Optimization of Aerosol Seeding In rain enhancement Strategies (OASIS)

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OASIS is a multidisciplinary project aiming at a comprehensive quantification of the role of atmospheric aerosols in efficient precipitation enhancement efforts in the United Arab Emirates (UAE). The projects specific scientific objectives are to: 1) undertake a comprehensive 1-year field campaign (Feb 2018 – Feb 2019) in the UAE employing a multitude of in-situ and lidar instruments to quantify the characteristics and the vertical profile of current background aerosol population as well as the key meteorological drivers of cloud formation in the study region, 2) identify optimal seeding strategies (in terms of e.g., time, location, amount of seeding) by using mesoscale meteorological simulations together with cloud-resolving model simulations with a highly advanced aerosol microphysics description, 3) quantify the characteristics of theoretically optimal ice nucleation seed aerosol by employing a suite of molecular-level simulation methods in order to support future experimental work aiming to develop more efficient ice nuclei, and 4) utilize novel statistical approaches to identify the major sources of uncertainty in prediction of rain enhancement success.

This presentation summarizes the main results from the first two project years after the completion of the field campaign and a substantial fraction of the mesoscale, cloud-scale and molecular scale modelling work. Our findings highlight the close connection between the aerosol concentrations and the boundary layer dynamics in the UAE atmosphere, illuminate the optimal seeding strategies in both winter stratocumulus and summer convective cloud cases, and point to surface defects as potential sites for efficient ice nucleation.