Comparisons Between Radiosondes and Remote Sensors During the 2004 NSA Arctic Winter Radiometric Experiment

Contributors
Ed R. Westwater, *University of Colorado/CET/ECE*

Research Highlight

During March 9-April 9, 2004, the North Slope of Alaska Arctic Winter Radiometric Experiment was conducted at the Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) North Slope of Alaska (NSA) site near Barrow, Alaska. The major goals of the experiment were to compare microwave and millimeter wavelength radiometers and to develop forward models in radiative transfer, all with a focus on cold (temperatures 0 to -40 deg. C) and dry (Precipitable Water Vapor [PWV] < 0.5 cm) conditions. To supplement the remote sensors, several radiosonde packages were deployed: the Vaisala RS90 launched at the ARM Duplex and at the Great White, and Sippican VIZ-B2 operated by the National Weather Service (NWS). In addition, eight dual-radiosonde launches were conducted at the Duplex, with the Vaisala RS90 and Sippican GPS Mark II, the latter was modified to include a chilled mirror humidity sensor. Temperature comparisons showed a nighttime bias between the VIZ-B2 and the RS90, which reached 3 degrees C at 30 hPa. Relative humidity comparisons indicated better than 5% average agreement between the RS90 and the chilled mirror. A bias of about 20% for the upper-troposphere was found in the VIZ-B2 and the Mark II measurements relative to both the RS90 and the chilled mirror.

Remote sensing instruments were also operated and included the Microwave Radiometer (MWR), a Microwave Radiometer Profiler (MWRP), a Global Positioning System receiver, and the Ground-based Scanning Radiometer.

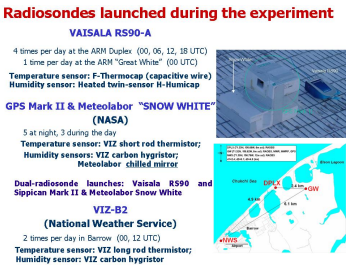
Because of the need to independently verify the water vapor retrievals of the MWR, the MWRP, the Global Positioning System, and the Ground-based Radiometer, measurements between all of the systems were compared. All of remote sensing instruments were able to measure Precipitable Water Vapor, and their comparisons were in basic agreement with an rms error of about 0.6 mm. However, there were significant differences between upper-tropospheric and lower-stratospheric humidity profiles as measured by the various radiosondes. In particular, RH as measured by the Vaisala RS90 systems and the chiller-mirror system were in excellent agreement, but the NWS synoptic soundings, using a VIZ humidity sensor, differed by about 20 to 40 % from the others.

Reference(s)

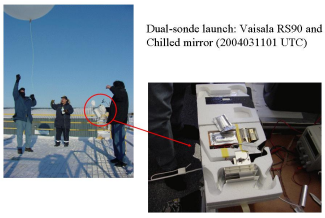
Mattioli, V. , E. R. Westwater, D. Cimini, J. S. Liljegren, B. M. Lesht, S. I. Gutman, and F. J. Schmidlin, 2007: Analysis of radiosonde and ground-based remotely sensed PWV data from the 2004 North Slope of Alaska Arctic Winter Radiometric Experiment. J. Atmos. Oceanic Technol. 243, 415-431.

Working Group(s)

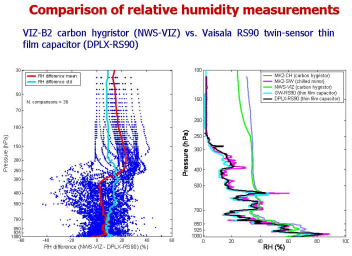
Radiative Processes



Description of radiosondes launched during the 2004 NSA Arctic Winter Radiometric Experiment.



Dual-radiosonde launch of the Vaisala RS90 and Chilled Mirror radiosondes is pictured here.



On the left is statistical comparisons between the RS90 and NWS-VIZ soundings. On the right is individual comparisons between all five radiosonde types used during the experiment.

Office of Science
U.S. DEPARTMENT OF ENERGY