AVIATION GUIDANCE FOR

CONVECTIVE WEATHER

Mitigating Hazards

Scientists and engineers in NCAR's Aviation Applications Program have a long history of conducting research on storm hazards affecting aviation and, in turn, developing technologies that help to detect these hazards. NCAR has developed systems to mitigate the threat of wind shear and lighting at airports. For domestic flight planning, NCAR teamed with other national labs and agencies to develop a storm prediction system which will be part of the NextGen Weather Processor (NWP). For international flight planning, NCAR is developing the next generation of probabilistic convective weather hazard guidance products. The goal of these efforts has been to improve flight safety and efficiency for the betterment of society.

AIRPORT TERMINAL R&D

For more than two decades, the Federal Aviation Administration (FAA) has funded research and development efforts aimed at improving short-term forecasting of storm hazards affecting aviation. Since 1983, NCAR has partnered with the FAA and other labs to develop and refine a low-level wind shear alert system (LLWAS) which detects wind shear and microburst on airport grounds. Today, NCAR's wind shear experts provide consultancy services to public and private organizations and governments around the world to help them understand the wind shear hazards impacting their local airport and to provide guidance on which wind shear detection system solutions may work best for a given airport's needs.

Benefits & Impacts

- 0-8-hour forecasts of convective hazards
- Proven life-saving wind shear alerts
- Lightning alerts for airport personnel
- Easily interpreted alerts for oceanic turbulence

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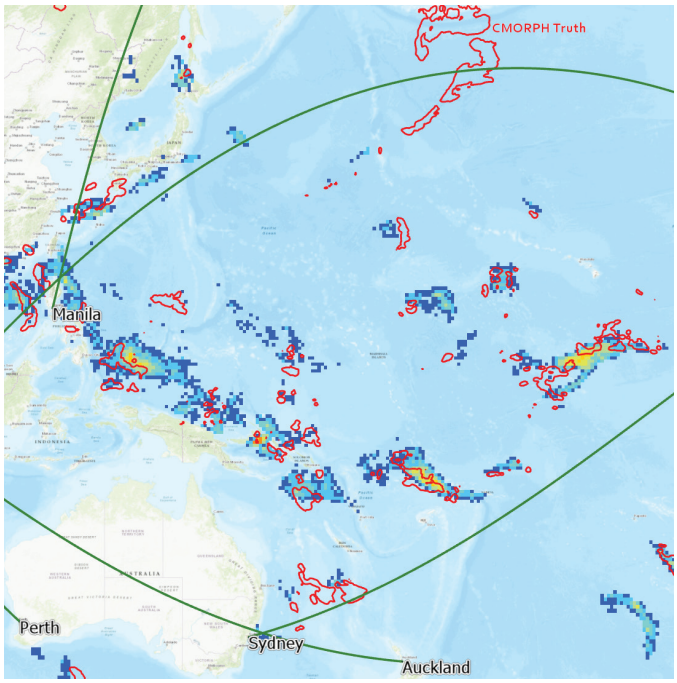
Lightning in terminal areas is also a significant hazard to airport personnel. NCAR recently completed a study that quantified the safety risk experienced by personnel working outdoors at airports when lightning is nearby. Using AvMet's Dynamic Airspace Routing Tool (DART), analyses suggested that lightning-induced ramp closures at a single airport can cause ripple effects across the National Airspace that result in significant delays. The study concluded that the optimal rule set that takes into account risk to airline employees and delays at major airport is to pull crews in if lightning is occurring within 5mile/10min. This work also indicated that airports need better lightning guidance that uses better sensors and takes into account evolving storm conditions and associated risks.

STORM PREDICTION FOR STRATEGIC PLANNING

Convective weather forecasts are used daily to plan air traffic flow structures both domestically and around the world. NCAR developed a convective weather forecast system that predicts storm intensity and echo top heights out to 8 hours into the future. An advanced blending algorithm was developed by NCAR that merges extrapolation forecasts with output from the High-Resolution Rapid Refresh (HRRR) model to produce convective weather forecasts that update every 5 min taking into account the latest weather radar information. This system is currently undergoing technology transfer to the FAA and will be a key component of the NextGen Weather Processor (NWP).

Convective storms over oceanic regions pose a safety threat to airlines mainly due to the potential for unexpected convectively induced turbulence which can occur above and/or adjacent to developing and existing convective storms. While global models continue to improve and become higher resolution, predicting the exact location and timing of convective storms will never be possible owing to the chaotic nature of the atmosphere, thus global forecast of convection must be probabilistic in nature and designed in such a way as to capture the full range of forecast uncertainty.

The Ensemble Prediction of Oceanic Convective Hazards (EPOCH) project is addressing these challenges by developing methodologies for producing probabilistic forecast guidance that spans this 36-hour window. Techniques are



EPOCH 24 hour forecast probabilities, truth, and select flight routes.

being developed to optimally combine forecast information from multiple world forecast centers to produce reliable probabilistic forecasts of storm location and storm top heights. An initial capability has been developed that calibrates and combines forecasts from the NCEP Global Ensemble Forecast Systems (GEFS) and Canadian Meteorological Center Ensemble (CMCE) models. Probabilistic forecasts from EPOCH are being supplied to the U.S. World Area Forecast Center (WAFC) to aid forecasters in developing the Significant Weather Charts (SIGWX). NCAR continues to work with both the Aviation Weather Center and the UK Met Office to move toward generating gridded convective weather forecast products for aviation.

NCAR will continue to engage in convective weather research and continue to develop new technologies in support of the FAA and other sponsors. The expected increase in demand for air traffic services (especially in response to emerging markets of Unmanned Aircraft System transportation and Urban Air Mobility) will require more accurate, higher-resolution, information on convective storms and their impacts on the local environment. To address these challenges, NCAR AAP is heavily involved in improving models and investigating new methods in the application of artificial intelligence that support future developments in aviation.

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