Update on MWRRET.v2
(Version 2 of the MWR Retrieval VAP)

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Photo by Paquita Zuidema
• Original “LOS” statistical retrievals had significant biases, especially in LWP
• Many studies had demonstrated the need for accurate LWP for radiation, cloud-aerosol interactions, etc (especially for smaller LWP values)
• MWRRET developed to perform physical retrievals to get the best possible estimates of PWV and LWP from the MWRs
  – Original algorithm designed for orig 2-ch MWRs (23.8 & 31.4 GHz)
  – Forward model is MonoRTM v3.0 (~2005)
  – Used variable $T_b$ offsets to remove bias in LWP during clear skies
  – Uses optimal estimation, so sample-specific uncertainties are produced
  – Implemented for all ARM MWRs, data in archive, running operationally
  – Turner et al., TGRS 2007
• 90 GHz observations have 3x sensitivity to LWP
MWRRET Background (2)

- Ordered many new MWR-3ch radiometers (23.8/31/89 GHz)
- Have several other higher frequency radiometers around also
  - 90/150 GHz systems (at SGP and AMF-1)
  - 170-183 GHz system at NSA

- Updated algorithm able to use any combination of frequencies to retrieve PWV and LWP; e.g.:
  - New MWR-3ch radiometers
  - GVR and GVRP at Barrow
  - Combine channels from multiple radiometers (e.g., MWR-2ch and MWR-HF at Azores)

- Updated forward model – MonoRTM v4.2 (Nov 2011)
  - Significant changes to H₂O continuum, H₂O line parameters (i.e., spectral widths), and N₂ continuum

- Updated algorithm can remove static Tₜ offsets

Cadeddu, Liljegren, and Turner, AMT, submitted
MWRRET v2 Status

- Evaluation datasets processed for:
  - SGP MWR-3ch (23.8, 31.4, 89 GHz)  Nov-Dec 2011
  - AMF/Gan MWR-3ch (23.8, 31.4, 89 GHz)  Nov 2011
  - AMF/Azores MWR-2ch + MWR-HF (23.8, 31.4, 90 GHz)  Jan-Dec 2010
  - Summit HATPRO + MWR-HF (23.8, 31.4, 90, 150 GHz)  Jul 2010-Oct 2012

- Currently being implemented as VAP (by Riihimaki et al)

- Concerns / future
  - Need method to account for time-varying biases in some channel(s)?
    - How to identify the channel(s) that need to have a bias correction?
    - Need automated way to determine clear skies from only the $T_b$ data
  - Identification of precipitation induced biases
  - Ability to retrieve LWP and PWV during precipitation
  - The modeled temperature dependence of the liquid water absorption needs to be improved

No $T_b$ bias offsets applied to these datasets!
Supercooled Liquid Water Absorption

- Strong temperature dependence of liquid water abs in µwave
- Using data from 3 locations: FKB, SMT, UFS
- Analyzed frequencies: 31, 52, 90, 150, 225 GHz
- No single abs model fits the obs well at all frequencies
- Seems that our current model (Liebe91) is among the worst

Kneifel, Redl, Cadeddu, Turner, and Löhnert, JAMC, in prep