ATM 612: Mesoscale Convective System Matrix Lab:
Due Monday, Nov. 6

The purpose of this lab is to familiarize you with the basic features of mesoscale convective systems such as squall lines and bow echoes, and their relationship to the environmental vertical wind shear profiles. Expect it to take about 2 h to complete each Part.

The MCS Matrix can be found at:

http://www.meted.ucar.edu/convectn/mcsmatrix/

Part 1: Two-Dimensional Dynamics:

1) Compare the Us = 10 ms-1 / 2.5 km (A1), 20 ms-1 / 2.5 km (C1), and 30 ms-1 / 5.0 km (G1) 2D perpendicular shear simulations.

What is the overall impact of vertical wind shear on the evolution of these lines?
Which case produces the strongest rear-inflow jet?
Which case produces the most stratiform precipitation?
Which case produces embedded bow echoes?

2) Compare among cases C1, D1, E1, and also among cases G1, H1 and I1.

How does the orientation of the shear vector relative to the squall line orientation effect system evolution?

3) Compare cases C1, F1.

What is the effects of a jet-type profile on system evolution?

Part II: Three-Dimensional Dynamics:

1) Compare the evolution of the 2D squall line simulations to that of the finite extent 3D non-Coriolis squall lines for the Us = 10 ms-1 / 2.5 km simulations (A1 and A2) and for Us = 20 ms-1 / 2.5 km simulations (C1 and C2).

How does the addition of line ends alter system evolution?

2) Compare the 3D non-Coriolis simulations to the 3D Coriolis simulations for the Us = 10 ms-1 / 2.5 km simulations (A2 and A3) and for the Us = 20 ms-1 /2.5 km simulations (C2 and C3).

How does the addition of Coriolis forcing alter system evolution?

3) Now consider all of the 3D Coriolis simulations (A3 through J3).

Which cases produce the most stratiform precipitation?
Which cases produce the strongest, most elevated RIJ?
How does shear-orientation relative to the initial line effect system evolution?
Which cases produce the best bow echoes? embedded supercells? MCV?
Which cases would be most apt to produce severe weather? What form would that severe weather take?