The Impact of Predator-Prey Processes in Bulk Microphysics Schemes on Simulated Aerosol-Cloud Interaction

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In bulk microphysics schemes, the behavior of the multiple processes that compete for cloud water and ice can be likened to the predator-prey relationship seen in the natural world. These processes provide compensatory feedback between production processes of precipitating hydrometeors.

In this presentation, we demonstrate the sensitivity of the predator-prey processes in two commonly-used microphysics schemes of the Weather Research and Forecasting Model (WRF) to perturbations in aerosol loading, using the simulations of an idealized 2-D squall line and idealized shallow convection in the marine boundary layer. Diagnoses of the parameterized pathways for hydrometeor production microphysics budget analysis reveal that the compensatory feedback associated with the predator-prey processes are quite similar between the schemes. Overall, the compensatory feedback makes the response of a scheme to perturbations in aerosol loading smaller than the differences between the two schemes with the same aerosol loading. This indicates that there remains great uncertainty in modeling the aerosol-cloud interaction in weather and climate models. Alleviating this uncertainty requires better microphysics parameterizations as well as better observations of cloud microphysical properties.