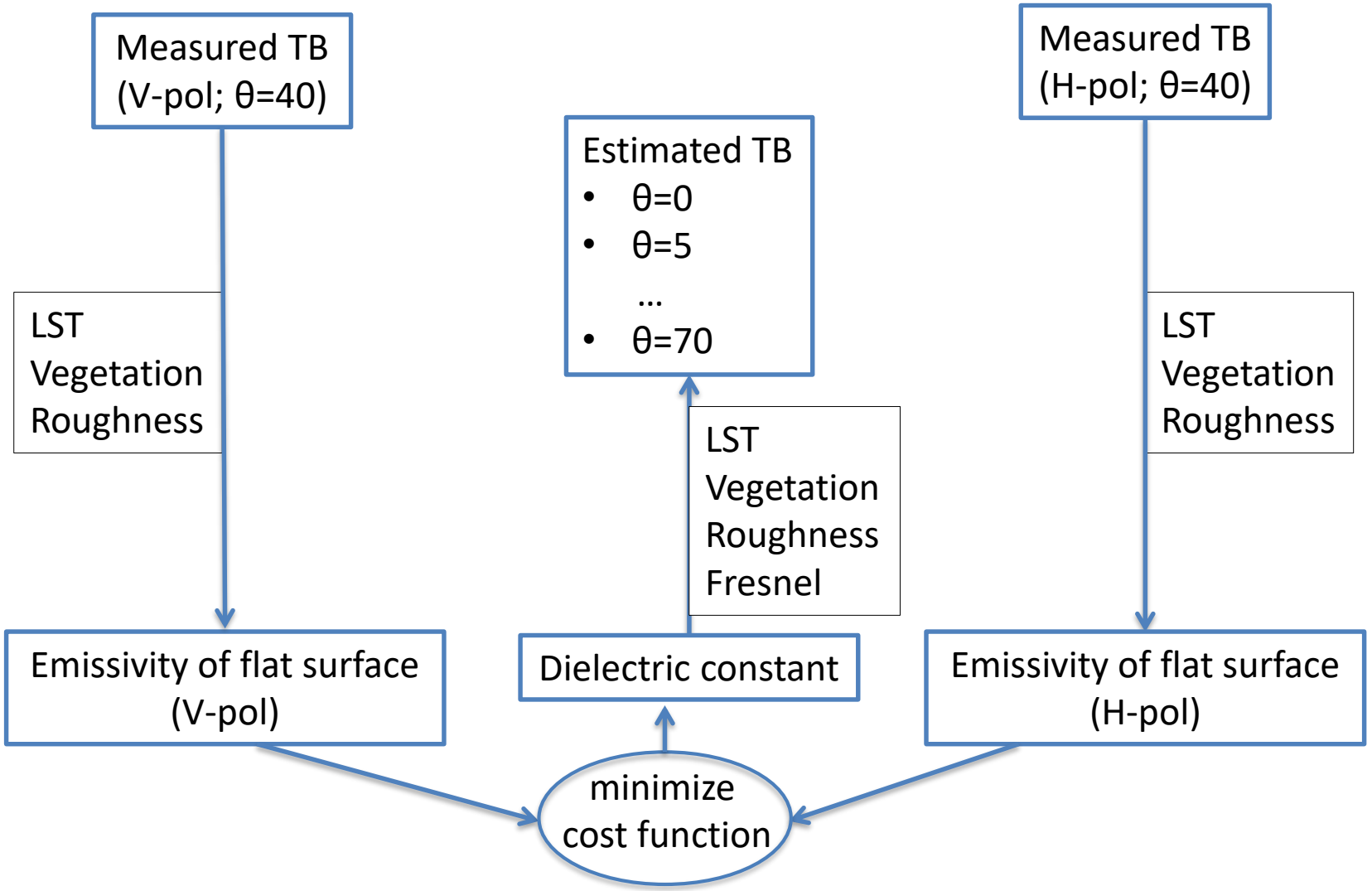
Land TBs at different inc. angles

The main idea is to use the actual SMAP measurements over land to compute the land correction. But, SMAP measures only at 40 deg incidence angle, whereas for the land correction we need TBs at a range of different angles.



Issue: using the measured TB in V- or H-pol leads to different dielectric constants.

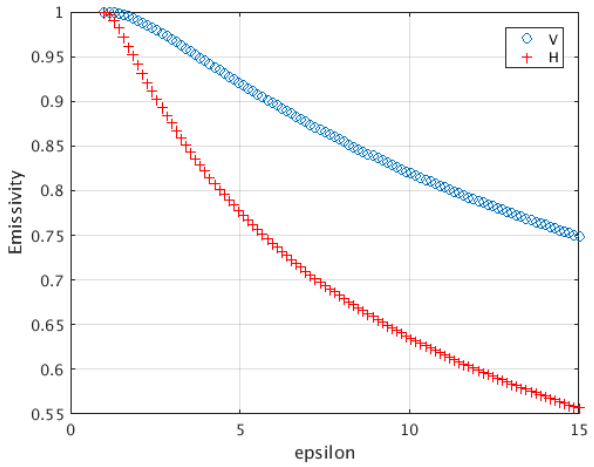
Land TBs at different inc. angles



Cost function

$$\Omega = \frac{\left(E_{V,retrieved} - E_{V,Fresnel}\right)^2}{\sigma_V^2} + \frac{\left(E_{H,retrieved} - E_{H,Fresnel}\right)^2}{\sigma_H^2}$$

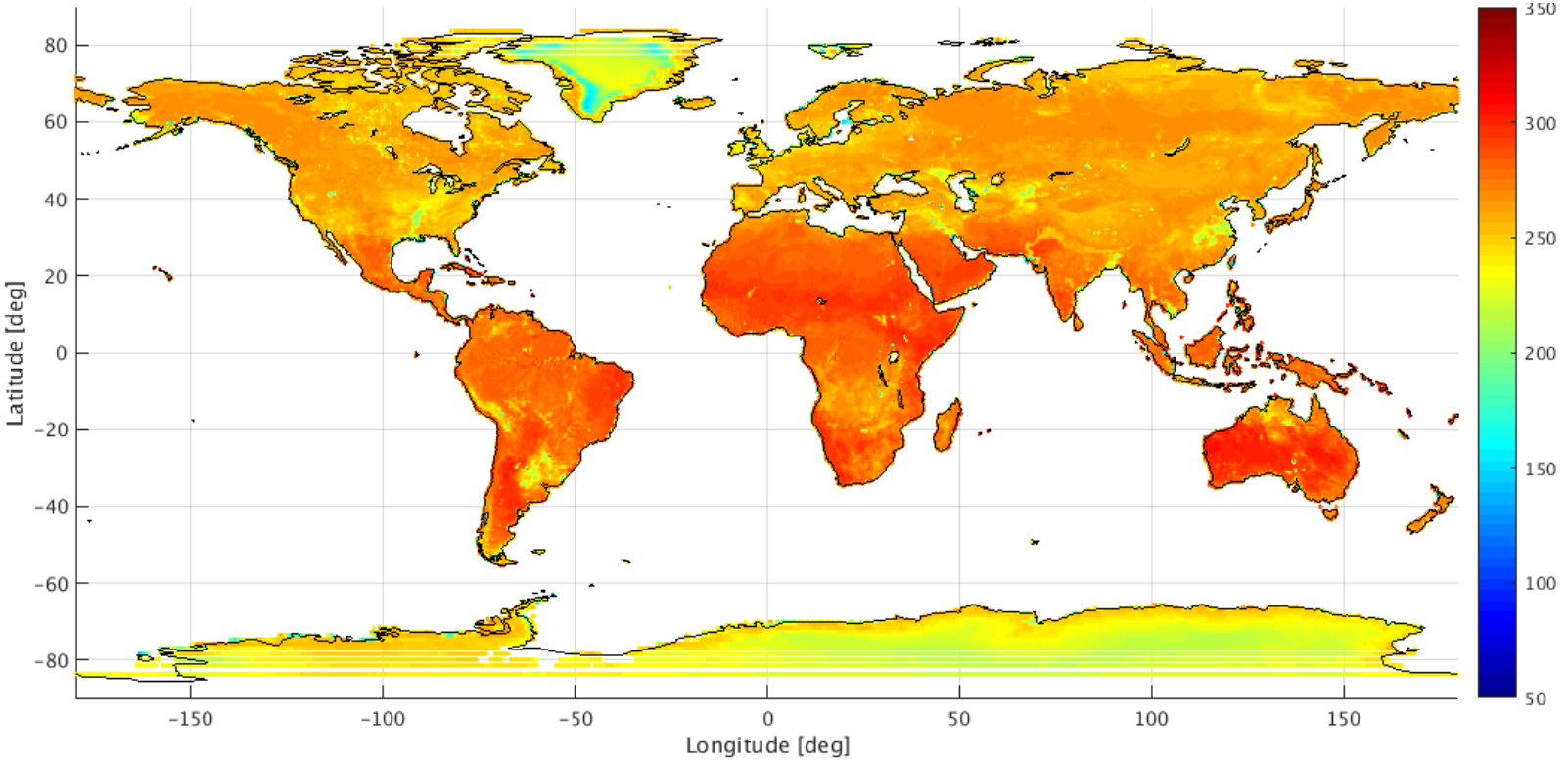
The V-pol and H-pol emissivities have different weights (w) because they have different sensitivities to changes in permittivity.



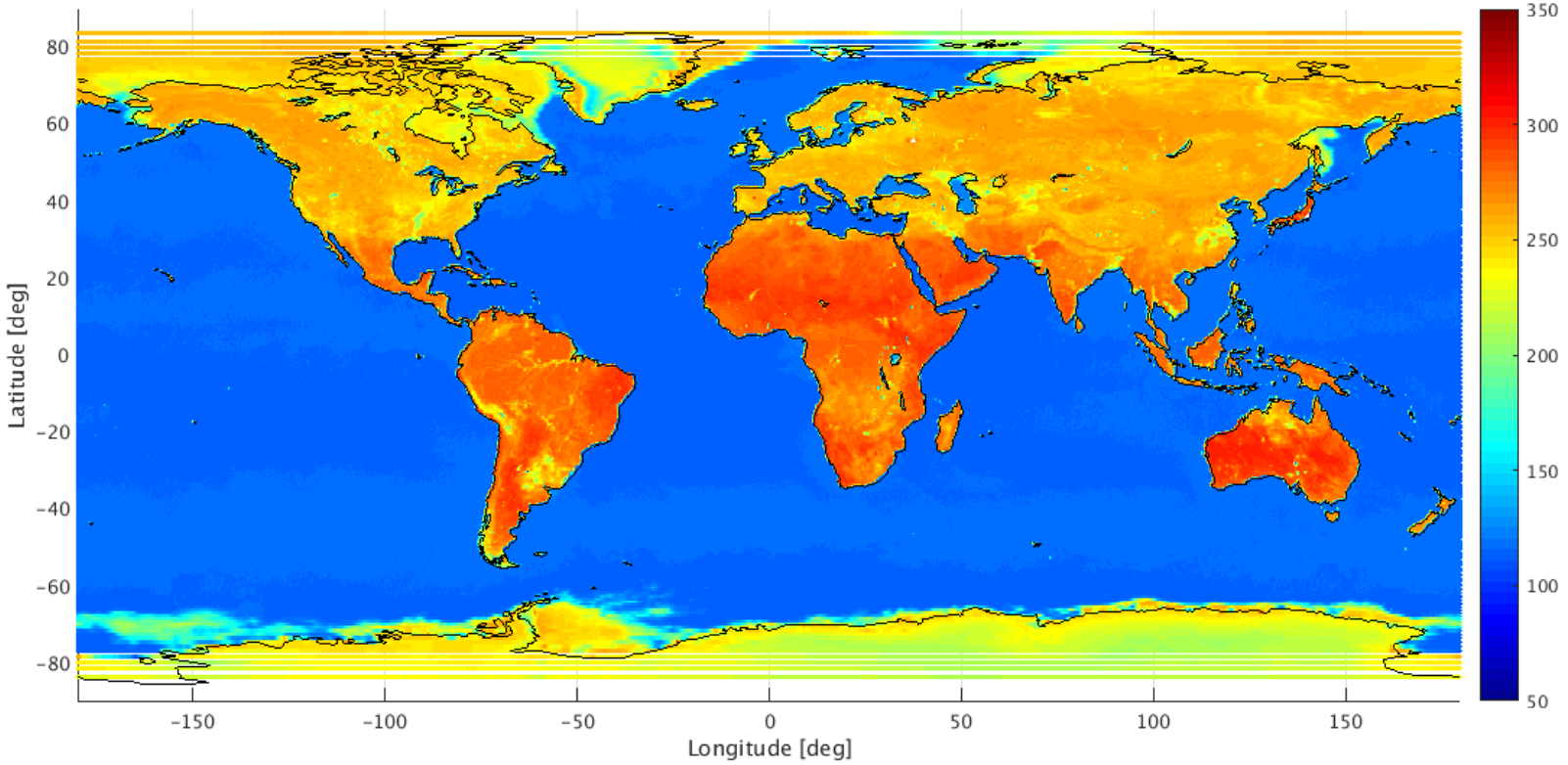
Frozen/very dry soil → Wet soil

σ_V = 0.07326
σ_H = 0.11344

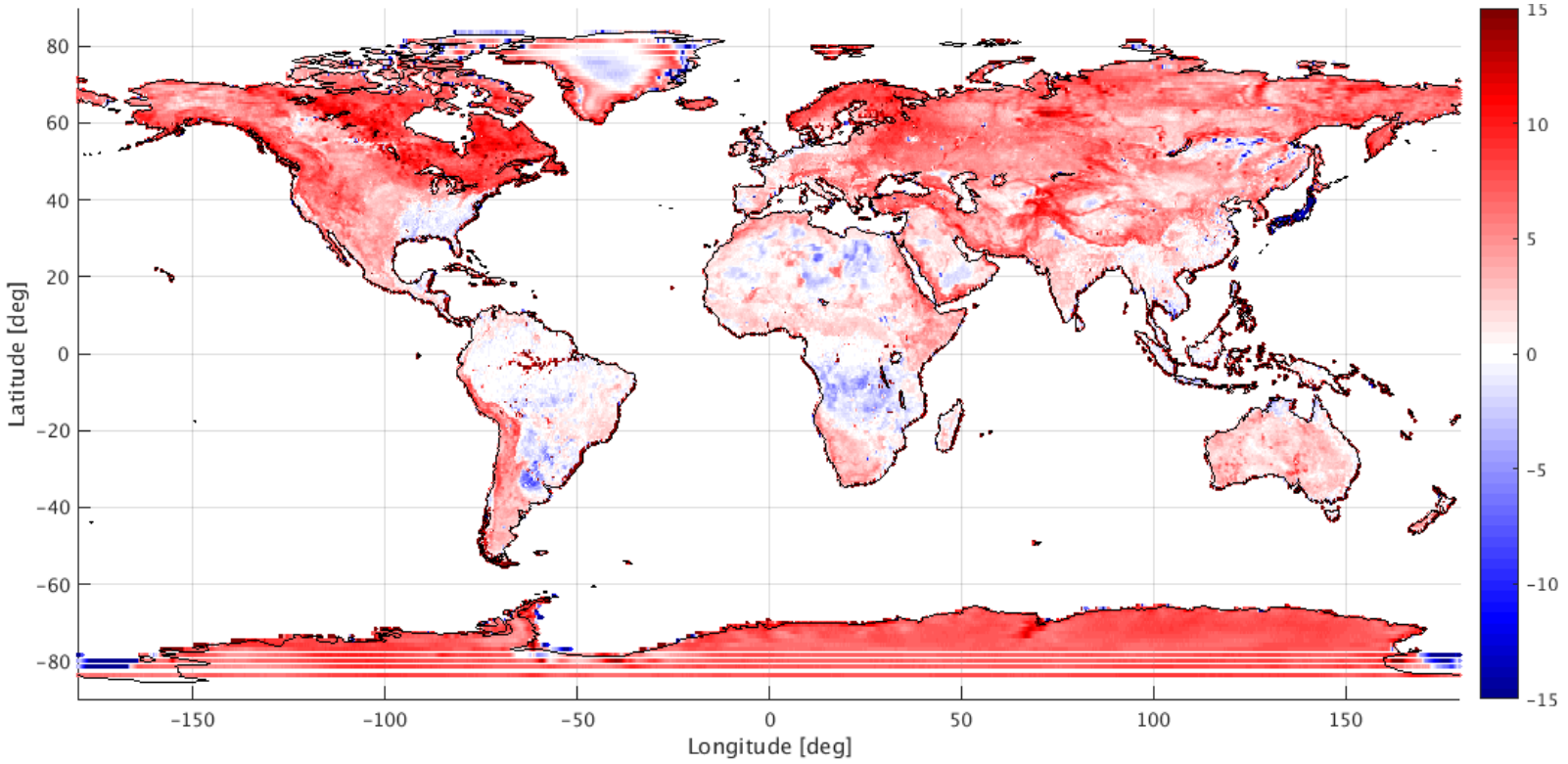
Estimated TbV at 40 deg



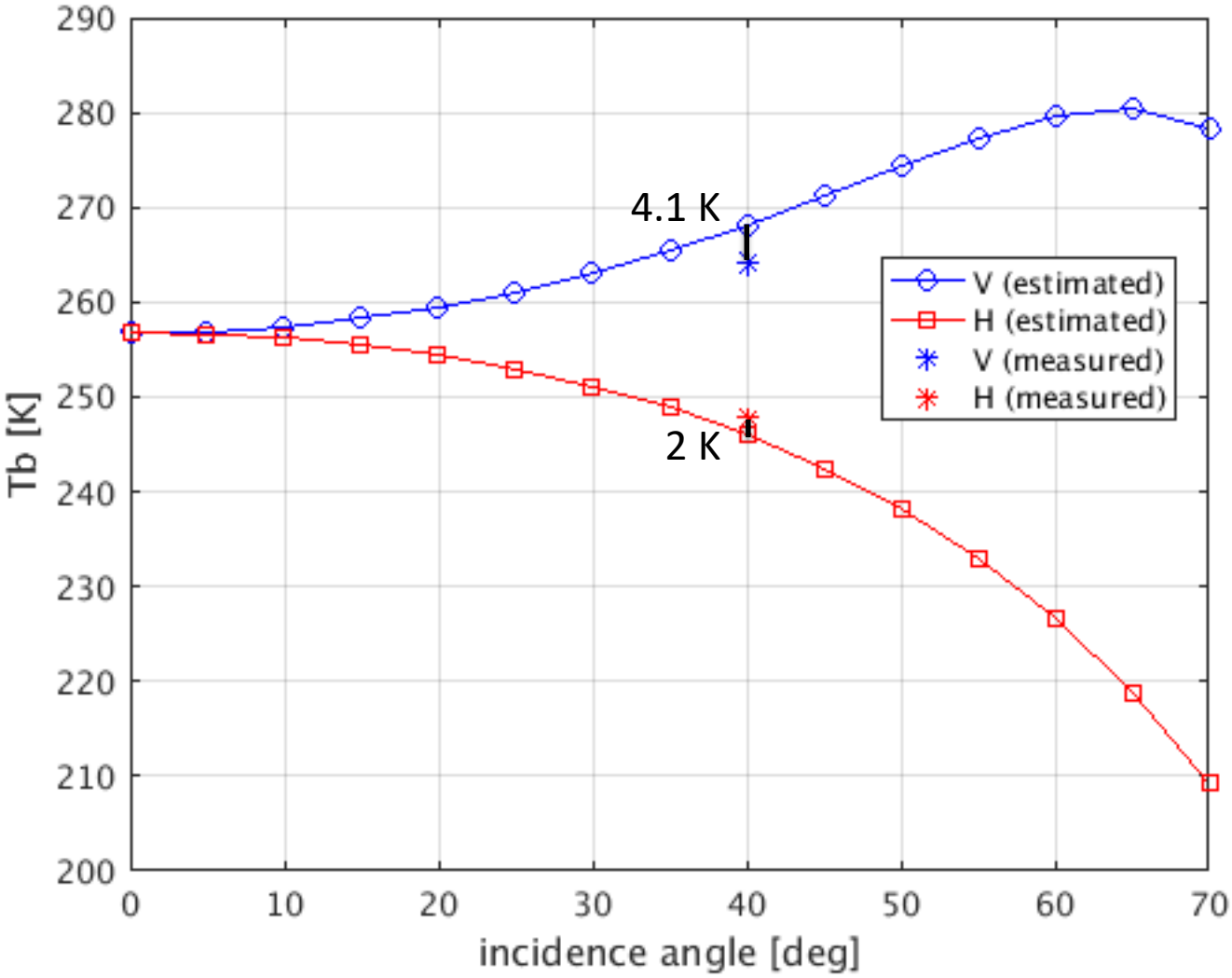
Measured TbV (8-days)



Estimated-Measured; 40 deg; V-pol



Angular signatures



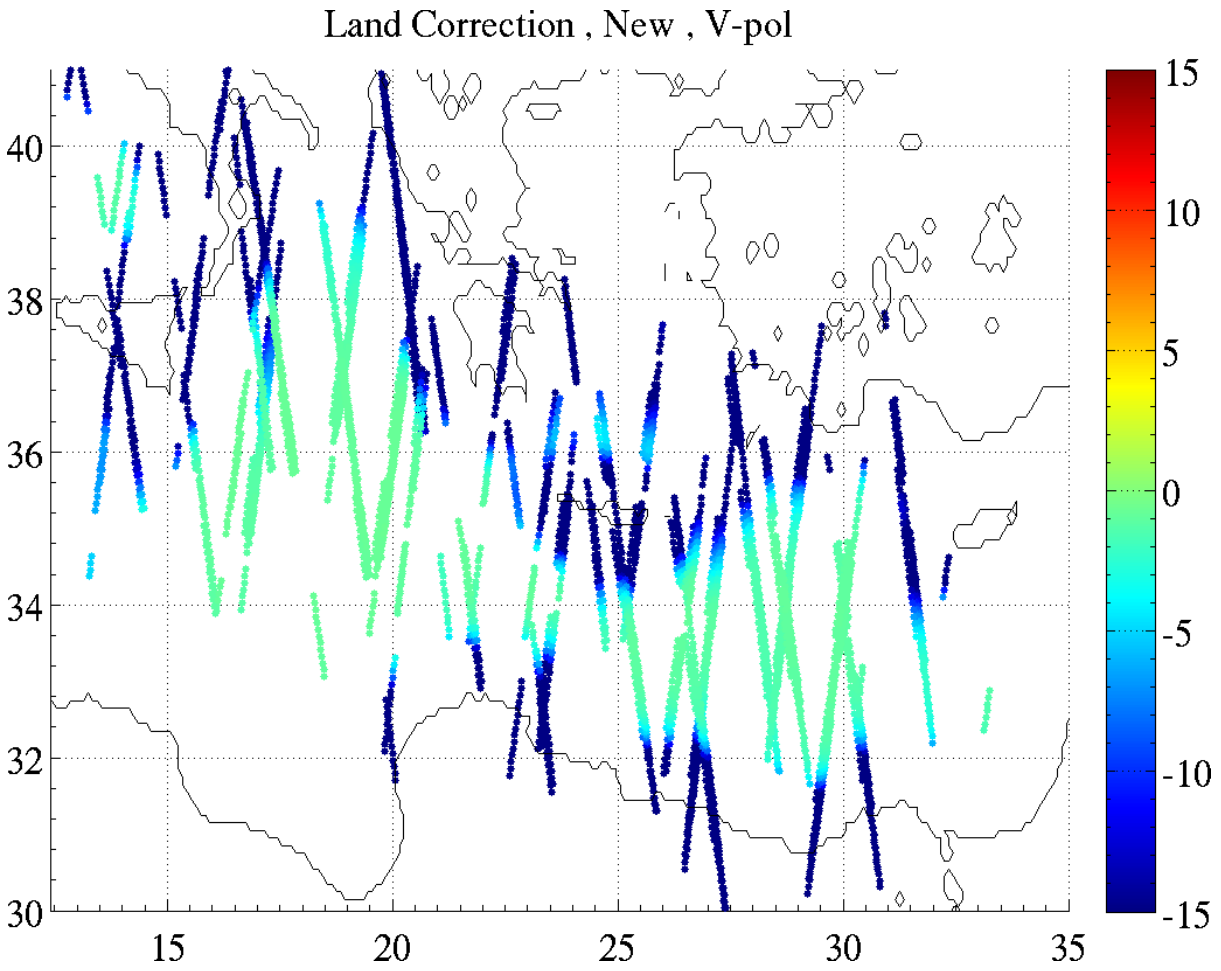
Land correction and ‘new’ SSS

1. Use Land TB maps and antenna patterns to compute ΔTa_land
2. Ta – ΔTa_land = Ta_ocean
3. Ta_ocean ==> new SSS

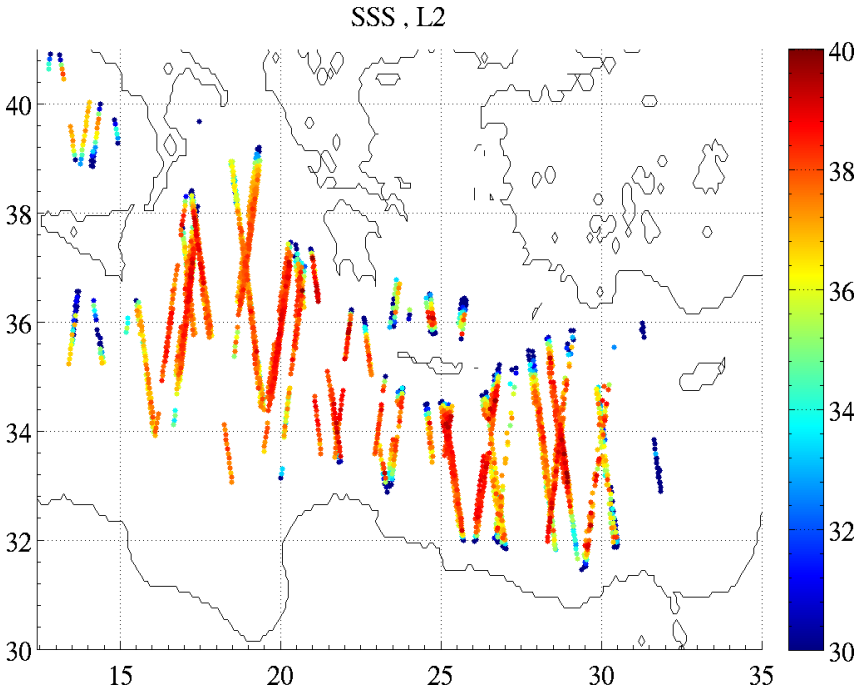
Emmanuel already developed these tools and applied them to a test case where:

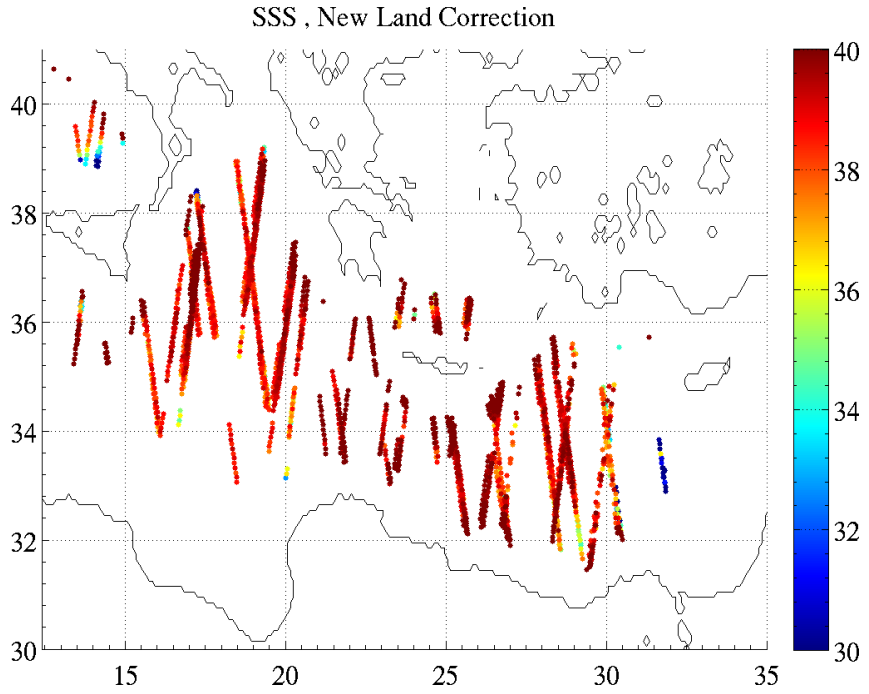
- the land TB was simply a map of the measured TBs at 40 deg;
- he corrected the Aquarius TAs (overlap period SMAP-Aquarius).

Example: ΔTa_land

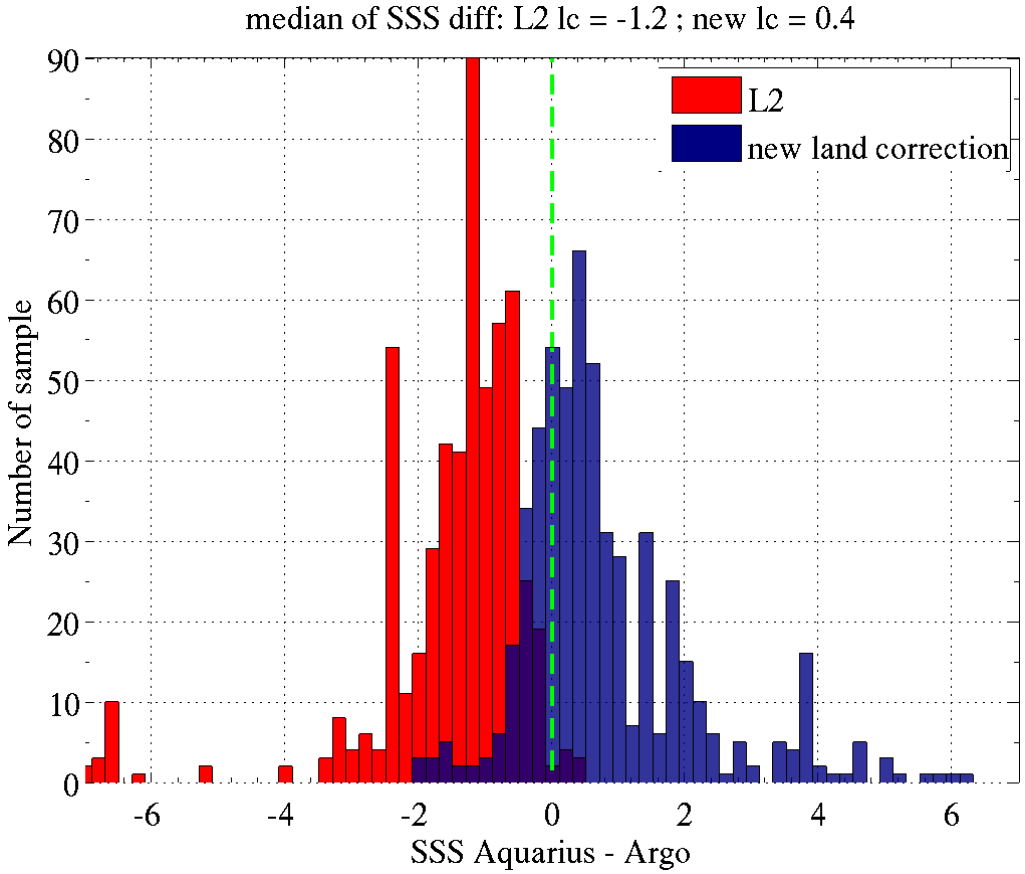


Retrieved SSS along track

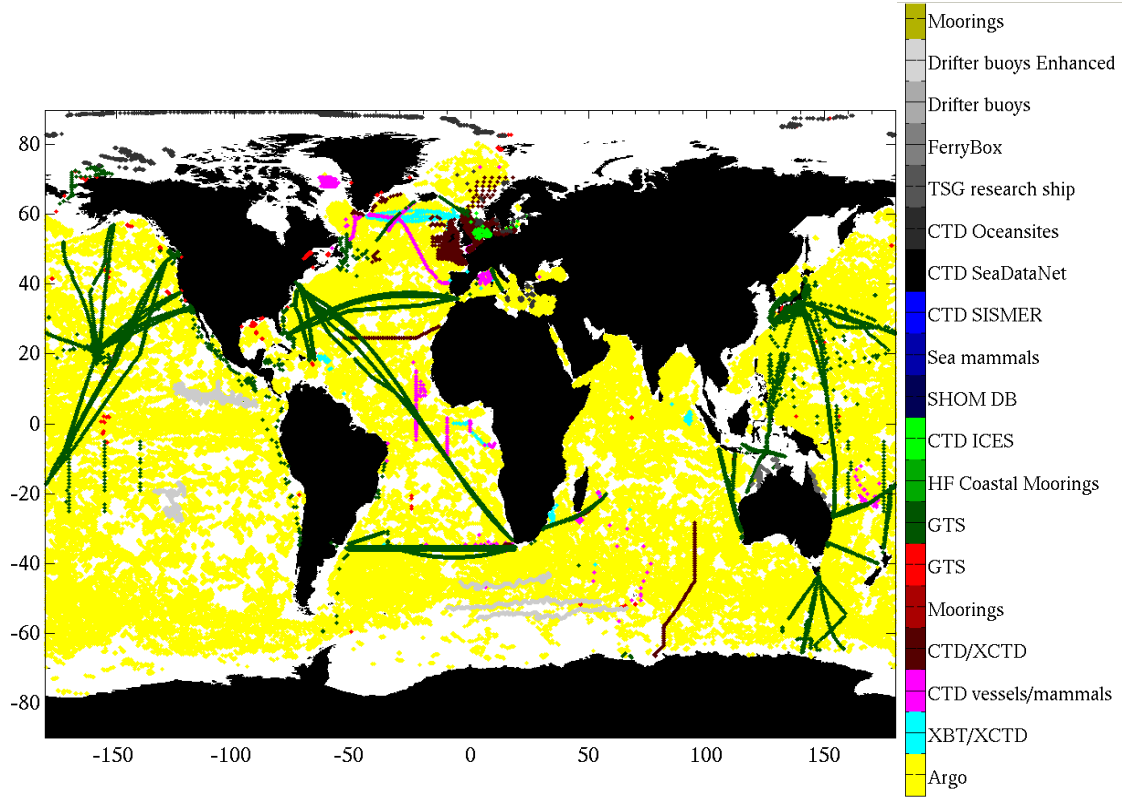




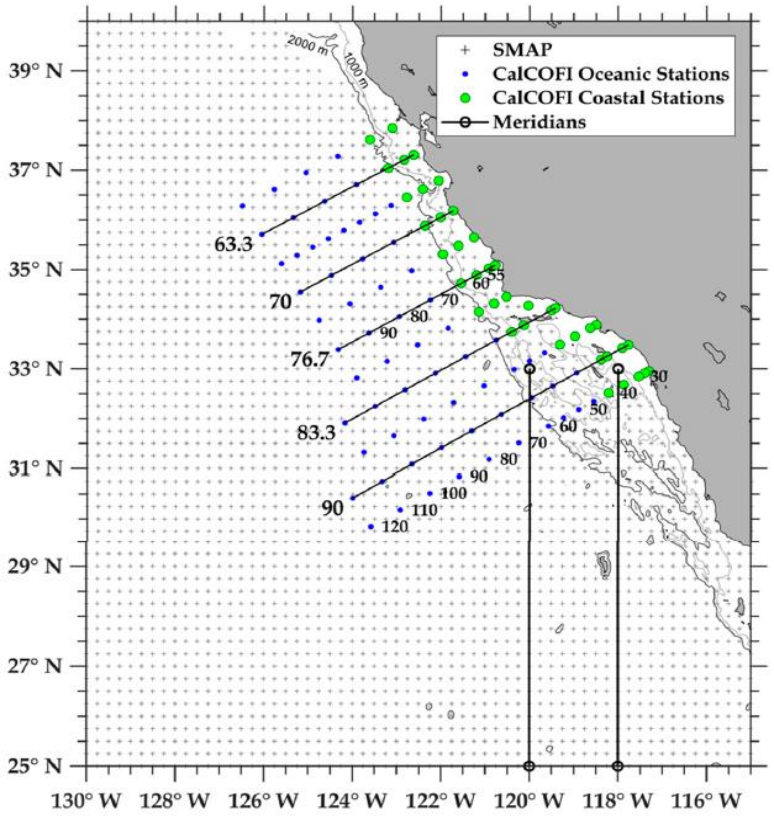
Validation: Mediterranean sea (Argo)



Candidate datasets for validation (coastal in-situ measurements)



Global datasets of various sensors type (CORA database)



Regional campaigns

Conclusions

- Created daily maps of “Land TB” for one month (Jan 2017). Each maps is computed from 8 days of SMAP measurements. The maps are computed for V- and H-pol and for incidence angles from 0 to 70 degrees, with 5 degrees increments.
- Validation of the SSS still to be done
- Plan for validation:
  - Select a few coastal regions that have in-situ SSS measurements;
  - For the footprints near the selected regions, use the Land TB maps to compute the ΔTa_land;
  - Retrieve the corrected SSS;
  - Compare with in-situ SSS.

Bonus

Example: ΔTa (Aquarius V4)