

Name of research institute or organization:

**Institute for Atmospheric and Earth System Research, Faculty of Science,
University of Helsinki**

Title of project:

Investigation of free tropospheric nucleation

Part of this programme:

ACTRIS

Project leader and team:

Dr. Federico Bianchi, project leader
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Dr. Martin Gysel
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Project description:

This project consists of a field study at the Jungfraujoch (JFJ) with state-of-the-art instruments to elucidate the various processes and mechanisms governing new particle formation in the free troposphere at a molecular level. From 2 years' extensive measurements with a neutral cluster air ion spectrometer (NAIS, from the University of Helsinki) we expect to gain an overview of the ion size distributions and new particle formation events over a long-time period. With this instrument we are able to detect aerosol particles smaller than 5 nm in diameter (ca. 0.8 nm - 45 nm mobility diameter for ions and 3 - 45 nm for neutral particles).

We installed the NAIS at the Jungfraujoch East ridge in July 2016 with the help of the Paul Scherrer Institute (PSI) colleagues. This is a new location compared to earlier measurements that became available only recently. Since the installation the instrument is working continuously and we have been able to detect several nucleation events (see example in Fig. 1). The instrument was serviced in October 2017 and a new heating inlet was installed. At the same time we investigated why the negative small ions seem to be missing from the observed data (upper left panel of Fig 1). It was concluded, that it is not an instrumental artifact, neither a problem with the heating inlet. Rather, we think that it is a phenomenon caused by the buildings or transmitters outside of the measurement site.

Ions can play a part in atmospheric nucleation and the changes in ion composition can tell about the chemical composition of the nucleating clusters. The chemical characterization of small ions at JFJ was recently published by Frege et al. (2017). With our additional data set we can evaluate the importance of ions in nucleation and get a better statistics of nucleation frequency, as well as calculate the formation and growth rates of ions and particles during these events. As clearly shown in Fig. 1, new particle formation events at JFJ are usually detected simultaneously in both ion polarities as well as in the total particle concentration.

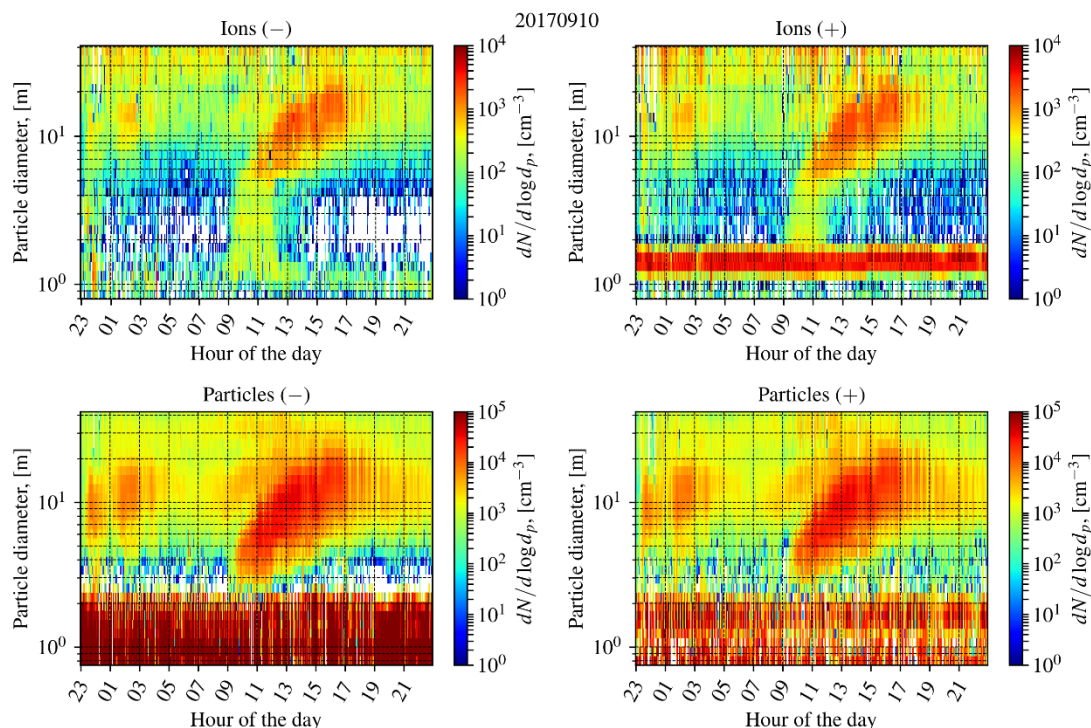


Figure 1. Ion (two upper panels) and particle (two lower panels) size distribution measured by the NAIS. The data clearly displays a nucleation event recorded at the Jungfraujoch station on 10.09.2017.

Key words:

Nucleation, ions, spectrometers, free troposphere

Collaborating partners/networks:

Paul Scherrer Institute

Scientific publications and public outreach 2017:

Refereed journal articles and their internet access

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Conference papers

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Bianchi, F., H. Junninen, A. Bigi, P. Bonasoni, S. Buenrostro Mazon, L. Dada, J. Dommen, C. Frege, C.R. Hoyle, P. Laj, K. Lehtipalo, J. Kontkanen, A. Marinoni, U. Molteni, M. Riva, V. Sinclair, K. Sellegri, C. Yan, D.R. Worsnop, U. Baltensperger, M. Kulmala, The Himalayan aerosol factory: the chemistry of new particle formation, European Aerosol Conference 2017, Zurich, Switzerland, August 27 – September 1, 2017.

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<https://blogs.egu.eu/geolog/2017/04/07/geotalk-how-are-clouds-born/>

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