Name of research institute or organization:

Departement Umweltwissenschaften, Universität Basel

Title of project:

Biological ice nucleators at tropospheric cloud height

Project leader and team:

Dr. Franz Conen, project leader
Dr. Emiliano Stopelli
Mr. Lukas Zimmermann

Project description:

Through this project we get insight into abundance and drivers of aerosol particles that can act as ice nucleators in moderately supercooled conditions (around -8 °C). Our goal is to clarify the impact these particles may have on the development of precipitation.

During 2016 we mainly analysed material and data we had collected previously at Jungfraujoch. A major achievement has been the isolation of *Pseudomonas syringae*, a prominent ice nucleating bacterium, from snow samples collected at Jungfraujoch. It is the first time that this bacterium has been isolated at such altitudes. Sequencing revealed a genetically diverse range of known phylogenetic groups (Stopelli et al., 2016). We also found that this bacterium constitutes only a very minor fraction of all ice nucleators active around -8 °C, at least in air masses passing Jungfraujoch. New experimental approaches in the coming years will focus more on the potential role that ice nucleators in general may have on the formation of precipitation in moderately supercooled clouds. We are grateful to the SNF for recently granting funds to employ a PhD student, who will conduct most of his or her field work on Jungfraujoch.

Another interesting study has been possible through the collaboration with colleagues at Empa. Provision of PM_{10} filter material from the NABEL stations in Payerne, on Chaumont and on Jungfraujoch has allowed us to get an idea of the vertical distribution of ice nucleators in the lower 3 km of the atmosphere (Fig. 1). The investigations continue.

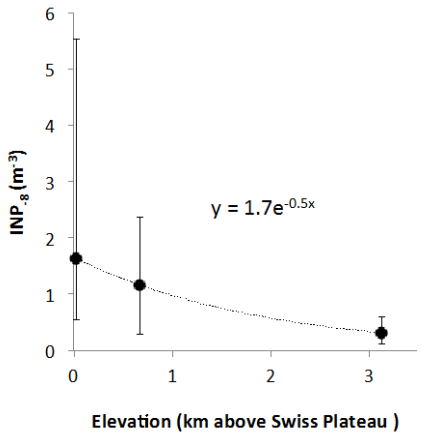

Figure 1. Vertical distribution of ice nucleating particles active at -8 °C (INP_{-8}) above the Swiss Plateau, as derived from the analysis of PM_{10} filters from Payerne, Chaumont and Jungfraujoch. Dots indicate the median, error bars the interquartile range of 37 samples from each station collected between 10.11.2013 and 16.12.2013 (data from S. Jeyachchandren, MSc Thesis, University of Basel, 2016).

Key words:

Ice nucleation, biological, snow, PM_{10}

Internet data bases:

https://umweltgeo.unibas.ch/forschung/abgeschlossene-projekte/biological-nucleators/

Collaborating partners/networks:

Laboratory of Atmospheric Chemistry, Paul Scherrer Institute, Villigen, Switzerland
Laboratory for Air Pollution/Environmental Technology, Swiss Laboratories for Material Science and Technology (Empa), Dübendorf, Switzerland
Institut national de la recherche agronomique (INRA), Pathologie vegetale, Montfavet, France

Scientific publications and public outreach 2016:

Refereed journal articles and their internet access

Stopelli, E., F. Conen, C.E. Morris, E. Herrmann, S. Henne, M. Steinbacher and C. Alewell, Predicting abundance and variability of ice nucleating particles in precipitation at the high-altitude observatory Jungfraujoch, Atmospheric Chemistry and Physics, **16**, 8341-8351, doi:10.5194/acp-16-8341-2016, 2016. www.atmos-chem-phys.net/16/8341/2016/

Stopelli, E., F. Conen, C. Guilbaud, J. Zopfi, C. Alewell and C.E. Morris, Ice nucleators have shorter persistence in the atmosphere than other airborne bacteria ce nucleation active particles, Biogeosciences Discussions, doi:10.5194/bg-2016-496, 2016 (under review for the journal Biogeosciences). http://www.biogeosciences-discuss.net/bg-2016-496/

Theses

Jeyachchandren, S., Influence of weather conditions on ice nuclei in the lower 3 km of the atmosphere, MSc Thesis, University of Basel, 2016.

Stopelli, E., Biological ice nucleating particles at tropospheric cloud height, PhD Thesis, University of Basel, 2016.

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