ATS/CIRA Colloquium

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The Role of Upper Tropospheric Cloud Systems in Climate: Building Observational Metrics for Process Evaluation Studies

Hosted by Sue van den Heever

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ATS room 101
Discussion will begin at 3:30 p.m.
Refreshments will be served at 3:15 p.m. in the weather lab

Upper tropospheric clouds, representing about 40% of the Earth's total cloud cover, play a crucial role in the climate system by modulating the Earth's energy budget and heat transport. They often form mesoscale systems. Cirrus emerge as outflow of convective and frontal systems or form in cold air supersaturated with water. Their evolution with climate change and their feedback can only be reliably estimated if these cloud systems are adequately represented in climate models. Recently GEWEX initiated working groups on Process Evaluation Studies (PROES) to provide observational based metrics for a better understanding of physical processes. One goal of the PROES working group on 'Upper Tropospheric Clouds and Convection' (UTCC) is to gain a better understanding of the role of convection on cloud feedbacks (Stubenrauch and Stephens 2017). Studies on tropical mesoscale convective systems so far concentrated mainly on the thick cirrus anvils, because radar and visible-infrared imagery either miss or misidentify thin cirrus. However, the thinner cirrus are thought to be a part of the anvils that has a significant radiative impact which might regulate convection itself.

Hence we are creating a synergetic data base of UT cloud systems anchored on IR Sounder observations, because these are sensitive to cirrus down to an optical depth of 0.2, day and night. By merging adjacent measurements with similar cloud height, the horizontal extent of these cloud systems has been determined, and convective cores, cirrus anvils and thin cirrus within these systems could be identified using cloud emissivity (Protopapadaki et al. 2017). The A-Train synergy provides information on the vertical structure and precipitation of these systems, essential to determine their heating rates, and helps to derive proxies for convective strength. We will present relationships of anvil properties with respect to convective strength and to their surrounding atmosphere. This observational metrics is being used to evaluate different convection / detrainment / microphysical parameterizations in climate models as well as studies of these processes using modelling at finer scale.

Link to colloquia page: https://www.atmos.colostate.edu/colloquia/