

# Impacts

ESRL Global Systems Division



*GSD research today for a better forecast tomorrow*

7/10/17

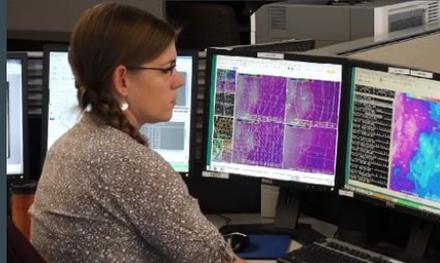


# Global Systems Division

Research today for a better forecast tomorrow



GSD research supports the U.S. economy with increasingly accurate weather data and forecasts to protect lives, property, and to promote economic prosperity.



GSD-developed technology helps the National Weather Service and emergency managers respond to weather threats quickly.



GSD research improves weather data, forecasts, and computing techniques used by industry to make operations more safe and efficient.



GSD researches and hosts efficient high-performance computing to support NOAA's mission.

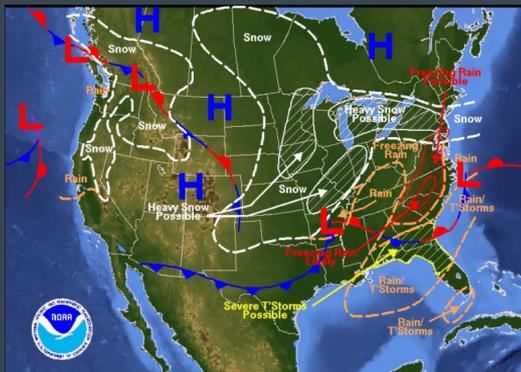


GSD technology encourages learning and discovery for a science-literate society.



# Economy

GSD research supports the U.S. economy with increasingly accurate weather data and forecasts to protect lives, property, and promote economic prosperity.



## Public

GSD develops weather prediction modeling systems that improve weather services and provide a net benefit of \$26.4B to the American public each year.

Houston	12:09P	9	ON TIME
Houston (Hobby)	12:10P	16	ON TIME
Houston	12:10P	16	ON TIME
Atlanta	12:35P	20	ON TIME
Atlanta	1:00P	22	DELAYED
Las Vegas	1:00P	1	ON TIME
Denver	1:00P	14	ON TIME
San Diego	1:00P	14	ON TIME
Dallas (Love)	1:05P	16	ON TIME
Dallas (Love)	1:05P	16	ON TIME
Houston	1:29P	3	ON TIME
Denver	1:35P	5	ON TIME
Los Angeles	1:40P	6	ON TIME
St. Louis	1:55P	14	ON TIME
St. Louis	1:55P	24	ON TIME

## Aviation

GSD weather models help reduce weather aviation flight delays that cost air travelers billions of dollars each year.



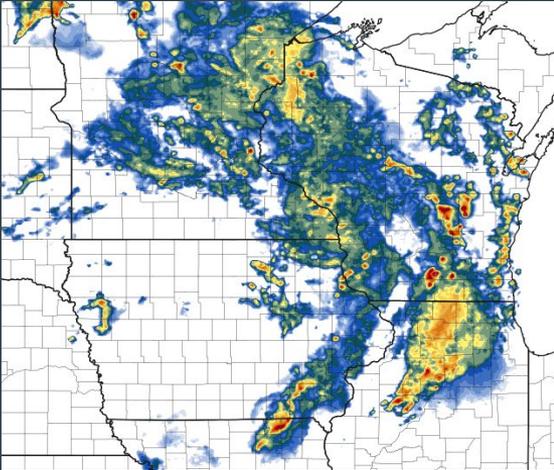
## Energy

GSD's continual advancement of forecast skill in weather models improves the stability of our electric grid.



# Industry

GSD research improves weather data, forecasts, and computing techniques used by industry, decision-makers, and stakeholders to make operations more safe and efficient.



The GSD-developed HRRR model is the only operational hourly-updated forecast in the world that predicts weather hazards over neighborhoods.



The HRRR weather model is the largest contributor to the FAA's NextGen Weather system that supports strategic traffic flow management.

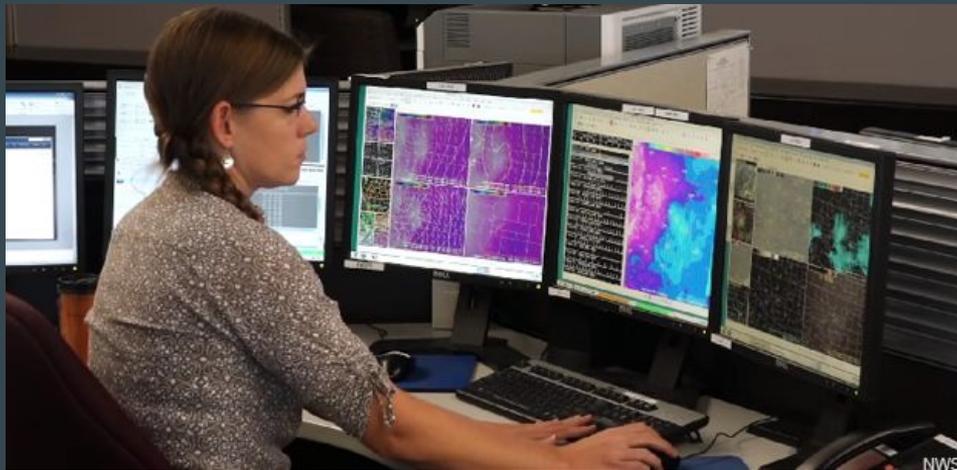


Increasingly accurate HRRR wind and precipitation forecasts are essential for agriculture production and managing wildfires.



# Public Safety

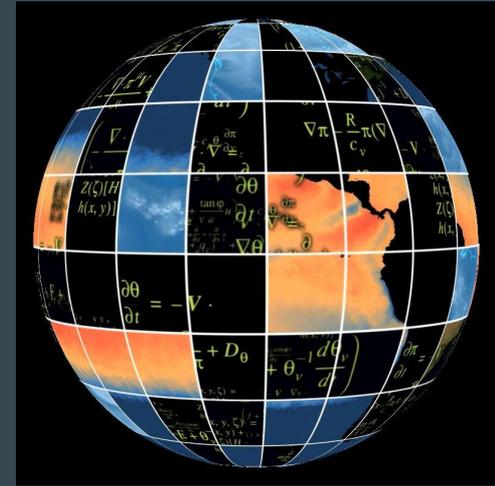
GSD-developed technology helps the National Weather Service and emergency managers respond to weather threats quickly.



- 94% of impact-based decision support for weather events is delivered by the NWS
- GSD-developed data delivery and decision support systems are the cornerstone of operations in all 122 NWS forecast offices

# High Performance Computing (HPC)

GSD researches and hosts efficient high-performance computing to support NOAA's mission.



- HPC is critical for data assimilation and numerical weather prediction research
- The HPC industry directly benefits from NOAA/GSD technology transfer of ideas

Data assimilation and  
Numerical Weather Prediction

# Giving back

GSD technology encourages learning and discovery for a science-literate society.



- 150 Science on a Sphere® sites around the world
- 37 million annual viewers
- Hundreds of datasets to illustrate science including flood impacts, tsunamis, El Nino
- 82% of visitors stated that seeing info on the sphere changed how they understood the information

# Denver Blizzard - March 2016

Due, in part, to GSD's research, the public had ample warning by the time schools closed and airlines canceled flights in the face of the spring 2016 Denver blizzard.

NWS meteorologists had been watching the evolving snowstorm for days as the GSD-developed weather data and analysis system had been steadily collecting 3 million weather observations each hour. The GSD-developed HRRR short-term high-impact weather model showed early signs that it could be a big event. Every hour as the HRRR weather model produced another forecast based on new data, the forecasters saw something they didn't like.

What happened? The NWS upgraded the winter weather advisories in the Denver Metro area to winter storm and blizzard warnings that alerted the public from being exposed to dangerous weather.

**DIA closed due to blizzard conditions**

**CLOSINGS ALERT 577 closing alerts**

## GSD's impact:

GSD developed the tools and weather models NWS forecasters used to monitor the growing storm and issue life-saving blizzard warnings.



## Impacts on the public and the economy:

- CDOT - chains required in the Denver metro area for the first time
- Thousands of miles of roadways became hazardous
- 2.8 million people were affected in Denver
- 1,000 flights were canceled
- 190,000 customers were without power
- Businesses, non-essential government were shut-down



# Houston Flooding - April 17-18, 2016

NWS forecasters discussed a heavy rainfall threat at least three days in advance of the "Tax Day Flood" of April, 2016, but it was unclear how much precipitation would fall and where the maximum amount would be.

On April 17, the GSD-developed HRRR weather model predicted a group of almost stationary thunderstorms would drop 15-20 inches of rain in a 12-hour period northwest of Houston, Texas. This was an unprecedented amount of rainfall for a forecast that signaled a potentially historic flooding event.

Meteorologists working the night shift at the NWS Weather Prediction Center in College Park, MD saw the HRRR rainfall forecast, and at 10:49 p.m. warned of extreme rainfall totals and life-threatening flash flooding.

What happened? On April 18 at 1:45 a.m., the NWS Houston/Galveston declared a rare "flash flood emergency." Officials closed schools, businesses, and government offices to keep residents off the roads.

GSD continuously pushes these high-impact weather models to the edge of computing power and scientific understanding, and transitions advances into the operational version used by the NOAA NWS about once each year.

## Impacts on the public and the economy:

- Largest flood event since tropical storm Allison
- 21,000 square miles covered in flash flood warnings
- 650 flight cancellations, 1100 delays
- 1200 high-water rescues
- Houston city offices, schools closed

## GSD's impact:

GSD's research improves forecast models and transitions the results to operations.



*Photo courtesy of Texas Military Department*