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Orogenic propagating precipitation systems

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Organized propagating systems in the lee of mountains make an important contribution to convective precipitation in midlatitudes (e.g., US during the warm season) and in the tropics throughout the year. These systems display a high degree of variability in regard to the thermodynamic state (i.e., temperature and moisture distribution) and kinetic state (i.e., vertical shear) of the atmosphere. However, propagating precipitation systems are absent from climate models and are inadequately represented in global numerical weather prediction (NWP) models, if they are present at all. The reason is simple. Firstly, traditional cumulus parameterizations do not represent interactions between latent heating, rain evaporation and wind-shear which are fundamental to the mesoscale convective dynamics. Secondly, the spatial resolution of climate models is too coarse to permit explicit mesoscale convective organization. This has practical implications for quantitative precipitation prediction and fundamental implications for the Earth's water cycle and its variability. This talk will describe issues regarding the parameterization of organized convection for climate models, its explicit representation by cloud-system resolving models (CRMs, and hybrid representation for high-resolution NWP models. Also described will be new methodologies for representing propagating precipitation systems in climate models: i)superparameterization whereby traditional convective parameterization is replaced by CRMs; ii) hybrid parametric representation of stratiform heating, mesoscale downdrafts, and organized momentum transport associated with propagating systems.