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Aerosol and Cloud Microphysical Properties in the Asir region of Saudi Arabia

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In recent advertent and inadvertent weather modification studies, a considerable effort has been made to understand the impact of varying aerosol properties and concentration on cloud properties. Significant uncertainties exist with aerosol-cloud interactions for which complex microphysical processes link the aerosol and cloud properties. Under almost all environmental conditions, increased aerosol concentrations within polluted air masses will enhance cloud droplet concentration relative to that in unperturbed regions. The interaction between dust particles and clouds are significant, yet the conditions in which dust particles become cloud condensation nuclei (CCN) are uncertain. In order to quantify this aerosol effect on clouds and precipitation, a field campaign was launched in the Asir region of Saudi Arabia as part of a Precipitation Enhancement Feasibility Study.

Ground measurements of aerosol size distributions, hygroscopic growth factor, CCN concentrations as well as aircraft measurements of cloud hydrometeor size distributions were done in the Asir region of Saudi Arabia in August 2009. Research aircraft operations focused primarily on conducting measurements in clouds that are targeted for cloud top-seeding, on their microphysical characterization, especially the preconditions necessary for precipitation; understanding the evolution of droplet coalescence, supercooled liquid water, cloud ice and precipitation hydrometeors is necessary if advances are to be made in the study of cloud modification by cloud seeding. Non-precipitating mixed-phase clouds less than 3km in diameter that developed on top of the stable inversion were characterized by flying at the convective cloud top just above the inversion. Aerosol measurements were also done during the climb to cloud base height.

The presentation will include a summary of the analysis and results with a focus on the unique features of the Asir region in producing convective clouds, characterization of the aerosol prior to convective development and the microphysical properties of convective clouds in the Asir region of Saudi Arabia.