UNITED STATES DEPARTMENT OF COMMERCE
The Inspector General
Washington, D.C. 20230

July 29, 2010

The Honorable Joe Barton
U.S. House of Representatives
Washington, DC 20515

The Honorable Dana Rohrabacher
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Barton and Mr. Rohrabacher:

This responds to your letter of June 19, 2009, requesting we examine the National Oceanic and Atmospheric Administration's (NOAA's) efforts to modernize the United States Historical Climatology Network (USHCN) and the steps the agency has taken to address deficiencies in the data generated by the network. In your letter, you expressed concern about the accuracy and quality of USHCN's temperature data. In particular, you questioned the siting of the weather stations in the network; the validity of the adjustments made to the raw data in USHCN; and whether users understand the quality, accuracy, and margins of error of the data.

In response, we initiated a review of USHCN to determine whether NOAA has taken appropriate steps to ensure quality climate data. During our review, we examined background documentation relating to NOAA's mission for USHCN, including budget requirements, operating procedures, management plans, and data quality assurance procedures. We also interviewed NOAA personnel at the National Weather Service (NWS), National Climatic Data Center (NCDC), and Atmospheric Turbulence and Diffusion Division (ATDD). We then spoke with several state climatologists, as well as experts from the American Association of State Climatologists (AASC), the United States Global Change Research Program, and the American Meteorological Society (AMS) to get the opinions of external users of USHCN data. We most recently briefed your staff on the results of our activities in January 2010.

NOAA acknowledges that there are problems with the USHCN data due to biases introduced by such means as undocumented site relocation, poor siting, or instrument changes. The agency has taken steps to improve data quality by implementing enhanced quality control steps and algorithms (referred to as USHCN Version 2) and having them peer reviewed. According to the peer reviews we examined, the resulting dataset improves upon the algorithms in the prior Version 1 data.

The respondents to our inquiries about the use of and adjustments to the USHCN data generally expressed confidence in the Version 2 dataset. Although experts from the three professional organizations we contacted had no official position on the efficacy of the adjustments, two of the experts stated that in their professional view the USHCN Version 2 dataset has value, with one expert saying it is the best dataset for detecting climate change and trends. All of the experts thought that an improved, modernized climate reporting system is necessary to eliminate the need for data adjustments.

NOAA recognizes the need for a modernized network to enhance its ability to collect and report regional climate data and is currently working to implement a modernized USHCN (USHCN-M). The new network is planned to initially consist of 141 pilot stations, with the goal of implementing a national network of approximately 1,000 sites. NOAA estimates that full implementation and operation of a modernized network will cost about $100 million between FY 2010 and FY 2020. While USHCN-M is expected to improve NOAA's ability to collect and transmit regional climate data, NOAA is uncertain whether it will receive enough funding to fully implement and maintain the network.

We have provided the detailed results of our review as an enclosure. If you have any questions, or if we can be of further assistance, please do not hesitate to contact me at (202) 482-4661 or Ann Eilers, principal assistant inspector general for audit and evaluation, at (202) 482-4328.

Sincerely,

Todd Zinser

Enclosure

cc: Representative Roscoe Bartlett
Representative Rob Bishop
Representative Marsha Blackburn
Representative Paul C. Broun
Representative John Campbell
Representative Jason Chaffetz
Representative Michael Conaway
Representative John Linder
Representative Cynthia M. Lummis
Representative Michael McCaul
Representative George Radanovich

Enclosure

Detailed Review Results Responding to June 19, 2009, Request

Background and Objectives

Established in 1987, USHCN provides observations of temperature and precipitation for analyzing long-term climate variability at national and regional levels. The network is a joint project of the Global Change Research Program of the U.S. Department of Energy and NCDC. NWS is responsible for operating and maintaining the stations within the network. Insert 1 explains the different systems NOAA uses to compile and interpret temperature and climate data for the United States.

USHCN originally used a subset of 1,219 high-quality stations within the 48 contiguous United States. These stations were chosen from the approximately 12,000 sites of the U.S. Cooperative Observer Network, which was created in 1890 under NWS' Organic Act (15 U.S. Code, section 313). It is a network in which over 12,000 sites provide observations, consisting of daily maximum and minimum temperatures, snowfall, and 24-hour precipitation totals, to help NWS measure long-term climate changes.

Each USHCN station was selected based on spatial coverage, data record length, data completeness, and historical stability. To be included in USHCN, a station had to be active in 1987, have at least 80 years of mean monthly temperature and precipitation data, and have experienced few station changes (e.g., changes in location).

Insert 1.
Different Networks, Different Data Collection Methods

NOAA uses several systems and collection methods to quantify climate changes at the national and regional level:

USCHN Version 1 compiles data from weather stations, adjusting data for variances unrelated to climate (e.g., station movement) for national and regional level climate analysis.

USHCN Version 2, implemented by NOAA in 2009, uses enhanced quality control steps and algorithms to further improve quality of data compiled from different weather stations for national and regional level climate analysis.

The United States Climate Reference Network **(USCRN)** measures climate data on a national level and serves as a reference standard for other networks due to factors such as ideal site locations and newer technology, which result in minimal external effects on the data.

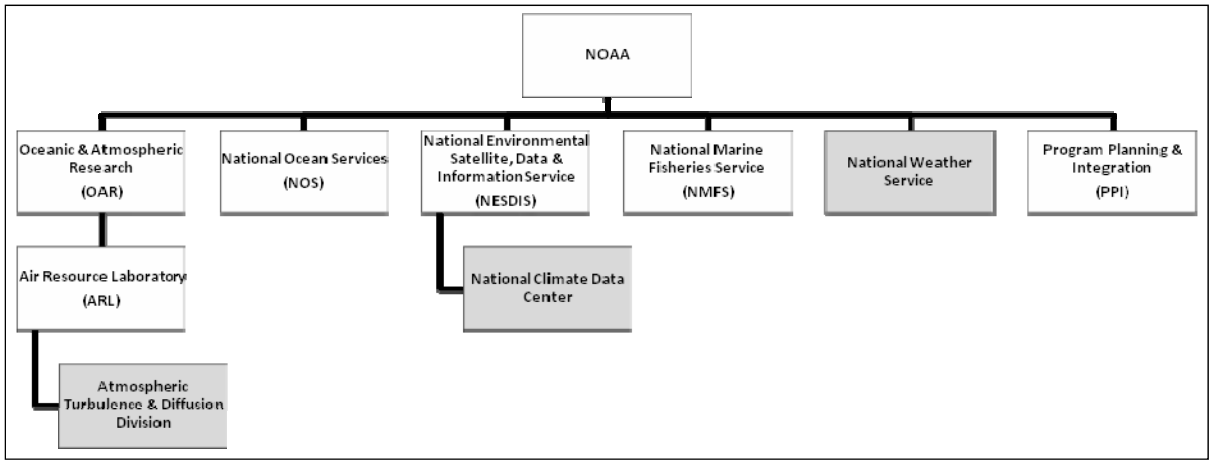
Also in 2009, NOAA began developing **USHCN-M** to compile regional weather information. USHCN-M's improved collection processes are intended to accurately record and transmit raw data without the need for non-climatic adjustments.

In June 2009, we received a letter from 13 members of Congress expressing concern that USHCN weather stations do not meet NWS' siting requirements and therefore produce unreliable data. The letter also stated that there is considerable likelihood that the data provided by USHCN are being used by unsuspecting individuals who lack an understanding of the quality, accuracy, and margins of error of the data. The letter requested that we initiate a review of USHCN to determine whether NOAA has taken appropriate steps to ensure quality climate data.

NOAA has acknowledged that there are problems with the USHCN data due to biases introduced by such means as undocumented site relocation, poor siting, or instrument changes.

In response to the request, we undertook a review to determine (1) what, if any, mitigating steps NOAA has taken to address any deficiencies in the USHCN data and whether those steps were effective; (2) what impact NOAA's efforts to modernize USHCN will have on its climate data collection and reporting ability; and (3) whether users understand, or are concerned about, its data quality issues. We focused on activities in three divisions of NOAA: Oceanic and Atmospheric Research (OAR); National Environmental Satellite, Data, and Information Service (NESDIS); and NWS, as shown in figure 1.

Figure 1. NOAA Organizational Chart Related To USHCN-M



Source: NOAA Web site

Findings

I. NOAA's Treatment of the USHCN Version 2 Algorithms Was Confirmed by Peer Review

The USHCN Version 2 algorithms[1] are applied to data to adjust for several different non-climatic factors. The algorithms went through an internal review process at NOAA as well as an external peer review prior to publication in the *Bulletin of the American Meteorological Society (BAMS)*.[2] A subsequent peer-reviewed journal article reported that USHCN Version 2 removes most of the bias resulting from poor siting and instrument changes. Poor siting means that either the specifications for weather stations are not being met, or data collection conditions are very poor. For example, urbanization may contribute to poor siting if a station is located next to a building that radiates heat. "Instrument changes" may refer to changing or improving data-collecting devices such as thermometers.

[1] An algorithm is a step-by-step procedure for solving a problem or accomplishing some end, especially via computer (source: *Merriam-Webster Online.* http://www.merriam-webster.com/dictionary/algorithm).
[2] Menne, M.J., C.N. Williams Jr., and R.S. Vose. 2009: The United States Historical Climatology Network Monthly Temperature Data–Version 2. *Bulletin of the American Meteorological Society*. 90:1000.

We also found that adjusting climate data is a common practice, with 35 developed countries that we researched performing similar types of adjustments.

USHCN Version 2 Was Created to Correct Data Quality Issues

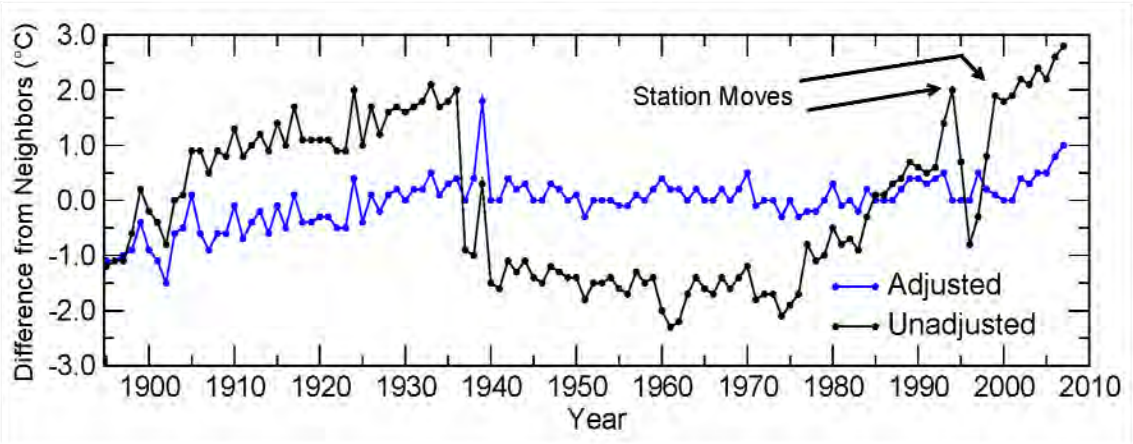
NOAA researchers created the USHCN Version 2 algorithms, which were implemented in 2009, to adjust climate data for several different factors. Mainly, Version 2 was intended to compensate for undocumented changes that were not addressed by its predecessor, USHCN Version 1. Version 1 had several issues that caused inconsistencies in climate data, such as undocumented changes in climate stations. These inconsistencies led to concerns in the climate community regarding the accuracy and reliability of the data.

The Version 2 algorithm adjustments are designed to correct biases in USHCN data related to:

- Time of Observation Issues: Cooperative Observer Network volunteers record observations at a set time of day; however, the time of observation has over time changed from afternoon to morning at most sites. Therefore, temperature readings will not be consistent with historical data unless an adjustment is performed.
- Documented and Undocumented Station Changes: USHCN stations have been replaced, moved, and removed over the years, sometimes without documentation of the activity being recorded. In addition, changes in the instrumentation that observes temperature have occurred. When station changes are not documented properly, they can result in temperature biases since, for example, a new station location may be warmer than the previous one.
- Urbanization Issues: USHCN stations have been affected by urbanization, not just in large cities but cities of all sizes. When originally placed, USHCN stations were not sited in locations that had external influences. Over time, urbanization occurred in areas surrounding the stations, which in turn can affect temperature readings and cause biased measurements.
- Missing Data: Instances in which NCDC is not provided climate data have occurred for a variety of reasons, including equipment failures, which lead to an incomplete dataset. In these cases, NCDC must obtain a more accurate estimate of the climate relationship between stations by using an algorithm.

Figure 2 illustrates the difference between adjusted and unadjusted data in one location and how artificial effects of events such as station moves, which cause large fluctuations in unadjusted data, can be removed when the algorithms are applied.

Figure 2. Comparison of USHCN Version 2 Adjusted Data vs. Unadjusted Data in Reno, Nevada



Source: Menne, M.J., C.N. Williams Jr., and R.S. Vose. 2009: The United States Historical Climatology Network Monthly Temperature Data–Version 2. *Bulletin of the American Meteorological Society*. 90:1000.

As described in a peer-reviewed *Journal of Geophysical Research – Atmospheres* paper, "On the Reliability of the U.S. Surface Temperature Record,"[3] some researchers have used photographs as evidence of poor station siting (e.g., near artificial sources of heat), and to reach the conclusion that USHCN surface temperature records over roughly the last 30 years are likely biased warm.

Significantly, the type of thermometers used in many of these stations changed when the stations were re-sited. Menne, Williams, and Palecki's analysis determined that the cool bias for maximum temperatures caused by the change in the thermometers exceeded any warm bias produced by re-siting the stations. The net cool bias due to changes in thermometers and re-siting of stations is largely removed by the Version 2 algorithm for documented and undocumented station changes. More specifically, this algorithm removes most of the bias due to station changes, regardless of whether it is warm or cool.

The Version 2 algorithms are critical to climate data since they are applied to past and present USHCN data, thus allowing historical data to be comparable to current data. Better historical records are important to the climate community since newer climate networks such as USHCN-M and USCRN, both of which are discussed later in this report, do not have a significant data history.

Internal and External Reviews Were Performed On the USHCN Version 2 Algorithms

The USHCN Version 2 algorithms were discussed in an article written by NCDC scientists and published in *BAMS* in July 2009.[4] Prior to publication, internal and external peer reviews of the

[3] Menne, M. J., C. N. Williams, Jr., and M. A. Palecki. 2010. "On the Reliability of the U.S. Surface Temperature Record." *Journal of Geophysical Research – Atmospheres* [Online], 115. D11108, doi:10.1029/2009JD013094.
[4] *BAMS*, 993-1007.

article were conducted. NOAA's methodologies in creating the algorithms were also examined as part of these reviews.

Peer reviews, which are performed by qualified and knowledgeable individuals in fields related to the topic being analyzed, are important to the scientific community since they help provide credibility to the item being published. In this case, the external peer review for the *BAMS* article was performed by individuals who were not affiliated with NOAA but were asked by the journal's editor to conduct the review. Their reviews concentrated on vetting the science behind the Version 2 algorithms, thus ensuring the quality of the information presented in the article.

NCDC Generally Followed Its Internal Review Process

Before submitting the article for publication in *BAMS*, NCDC staff reviewed the article to ensure that NCDC policies and procedures were met and that it accurately reflected the results of their research. They performed several levels of review, which checked for areas such as scientific viability, grammar, and compliance with policies.

At that time, NCDC was using Guideline Number 100-01-001 of *NOAA/NESDIS National Climatic Data Center Guideline Services, Publication Review and Approval* (2003). Section G of the guideline discusses the review process; its key points are outlined below:

- Peer-reviewed articles are to be reviewed at the NCDC deputy director level.
- Each article will have two reviewers; external reviewers may be used if they are well qualified for the subject area.
- Reviewers are to complete a form titled "National Climatic Data Center Manuscript Review." This form includes, but is not limited to, questions such as:
  - whether the information is presented clearly
  - whether the subject matter is appropriate for publication from NOAA
  - whether the work presented is original
  - whether the abstract is complete, clear, and informative
  - whether references are adequate, accurate, and include complete bibliographic data
  - whether the reviewer recommends the article for publishing or if additional revisions are needed
- The deputy director is to complete a review form titled "Record of Review and Release of Scientific or Technical Manuscript." This form states that the deputy director has reviewed the document in accordance with NOAA policy (which is NCDC Guideline 100-01-001), whether it is approved for publication, and whether additional revisions are needed.

We requested the hardcopy files from the internal review, but NCDC could not find them. The files should have contained, among other things, three sets of review notes: one from each reviewer and one from the deputy director. However, we were able to see one set of notes since one reviewer had saved his separately. Although the deputy director did not have her notes, she had saved an e-mail to the author indicating her review was complete and the article was approved for publication, thus verifying that she had performed a review. Because all of the

review notes were not available, for the purpose of our evaluation NCDC officials obtained notarized certifications from the reviewers to confirm their inspection of and concurrence with the contents of the article.

Although NCDC was not able to find all notes to verify that a complete internal review was performed, this does not affect the validity of the *BAMS* article since the staff was able to provide evidence that supported the reviewers' agreement with the paper. In addition, as discussed below, the paper also went through an extensive external peer review process.

Subsequently, in June 2008, NCDC began using an electronic software package designed for reviewing articles. Although we did not review this new process, NCDC stated that reviews are now performed within this system, which stores and tracks them electronically. The system decreases the possibility of losing review notes or being unable to verify whether a review was performed. However, we do recommend that NCDC periodically perform quality control checks of this system to verify that it is functioning correctly and tracking and saving all necessary documentation.

An External Peer Review Was Performed and the Article Was Approved for Publication

Once the internal review was complete, the article was sent to *BAMS*, where it went through an extensive peer review process. For the USHCN Version 2 *BAMS* article, the following review processes were performed; we obtained documents verifying that each step occurred:

- Reviews were performed by three peer reviewers.
- Once comments were returned to the authors at NOAA, the authors documented whether they changed the article based on the reviewers' comments. If no changes were made, the authors explained their reasoning.
- The authors' comments were sent back to the peer reviewers for a second round of reviews.
- Two of the three reviewers accepted the *BAMS* article for publishing, while one felt that it was not ready.
- The reviewer who stated that the article was not ready for publishing felt that several items within the article were not adequately addressed.
- The publisher, who makes the final determination based on the peer review results, accepted the article for publication.

Our inspection of these documents indicated that a complete external peer review had been performed. We were able to verify each step in the process, thus confirming that the USHCN's Version 2 algorithms had been properly reviewed and approved. We found no evidence that NCDC was involved in either the selection of the external peer reviewers or in the external peer review process beyond responding to the reviewers' comments.

NOAA Applies Quality Control Process to USHCN Version 2 Dataset

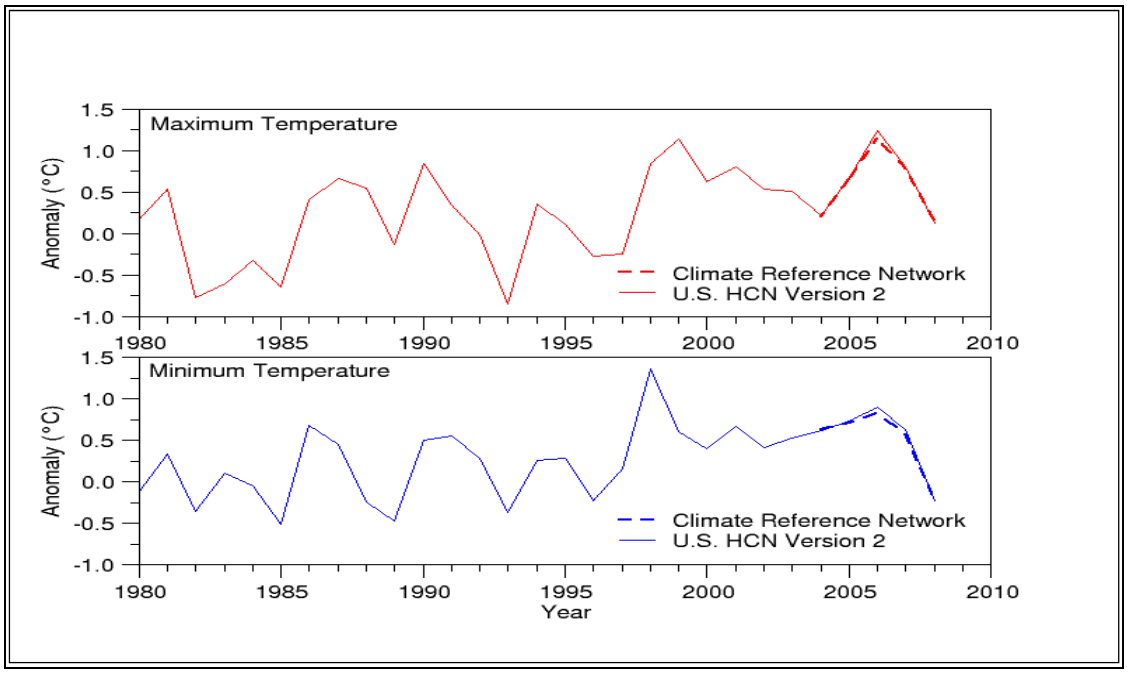
According to NOAA, its adjustments to the historical and current USHCN data allow users to compare data for any period in a station's record without external influences such as undocumented station moves biasing their results. The Version 2 algorithms are applied to the

datasets from more than 1,200 Cooperative Observer Network stations around the country, compiled from five complementary source datasets: three daily and two monthly summaries.

To ensure that the published Version 2 dataset is accurate, quality control measures are included during its development. The three daily datasets go through a quality assurance review checklist, with each step in the checklist geared to identify a specific data problem. The data must pass each step in order to proceed to the next step. Once this is completed, the daily datasets are converted to monthly data and merged with the two monthly datasets to form a dataset of serial monthly temperature values. This dataset then goes through another round of quality checks. Once those reviews are complete, the data adjustments from the algorithms are applied, resulting in the USHCN Version 2 dataset.

To gauge whether USHCN Version 2's adjusted data appeared accurate, scientists at NCDC compared it to USCRN data for the same time period. Their results, noted in figure 3, found that for the 5-year period under comparison, the adjusted Version 2 data was very similar to the USCRN data. Although the USCRN data dates back only a few years, this comparison has been peer reviewed and published in the *Journal of Geophysical Research.*

Figure 3. Comparison of USHCN Version 2 Data and USCRN Data



Source: Menne, M.J., C.N. Williams, Jr., and M.A. Palecki. 2010. On the Reliability of the U.S. Surface Temperature Record. *Journal of Geophysical Research* [Online], doi:10.1029/2009JD013094.

Other Developed Countries Perform Climate Data Adjustments

During our review, we found that 35 countries perform adjustments to climate data to address data deficiency concerns, while 2 more are currently developing an adjustment process. Based on these numbers, the United States is part of a large group of developed nations that adjust climate

data. See page 12 for the methodology we used to inquire about other countries' use of climate data adjustments.

II. Interviews with Experts Outside NOAA Indicate General Confidence in the Treatment of the Version 2 Data

We attempted to contact a number of state climatologists who are users of the Version 2 dataset to obtain their input on the quality of the adjusted data and concerns about either the raw or adjusted data. However, we received only five responses to our inquiries. Those who did respond generally had confidence in the dataset.

We also interviewed the president of AASC, the head of the U.S. Global Change Research Program, and the Applied Climatology Committee chair of AMS. Only the interviewees from AASC and AMS were familiar with the Version 2 dataset. None of the organizations had an official position on the efficacy of the adjustments in the USHCN Version 2 dataset, but the two who were familiar with the dataset provided their professional opinion.

The president of AASC stated that although he was familiar with the Version 2 dataset, he had not used it. He, along with other climate experts, decided to develop their own dataset for their local region. They used a subset of USHCN and other Cooperative Observer Network stations that were not part of USHCN to develop their dataset. He created a dataset that he believed had better quality stations than USHCN. When asked if he felt there was value to the Version 2 dataset, he responded in the affirmative. However, he felt that people are confused by NCDC's adjustment process and that NCDC should provide more explanation of the process.

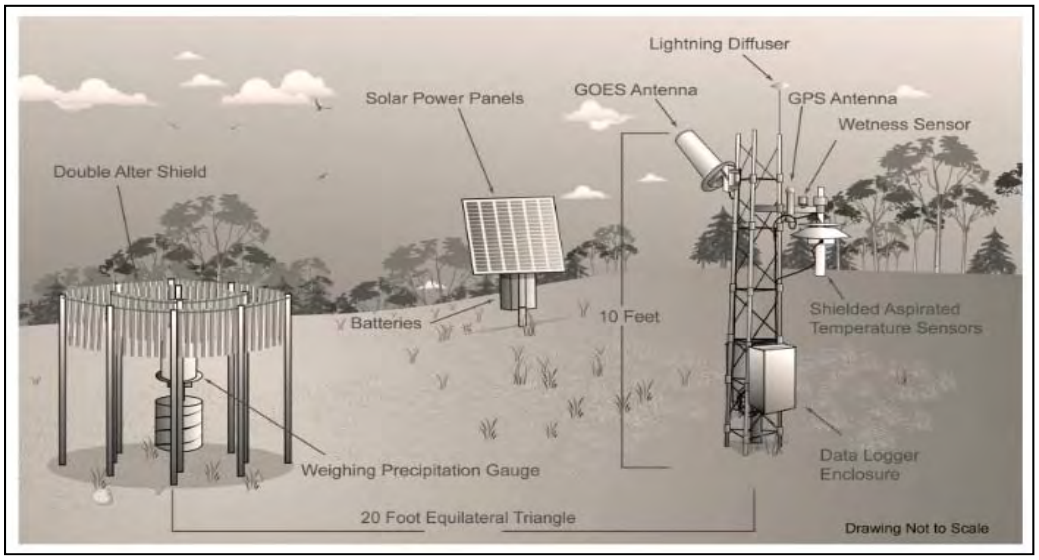
The Applied Climatology Committee chair for AMS told us that she had observed a USHCN Version 2 dataset presentation led by the NOAA scientist who created the algorithms. She stated that the scientist did a "fantastic job" developing the best dataset for detecting climate change and trends, while addressing issues such as discontinuity of changes in equipment. She indicated that her group uses a similar methodology for dealing with systematic artificial shifts in climate data and that her group's approach was peer reviewed and accepted.

All three of the experts we interviewed expressed the opinion that there is a need for an improved, modernized climate reporting system to eliminate the necessity of data adjustments.

III. NOAA Is Attempting to Enhance Its Ability to Collect and Report U.S. Regional Climate Data

In order for NOAA to improve its ability to collect and report U.S. climate data, NOAA officials are investing resources to create new national and regional climate monitoring systems. USCRN, a national climate monitoring system, was established in 2000. USHCN-M, a regional climate monitoring system, began to operate in 2009 and is in the initial pilot phase (see figure 4 for an illustration of a USHCN-M station). NOAA officials intend to fully implement USHCN-M and use satellite technology to help provide reliable climate data, but acknowledge they need additional funding to complete implementation of USHCN-M.

Figure 4. Illustration of USHCN-M Station



Source: NOAA Website

USHCN-M is Intended to Improve NOAA's Ability to Collect and Transmit Regional Climate Data

USHCN-M is an automated climate monitoring system that utilizes triple-redundant temperature sensors[5] and automated data monitoring software. It automatically transmits regional climate data to NCDC via NOAA's GOES satellite.[6]

NWS follows a set of procedures and processes designed to ensure the USHCN-M data collection and reporting activities are accurate, reliable, and efficient. We identified three main stages of activity followed by NOAA:

1. **Site Identification, Survey, Evaluation, Selection Process**

   A NOAA panel of representatives from NWS, NESDIS, and OAR identifies, surveys, evaluates, recommends, and selects USHCN-M sites within grid areas evenly distributed across the 48 contiguous states. The panel analyzes survey packets consisting of a site survey checklist, site score sheet, site obstruction drawings, and site photos to determine the ideal location of USHCN-M stations. The USHCN-M Executive Steering Committee overseeing the panel is chaired by the directors of NCDC and the Office of Climate, Water, and Weather Services. Members of the committee come from various NOAA organizations, as well as the Commerce and Transportation Program Office.

[5] NOAA designed USHCN-M stations with three temperature sensors encased within a shielded unit to ensure the system captures climate data accurately. Each sensor acts as a backup for the other in the event one sensor is not operating correctly; this ensures climate data will be captured accurately and without the system experiencing downtime.

[6] GOES satellite: NOAA's geostationary satellite that constantly monitors the Western Hemisphere from around 22,240 miles above the Earth. Scientists use a data collection system on the satellite to relay data from transmitters on the ground to researchers in the field.

2. **Acquisition of Land, Testing of Equipment, and Implementation**

   NOAA personnel obtain all legal rights to land needed by NWS in the form of completed site land agreements. NOAA's ATDD personnel procure, test, and install the necessary equipment for constructing USHCN-M stations.

3. **Analysis and Publishing of USHCN-M Data**

   USHCN-M stations automatically transmit data via satellite to NCDC. NCDC personnel analyze the data, run tests to ensure the data is accurate and reliable, and publish the results on NOAA's Web site.

These processes, if fully implemented, should enhance NOAA's overall ability to collect and report U.S. regional climate data.

NOAA Is Following Best Practices in Planning and Developing USHCN-M

NOAA designed USCHN-M to provide the same level of climate science data quality as USCRN's and therefore followed guidelines used in that system's development. As noted previously, USCRN monitors climate data at a national level and serves as a reference standard for USHCN-M. NOAA expects these two national and regional networks to provide accurate and reliable climate data to government agencies, industry professionals, the scientific community, and the public for the next 50 to 100 years.

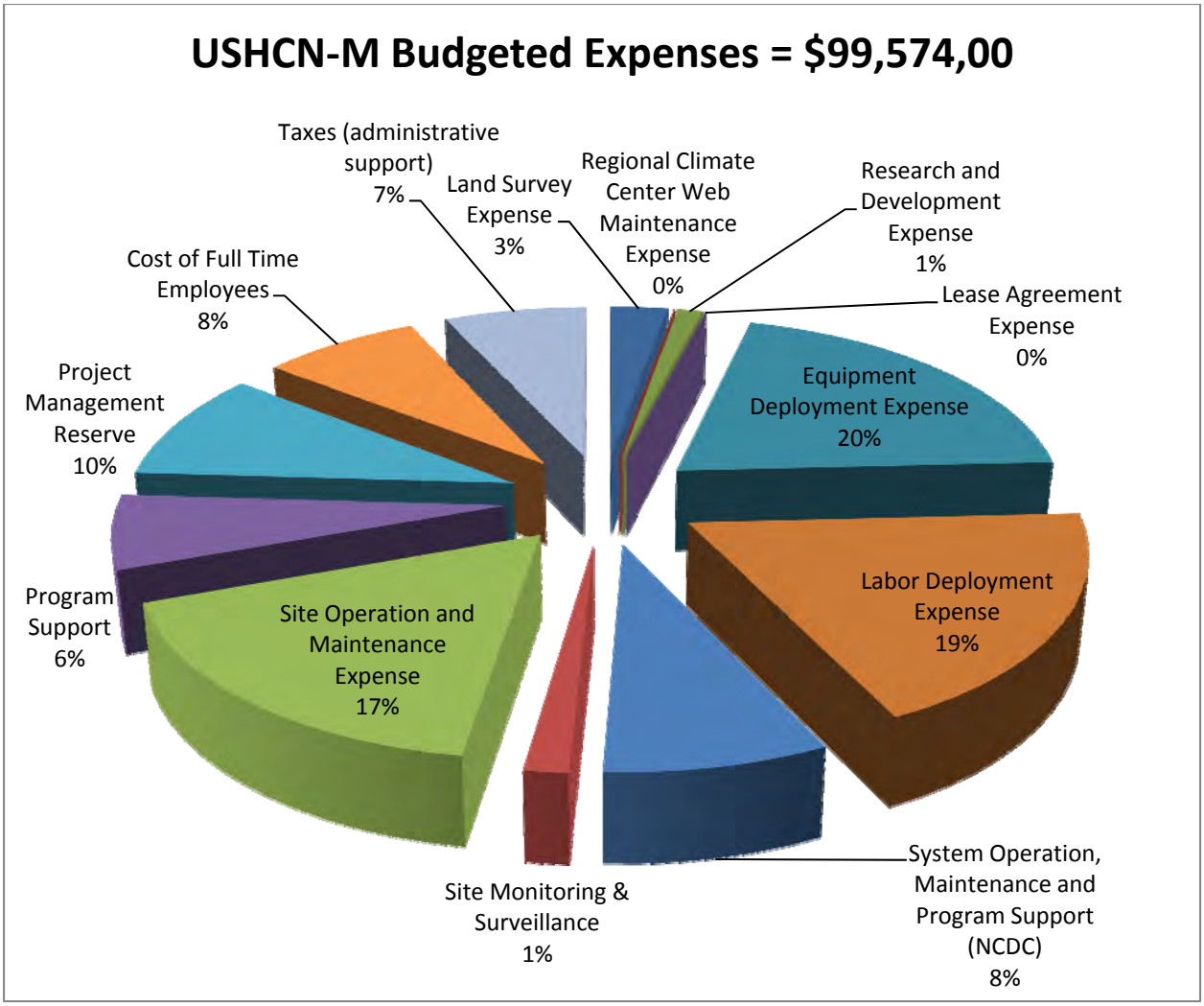
In creating USHCN-M, NOAA adopted guidelines from USCRN for life-cycle activities such as functional requirement definitions, program development, configuration management, testing and evaluation, site information, site acquisition, and field site maintenance. In addition, NOAA is using as a guideline the *Climate Monitoring Principles of the Global Climate Observation System*,[7] which includes assessing the impact of new systems or changes to existing systems before implementing a climate observation network and ensuring a suitable period of overlap for new and old observing systems.

Funding to Complete Implementation of USHCN-M Is Uncertain

As of the date on this report, 37 USHCN-M sites were operational, but 104 still needed to be installed in New Mexico, Utah, Arizona, and Colorado as part of NWS' pilot program. NOAA expects it to cost over $3.7 million in FY2010 and FY2011 and approximately $10.2 million from FY2012 through FY2020 to fully fund the implementation and ongoing maintenance of 1,000 USHCN-M stations (figure 5). However, at the time of our review, NOAA only expected approximately $3.7 million per year to fund the project, leaving a gap of $6.5 million per year as of FY 2012.

[7] The Global Climate Observation System is a joint undertaking of the World Meteorological Organization, the Intergovernmental Oceanographic Commission of the United Nations Educational Scientific and Cultural Organization, the United Nations Environment Programme, and the International Council for Science. Its goal is to provide comprehensive information on the total climate system, involving a multidisciplinary range of physical, chemical and biological properties, and atmospheric, oceanic, hydrological, cryospheric, and terrestrial processes.

Figure 5. NOAA's Estimated Budgeted Expenses for USHCN-M from FY2010 to FY2020



Source: NOAA

NOAA projected the expenses based upon the cumulative number of USHCN-M sites it plans to deploy each fiscal year. NOAA does not believe the benefits derived from having USHCN-M can be realized if the project is not fully funded. We did not examine the validity of the budget data or the NOAA claims about funding because they are outside the scope of this review.

Objectives, Scope, and Methodology

Our objectives for this inspection were to determine (1) what, if any, mitigating steps NOAA has taken to address any deficiencies in the USHCN data and whether those steps were effective, (2) what impact NOAA's efforts to modernize USHCN will have on its climate data collection

and reporting ability, and (3) whether users of the data understand the data quality issues and have concerns involving the data.

We examined background documentation relating to NWS', NCDC's, and ATDD's mission, budget requirements, operating procedures, and management plans. We also examined specific documentation relating to NCDC's USHCN data quality assurance procedures and NWS' efforts to establish USHCN-M. We conducted most of our inspection work at three NOAA agency sites: (1) NWS headquarters in Silver Spring, Maryland; (2) NCDC headquarters in Asheville, North Carolina; and (3) ATDD headquarters in Oakridge, Tennessee. We attempted to contact 10 state climatologists to obtain their thoughts on the quality of NOAA's climate data collection and reporting, but received only five responses. We also interviewed the president of the American Association of State Climatologists, the acting director of the United States Global Change Research Program, and a committee chair of the American Meteorological Society.

Foreign Countries that Perform Adjustments to Climate Data

We also researched other countries to determine if they perform data adjustments as well. We selected 18 of the 20 countries from the Group of 20 (G-20) to research (the remaining countries were the United States and the European Union). The G-20 is comprised of finance ministers and central bank governors, and is a forum for countries to study, promote, and discuss the international financial system. The G-20 was our focal point since the countries involved made up two-thirds of the world population and are considered industrial and emerging-market countries.

From inquiries with NCDC scientists and research over the Internet, we determined that 11 of the 18 countries perform data adjustments and 2 are developing an adjustment process. We were unable to determine whether the remaining countries perform adjustments. NCDC scientists also provided us with a Web site regarding a group that has been coordinating efforts to improve climate data adjustment algorithms for the European Union, as well as several non-European Union countries. This project, named the "Advances in Homogenization Methods of Climate Series: an Integrated Approach," is made up of representatives from member countries. From this site, we found that 24 countries within this group performed data adjustments. Combined, we were able to determine that 35 countries adjust their climate data.

Our work was performed in accordance with the *Quality Standards for Inspections* (2005) issued by the President's Council on Integrity and Efficiency, and under authority of the Inspector General Act of 1978, as amended, 5 U.S.C. App. 3, and Department Organization Order 10-13 (2006).