Detection of charged aerosols during the BEXUS18 stratospheric flight: main results and open questions

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Electrified aerosols have been previously detected in the troposphere and mesosphere, not only during disturbed weather but also in fair weather atmosphere. The detection of electric charges and discharges of volcanic ashes (Gilbert *et al.*, 1991; Mather and Harrison, 2006; James *et al.*, 2008; Harrison *et al.*, 2010) and of Saharan dust layers (Ulanowski *et al.*, 2007; Nicoll *et al.*, 2011) are only a few examples of charged aerosols in the troposphere. On the contrary, charged particles have been seldom detected in the stratosphere (Renard *et al.*, 2013).

The "A5-Unibo" experiment by the University of Bologna has been developed to the aim of studying vertical profiles of atmospheric ions and particles all along the flight of the BEXUS18 stratospheric flight. The experiment was flown from the Esrange Space Center from Kiruna (Sweden) on 10th October 2014 within the REXUS/BEXUS programme.

The experiment (Figure 1) collected vertical profiles of: 1) atmospheric parameters such as temperature, relative humidity, and pressure; 2) particles size distribution with an innovative aerosol counter (LOAC "Light Optical Particle Counter"); 3) ion (both positive and negative) densities (Air Ion Counter, AlphaLab Inc.).

Figure 1. A5-Unibo experiment onboard Bexus 18 stratospheric balloon.

The preliminary results obtained (Figure 2) indicate good correlations between particle concentrations and ions above the tropopause level and in the stratosphere, and suggest in particular the presence of layers of electrified aerosols in the middle stratosphere similar to Renard et al. (2013).

Even though model calculations are now being used to quantify the electrification of the aerosols with a stratospheric aerosol-ion model (Rawal et al., 2013; Renard et al., 2013), the need for further measurements to be conducted on stratospheric balloons clearly emerges. In fact, the presence of layers of electrified aerosols could have significant implications for sprite formation.

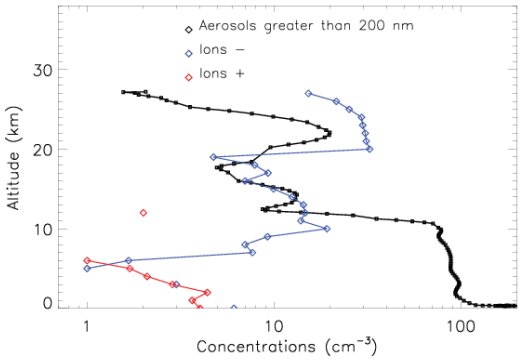

Figure 2. Vertical profiles of integrated concentrations for all the aerosols greater than 200 nm and of negative and positive ion densities recorded during the balloon ascent (a sliding smoothing is applied to suppress small length-scale fluctuations).

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