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Concordia Multi-Process Atmospheric Studies (CoMPASs): study of the vertical structure of the Antarctic atmosphere with a synergy of different remote sensing techniques

Giovanni Bianchini (1), Stefania Argenitini (2), Massimo Baldi (1), Francesco Cairo (2), Francescopiero Calzolari (3), Giampietro Casasanta (2), Alessandro Conidi (2), Massimo Del Guasta (1), Gianluca Di Natale (4), Stefano Federico (2), Angelo Lupi (3), Mauro Mazzola (3), Mauro De Muro (2), Luca Palchetti (1), Igor Petenko (2), Boyan Petkov (3), Marcel Snels (2), Giuliano Trivellone (3), Angelo Viola (2), and Maurizio Viterbini (2)

(1) INO-CNR, via Madonna del Piano 10, 50019 Sesto Fiorentino, Italy, (2) ISAC - CNR, via Fosso del Cavaliere 100, 00133 Roma, Italy, (3) ISAC - CNR, via Gobetti 101, 40129 Bologna, Italy, (4) University of Pisa, Lungarno Pacinotti 43, 56126 Pisa

Concordia station, in the Dome C region, Antarctica, is the ideal site for the study of micro-physical, meteorological and chemical processes in unperturbed and extreme conditions: the relative absence of perturbations at the mesoscale allows highly representative observations of the atmosphere inside of the polar vortex, as well as the possibility of studying the micro-meteorological "asymptotic" conditions in the boundary layer. Given these privileged conditions, the interaction between the different processes will be especially noticeable.

The CoMPASs (Concordia Multi-Process Atmospheric Studies) project has been developed in order to identify and characterize these feedbacks and interactions between processes, spanning across three different atmospheric regions: the boundary layer, the troposphere and the stratosphere.

The main research themes follow the vertical structure of the atmosphere:

- Characterization of the atmospheric boundary layer (ABL) in terms of dynamics, turbulence and radiation, especially during the winter period, in which the ABL has peculiar properties in terms of reduced thickness and extreme sensitivity to external forcing.

- Study of the clouds in the free troposphere, which, in the region of Dome C, shows a remarkable variability, both daily and seasonal, and therefore requires continuous monitoring to quantify its interactions with the neighbouring atmospheric layers.

- Study of the stratospheric processes within the Antarctic polar vortex, as ozone chemistry and polar stratospheric clouds, carried out throughout the year in order to constantly follow the evolution of the vortex itself.

CoMPASs makes use of a strong observational component, deploying an array of different instruments all characterized by the vertical remote sensing measurement technique: stratospheric and tropospheric lidars, UV and middle/far-infrared spectroradiometers, and a high-resolution mini-sodar. The turbulence in the surface layer will be monitored with fast response sensors.

The study involves different spatial and temporal scales. The prevalent use of remote sensing instrumentation from the ground allows the characterization of a large part of the atmosphere. The instrumentation is expected to operate continuously, automatically or semi-automatically through the intervention of personnel present even during the winter season, thus obtaining a characterization of processes with temporal coverage on different scales (daily, seasonal, annual).

In the presentation we will describe the CoMPASs project which is under way at Concordia station and we will present some preliminary results from the field experiment.