Universität Basel

Research Project

Biological ice nucleators at tropospheric cloud height

Third-party funded project

Project title Biological ice nucleators at tropospheric cloud height
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Biological ice nucleators (IN) are the most abundant agents to catalyze ice formation at warm temperatures (>-10 ^{o}C). Yet, the relevance of biological ice nucleation for cloud processes, such as initiating precipitation, remains ambiguous. Very little is known about abundance and nucleation spectra of biological IN at tropospheric cloud altitudes. Equally unknown is the relative importance of different kinds of biological IN in this part of the atmosphere, its likely change with seasons, with weather and air mass origin. In this project we address four major questions to shed more light on these issues:

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1. What are the abundance and nucleation spectra of warm-temperature ice nuclei (active between -3 and -13 ^{o}C) at tropospheric cloud altitude?

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1. Do abundance and nucleation spectra correlate with (a) season / weather, (b) source region and/or (c) aerosol number-size distribution of air masses?

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1. What are the relative contributions to the total number of IN by intact micro-organisms and by biological residues on soil dust?

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1. Do we find *Pseudomonas syringae*, currently considered the most ubiquitous and most efficient warm-temperature ice nucleus, in air masses with high numbers of IN active at warm temperatures?

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Field work will take place at the High Alpine Research Station Jungfraujoch located in the Swiss Alps at 3580 m above sea level. Air masses surrounding the station are presumed to be representative for the lower troposphere above the continent (more precise characterisation will be done with our two atmospheric ^{222}Rn monitors at Bern and on Jungfraujoch (http://radon.unibas.ch/) as part of ongoing work at the institute, but outside the scope of this proposal). The station is frequently within clouds. To address our questions, air will be sampled over two years during a total of 18 weeks with liquid impingers and

analysed at the station in drop freeze tests for abundance and nucleus spectra (**Question 1**). High-resolution transport simulations (FLEXPART) by our collaborator Dr. Stefan Henne (Air Pollution / Environmental Technology, Empa, Switzerland) will enable us to identify the main source regions (**Question 2b**). Data on number-size distributions of total aerosol during our sampling campaigns (**Question 2c**) becomes available through the collaboration with Dr. Ernest Weingartner (Head, Aerosol Physics Group, Laboratory of Atmospheric Chemistry, PSI, Switzerland). Differentiation between bacteria, spores, and biological residues associated with soil dust (**Question 3**), and isolation of *Pseudomonas syringae*, (**Question 4**) is done in close collaboration with the group of Dr. Cindy Morris (Director, Plant Pathology Research, INRA, Avignon, France).

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Add publication

Published results

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3289568, Stopelli, Emiliano; Conen, Franz; Morris, Cindy E.; Herrmann, Erik; Bukowiecki, Nicolas; Alewell, Christine, Ice nucleation active particles are efficiently removed by precipitating clouds, 2045-2322, Scientific Reports, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

3438419, Conen, Franz; Stopelli, Emiliano; Zimmermann, Lukas, Clues that decaying leaves enrich Arctic air with ice nucleating particles, 1352-2310, Atmospheric environment, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

3566522, Stopelli, Emiliano; Conen, Franz; Morris, C. E.; Herrmann, Erik; Henne, Stephan; Steinbacher, Martin; Alewell, Christine, Predicting abundance and variability of ice nucleating particles in precipitation at the high-altitude observatory Jungfraujoch, 1680-7316, Atmospheric chemistry and physics, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

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