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Investigation of aerosol effects on precipitation initiation processes in the alternately clean and aerosol-laden environment of New Zealand Aotearoa

Friday 21 March 2025 10:30 (15 minutes)

Down to temperatures of -38℃ the primary formation of liquid or frozen hydrometeor requires the availability of aerosol particles, which act either as cloud condensation nuclei (CCN) or ice nucleating particles (INP). An actual quantification of the influence which perturbations in the aerosol load do have on a clouds' microphysical structure and its evolution toward precipitation is nevertheless still hardly achievable. Strong need is given to improve this lack of scientific understanding, because state-of-the-art physical representations of cloud processes show a lack of accuracy especially in regions where the aerosol load deviates from the general mean.

It is scope of the project ACADIA (Aerosol-Cloud-rADiation-interaction over Aotearoa) to conduct a unique contrast study which is about to disentangle the relationships between aerosol load, cloud and precipitation processes, and the radiation budget, based on a 1-year multi-site field campaign on the South Island of New Zealand Aotearoa. ACADIA, which is a joint project of Leibniz Institute for Tropospheric Research (TROPOS) and the Leipzig Institute for Meteorology (LIM) of the University of Leipzig, will exploit the alternation of Australian and clean Southern-Ocean dominated air masses and the transformation processes during transport over 400 km of landmass of the South Island of New Zealand to disentangle the role of aerosol load on the microphysical and radiative properties of clouds and their evolution. TROPOS and LIM will place extensive ground-based remote sensing equipment to the sites of Invercargill and Tawhaki, respectively. The key instrumentation consists of multi-wavelength cloud Doppler polarization radar and lidar systems with polarization, fluorescence and Doppler capabilities. ACADIA is scheduled to take place from August 2025 to August 2026 and will be embedded in a series of already scheduled field experiments, which are implemented under the umbrella of the goSouth-2 consortium. Those include deployments of the HALO aircraft, the research vessel Sonne, and the mobile ground-based remote sensing infrastructure LACROS of TROPOS. Contextualization with spaceborne profiling lidar and radar observations from the EarthCARE satellite and aerosol-permitting model simulations will take place, in addition.

The presentation will focus on three subjects. We will provide an overview on recent findings about the role of aerosol perturbations on precipitation initiation processes. We will motivate the location of New Zealand for aerosol perturbation studies. Finally, the ACADIA project and the partner projects which are scheduled to take place within the goSouth-2 consortium will be introduced and the possibilities for additional collaborations will be elaborated.

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Session

Enhancing Process Understanding: New observations for modeling and parameterization development

Preferred Contribution Type

Oral Presentation

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