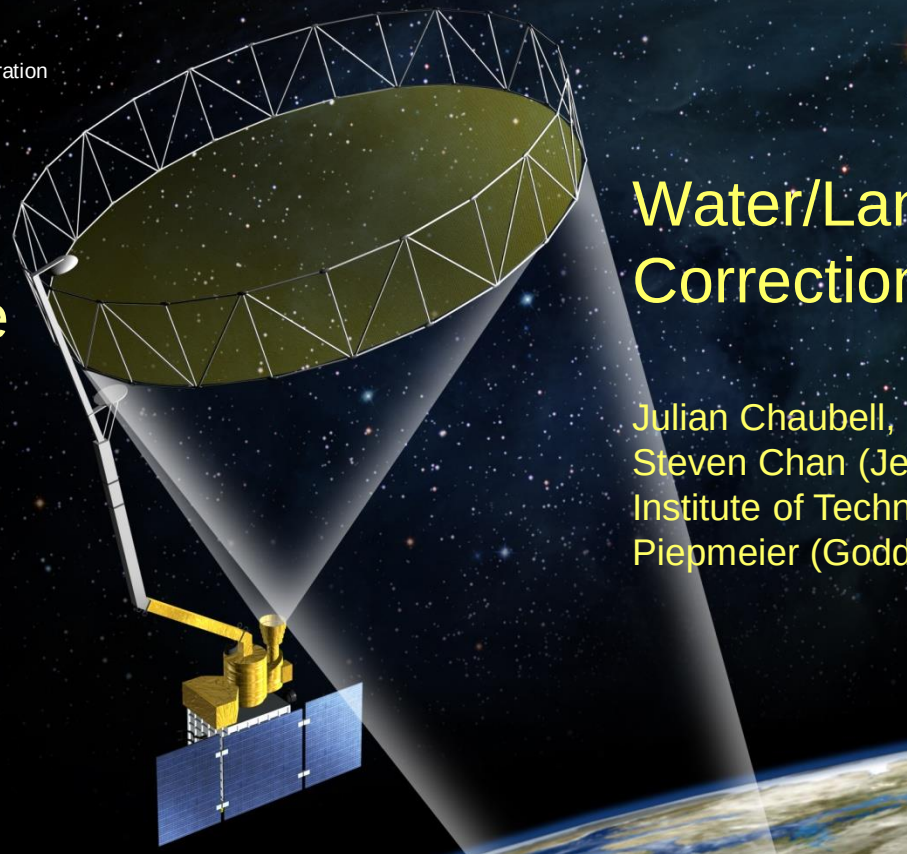
National Aeronautics and Space Administration

Soil Moisture Active Passive Mission

SMAP



Water/Land Contamination Correction

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Outline

- Review of Implementation
- Overview of new elements in the L1B_TB and L1B_TB_E product
- Explanation of rules for the status of corrected temperatures
- Show some results
- Conclusions

Water Contamination Correction Implementation

The total measured temperature can be separated into two contributions:

$$TB_p = (1-f) * TB_p^{land} + f * TB_p^{water}$$

– If footprint is on land we apply the formula:

$$TB_p^{land} = \frac{TB_p - f * \overline{TB}_p^{water}}{1-f}$$

– If footprint is on water we apply the formula:

$$TB_p^{water} = \frac{TB_p - (1-f) * \overline{TB}_p^{land}}{f}$$

where *f* is the water fraction. *f*=1 in pure water and *f*=0 for pure land.

$$f = \int G.M d\Omega = \int_{\theta=[0,\pi],\psi=[0,2\pi]} G(\theta,\psi)\, M(\theta,\psi) \sin\theta \;\; d\theta d\psi$$

$$\cong \int_{\theta=[0,10*\pi/180],\psi=[0,2\pi]} G(\theta,\psi) M \sin\theta \;\; d\theta d\psi$$

L1B_TB Product – New Elements Overview

New field	Description
footprint_surface_status	Indicates if the center of footprint lies on land (0) or water (1).
surface_water_fraction_mb_h	Gain weighted fraction of static water within the radiometer H pol antenna pattern
surface_water_fraction_mb_v	Gain weighted fraction of static water within the radiometer V pol antenna pattern
tb_h_surface_corrected	Water/land contamination corrected horizontally polarized brightness temperature at the surface after RFI filtering
tb_v_surface_corrected	Water/land contamination corrected vertically polarized brightness temperature at the surface after RFI filtering

Note that tb_h and tb_v were not eliminated.
surface_water_fraction_mb was replaced by surface_water_fraction_mb_v and surface_water_fraction_mb _h

Output Surface Corrected TB rules

- If footprint boresight is over land then water contamination correction is performed.

- If footprint boresight is over water then land contamination correction is performed.

- Over land, water contamination correction is performed if water fraction is smaller than 0.9.

- Over water, land contamination correction is performed if water fraction is greater than 0.1.

- Correction is performed only if sea ice fraction is equal to zero.

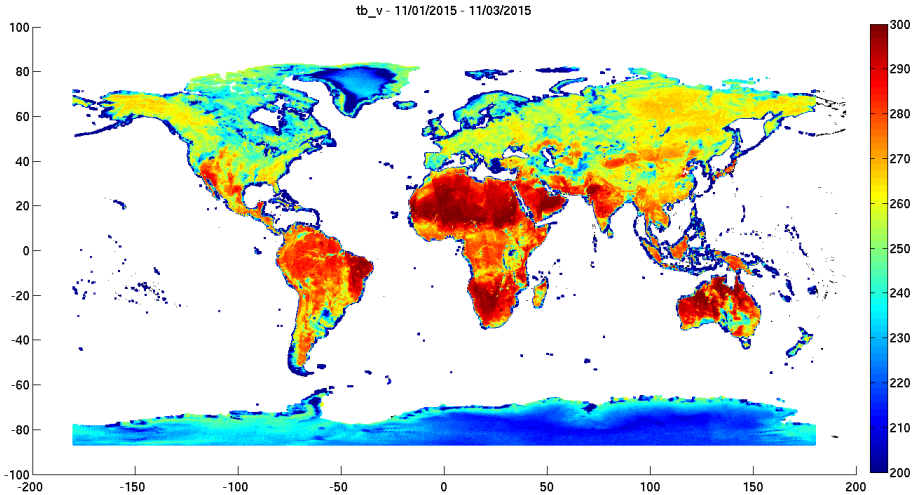
- Valid range for TB V polarization [50K: 340K]. Values outside this range are replaced with fill values.

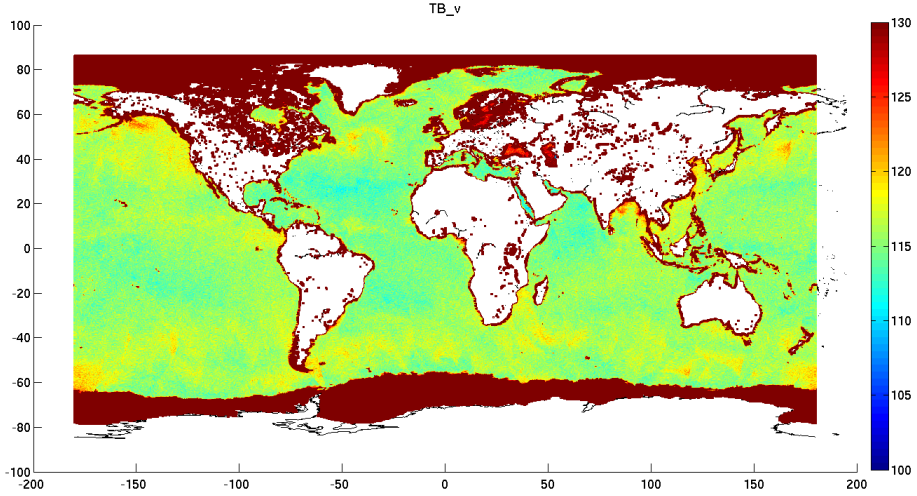
- Valid range for TB H polarization [30K: 340K]. Values outside this range are replaced with fill values.

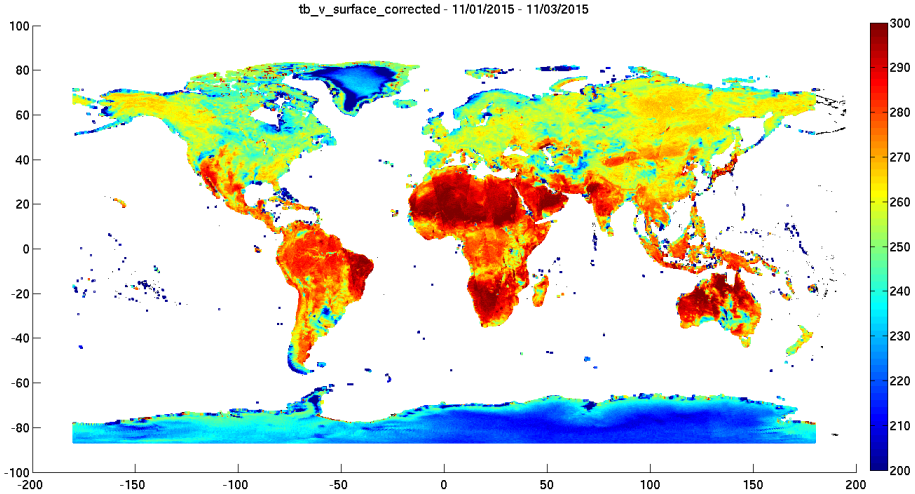
- Over land, if tb_surface_corrected < tb then value is replace with fill values.

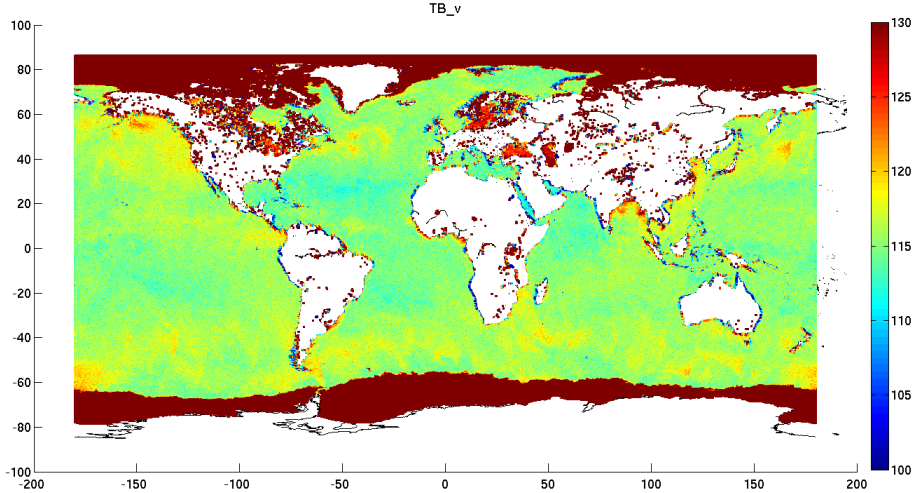
- Over water, if tb_surface_corrected > tb then value is replace with fill values.

Global Map tb_v corrected and uncorrected (11/01-03/2015)

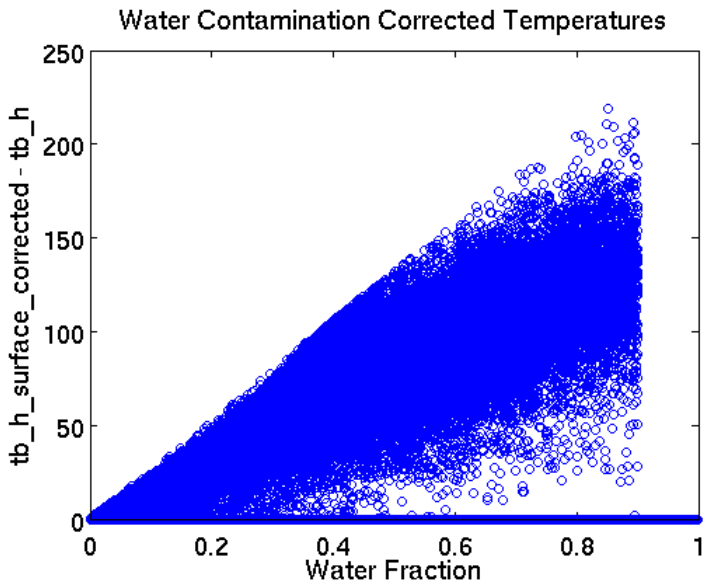


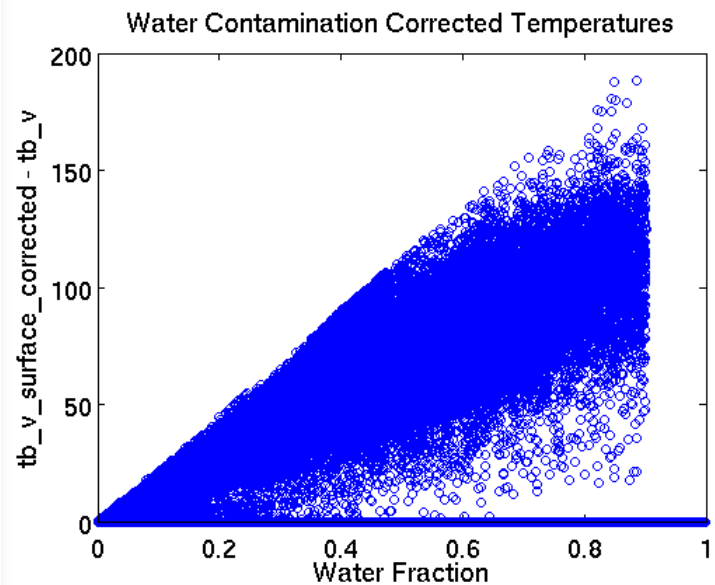


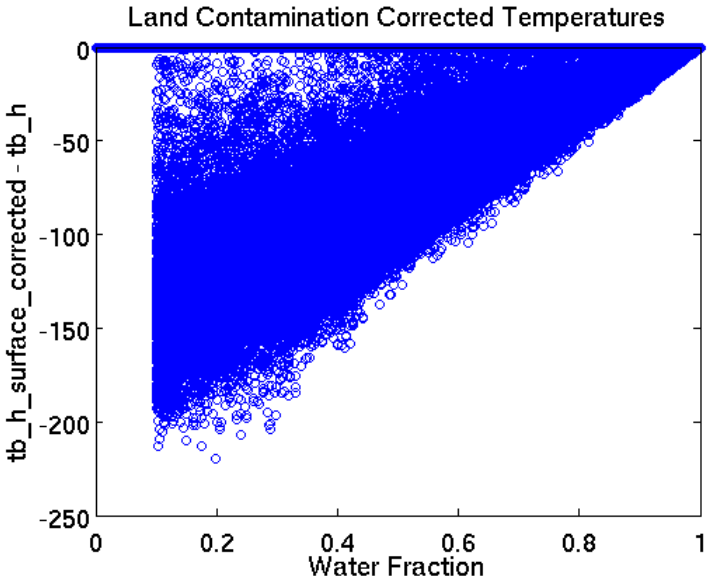


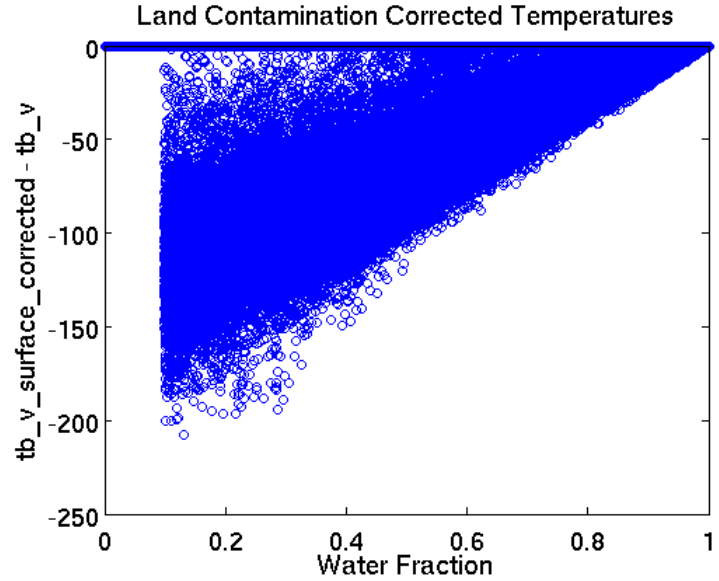


Test Verification: tb_surface_corrected – tb

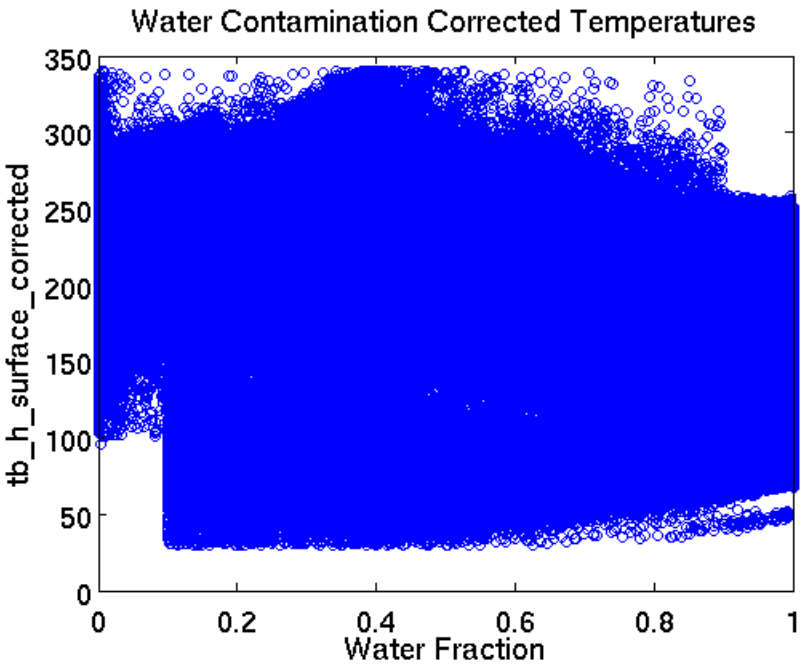


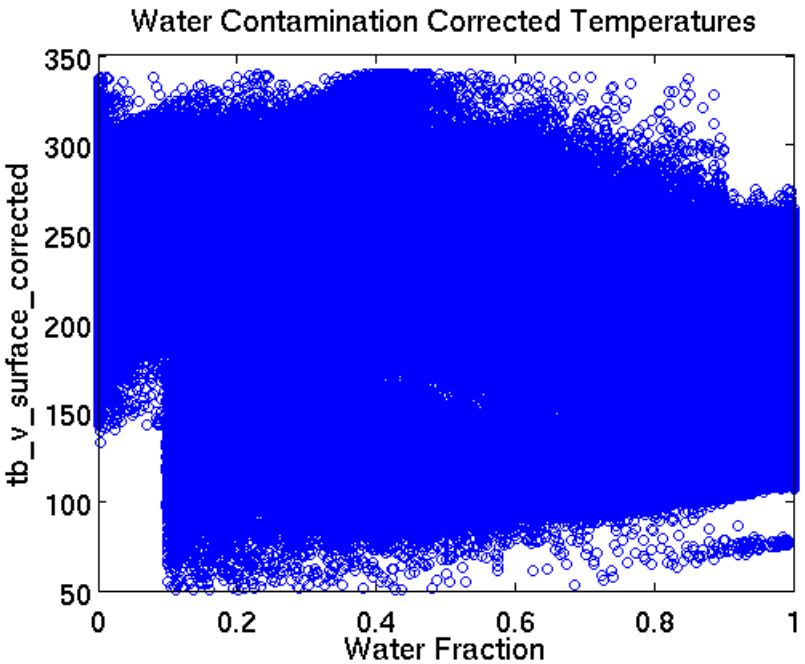






Range Verification



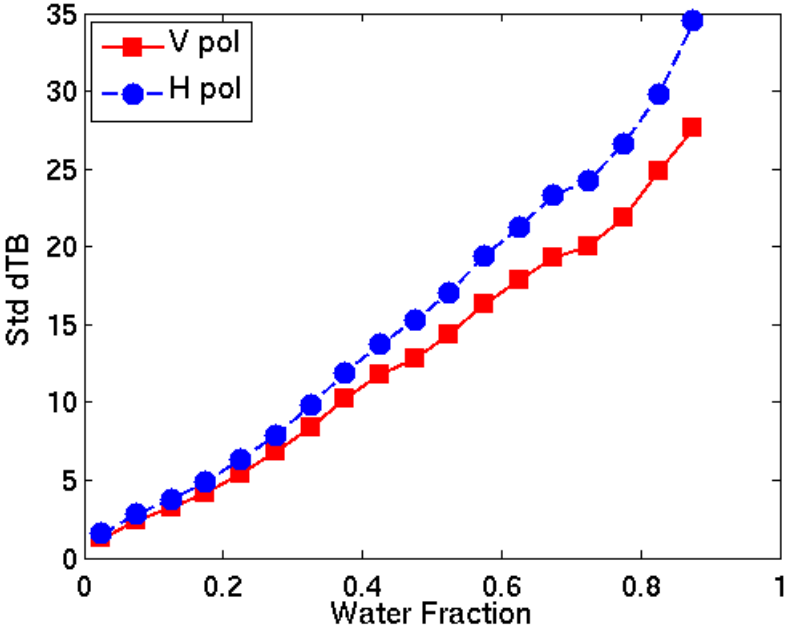


Acceptable range for tb_h: [30K 340 K]

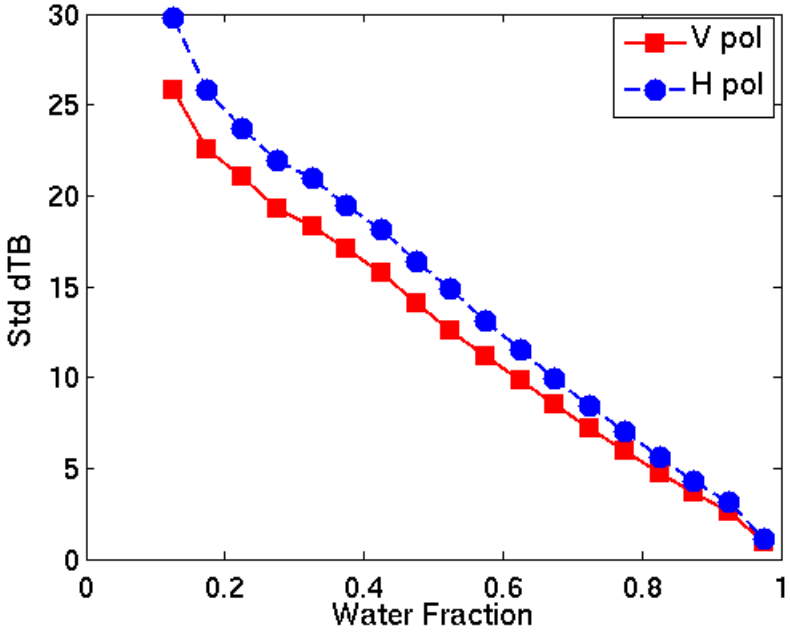
Acceptable range for tb_v: [50K 340 K]

Uncertainty

Land TB uncertainty



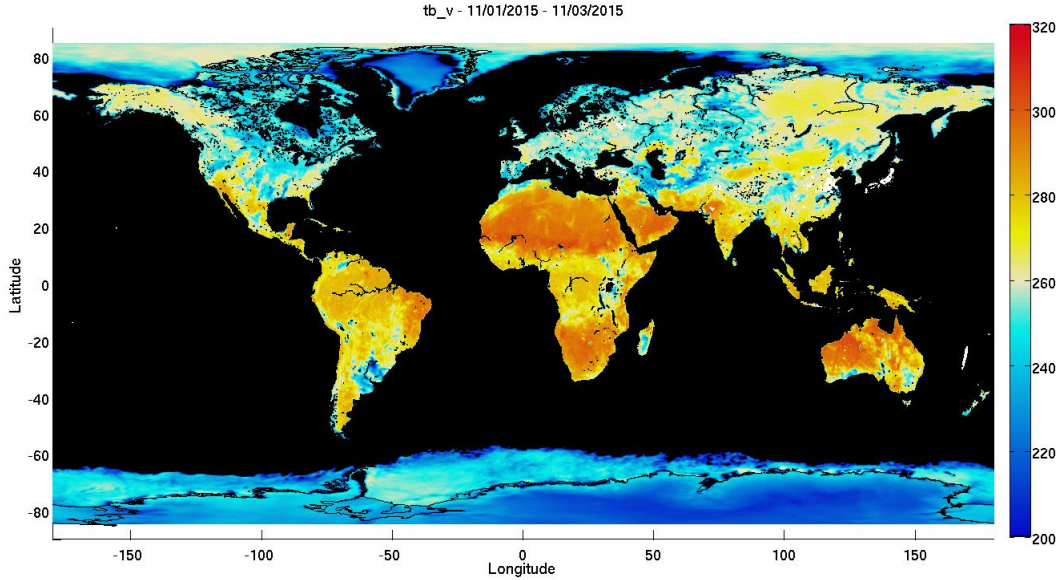
Water TB uncertainty

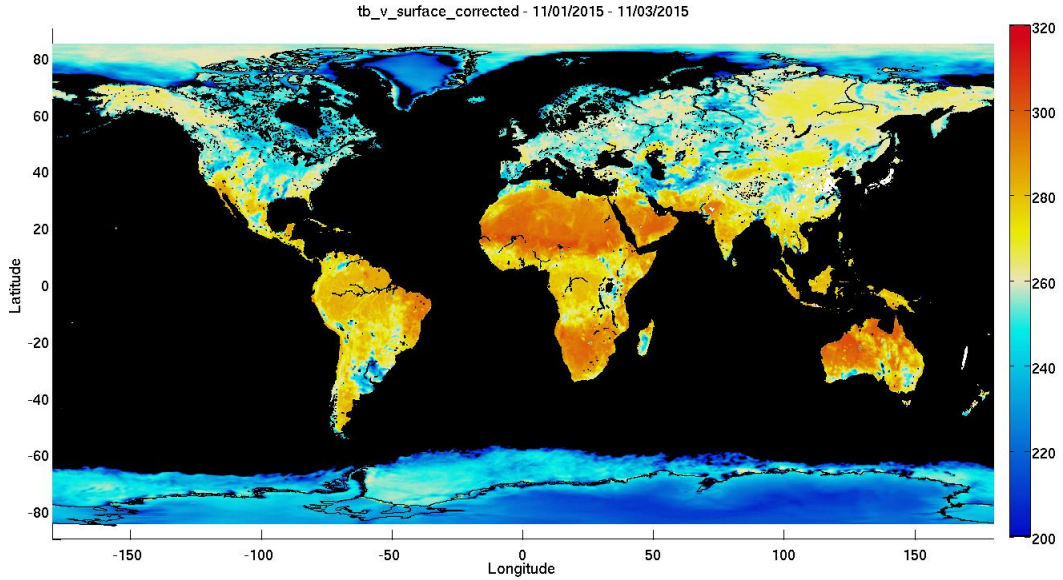


L1B_TB_E Product – New Elements Overview

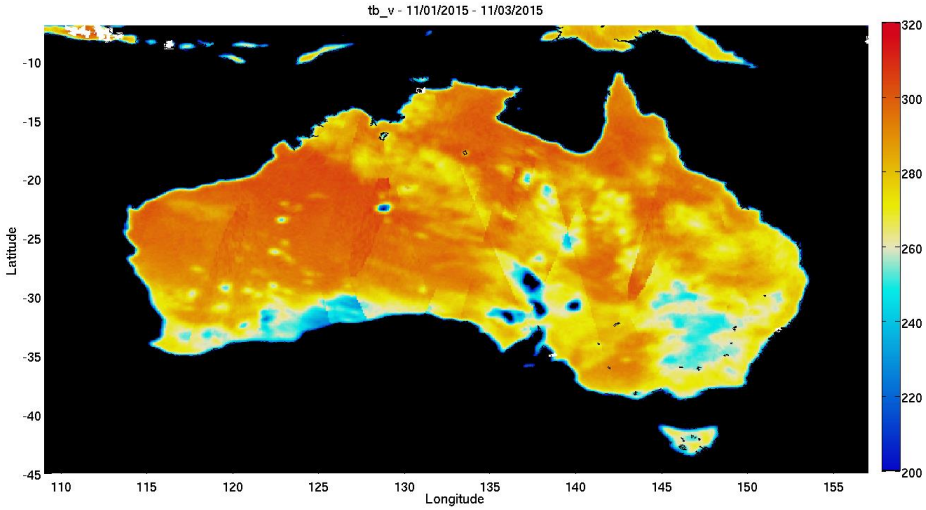
New filed	Description
grid_surface_status	Indicates if the grid point lies on land (0) or water (1)
surface_water_fraction_mb_h_aft	Gain weighted fraction of static water within the radiometer H pol antenna pattern for aft looks
surface_water_fraction_mb_h_fore	Gain weighted fraction of static water within the radiometer H pol antenna pattern for forward looks
surface_water_fraction_mb_v_aft	Gain weighted fraction of static water within the radiometer V pol antenna pattern for aft looks
surface_water_fraction_mb_v_fore	Gain weighted fraction of static water within the radiometer V pol antenna pattern for forward looks
tb_h_surface_corrected_aft	Water/land contamination corrected horizontally polarized brightness temperature at the surface after RFI filtering for aft looks
tb_h_surface_corrected_fore	Water/land contamination corrected horizontally polarized brightness temperature at the surface after RFI filtering for forward looks
tb_v_surface_corrected_aft	Water/land contamination corrected vertically polarized brightness temperature at the surface after RFI filtering for aft looks
tb_v_surface_corrected_fore	Water/land contamination corrected vertically polarized brightness temperature at the surface after RFI filtering for forward looks

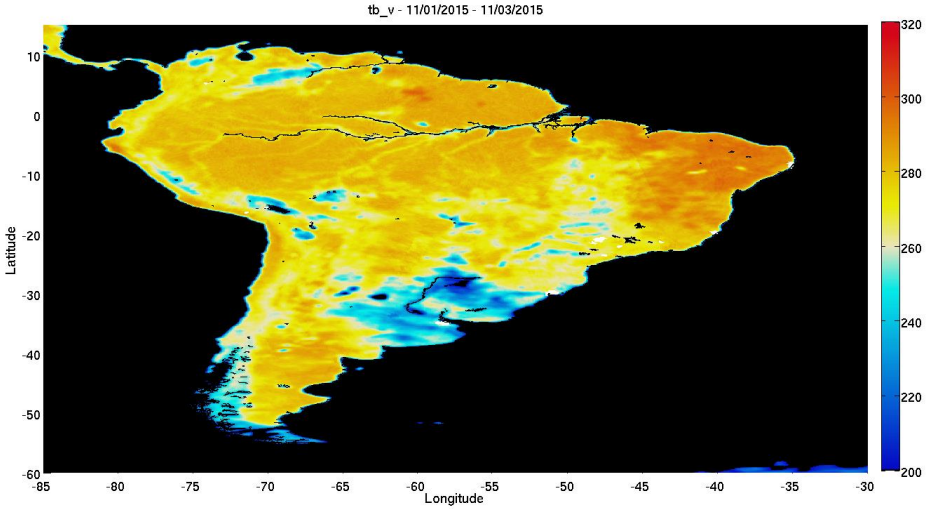
Global Projection

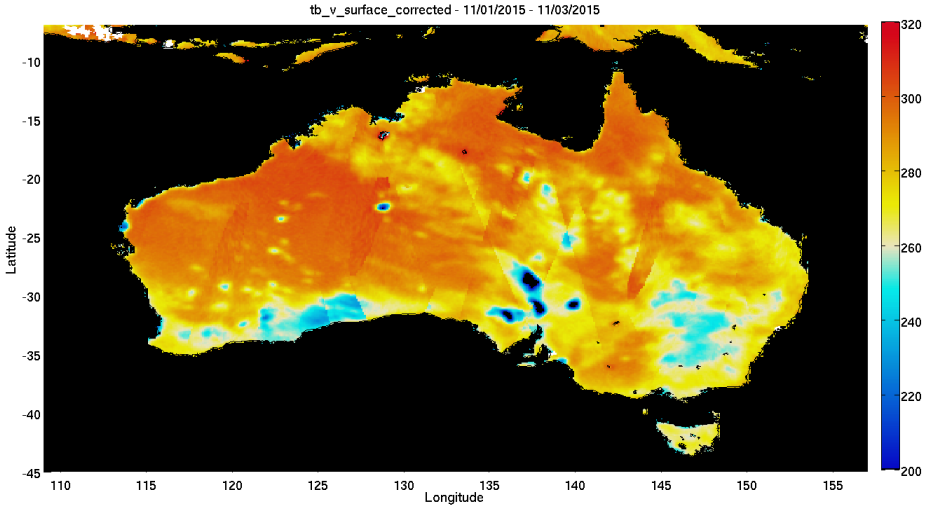


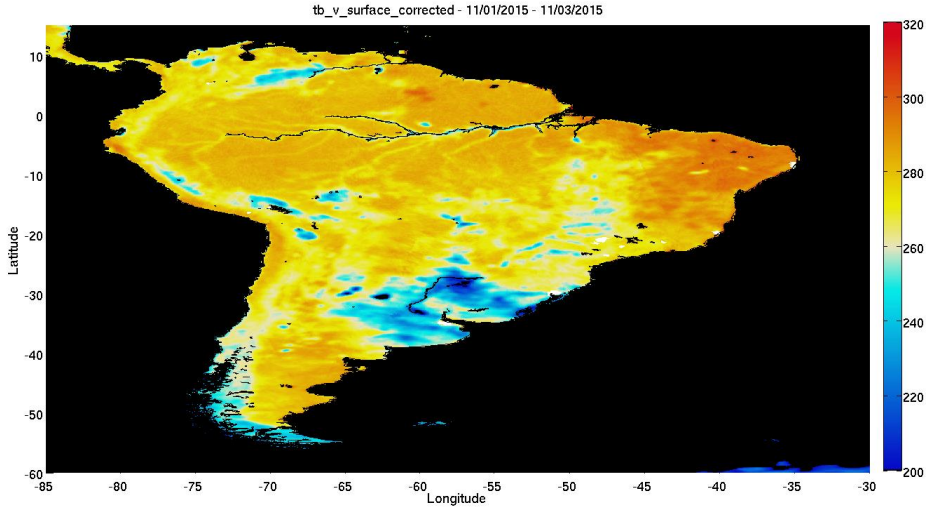


Global Projection

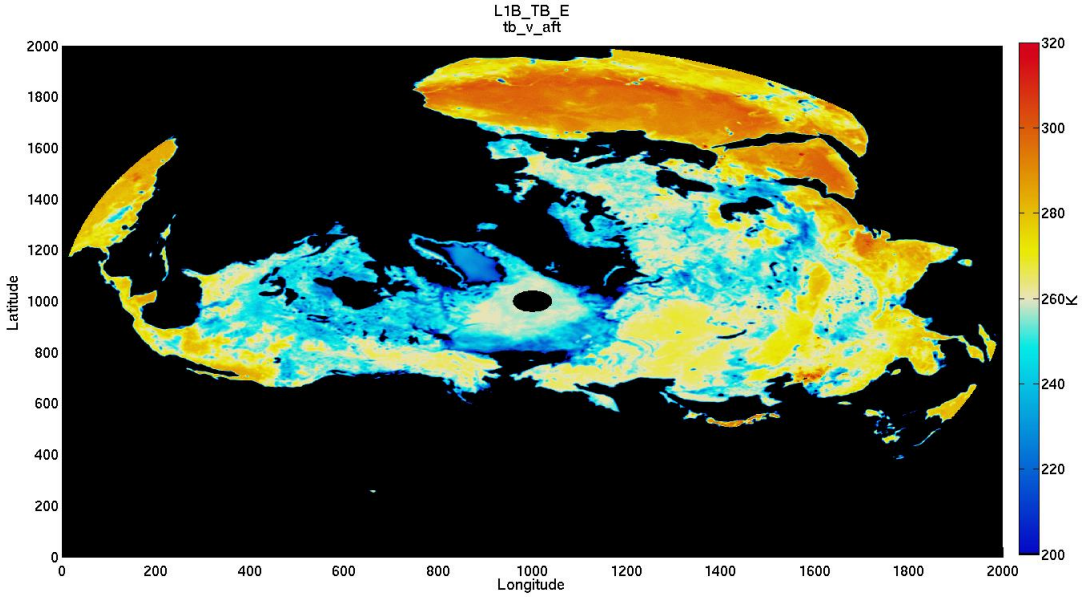


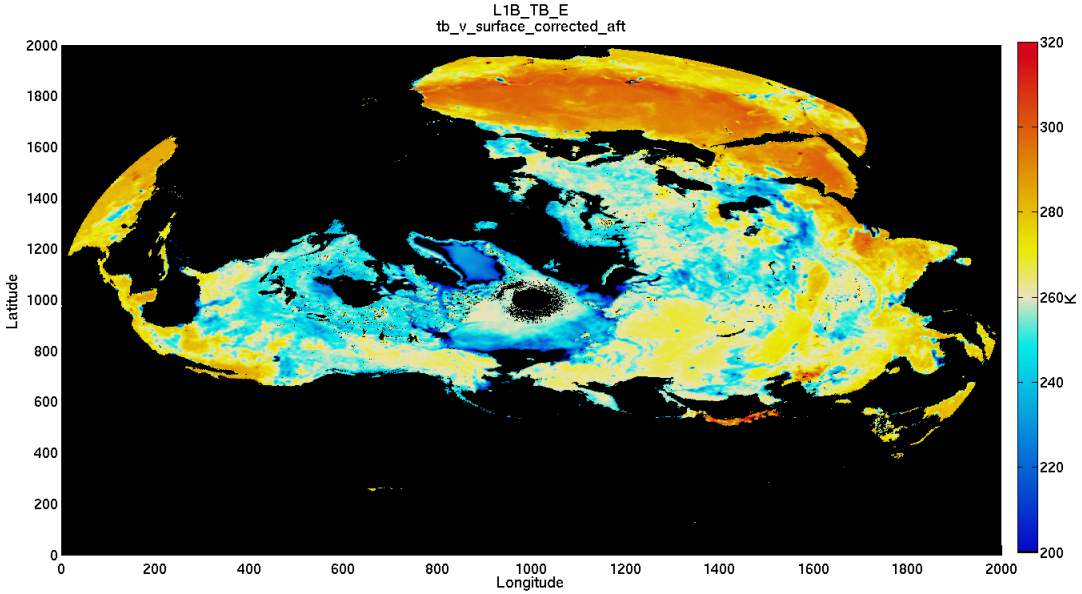




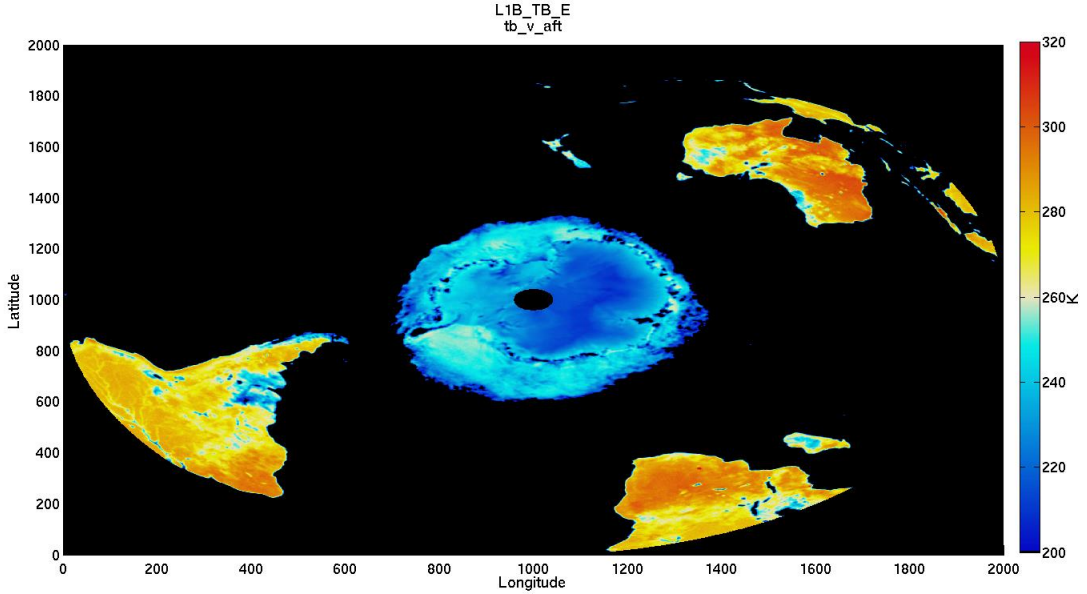


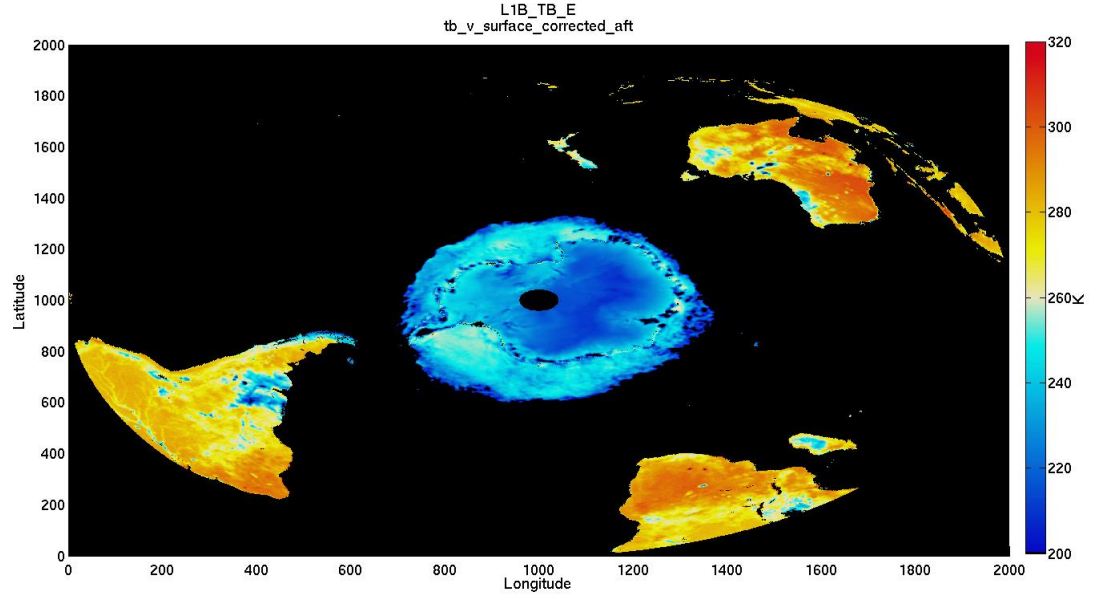
North Projection



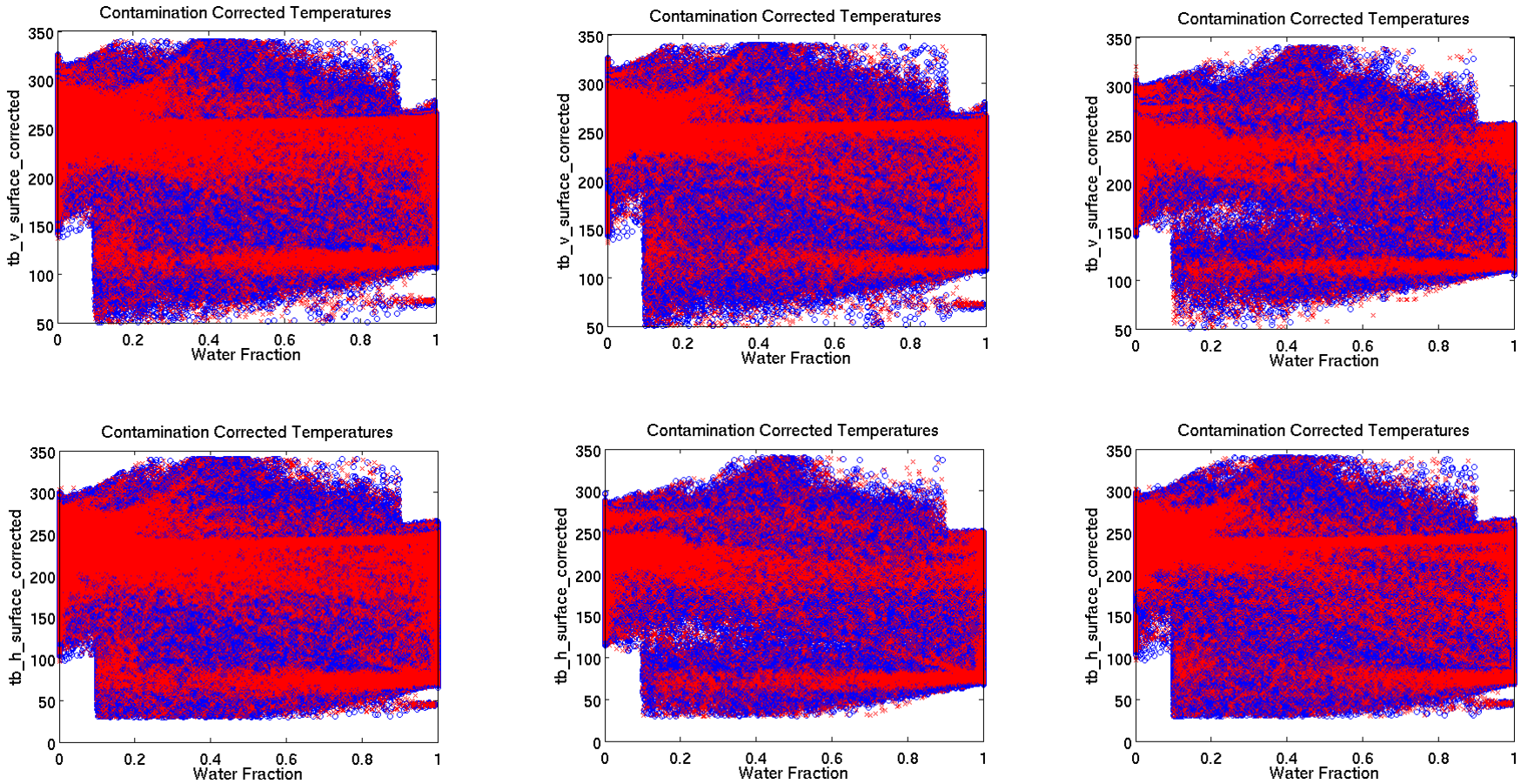


South Projection





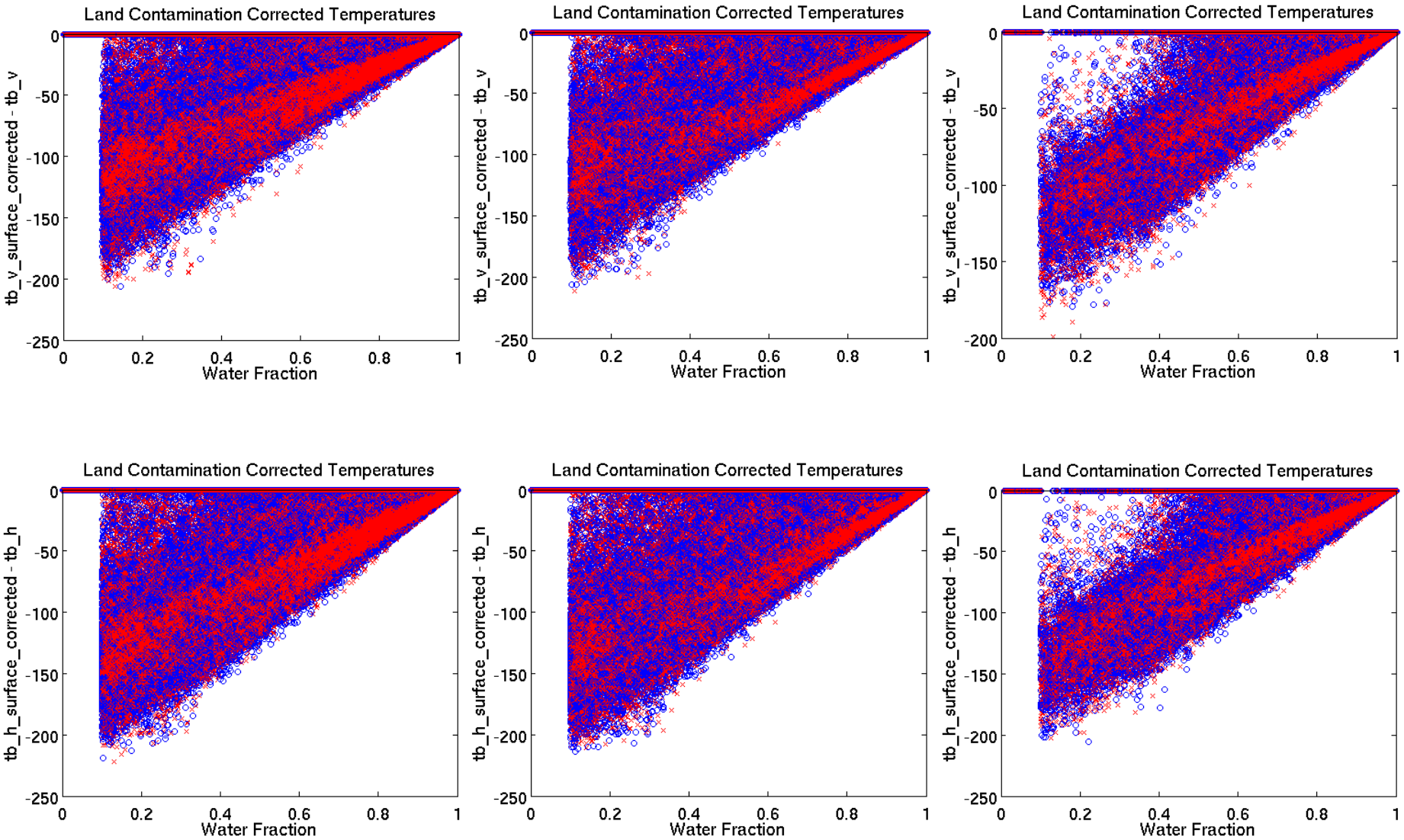
Range Verification



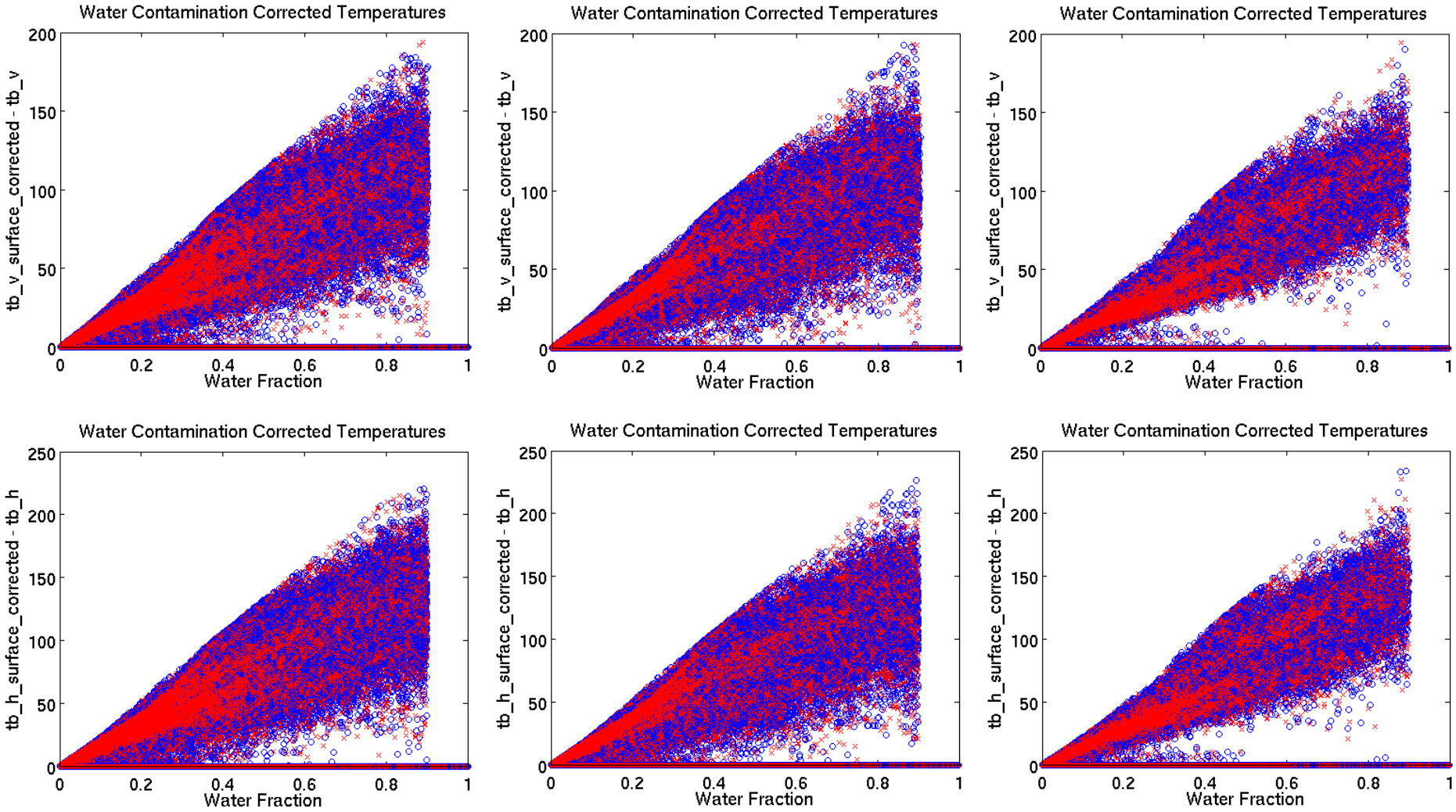
- Red for Fore looks
- Blue for Aft looks

Acceptable range for tb_h: [30K 340 K] Acceptable range for tb_v: [50K 340 K]

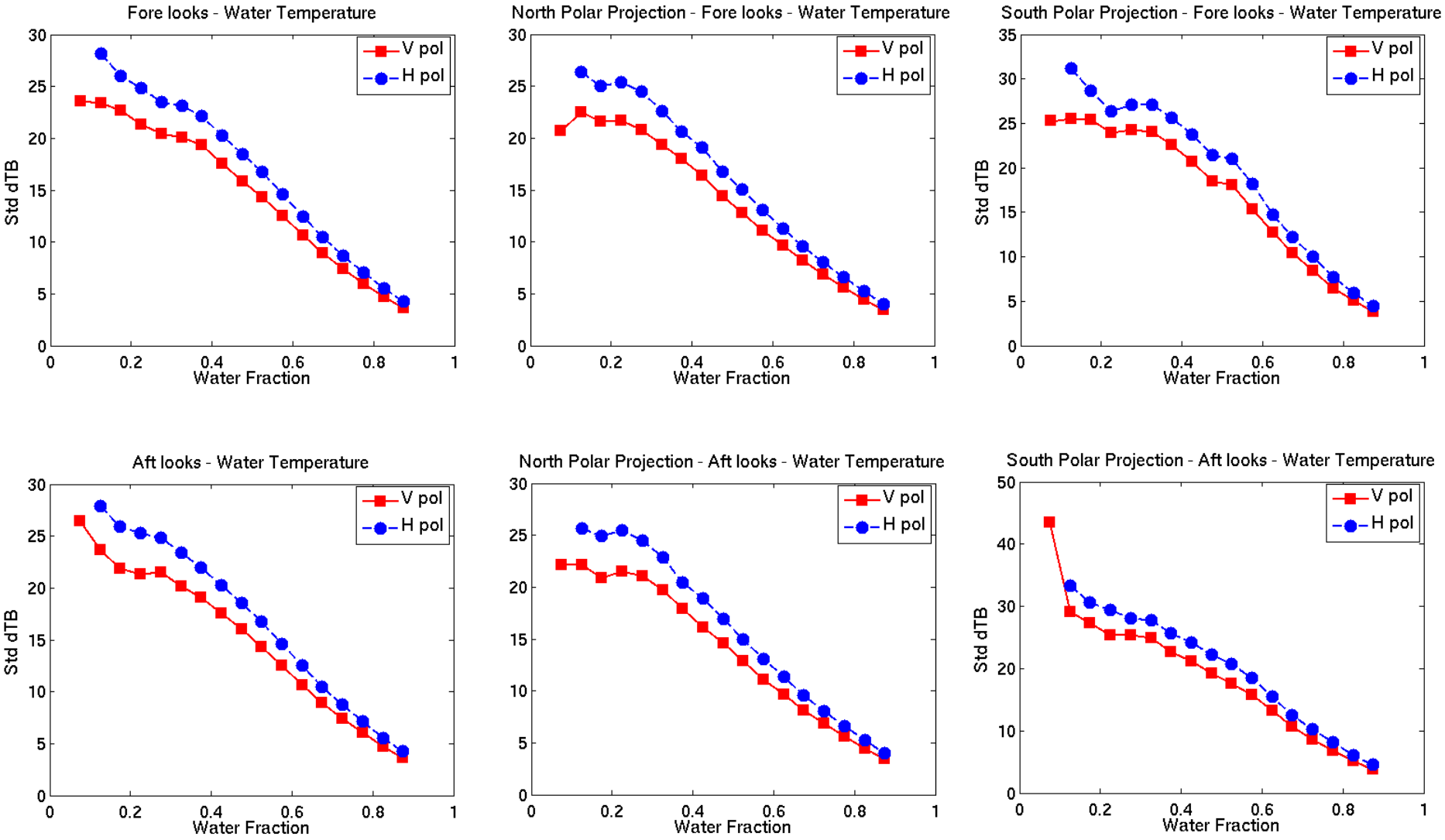
Test Verification over Water: tb_surface_corrected – tb



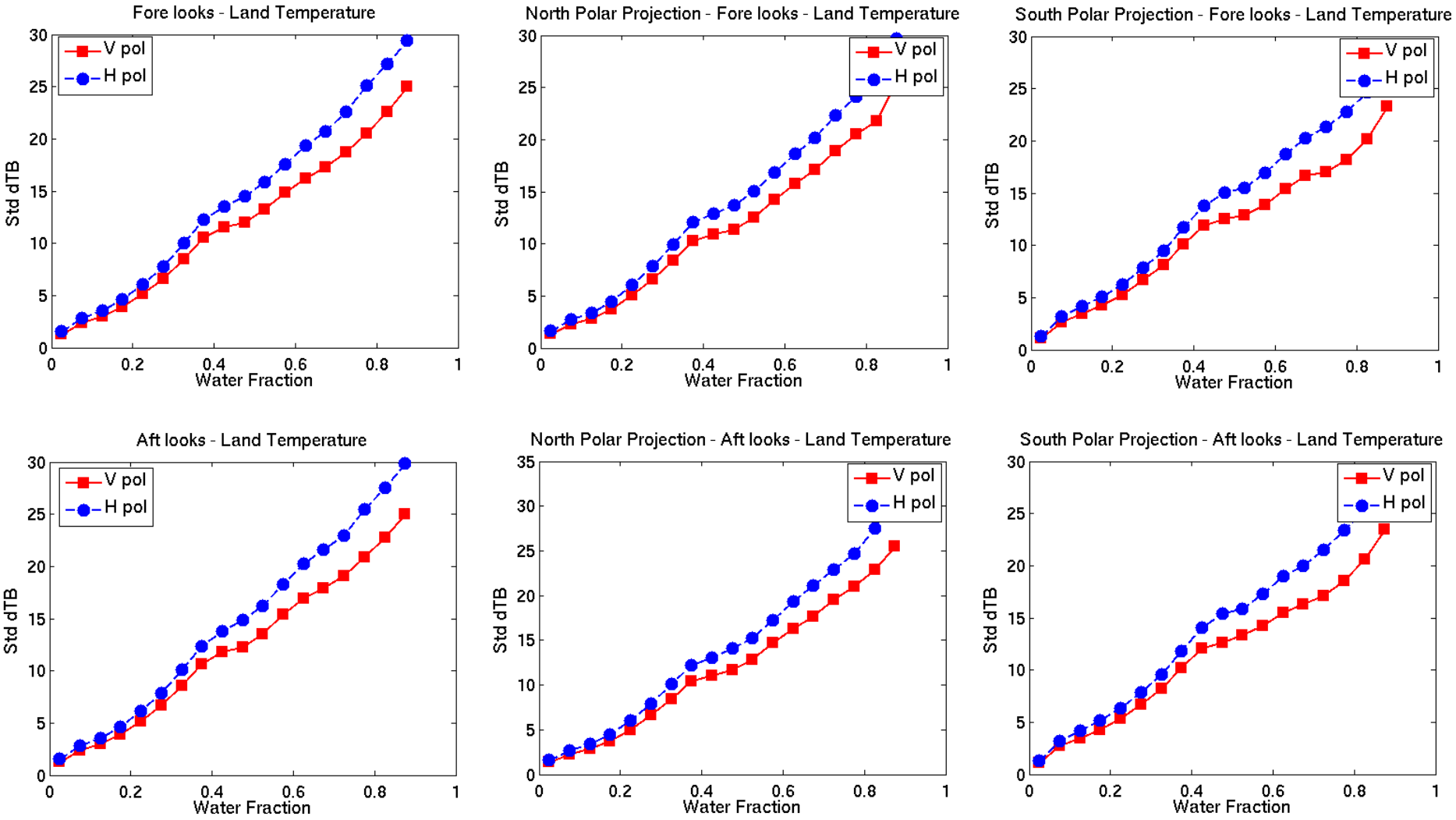
Test Verification over Land: tb_surface_corrected – tb



Water Temperature Uncertainty



Land Temperature Uncertainty



Conclusion

- Uncertainty plots show consistency between L1B_TB and L1B_TB_E.
- Uncertainty plots show consistency between L1B_TB_E groups.
- Scattering plots show that all fields satisfy range conditions.
- The water/land contamination correction improvement is ready for deployment.
- Some improvements can be pursued, in particular, for the estimation of water temperatures.

I hope you enjoy the new product!