Air Resources Laboratory

Climate Research and Development

Providing Information and Tools for Understanding Climate Now and in the Future

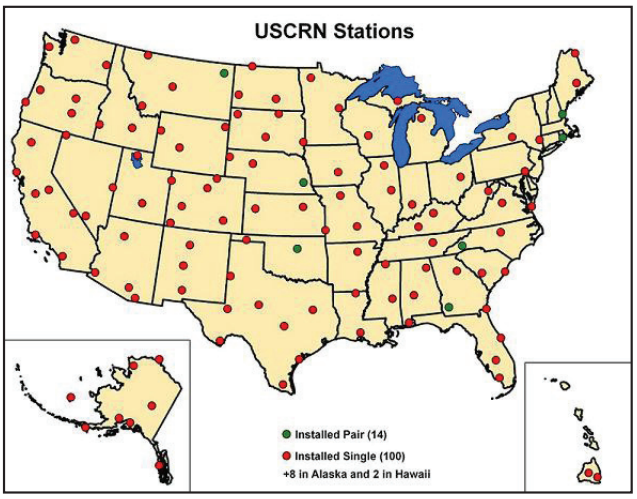
Weather and climate influence every sector of society. Changes in the climate can influence economic prosperity, human and environmental health, and national security. Citizens, communities, businesses, governments, and international organizations are demanding climate information and products to cope with climate variability and to adapt to and mitigate climate change. The Air Resources Laboratory (ARL) provides essential information and tools for decision-makers to understand how and why climate has changed and what changes might occur in the future. National and international climate scientists and decision-makers use ARL's information to understand climate trends and the need for mitigating and adapting to climate change.

What We Do

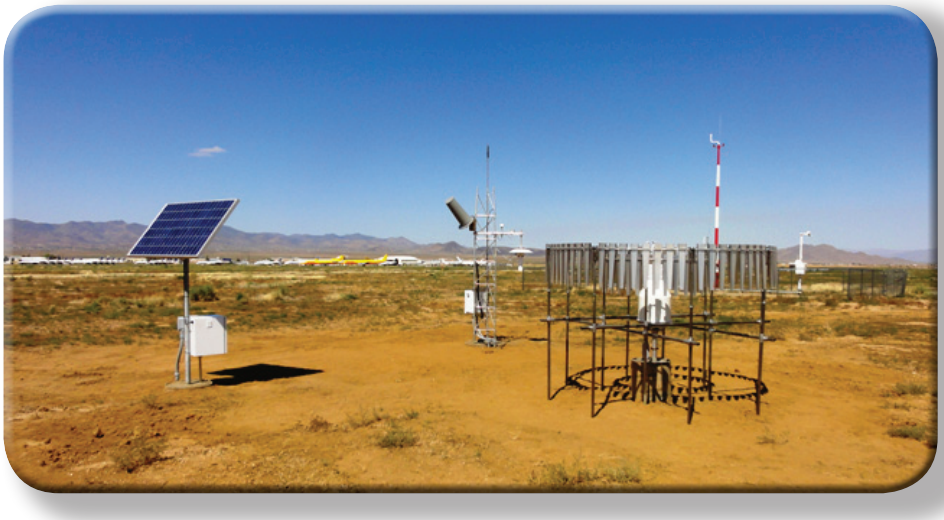
ARL's Climate Research and Development program concentrates on developing reference observing systems to meet climate requirements and analyzing long-term observational datasets to understand climate variability and change on diurnal to multi-decadal time scales. ARL also collaborates on the development and evaluation of modeling tools to assess regional climate impacts.

Climate Observations

Until recently, data for analysis of climate change were essentially compilations of archived weather observations that lacked long-term quality and continuity essential for clear-cut identification of climate trends. Changes in instruments, methods, station locations, and data processing procedures all introduce biases that could be mistaken for, or mask, real climate changes. Now, it is recognized that dedicated climate reference observing networks are needed both to monitor climate change *in situ* and to calibrate measurements collected from other observing systems, such as satellites, to make data more suitable for climate work.



Map of US Climate Reference Network (USCRN)



A Regional U.S. Climate Reference Network station at Kingman, AZ (Photo: NOAA)

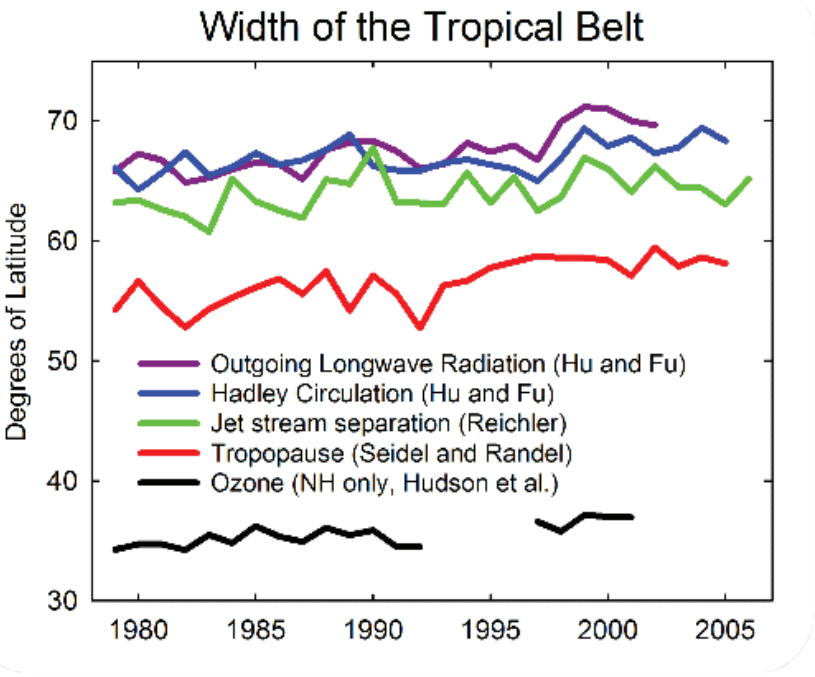
ARL contributes to two land-based climate reference networks, the U.S. Climate Reference Network and the Regional U.S. Climate Reference Network, through the design, establishment, operation, maintenance, and analysis of these observing systems. ARL also provides scientific leadership and research for the establishment of an upper air climate reference network, called the Global Climate Observing System Reference Upper-Air Network.

ARL's climate measurement expertise is also used to support the Surface Energy Budget Network. This network is a consolidation of several independent but closely related observing systems into a single, cost-effective and efficient network that seeks to explain why climate variables (e.g., air temperature, precipitation) have changed. Data are used to provide detailed examination of the land-surface feedbacks and related radiative processes that can drive regional climate. Data are also used to improve weather predictions.

A Surface Energy Budget station at Ft. Peck, MT (Photo: NOAA)

Climate Variability and Change Analysis

ARL analyzes daily to multi-decadal atmospheric variations measured by many types of climate observation systems, with a special emphasis on radiosonde (weather balloon) data. ARL's radiosonde research has identified important data problems and produced new, improved datasets by removing artificial, non-physical signals from weather observations. ARL uses these and other datasets to identify and characterize climate variability and trends. Through collaboration with climate modeling groups, ARL's datasets are used to evaluate global climate models.



Estimates of the width of the tropical belt from multiple techniques. All show widening over several decades, which is occurring faster than has been predicted by climate models. Such changes could significantly affect weather patterns. (Nature Geoscience, Seidel et al., 2008)

Assessment of Regional Climate Impacts

ARL supports and coordinates development of the climate extension of the Weather Research and Forecasting model so it can be used to study regional climate issues. Applications of the model include examining water resources and extreme weather events in potential future climates.

Two examples of reports with significant ARL climate scientists' contribution

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Climate Reference Network
http://www.atdd.noaa.gov
Climate Variability & Change Analysis
www.arl.noaa.gov/CVCAnalysis.php
Air Resources Laboratory
www.arl.noaa.gov

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