A Roughness Correction Algorithm for Aquarius using MWR

W. Linwood Jones, Yazan Hejazin, Salem El-Nimri

Central Florida Remote Sensing Laboratory, University of Central Florida

Abstract

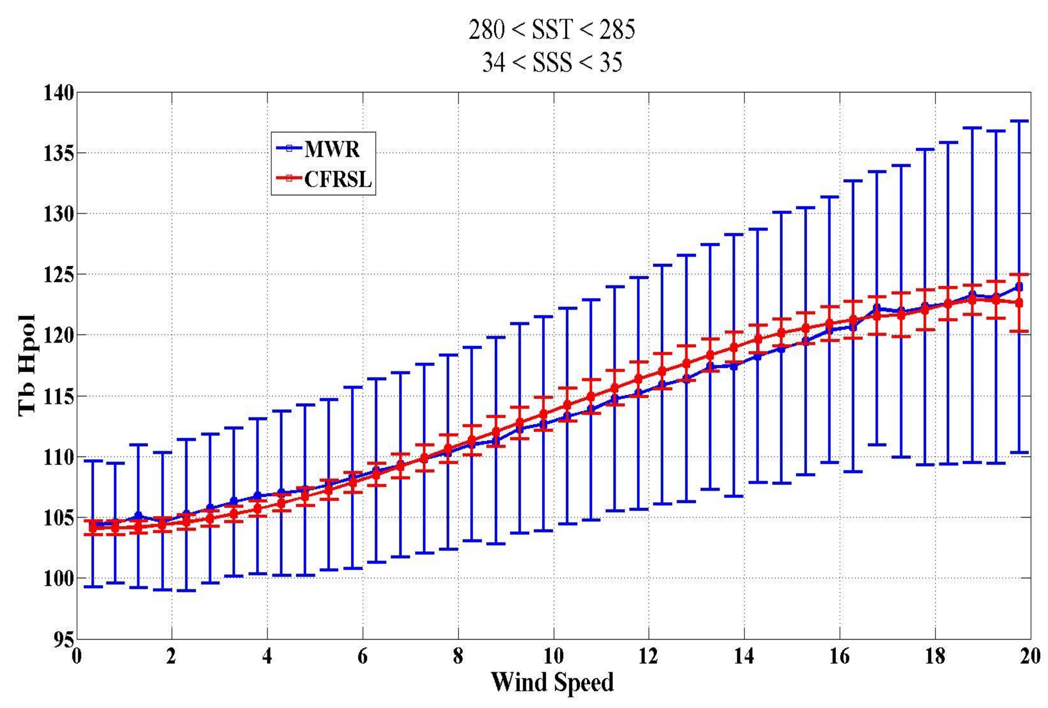
This paper presents an alternative independent approach for the AQ roughness correction, which is derived using simultaneous measurements from the CONAE Microwave Radiometer (MWR).

For the majority of ocean wind speeds, the ocean excess emissivity (Δεexcess) provided by the radiative transfer models (RTM) is reasonably well understood given a measurement of ocean surface wind vector. Scatterometer ocean normalized cross section measurements provide an alternative empirical approach to correct for the roughness error in salinity measurements. The MWR provides a third complementary semi-empirical approach by measuring the excess ocean emissivity at 36.5 GHz and applying RTM (improved ocean surface emissivity model) to translate this to the AQ 1.4 GHz frequency. This RTM will be validated using a one-year of AQ dataset using L-band surface brightness temperatures and SSS retrievals, on-orbit MWR brightness measurements, and actual AQ Validation Data System (AVDS) buoy SSS measurement collocations. Simulated roughness errors will be introduced and techniques to characterize these errors will be evaluated. A prototype MWR roughness correction algorithm will be described and results presented, which illustrate the effect of applying the roughness correction algorithm on salinity retrievals.

Overview

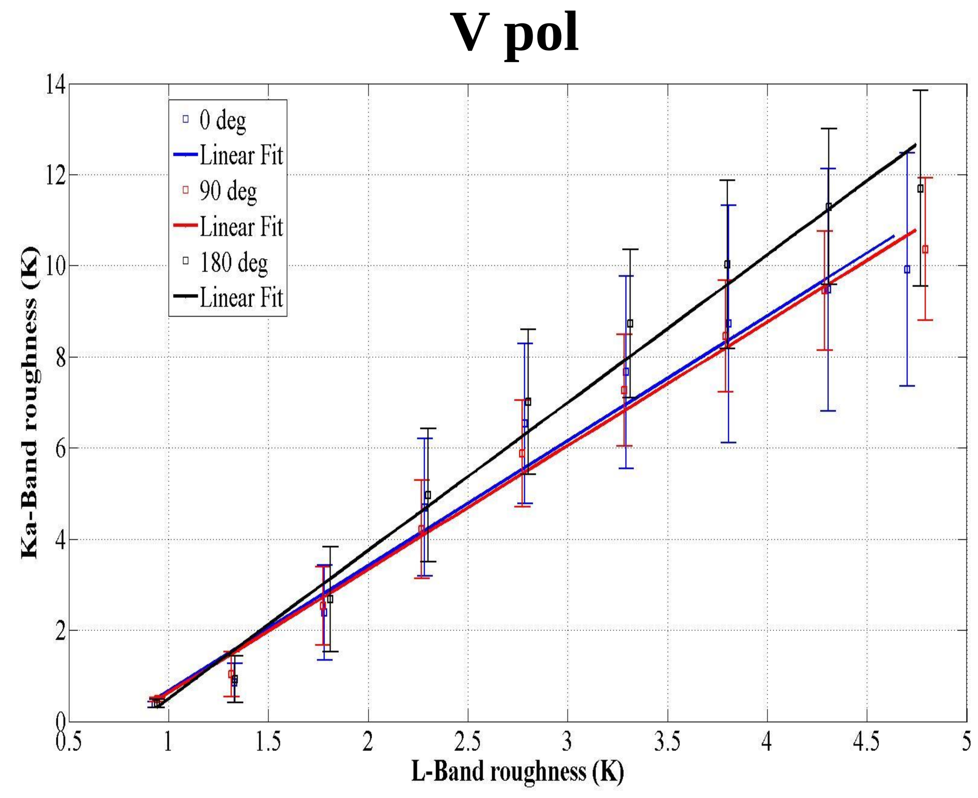
- An alternative approached was developed to calculate AQ roughness correction
  - Using MWR Tb 36.5 GHz V- & H-pol
- The Radiative Transfer Model (RTM) was tuned using on-orbit MWR data
  - To generate surface Tb @ 36.5 GHz
- Wind speed and wind direction effects were simulated using over one year of MWR data
  - MWR data V5.0S
  - 2.5M points
- Roughness correction at Ka-band was compared with AQ roughness correction
- Empirical relationship was found

Tuning the RTM for Wind Speed @ Ka-Band for Hpol

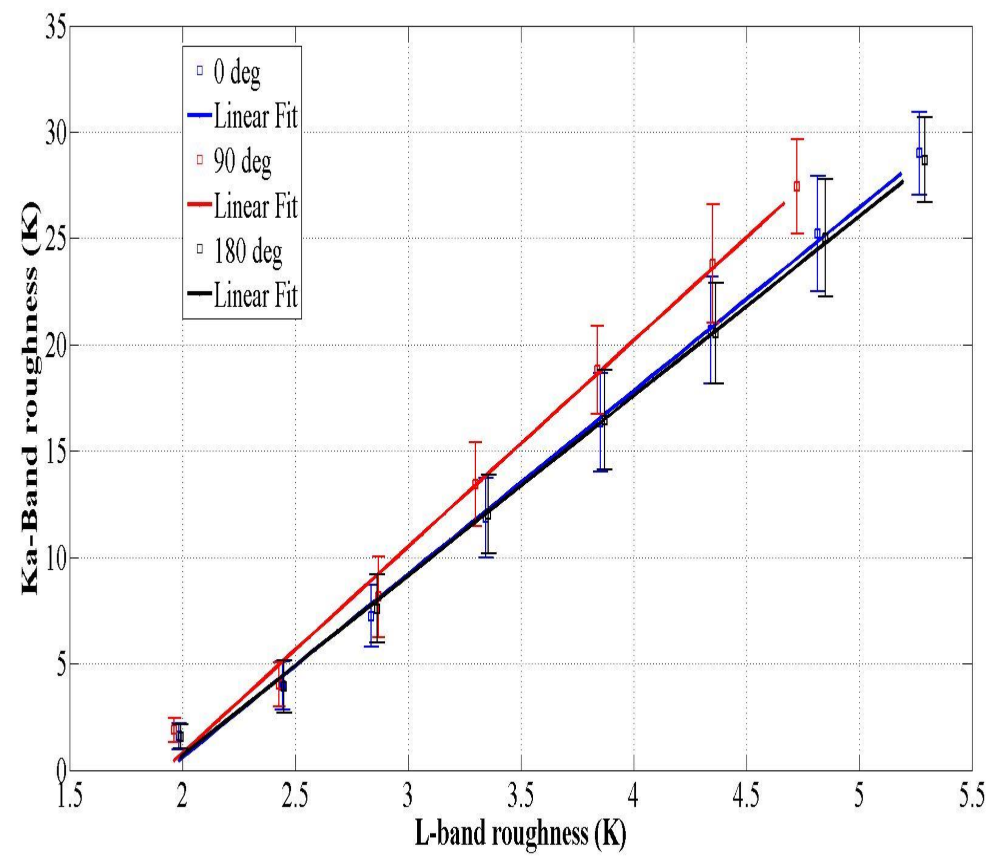


AQ & MWR roughness corrections (for different WD)

V pol



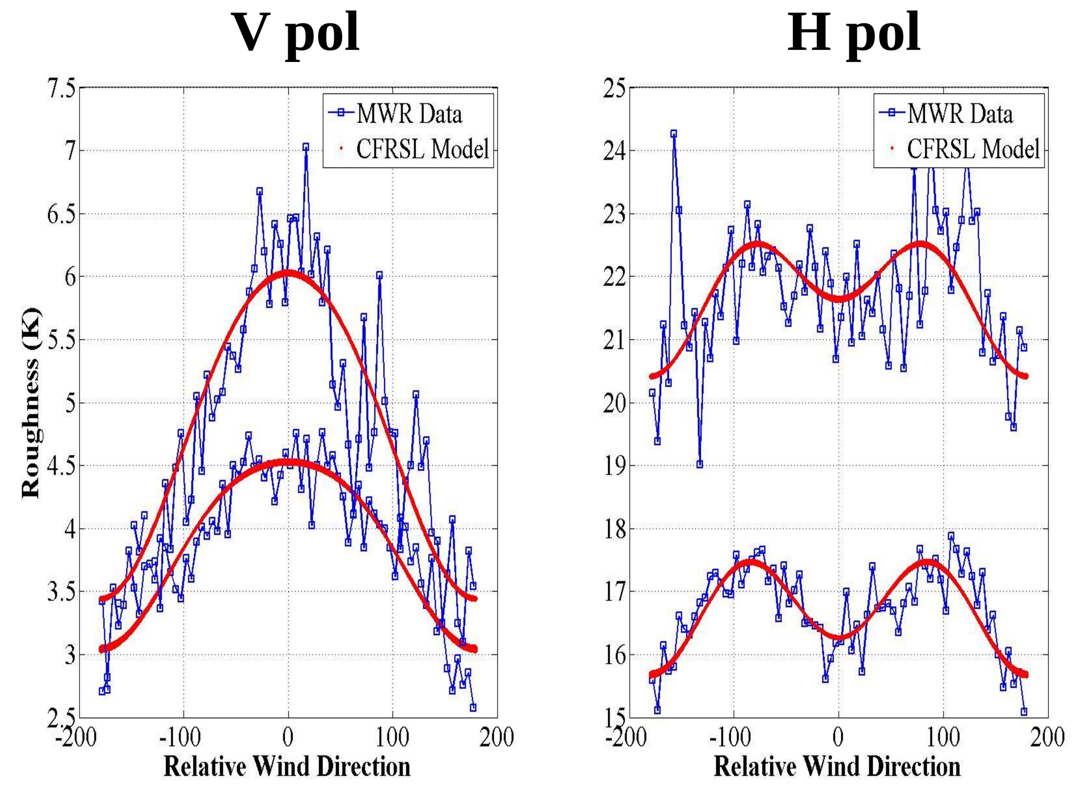
H pol



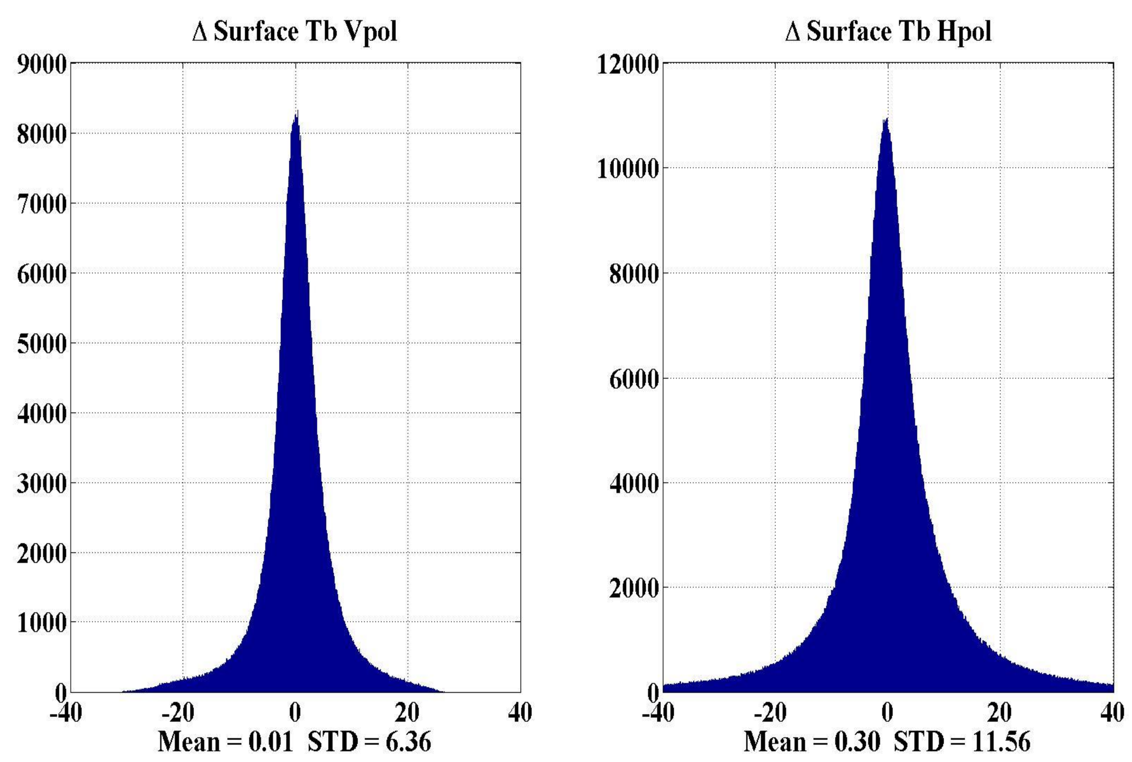
Tuning the RTM for Wind Direction @ Ka-Band

V pol

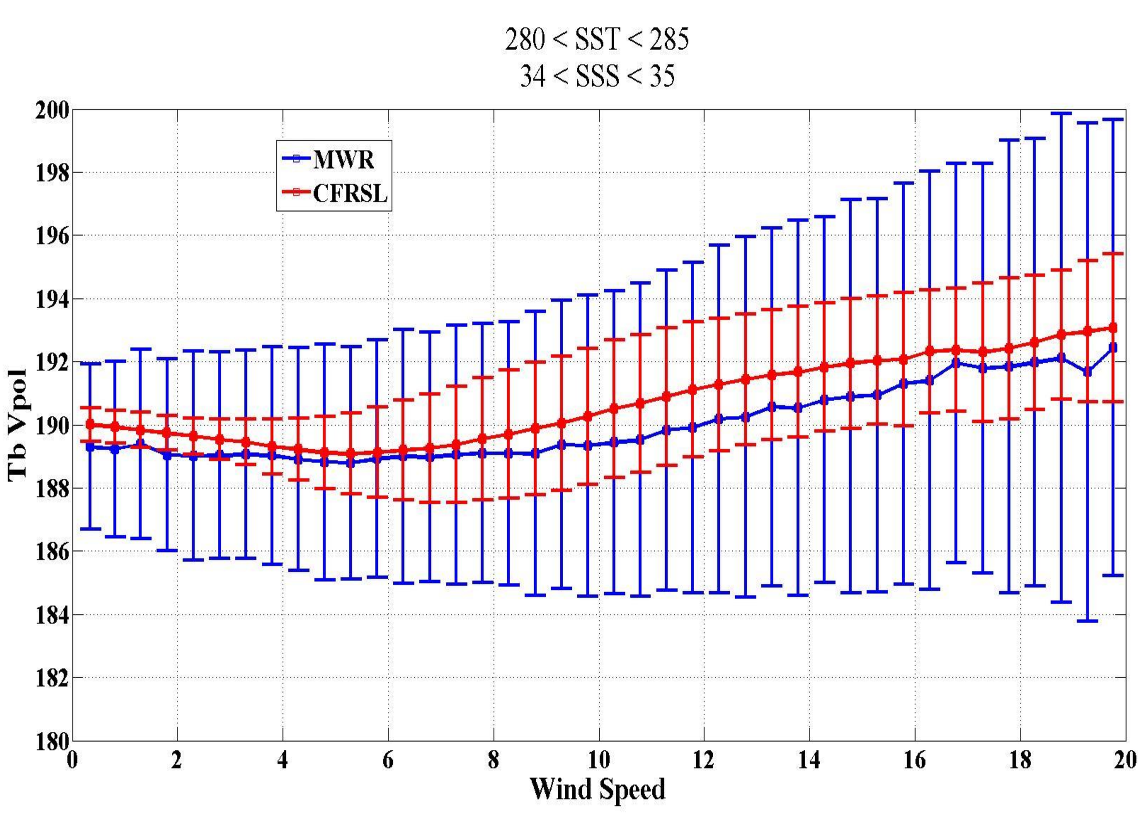
H pol



Comparison Between Measured and Simulated Surface Tb @ Ka-Band



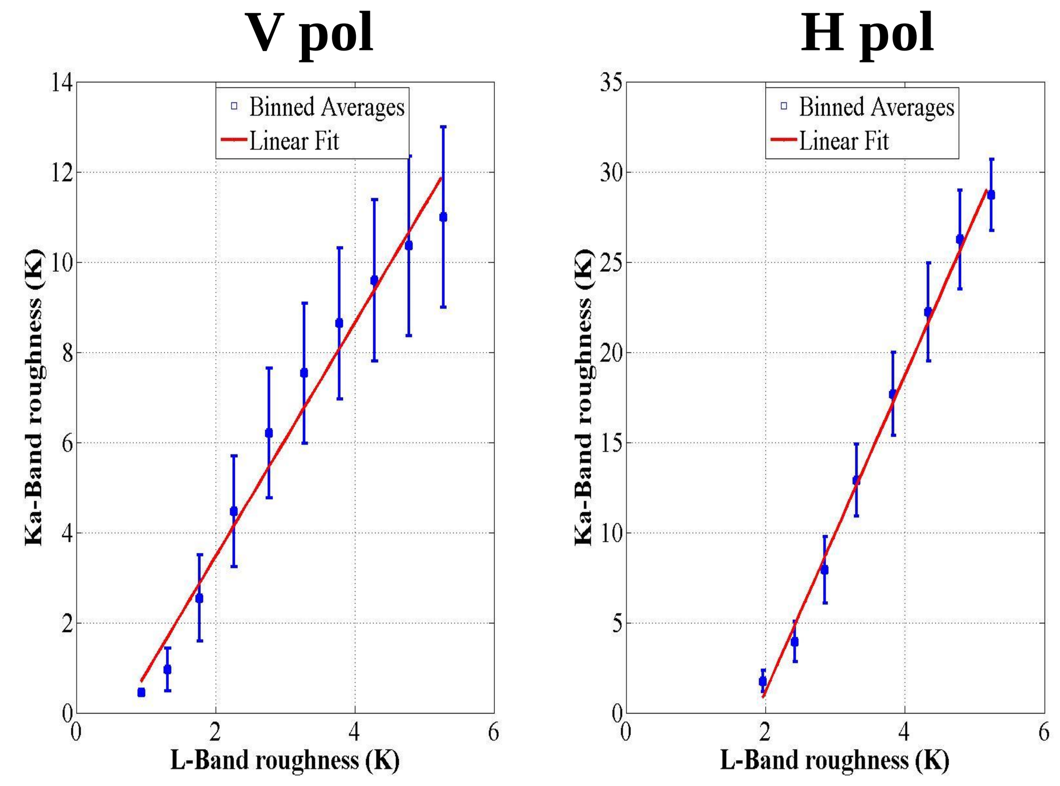
Tuning the RTM for Wind Speed @ Ka-Band for Vpol



AQ & MWR roughness corrections All WS & WD

V pol

H pol



Summary

- The CFRSL emissivity model was empirically tuned using on-orbit MWR data at Ka-band (36.5 GHz)
- The model is a function of incidence angle, SST, SSS, WS and WD
- An empirical relationship can be found between Ka-band roughness correction and L-band roughness correction

References:

[1] A. Stogryn, 1967, "The apparent temperature of the sea at microwave frequencies,"*IEEE Trans. Antennas Propag.*, vol. AP-15, no. 2, pp. 278–286, Mar.

[2] S. El-Nimri et al., 2010, "An improved C-band ocean surface emissivity model at hurricane force wind speeds over a wide range of earth incidence angles," IEEE Geosci. Rem. Sens. Letters, vol. 7, NO. 4, October.