Observation and Modeling of Mesoscale Convective Systems and their Large-scale Environments

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Organized mesoscale convective systems (MCSs) are responsible for ~60% of summer rainfall in the U.S. Great Plains and 50-60% of tropical rainfall globally. Deficiency in representing MCSs contributes significantly to climate model biases in simulating the precipitation and its diurnal variability over the U.S. and the tropical circulation, with important implications to modeling the regional and global water cycles. In the past decades, observed increases in springtime total and extreme rainfall in the central U.S. have been dominated by increased frequency and intensity of long-lasting MCSs. Understanding the environmental conditions producing long-lived MCSs is therefore a priority in determining how the characteristics of precipitation may change in the future. Regional and global variable resolution models are being used to perform convection permitting simulations of MCSs and their interactions with the large-scale environment. The large-scale and mesoscale ingredients identified from the simulations and analysis of CMIP5 models provide a framework for understanding and modeling the potential changes in MCSs and hydrometeorological extremes in the future.

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EARTH SYSTEM SCIENCE PROGRAMME

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