Modeling the Atmosphere

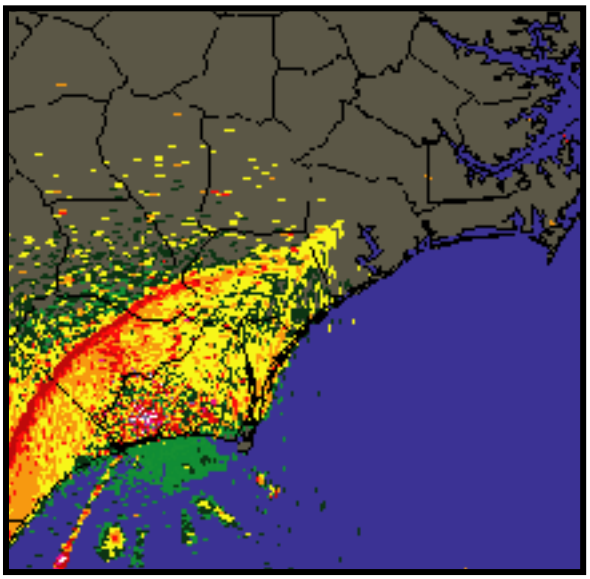
Numerical atmospheric models are valuable tools for understanding weather and climate dynamics. The SCO is actively investigating several factors that influence local weather and climate, including complex geography and atmospheric circulations in the mountains, piedmont, and coastal plain.

In the mountains, atmospheric simulations have shown that there is a complex wind circulation that produces upslope winds and causes changes in the direction and transport of pollutants along the eastern edge of the Blue Ridge Mountains. These circulations can develop and be maintained for several hours, potentially producing locally heavy rainfall over an extended period.

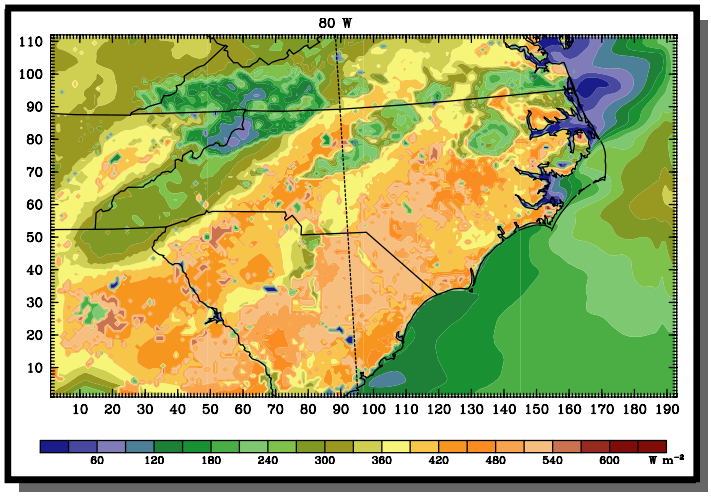
In the piedmont, variations in land use and soil patterns can lead to unique circulations over the sandhills region. Air temperature and humidity drastically change from the forested, clay soils in the piedmont to the crop-based, sandy soils of the sandhills and coastal plain. These variations in turn cause local circulations and an increase in precipitation.

Along the coast, sea breeze circulations produce wind shifts and local precipitation patterns unique to the coast of North Carolina.

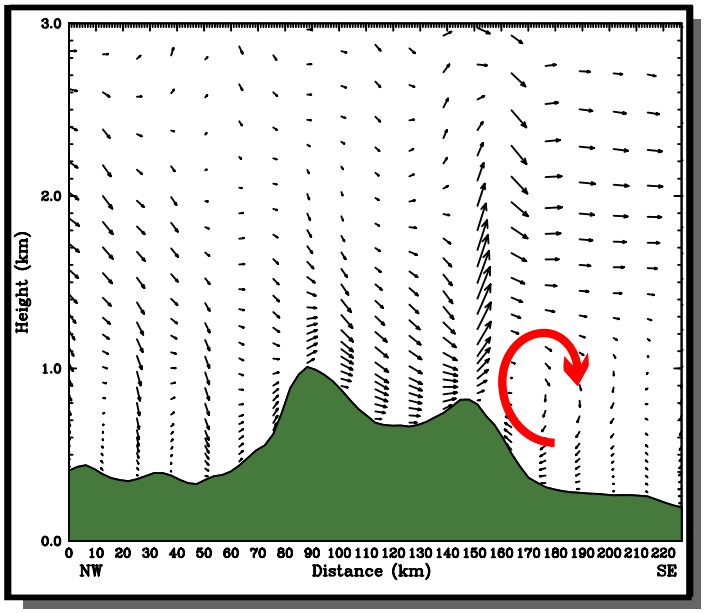
In each of these regions, local circulations affect the weather and climate pattern. As we advance our knowledge of these circulations, we will improve weather forecasts and management of our resources.



Seabreeze circulations along the coast of the Carolinas affect pollution and pathogen transport as well as cause locally intense thunderstorms. Here, the seabreeze front is marked by the high (red) reflectivity from a doppler radar.



The SCO is active with advanced numerical modeling efforts. This simulation above depicts the latent heat flux, a measure of energy available to produce thunderstorms, over the Carolinas. Research at the SCO has shown that there is an increase in precipitation potential during the summer months over the sandhills region of the Carolinas.



Circulations on the eastern edge of the NC mountains are complex. Atmospheric modeling efforts at the SCO have shown upslope flow in some situations despite background winds from the west. Simulations such as these use computing resources provided by the NC Supercomputing Center (NCSC).