NOAA Earth System Research Laboratory
Global Systems Division

Impacts

Industry

GSD research improves weather data, forecasts, and computing techniques used by industry.

Computing: GSD develops high-performance computing methods to increase compute power at minimum cost.
- GSD has improved the speed of NOAA’s new global model by 25%.

Agriculture: Both short- and long-term forecasts are essential in agriculture production.
- HRRR predictions support better localized precipitation forecasts.

Aviation: The FAA requires airlines to carry enough fuel for an aircraft to fly to an alternate destination if weather conditions fall below certain thresholds.
- The HRRR model is the largest contributor to the FAA’s NextGen Weather system that supports strategic traffic flow management.

Many household decisions depend on weather forecasts and weather data.
- GSD developed the weather data collection system that benefits all users of smart-phone weather apps.

Economy

GSD research supports the U.S. economy with increasingly accurate weather data and forecasts.

Public: The American public collectively receives $31.5B in benefits from forecasts each year.
- “GSD’s development of foundational and pragmatic state-of-the-science technologies to improve predictions of weather and its impacts on society has been one of the nation’s true success stories that is significantly under-appreciated given the enormous value it returns to the nation.” - The Weather Company

Aviation: 69% of aviation flight delays are caused by weather costing air travelers billions of dollars each year.
- “The most recent transition of the High-Resolution Rapid Refresh (HRRR) model to NWS operations improves aviation forecasts at air terminals and aloft, reducing air traffic delays which cost the airline industry billions of dollars annually.” - FAA

Energy: Cost estimates from storm-related power outages to the U.S. economy are between $20B and $55B annually.
- “NOAA’s continual advancement of forecast skill improves the stability of our electric grid.” - Vaisala Corporation

Public Safety

GSD-developed technology supports the NOAA National Weather Service (NWS) and public situational awareness.

94% of impact-based weather decision support is delivered by the NWS.
- GSD-developed data delivery and decision support systems are the cornerstone of operations in all 122 NWS forecast offices.
- The GSD-developed HRRR forecast model is the only hourly-updated forecast in the world that is proven to predict weather hazards for individual neighborhoods.

Giving back

GSD-developed technology is used world-wide to educate the public about science.

150 Science on a Sphere® systems have been installed around the world.
- 37 million people see Science on a Sphere® each year.
- 82% of visitors stated that seeing datasets on the sphere changed how they understood information.
- A flat-screen version called SOS Explorer™ makes Science on a Sphere® more accessible, portable, and interactive.
Denver Blizzard - March 2016
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 models 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.

Impacts on the public and the economy
• Colorado Department of Transportation implemented timely traction laws in the Denver metro area
• 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

GSD’s impact
• Weather data were collected and quality-controlled by GSD-developed system.
• Data were analyzed, delivered, and shared through the GSD-developed weather forecasting analysis and display system.
• The GSD-developed model alerted forecasters who then upgraded the Denver metro area to winter storm and blizzard warnings.

Houston Flooding - April 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 where the maximum precipitation would fall.

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 were covered in flash flood warnings
• 650 flights were canceled, 1100 were delayed
• Emergency responders conducted 1200 high-water rescues
• Houston city offices, schools were closed

GSD’S Impact
• GSD HRRR model accurately predicted 15-20” of rainfall in a 12-hour period
• This was an unprecedented amount forecast by a model
• Based on the GSD-developed model, the NWS Weather Prediction Center warned of extreme rainfall totals and life-threatening flash flooding, and the local NWS issued flash flood emergencies.