



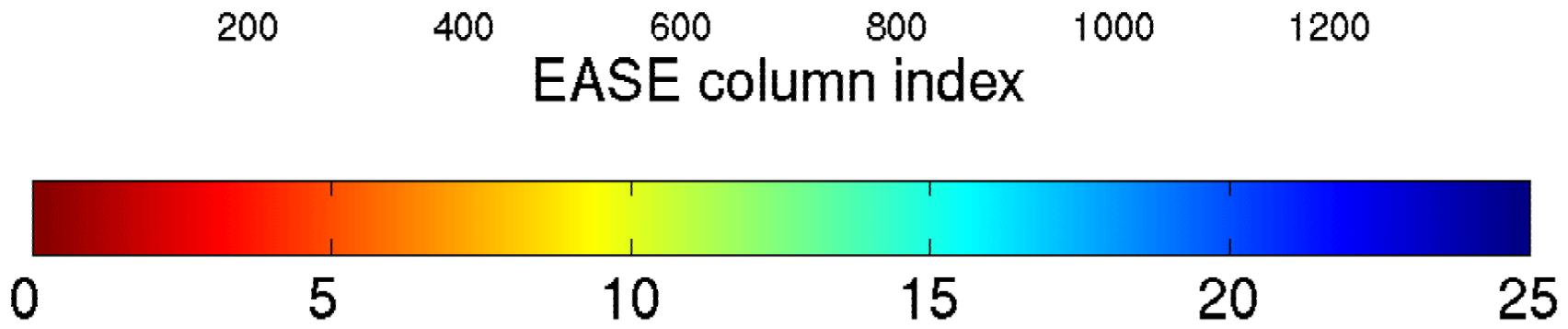
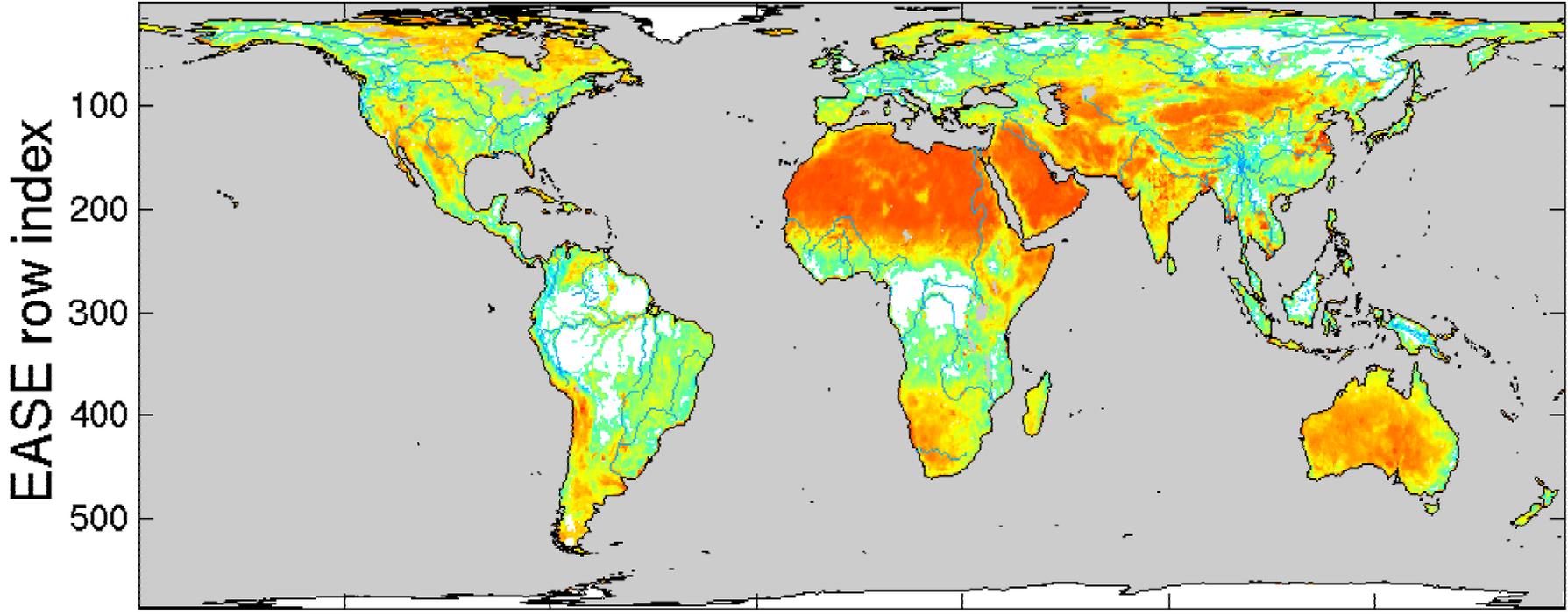
AMSR-E Soil Moisture

**Eni Njoku
Steven Chan**

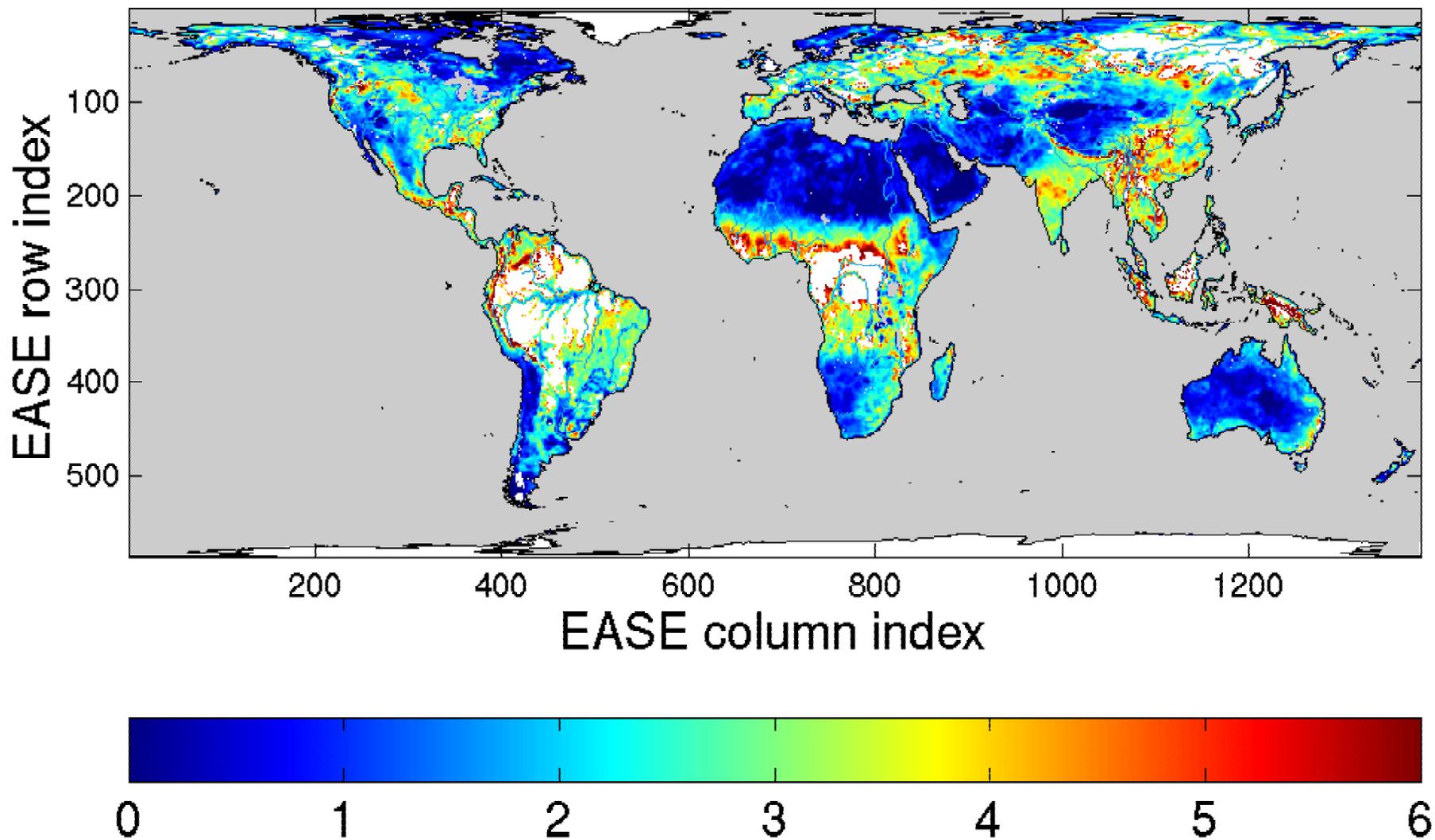
Jet Propulsion Laboratory, Pasadena, CA

*Joint AMSR Science Team Meeting
Fort Collins, CO
2-3 August, 2004*

Soil Moisture (%): 200206D

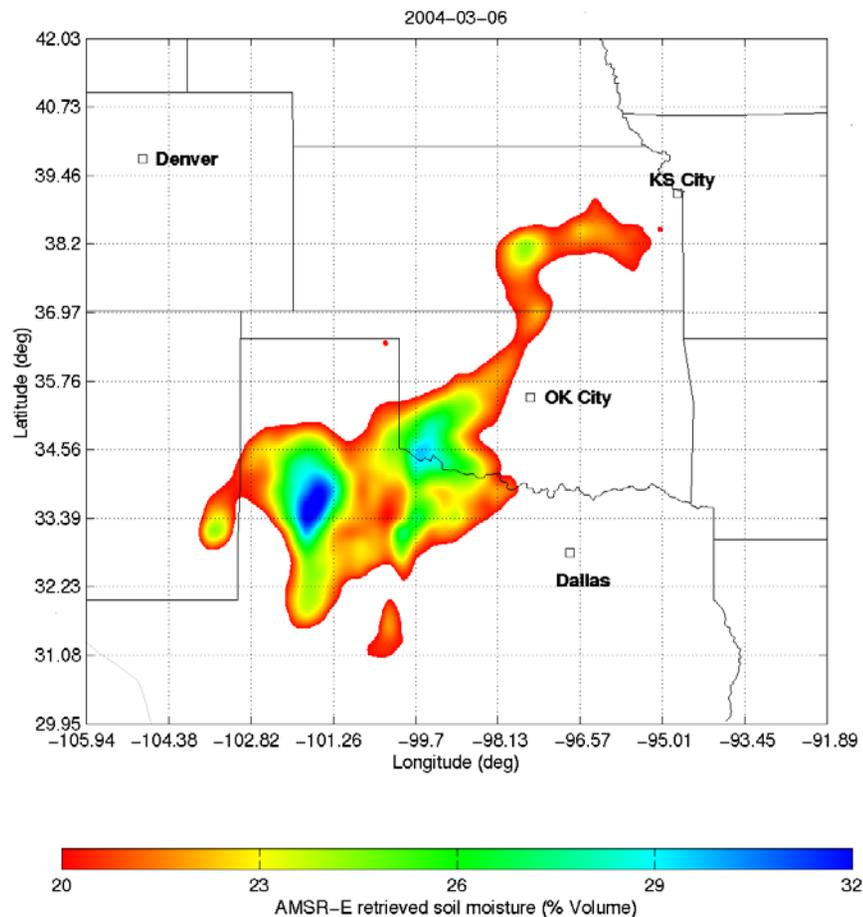


Vegetation Water Content (kg m⁻²): 200206D



Using AMSR-E Soil Moisture Data to Study Extent of March 2004 Flood (JPL/NSIDC)

<http://nsidc.org/data/amsr/okflood/>

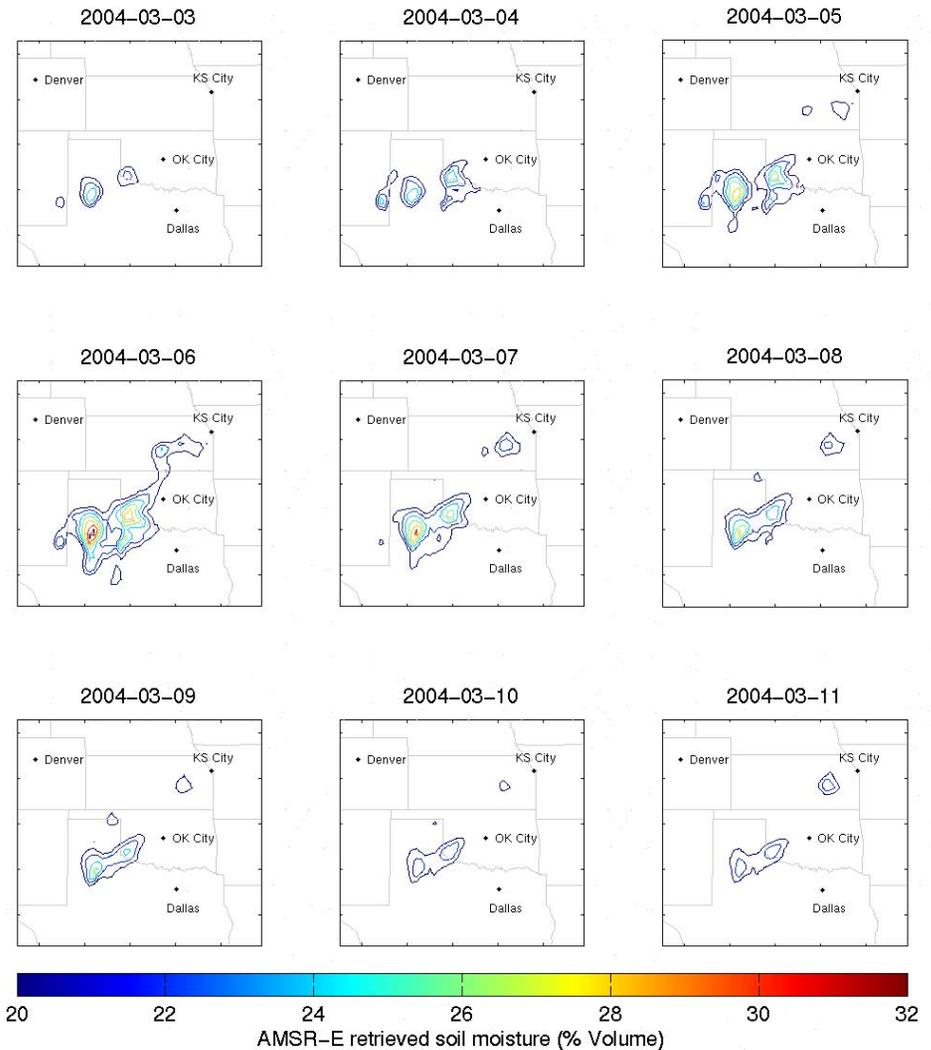
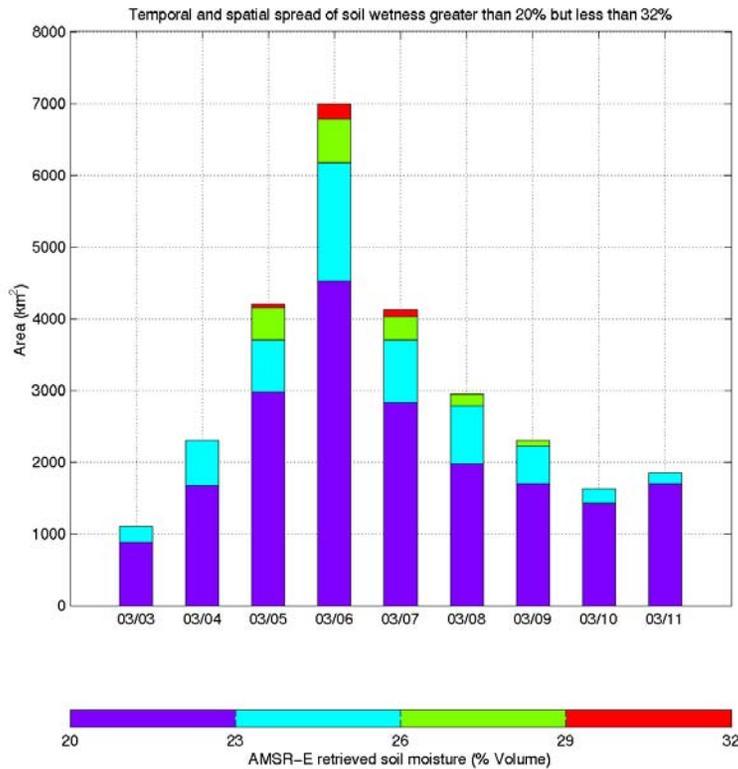


Fast-moving line of thunderstorms in early March 2004 stretched from central Kansas to northern Texas (photo above)

Analysis of AMSR-E data indicated the daily spatial extent of elevated soil moisture - 06 March 2004 image at left)

The image shows the observed maximum extent of retrieved soil moisture greater than 20% (vol) during the observation period

AMSR-E Daily (Interpolated) Soil Moisture Extent During March 2004 Storm



Algorithm Status

- The current soil moisture retrieval algorithm is based on a change-detection approach using the polarization ratio (insensitive to surface temperature)

$$\zeta = (T_{Bv} - T_{Bh}) / (T_{Bv} + T_{Bh})$$

- A vegetation/roughness estimate, g , is first obtained – Vegetation and roughness have similar effects on ζ and hence are lumped together as a single parameter used as a correction for the soil moisture retrieval

$$g = \beta_0 + \beta_1 \ln(\zeta_{10.7}) + \beta_2 \ln(\zeta_{18.7})$$
$$m_v = m_v^* + \alpha_0 g + \alpha_1 (\zeta_{10.7} - \zeta_{10.7}^*) \exp(\alpha_2 g)$$

- The α and β coefficients are calibrated empirically using AMSR-E data over a range of vegetation, roughness, and moisture conditions (desert to forest transects, flood to dry temporal change). The quantities m^* and ζ^* are baseline (bare, dry soil) values of m and ζ (obtained from monthly minima over an annual cycle).
- Areas of dense vegetation, permanent ice, and snow are masked out (white). Mountains, frozen ground and precipitation are not currently masked.

Upgrades: Choose between 'B1' vs. 'at-launch' algorithm. Fine-tune and implement surface type flags. Determine whether to include 6.9 GHz.

Radio-Frequency Interference (RFI) Observed in AMSR-E 6.9 GHz and 10.7 GHz Data

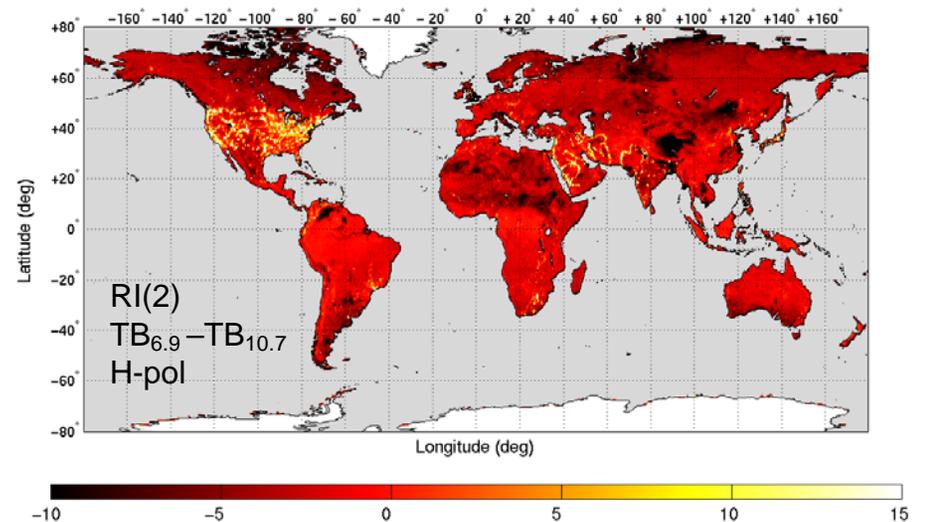
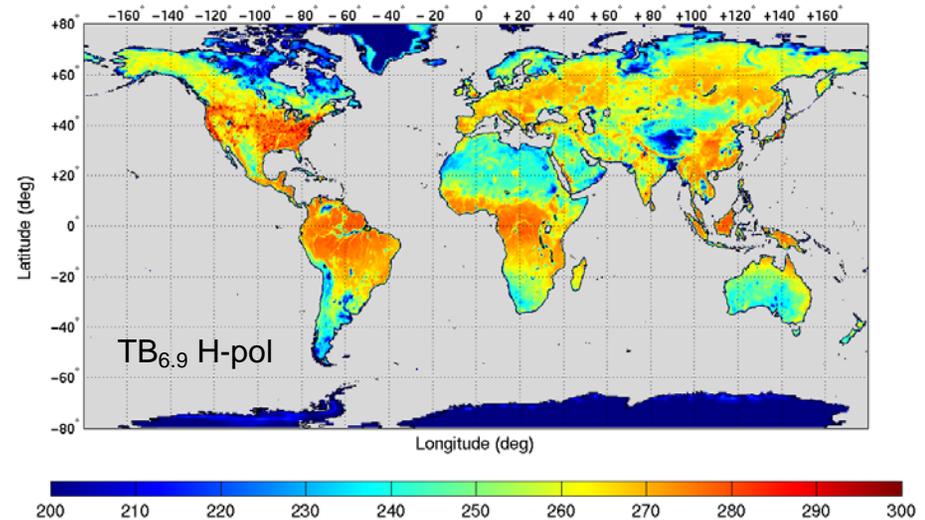
Li, Ashcroft, Chan, Njoku, et al.

Spectral difference methods have been investigated to identify and mask occurrence of RFI (Li et al., Njoku et al., TGARS 2004a, 2004b)
– These methods are not robust for '**weak**' RFI

Means and standard deviations of TB spectral difference indices can be used to identify and mask '**strong**' RFI

RFI Indices:
RI(1): $TB_{6.9} - TB_{10.7}$ (V-pol)
RI(2): $TB_{6.9} - TB_{10.7}$ (H-pol)
RI(3): $TB_{10.7} - TB_{18.7}$ (V-pol)
etc.

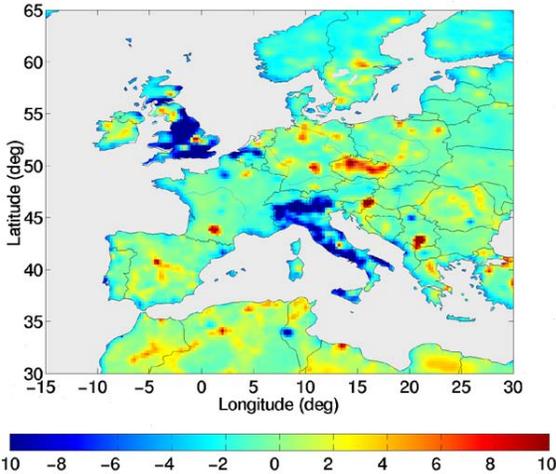
TB (K): June 2004 (Mean, Descending)



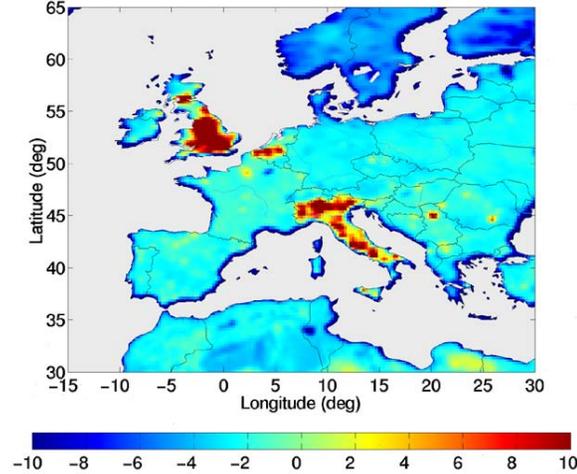
Regional Statistics (July 2002)

Mean

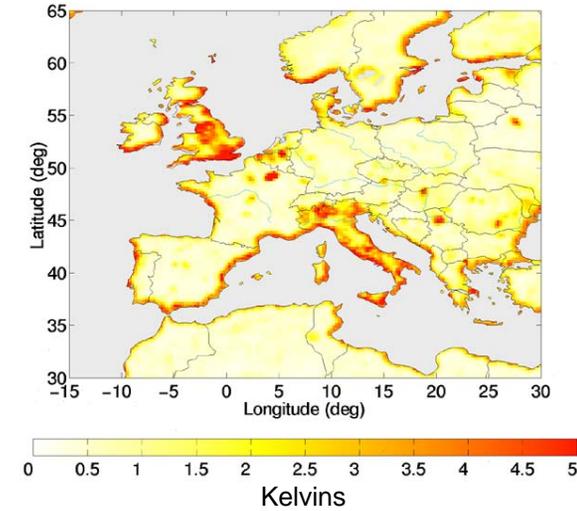
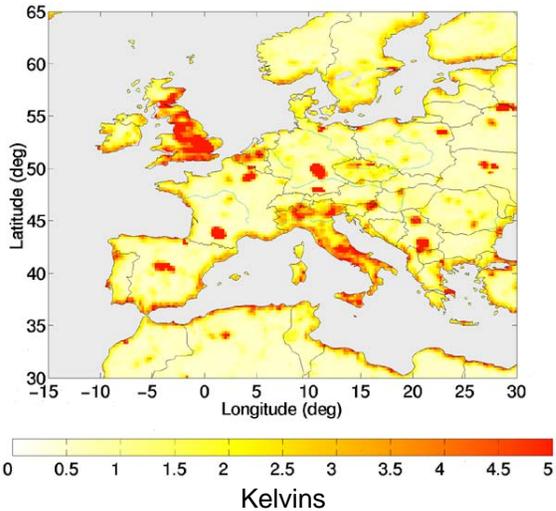
RI(1): $TB_{6.9V} - TB_{10.7V}$



RI(3): $TB_{10.7V} - TB_{18.7V}$

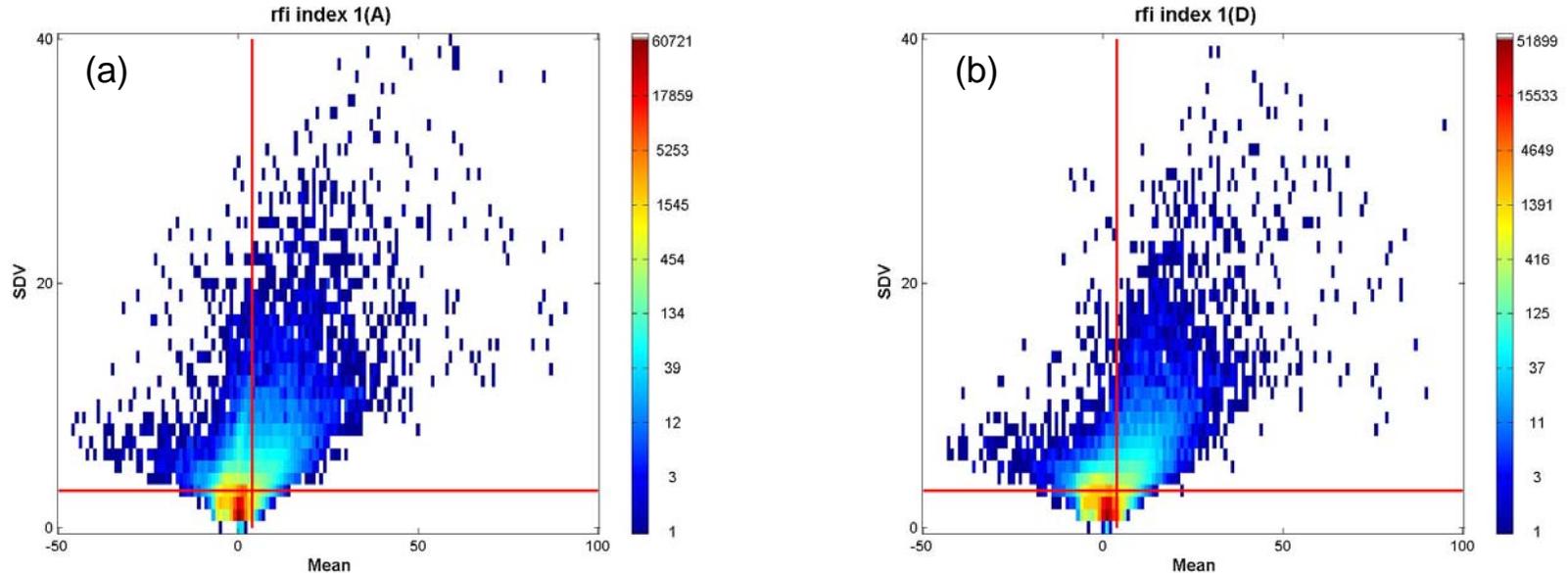


Standard Deviation



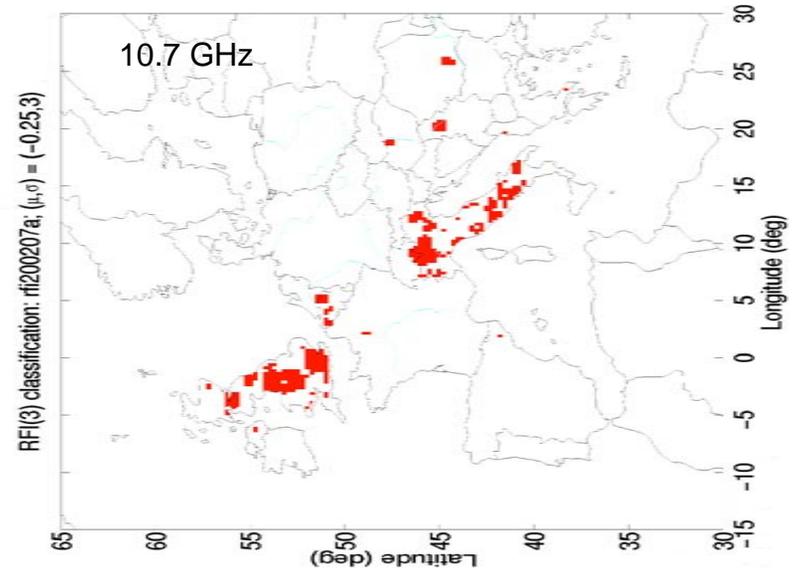
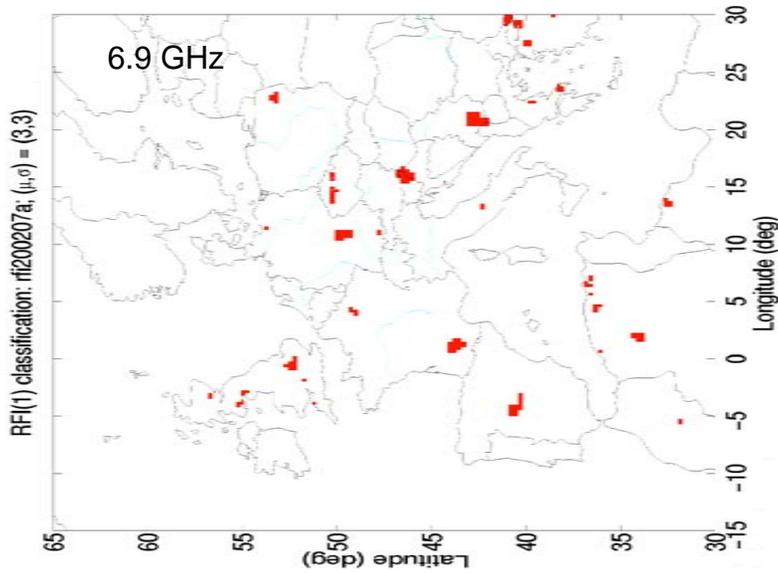
Thresholds for RFI Classification

Two dimensional histograms of RI(1) *mean* and *standard deviation*:
(a) day, (b) night. Each point represents 0.25° lat-lon binned location.

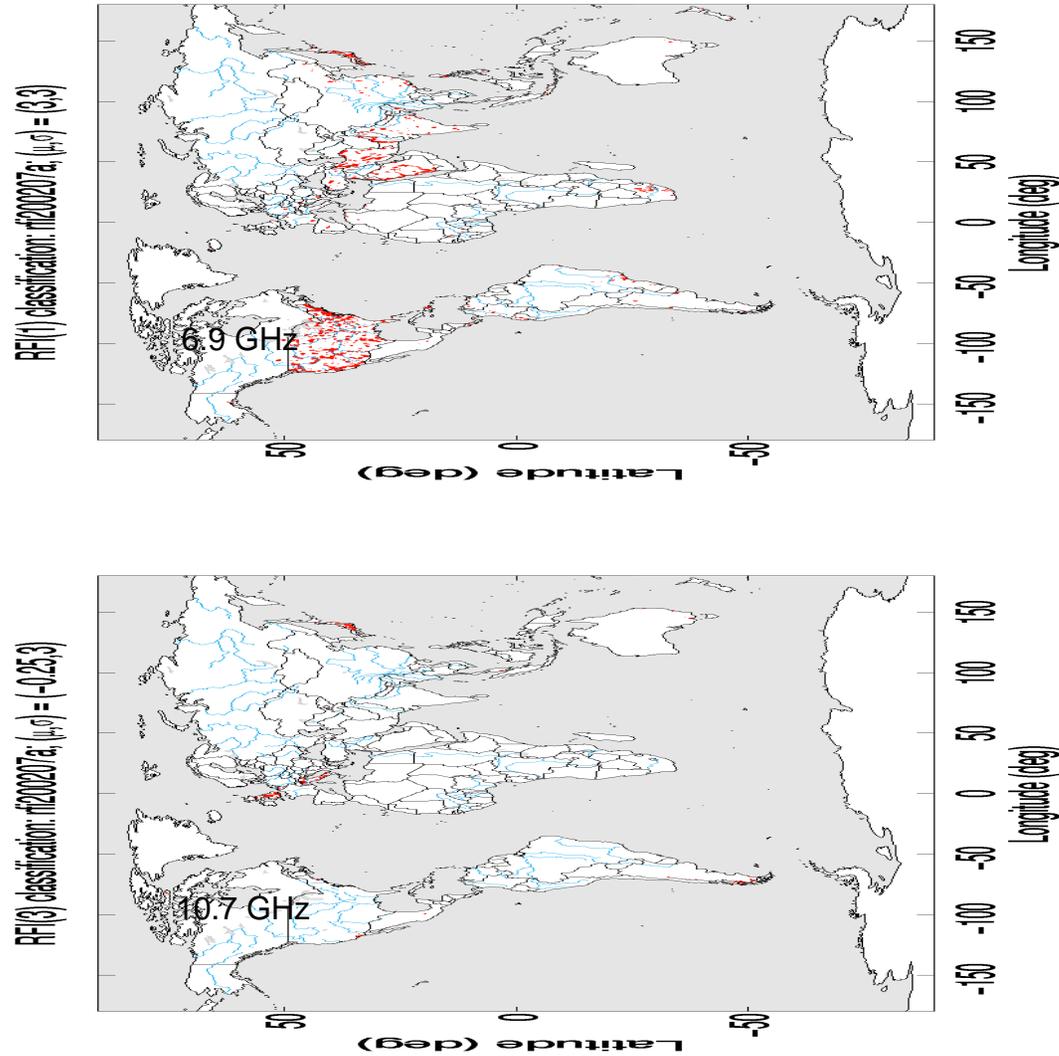


- Red lines indicate subjective thresholds for classifying possible RFI
- Thresholds are shown at a mean of 4 K and standard deviation of 3 K
- There are no clear break points in the distributions to indicate unambiguous identification of RFI

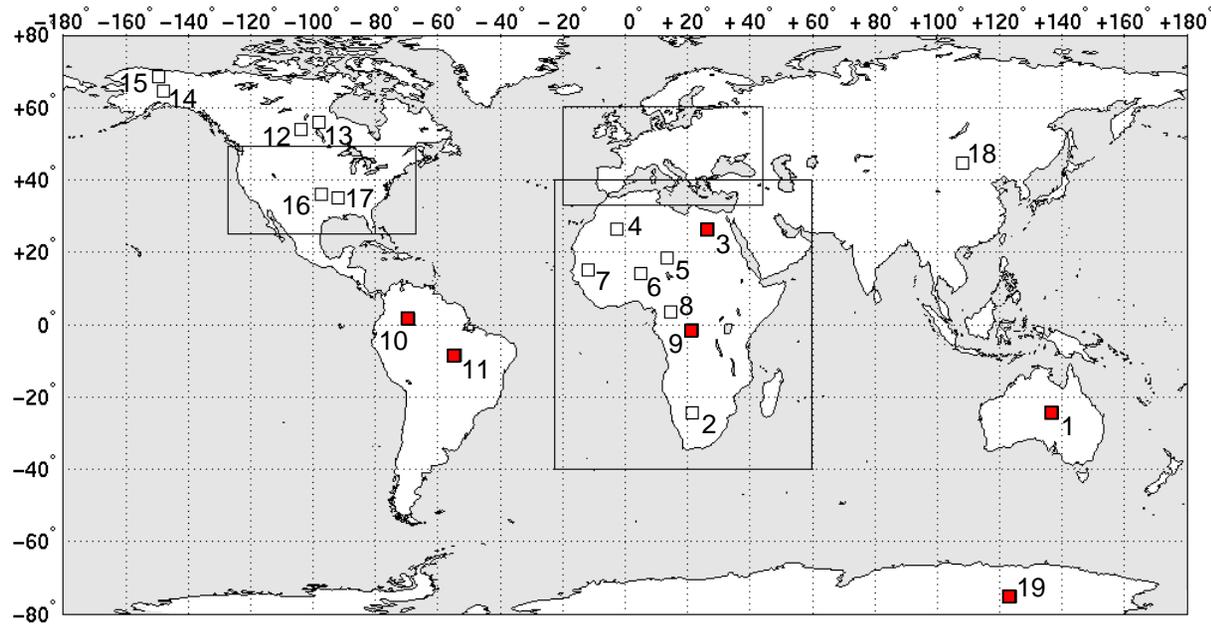
Regional RFI Classification at 6.9 GHz and 10.7 GHz



Global RFI Classification at 6.9 GHz and 10.7 GHz



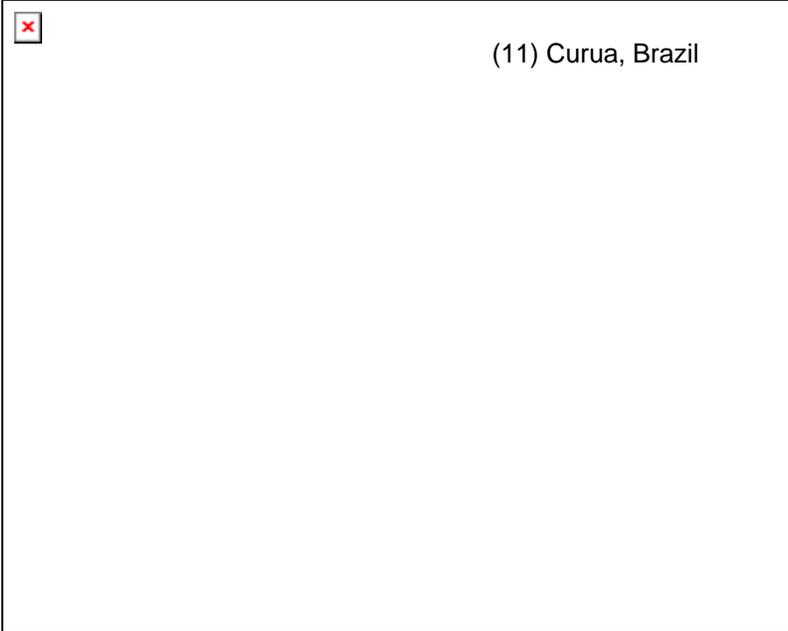
AMSR-E On-Orbit Land Calibration Analysis



Global map showing locations of data extraction sites for long-term brightness temperature trend and calibration monitoring. (Red indicates selected forest, desert and ice sheet sites)

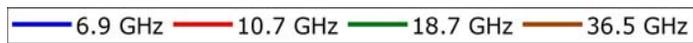
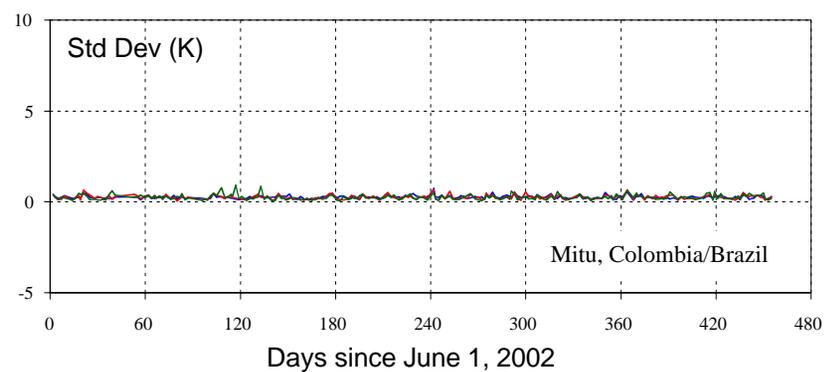
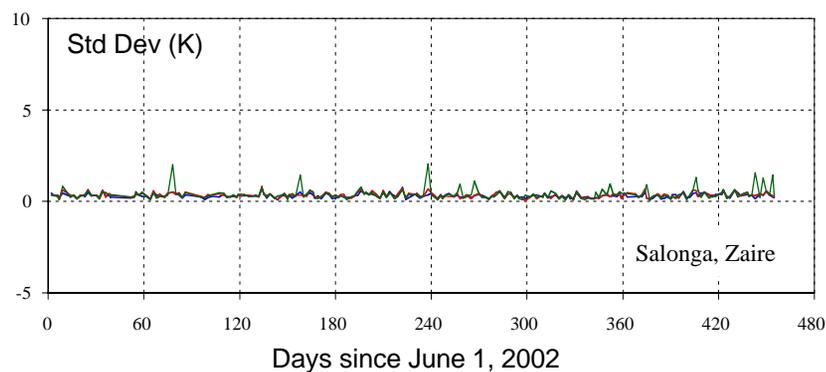
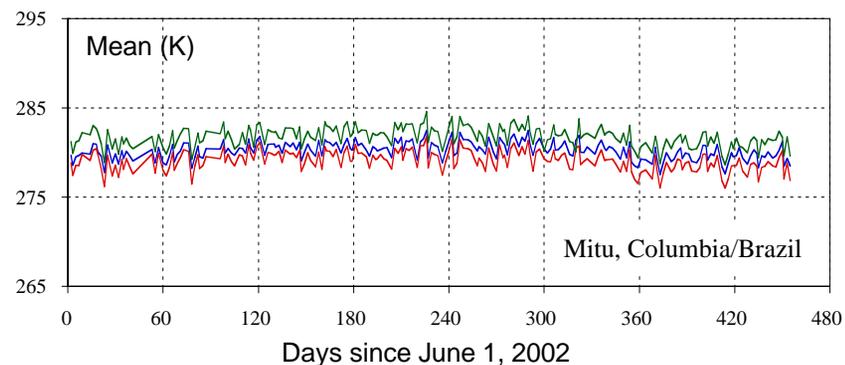
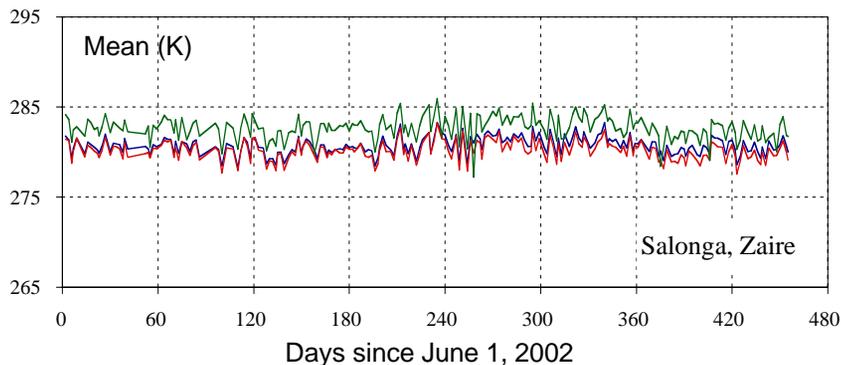
Tropical Forest TB vs. Freq. ('X1' Data)

3-Month average – June through August 2002



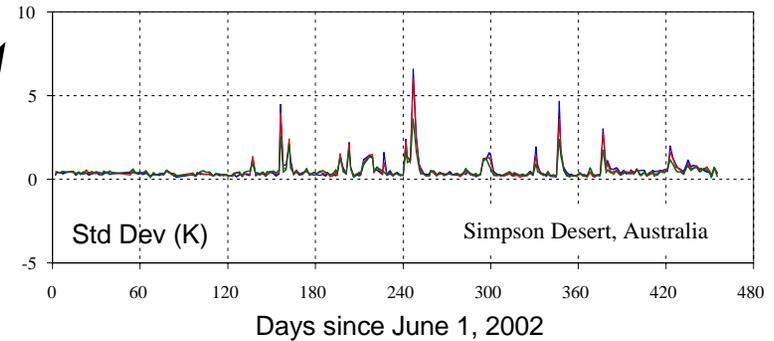
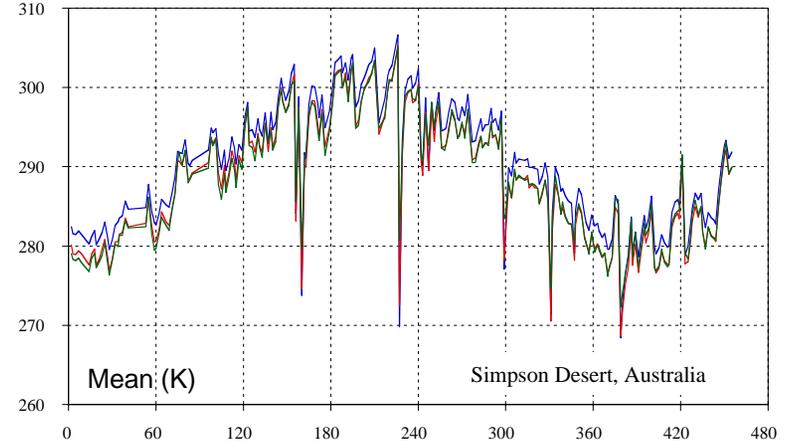
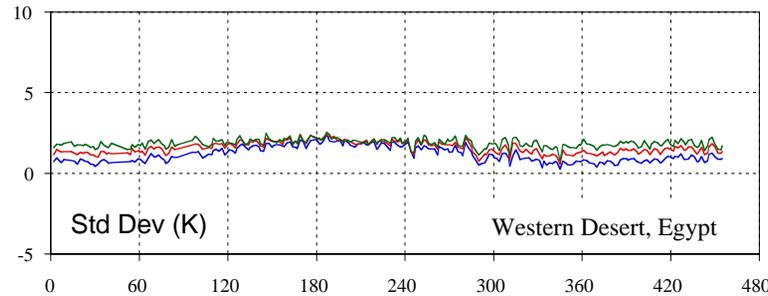
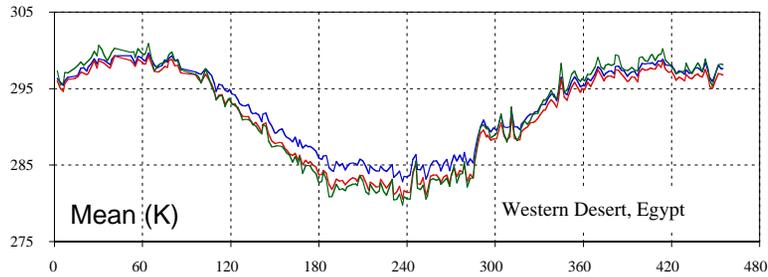
Forest Site TB Statistics ('B1' Data)

Within 3x3 (~75x75 km) Grid Area (V-pol, Desc)

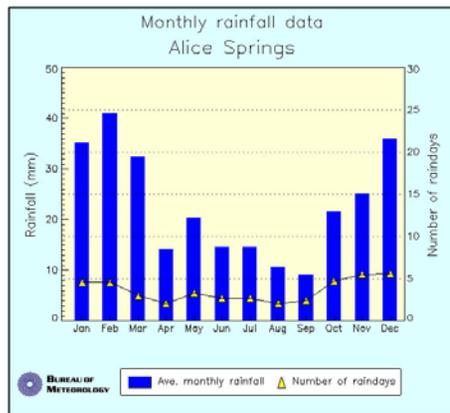


Desert Site TB Statistics

Within 3x3 (~75x75 km) Grid Area (V-pol, Desc)

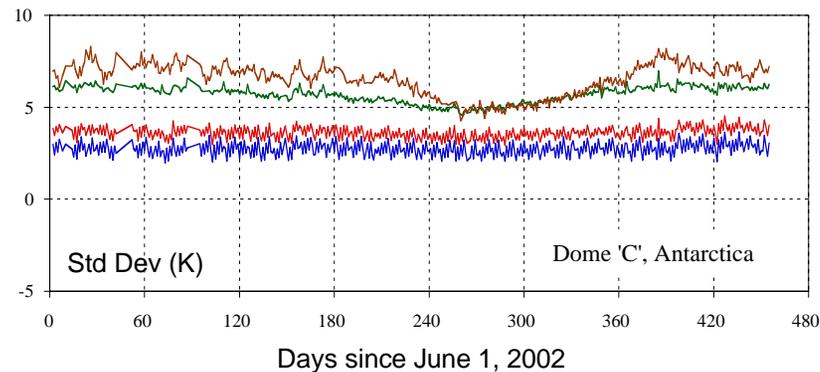
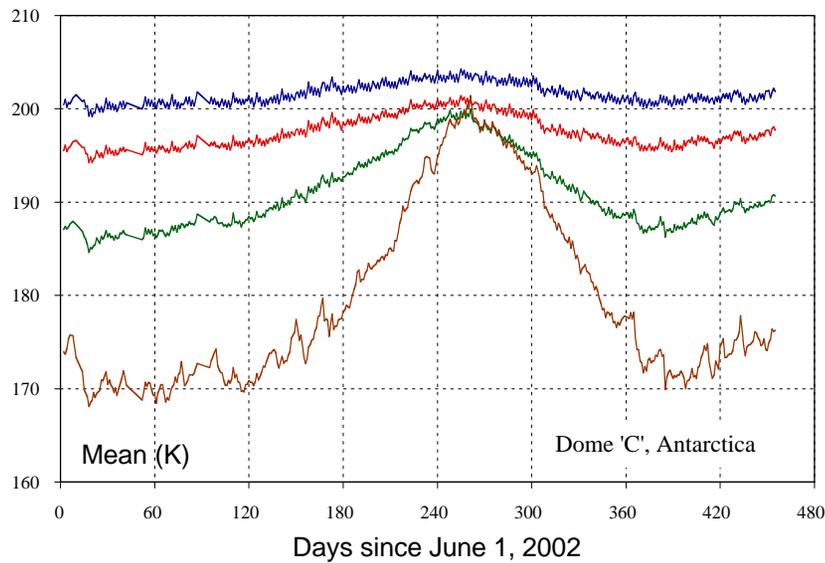


— 6.9 GHz — 10.7 GHz — 18.7 GHz — 36.5 GHz



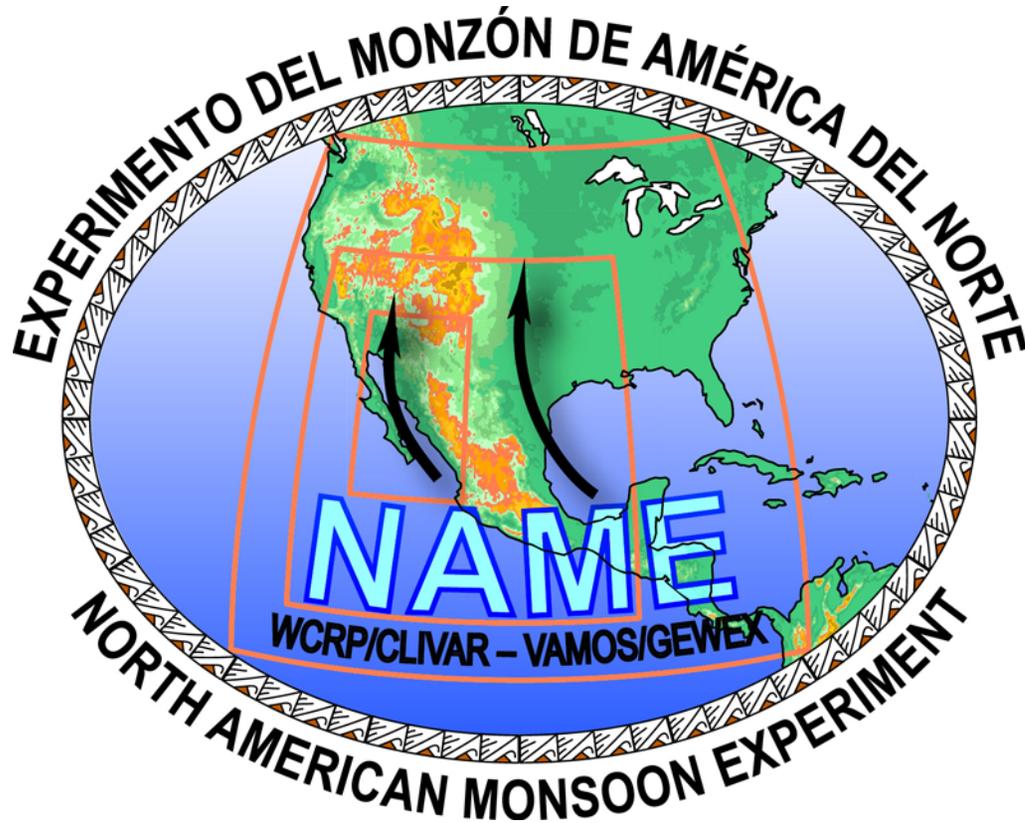
Dome 'C' (Antarctic) TB Statistics

Within 3x3 (~75x75 km) Grid Area (V-pol, Desc)



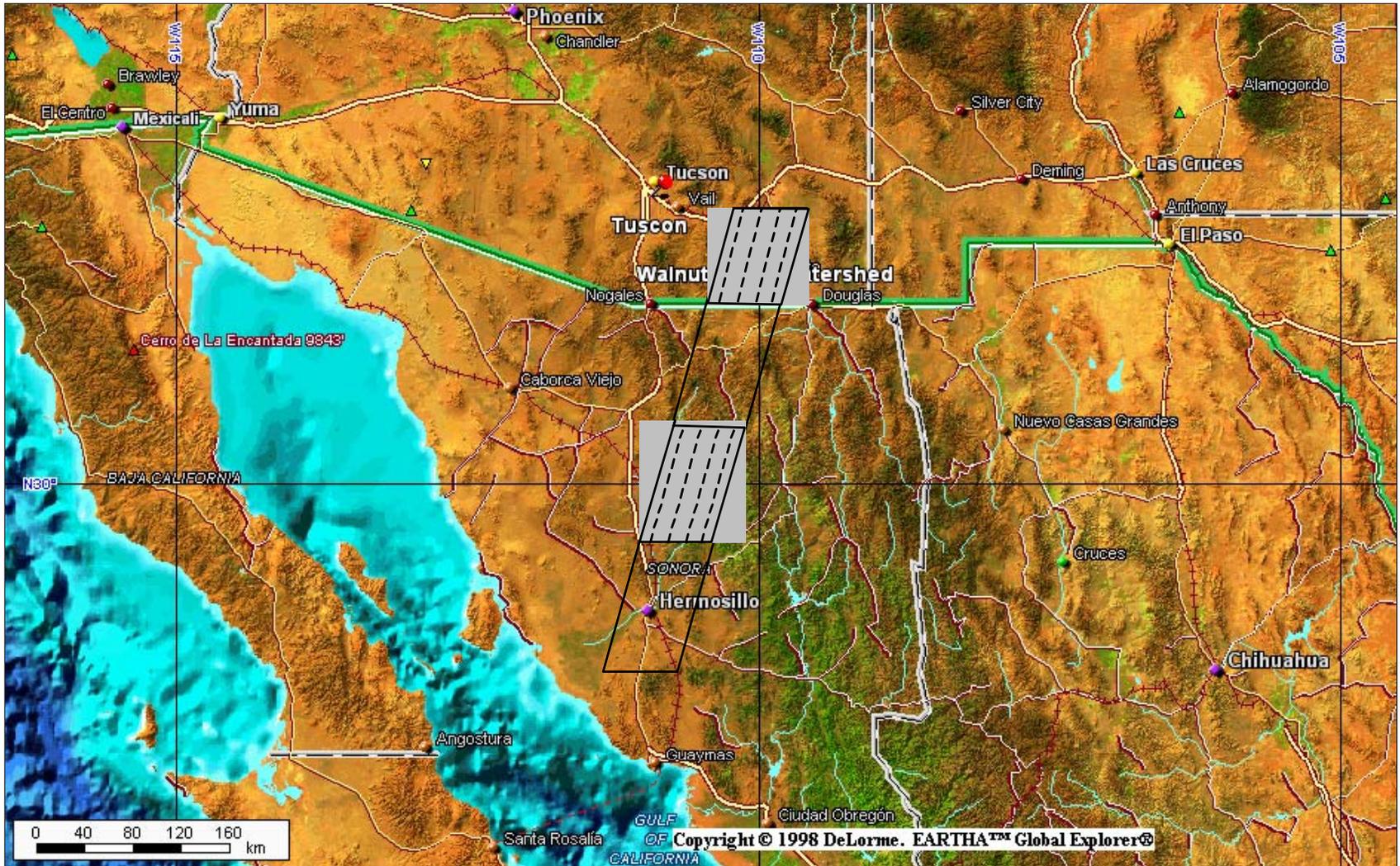
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NAME/SMEX04 Experiment – August 2004



<http://www.joss.ucar.edu/name>
<http://hydrolab.arsusda.gov/smex04>

SMEX04 Soil Moisture Study Region and Aircraft Mapping



New: validation of Walnut Gulch data set and mountainous terrain in Mexico

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