

Name of research institute or organization:

Institute for Atmospheric and Climate Science, ETH Zurich

Title of project:

Field measurements of atmospheric ice nuclei and properties of mixed phase clouds

Project leader and team:

Dr. Olaf Stetzer and Prof. Ulrike Lohmann, project leaders
Jan Henneberger, Yvonne Boose, Monika Kohn, PhD students

Project description:

The cloud physics group at ETH Zurich has developed the HOLographic Imager for Microscopic Objects II (HOLIMO II) to measure the micro-physical properties of mixed-phase clouds as reported in the 2011 report. In 2012 HOLIMO II was deployed to the Jungfraujoch during two campaigns for this purpose. HOLIMO II images *in-situ* single cloud particles larger than 6.8 μm using digital holography. The measured size distributions were compared to a Fog Monitor (DMT FM-100) and agree quite well with this instrument (Figure 1). The development of the size distribution of a mixed phase cloud over eight hours was measured with a high temporal resolution and a bi-modal structure of liquid droplets and ice crystals could be observed (Figure 2).

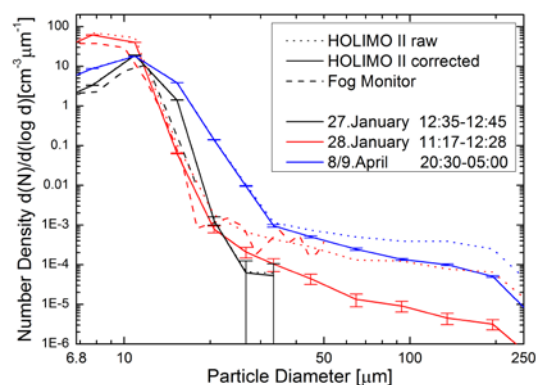


Figure 1: Cloud particle size distribution measured by the Fog Monitor (dashed) and HOLIMO II (dotted/solid). The raw HOLIMO II data (dotted) were corrected accounting for the inlet efficiency (solid).

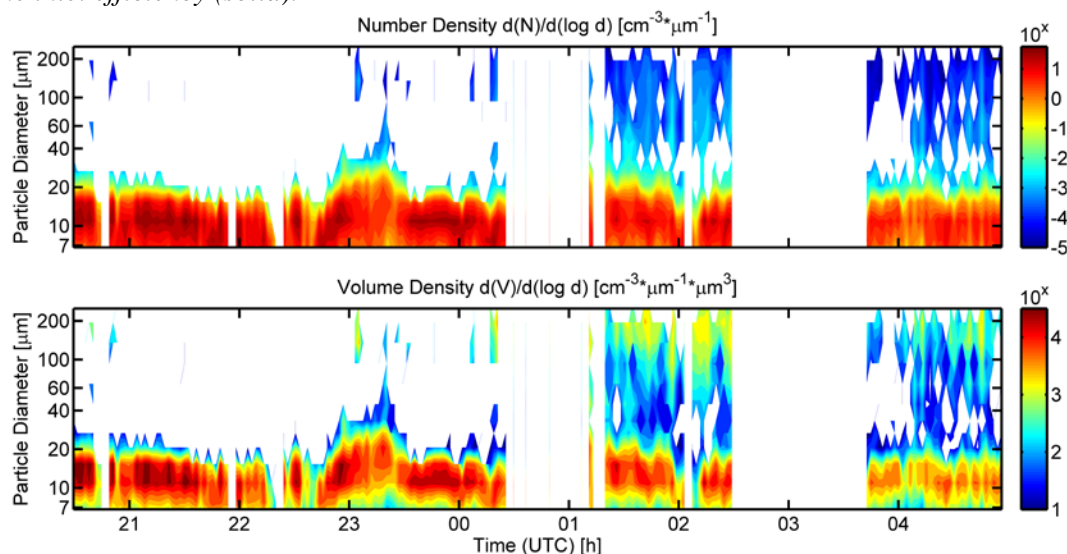


Figure 2: Development of the cloud particle size distribution between 6 April 20:00 and 04:00 (UTC) measured by HOLIMO II. Data gaps are due to icing on the windows.

In addition, further measurements of ice-nuclei concentrations with the portable ice nucleus counter (PINC) were performed in parallel during the campaign in January as reported in Figure 3. Since the concentrations of IN were very low (between 1 and 3 per liter) in this month the data was below the detection limit in many cases. To overcome this instrumental limitation, an aerosol concentrator was purchased for future campaigns. First tests with this concentrator were already performed and revealed, that a concentration ratio of 10:1 could be reached as was expected from the specifications of this device.

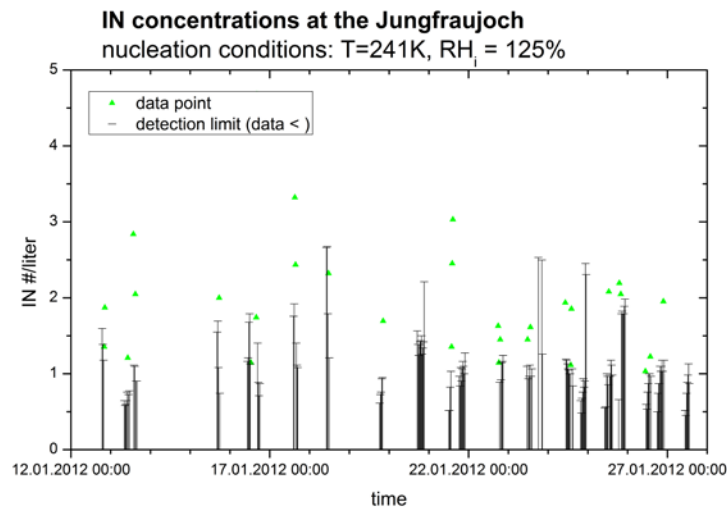


Figure 3: Ice nuclei concentrations at the Jungfrauoch in January 2012 at a temperature of 241K and a RH_i of 125%. For many occasions, the measured concentrations were below the detection limit, which is reported as black bars in these cases.

Key words:

Ice nuclei, heterogeneous nucleation, aerosol particles, clouds, ice crystals, mixed phase clouds

Collaborating partners/networks:

Ernest Weingartner, Martin Gysel, Nicolas Bukowiecki, PSI
Jacob Fugal, MPI Mainz

Scientific publications and public outreach 2012:

Conference papers

Henneberger J., O. Stetzer, U. Lohmann, Field measurements of the microstructure of mixed-phase clouds, 16th International Conference on Clouds and Precipitation, ICCP-2012, Leipzig, Germany, July 30 – August 3, 2012.

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