Intercalibration of SMOS and Aquarius over land, ice and ocean.

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Introduction

Only 2 current missions provide L-Band global measurements of brightness temperatures

Primary objectives are soil moisture and ocean salinity retrieval.

Also used for freeze/thaw detection, sea ice assessment

SMOS since November, 2^{nd} 2009

- 4 Stokes, incidences [0°,65°]

Radiometric interferometer

- Calibration based on internal noise diodes and deep sky
- Absolute brightness temperature accuracy
- Temporal stability short/long term
- Directional stability
  - Within field of view, special care given to extended alias free
  - 1st reprocessing data set

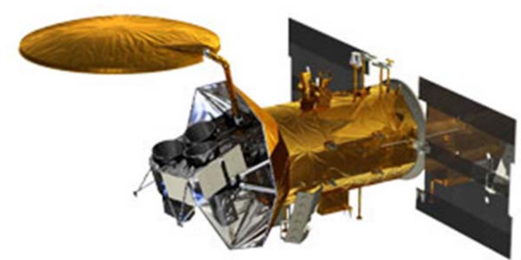
Aquarius since June, 10^{th} 2011

- 3 Stokes, incidences 28°, 38°, 46°

2.5 m reflector and feed horns

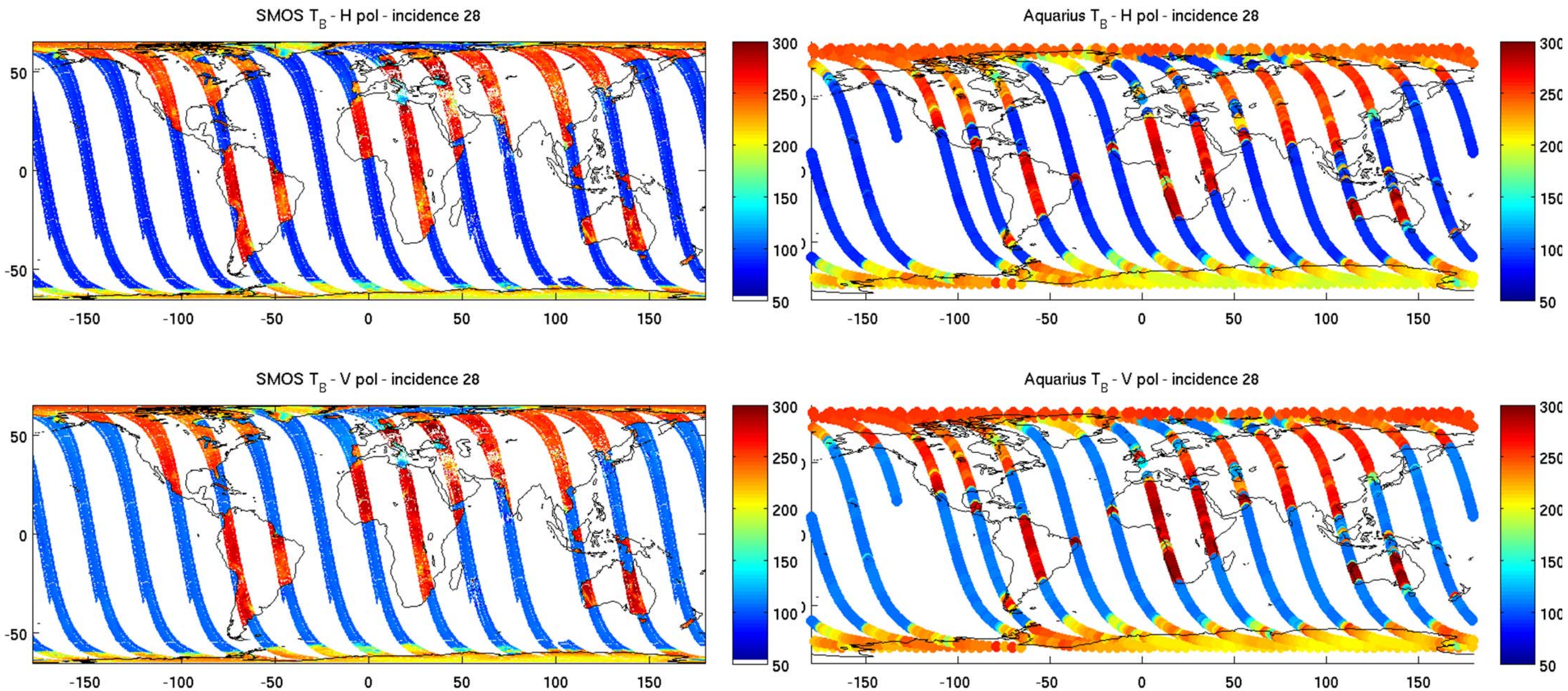
- Calibration based on internal noise diode and vicarious
- High sensitivity
- Long term drift
- beam-to-beam consistency

Processing v2.0



Brightness temperature maps

At the global scale, comparison is far too coarse because of too different conditions at acquisition time



Howto compare TBs

Comparison methods must account for

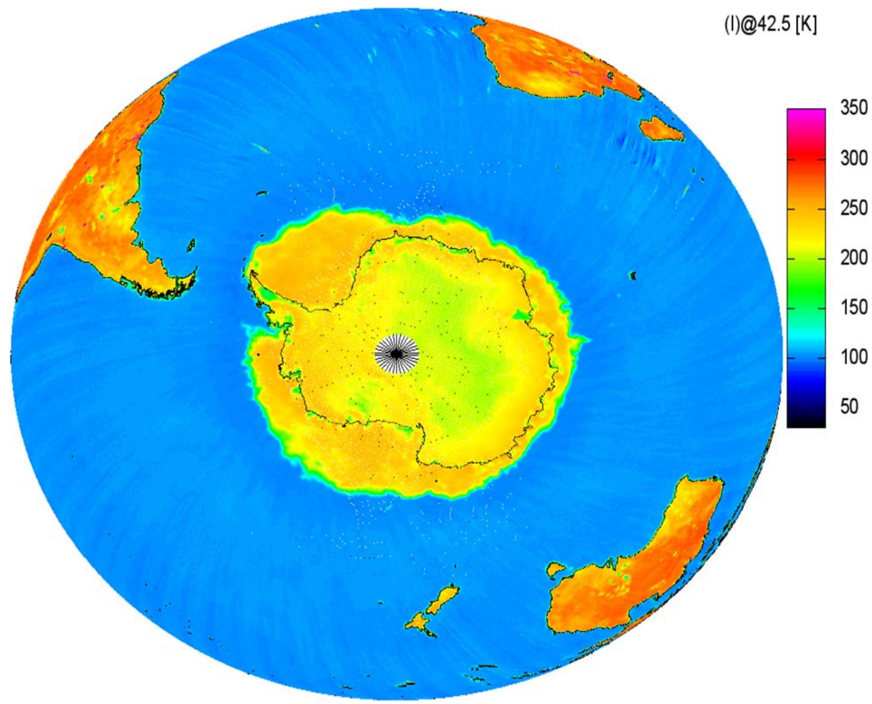
- Geometry of acquisition
  - Careful selection in SMOS directional sampling covers Aquarius incidences
- Footprint, antenna patterns, sampling
  - Homogeneous areas
  - Taking advantage of SMOS capabilities to simulate Aquarius measurements
- Surface change
  - Stable zones
  - Simultaneous observations

Antarctica around Dome Concordia

Antarctic plateau around Dome C appears a very good candidate for stability monitoring and across fov consistency check

On-ground measurement campaign took place in 2009, 2010

New campaign on-going



E. Slominska

Long term stability over Antarctica

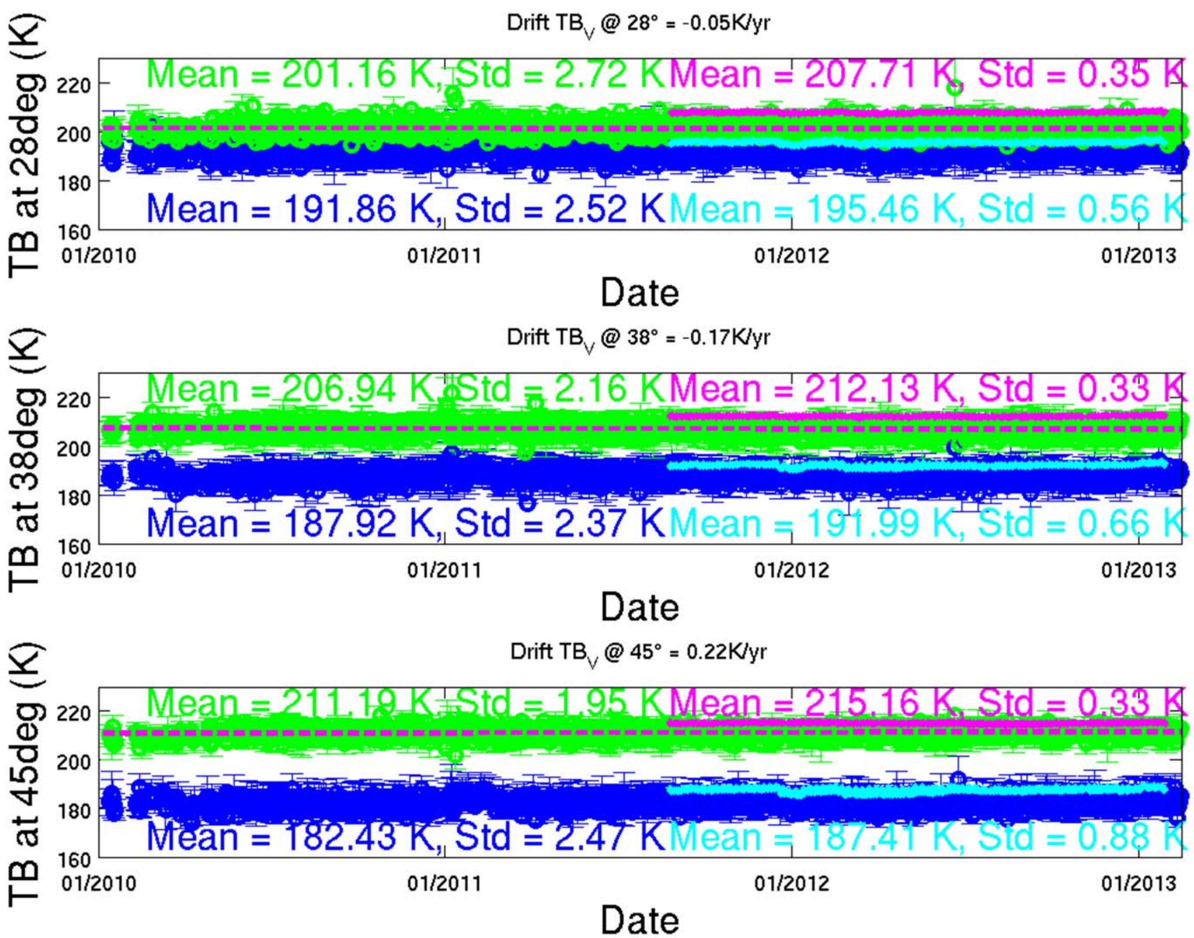
Both instruments show good long term stability

Difference in sensitivity clearly evidenced

Summer surface changes induce noisier behavior at V polarization

Mean biases

	H	V
inner	6.11	5.54
middle	5.12	3.40
outer	5.54	3.99



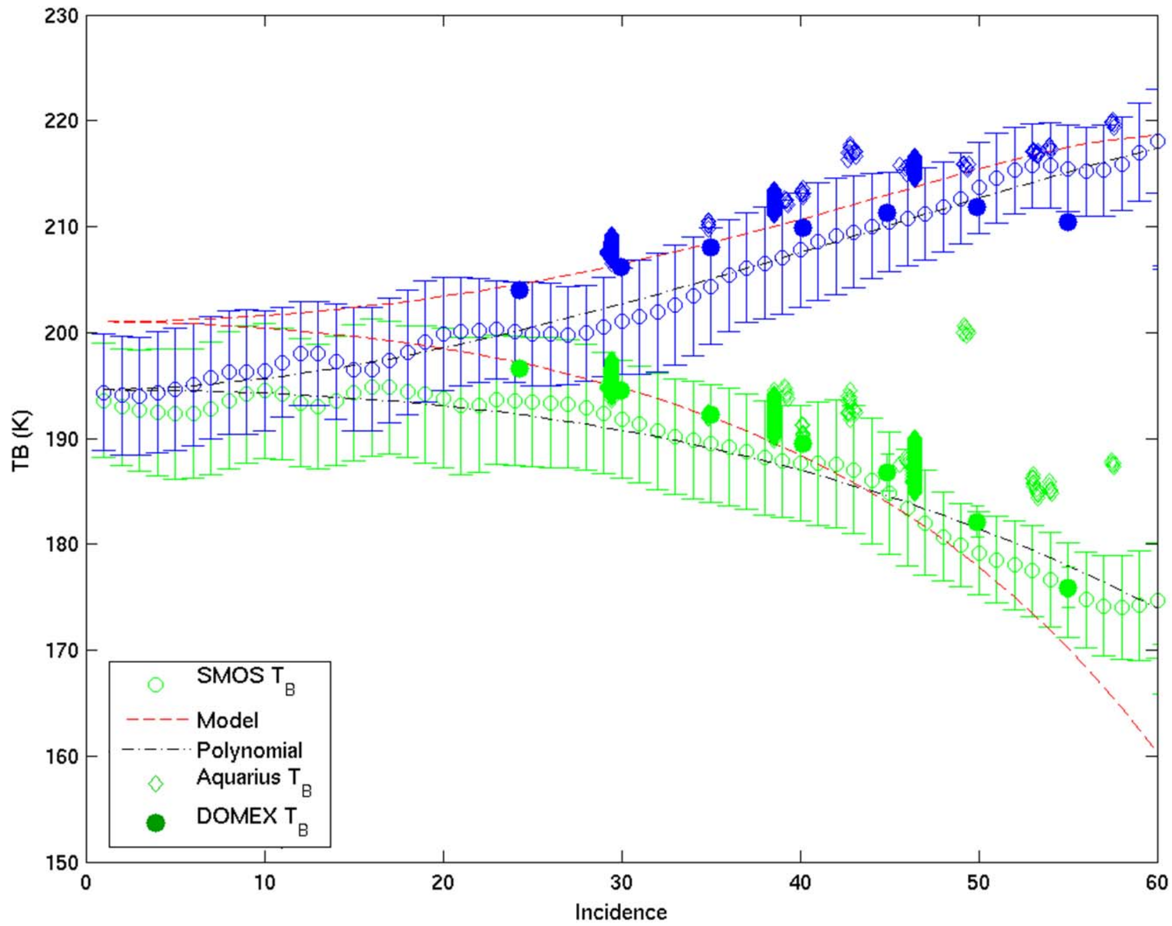
Directional behavior

SMOS TBs exhibit
- Downward trend at low incidence
- low to medium spatial frequency oscillations

Aquarius show warmer TBs at H pol and consistent directional signature

DomeX (G. Macelloni) appears between SMOS and Aquarius

Model and polynomial for reference only



Hallikainen model (one layer, Tsnow=-54)

Aquarius co-locations

Every 3 days, SMOS over flies Aquarius in 2 to 4 occasions

Over 500 days in 2011-2012, over 750 co locations where selected

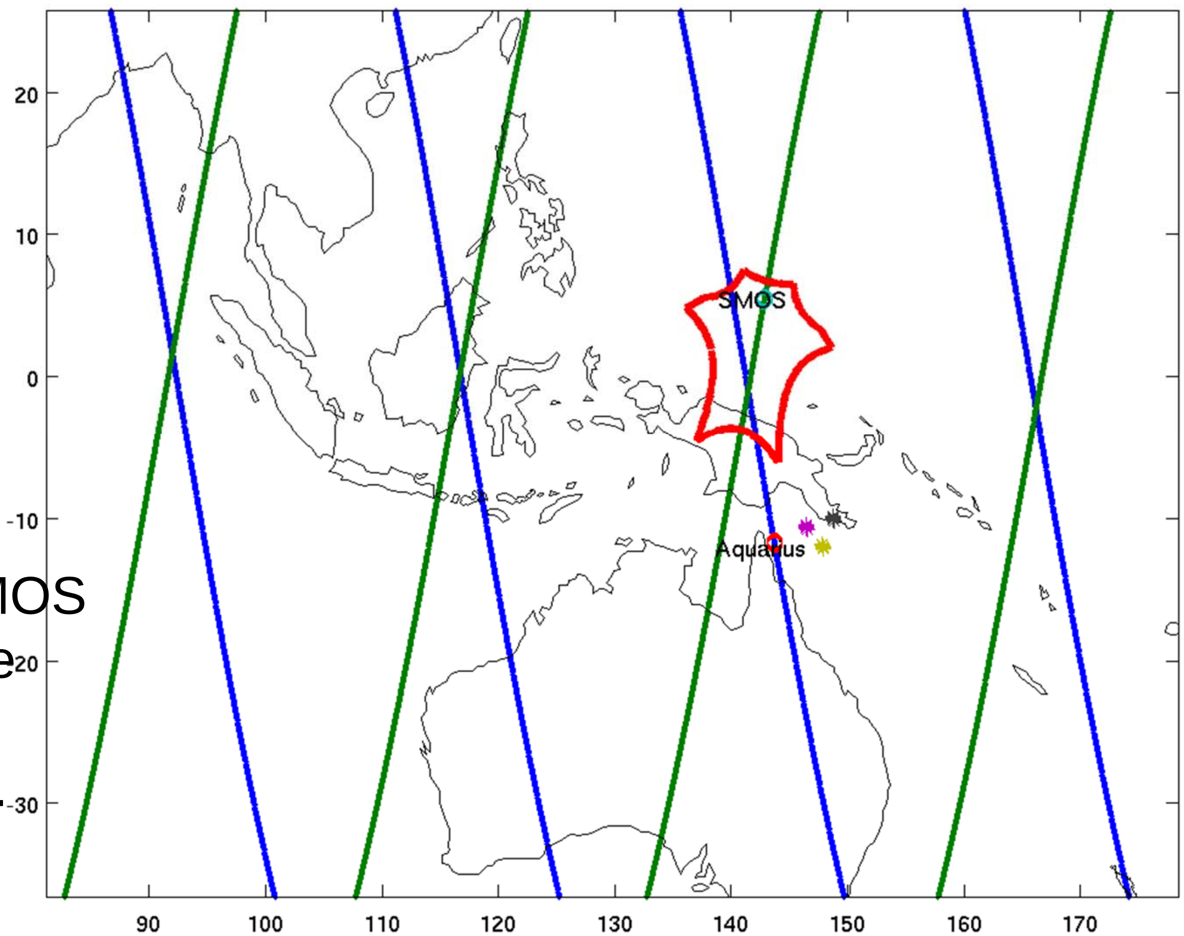
Over fly:

Seen from ground

apparent distance

less than 2.5°

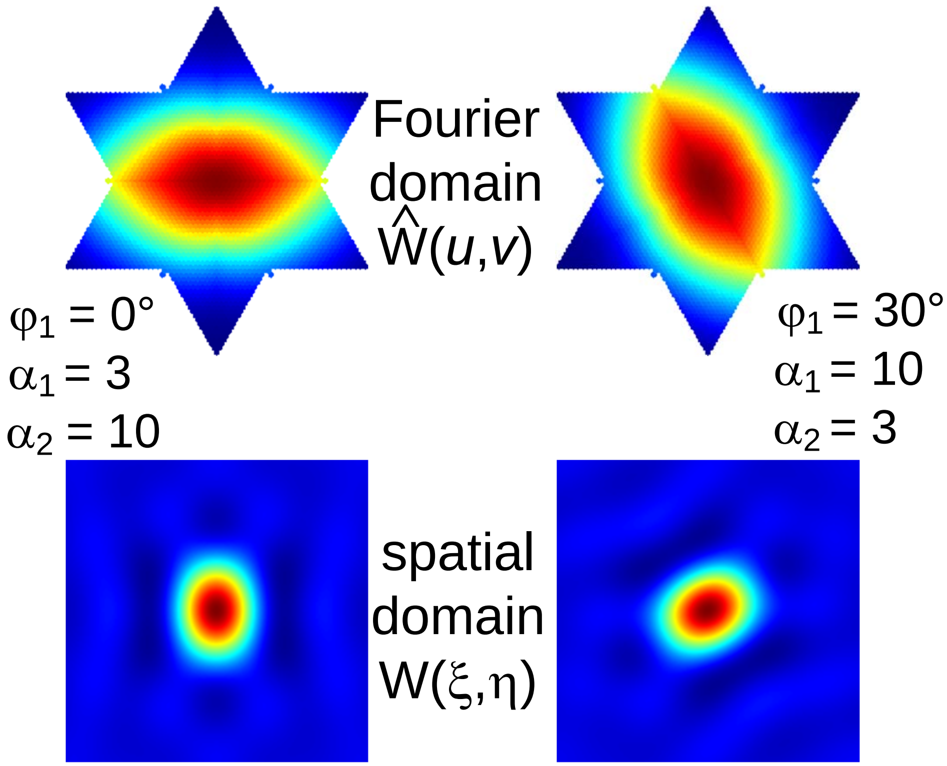
Over collocations,
- spatial frequencies as measured by SMOS are used to simulate Aquarius footprint and measurements.

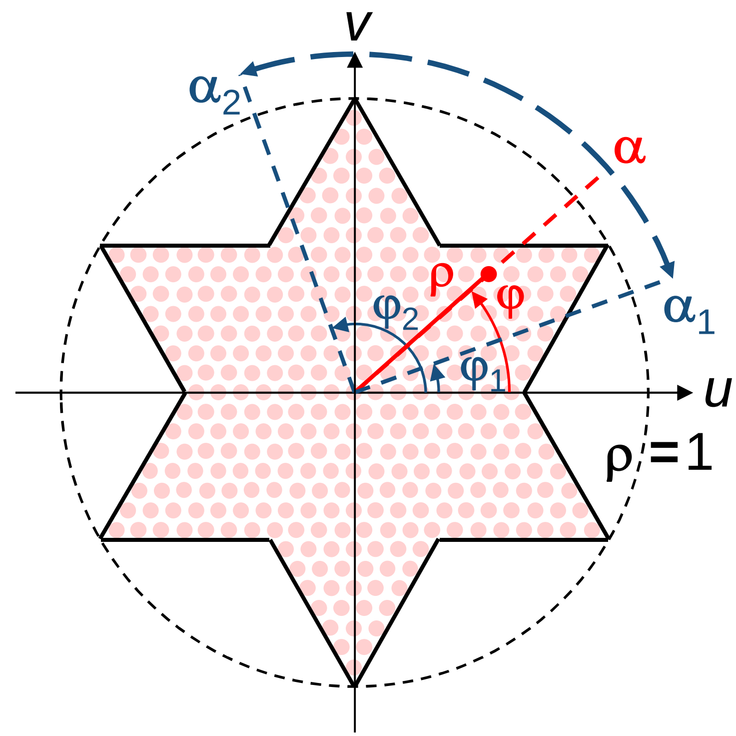


Kaiser window: 3 parameters

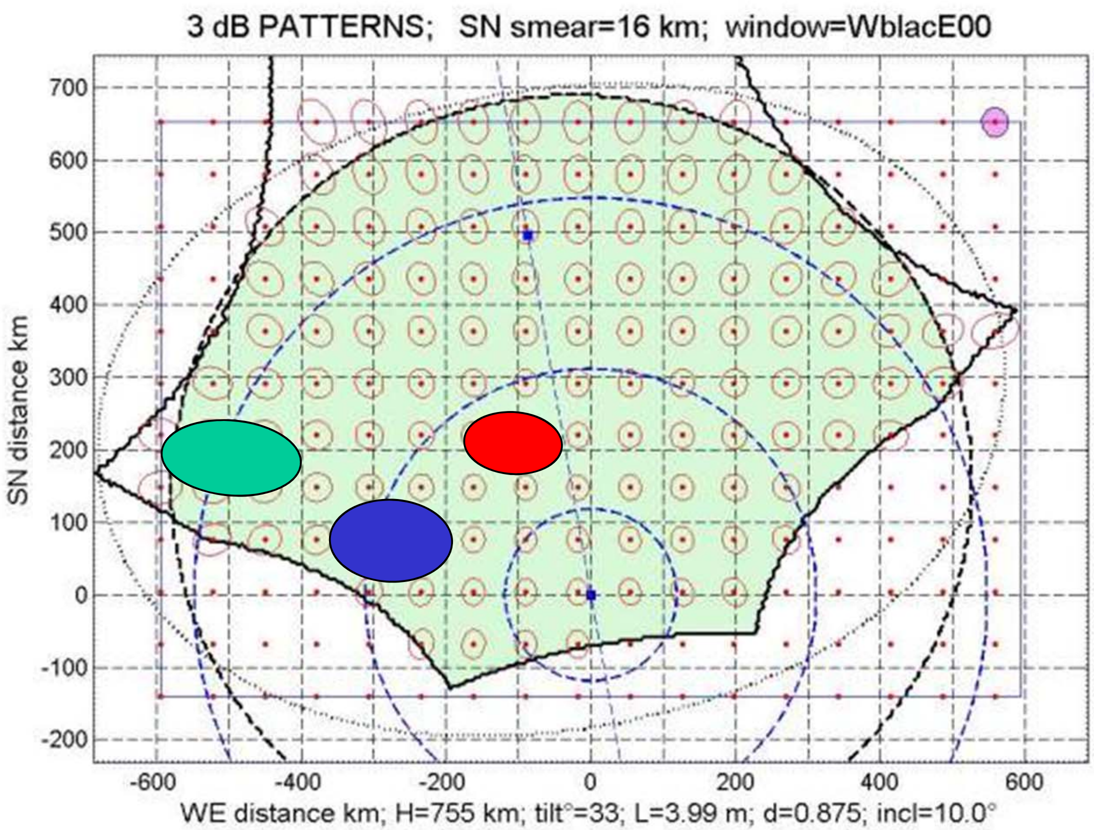
- It is possible to control the shape of $W(\xi,\eta)$:

$$\hat{W}(u,v) = \frac{I_0(\alpha\sqrt{1-\rho^2})}{I_0(\alpha)}$$





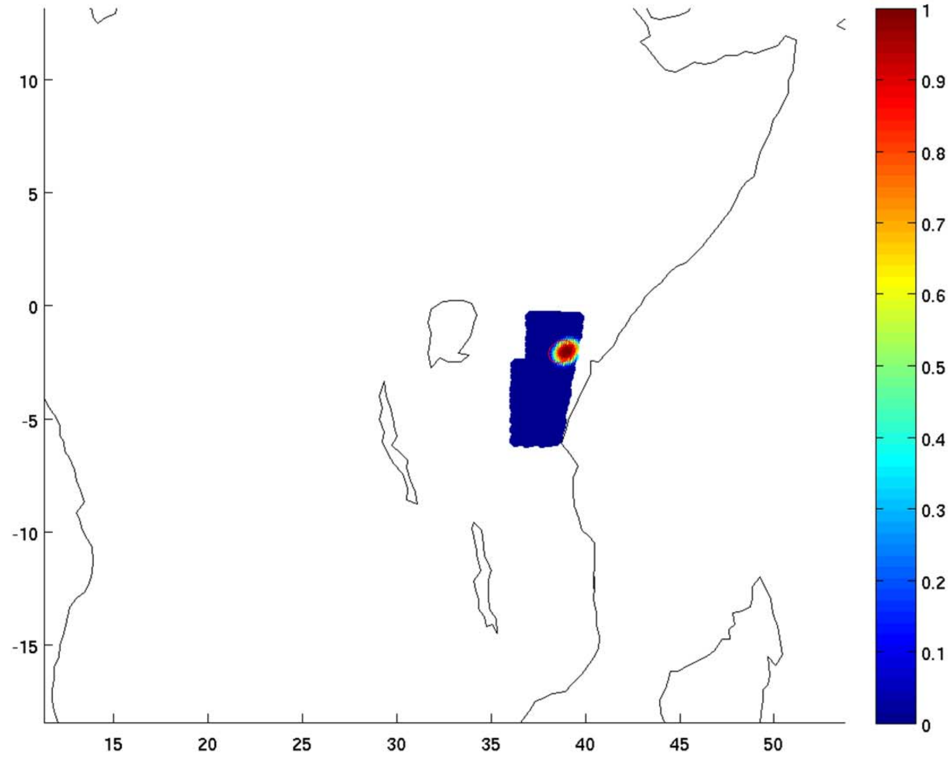
AQUARIUS in SMOS



Aquarius-like SMOS TBs

Equivalent to convolution of SMOS brightness temperatures with Aquarius antenna footprint

Could be improved by using actual Aquarius antenna pattern...

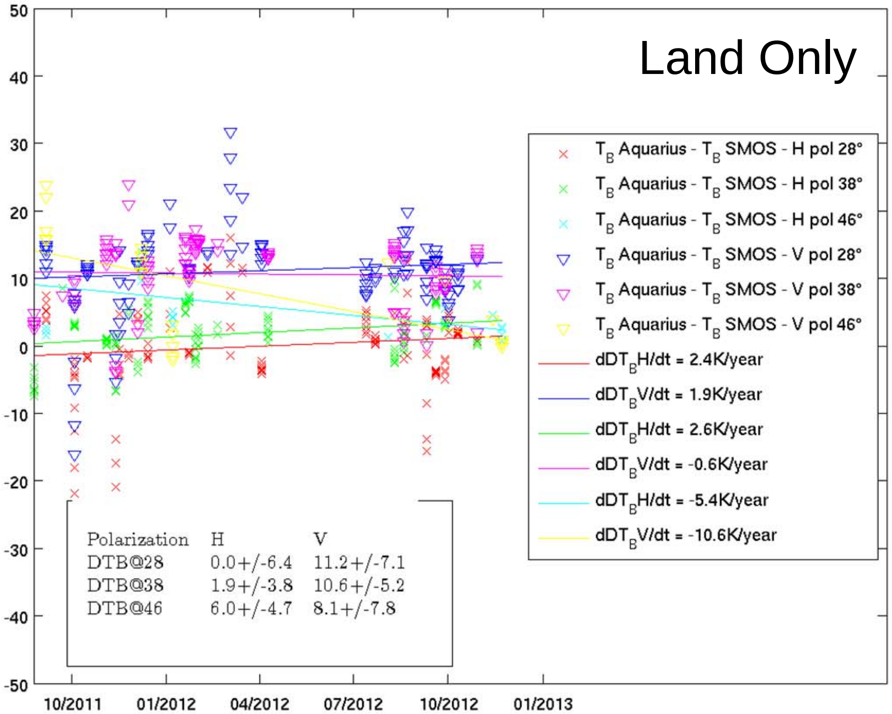


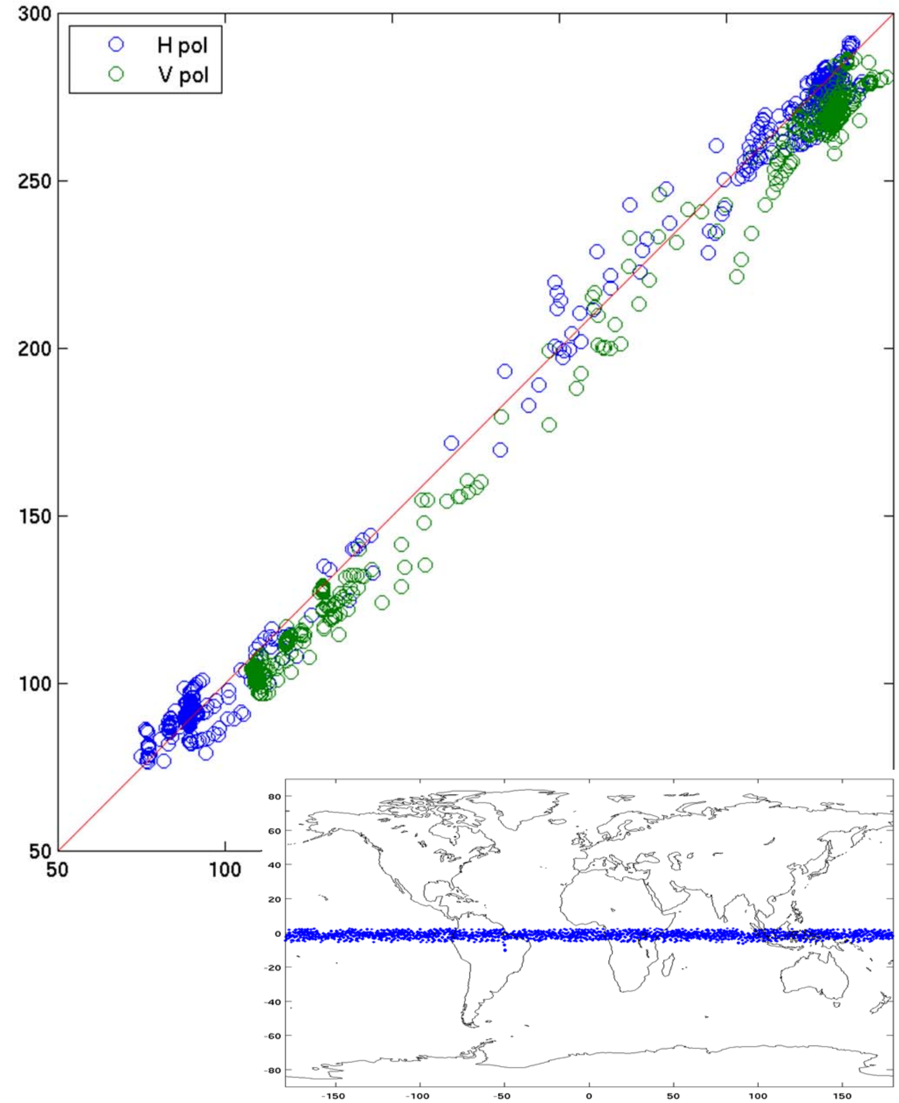
SMOS-Aquarius comparison over all surfaces

Collocations show slightly different trend from DomeC

Main issue is dependency wrt Tb evidenced by selecting land only

Accuracy is much lower because of surface heterogeneity



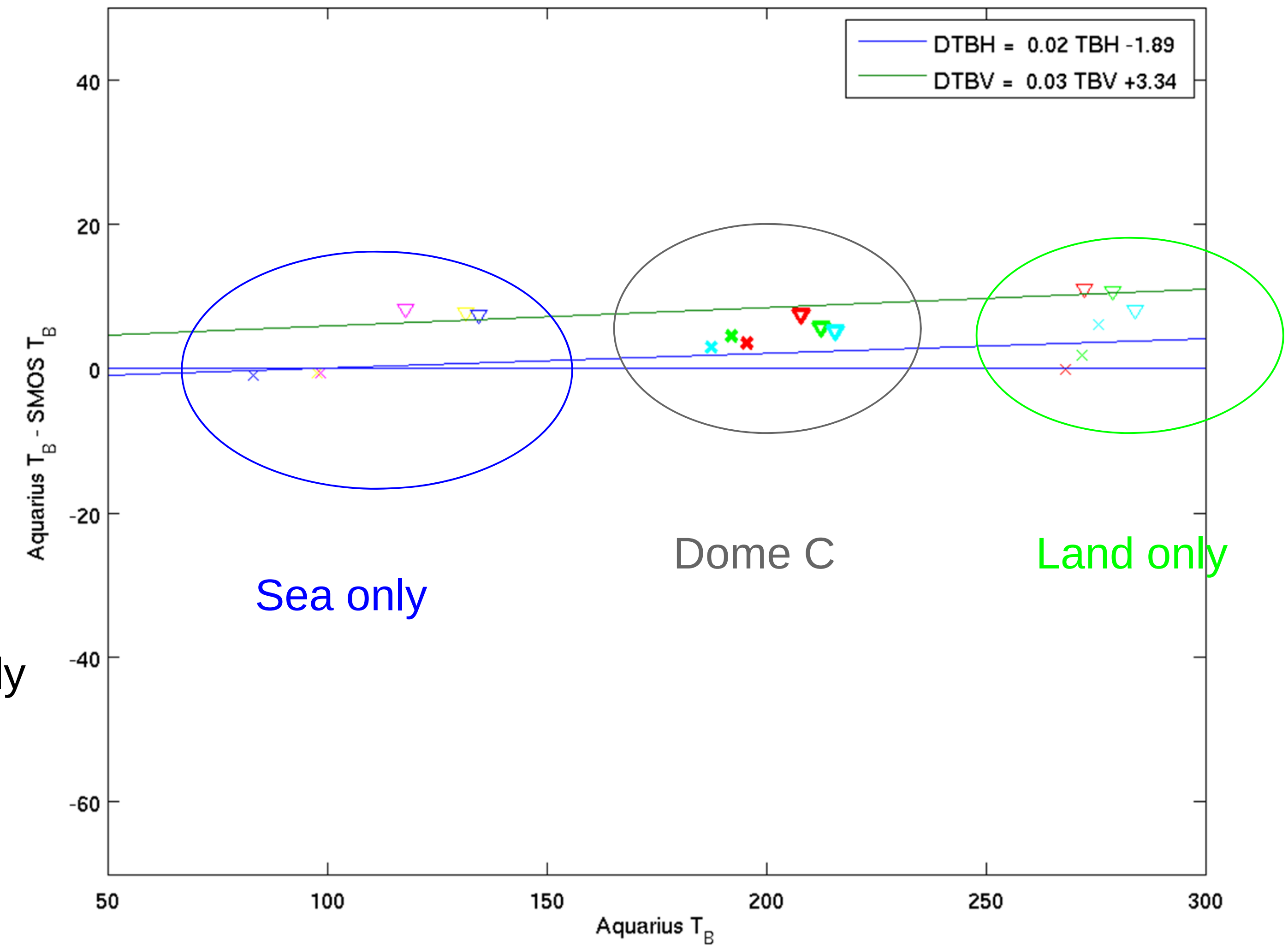


SMOS & Aquarius science workshop, 15/04/2013

All sites summary

Different biases in H and V Aquarius beams show mostly consistent results

Discrepancies between land, sea and ice appear closely linked to brightness temperature level



Summary

SMOS Tbs are consistently lower than Aquarius Tbs v2.0

- Biases vary from 0-2.5K over ocean up to 6-9K over land, with a linear increase with Tb.

Dome C and Collocations give access to full range of temperatures for intercalibration

Yet not enough to characterize proper biases in each instrument.

Comparison with ground measurements and model of reference might help. And DomeC is a very good candidate.

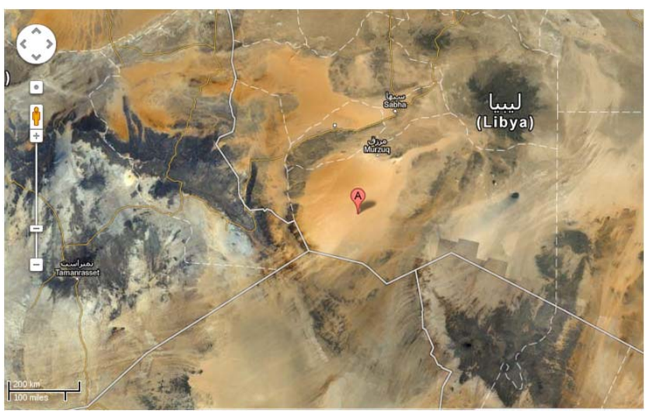
But will not allow to explore the whole range.

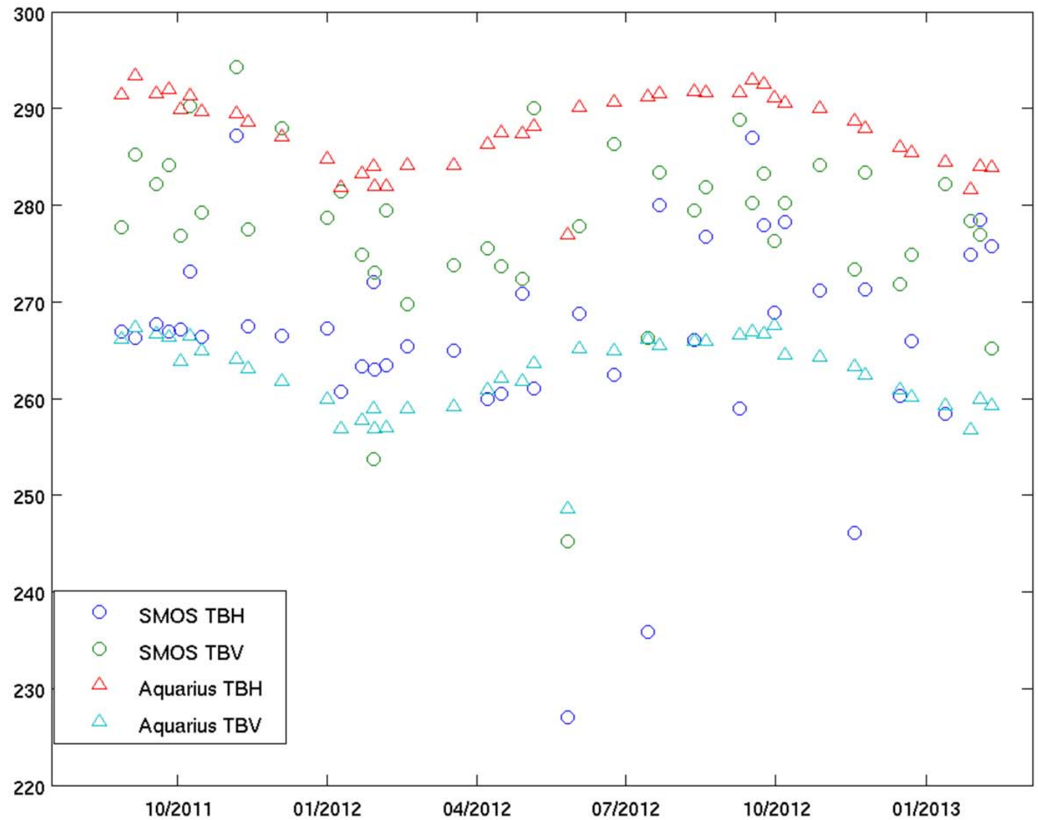
Standard definition will need various levels of temperature to cover for land, ice and ocean thematics.

Yet other comparisons...

Saharan desert, although not stable in time could still be used for intercomparison on a daily basis.

Southwest Libya offers a good example





Work in progress...