Properties of pure ice clouds in an alpine environment

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Introduction	Instrumentation	Meteorological situation
The CLACE2013 field experiment was designed to	During CLACE2013, numerous cloud particle in-	An upper trough filled with very cold air was cen-
investigate the physics and chemistry of aerosols,	struments from different universities / institutes	tered over central Europe. During this case study,
ice nuclei and cloud hydrometeors. It took place in	were operated on the outer platform of the High	an almost constant northwesterly background flow
January and February 2013 at the High Altitude Re-	Alpine Research Station Jungfraujoch. Presented	with 5-6 m/s was present. Temperatures stayed
search Station Jungfraujoch in Switzerland (3580	are results from the holographic cloud probe Gipfel-	around $-26^{\circ}C$, decreasing to $-27^{\circ}C$ in the night
m ASL). During the experiment, the temperature	Holo (MPI-C Mainz, open path) and the imaging	hours. Time intervals with ice supersaturation /
covered a range from $-30^{\circ}C$ to $0^{\circ}C$. Wind speeds	cloud probe 2D-S (University of Manchester, con-	ice subsaturation alternated throughout the whole
covered the full range of the Beaufort scale (from	stant flow through inlet). Both instruments record	evening and night. No high or mid level clouds were

calm to hurricane force).

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particle images from $\sim 15~\mu{\rm m}$ up to $\sim 1~{\rm mm}$.

observed when the diamond dust event started.

Ice particle number concentration and size distribution

Top row: Data from 2D-S. Bottom row: Data from GipfelHolo.

Number concentration vs. time and particle size (30 s running average)













30 s running average of number concentration



Particle image examples



Instrument comparison and particle habit analysis





Size distribution



Comparison of both instruments







Conclusions

Similar to the observation of diamond dust in Antarctica at temperatures around -35°C by Lawson et al. (2006), we found columns being the dominant particle habit. The median of the cumulative size distribution is 100 μ m (data from 2D-S), respectively 85 μ m (data from GipfelHolo). The maximum of the cumulative size distribution is 75 μ m for both instruments. Ice particle numbers decreased after 21:20 UTC and irregular particles from blowing snow became the dominant habit.

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Future work

We recorded some more diamond dust events during CLACE2013 which can be analyzed in a similar way. From the holographic data set we can obtain the three dimensional position and the average inter-particle distances in diamond dust.

References

R. P. Lawson et al. (2006): Microphysical and Optical Properties of Atmospheric Ice Crystals at South Pole Station. J. Appl. Met. Clim. 45, 1505-1524.