Microwave Radiometer Focus Group

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Radiative Processes Working Group
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Princeton, NJ

Activities

New generation MWRs

New 183-GHz radiometer

Data Analysis

New MWRs

RFP for new radiometers was put out ~ 1 year ago

Instrument requirements came from meeting at last year's microwave focus group meeting

4 companies responded

Radiometrics corporation will build the new radiometers

2 of these new MWRs have been ordered and should arrive this FY, more will be ordered in out years

Plan is to have new MWRs at each of the main ARM facilities (sgpC1, nsaC1, twpC1, twpC2, twpC3, amfM1, and amfM2)

Req: Addition of a higher frequency channel (90-GHz) to the two-channel (20-30 GHz) system to improve sensitivity to liquid water and reduce retrieval uncertainties of LWP when the LWP < 100 g/m^2.

21 calibrated channels between 20 and 30 GHz plus 1 channel at 90 GHz. The actual number of channels for observations can be tuned

Req: Improvements in the spatial resolution of the measurements in the 20-30 GHz frequency range. This implies a reduction of the radiometer field of view to about half of the current specifications (from 5-6 to 3.5 degree).

FOV ~ 3°

Req: Matching (as much as possible) field of view for all channels.

85 mm lens for 90 GHz and a 280 mm lens for K band. All radiometers and IRT FOVs ~ 2.8^{o} to 3.5^{o}

Req: Temporally coincident (or near-coincident) measurements for all channels.

Measurements synchronized to ~ 1s

Req: Increased temporal resolution of the measurements (data rate 0.5-1 Hz is desirable).

Configurable 3 channel observation cycle times down to < 4 seconds

Req. Improved rain detection and rain mitigation technique that will allow the instrument to provide accurate brightness temperature measurements during rain conditions.

Latest Vaisala rain detection system and new design proposed for rain mitigation

Modular design

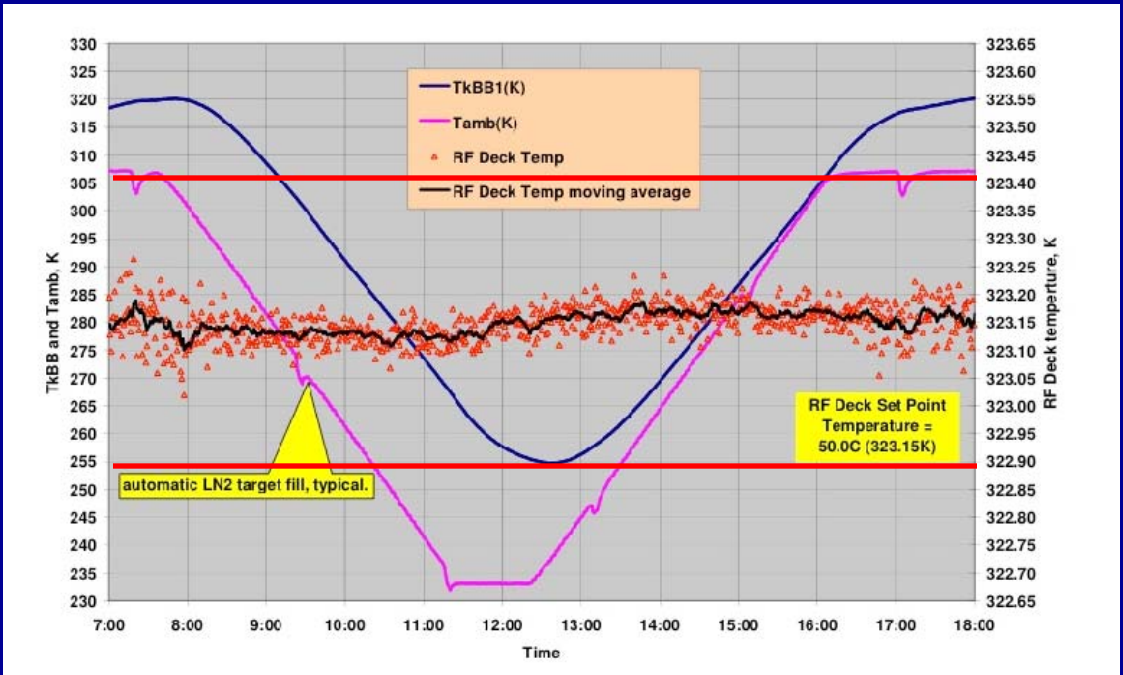
Separate receivers for K-band and W-band

Possibility of adding V-band receiver or other receivers in the future

Minimal disruption in case of failure (can replace individual receivers in the field)

Positioner

Receivers mounted on a Pan Tilt Unit (PTU)
Manufacturer: Directed Perception



Thermal stability: 30 mK

Current thermal stability: 0.25 K

Rain detection system

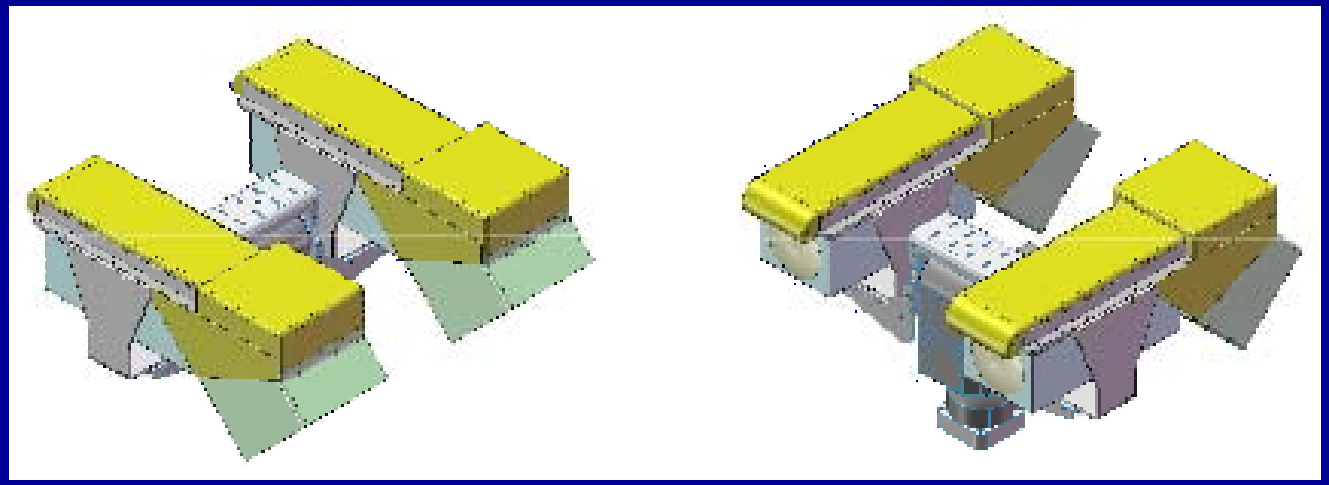
Vaisala Weather Transmitter WXT510 (or 520) based on detection of individual rain drops.

Real-time measurements of accumulated rainfall, rain intensity and duration. Wind speed and direction.

Rain mitigation

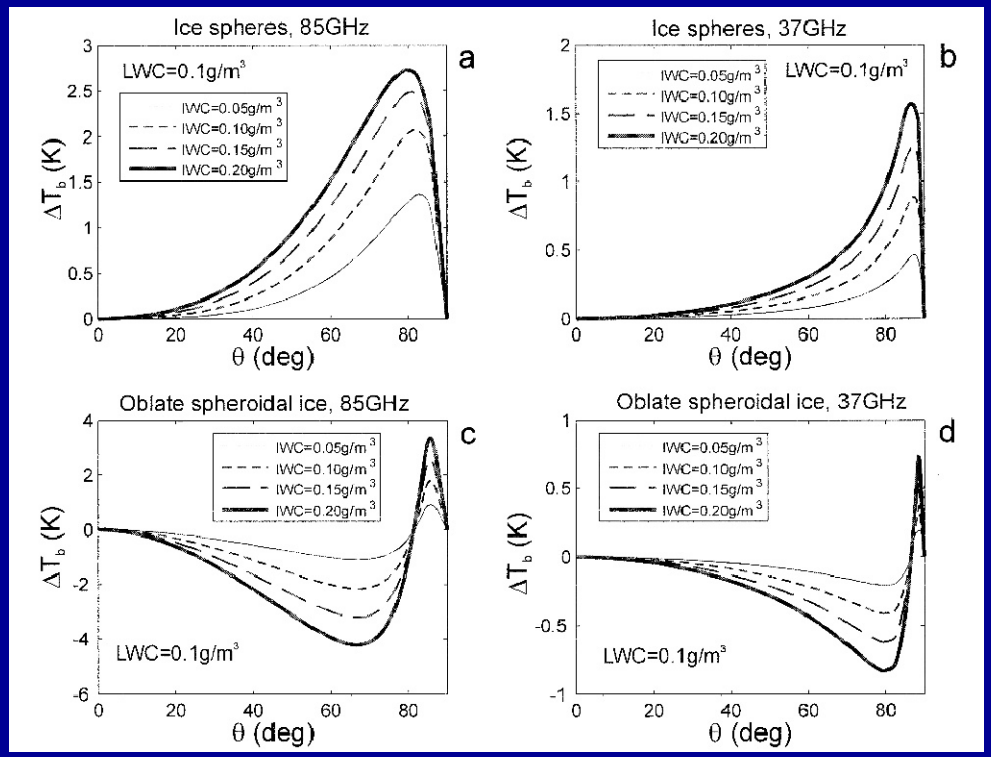
1. Highly effective in light to moderate rain
2. Easily transportable total system
3. Compact and low power for use with pointed radiometers
4. Reasonably low cost...affordable and…
5. Schedule compatible; ready to test by early next year

Radiometrics is working on possible solutions…



Initial delivery and testing probably ~ Jan 2009

Possibility to add polarization to 90 GHz channel



The dependence of the thermal radiation polarization difference *Tb* as a function of zenith angle for a mixed-phase cloud having differing IWC values but constant LWC=0.1 g/m^3 , and an average ice particle size *D*=500 μm.

A.V. Troitsky, A. M. Osharin, A. V. Korolev, J. W. Strapp, *J. Atmos. Sci.,* vol. 60, pp. 1608-1620, 2003

New G-Band Vapor Profiler radiometer in Barrow

Formerly the “MP-183”

GVRP: 15 channels between 170 and 183.31 GHz

Retrievals: PWV, LWP. The same retrieval of PWV and LWP will be applied to both instruments

GVRP to Chile for RHUBC-II in 2009

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

GVR

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GVRP

GVRP currently on the Ron Brown participating in the VAMOS Ocean-Cloud-Atmosphere-Land Study Regional Experiment (VOCALS-REX) in the South-East Pacific.

Supplement 2-channel retrievals of LWP from U. of Miami MWR and NOAA 90-GHz radiometer

ARM GVRP

U. Of Miami 2- channel MWR

Analysis Activities

Operational calibration of at higher frequencies (90 & 150 GHz)

Improving clear sky RT models at higher frequencies

Evaluating information content in MWR observations for LWC(z)

Evaluate accuracy of liquid water absorption models at higher frequencies (future)

Improvements in MWRRET to use 3-channel instruments (future)