Update and Refinement of the IWRAP GMF

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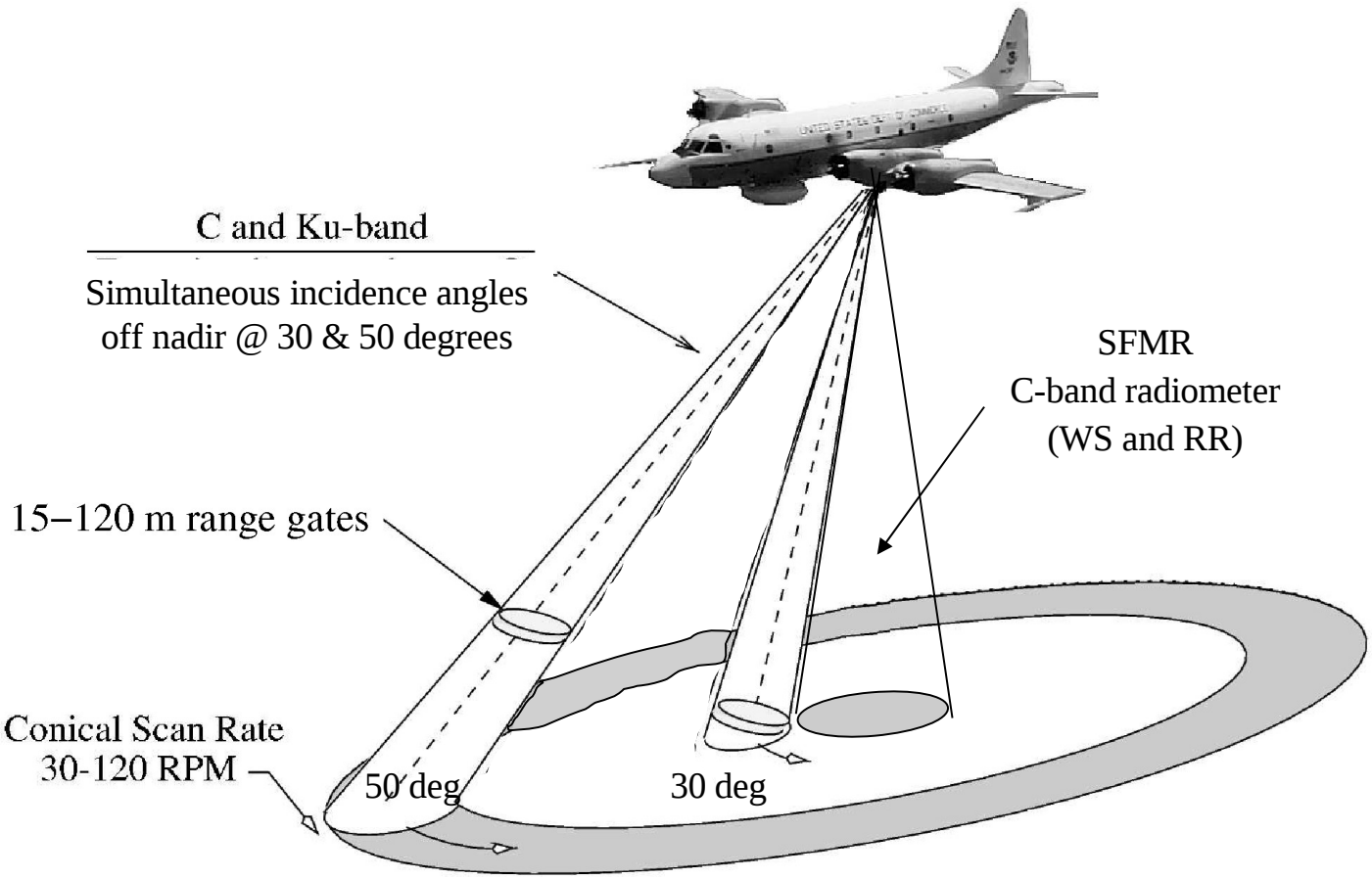
Outline

- Original IWRAP GMF
  - Esteban et al., 2006
- Subsequent changes in SFMR wind-speed GMF
  - The ground truth changed...
- Remapping of IWRAP GMF
  - Behavior of A0, polarization ratio
- Recent dual-polarization measurements
  - See poster by Joe Sapp

Imaging Wind and Rain Airborne Profiler (IWRAP)



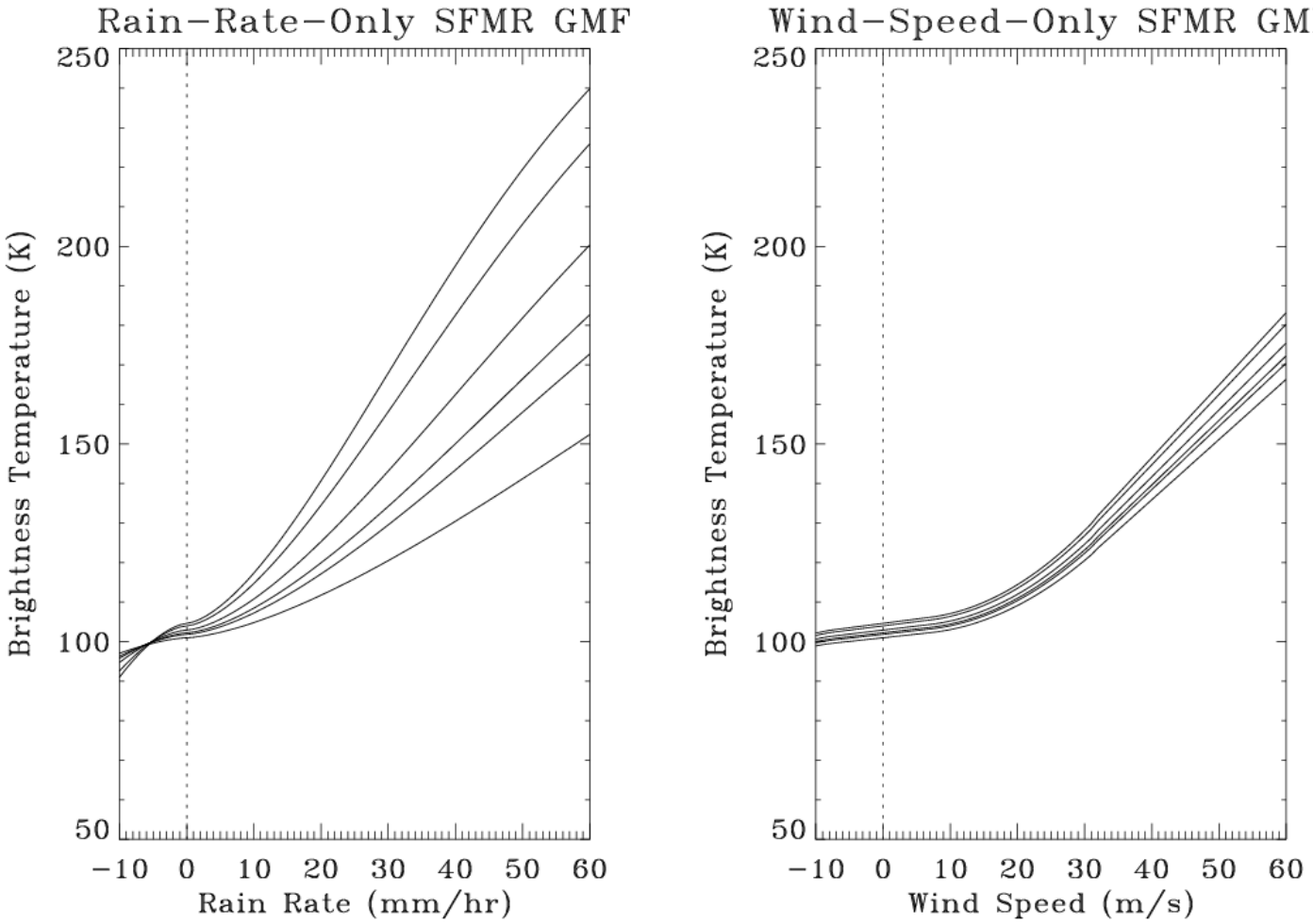
IWRAP GMF

- Esteban et al., 2006, “Dual-polarized C- and Ku-band ocean backscatter response to hurricane force winds”, JGR.
- For both C- and Ku-band
  - 25 m/s - 60 m/s
  - at 4 fixed incidence angles near 30, 35, 40, 50 deg
  - VV and HH polarizations
  - Derived from data collections in 2002 and 2003 (Lilli, Fabian, Isabel)
- Referenced to simultaneous measurements with UMass SFMR.

Stepped Frequency Microwave Radiometer

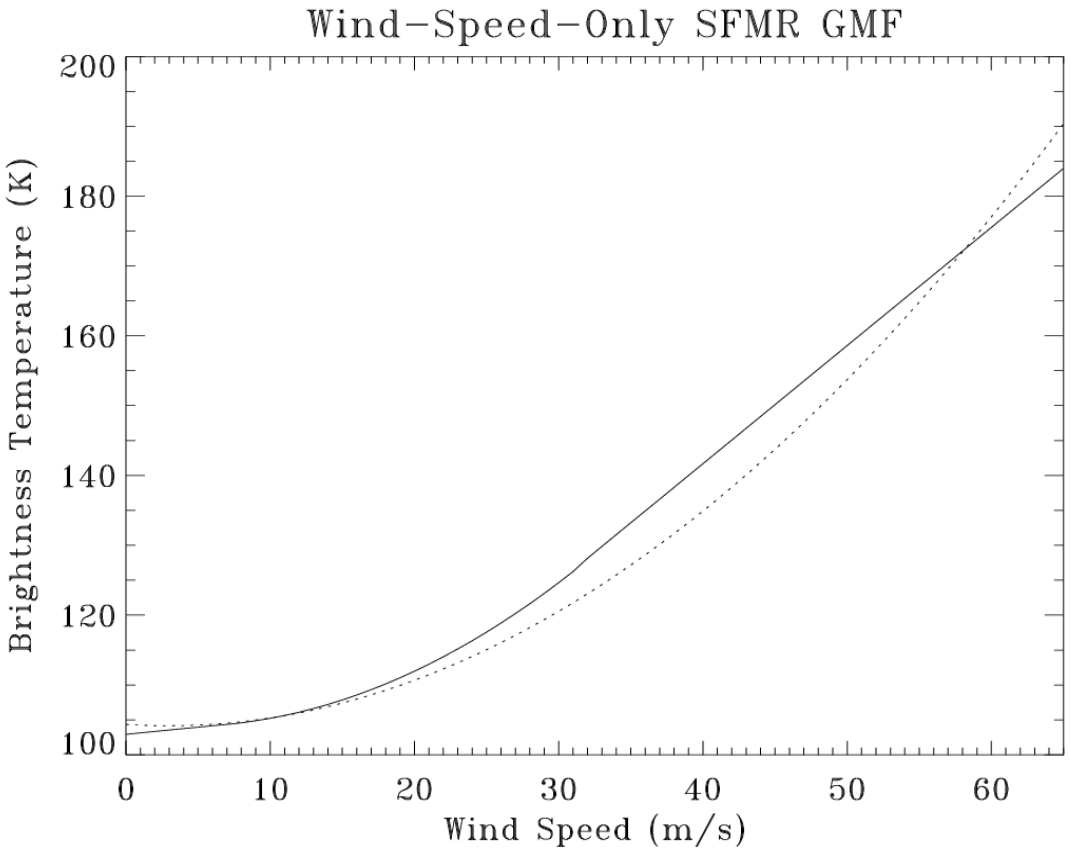
- Nadir Tb measured at up to 6 C-band frequencies
  - 4.74, 5.31, 5.57, 6.02, 6.69, 7.09 GHz
- Forward model for Tb due to surface emission
  - SST and Klein-Swift model for dielectric const of seawater
  - +excess emissivity due to wind speed (roughness and foam)
- Forward model for atmospheric transmissivity and emission influence on Tb (rain-rate)
- Pseudo-inverse scheme used to solve for both simultaneously minimizing mse in obs-model Tb

SFMR

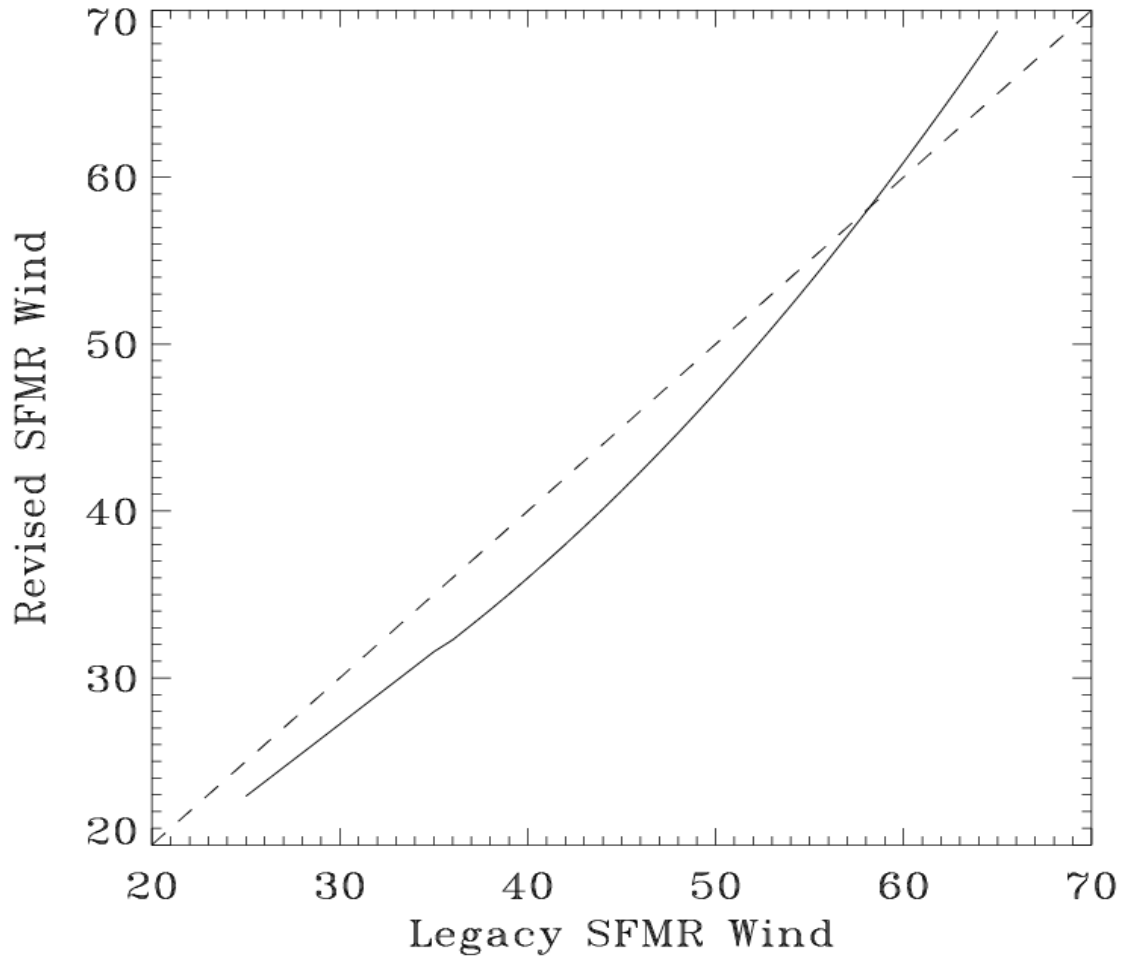

Rain−Rate−Only SFMR GMF
Brightness Temperature (K)
250
200
150
100
50
−10 0 10 20 30 40 50 60
Rain Rate (mm/hr)
Wind−Speed−Only SFMR GMF
Brightness Temperature (K)
250
200
150
100
50
−10 0 10 20 30 40 50 60
Wind Speed (m/s)

Wind speed model revised (Uhlhorn et al. MWR 2007)

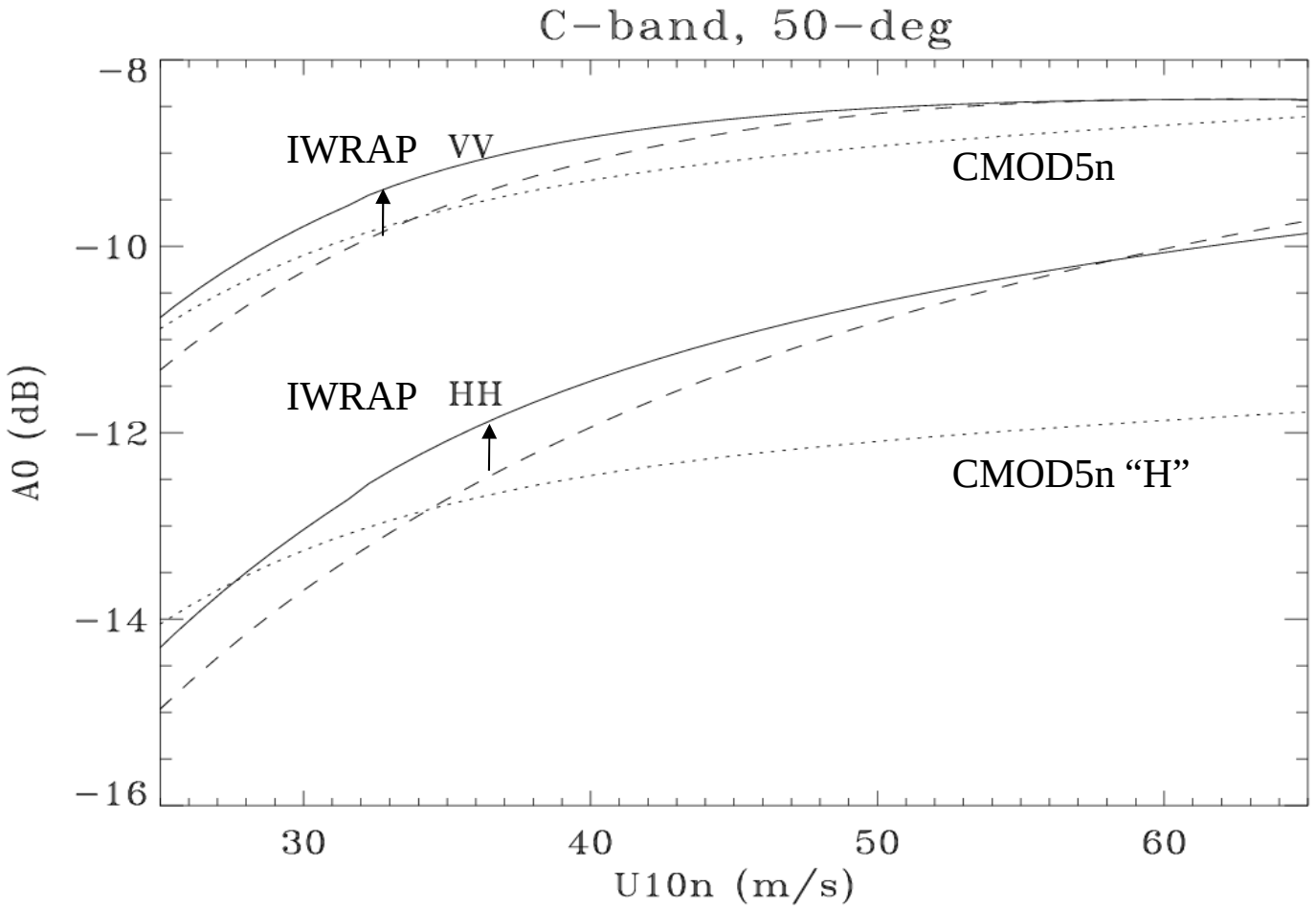
- Dotted line: legacy
  - $a_0 + a_1 u_{10n} + a_2 u_{10n}^2$
- Solid line: revised
  - Piecewise constant, then quadratic, then linear
  - Reflects reduced drag coefficient at high wind speed



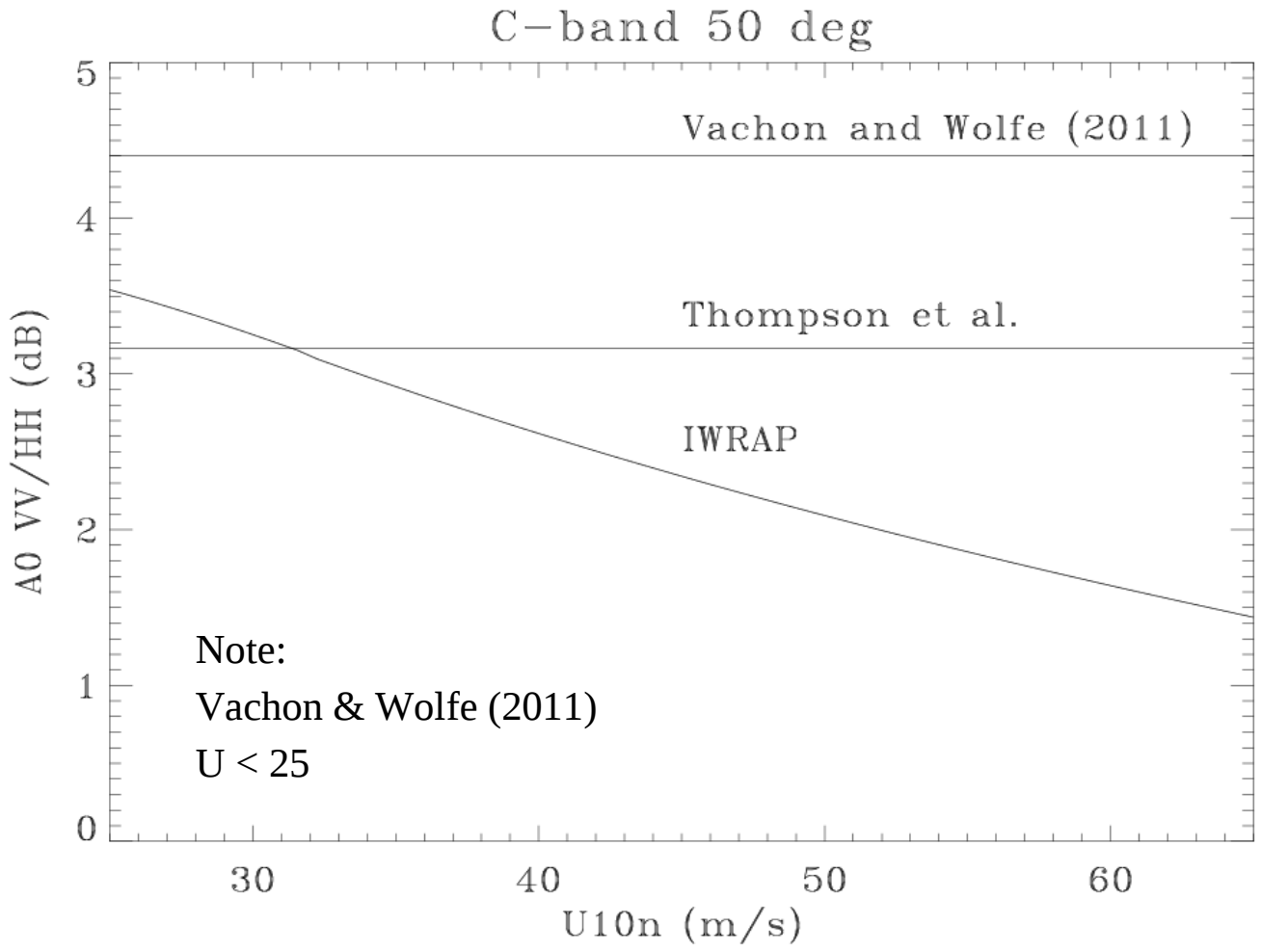
Impact on wind retrieval



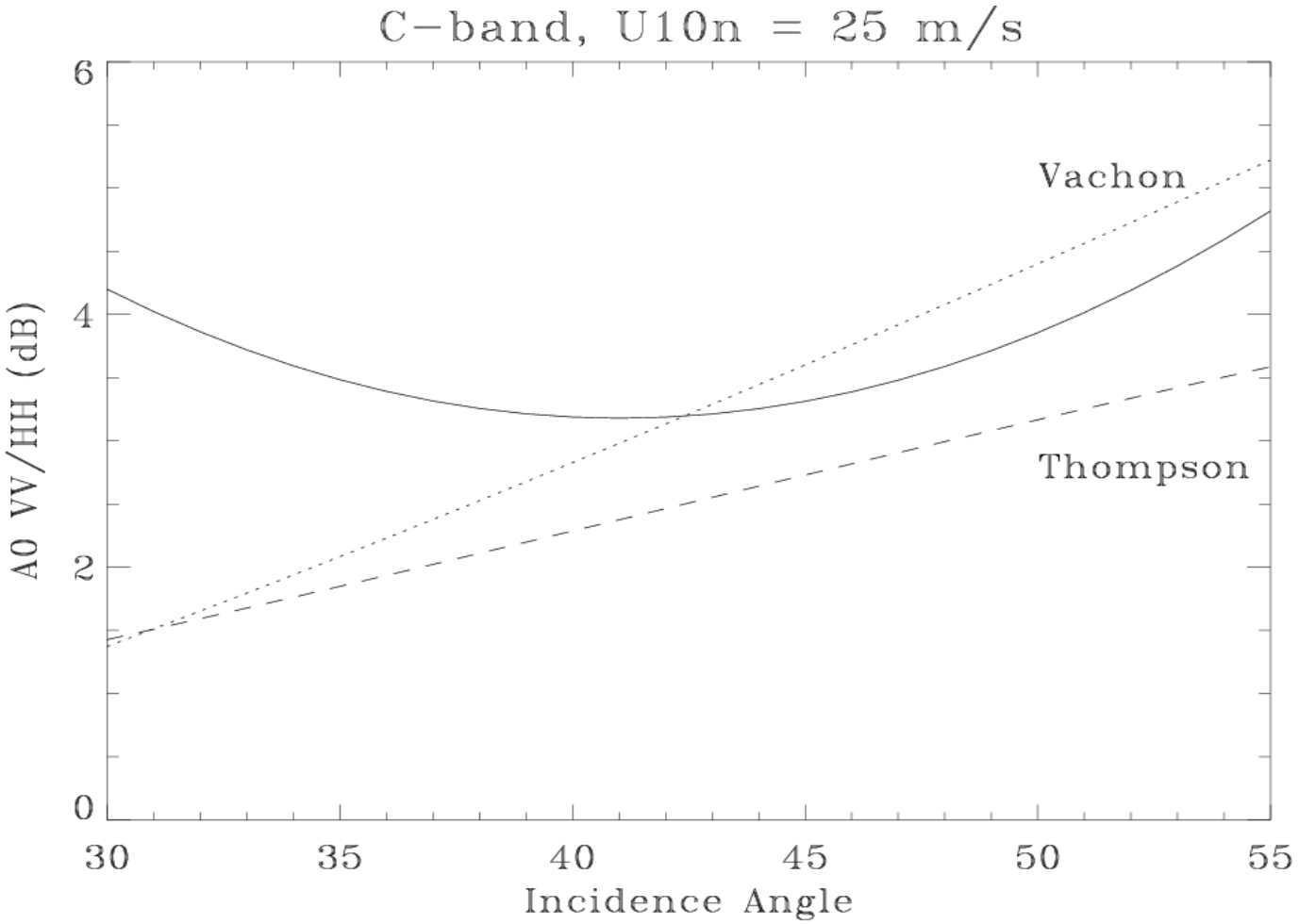
Impact on IWRAP GMF



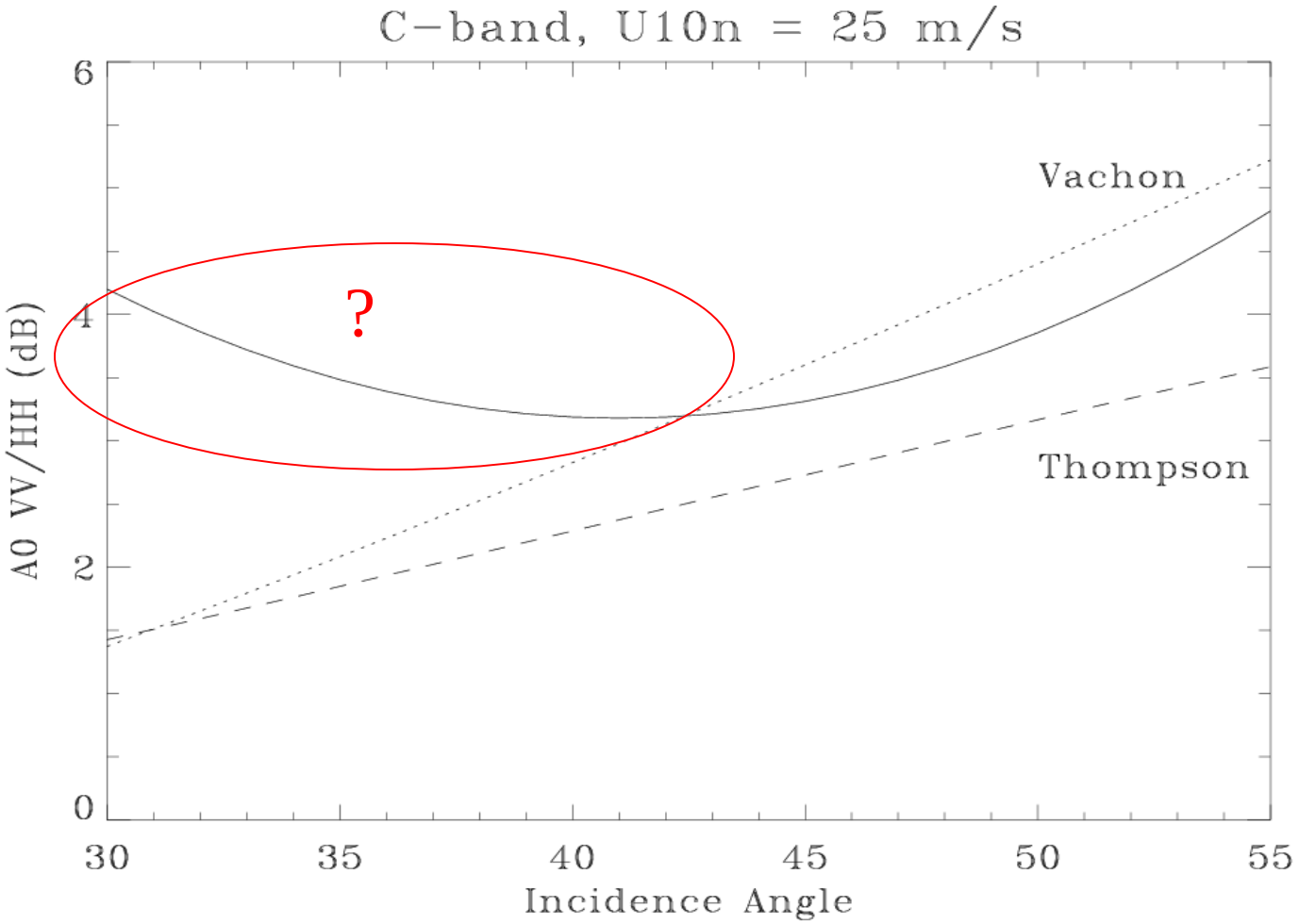
Polarization Ratio vs. U10



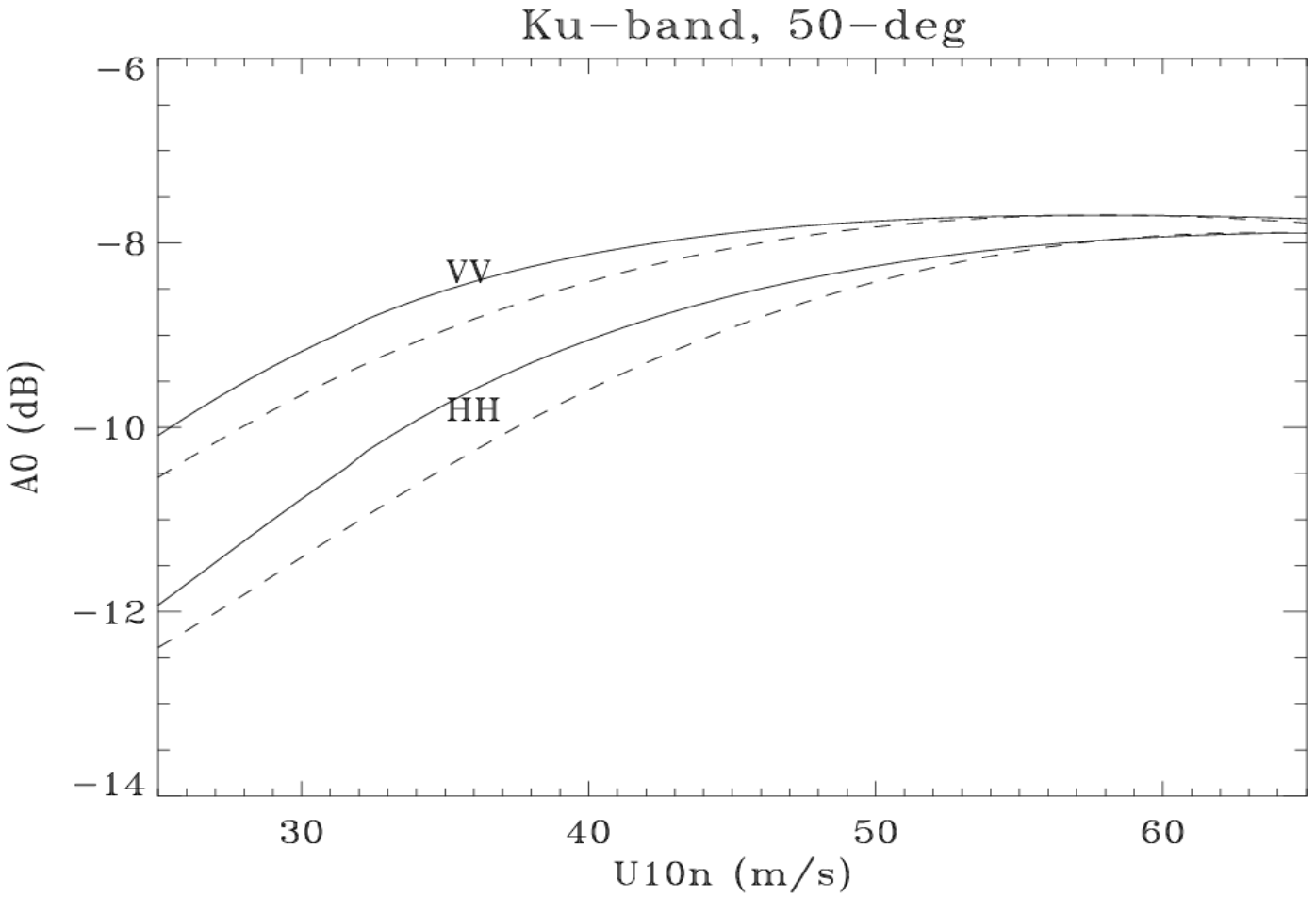
Polarization Ratio vs. Incidence



Polarization Ratio vs. Incidence



Impact on IWRAP2006 GMF



Summary

- Changes in SFMR wind-speed model yield a remapping of the IWRAP GMF
- Wind speed dependence of A0 is slightly reduced at highest wind speeds
  - Saturation effects for C-band V-pol and Ku-band remain or are slightly enhanced
  - C-band H-pol remains monotonically increasing
- Dual-pol measurements are continuing
  - Extended incidence angles via roll maneuvers
  - Cross-pol desired

Winter 2011 flights

C-band
alternating H-V
(H shown)

Circle pattern
w/ 10 deg roll