

Air Resources Laboratory



CLIMATE ANALYSIS AND THE US CLIMATE REFERENCE NETWORK

Climate change involves a number of effects on the planet, with global warming being chief among those. Our planet has been warming at a steady and increasing rate since the beginning of the Industrial Revolution, and this is now the warmest period in the history of modern civilization. Climate change can alter rainfall, influence agricultural crop yields, affect health, alter our oceans and forests and increase the likelihood of extreme events such as flooding, drought and tropical cyclones. Determining the degree of climate change requires an accurate set of long-term data from a variety of resources, and high-quality data to serve as a reference standard are extremely important. Such observations are fundamental to our understanding of how and where our climate has changed, and will change, in the future.

US Climate Reference Network

NOAA's U.S. Climate Reference Network (USCRN), was developed in the 1990's as a partnership between OAR's Air Resources Laboratory (ARL) and NESDIS' National Centers for Environmental Information (NCEI). The goal was to provide our Nation with long-term, high quality observations of air temperature and precipitation collected in relatively stable and pristine environments. The first stations were installed in 2002, and from 2009-11, the network was enhanced with high-quality observations of soil moisture and temperature in support of the National Integrated Drought Information System (NIDIS) program. The USCRN's measurements are critical anchor points for evaluating other observing networks, both public and private, to assist in the calibration and validation of data for the purpose of better documenting climate change as is done via the National Temperature Index.

USCRN data are also used by the National Weather Service to improve both short- and long-term forecasts to protect lives and property. ARL, in concert with NCEI, designed, installed and maintains the 114 stations of the USCRN in the continental U.S. (CONUS), plus 23 stations in Alaska and two stations in Hawaii. Up to seven more stations are due to be installed in Alaska by 2025. Each station monitors a set of primary observations of air temperature, precipitation, and soil moisture and temperature. Unlike weather observing networks, the USCRN was specifically

designed with climate in mind, and the most unique feature is the triple sensor redundancy employed for air temperature, precipitation, and soil moisture and temperature, which is key to maintaining high quality datasets. There are also other ancillary variables observed to assist in the quality control of the primary variables, and these include 1.5m wind speed, solar radiation, and ground infrared temperature. Each station is strategically placed away from urban and suburban influences to avoid locally-induced biases in the climate record. ARL also provides analysis of emerging sensor technologies for future applications, and maintains the sites with regular calibration of the sensors.

Drought Information

The USCRN-NIDIS partnership is response to the demand for drought-related information as it becomes more urgently needed as a result of more frequent droughts; the USCRN data allows the NIDIS Program to better determine drought's physical, hydrological, and socio-economic impacts on an on-going basis. Soil moisture information is critical for weather and climate, runoff potential, flood control, soil erosion, prediction of crop yields and reservoir management. Soil moisture plays an important role in the ecological cycle of weather patterns and the production of precipitation. The USCRN is the only ground-based soil moisture network that spans the entire contiguous U.S. with a distribution of stations in nearly all the different topographical, vegetation, and climate environments of the country.

Nontraditional Uses of Climate Data

In addition to climate scientists, the USCRN user base covers a diverse set of sectors of the economy, including but not limited to: energy; insurance; agriculture; and natural resources and water managers. USCRN data has become increasingly useful for the calibration and validation of a number of satellite observations (e.g., surface infrared, surface air temperature, precipitation, and soil moisture). The use of these data have resulted in the creation of value-added satellite products, input into climate models used for long term prediction and attribution, and validation of climate model output. As an example, the Space Science and Engineering Center at the University of Wisconsin uses USCRN radiation

data in real-time to validate estimates of incoming solar radiation from the GOES satellite array. A more recent use of USCRN data has been in its application to the Health sector, where real-time USCRN data has assisted in identifying the location of a weather-related health crisis such as a fairly recent outbreak of Valley Fever in the Southwest U.S. Monitoring a changing climate is important for tracking the spread of disease potential for other diseases such as malaria and Hantavirus. Expanding the USCRN into Alaska has provided real-time precipitation data to NWS Weather Forecast Offices (WFO) that have aid in their warning and forecast functions for areas of Alaska with a low density of observations.

The U.S. Climate Reference Network provides our Nation with a climate-quality benchmark observing system that meets national commitments to monitor the climate of the United States for the next 50-100 years. Society and the economic benefit from the USCRN as its data are used in the decision support activities for a number of applications including weather warnings, water resource management, and reinsurance.

Where is the USCRN data?

NCEI hosts USCRN data, near real-time raw data observations from each station, reports, visualizations, and diagnostic tools: <https://www.ncdc.noaa.gov/crn/>

Long Term, Quality Controlled Data Sets:

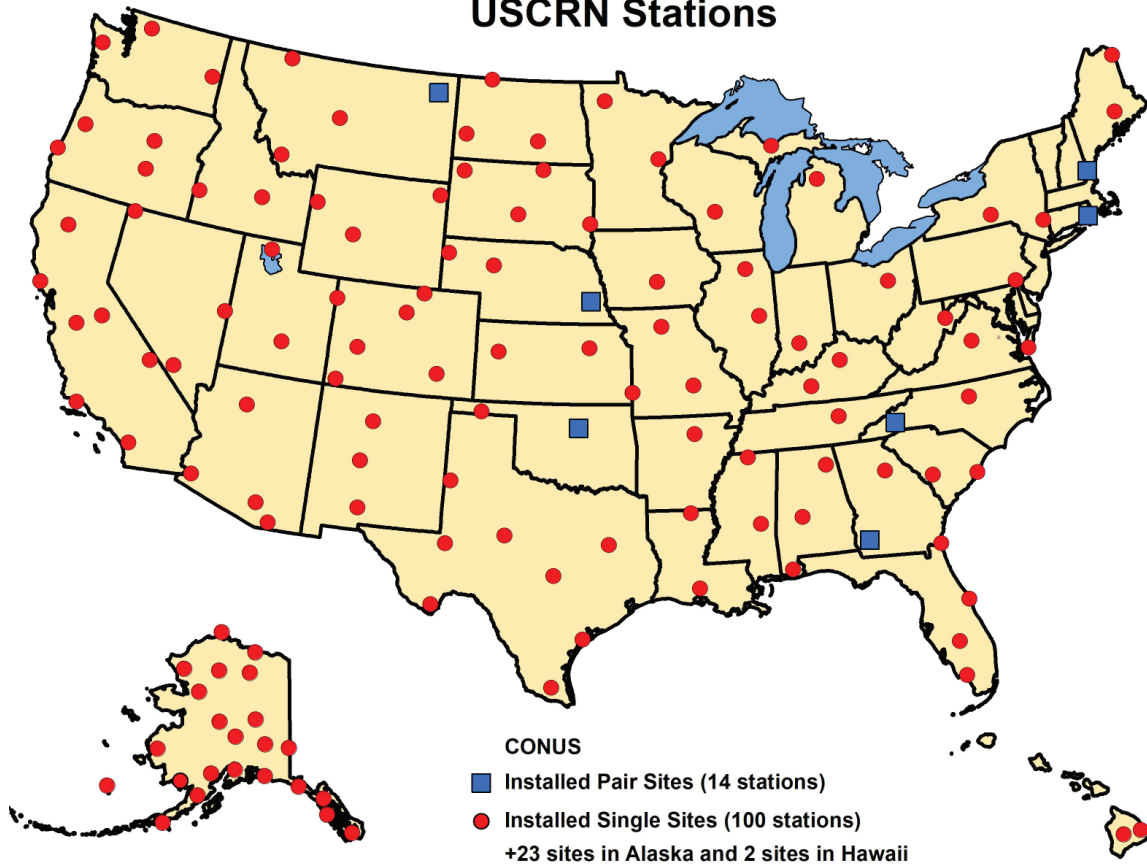
<https://www.ncdc.noaa.gov/crn/qcdatasets.html>

National Temperature Index: <https://www.ncdc.noaa.gov/temp-and-precip/national-temperature-index/>

[temp-and-precip/national-temperature-index/](https://www.ncdc.noaa.gov/temp-and-precip/national-temperature-index/)

Image Captions, Front left: Image of Mauna Kea Climate Reference Network station; front right: USCRN rain gauge; reverse; map of current U.S. Climate Reference Network Station. Source: NOAA, National Centers for Environmental Information

USCRN Stations



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