MMM SEMINAR SERIES

Mesoscale & Microscale Meteorology MMM LABORATORY

Investigation of MCS cloud and precipitation properties through an integrative analysis of aircraft in-situ measurements, ground-based remote sensing and WRF simulations

Xiquan Dong

University of Arizona

MCSs have regions of both convective and stratiform precipitation where significant different microphysical and thermodynamical features are observed. In a recent study, a classification method has been developed to objectively identify components of MCS as convective rain (CR, heavy rain), stratiform rain (SR, moderate-light rain), and anvil clouds (AC, no rain) using ground-based NEXRAD radar reflectivity, which provides a thorough means for studying the lifecycle of MCSs' components, as well as their associated cloud and precipitation properties. We also developed a tracking algorithm using GOES IR temperature and tracked and analyzed a total of 4221 MCSs during two warm seasons from 2010 to 2011 over the central US and found that the CR precipitation intensity is an order higher than the SR one, but the SR coverage is much larger than the CR one.

The DOE Atmospheric Radiation Measurement (ARM) conducted a field campaign, the Midlatitude Continental Convective Clouds Experiment (MC3E), at the ARM Southern Great Plains site from April to June 2011. During the MC3E field campaign, the University of North Dakota (UND) Citation II research aircraft carried out the major in situ measurements of cloud microphysical properties. This study investigates microphysical properties at ice-phase layer using the measurements collected by UND Citation II aircraft and the focus is on the correction of cloud ice water content (IWC) and the reconstruction of particle size distribution (PSD) based on multiple sensors measurements.

To investigate the NSSL WRF simulated the warm season (April-September) precipitation over the Great Plains (GP), we use long-term (NCEP) Stage IV data over the Great Plains (GP). Specifically, two subdomains, namely the Southern Great Plains (SGP, 99.985° W to 94.985° W, 34.66° N to 38.66° N) and Northern Great Plains (NGP, 100.75° W to 95.75° W, 45° N to 49° N) are selected. By using Self-Organizing-Map (SOM) method, a total of 808 convective systems during the period 2007-2014 are objectively classified into 6 classes according to the integrative analysis of synoptic characteristics over each sub-domain respectively. Despite the difference in regional climatology, both regions demonstrate prominent seasonal contrast in dominant synoptic patterns. The early summer convective systems are more impacted by the extratropical cyclone, while the late summer/early fall events are strongly associated with subtropical ridge. Based on the SOM results, the real-time weather forecast product generated by the National Oceanic and Atmospheric Administration (NOAA) National Severe Storms Laboratory (NSSL) is evaluated using NCEP Stage IV data for each individual SOM class over each region.

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