Improving Safety for General Aviation

Adverse ceiling and visibility (C&V) conditions seriously test the general aviation pilot’s judgment. When deteriorating conditions go unrecognized, and the threat of a sudden drop in ceiling or visibility becomes alarmingly real, the pilot is all too often unprepared and unable to quickly identify an escape route. The threat and its consequences are further amplified when complex, rising terrain plays a role in the flight environment. Spatial disorientation, loss of control, controlled flight into terrain, and forced landings are some of the recurring consequences of C&V hazards. These hazards illustrate C&V’s overall role as a contributing factor in over 35% of all weather-related accidents in the U.S. civil aviation sector.

Improved national-scale analyses and forecasts of C&V and new tools to present this to pilots, weather briefing staff and others are key to improving the C&V safety record.

Automated Ceiling and Visibility Products for the Continental U.S. and Alaska

Automated 24 h/day analysis products, with updates on the timescale of minutes rather than hours and flexible web-based displays, provide advantageous guidance to the professional meteorologist and tailored products for the aviation end user. The C&V team develops and supports a suite of products that include ceiling, visibility and flight category.

NCAR’s continental U.S. (CONUS) C&V analysis product displays current ceiling, surface visibility and flight category information based on real-time METAR and satellite data, registering any available sub-hour analysis updates every 5 minutes. The color-coded display presents current conditions in terms of aviation-critical thresholds with options for user-selectable overlays of individual METAR values and cloud coverage.

NCAR is also developing a C&V analysis product for Alaska utilizing an approach that combines surface observations, weather camera and satellite imagery with numerical weather model C&V analysis and forecast fields to help overcome data scarcity challenges in this region.

While development of automated C&V systems has concentrated historically on areas over the U.S., these systems could also be adapted to operate over other geographical locations which are impacted by adverse C&V conditions, assuming there is adequate input data available from observations and model data.

When deteriorating conditions go unrecognized, the pilot is all too often unprepared and unable to quickly identify an escape route.
**Field Research in Ceiling and Visibility**

Improved forecasting of ceiling and visibility conditions is critically dependent upon our understanding of the underlying physical processes at work. In past years NCAR has maintained a fully instrumented field site supporting ongoing studies of the formation and evolution of fog and low ceiling events. The site is located on the grounds of Brookhaven National Laboratory on east-central Long Island, New York. Research focused on the formation of fog of several types – including radiation, precipitation-related, and advection fog.

**Airport Terminal Area Ceiling and Visibility**

Adverse C&V conditions also impose critical restrictions upon the rates of traffic flow into and out of major airports across the country, and these restrictions, in turn, strongly affect the capacity and efficiency of U.S. air traffic as a whole.

NCAR staff worked with colleagues from MIT/Lincoln Laboratory to develop and display more accurate forecasts of operationally significant changes in ceiling height and visibility near major airports in the Northeastern U.S. This recent effort follows the 2004 completion of the San Francisco Marine Stratus Forecaster Display system, which provides forecasts of the time that low clouds and fog will clear the approach to the San Francisco Airport. The system was transferred to the NWS and is currently running operationally.

**Impacts of Volcanic Ash on Airport Operations**

On March 27, 2016, the Pavlof volcano in the Aleutian islands of Alaska erupted suddenly, 30 min after earthquakes began in the region. The ash plume reached between 20,000 to 30,000 feet. The FAA issued "red" aviation alerts and Alaska Airlines cancelled 41 flights into Anchorage. The NCAR C&V flight category product for Alaska on March 31st, four days later, shows the persistent, extensive regions of LFR and IFR due to the volcanic ash plume moving from southwest to northeast, through central Alaska. These C&V analysis products are being installed at the Alaska Aviation Weather Unit office in Anchorage and will be running in real-time starting May 2016.

**For More Information, Contact:**

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The San Francisco Marine Stratus Forecaster Display (above) is used operationally by CWSU forecasters, WFO aviation forecasters, FAA traffic managers, and airline meteorologists. The left side provides displays of sensor data used in four forecast models. The right side provides the consensus forecast.

Pavlof volcano in eruption. Courtesy of Colt Snapp

NCAR flight category analysis based on ceiling and visibility, for Alaska.
LFR: dark gray, IFR: light gray, MVFR: yellow, VFR: green