Using Advanced Experimental - Numerical Approaches To Untangle Rain Enhancement (UAE-NATURE)

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UAE-NATURE is a project aims to understand the quantitative effect and the associated uncertainties of cloud seeding on clouds, rainfall and groundwater in a long period over the UAE using an advanced large cloud chamber and advanced modeling capabilities.

The specific scientific objectives are to: 1) improve knowledge of hygroscopic seeding impact on the warm rain initiation under different aerosol backgrounds using both chamber experiments and a Direct Numerical Simulation (DNS) cloud model; 2) discriminate the dynamical and microphysical processes by which natural and seeded precipitation forms and evolves within clouds using cloud-resolving modeling with piggybacking approach; 3) quantify the potential seeding impact and uncertainties on UAE rainfall in a 10-year period using high-resolution regional climate simulations and ensemble seeding simulations; 4) understand how cloud seeding affects the cloud cover, lifetime, and the subsequent effect on evapotranspiration and groundwater availability using cloud-resolving seeding simulations; 5) quantify the rainfall spatial and temporal distributions in UAE using the high-resolution regional climate simulations; and 6) identify large-scale and synoptic conditions that produce clouds suitable for seeding using regional climate simulation data.

This work summarizes the progresses and main results of each objective during the 1st project year.