Project: **1178**

Project title: **Analysis of representation of wind fields in high resolution atmospheric models and potential improvements for online emission of natural aerosol components**

Principal investigator: **Roland Schrödner**

Report period: **2025-05-01 to 2026-04-30**

The project was outlined for two main tasks: i) statistical analysis of the wind fields simulated by the models participating in DYAMOND summer, DYAMOND winter as well as nextGEMS (https://easy.gems.dkrz.de) and ii) investigating the effects on modelled global mineral dust and sea spray emissions. As an additional project component, iii) an analysis of ice nucleating particles (INP) and underlying aerosol conditions from global aerosol simulations (ECHAM, EC-Earth) were conducted. The project is therefore mainly a data analysis project, which requires storage capacities as the simulation data of several TB cannot easily be transferred to other machines. The project did not require and use large computational resources. The project tasks were and are mainly conducted by student helpers and are therefore not continuously worked on.

In the reporting period, only analysis for task iii) was conducted. Tasks i) and ii) were not continued in this project and resources will not be applied for these tasks.

During the project duration, most of the planned storage resources were used temporarily. Computational resources were not used and less will be applied for in the upcoming allocation period. The already analyzed data that is saved under the project's resources, but will be transferred to the archive to free storage resources. Therefore, similar storage resources will be applied for, but additionally archive resources.

Results of analysis of aerosol simulation data for diagnosing INP

Under task iii), simulations with the global atmospheric model ECHAM (30 simulation years, done under resources of a different project) and EC-Earth (available from a recent publication) were further post-processed and these data saved for use in this project.

In the reporting period, global aerosol simulation data of the global models ECHAM and EC-Earth were used to diagnose spatiotemporally varying fields of INP concentrations. For this purpose, INP parameterizations were applied to certain aerosol data proxies (mineral dust, sea spray aerosol, and marine polysaccharides and proteins). The resulting INP-temperature-spectra were compared to available observational data. The observational data set was enhanced and part of the analysis were repeated. The utilized simulation data sets now comprise 1 year with hourly output (EC-Earth) and 30 years with 6-hourly output of aerosol concentrations with a horizontal resolution of roughly 2° x 3°. Previously to the reporting period, the analyzed INP data set was used in a recent publication (Hartmann, Schrödner, Zeppenfeld et al., 2025) and the cloud and temperature fields of the 30-year ECHAM runs were investigated for the likelihood of the occurrence of secondary ice production in clouds, which was used in a Bachelor Thesis (Küchler, 2025).

In the reporting period, the analysis of the 30yr ECHAM datasets was continued by taking into account further INP observations and other INP parameterizations, i.e., for marine polysaccharides based on the previously published parameterization (Hartmann, Schrödner, Zeppenfeld et al., 2025). The project shall be continued by using INP parameterizations fro proteins, and mineralogically resolved mineral dust simulation data (from a different project).

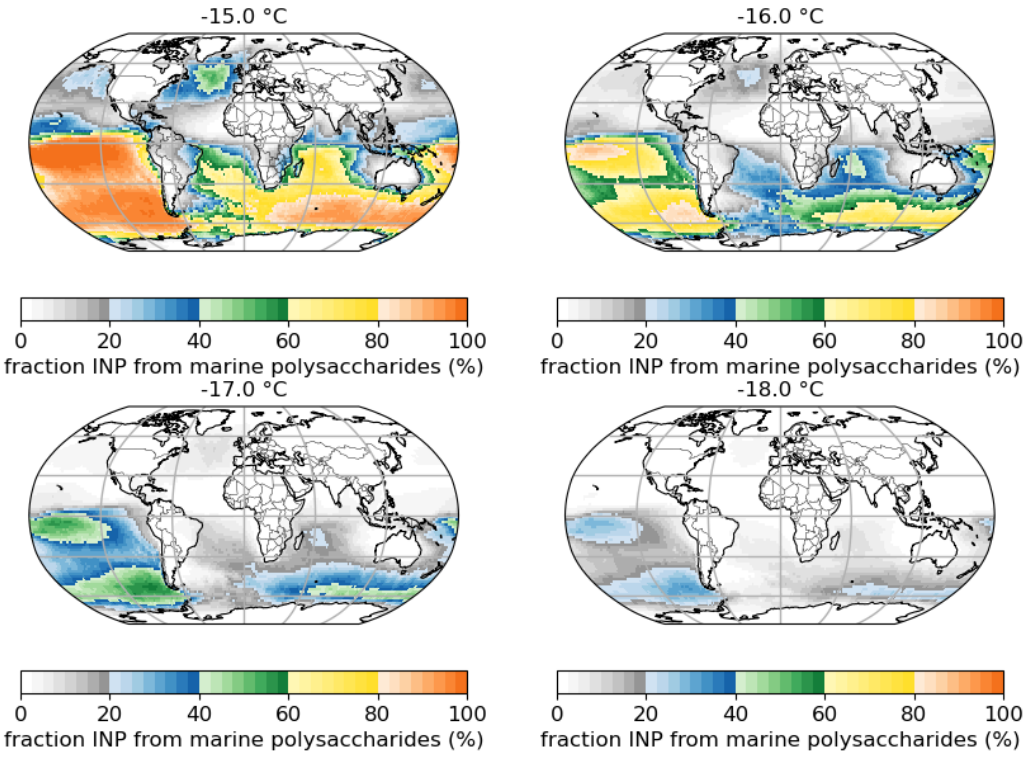

Figure 1: Multi-year average fraction of modelled INP from marine polysaccharides in the total INP (mineral dust + marine polysaccharides). At low temperatures, marine INP are competitive to mineral dust in the remote oceans of the Southern Hemisphere. However, mineral dust is the main INP component worldwide at temperatures colder than -17 °C.

Hartmann, S., Schrödner, R., Hartmann, M., van Pinxteren, M., Fomba, W., Stratmann, F., Herrmann, H., Pöhlker, M., Hassett, B. T., and Zeppenfeld, S. (2025): Marine polysaccharides - Important Constituents of Ice Nucleating Particles of Marine Origin, Env. Sci. & Tech., 59 (10), 5098-5108, https://doi.org/10.1021/acs.est.4c08014.

Küchler, J. (2025), Globale Analyse der potentiellen Bedeutung von sekundärer Eisproduktion, Bachelor Thesis, Universität Leipzig.