

**Top.** PSD has conducted extensive weather and climate research in the fast-changing Arctic. In 2008, PSD scientists deployed a suite of instruments on the Swedish icebreaker *Oden*, as part of an international effort to better understand cloud formation in the region. Photo courtesy of Allan Miller, NSF.

**Middle.** PSD scientists are working with meteorologists and others to improve observation and forecasting of severe winter storms that cause flooding across California. NOAA image.

**Bottom.** PSD hosts the Western Water Assessment, a NOAA RISA (Regional Integrated Sciences and Assessment) dedicated to helping Western water managers and policy makers better understand the effects of climate change and weather variability. NOAA photo.

## What Does The Physical Sciences Division Do For The Nation?

The Physical Sciences Division (PSD) of the Earth System Research Laboratory (ESRL) analyzes and diagnoses physical processes that influence weather and climate, to better understand and make predictions on global-to-local scales. PSD's research addresses questions of short- and long-term societal and policy relevance, and our research supports a suite of information and forecast products ranging from short-term flood forecasts to long-term climate projections.

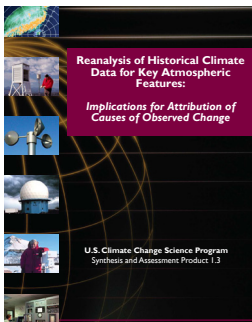
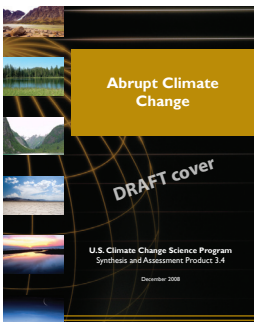
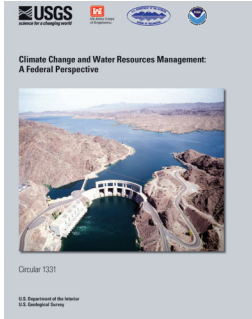
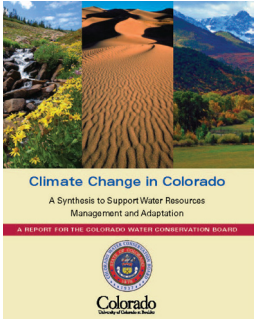
## PSD Scientific Goals

PSD helps NOAA meet its mission goals in weather and climate by:

- Providing observation, analysis, and diagnosis of processes in weather and climate to better understand the physics of the atmosphere, ocean, cryosphere, and land, and to improve weather and climate predictions.
- Improving knowledge of and prediction of high-impact climate phenomena such as the El Niño-Southern Oscillation (ENSO).
- Improving climate variability observations and analysis through surface and satellite observations and their incorporation into climate models.
- Identifying patterns of climate variability on decadal and longer time scales, including natural and human-induced change.
- Developing new climate information to benefit society and mitigate potential adverse impacts, such as the effects of climate variability and weather on water resources in the western U.S.
- Hosting the Western Water Assessment and National Integrated Drought Information System to strengthen the link between research and decision-makers who use weather and climate information.

## Recent Accomplishments

- Led creation of NOAA's Climate Attribution Team, which diagnoses the principle causes of or physical explanations for observed climate conditions, in the context of climate variability and long-term change.
- Improved NOAA seasonal climate forecasts and developed prototypes for new climate forecast products. NOAA has further developed and disseminated these new climate forecast products, providing a basis for expanded NOAA climate services.
- Improved several physical parameterizations in NOAA weather and climate models to reduce uncertainty in climate predictions and improve short-term severe weather forecasts.
- Improved climate predictions on time scales from a few weeks to a season, allowing for mitigation of the impacts of floods over the West Coast and effects of Eastern Pacific and Gulf of Mexico tropical cyclones.
- Improved access to climate information products, enabling a broader range of customers to easily use NOAA observational and model data. PSD's web-based tools have also helped NOAA develop expanded, near-real-time climate diagnostic capabilities.



**Top.** PSD staff lead NOAA's Climate Attribution Team, to quickly diagnose the causes of high-impact weather events, such as the lowa floods of 2008. Photo courtesy of the U.S. Geological Survey.

**Below.** PSD recently wrote an assessment of Climate Change and water resources for the state of Colorado, co-authored a federal report on Climate Change and Water Resources Management, and co-authored two national reports for the U.S. Climate Change Science Program. CCSP images.

- The Hydrometeorology Test bed (HMT) program is developing new observing and modeling capabilities, which will improve NOAA's weather and water forecasts and warnings. HMT findings in California have resulted in a strong partnership with state emergency managers, and a new project to explore the impact of climate change and aerosols (atmospheric particles) on precipitation.
- Worked on remote sensing technologies for Unmanned Aircraft Systems to improve forecasts and warnings of natural disasters, such as West Coast winter flash floods and dangerous debris flows.

## What's Next For PSD?

During the next five to ten years, PSD will continue to support NOAA by:

- Improving understanding of the physical-process links between short-term climate variations and long-term trends.
- Establishing additional hydrometeorology test beds in other at-risk regions of the United States.
- Improving observation and understanding of physical processes in polar regions, especially as related to impact on the mid-latitudes and climate change.
- Improving physical understanding of the causes of regional climate change.
- Expanding NOAA climate services by developing, evaluating, and disseminating a broad range of experimental climate products.
- Developing climate information to address critical regional issues such as water management in the western United States.
- Contributing to improvements to the Ocean Observing System.
- Helping NOAA develop observations, forecasts, and science needed to accelerate the expansion of renewable energy in the United States while protecting ecosystems from unintended harm.

## Research Partnerships

PSD works collaboratively with the other Earth System Research Laboratory Divisions, such as in the Unmanned Aircraft Systems project. PSD also works extensively with the NOAA Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado at Boulder, which facilitates collaborations among scientists at the university, NOAA, and other institutions. Additional partners include other NOAA Research laboratories, other NOAA line offices and programs, the International Research Institute for Climate Prediction, Scripps Institution of Oceanography, state agencies, and other federal agencies, including the Bureau of Reclamation.



[www.esrl.noaa.gov/psd](http://www.esrl.noaa.gov/psd)

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