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STATE CLIMATE OFFICE OF NORTH CAROLINA

2009-2010 Annual Report

The State Climate Office of North Carolina (SCO) serves as the primary scientific extension resource for weather and climate science focused on North Carolina. Founded in 1976 and chartered as a Public Service Center by the UNC Board of Governors in 1998, the SCO focuses on service to public and private sectors of North Carolina through climate science extension, research, and education.

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Executive Summary

In the Academic Year 2009-2010, the State Climate Office continued its efforts to deliver climate information, climate data, and climate services to the state of North Carolina.

Extension efforts were focused on delivery of services through direct interaction and communication with clients, partnerships with state agencies, and collaboration with extension specialists and scientists at NC State University. Significant extension activities in 2009-2010 included deployment of one new ECONet station, several CRONOS updates, initiation of new projects with agricultural scientists, and continued collaboration with the Southeast Climate Consortium.

Research efforts in the past year focused on the study of North Carolina's climate and its interaction with the environment. Specific activities include atmospheric dispersion modeling validation, evaluation of model performance for several agro-meteorological applications and development of a recreation and tourism climatology.

Educational outreach activities in the State Climate Office are designed so that climate scientists interact with K-12, community college teachers and students, and with other community organizations on different aspects of NC climate and environment. Specific activities include the NC Science Olympiad, Stormfest, hosting Centennial Campus Middle School students, and numerous community and school group presentations.

Extension

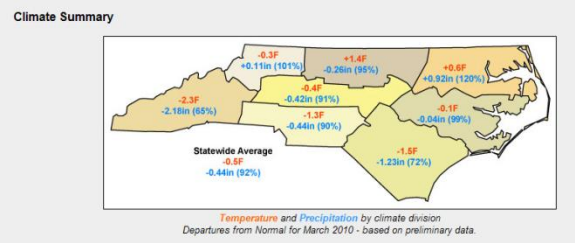
Extension efforts were focused on delivery of services through direct interaction and communication with clients, partnerships with state agencies, and collaboration with extension specialists and scientists at NC State University. Significant extension activities in 2009-2010 included deployment of one new ECONet station, several CRONOS updates, initiation of new projects with agricultural scientists, and continued collaboration with the Southeast Climate Consortium.

Climate Information Services

The primary service of the State Climate Office is to provide scientific and data expertise to clients who request information. Climate Services is a broad concept, but fundamentally involves interaction between a client who needs climate information and SCO scientists who are experts in climate data and climate science. Most users are not sure what data or information is best for their needs, and many need guidance on how to properly use and interpret climate information. SCO staff and students interact directly with users to ensure responsive and reliable climate information services.

- **Requests for Services**: 8% decrease in time spent directly responding to requests for services from clients. Clients request services via email, phone, and through the Climate Office website. Increasing web traffic and decreased direct staff requests suggest more users are finding the information they need via the SCO website or through other resources. A large percentage of time is devoted to supporting requests from faculty, staff, and students at Universities. 49% of time for requested services was in response to Universities, with 38% of all time supporting requests from within the UNC system, which is in line with experiences from the previous year. A more detailed breakdown of request-driven climate services is provided in Appendix A.

- **Monthly climate summaries**: Climate summary reports are prepared each month to highlight climate patterns and impacts to agriculture and water resources in NC. These are distributed via a monthly online newsletter, reports to NOAA through the Southeast Regional Climate Center (SERCC), and reports to the American Association of State Climatologists (AASC). The SCO uses the newsletters to also inform users about new products and services. The AASC provided $2500 in 2009 to support this activity. While direct support for this activity is no longer available from AASC, the SCO continues to provide these monthly climate reports and newsletters to enable improved communication with its stakeholders.



- **NCDA Monitoring**: NC Department of Agriculture receives a feed of climate data from the SCO to develop their weekly weather and crop status reports. Weekly temperature, precipitation, and degree day accumulations are provided for dozens of sites across the state. A map of precipitation accumulation based on radar estimates is also provided.

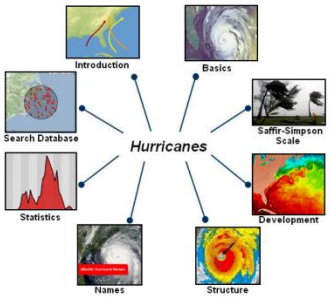
- *Team: All students, Ashley Frazier, John McGuire, Mark Brooks, Ryan Boyles*

Website

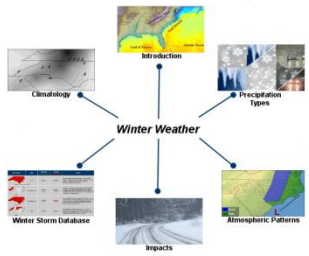
The SCO website is often the first point of contact with clients who need climate information. Effort over the past several years has been focused on linking web products and tools to the climate observation database to provide products and services that are dynamically updated.

- **Usage**: 30% increase in website activity as measured by the number of unique visitors. The SCO website averages over 15,200 unique visitors every month. Other measure of website activity such as bandwidth and hit counts are available but may be biased by the increase in the number of pages and content added to the site over the past year.

- **Tropical Cyclone Climatology**: A series of pages on tropical cyclones was added to the SCO website in 8 parts, including historical statistics and an overview of storm development and impacts. The feature tool included in these pages is an interactive database of all tropical cyclones where users can search by year, name, storm intensity, and proximity to any location of interest.

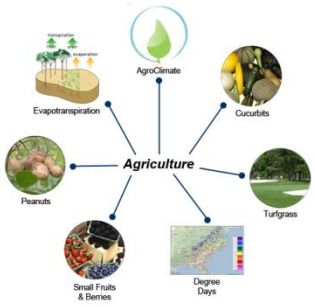


- **Winter Weather Climatology:** A series of web pages on winter weather storms and their impacts was developed. The highlight of the new winter weather section is a searchable database of the official "Storm Reports" for all winter weather events, many of which were previously not available in electronic form. Users can search all types of winter weather events and view the associated climate data stored in CRONOS.



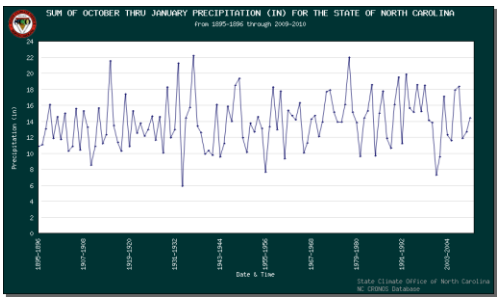
- **Agriculture Tools**: A new resource for all SCO agriculture tools was created to highlight projects with partners in CALS such as peanut disease advisories and the Cucurbiut Downy Mildew forecasts. Several CRONOS-based tools are highlighted, including:

    - **Growing Degree Day Maps:** users can define GDD base and period of interest to map accumulated GDD across the southeast.



- **Blueberry & Blackberry Heat/Chill unit models**: tools previously developed for testing with Bill Cline and Gina Fernandez are now operational.

- **Reference Evapotranspiration Tools**: monitoring and climatology tool that includes map and time series analysis of accumulated RefEt across the southeast.



- **Climate Division Data**: Data by region since 1895, including temperature, precipitation, and a variety of drought indices, can be compiled and graphed. This tool has been especially helpful with monthly climate summaries.

- **Ask a Meteorologist database**: an interactive and easy-to-use way to view questions about weather and climate. The database was assembled from questions that meteorologists at the State Climate Office have answered in the past. The purpose of the database is to give users with a weather- or climate-related question a chance to find their question or similar questions, and to do so without searching through pages of unrelated questions and answers.

- **Climate Change in NC** – renovated, expanded overview of climate change in NC focused on observation.

- *Team: Ashley Frazier, John McGuire, Corey Davis, Bradley McLamb, David Church, Heather Dinon, Bryan Aldridge, Mark Brooks, Ryan Boyles*

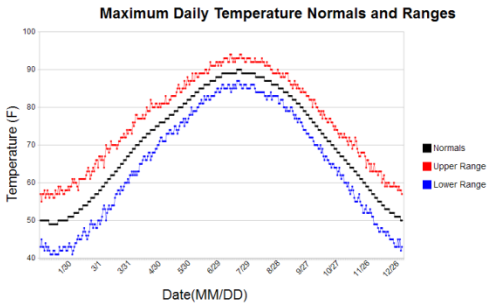
Climate Retrieval and Observations Network of the Southeast (CRONOS)

CRONOS is the name given to the SCO's climate database, which includes data from surface observational networks, severe weather data, and almost every type of climate data we have. The CRONOS database serves as the foundation for most SCO products and services.

- **Usage**: Average of 5,350 queries per month to CRONOS, the SCO online climate database. This is an increase of 22% over previous year.

- **CRONOS API**: An application programming interface (API) continues to be developed to allow authorized users to access CRONOS data without going through the web interface. This tool allows for development of web services that will facilitate internal and external data use, allowing staff, students, and collaborators access to data for research and product development without requiring SQL expertise. The Southeast Climate Consortium is testing this tool to develop new products for AgroClimate.org.

- **Normals Range:** Based on an SCO-authored manuscript from 2006, daily climate normals as published by NOAA are not very meaningful since they do not account for typical daily variability. To address, SCO has implemented daily normals "range" that conveys the typical temperature variability that one might expect for any location in NC. SCO plans to target NWS and media to encourage a daily normals range be reported instead of just the NOAA published normal for any given day.



- **Departure from Normal**: users can now automatically calculate the departure from normal for temperatures.

- *Team: Ashley Frazier, Corey Davis, Adrienne Wootten, John McGuire, Bryan Aldridge, Mark Brooks, Ryan Boyles*

NC Environment and Climate Observing Network (ECONet)

The ECONet is a network of real-time research-grade monitoring stations that provide observational data on atmospheric and soil conditions. Base funding for the ECONet is provided by NC Agricultural Research Service, which supports the maintenance of sensors at Ag Research Station. Additional support is provided by DENR Air Quality, RENCI, NC Electric Cooperatives, and individual partners. The ECONet is unique in North Carolina, and provides information that is not collected by any other sensors in the state.

- **New Installations**: One new station was installed in New London (Stanly County) at Kendall Valley Elementary School. This station was supported by RENCI.

- **Planned Installations**:
  - A new station has been approved for installation at the Lonnie Poole Golf Course on Centennial Campus. However, this installation has delayed indefinitely until a site with more suitable sensor exposure can be identified.
  - Site surveys for a station on Ocracoke Island (Hyde County) were performed, but after a series of exhaustive searches no suitable locations were identified that met SCO criteria and National Park Service criteria. Site surveys near Swanquarter are planned for 2010. The Hyde County site will be the final RENCI supported site, as the RENCI outreach

program that funded these was dissolved due to budget cuts.
    - In partnership with Appalachian State University, a permanent ECONet station is planned for installation on Grandfather Mountain in the autumn of 2010. SCO supported sensors have been on the mountain peak for several years, but a full suite of sensors has not been planned until now.

- **Sensor Upgrades**: Upgrades of new dataloggers, solar radiation sensors, sonic wind sensors, and impact precipitation sensors is complete. These upgrades also provide data recorded every minute.

- **Radio Licenses**: The SCO has FCC approved radio licenses for all ECONet. The SCO is authorized to use two different VHF frequencies at each site, which are part of the NOAA spectrum. NWS-Raleigh provided support for the license applications. Equipment has been purchase to test data relay using the State Highway Patrol infrastructure, and SCO is currently working with SHP to install test equipment on the Garner communication tower. Once successful, the transition of ECONet data communication will provide more robust services and largely eliminate the ongoing costs for telephone line connections in the field and long-distance phone services.

- **Data Quality Control**: Beginning in late 2009, a complete overhaul began on the real-time quality control (QC) procedure. Currently in the testing phase, the finished product will include a more comprehensive range check as well as added spatial check features.

- **Mount Mitchell**: The severe winter of 2010 took its toll on the station at Mount Mitchell. High winds and icing bent the aluminum supports on the tower, bringing it and its sensors to the ground. Repairs have been made, and DENR Division of Air Quality continues to support this station.

- *Team: Ashley Frazier, John McGuire, Bryan Aldridge, Mark Brooks, Sean Heuser, Aaron Sims, Ameenulla Syed, Ryan Boyles*

Drought Monitoring and Response

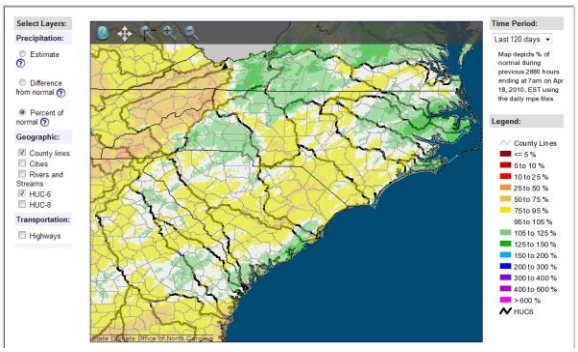
- SCO is a key member of the NC Drought Management Advisory Committee, participating in weekly drought monitoring conference calls and providing public presentations on drought in NC. Through CRONOS, SCO provides state agencies with climate and weather data for drought monitoring and management planning. Drought monitoring products have been developed and are used each week for discussions on depictions of drought severity as part of communicated recommendations to the US Drought Monitor. Fortunately, the past year has mostly been free of drought in North Carolina.

- SCO has also developed a regional precipitation monitoring tool using MPE.

Users can view accumulated precipitation and the difference from normal in a web-based mapping interface.

- http://www.nc-climate.ncsu.edu/mpe_departure/

- SCO was a host for the National Drought Tools workshop at McKimmon Center on April 1, 2010. Sponsored by the National Drought Mitigation Center and USDA/RMA, the meeting highlighted information tools in development to support local drought monitoring and drought management. North Carolina was selected as the site for this workshop because of its national reputation as a leader in effective and responsive drought management.



- *Team: Ashley Frazier, Mark Brooks, Aaron Sims, Ryan Boyles*

ECONet Monitoring for DENR Division of Air Quality (DAQ)

- A contract to maintain the seven ECONet stations supported by DAQ has been implemented to support DAQ stations through 2014. DAQ has expressed interest in expanding the number of high elevation stations in western NC to support their air quality monitoring and forecasting.

- *Team: Sean Heuser, Ameenulla Syed, Ryan Boyles*

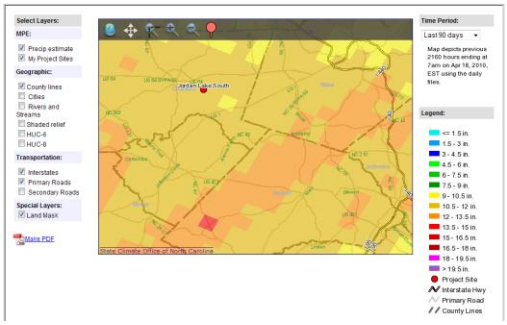
Water Data Support for DENR Division of Water Resources (DWR)

- SCO has been supported in recent years to support the water resources database and tools used by DENR Water Resources. The CRONOS-H2O database archives and disseminates streamflow, groundwater, reservoir, and precipitation observations from several providers, including US Geological Survey, US Army Corps of Engineers, Duke Energy, National Weather Service, and DWR. Due to budget cuts, support from DENR Water Resources was not provided in 2009, but funding is anticipated in 2010.
  - http://www.nc-climate.ncsu.edu/cronosh2o/

- *Personnel Involved: Ashley Frazier, John McGuire, Bryan Aldridge, Mark Brooks, Aaron Sims, Ryan Boyles*

Precipitation Monitoring and Alerts for DOT Stormwater Management

- SCO has a contract with DOT to provide precipitation monitoring and heavy rainfall alerts to support testing and evaluation of highway and construction stormwater controls. DOT continued financial support of this tool in 2009-2010 and funded several enhancements. Products derived from this tool are now used by DENR Water Resources. DOT is looking to develop a long-term support strategy for these tools that would allow multiple state agencies to fund and use the multi-sensor precipitation estimates.
    - http://www.nc-climate.ncsu.edu/dot/



- *Team: Ashley Frazier, John McGuire, Bryan Aldridge, Mark Brooks, Aaron Sims, Ryan Boyles*

Peanut Disease Advisories

- Working Dr. Barbara Shew (NCSU Plant Pathology), SCO provided daily guidance for fungicide spraying to peanut growers in NC from June-October 2000. These advisories take advantage of research into the relationships between climate and the development of two peanut fungal diseases. In 2010, SCO will begin its 6th year of collaborating with Dr. Shew to provide these advisories.

- *Team: John McGuire, Mark Brooks, Aaron Sims, Ryan Boyles*

Strawberry Frost Guidance

- Working with Dr. Barclay Poling (NCSU Horticulture Science), SCO is working to develop a weather-based decision support system for strawberry growers to evaluate their risk to frost and freeze events. A website is being developed that will help predict the type of frost likely to occur at a given location. We are currently building crop stage and farm management capabilities into the website to help growers figure out how this frost risk translates to their specific farm. Dr. Poling has identified a small set of growers who would like to begin testing the website in late 2010.

- *Team: John McGuire, Mark Brooks*

Climate Information for Thrips Risk Assessment

- In collaboration with Drs. George Kennedy and Hannah Burrack (NCSU Entomology), SCO is working to develop an online, automated advisory system that evaluates the risk of thrips in tobacco. Work began in summer 2009 and a beta website will be tested by select growers in summer 2010.

- *Team: Rebecca Cumbie, Mark Brooks*

Tobacco Blue Mold Support

- In collaboration with Dr. Asimina Mila (NCSU Plant Pathology), SCO is providing IT support for the tobacco bluemold reporting and forecast website.

- *Team: John McGuire, Rebecca Cumbie, Mark Brooks*

Climate Information for pre-season TSWV risk in Tobacco

- In collaboration with Dr. Asimina Mila (NCSU Plant Pathology), SCO is providing climate data/expertise and automating equations for estimating the pre-season risk for tomato spotted wilt virus(TSWV) in tobacco. Work began in April 2010 and will conclude by July 2010.

- *Team: Rebecca Cumbie, Mark Brooks*

Water and Climate Data for Tennessee Valley Water Partnership

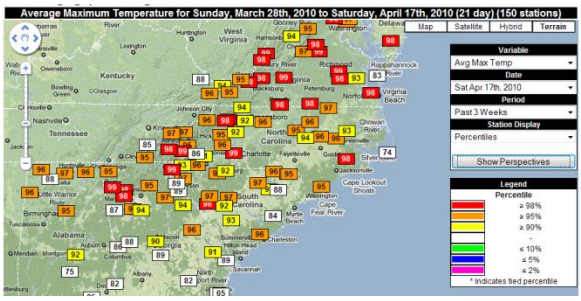
- Based on work to support DENR Water Resources, SCO is working with partners in seven states that form the Tennessee Valley Water Partnership to expand the NC water resources database and monitoring tools to Kentucky, Virginia, Tennessee, Mississippi, Georgia, and Alabama. Called the Water Atlas of The Eastern Region (WATER), a test version is now online for review. Ongoing funding to support this service is expected after the initial development phase.
    - http://www.nc-climate.ncsu.edu/tva/

- *Team: Ashley Frazier, Aaron Sims, Mark Brooks, Ryan Boyles*

Climate Information Support for the NOAA Southeast Regional Climate Center

- NCSU and UNC-Chapel Hill were awarded the NOAA Southeast Regional Climate Center (SERCC) in 2007. As part of that award, the SCO is responsible for supporting and maintaining the Applied Climate Information System (ACIS), which serves as the climate database for all six NOAA Regional Climate Centers. Additionally, SCO is responsible for developing and maintaining the SERCC web services and online climate tools.

- Over the past year, SCO has provided operational support for ACIS and the SERCC website. SCO has successfully added new data feeds to support SERCC and enhanced the Climate Perspectives tool that places recent climate observations in geographical and historical context.
    - http://www.sercc.com/perspectives/



- A new 3-year contract for the regional climate center has been submitted and will begin in June 2010. SCO will continue to provide web and climate information support.

- Collaborators are Dr. Peter Robinson (UNC-CH), Dr. Chip Konrad (UNC-CH), William Schmitz (UNC-CH).

- *Team: John McGuire, Bryan Aldridge, Ashley Frazier, Mark Brooks, Ryan Boyles*

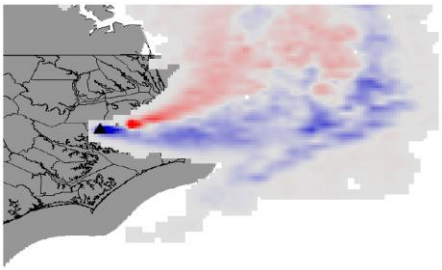
Applied Research

Research efforts in the past year focused on the study of North Carolina's climate and its interaction with the environment. Specific activities include atmospheric dispersion modeling validation, evaluation of model performance for several agro-meteorology applications and development of a recreation and tourism climatology.

Research Presentations and Publications

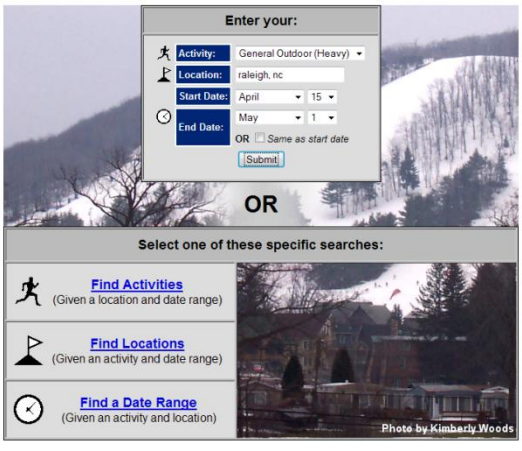
- SCO gave seven (7) presentations at the 2010 Annual Meeting of the American Meteorological Society in Atlanta, GA
- SCO gave eleven (11) presentations at 2009 Virginia and Carolina's Climate Conference, hosted by National Weather Service in Wilmington, NC.
- 4 manuscripts on applied climatology are in development for submission to peer-reviewed journals

Comparison of Operational Dispersion Models for Smoke Management



- As part of her graduate research, Lara Pagano evaluated the performance of 2 operational dispersion models for 2 fire case studies in North Carolina. Results from this research are being used as guidance for the ipmPIPE project and as input for a proposal to NC DENR Division of Forest Resources.
- *Team: Lara Pagano, Aaron Sims, Ryan Boyles*

Recreation and Tourism Climatology



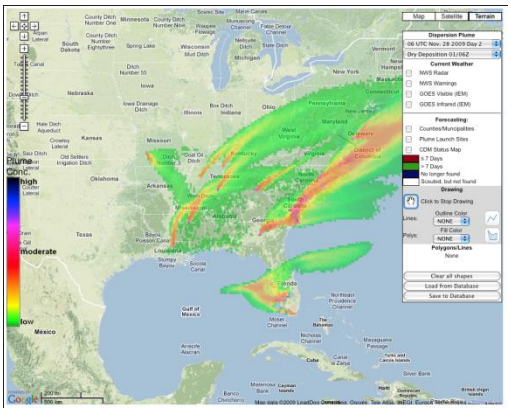
- Based on media interest and discussions with colleagues at the ECU Center for Sustainable Tourism, SCO is researching the variability of climate conditions favorable for a range of recreational activities. A working web page has been developed and is being evaluated by NOAA Regional Climate Center and ECU.
- *Team: Corey Davis, Mark Brooks, Ryan Boyles*

USDA/RMA Cucurbit Downy Mildew Forecasts

- NCSU was awarded a 3-year grant from USDA Risk Management Agency to develop national operational integrated pest management (IPM) forecasts for Downy Mildew that affects cucurbits (cucumbers, melons, squash). As part of this project (known as ipmPIPE), SCO is responsible for providing weather information, technology support, and dispersion forecast guidance.

- Over the past year, SCO has developed online tools for partners to input mildew monitoring and maps for cucurbits yields. A new website to provide all forecasts and monitoring products has been developed and is being tested, including maps that dynamically link to online monitoring inputs. Users can now subscribe to text and/or email alerts for notification of nearby infection reports.

- SCO has expanded the domain for numerical weather prediction tools based on the Weather Research and Forecast (WRF) model to support the forecast development. This effort required an overhaul of the computing cluster used for mesocale modeling.



- Working with a partner at Lawrence Livermore National Lab, SCO has linked the FLEXPART dispersion model to SCO WRF output. FLEXPART is being operationally tested during the 2010 season as a primary tool to support the operational mildew transport and risk forecasts. Enhanced disease forecasts are being testing in 2010 to visually provide qualitative risk assessment.

- Collaborators at NCSU are Dr. Peter Ojiambo (PI), Wendy Britton, and Thomas Keever in the Department of Plant Pathology. Dr. Gerald Holmes, who originally developed the proposal, served as PI until December 2008 when he left NCSU.
    - http://cdm.ipmpipe.org/

- *Team: Lara Pagano, John McGuire, Bryan Aldridge , Mark Brooks, Aaron Sims, Ryan Boyles*

Evaluation of Operational Model Forecasts

- RENCI supported the SCO in previous years to develop automated tools for qualitative and quantitative evaluation of RENCI operational model forecasts. RENCI funding was not available in 2009-2010, but Aaron Sims, John McGuire, and Heather Russett continue to develop these tools for internal use and in hopes of future funding opportunities.

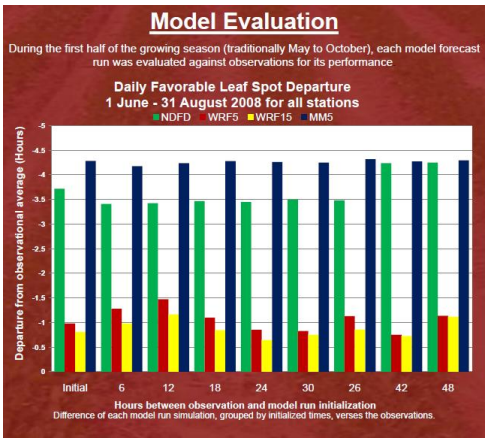
- *Team: Heather Russett, John McGuire, Aaron Sims*

Data Assimilation for Improved Model Forecasts

- RENCI previously funded SCO to develop improved forecasts through the implementation of 3-dimensional variational data assimilation (3D-VAR) into the Weather and Research Forecast (WRF) model. This effort continues without funding by Aaron Sims and John McGuire as a side research project in order to improve SCO experimental forecasts and as a mechanism for developing a high-resolution model-based climatology dataset.

- *Team: John McGuire, Bryan Aldridge, Aaron Sims*

Evaluation of Peanut Disease Forecasts



- Research into the effectiveness of using numerical weather models (MM5, NAM, NDFD) to predict the growth of sclerotinia and peanut leaf spot diseases. This work was presented at the 2010 Annual Meeting of the American Meteorological Society and a manuscript is in development for publication.

- Collaborator is Dr. Barbara Shew (NCSU Plant Pathology)

- *Team: John McGuire, Mark Brooks, Aaron Sims*

Evaluation of Multi-Sensor Precipitation Estimates (MPE)

- SCO uses MPE products provided by NWS River Forecast Centers and the National Center for Environmental Prediction in several products and tools used by DOT, DWR, TVA, and others. As part of the ongoing use of the data, SCO is revisiting an evaluation from 2006 to incorporate data from recent years and compare with next-generation precipitation estimates under development at the National Severe Storms Lab.

- Collaborator is Dr. Suzanne VanCooten (NSSL)

- *Team: Adrienne Wootten, Mark Brooks, Aaron Sims, Ryan Boyles*

Development of a Q2 Climatology for NCDC

- Based on previous research on MPE and collaborations with NSSL and

National Climatic Data Center (NCDC), SCO proposed and was awarded funds through the NOAA Cooperative Institute for Climate and Satellites (CICS) to start development of a radar-based precipitation climatology using NSSL's 2nd generation precipitation estimation technique, called Q2. Mr. Scott Stevens was hired in March 2010 and is based at NCDC in Asheville, NC
    - http://cicsnc.org/projects/ryan-boyles.html

- Collaborators are Steve DelGreco (NCDC), Brian Nelson (NCDC), and Ken Howard (NSSL).

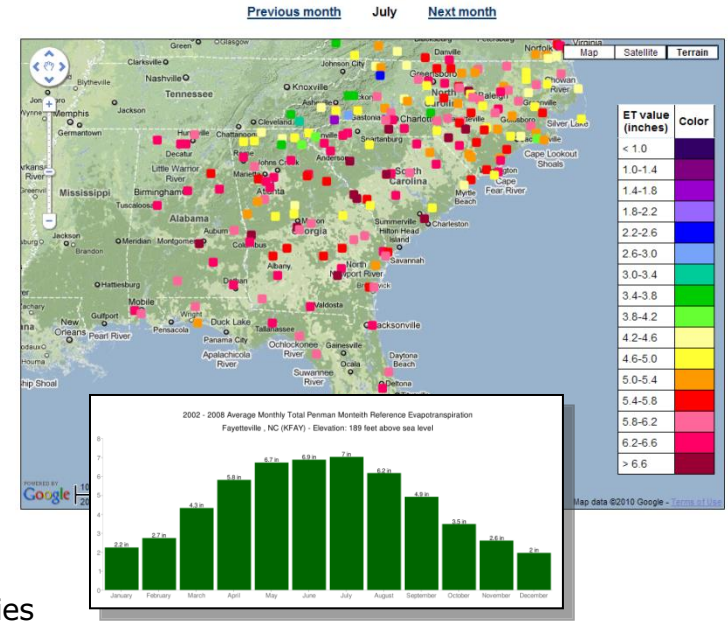
- *Team: Ryan Boyles, Scott Stevens*

Southeast Climate Consortium (SECC)

- The Southeast Climate Consortium is a group of Universities in FL, AL, and GA working to develop climate risk research and decision support tools for agriculture in the southeastern US. Funding for the SECC is provided through USDA RMA, NOAA Climate Program Office, and a congressional earmark (primary funding source). NCSU was invited into this Consortium in 2008. This effort has research, education, and extension components.

- As part of our SECC contract with USDA Risk Management Agency, SCO is researching the historical relationships between crop yield and climate. In particular, attention is focused on the relationship between yield of peanuts, cotton, and corn with the phase of the El Niño – Southern Oscillation (ENSO). Research is also underway to develop improved understanding of evaporation and solar radiation variability.

- A new evapotranspiration climatology has been developed based on this work. Research on evapotranspiration and solar radiation is ongoing, but preliminary results show the sensitivitiy of evapotranspiration to solar raditation, and strongly suggests that widespread solar radiation monitoring is needed.



- A proposal to USDA RAMP program was submitted with this partnership in March 2010 to fund development of automated disease forecasts for peanuts and strawberries across the SE.

- Working with Dr. Guillermo Baigorria at the University of Florida, SCO is implementing and evaluating a technique to provide advanced geospatial

downscaling for seasonal and climate change forecasts over the southeastern US. Baigorria's technique offers unique advantages over traditional statistical downscaling. If this technique performs well, SCO will attempt to provide experimental seasonal forecasts on an operational basis beginning in 2011.

- Collaborators are Dr. Gail Wilkerson (NCSU Crop Science), Dr. David Jordan (NCSU Crop Science), Bridget Lassiter (NCSU Crop Science), Dr. Jim Jones (U. Florida), Dr. Clyde Fraisse (U. Florida), Dr. Guillermo Baigorria (U. Florida), and Dr. Jim O'Brien (Florida St. U.)

- *Team: Adrienne Wootten, Heather Dinon, Ashley Frazier, Ryan Boyles*

Educational Outreach

Educational outreach activities in the State Climate Office are designed so that climate scientists interact with K-12, community college teachers and students, and with other community organizations on different aspects of NC climate and environment. Specific activities include the NC Science Olympiad, Stormfest, hosting Centennial Campus Middle School students, and numerous community and school group presentations.

Undergraduate & Graduate Student Training

- SCO supported 9 undergraduate and 3 graduate students over the past year
- Four (4) undergraduate students will be supported during the summer of 2010

Invited Presentations and Visitor Programs

- Total Direct Educational Outreach Contact Hours: 260
- SCO staff provided 7 presentations by invitation
- SCO provided tours and programs for 6 visitor groups

Centennial Campus Middle School Internship

- SCO hosted three 7th grade and one 8th grade student interns from Centennial Campus Middle School for the period October 2009 through March 2010. This is the 7th year of this internship program, where students spend an afternoon every week in the SCO to learn about NC climate and develop their own research projects.
- *Team: Heather Dinon, Corey Davis, Adrienne Wootten, Ashley Frazier*

Clayton High School Senior Projects

- Sean Heuser and Ryan Boyles each worked with two graduating seniors at Clayton High School on their senior research project.

Stormfest at NC Museum of Natural Sciences

- SCO staffed a booth for visitors to the NC Museum of Natural Sciences as part of StormFest. Thousands of visitors learned about SCO sensors and data resources.

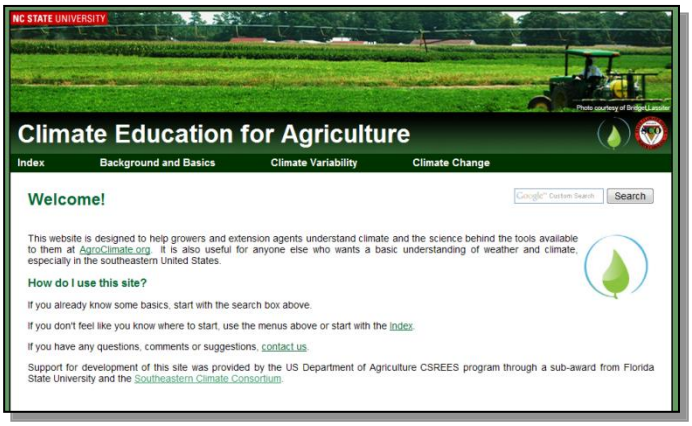
- *Team: Ashley Frazier, Corey Davis, Bryan Aldridge, Heather Dinon, Lara Pagano, Sean Heuser, John McGuire*

NC Science Olympiad (NCSO)

- The Science Olympiad is an annual science contest for middle and high school students. The theme for the state contest in 2010 was weather, and the SCO worked extensively with NCSO to host and implement a weather test event for the Olympiad.

- *Team: Heather Dinon, Corey Davis, Adrienne Wootten, Ashley Frazier*

Southeastern Climate Consortium



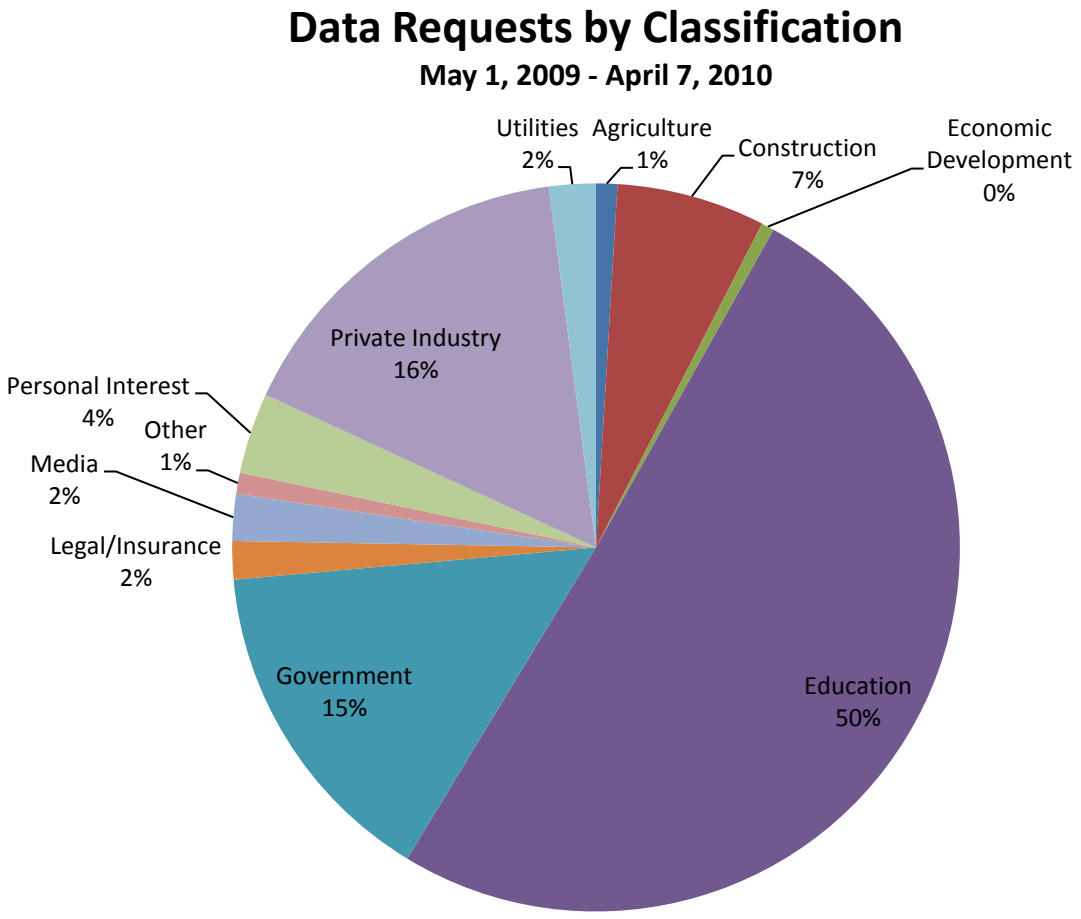
- A series of climate education modules for agricultural clients is in development to improve basic understanding of climate science, including climate variability and climate change, among growers in NC and the southeast.

- The basic science modules will be used to provide similar training for K-12 teachers, and later adapted to provide training for water resource managers and city/regional planners. While the core science modules will not change, the examples and context used will be adapted for each audience.

- Collaborators are Dr. Sharon Schulze (NCSU Science House), Dr. Anantha Aiyyer (NCSU MEAS), Dr. Gail Wilkerson (NCSU Crop Science), Bridget Lassiter (NCSU Crop Science), and Pam Knox (UGa).

- *Team: Amy Lee, Dan McKemy, Megan Embrey, Corey Davis, Heather Dinon, Ashley Frazier, Ryan Boyles*

Appendix A: Climate Services by Client Classification



Climate Services by Classification - Details

May 1, 2009 – April 7, 2010

Classification	Number of Requests	Hours Worked
Agriculture	5	**5**
Construction	35	**35**
Economic Development	3	**4**
Education: K-12	11	**11**
Education: NCSU/UNC	204	**219**
Education: Other Colleges	53	**63**
Government: Federal	35	**38**
Government: Local	18	**19**
Government: State	26	**27**
Library	0	**0**
Legal / Insurance	9	**9**
Media	11	**11**
Other	5	**7**
Personal Interest	19	**20**
Private Industry	85	**103**
Utilities	11	**11**
Total	**527**	**579**
Percent change *	***-7.5%***	***- 7.2%***

* Compared with May 1, 2007 – April 7, 2008.

Appendix B: Simplified Budget

Source	Personnel	Operating Expenses	Total	Percent
College of Physical & Mathematical Sciences	$224,137	$30,000	$254,137	27%
NC Agriculture Research Service	$134,385	$58,000	$192,385	21%
External Contracts & Grants	$430,823	$51,362	$482,185	52%
Service Center		$5,000	$5,000	1%
Total	**$789,344**	**$144,362**	**$933,706**	

Appendix C: Impact Statement

State Climate Office of North Carolina

NC State University

The Need

North Carolina has a complex climate due to its three distinct regions: the mountains, the piedmont, and the coastal plain. Climate affects many aspects of our daily lives - agriculture, environment, transportation, tourism, and natural disasters to name a few. Nearly one-third of our nation's economic activity is estimated to be sensitive to weather and climate. Scientific discovery and understanding of weather and climate begins with environmental data collection, research and education.

Serving the Need

The State Climate Office (SCO) is a public-service center for climate-environment interactions in North Carolina and chartered by the UNC Board of Governors. The SCO is housed at NC State University in the College of Physical and Mathematical Sciences with support from the NC Agricultural Research Service. It was acknowledged by the American Association of State Climatologists as one of the first officially recognized State Climate Offices. The SCO is the primary source for North Carolina weather and climate information and is involved in all aspects of climate research, education, and extension services. Activities include:

- Operate and collect high-resolution weather data from a growing network of 37 research quality weather stations called the Environment and Climate Observing Network (ECONet).
- Disseminate climate information to the citizens and businesses of North Carolina through the CRONOS database, an intuitive website making climate data available from over 20,000 surface weather and water resource stations in and around North Carolina.
- Assist state government agencies in climate adaptation activities that reduce costs and conserve resources.
- Collaborate with extension scientists to provide agricultural guidance to growers for disease management and irrigation, which lead to crop loss mitigation and better production decisions. Drought monitoring and management at community, statewide, and national scales.
- Study climate variations and impacts on North Carolina, including sensor and model evaluation, severe weather patterns, drought and water resource management, and economic impacts.
- Numerous community presentations, science fairs, and other interactions with K-12, college students and teachers.

Impact beyond North Carolina

Undergraduate and graduate students working at the SCO gain a genuinely multi-disciplinary experience that contributes to career growth and lifelong learning. Many successes of the SCO are often heralded as a model for other states' climate offices.