Climate Information Needs in the Southeast: Analysis of Requests

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Introduction

State climatologists serve the general public, private interests, as well as local, state and federal agencies by providing climate information or referrals on a wide array of questions. Their experience is unique and critical to understanding what is useful, decision-relevant climate information because they are directly engaged in helping people make decisions or understand events that are influenced by climate conditions.

The climate information requests from individuals and organizations to State Climatology Offices (SCOs) and Southeast Regional Climate Center (SERCC) provide important insight into climate sensitivities because these groups are attuned to the influence of climate within their sectors and interests. Indeed, the groups currently requesting climate information are arguably among the most advanced users of climate information. Many of them have developed understanding through engagement with their state climatologists over time. Analyzing specific climate information requests across sectors and SCOs and SERCC will provide insights into the climate sensitivities of each sector and the value of different climate information sources and types, which may be used to identify opportunities for better use of climate information in sectors over all. Despite the central role and hands-on insight into the breadth of climate concerns in their states and regions, there has not been an attempt to assemble the insights of this group . This paper reports on an initial effort to gather these experiences for the Southeast region.

The first section introduces the approach to creating an on-line reporting tool and piloting the reporting effort. The second section discusses the different types of clients served by SCOs during the pilot testing of the on-line reporting tool. The third and fourth sections review the different types of requests received during this pilot and how that climate information is used in decision making. The summary addresses insights on current climate information uses, implications for the use of model projections on climate variability and change, and issues to consider in advancing a tracking system such as this pilot.

Creating and Pilot Testing a Reporting Tool

The NOAA Southeast Regional Climate Center (SERCC) and the state climatologists of Alabama, Florida, Georgia, North Carolina, Puerto Rico, South Carolina, and Virginia worked with researchers at the Carolinas Integrated Sciences and Assessments to develop a web-based tool for tracking client requests. The tool is based on the reporting system used by the North Carolina SCO. Staff there modified the tool to create password protected access for each SCO. The format for individual record entries was also expanded to include a set of questions on the uses of climate information and potential future climate information needs. Initial drafts of questions were developed and reviewed during monthly Technical Advisory Committee calls and the working version was finalized at the annual meeting of the Technical Advisory Committee in February 2011.

The request tracking tool includes four sets of questions in addition to names, affiliation, and contact information. The first set of questions covers the standard details of location(s), parameters, types of observations (e.g., averages or extremes), time interval (hourly, daily, or monthly), and period of interest. The second set of questions asks about the intended use of the information, the implications of associated decisions, whether this information is needed regularly, and what determines the timing of the information need. The third set of questions centers on the capacity to find and use climate information. Questions address how the client found the SCO, whether there was additional processing of data required for their uses, and whether the processing was done in-house or with other assistance.

The last set of questions asked about needs for information on climate variability and change currently or in the coming year and use of climate information for planning. For the purposes of summary analysis, all contact information was stripped from the database and each request was assigned an identification number.

Three constraints contributed to considerable variability in the number and detail in the record of information requests from each SCO. First, SCOs operate in different institutional settings and vary a great deal in how the offices are staffed and supported. Many face substantial pressure on staff resources and time. For example, in Puerto Rico student strikes closed the university where the SCO office is located for several months during the recording period. Second, SCOs place a high priority on making information access convenient for clients and maintain ongoing relationships. While SCO staff regularly work with clients to help them better define what type of information would be most useful for their interests, there was some reluctance to extend conversations to include additional questions. Finally, some clients also gave limited answers. Consequently, while this data set provides insight, it should not be interpreted as a representative sample, but only suggestive of the scope of information needs served in the Southeast. The number of responses to each question also varies and is reported at the top of each table or with references in the text

1109 climate information requests were collected between February and September 2011 (Table 1). The number of requests reported per month varied and some reports were not recorded immediately.

Table 1: Information Requests Reported by Office

Office	N=1109	% of total
Southeast Regional Climate Center (SRCC)	173	16%
Alabama State Climate Office (ASCO)	29	3%
South Carolina State Climate Office (SCSCO)	261	24%
North Carolina State Climate Office (SCONC)	95	8%
Florida State Climate Office (FSCO)	50	4%
Virginia Climate Office (VCO)	416	38%
Georgia State Climate Office (GSCO)	80	7%
Commonwealth Climate Office of Puerto Rico (CCPR)	5	< 1%

Clients Served

Clients were classified into 18 groups, according to sector or interest represented (Table 2). Approximately 60% of requests came from private entities and individuals. Requests from media including television, radio stations, newspapers, magazines, and other print sources comprised 25% of the total. Colleges and universities generated the second most requests, accounting for 19% of

requests. The personal interest category, which consists of clients who did not request information for any specific agency or firm, represents 14%. The remaining 15 categories illustrate the diversity of clients and sectors served. These include major economic sectors of agriculture, construction, energy, manufacturing and tourism as well as public sector interests in education, economic development, emergency management, health, and environment. The weather/climate category includes information sharing among climate offices. The use of climate information by these sectors is discussed in more detail in later.

Table 2: Clients by Sector and Interest

Client Classification by Sector and Interest	N=1033	% of total
Agriculture	36	3%
Construction	31	3%
Economic Development	10	1%
Education: College, University	195	19%
Education: K-12	17	2%
Emergency Management	9	1%
Energy	20	2%
Engineering	58	6%
Environment	36	3%
Health	15	1%
Legal/Insurance	85	8%
Manufacturing	12	1%
Media	256	25%
Personal Interest	140	14%
Tourism/Recreation	11	1%
Water	32	3%
Weather/Climate	21	2%
Other	45	4%

The majority of reports indicated that clients were quickly able to find the resources of the SCOs and SERCC. Only 5% reported needing more than 5 minutes. 62% (N=785) of clients were already familiar with the SCOs and SERCC offices. Among those not familiar, 16% asked a colleague and 12% relied on an internet search to find these offices. An additional 7% were referred by the National Weather Service. The majority, 97% (N=707/717) of those who responded, reported did not need require further data processing. 172 clients stated that their in-house staff conducted the information processing.

Types of information Requested

The information requests included a variety of time periods, some extending upto and beyond the 30 years typically used in calculating a climatology, while others specifically requested shorter time periods. The full range of information requests is reported, followed by a discussion of requests covering longer time periods. Table 3 summarizes the requests in descriptive categories. Common pairings of data requests such as “temperature and precipitation” and “precipitation and drought” were maintained as

separate categories. In some cases, the request covered combinations of two or more other categories and were coded as “multiple”. For example, one request included average air temperature, minimum air temperature, maximum air temperature, total precipitation, average soil temperature, minimum soil temperature, maximum soil temperature, average soil moisture, and calculated plant available water. Parameters, such as heating degree days, requested fewer than five times were recorded as “other.”

Overall, precipitation information was the most requested information need, both individually and in combination with temperature and drought status. Requests for information from the emergency management community related to extreme events, such as hurricanes and tornados, were second most common. In the emergency management category, the shortcomings of the sample are likely to be particularly influential. The South Carolina SCO received a large portion of requests for information about hazards, a pattern that may be related to their active reporting and the high number of requests directed to the Severe Weather Liaison, who is employed by the South Carolina SCO. The temporal bias resulting from the short recording period may also account for high percentage of drought and pollen information requests received by the Georgia SCO during a period of severe drought and exceptionally high pollen counts. A multi-year record might not show these variables to be of such interest. The Southeast Regional Climate Center is able to process access to ACIS/CLIMOD services.

Table 3: Category of Information Requested by State Climate Office

	SERCC N=153	ASCO N=29	SCSCO N=254	NCSCO N=93	FSCO N=43	VCO N=402	GSCO N=80	CCPR N=2	Total N=1056
ACIS/CLIMOD	**10%** (n=16)	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**2%** (n=16)
Averages	**1%** (n=1)	**0%** (n=0)	**0%** (n=1)	**1%** (n=1)	**0%** (n=0)	**1%** (n=5)	**0%** (n=0)	**0%** (n=0)	**1%** (n=8)
Climate Data (observations)	**1%** (n=2)	**0%** (n=0)	**0%** (n=1)	**0%** (n=0)	**2%** (n=1)	**3%** (n=11)	**0%** (n=0)	**0%** (n=0)	**1%** (n=15)
Climate Info (e.g., reports and papers)	**1%** (n=1)	**0%** (n=0)	**0%** (n=1)	**0%** (n=0)	**0%** (n=0)	**3%** (n=12)	**1%** (n=1)	**0%** (n=0)	**1%** (n=15)
Drought	**3%** (n=4)	**3%** (n=1)	**1%** (n=2)	**2%** (n=2)	**0%** (n=0)	**1%** (n=6)	**29%** (n=23)	**0%** (n=0)	**4%** (n=38)
Extremes	**1%** (n=2)	**0%** (n=0)	**1%** (n=2)	**2%** (n=2)	**0%** (n=0)	**1%** (n=3)	**3%** (n=2)	**0%** (n=0)	**1%** (n=11)
Forecast	**1%** (n=1)	**0%** (n=0)	**1%** (n=2)	**1%** (n=1)	**0%** (n=0)	**3%** (n=12)	**8%** (n=6)	**0%** (n=0)	**2%** (n=22)
Groundwater	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**2%** (n=8)	**0%** (n=0)	**0%** (n=0)	**1%** (n=8)
Hazards	**4%** (n=6)	**7%** (n=2)	**40%** (n=101)	**6%** (n=6)	**2%** (n=1)	**5%** (n=22)	**13%** (n=10)	**0%** (n=0)	**14%** (n=148)
Multiple	**5%** (n=8)	**7%** (n=2)	**6%** (n=14)	**28%** (n=26)	**16%** (n=7)	**18%** (n=73)	**9%** (n=7)	**50%** (n=1)	**13%** (n=138)
Pollen	**1%** (n=1)	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**0%** (n=1)	**6%** (n=5)	**0%** (n=0)	**1%** (n=7)
Precipitation	**29%** (n=44)	**62%** (n=18)	**20%** (n=50)	**24%** (n=22)	**23%** (n=10)	**16%** (n=63)	**5%** (n=4)	**50%** (n=1)	**20%** (n=212)
Precip/Drought	**0%** (n=0)	**0%** (n=0)	**0%** (n=1)	**0%** (n=0)	**0%** (n=0)	**4%** (n=18)	**0%** (n=0)	**0%** (n=0)	**2%** (n=19)
Precip/Temp	**8%** (n=13)	**14%** (n=4)	**2%** (n=6)	**5%** (n=5)	**26%** (n=11)	**11%** (n=43)	**3%** (n=2)	**0%** (n=0)	**8%** (n=84)
Radiation	**0%** (n=0)	**0%** (n=0)	**0%** (n=0)	**3%** (n=3)	**0%** (n=0)	**1%** (n=4)	**1%** (n=1)	**0%** (n=0)	**1%** (n=8)
Temperature	**12%** (n=19)	**0%** (n=0)	**5%** (n=12)	**10%** (n=9)	**16%** (n=7)	**11%** (n=45)	**3%** (n=2)	**0%** (n=0)	**9%** (n=94)
Weather Obs (short-term, unspecified)	**3%** (n=4)	**0%** (n=0)	**15%** (n=37)	**1%** (n=1)	**2%** (n=1)	**5%** (n=20)	**1%** (n=1)	**0%** (n=0)	**6%** (n=64)
Wind	**5%** (n=8)	**0%** (n=0)	**1%** (n=3)	**4%** (n=4)	**5%** (n=2)	**4%** (n=17)	**3%** (n=2)	**0%** (n=0)	**3%** (n=36)
Winter Weather	**3%** (n=5)	**3%** (n=1)	**2%** (n=5)	**0%** (n=0)	**2%** (n=1)	**4%** (n=16)	**8%** (n=6)	**0%** (n=0)	**3%** (n=34)
Other	**12%** (n=18)	**3%** (n=1)	**6%** (n=16)	**12%** (n=11)	**5%** (n=2)	**6%** (n=23)	**10%** (n=8)	**0%** (n=0)	**7%** (n=79)

Within a category, data requests varied a great deal. For example, the types of precipitation information requested include:

- annual, seasonal, monthly, daily, and hourly time intervals
- 95th percentile of precipitation events

- association with hurricanes
- 24 hour extreme events
- precipitation over 0.5 inches
- rainfall intensity
- forecasts
- return frequencies
- radar precipitation estimates.

Wind requests include direction, averages, gusts, and maximum recorded and different elevations.

Temperature information requests include:

- chill hours
- heating degree days
- cooling degree days
- average wet bulb temperature
- water temperature
- heat index values for livestock
- dewpoint,
- soil temperatures at various depths
- mean, minimum, maximums and runs of time with temperatures above or below some specified level.

The category "other" includes pan evaporation data, lightning strikes, stable isotope data of rainfall (d2H and d18O), solar radiation, cloud cover, and atmospheric aerosols.

Information requests also specify the geographic scale (e.g., city, county, state) and the interval of data (e.g., hourly, daily, monthly), and whether they are interested in all observations, an average, or a subset. These information requests focused on relatively small areas at periods of hours to days were most often requested. Requests for information on cities was the most requested, comprising of about 49% of the total (Table 4)[1]. Another 7% of requests focused on specific locations, such as an airport. Requests for information covering larger areas comprised most of the remaining requests.

[1] Requests were placed into the "city" category when a specific city was listed, even if the corresponding county was also listed. For example, certain requests were made for Charleston, SC (Charleston County). Requests with the words "area" and "metro" were also placed into the "city" category (i.e., Atlanta metro, Greater Columbia area). Requests that listed counties only went into the "county" category. Regions within states were placed into the "region" category. This includes entries with multiple counties/cities that are in the same region of the state (i.e., Charleston, SC., Mt. Pleasant, S.C., and Georgetown, SC.). The "Specific Locations" category includes listed locations inside a city (i.e., airport, weather station). "State" contains requests that listed one specific state, or multiple locations that were scattered throughout the entire state (i.e., Greenville, SC., Columbia, SC., and Charleston, SC.). "Other" contains larger or multiple geographic areas, such as continents and regions of countries (Southeast U.S.).

Table 4:Geographic Scale of Information Requested

Geographic Area of Interest	N=1013	% of total
City	492	49%
Country	11	11%
County	52	5%
Region	130	13%
Specific location	68	7%
State	227	22%
Other	33	3%

Climate information at the daily time step was the most frequently requested time interval, followed by hourly and monthly (Table 5). Information at longer time periods was seldom requested, with only 1 request for seasonal information and 56 requests for annual information. At the geographic scale of cities, requests included 100 hourly, 273 daily and 63 monthly data sets. Hourly data were also requested 113 times for statewide coverage. The majority of other time/spatial scale combinations occurred less than 25 times.

Table 5: Time Interval for Data Requested

Time Interval	N=927	% of total
Hourly	173	19%
Daily	536	58%
Monthly	161	17%
Seasonal	1	0%
Yearly	56	6%

Observational records were most frequently requested (Table 6). Some clients requested that the SCOs calculate averages over a specific period, provide the 30-year normal, or identify extremes in a record.

Table 6: Data Type

Data Type	N=1049	% of total
Observational Records	817	78%
Average over Period	96	9%
30-Year Normal	77	7%
Extremes	59	6%

Several questions focused on determining if there are types of requests that might be made regularly and if there were any standard decision deadlines that resulted in requests for information at a point in time. The goal of this question was to investigate possible interest in forecast information including the lead time and parameters of interest. In this limited set, about 30% (N=213/741) clients expected that they would repeat their request for information again in the future. Only 55 clients indicated that they

had decision deadlines (e.g., the purchase of crop insurance) that influenced the timing of their requests.

Uses of Information

Over the past 20 years, an increasingly wide variety of groups has begun to give attention to how climate variability and change influences decision-making and practices. With this attention is a growing, but still not widespread, understanding of the sensitivities and potential value of climate information in different sectors. While many information requests reflect well-recognized interests, others are less familiar. Many of those currently requesting climate information are arguably leaders in understanding how climate influences their interests and responsibilities. Others are conducting research to better understand the role of climate, often consulting with SCOs and the SERCC. While this data set is limited, and this question was not asked in all cases, it does offer greater insight into the details of this emerging understanding and incorporation of climate information in decision-making.

Clients were asked about what decisions would be influenced by climate information. The reporting form included some categories based on past experiences. Many of the decisions reported were related to engineering issues include the reliability of equipment, infrastructure, or other designs under variable conditions (Table 7). 12% of requests were to inform assessment of resilience of different practices under conditions of climate variability or change. 8% provided information to inform legal proceedings. In addition, 7% of clients said they needed information to estimate delays to maintenance or construction activities. The economic value of climate information was less directly apparent with insurance purchases, hiring, and inventory management representing only a small portion of the reports. 50% of requests were outside of the groupings initially anticipated in the design of the reporting tool so all requests accompanied by additional information from the SCOs were coded into more detailed categories (Table 8) . The differences between Tables 7 and 8 reflect inconsistencies between the category checked and category assigned based on additional qualitative detail.

Table 7: Decision implications of Climate Information

Decision Implications	N=674	% total
Understand resilience under changing weather/climate conditions	83	12%
Estimating delays to maintenance or construction activities	48	7%
Inform hiring decision	2	< 1%
Inform insurance purchase	17	3%
Inform inventory management	3	<1%
Inform legal proceedings	57	8%
Understand reliability of equipment, infrastructure or design under variable climate conditions	130	19%
Other	334	50%

As noted above there is great diversity among the clients requesting information from the SCOs and SERCC (Table 2). Table 8 provides a more detailed summary of the intended uses of information. Among the top categories, 23% of the requests related to a news story, 11% to personal interests, and

10% were related to engineering, construction, or manufacturing. Research-related requests totaled almost 20%. Although not as common, there were also requests aimed at informing agricultural practices, economic development, health, development of regulations, and accident investigations, insurance or legal proceedings. Some of the responses indicated that clients requesting access to ACIS/CLIMOD were using the databases to extract more specific types of climate information, such as frequency of rainfall events greater than 1 inch.

Table 8: Specific Uses of Information

Climate information	N=751	% of total
Access to ACIS/CLIMOD data sets	31	4%
Agriculture	33	4%
Economic Development	4	1%
Education	12	2%
Emergency Management and Planning	35	5%
Engineering, Construction, and Manufacturing	75	10%
Environmental Analysis	10	1%
Health	8	1%
Inform Development of Regulations	2	< 1%
Insurance/Accidents/Legal	79	11%
News Story	169	23%
Personal Interest	81	11%
Planning an outdoor event	26	3%
Presentation	4	1%
Records and Data	31	4%
Research - not specified	45	6%
Research-drought	5	1%
Research-ecological	16	2%
Research-energy	28	4%
Research-health	5	1%
Research-student	24	3%
Research-water	13	2%
Other	15	2%

Some clients were asked about their needs for more information on processes of climate variability or change. Of those asked, about 30 responded that they have current need for information on climate variability or change or anticipate that they will need the information in the coming year (Table 9). These responses are somewhat at odds with the data requests themselves. About 10% of requests were for observations over periods of 30 years or more.

Table 9: Current or Anticipated Need for Climate Change Information

Climate Needs	N=582	% total
No current need for information on climate variability or change.	534	92%
No, I/we do not anticipate any needs for information on climate variability or change within the coming year.	18	3%
Yes, I/we have current need for information on climate variability or change.	12	2%
Yes, I/we anticipate need for information on climate variability or change within the coming year.	18	3%

Specific examples of the types of data and decisions using long (30+ year) data sets may be useful as indications of additional types of information could become more broadly useful to decision making. Tables 10, 11, and 12 provide more detailed examples of the types of requests received for data records of 30 years and greater. The responses in Table 12 suggest sectors and topics which may benefit from greater understanding of climate variability and change.

Table 10: Time Interval for 30+ Data Requested

Temporal scale	N=113	% of total
Hourly	11	10%
Daily	46	41%
Monthly	34	30%
Seasonal	1	< 1%
Yearly	21	19%

Table 11: 30+ year records only

Geographic Area of Interest	N=120	% of total
city	47	39%
country	4	3%
county	8	6%
region	18	15%
specific location	10	8%
state	27	23%
other	6	7%

Table 10:Climate parameters specified in requests for 30+ years

Parameter	N= 112
Averages	3
Climate Data	6
Drought	5
Extremes	1
Forecast	1
Groundwater	0
Hazards	6
Multiple	15
Pollen	0
Precipitation	21
Precip/Drought	1
Precip/Temp	14
Radiation	0
Temperature	13
Wind	7
Winter Weather	8
Other	12

Details on the requests for longer observational records and averages offer some insight into the types of decisions that may be sensitive to climate variability and change. Table 13 illustrates several of the climate-sensitive decisions with planning lifetimes less than 30 years. For example, a user in the agriculture sector was interested in minimum, maximum, and average air and soil temperatures to determine survival of pine seedlings. In another example, a private company was interested in acquiring information on relative humidity, which affects the baking and cooling process. Together, these specific climate concerns, information needs, and decisions illustrate the uses of relatively fine scale temporal and spatial information and the very specific and less frequently discussed climate concerns.

Table 13: Detailed Examples of Climate Information Needs and Uses – requested records of 30+ years

Sector	Climate information requested (parameter, geographic scale, time interval)	Climate-related concern
Agriculture	Number of days below normal December temperatures; county; monthly	Need information to assess waste treatment system associated with a chicken farm
Agriculture	Average temperature; region; annual	Is the area warm enough to support a fish hatchery business?

Energy company	Pan evaporation; specific location; monthly	Measuring evaporation rates for a reservoir
Engineering	Wind data; city; 30 year average	An engineer doing Port Facility Design needed to know the stats on what a 50 year Wind characteristics
Engineering	Temperature and relative humidity; city; daily	To design a greenhouse operations for offseason agriculture
Private Entity	Temperature and precipitation; county; annual	Client is a farmer looking to plant persimmon, and he wants to know how often temperatures below 12 degrees occur (since persimmon does not tolerate temperatures that low) and how much yearly precipitation he can expect, since that plant likes plenty of water.
Private entity	Precipitation; city; daily	Consulting firm conducting a site survey

Requests also revealed information needs associated with planning horizons and design lifetimes exceeding 30 years (Table 14). Table 14 shows some of the data requests associated with forestry, manufacturing, engineering, environmental regulation, and land use planning. While precipitation is a very important parameter for decision-making here, requests included a variety of other information that is less commonly available in forecasts and projections. For example, a farmer wanted to know the frequency in which annual temperatures fall below 12°F, because this temperature is a suitability threshold for persimmon trees. Together, these longer term planning decisions illustrate that SERCC and SCO clients across multiple sectors are concerned about long-term variability in climate and are trying to access specific climate information to facilitate planning efforts.

Table 14: Detailed Examples of Climate Information Requests and Uses for periods less than 30 years

Sector	Climate information requested	Climate-related concern
Agriculture	Min/Max/Average air temperature;-- Total precipitation; Min/Max/Average soil temperature; Average soil moisture; Calculated plant available water	Survival analysis of planted pine seedlings.
Engineering	Precipitation	Purpose is to compare embankment slope movement readings to rainfall measurements.
Engineering	Weather variables	Transportation reliability
Engineering	Precipitation	Investigating whether high rainfall rates accounted for damage to roadbed
Engineering	Precipitation	Investigating rainfall on a landfill site

Local Government	Precipitation	Need information to address flooding problems, consider building and permitting practices
Private Entity	Precipitation	Client's company produces storage products, including large drums that might be outdoors and exposed to the elements. He wants to know about the heaviest rain they might expect in a 24-hour period (with a return frequency of 25 years)
Private Entity	Absolute humidity	Our company is preparing to open a baking facility. We are concerned about the effects of the Absolute Humidity on our baking/cooling process. We are in the final planning stages for the facility and this information will help us to determine or HVAC needs and any other possible climate control needs.
Private Entity	Relative humidity	The client's company, xx, works with some materials that are extremely sensitive to changes in moisture, so he wanted relative humidity data from the past year to compare with their own observations of how their materials fared in the spring (April) and summer (September).
Private Entity	Precipitation	Design a wetlands restoration project
State government – water division	Pan evaporation, drought information	Inform the development of baseline for regulatory purposes
State government – water division	Hourly rainfall	To calculate the Total Maximum Daily Load (TMDL) for water discharge permitting purposes

Summary

Data gathered through this pilot project demonstrate the diversity of clients served by SCOs and the SERCC. Although the media, colleges and universities, and personal interests were the most frequent users of climate information, there was a wide range of other users across the Southeast. These climate-sensitive sectors include agriculture, construction, economic development, energy, engineering, insurance, and tourism (Table 2). Information on precipitation and extreme events were the two most frequently requested sources of climate information across all users and sectors. However, there was great variability within each information request category. For example, precipitation requests varied according to measurement interval (annual, seasonal, daily, hourly), geographic area of interest, and data type (observational, annual, or 30-year normal). The broad range of engaged clients and the detail of their information needs is suggestive of larger, more diverse group of advanced climate information users that are typically acknowledged by the climate adaptation community.

While many requests are for short time frames, a portion of requests provide some insight into potential uses of information on climate variability and change. The desire for a diverse set of climate variables is also apparent among clients requesting relatively long data records (Table 13). That diversity is illustrated further by clients working projects with long design lifetimes (Table 14). The majority of

requests are at a relatively fine spatial and temporal scale including specific locations and cities and data at hourly and daily timescales. These requests are consistent with decision maker requests for more specific information on projected climate changes.

Based on these requests, the spatial and temporal scales of current decision-making practices, including those involving long project lifetimes, do not match well with the more robust output of general circulation models or regionally downscaled models. Many of these requests also focus on precipitation, a particularly challenging variable for fine scale forecasting in the Southeast. Several requests suggest that there may also be need for other less commonly reported parameters such as relative humidity and wind speed. This gap between model capabilities and current analytical practices is an important challenge to integrating climate information into decision making.

Data from this pilot also suggest that clients have specific data needs, such as temperature thresholds and precipitation amounts, which are at different thresholds than typically provided in standard download formats. For example, a persimmon farmer needed information on the frequency of days where temperatures dropped below 12°F. Although this information is available in long term data sets, most data deliverables are in formats such as the average annual temperature, days below normal in December, daily maximum, frost free days, and so forth. Further investigation into the detail of requests could inform the development of useful climate tools useful throughout the region. For example, if the level of demand is sufficient, it may be worth investing in a tool that allows temperature and precipitation data to be queried by specific thresholds.

This pilot project also demonstrated many challenges associated with designing and implementing this type of data collection process. Further efforts to document climate information needs in the US through engagement with the Regional Climate Centers (RCCs) and SCOs will need to address staffing constraints to record information requests, familiarity with soliciting and providing additional information on climate decisions, and improved design of a reporting tool. Despite these challenges, tracking of climate information requests by SCOs and RCCs can provide more comprehensive understanding of the specific climate concerns, information uses, and decisions across a wide-range of sectors. Deepening our understanding of these requests will enable SCOs and RCCs to communicate information needs to policy makers and provide information in formats desired by clients.