Improved Retrievals of Temperature and Water Vapor Profiles using a 12-Channel Microwave Radiometer

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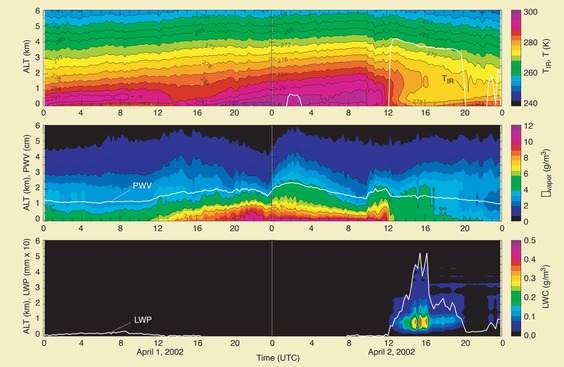
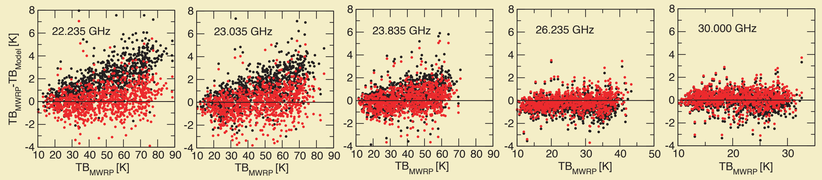


Time-height contours of temperature (top), water vapor density (middle), and liquid water content (bottom) for 1-2 April 2002 at the SGP CART site near Lamont, OK. The heavy white line in the top panel indicates the temperature reported by the infrared thermometer (IRT). The heavy white lines in the middle and bottom panel indicate the precipitable water vapor (PWV) and liquid water path (LWP), respectively.

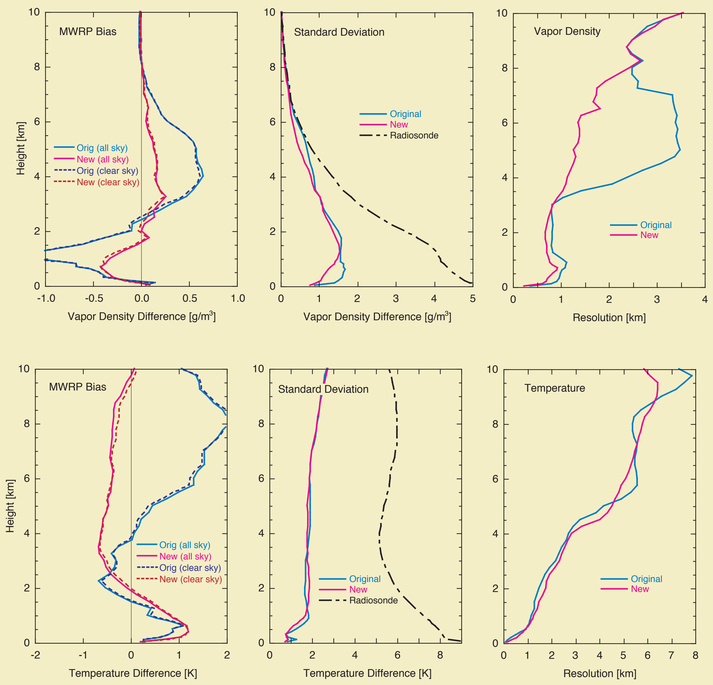
Improved Spectroscopy

- Comparison of brightness temperatures measured by the 12-channel microwave radiometer profiler (MWRP) with model calculations using scaled radiosondes (black circles) suggests the 22.235 GHz water vapor line width parameter Δ_C is about 5% too large (per S.A. Clough). Brightness temperatures calculated using a reduced value of Δ_C (red circles) exhibit much improved agreement with measurements.

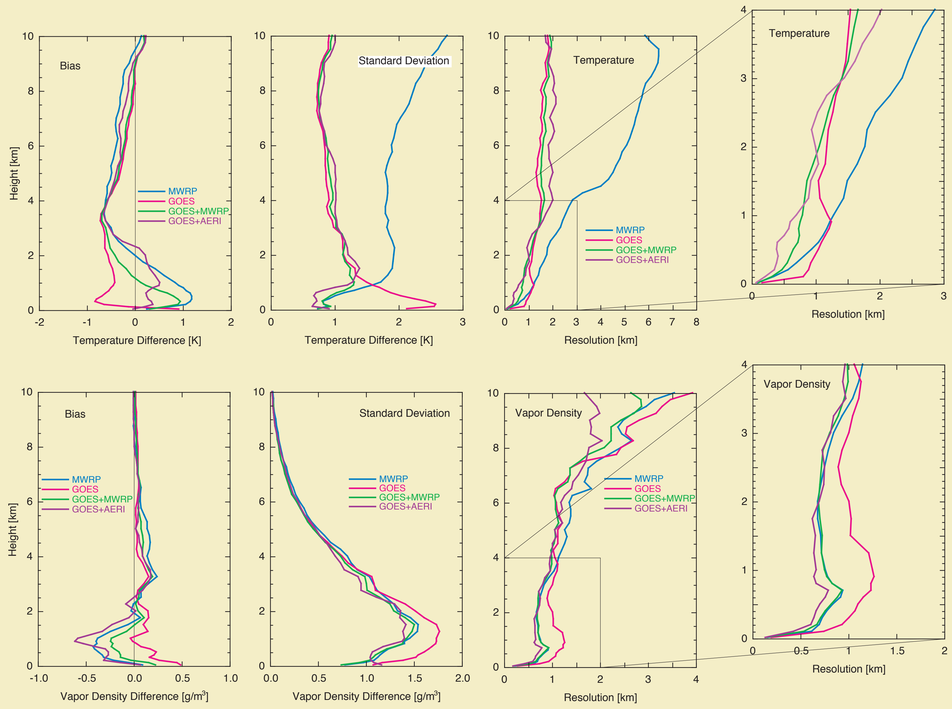


- Statistical water vapor profile retrievals based on the reduced line width exhibit substantially reduced bias (compared with radiosondes) and slightly reduced standard deviation in the lower and middle tropophere. Vertical resolution for water vapor is dramatically improved in the mid-troposphere and slightly improved in the lower troposphere.

- Statistical temperature profile retrievals based on the reduced line width also exhibit dramatically reduced bias in the mid-to-upper troposphere.



Combined with GOES



- Water vapor and temperature profiles from the microwave radiometer profiler (MWRP) are combined with GOES profiles using an inverse covariance weighting technique.

- For temperature profiling, combining with GOES results in significantly improved bias, standard deviation and vertical resolution.

- For water vapor profiling, combining with GOES offers modest improvements over the MWRP alone. The most noticeable improvement is in the vertical resolution above 4 km.

Multi-Angle Retrieval

- Using brightness temperatures measured at an elevation angle of 15 in addition to zenith can noticeably improve vertical water vapor resolution because the 22.235 GHz water line is weakly absorbing. This means that the continuous tip curve data can be used for water vapor profile retrievals in addtion to calibration.

- Because the oxygen aborption lines near 60 GHz are strongly absorbing, little improvement in vertical temperature resolution is likely to be realized by multi-angle measurements.