

## **Investigation of gas absorption models from 22 to 183 GHz observed at low water vapor concentrations in the Atacama Desert in Chile**

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The Atmospheric Radiation Measurement (ARM) program is conducting the second phase of the Radiative Heating in Underexplored Bands Campaign (RHUBC-II) in Aug – Oct 2009 at a site on Cerro Toco (5320 m MSL, 530 mb), which is located in the Chajnantor Plateau in Chile. The primary focus of RHUBC-II is to characterize and improve the accuracy of water vapor absorption models (near-infrared to submillimeter wavelengths) using high-spectral-resolution radiance observations in spectral regions that are normally opaque at lower altitudes due to strong water vapor absorption. The microwave and submillimeter portion of the spectrum is covered by two radiometers: the MP-183, with 15 channels between 170 and 183.3 GHz (deployed by ARM) and the HATPRO-G2 (Humidity and Temperature Profiler – Generation 2) operated by the Institute for Geophysics and Meteorology of Cologne. Observations of both instruments are used to address three points:

- 1) The measurements of atmospheric brightness temperatures (TB) between 170 to 183.3 GHz are being used to evaluate existing water vapor continuum models at very low water vapor column ( $< 1 \text{ kg m}^{-2}$ ) and temperatures. MP-183 observations allow the evaluation of these absorption models under non-saturated conditions at 5400 m.
- 2) The HATPRO-G2 measures atmospheric radiation along the 22.24 GHz water vapor line and the oxygen absorption complex centered around 60 with a total of 14 channels. The frequency channels have been designed with sharply well characterized band pass filters, allowing high accuracy TB measurements. Observed and simulated TB along the oxygen complex will be compared and used to evaluate the existing oxygen absorption models. Additionally, due to the lower oxygen concentration at 530 mb, the tipping curve procedure can be used to calibrate the lower frequency oxygen channels.
- 3) Astronomical observations at sub-mm frequencies in the Cerro Toco region need to be corrected for atmospheric path delay fluctuations due to variable water vapor content (wet delay) and temperature variations (dry delay). HATPRO-G2 is beneficial to estimate the dry delay fluctuation component. Wet delay determination of HATPRO-G2 measurements at 22.24 will be exploited at larger airmass values concerning the signal to noise ratio.

The ARM program launched approximately 120 radiosondes during the experiment to support these analyses. Furthermore, both the HATPRO-G2 and the MP-183 have been scanning continuously to measure at different airmass values. We will show the initial results from these analyses, focusing on the accuracy of the observations and the absorption models.