**Background**

The Carolinas Integrated Sciences and Assessments (CISA) project is a part of the NOAA-funded Regional Integrated Sciences and Assessments (RISA) program. CISA is committed to improving the range, quality, relevance, and accessibility of climate information for decision making and resource management in North and South Carolina.

We conduct research in collaboration with stakeholders in the Carolinas to identify and develop effective methods of providing climate science, data, and education. The work includes research on drought, water supply and quality modeling, and coastal climatology.

Here we focus on one aspect of our work, to develop watershed simulation models of the Yadkin Pee Dee and Waccamaw River watersheds. The purpose is to aid resource managers in understanding the potential direct and interacting effects of long-term climate change, changes in water management, and land use change on stream flow and water quality.

**Methods**

**Precipitation**
- This is a key driver in watershed modeling
- Need hourly data
- Few hourly stations
- WDM utility to disaggregate daily
- Thiessen polygon weighted precipitation
- Polygon intersection with watershed area
- Was problematic near the coast due to
  - Greater spatiotemporal variability
- Also tested radar precipitation
  - Significant manual processing
  - Results inconclusive
  - Considering additional testing

**Fables**
- Depth, area, volume, outflow relationship
- Inadequate for Coastal Plain rivers
- Manning’s n – channel vs floodplain
- Alternative Fable creation
  - Adapted for Coastal Plain

**Results**

- South Yadkin River
  - 2352 km²
- Piedmont
- Waccamaw River
  - Lower Coastal Plain
  - 3730 km²
- Wetlands are 52% of watershed

**Climate Change Scenarios**

**Downscaling general circulation model output**

- Dynamically
  - North American Regional Climate Change Assessment Program (NARCCAP, http://www.narccap.ucar.edu)
  - Output from GCMS drives six regional climate models
  - Regional models produce 3-hourly data on a 50-km grid

- Assessment of regional climate models for historical conditions
- Measure performance in Southeast
- Temperature and precipitation biases identified
- Differences likely due to two factors:
  1) GCM used for boundary conditions
  2) Internal physics and parameterizations of the RCM

- Statistically
  - Received downscaled data sets provided by the DOI
  - Also exploring Automated Statistical Downscaling (ASD) tool

- Tool derives from Canadian Climate Change Scenarios Network (<http://yukon.cccsn.ca/>)

**Current Model Uses**

- Assess the impact of salt-water intrusion in the Carolinas under future climatic and sea-level conditions
  - Intrusion of brackish water already seen
  - Meet the need for a coastal water resource management planning tool

- Urban densification to reduce vehicle use is likely to increase impervious percent
  - Effects of efforts to decrease impervious cover
  - Simulating stream flow and water quality (temperature, dissolved oxygen, biochemical oxygen demand, and ammonia)