Tornadogenesis - Doug Dokken and Kurt Scholz

Students in this project will investigate certain atmospheric conditions that are believed to promote and enhance the process of tornado formation: cell mergers, interactions of cells and boundaries, and a squall line interacting with a supercell. Using the Advanced Regional Prediction System (ARPS), a numerical modeling software, the students will investigate tornadogenesis due to at least of the three above phenomena. While the formation of supercell thunderstorms that produce most tornados is reasonably well understood, tornadogenesis is not. A number of papers they will study, present case studies of storms attributable to one of these three phenomena, serving as a guide to possible model outcomes. The model output provides very detailed information about variables such as trajectories of air parcels and cold pools pointing to the origins of low level vorticity, which when tilted vertically, are believed to often produce tornados. By adding subroutines to the ARPS Fortran code, they will be able to initiate several storms at a time, with the object of placing them in such a manner that the storms merge. They will also be able to halt the run and restart in order to initiate additional storms.

To study the mergers, the students must also modify the output code to plot components of horizontal vorticity and its magnitude as well as other variables that may play a role in tornadogenesis. To obtain a higher resolution in certain areas, one or two-way nested grids will be used. The students will write JAVA code to take weather sounding data, downloaded from a weather archive, and format it so it can be read by ARPS. The individual output files will be converted to a format for Vis5d, a 3-d visualization tool for model output, and then appended to create an animation. The students will write a pearl script to append the individual Vis5d files.