GLOBAL SYSTEMS LABORATORY

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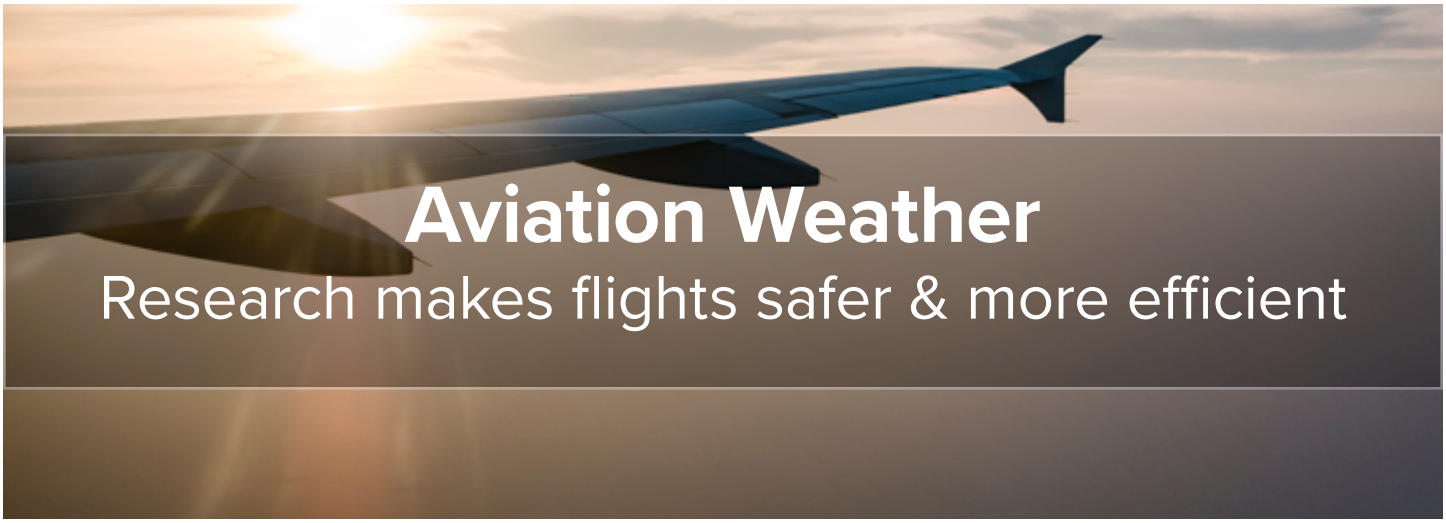

Aviation Weather

Research makes flights safer & more efficient

69% of flight delays are caused by weather, costing passengers and the aviation industry about **$30B** each year.[1]

These delays are often the result of unruly—and sometimes difficult to predict—weather. Weather forecasts are crucial for aviation operations–from predicting snow on the runways to storm conditions when in the air. NOAA GSL develops high-resolution models used daily by the Federal Aviation Administration (FAA) and the aviation industry to safely route aircraft around hazardous weather in the air and at terminals. The aviation industry also benefits from GSL research that advances the understanding and use of weather information through impact-based forecast assessments.

GSL research targets real-time information delivery to benefit decision-making in response to high-impact weather events.

Helps air traffic operate more efficiently

Helps the FAA decide which aviation products to fund

Helps minimize delays for passengers

Solutions

HIGH-RESOLUTION WEATHER MODELS

GSL developed NOAA's high-resolution hourly-updating models that predict weather over the U.S. The Rapid Refresh (RAP) predicts weather over the U.S. on a 13km grid, and is the parent model for the High-Resolution Rapid Refresh (HRRR) weather model that covers the U.S. with a 3km grid. RAP is the parent model of the High-Resolution Rapid Refresh weather model that covers the U.S. with a 3km grid.

NOAA models can predict ceiling heights, visibility, and icing conditions, all critical for aircraft operations. These models are also the base model for aviation hazard products developed by our partners:

1. National Center for Atmospheric Research:
   - **Graphical Turbulence Guidance** - provides contours of turbulence potential based on NWP model forecasts out to 12 hours lead time. The GTG system is part of the NOAA National Centers for Environmental Prediction operational suite
   - **Current Icing Product (CIP)** - combines sensor and Numerical Weather Prediction model output to provide an hourly, three-dimensional diagnosis of the icing environment.
   - **Forecast Icing Product (FIP)** - is similar to CIP except that it is strictly a forecast and does not include the sensor inputs.

- CIP/FIP outputs include calibrated icing probability, icing severity, and potential for supercooled large drops - includes freezing drizzle and freezing rain.

2. Massachusetts Institute of Technology Lincoln Labs:

- **Corridor Integrated Weather System (CIWS)** - an automated system used by the FAA that uses model data to support convective weather impact mitigation for congested airspace.
- **Consolidated Storm Prediction for Aviation (CoSPA)** - a forecast product that ingests the HRRR

Assessments

The FAA uses GSL assessments to make important safety and efficiency decisions. GSL provides third-party, independent evaluations of FAA-funded weather products to inform research to operations decisions. These assessments have informed decisions such as the selection of the Localized Aviation MOS Product (LAMP) to provide ceil-ing and visibility data for the Helicopter Medical Emergency Services (HEMS) Tool, and delaying the implementation of the Offshore Precipitation Capability (OPC) to improve product performance.

(1) https://www.faa.gov/nextgen/programs/weather/faq

CLOSER LOOK

Forecast Verification for Denver International Airport

A recent study, led by NOAA GSL scientists, investigated the skill of four meteorological models in predicting snowfall for decision-making at Denver International Airport.

Aviation managers are often faced with many forecasting options to help make decisions. In winter, these forecasts are used to decide which snow alert level to declare and when to declare it. Snow alerts have significant impacts for airport operations, and for the customers who rely on them.

A recent study, led by NOAA GSL scientists, investigated the skill of four meteorological models in predicting snowfall for decision making at Denver International Airport.

METHODS

The study compared the accuracy of forecasts from the four models with the Meteorological Aerodome Reports (METARs). The models included were:

- Short Range Ensemble Forecast (SREF)
- High Resolution Rapid Refresh Ensemble (HRRRE)
- National Blend of Models (NBM)
- Probabilistic Snow Accumulation Forecast (PSA)

The amount of snow and start and end times of snowfall were tested from November 2018 to April 2019 as the first season, and December 2019 the April 2020 as the second season.

RESULTS AND CONCLUSIONS

Results found that NBM had the most accurate predictions of snowfall timing. NBM also predicted fewer events and rarely produced high probabilities, unlike the other systems. The missed events and false alarms with HRRR and SREF were slightly larger than with NBM and PSA. All products over-forecasted snow to some extent.

IMPACTS AND WHAT'S NEXT

The results of the study have significant implications for both airport personnel and the Boulder National Weather Service Forecast Office. Operationally relevant verification results on timing and severity of snowfall is key to minimizing negative impacts at the airport. Accurate forecasts ensure customer and employee safety, airspace efficiency, and reduced costs. The timing of snowfall has significant implications for scheduling staff and resources, as well is in preparing for snow removal from runways.

The study can be quite helpful for aviation decision makers as they decide which forecast models to use. Next steps in the study include repeating the study with higher intensity snowfall events. Studies that explore this verification are crucial in making infrastructure more resilient to a changing climate.

Read the full storymap at https://storymaps.arcgis.com/stories/080a596c723c4a17ad97f6d45227baf1