The NOAA Earth System Research Laboratory Global Systems Division (GSD) does the research to provide the National Weather Service (NWS) and the public with rapidly-updating environmental models, state-of-the-art decision support tools, innovative visualization systems, and high-performance computing technology to support commerce and a weather-ready nation.

About GSD

GSD is part of NOAA’s Earth System Research Laboratory and is located in Boulder, Colorado.

GSD has four branches:
• Model Development
• Assimilation Development
• Evaluation and Decision Support
• Advanced Technology and Outreach

GSD strategic partnerships
• University of Colorado-Boulder’s Cooperative Institute for Research in Environmental Sciences
• Colorado State University’s Cooperative Institute for Research in the Atmosphere.

GSD research partners:
• National Weather Service
• Federal Aviation Administration
• Department of the Interior
• Department of Energy
• National Science Foundation
• National Center for Atmospheric Research
• Private sector
• Other academic and research institutions worldwide.

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Environmental modeling

GSD develops the experimental high-impact neighborhood-scale to global-scale weather prediction models that will be used in NWS forecast operations.

GSD’s environmental modeling systems predict weather parameters such as:
• Energy in the atmosphere for severe weather.
• Visibility and ceilings for the aviation industry.
• Wind turbine height wind forecasts for the energy industry.
• Wildfire smoke plumes to support air quality advisories.

GSD also looks at ways to use satellite, radar, and aircraft data to make these forecasts more accurate.

Recent GSD successes are the first models to give forecasters and decision-makers fast high-impact weather guidance on a neighborhood scale. These weather models are considered “game changers” by NWS operations and are upgraded each year with new science advances.

GSD develops the high-performance software infrastructure required to link models of the ocean, land, and atmosphere.

GSD’s expertise in physics, data assimilation, modeling, and verification helps build the foundation for the future state-of-the-art NWS extended global forecasts.

One of several wind farms in the Antelope Valley of California.
Technology to manage and display data

GSD pioneers innovative ways to maximize computing power, manage big weather data, and educate the public.

GSD leads the large-scale use of NOAA’s high-performance computer cluster to build the next generation weather forecast models that will better predict weather phenomena such as tornado-producing thunderstorms. GSD-developed techniques have already improved the speed of NOAA’s new global model by 25%.

A weather data management system developed by GSD automatically ingests, quality controls, and distributes 3 million weather observations every hour. The data is used to help improve climate and weather models, and is used in weather applications and products around the world.

GSD developed Science on a Sphere® (SOS) and SOS Explorer™ (SOSx) to help explain complex environmental processes to the public in an intuitive and captivating way. SOS is a six-foot in diameter animated globe, and SOSx is the flat-screen version. These systems are used to display more than 500 Earth science datasets and can be seen at more than 145 educational sites around the world.

Tools to support forecast operations

GSD develops state-of-the-art visualization and evaluation systems to support the weather decision-making process.

GSD created the cornerstone of each NWS Forecast Office, the Advanced Weather Interactive Processing System (AWIPS). AWIPS integrates all weather information into one place and helps NWS forecasters efficiently view and use large amounts of weather data. GSD continues to work with the NWS and the private sector to advance this system as weather observations and model capabilities increase.

GSD is working on an experimental high-impact weather decision support application called “Hazard Services” that streamlines NWS watch, warning, and advisory-related services into one interface. It can also be customized for each office, region, or type of weather, and is being tested in the NOAA Hazardous Weather Testbed.

GSD developed the INtegrated Support for Impacted air-Traffic Environments (INSITE), a tool that incorporates weather observations, forecast products and near real-time air traffic. The NWS forecasters can use INSITE to report potential weather impacts to airspace so FAA Air Traffic Managers can re-route aircraft inflight.

GSD researchers talk with a NWS Denver/Boulder forecaster about GSD’s experimental HRRR model forecasts in development.

An exhibit version of Science on a Sphere Explorer™ was recently released to the public. Users can control the globe using a mouse or an iPad to explore a wide variety of datasets.