Earth System Research Laboratory

Global Systems Division

Making forecasts better www.esrl.noaa.gov/gsd/

What does ESRL's Global Systems Division do for the nation?

The Global Systems Division (GSD), part of NOAA's Earth System Research Laboratory (ESRL), leads the design, development, testing, and delivery of accurate and reliable weather forecast system solutions.

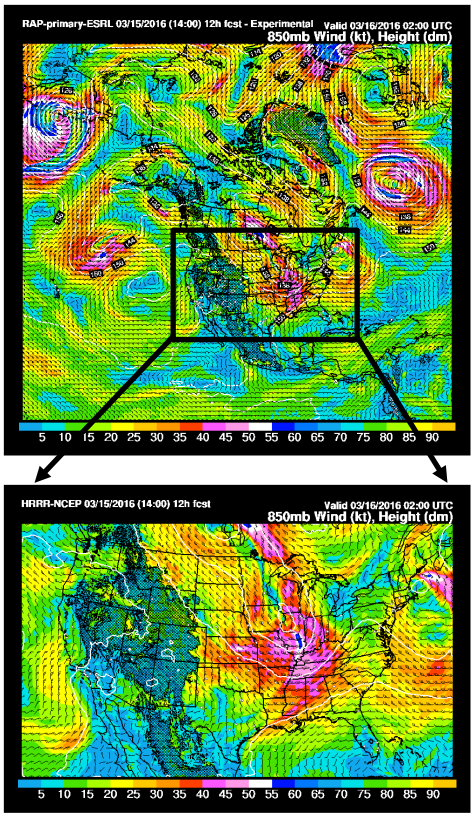
Research highlights:

Global to local modeling: GSD's weather forecast models support the NWS, FAA, and transportation and renewable energy industries.

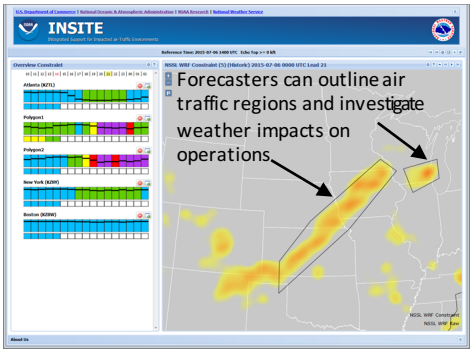
- GSD developed both the Rapid Refresh (RAP) and the High Resolution Rapid Refresh (HRRR) weather prediction models now used in NOAA National Weather Service (NWS) operations. These models provide 15-minute snapshot forecasts of flash floods, winter weather, and thunderstorms that could produce a tornado. The RAP and HRRR are the first storm-scale models to give forecasters and decision-makers fast and local weather guidance. Research to improve these models is ongoing.
- GSD is testing a prototype "HRRRE" in the VORTEX-Southeast project. HRRRE merges real-time radar, aircraft, balloon, and other weather data to bring small-scale storm structures into focus.
- GSD's modeling team received a Department of Commerce Gold Medal, and the prestigious Colorado Governor's Award for High Impact Research for the development and implementation of the HRRR.

Evaluation and decision support: GSD develops, tests, and evaluates forecast and decision support systems to give forecasters, emergency managers, and the public timely and accurate hazard information.

- The cornerstone of each NWS Forecast Office is the Advanced Weather Interactive Processing System (AWIPS) originally developed by GSD. GSD continues to work with the NWS and the private sector to improve AWIPS, and recently delivered a new Tropical Forecast package.
- GSD plays a major role in the Hazard Services project to transform leading edge science and legacy tools into actionable information for decision-makers. Hazard Services can be customized to handle different types of severe weather. Forecasters will practice with an experimental Hazard Services this spring in the NOAA Hazardous Weather Testbed as part of the Forecasting A Continuum of Environmental Threats (FACETs) project.
- The prototype **In**tegrated **S**upport for **I**mpacted Air-**T**raffic **E**nvironments (INSITE) tool uses weather forecasts to identify hazardous weather that could impact air traffic routes. NWS forecasters can use INSITE to inform FAA Air Traffic managers about potential weather hazards so they can re-route air traffic. INSITE will be transitioned to operations in 2017.



The RAP (top) predicts weather on an 8-mile grid, and is the foundation for the higher-resolution HRRR (middle) that predicts weather on a 1.8 mile grid.



INSITE helps identify weather that could constrain aviation operations so traffic managers can efficiently route traffic . Source: NOAA GSD

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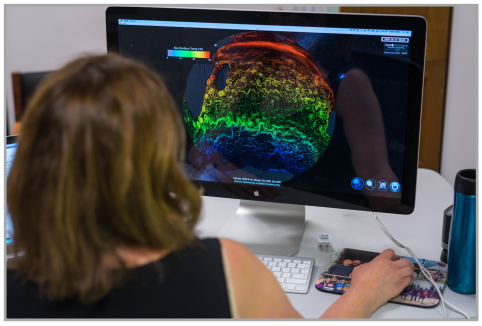
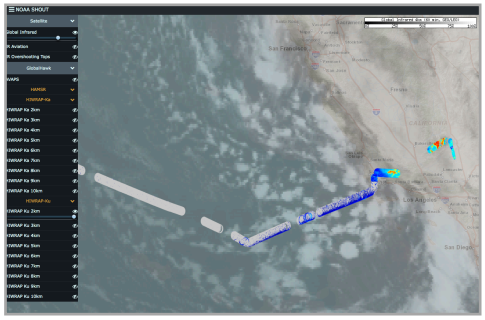
More GSD research highlights:

Advanced technology and outreach: GSD identifies, investigates, and develops high-performance computing methods and innovative visualization systems.

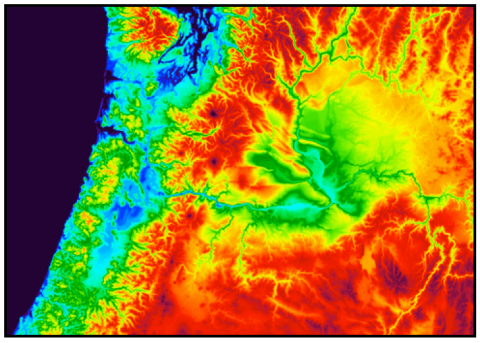
- Last fall GSD released Science On a Sphere Explorer (SOSx™), a downloadable flat-screen version of the six-foot diameter Earth science display system Science On a Sphere ®. This revolutionary software makes SOS technology and datasets accessible to any classroom or museum with a computer.
- GSD leads the large-scale usage of NOAA's new high-performance computer cluster to build next-generation weather forecast models that will better predict weather phenomena such as hurricanes and El Niño.
- NOAA's El Niño Rapid Response team used GSD's NOAA Earth Information System to view data collected by the Global Hawk Unmanned Aircraft System.



SOSx™ flat screen software makes Earth system data accessible. Source: NOAA GSD



NOAA Earth Information System display of Global Hawk data for the El Niño Rapid Response project. Source: NOAA GSD



The 750m super-high resolution HRRR "nest" for the Wind Forecast Improvement Project-2 region. Source: NOAA GSD

What's next for GSD?

- **Next-Generation Global Prediction System (NGGPS)** is a research-to-operations initiative to build the foundation for the next NWS global forecast guidance system. Working with the NWS, GSD supports NGGPS with expertise in physics, data assimilation, modeling, and verification.
- **Wind Forecast Improvement Project-2 (WFIP-2)** researchers deployed instruments in Oregon's Columbia River Gorge so real-time data can be ingested into an experimental HRRR. WFIP-1 in the Great Plains used these extra observations, in combination with model physics, to make turbine height wind forecasts 15% more accurate.
- Through **Observing System Experiments (OSEs) and Observing System Simulation Experiments (OSSEs),** GSD helps NOAA cost-effectively identify and prioritize proposed observing systems to improve the skill of NOAA's weather prediction models.

Research partnerships

GSD has research partnerships with NOAA's Cooperative Institute for Research in Environmental Sciences (CIRES) at University of Colorado and the Cooperative Institute for Research in the Atmosphere (CIRA) at Colorado State University. Other partners include the NWS, FAA, Department of the Interior, Department of Energy, National Science Foundation, the National Center for Atmospheric Research (NCAR), the private sector, and other academic and research institutions worldwide.

Budget and Staff

The Fiscal Year (FY) 2016 President's budget request for GSD through NOAA Oceanic and Atmospheric Research (OAR) is $13.7M. The FY 2015 enacted funding for GSD is $10.9M and the FY 2014 enacted funding was $10.8M. GSD is located in Boulder, CO and employs 184 people.

Did You Know?

MADIS, HRRR, RAP all developed by GSD, provide the foundation data for most smart-phone weather apps in use today!

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