

Dome C Tropospheric Observer (DoCTOr): Synergy of active and passive optical remote sensing techniques for the continuous monitoring of the Antarctic troposphere.

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The polar regions have a fundamental role in climate, being the main radiative sink of the Earth system thanks to their high visible-UV albedo and high thermal emissivity. On the other hand, the East-Antarctic plateau is a rather isolated system due to its atmospheric circulation, and is also relatively simple in terms of orography, so it qualifies as an optimal system for the study of the mechanisms of climate.

The DoCTOr (Dome C Tropospheric Observer) project aims to establish an integrated monitoring system to measure simultaneously, continuously and with a high temporal resolution the water vapor and temperature vertical profiles and the radiative exchanges vs. altitude in the Dome C region on the Antarctic plateau, at the Italian-French station Concordia.

The DoCTOr project will feature the integration of all the deployed instrumentation in a single acquisition system simplifying greatly the data analysis needed to retrieve the final products: The REFIR-PAD (Radiation Explorer in the Far-InfraRed – Prototype for Application and Development) spectroradiometer, already operating at Concordia station since 2011, will provide spectrally-resolved atmospheric downwelling radiances in the mid to far-infrared spectral range, while a diode laser vertical profiler will characterize the microphysics state of the first 3 km of the atmosphere. A real-time data analysis system based on an atmospheric radiative transfer model will then retrieve from the acquired data the temperature and water vapor profiles and the cloud optical thickness in almost all weather conditions found at Concordia, with a temporal resolution of about 10 minutes.

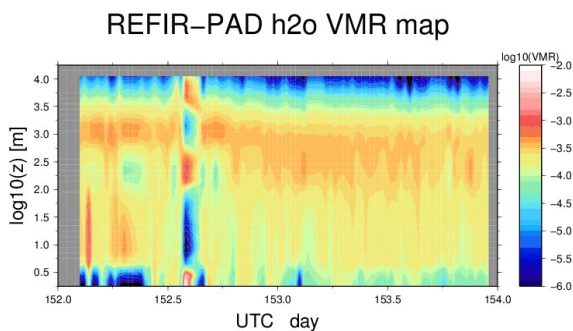


Figure 1: Vertical water vapor profile map obtained from REFIR-PAD spectra. In presence of clouds the water vapor profile is perturbed.

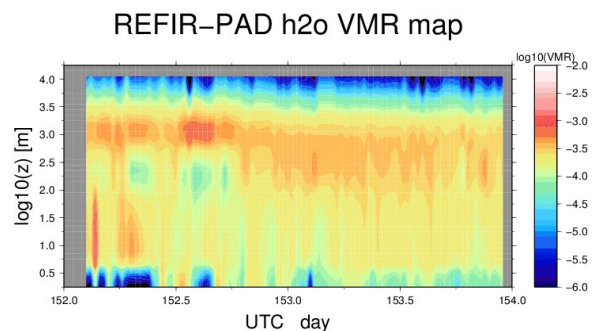


Figure 2: The additional information on cloud geometry provided by the laser profiler gives a correct water vapor vertical distribution.

The effect of the additional information provided by the profiler can be seen comparing Figure 1 and Figure 2: the presence of low clouds perturbs the retrieval process producing as a result wrong vertical profiles and an overestimated total water content. If the correct information about cloud geometry (cloud bottom, layer thickness) is provided, the alterations in vertical profiles and the corresponding water vapor overestimate disappear.