LARGE SCALE SAR ATMOSPHERIC PHASE SCREENS ESTIMATION WITH GNSS CROSS-CALIBRATION

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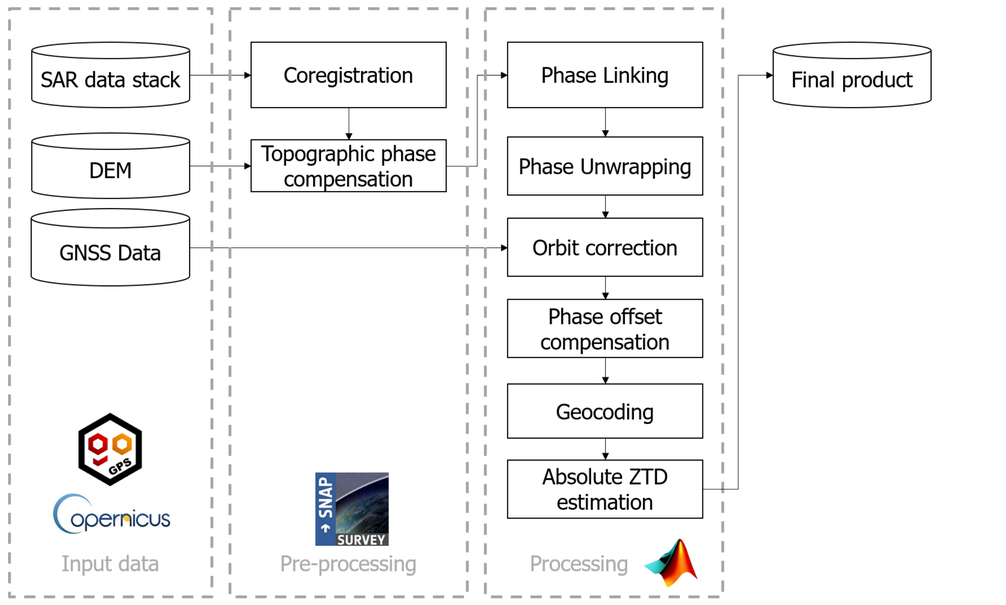
1. Introduction

- Spaceborne Synthetic Aperture Radar (SAR) and Global Navigation Satellite Systems (GNSS) can provide useful information about the water content in the atmosphere;
- A cross-calibration of SAR data with GNSS is necessary to mitigate orbital errors of SAR;
- The final product is a wide and dense water vapor maps with unprecedent spatial resolution. The generated maps are $250 \times 850\ km$ wide

2. Method overview

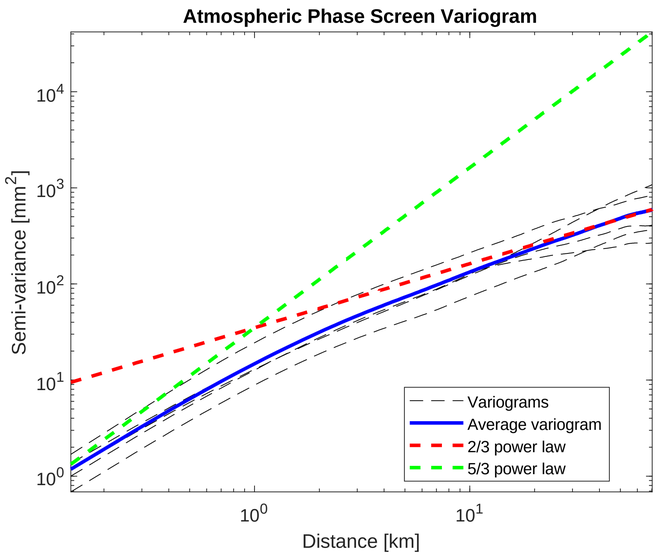
- The procedure exploits free and open data from the ESA constellation Sentinel-1;
- A stack of focused and coregistered data is Phase Linked [1] to obtain reliable water vapor maps;
- The maps are then calibrated using GNSS atmospheric data to remove orbital SAR errors.

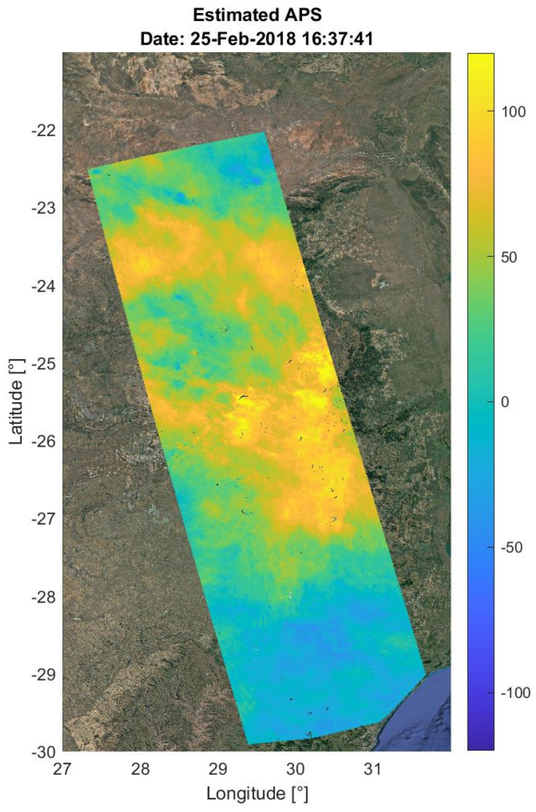


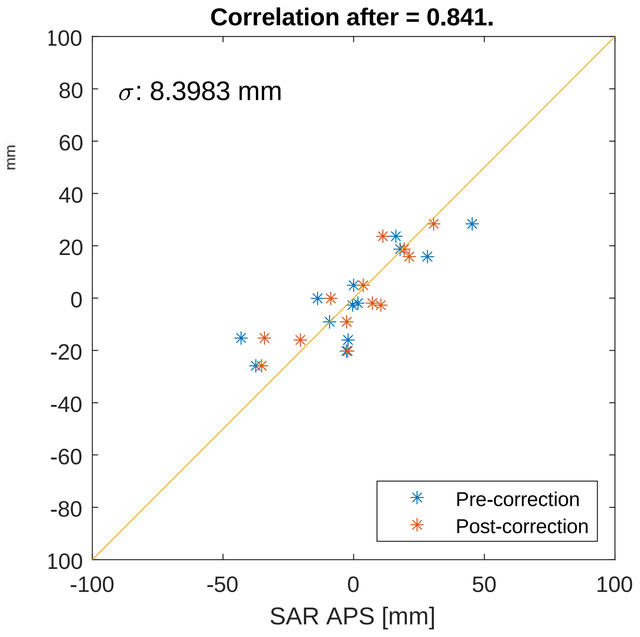
3. Results

South Africa

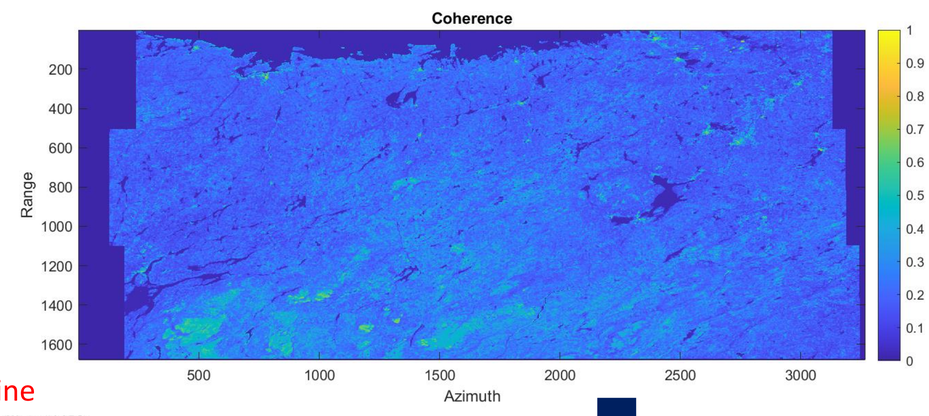
- The South African Experiment is composed by five S1 frames ($250 \times 850\ km$) with 17 GNSS stations distributed in the scene.
- An analysis of the spatial characteristics of the maps confirm the accordance with the theoretical models;



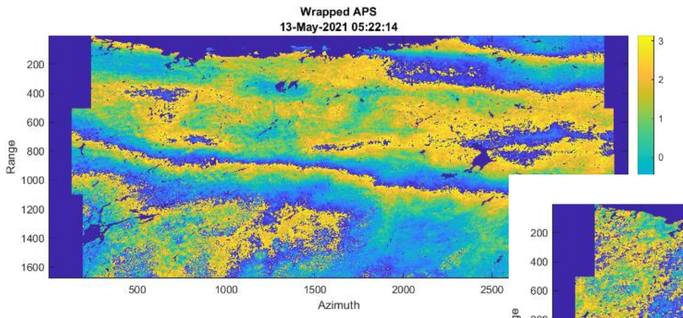




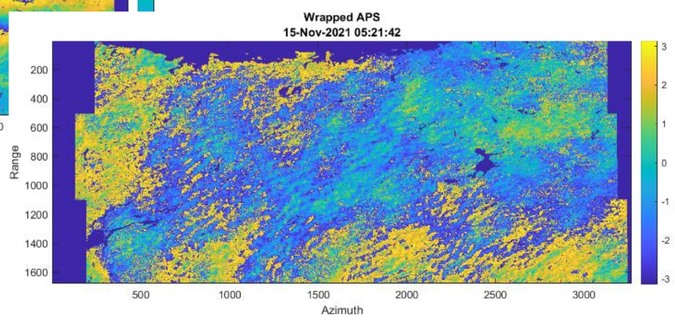
Sweden

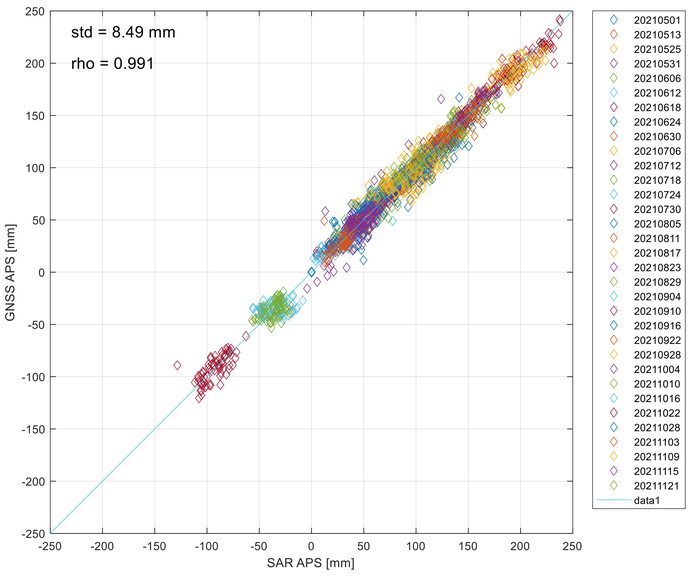


6 days temporal baseline



6 months temporal baseline





Average correlation of 0.99! Less than 1cm of standard deviation.

4. Conclusions

- In this work, we exploited SAR data to gather information about the water vapor content in the atmosphere;
- Such an instrument can be particularly useful when in-situ measurements are scarce and/or unreliable: this is the typical scenario in the African continent;
- We proved the reliability of the generated maps by cross-validating with GNSS measurements. Assimilations experiments into NWPM are ongoing

References:

[1] On the Exploitation of Target Statistics for SAR Interferometry Applications - IEEE Transactions on Geoscience and Remote Sensing (Volume: 46, Issue: 11, Nov. 2008)

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