# A5-Unibo: an experiment on aerosols and cloud formation on-board Bexus 18 stratospheric balloon

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Aerosols can affect the climate in two major ways, through direct and indirect processes. The direct effect is the one exerted by aerosols themselves on the radiative balance of the Earth through a combination of scattering and absorption of radiation. The indirect effects are a suite of possible impacts on aerosols through the modification of cloud properties interaction of aerosols on clouds (IPCC, 2013). Clouds and aerosols continue to contribute the largest uncertainty to assessment and understanding of "climate change" (IPCC, 2013).

Research is currently focused on the study of a possible link between cloud formation processes and the ionization of atmospheric particles caused by Cosmic Rays. The most widely studied mechanism proposed to explain the possible influence of the cosmic ray flux on cloudiness is the so-called "ion aerosol clear air mechanism (Carslaw *et al.*, 2002; Usoskin and Kovaltsov, 2008). A second mechanism linking the cosmic ray flux to cloudiness has been proposed through the global electric circuit (Khain *et al.*, 2004; Harrison and Ambaum, 2008; Nicoll and Harrison, 2008; Tinsley, 2008). Our current understanding of these mechanisms remains very low, mostly due to the reduced number of in-situ observations.

The "A5-Unibo" experiment by the University of Bologna has been developed to this aim. It has flown in BEXUS18 stratospheric balloon within the REXUS/BEXUS programme, realised under a bilateral Agency Agreement between the German Aerospace Center (DLR) and the Swedish National Board (SNSB) in the framework of the European Space Agency (ESA)

The primary objective of the experiment was to collect vertical profiles of different atmospheric parameters involved in these processes, while the secondary one was the sampling of stratospheric aerosols for a post-flight analysis.

Figure 1. A5-Unibo experiment onboard Bexus 18

A5-Unibo experiment measured profiles of particles size distribution with an innovative aerosol counter (LOAC "Light Optical Particle Counter"), ion (both positive and negative) densities (Air Ion Counter, AlphaLab. Inc.), and key atmospheric parameters such as temperature, humidity, and pressure.

In this way, a correlation between ionization and aerosol formation processes has been investigated through a rather simple multi-instrument approach. Our preliminary results have identified a possible role of positive ions in condensation, as well as a larger importance of humidity with respect to temperature.

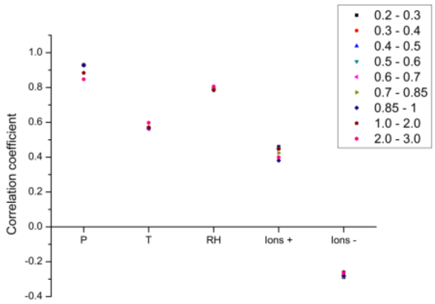


Figure 2. Correlation coefficients for particles in the 0.2 – 3.0 µm diameter range with pressure (P), temperature (T), relative humidity (RH), and ion densities.

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