Evaluation of the Baseline NEXRAD Icing Hazard Product

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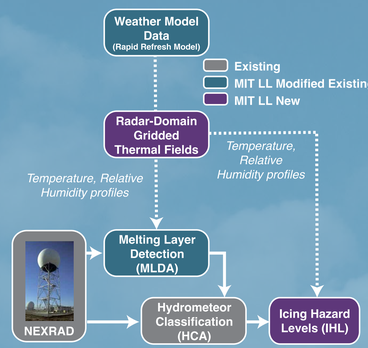
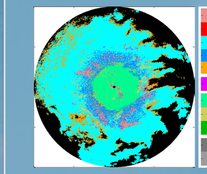
Introduction

The Icing Hazard Levels (IHL) algorithm is operational throughout the NEXRAD network. The baseline version product is predicated on the presence of graupel as determined by the NEXRAD Hydrometeor Classification Algorithm (HCA) and augmented vertically with favorable model temperature and relative humidity interest fields. A study was performed to assess IHL performance using pilot reports (PIREPs) of icing for verification. Results indicate the baseline IHL algorithm is an effective indicator of icing hazard but, as expected, does not fully expose the hazard when HCA graupel is not detected.

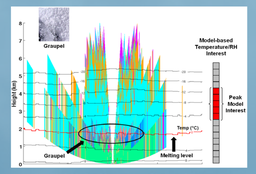
Algorithm



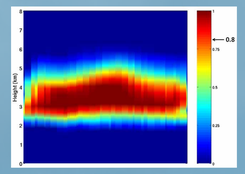
- IHL algorithm searches for NEXRAD HCA graupel classifications
- Lowest (highest) beam angle where graupel is found determines altitude of icing bottom (top) for each range bin
- Search from the top down to where three-dimensional model interest first exceeds 0.8
- Extend graupel-based icing top altitude only to model interest altitude identified above



HCA 1.5˚ PPI

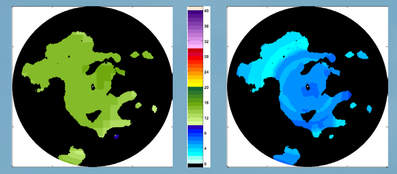


HCA Cross Section



Model Interest Product

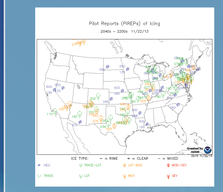
- IHL produces top and bottom altitude product depicting the icing hazard for each volume scan
- Product resolution: 1 km × 1 deg out to 300 km range
- Confidence and severity components planned for future releases



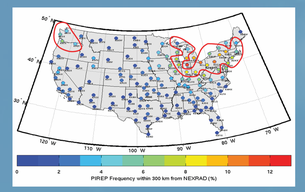
Icing Top Height

Icing Bottom Height

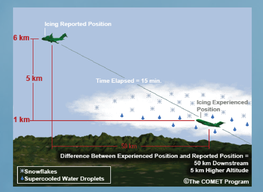
Verification Study



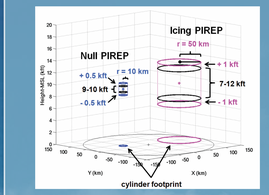
ADDS Icing Reports



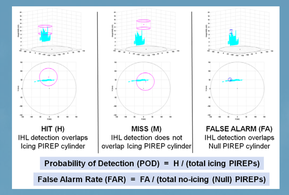
PIREP Frequency Relative to NEXRAD (2010–2012)



PIREP Spatial and Temporal Uncertainty

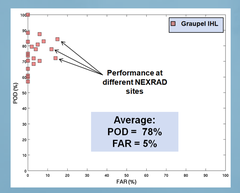


PIREP Cylinder of Influence Geometry

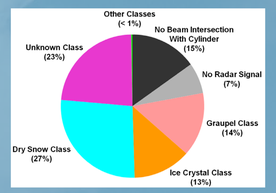


IHL Scoring Categories

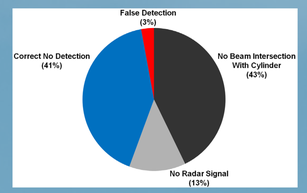
- Feb–Mar 2013 icing PIREPs used to assess IHL performance at 23 NEXRADs
- Cylinder geometry accounts for PIREP uncertainty for comparison to IHL detections
- IHL's POD shows use of HCA graupel with model interest is effective for a subset of the icing hazard but other classes require further focus



IHL POD vs. FAR Scoring Performance

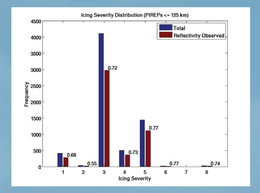


Icing PIREP (7761) Category Breakdown

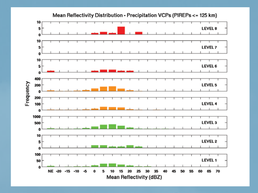


Null PIREP (899) Category Breakdown

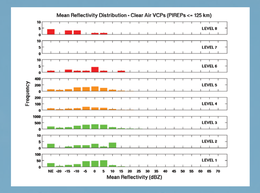
PIREP Frequency vs. Icing Severity



Total vs. Reflectivity Observed



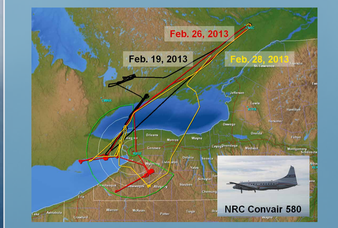
Precipitation Mode Scanning



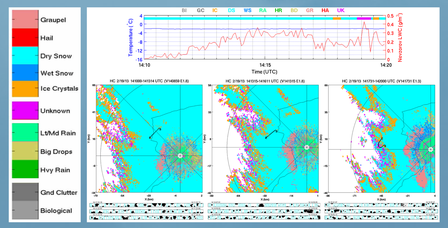
Clear Air Mode Scanning

Icing hazards associated with low reflectivity winter events are observable with clear air scanning

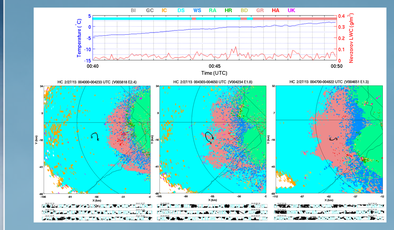
Comparison of HCA Classifications and In Situ Observed Icing



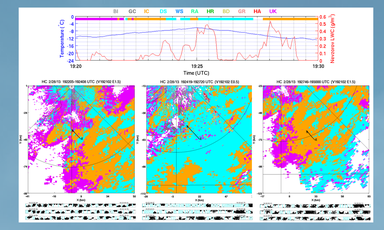
Buffalo, NY In Situ Flight Tracks



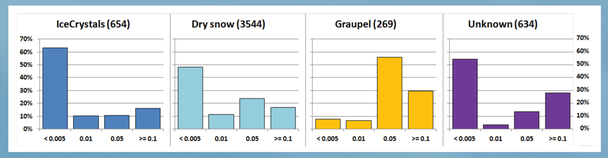
Feb 19, 2013 1410 – 1420 UTC



Feb 27, 2013 0040 – 0050 UTC



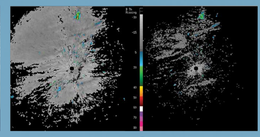
Feb 28, 2013 1920 – 1930 UTC



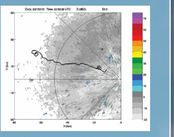
Frequency Distributions of Liquid Water Content vs. Hydrometeor Classification

Future Focus

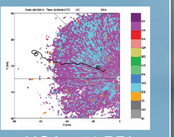
Piper Archer Icing Encounter Madison, WI Feb 21, 2013



Reflectivity Clear Air vs. Precipitation Scanning



Reflectivity 1.5° PPI



HCA 1.5° PPI

- Explore clear air scanning to better support icing hazard detection
- Develop additional methods to exploit non-graupel class icing dual pol signatures

This work is sponsored by the Federal Aviation Administration (FAA) under Air Force Contract FA8721-05-C-0002. Opinions, interpretations, conclusions, and recommendations are those of the author and are not necessarily endorsed by the United States Government.