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The PRANA experiment: characterization of atmospheric downwelling long-wavelength radiance over the Antarctic plateau.

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A complete understanding of the radiative processes that control the Earth's climate is a fundamental step to answer the most compelling questions that the climatology community is facing nowadays.

The study of the contribution of water, in its vapor and condensed states, to these processes is a particularly challenging task due to the different ways in which atmospheric water influences climate, and to the complex feedbacks to which these are subject.

On the other side, water vapor contribution to the Earth's radiative balance happens mainly in the far-infrared region (FIR), that, at the moment, is a relatively unexplored spectral region for what concerns atmospheric sciences. Nevertheless, this contribution is of the same order of magnitude, and in certain conditions can be even higher, than that of carbon dioxide.

In order to address this scientific issue, en experiment has been designed revolving around a zenith-looking broadband spectroradiometer capable of monitoring the whole thermal emission spectrum of the atmosphere.

The experiment, named Radiative Properties of Water Vapor and Clouds in Antarctica (PRANA, "Proprieta' Radiative del vapore Acqueo e delle Nubi in Antartide"), is funded by the Italian Antarctic research program, and has now completed the first year of operation at Concordia station, in the Dome C region of the Antarctic plateau.
The experiment includes a Fourier-transform spectroradiometer for the characterization of the downwelling longwave radiance in the 100-1400 cm-1 spectral region, with a 0.4 cm-1 resolution and a 0.25K radiometric accuracy, and a backscatter/depolarization LIDAR to characterize a possible cloud coverage.

Data provided by the main instruments is complemented by a wealth of atmospheric instruments that are installed in the same location: cameras to monitor the skyconditions, integrated radiometers, microwave and UV spectrometers and meteorological stations. Radiosounding is also performed daily, at 12:00 UTC.

The FIR spectroradiometer is operating continuously since December 2011, the corresponding dataset is presented, along with some of the preliminary analysis results, showing the possible products that can be retrieved from such a dataset: integrated precipitable water vapor, water and temperature vertical profiles, and cloud optical thickness. A number of different applications can make use of the provided data: the identification and characterization of the effect of the different atmospheric components on the radiation budget, the improvement of the spectroscopic models of water vapor in its rotational band, the characterization of the spectral signature of thin ice clouds.