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Roughness Correction for AQ SSS Algorithm using MWR

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Central FL Remote Sensing Lab
AQ Science Team Meeting
Nov. 2013
BsAs, Argentina

MWR Derived Ocean Roughness Correction

- An alternative approached has been developed to calculate AQ roughness correction
  - Uses MWR Tb 36.5 GHz V- & H-pol
- CFRSL Radiative Transfer Model (RTM) has been tuned using on-orbit AQ & MWR data
  - Rough ocean surface *Tb* (emissivity)
    - @ L-band & Ka-band for V- & H-pol
    - Accounts for Wind Speed and Wind Direction effects

MWR Roughness Correction cont.

- Wind speed and wind direction effects were analyzed using > 1 year of AQ & MWR data
  - MWR Tb V5.0S
  - AQ L-2 V2.0
- For rain-free conditions, **Excess Roughness (ER)** is defined as the increase in surface *Tb* above the smooth surface *Tb* (due to Fresnel reflection coeff)
- **ER** at Ka-band was cross-correlated with AQ roughness correction (**ER**) at L-band
  - Empirical relationship was established

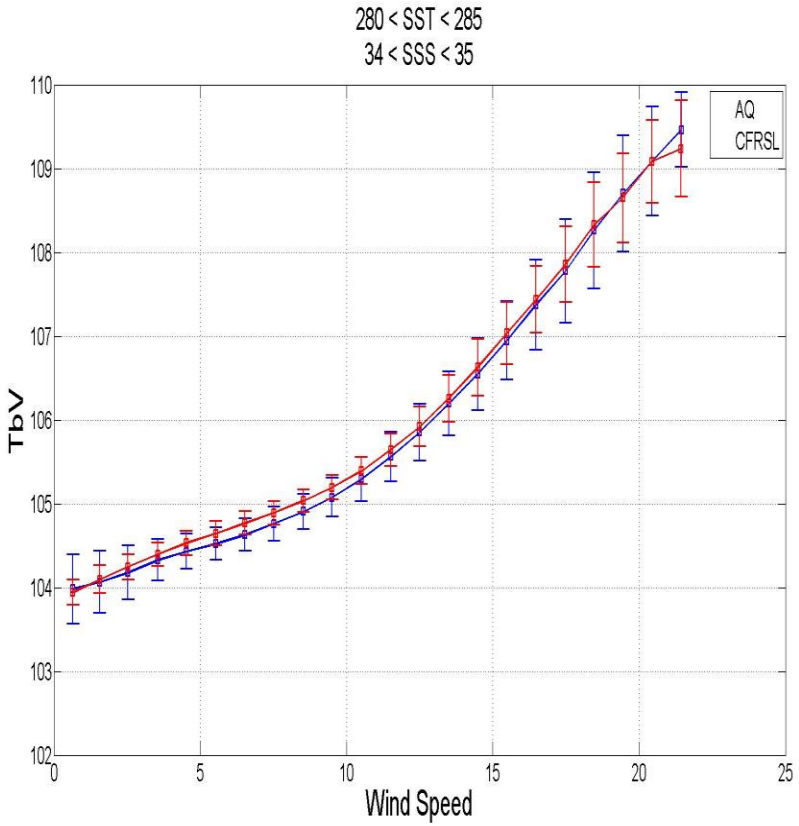
L-Band Excess Roughness Calculation

- Using AQ L-2 data, the rough-ocean *Tb* is given and we subtract the theoretical smooth *Tb* (Fresnel refl coeff) to calculate the excess roughness *Tb_ex*
- CFRSL excess ocean emissivity is tuned to match the experimental AQ excess roughness

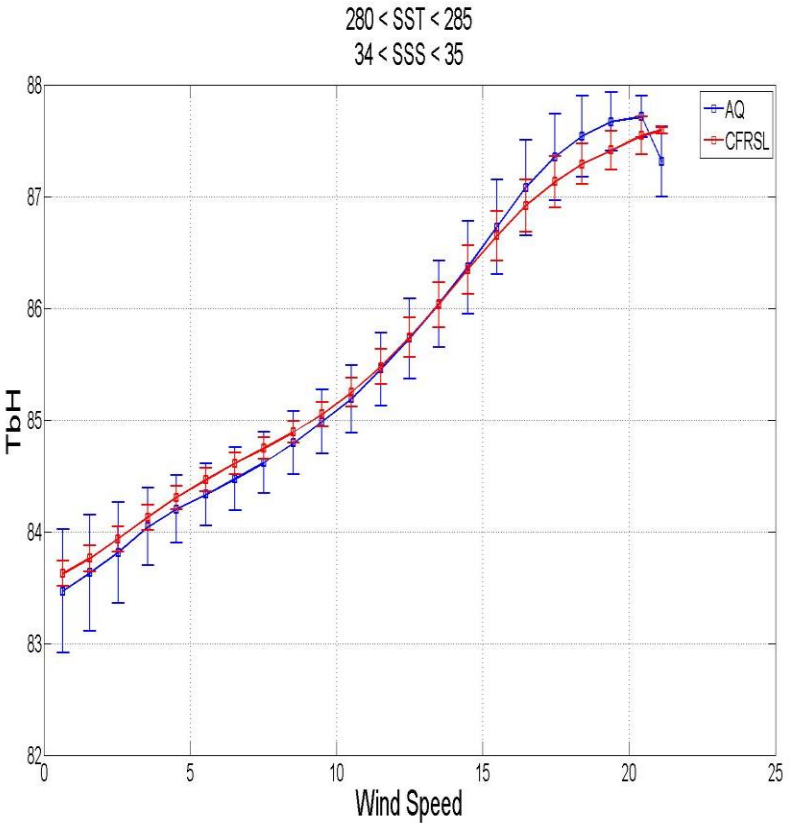
$$\varepsilon_{rough} = Tb\_ex / SST$$

Tuning RTM for Wind Speed @ L-band

V-pol

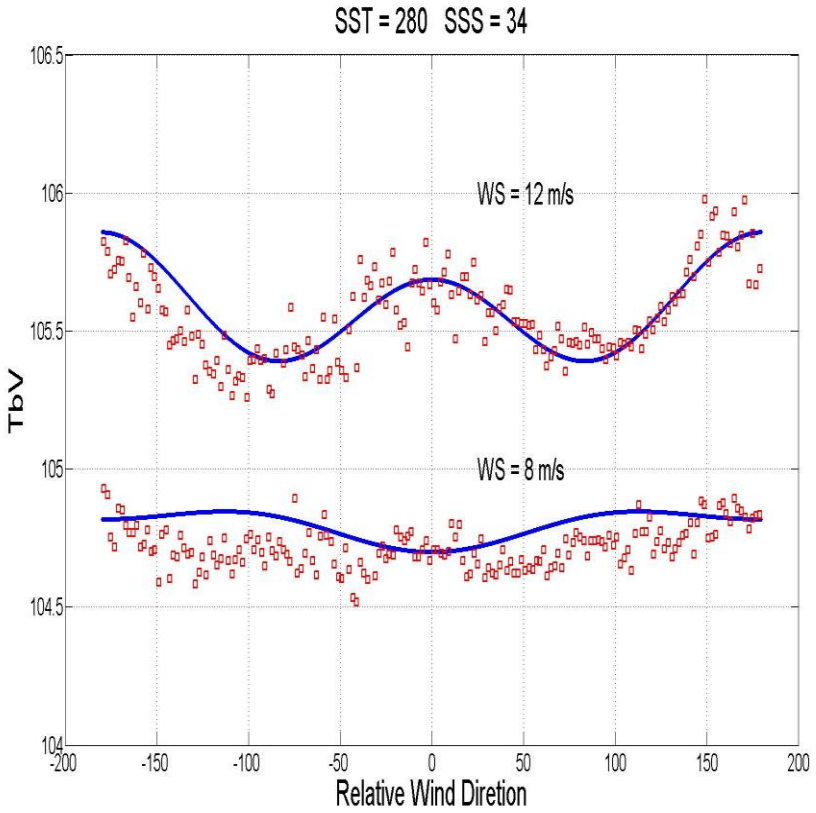


H-pol

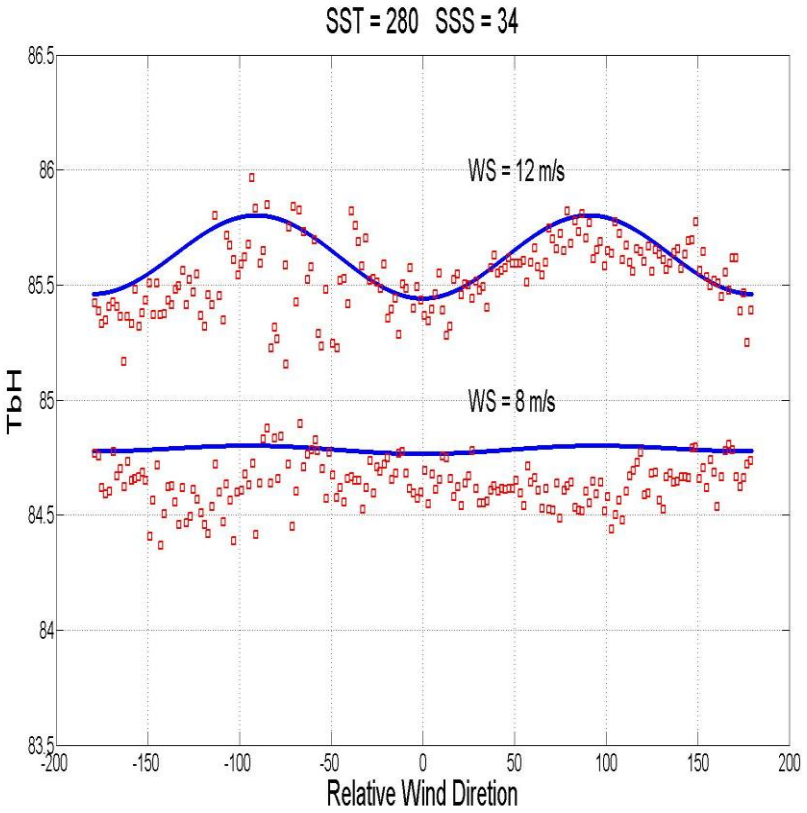


Tuning RTM for Wind Direction @ L-band

V-pol



H-pol



Ka-band Surface (Tb) Calculation

- MWR Tb measurement is top of the atmos (TOA)

$$T_{meas} = T_{TOA} = T_{up} + t(T_b + T_{dn} * G)$$

  - T_{up}, T_{dn}, τ, & Γ are calculated using XCAL radiative transfer model (RTM) with NCEP atmos pars

$$T_{b\_meas} = (T_{meas} - T_{up})/\tau - T_{dn} * \Gamma$$

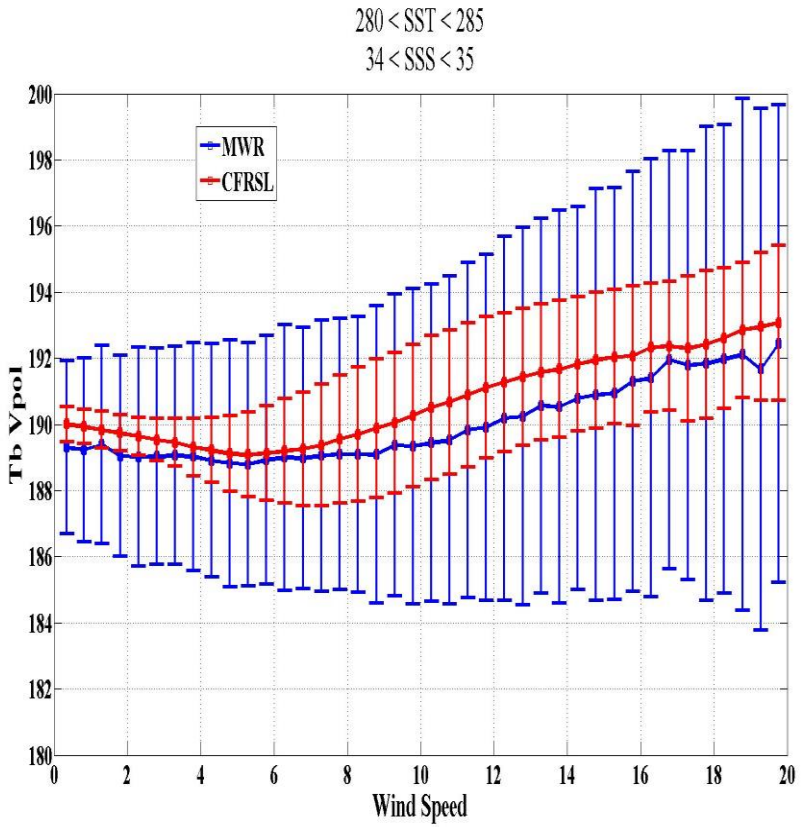
$$T_{b\_model} = SST * \varepsilon_{ocean\_smooth} + ER$$

$$ER = SST * \varepsilon_{rough}$$

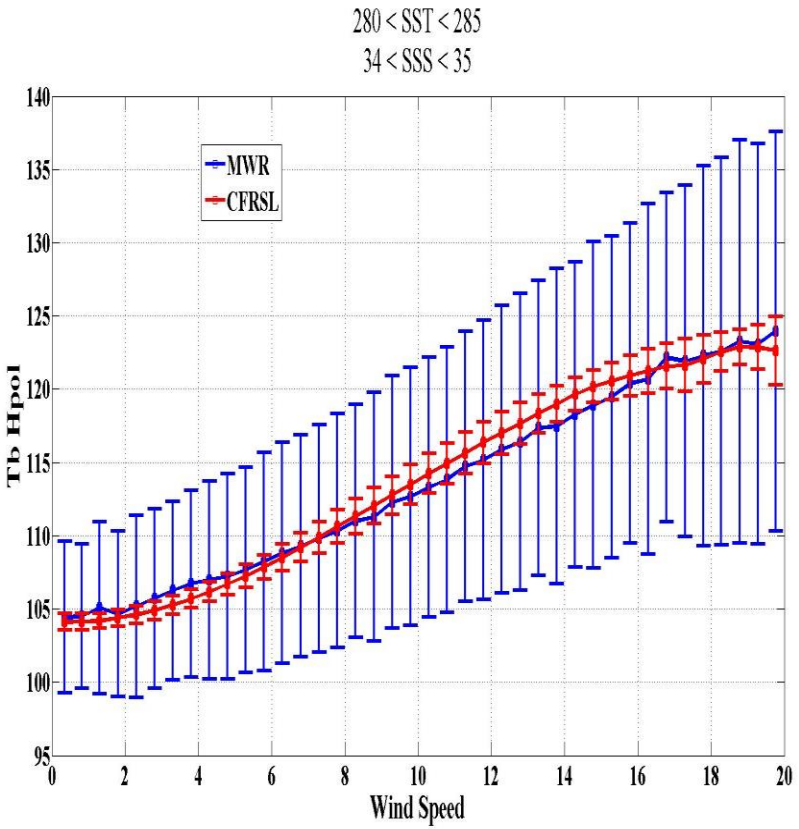
  - Tune CFRSL ocean surface emissivity model parameters to force $T_{b\_meas} = T_{b\_model}$

Tuning RTM for Wind Speed @ Ka-band

V-pol

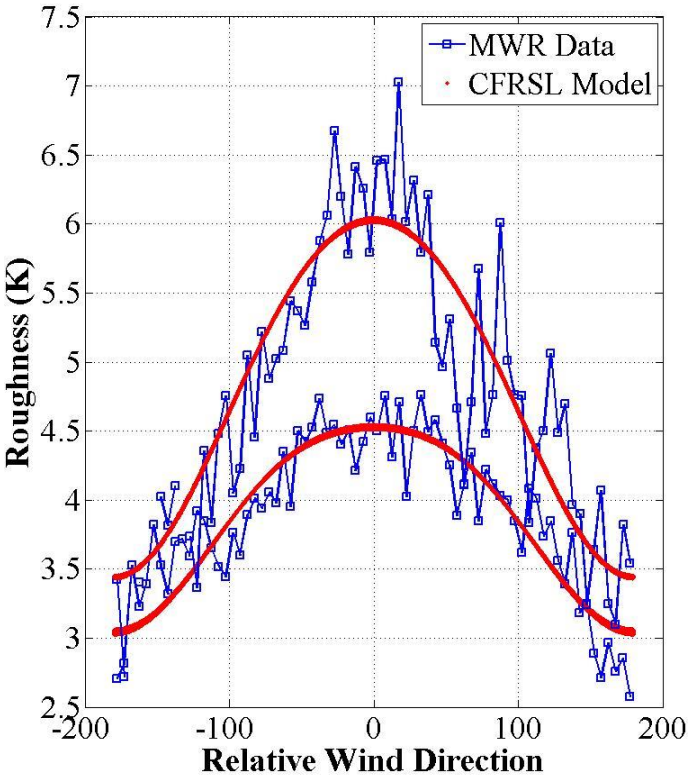


H-pol

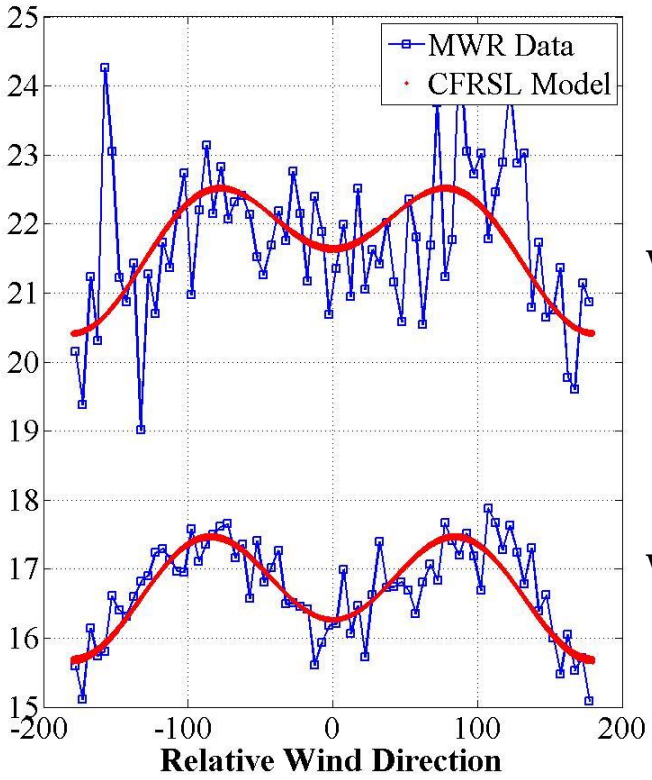


Tuning RTM for Wind Direction @ Ka-band

V-pol



H-pol



WS = 12 m/s

WS = 8 m/s

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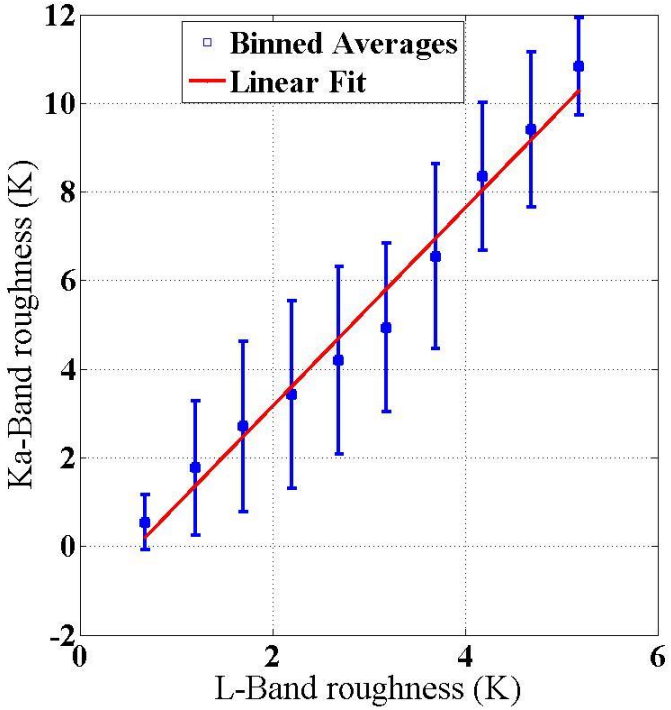
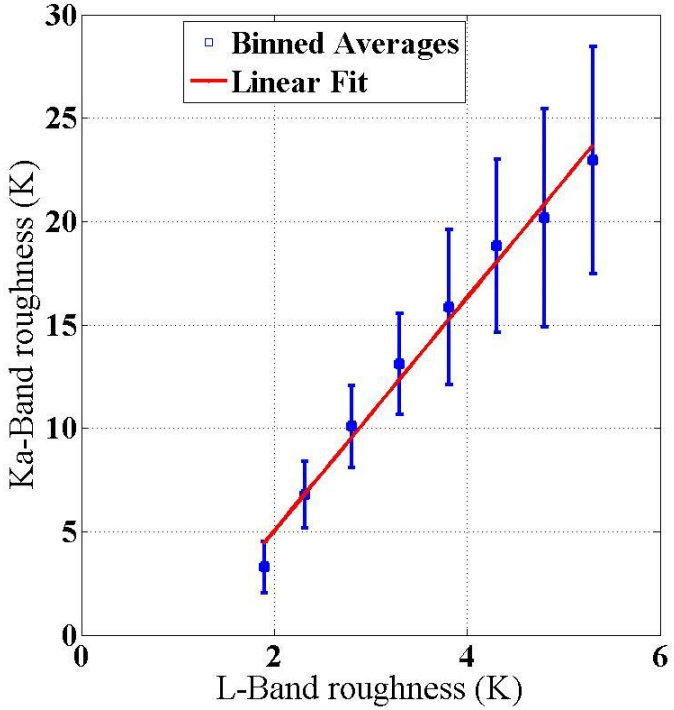
L-band/Ka-Band Excess Roughness Geophysical Model Function (GMF)

L-Band / Ka-Band Roughness Corrections Geophysical Model Functions (GMF)

V-pol

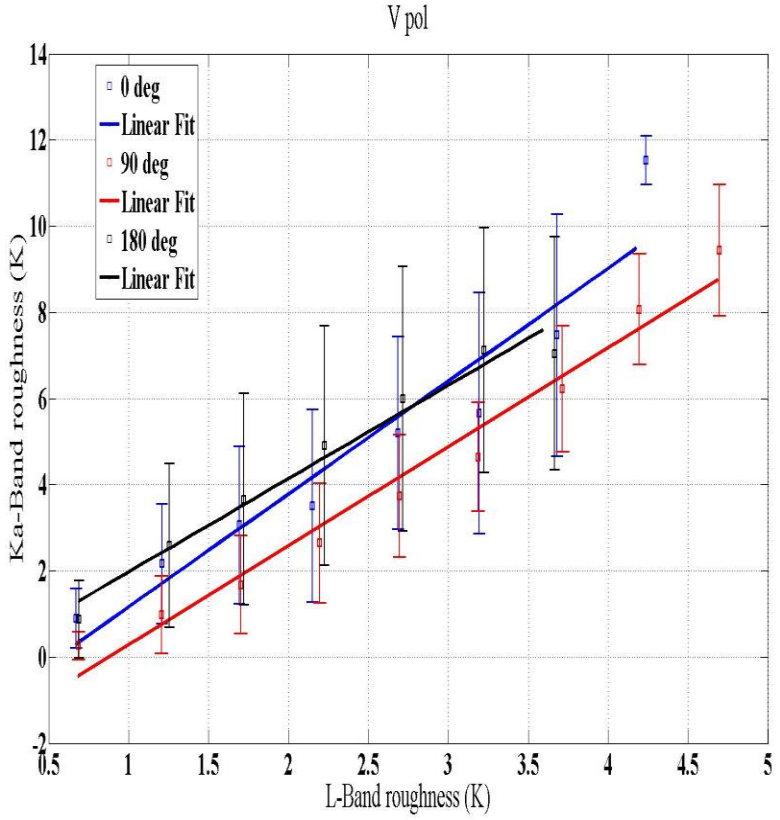


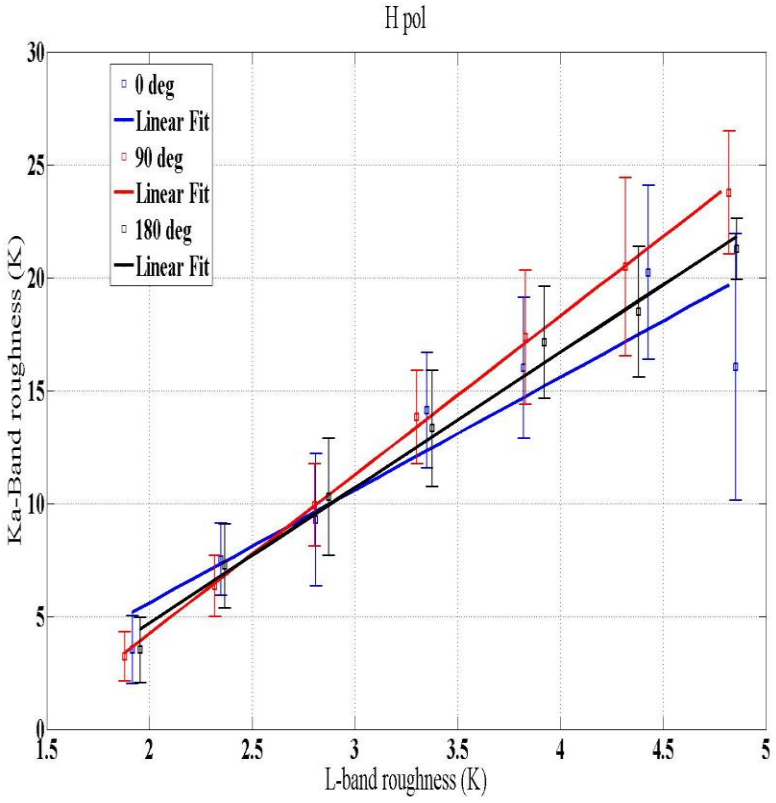
H-pol



Averaged over all wind directions

L-Band & Ka-Band Roughness GMF (for different WD)





χ = 0 deg → MWR relative wind is up-wind

χ = 90 deg → MWR relative wind is cross-wind

χ = 180 deg → MWR relative wind is cross-wind

Conclusions

- AQ/MWR Geophysical Model Functions are in-progress
  - Re tuning using MWR Tb V6.0
- SSS retrieval algorithm to be performed
  - MWR ER comparisons with Scat roughness correction