EMC CCB Meeting for New Product

Global Current Icing Potential (GCIP)

(Q4FY2015)

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July 7 2015

Motivation

- WAFC Washington, which consists of NOAA and FAA, had taken on responsibility of verifying WAFS icing forecast
- Verification results provide customers with base for calibration and developers with ideas for areas of improvement
- Limitation on current icing observation data makes it challenging to verify global in flight icing forecast
- The data either has small non-global coverage or is not a direct measurement of in flight icing

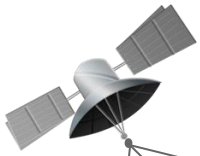
Motivation (Continued)

- CONUS Current Icing Potential Product (CONUS CIP) was developed by NCAR and has been used by AWC as a near real-time icing analysis product for aviation decision making
- EMC proposed and obtained approval to develop Global Current Icing Potential Product (G-CIP) as verifying analysis for WAFS Global Icing Forecast Product by expending CONUS CIP
- EMC has also expanded its G2G verification package to verify WAFS Icing forecast against G-CIP

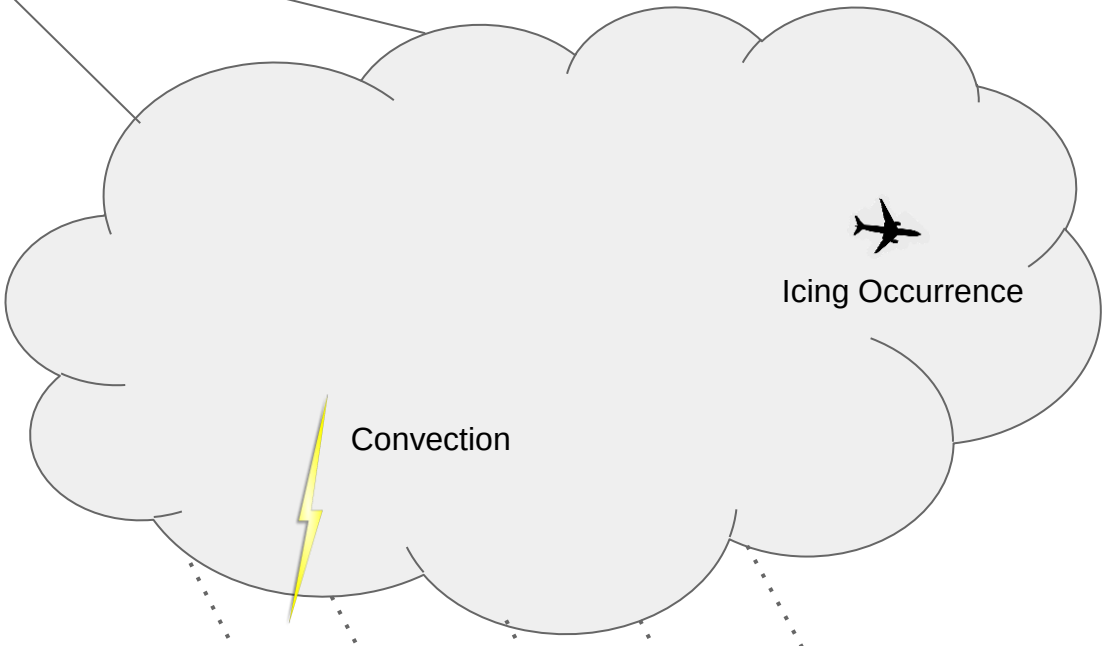
Methodology
Schematic and Flow Chart provided next

Strategies to expand CIP globally are as follows:

- Use GFS analysis or 3 hour forecast as initial guess instead of RAP
- Use NESDIS global satellite mosaic data which is a combined products from 5 geostationary orbiting satellites (GOES-East, GOES-West, Meteosat at 0, Meteosat at 63E, and MTSAT)
- Use existing in house global METAR data
- Use optional PIREPs, radar, and lightning data wherever available (limited coverage but expansion underway)



Cloudy / Clear
Cloud Top Temperature



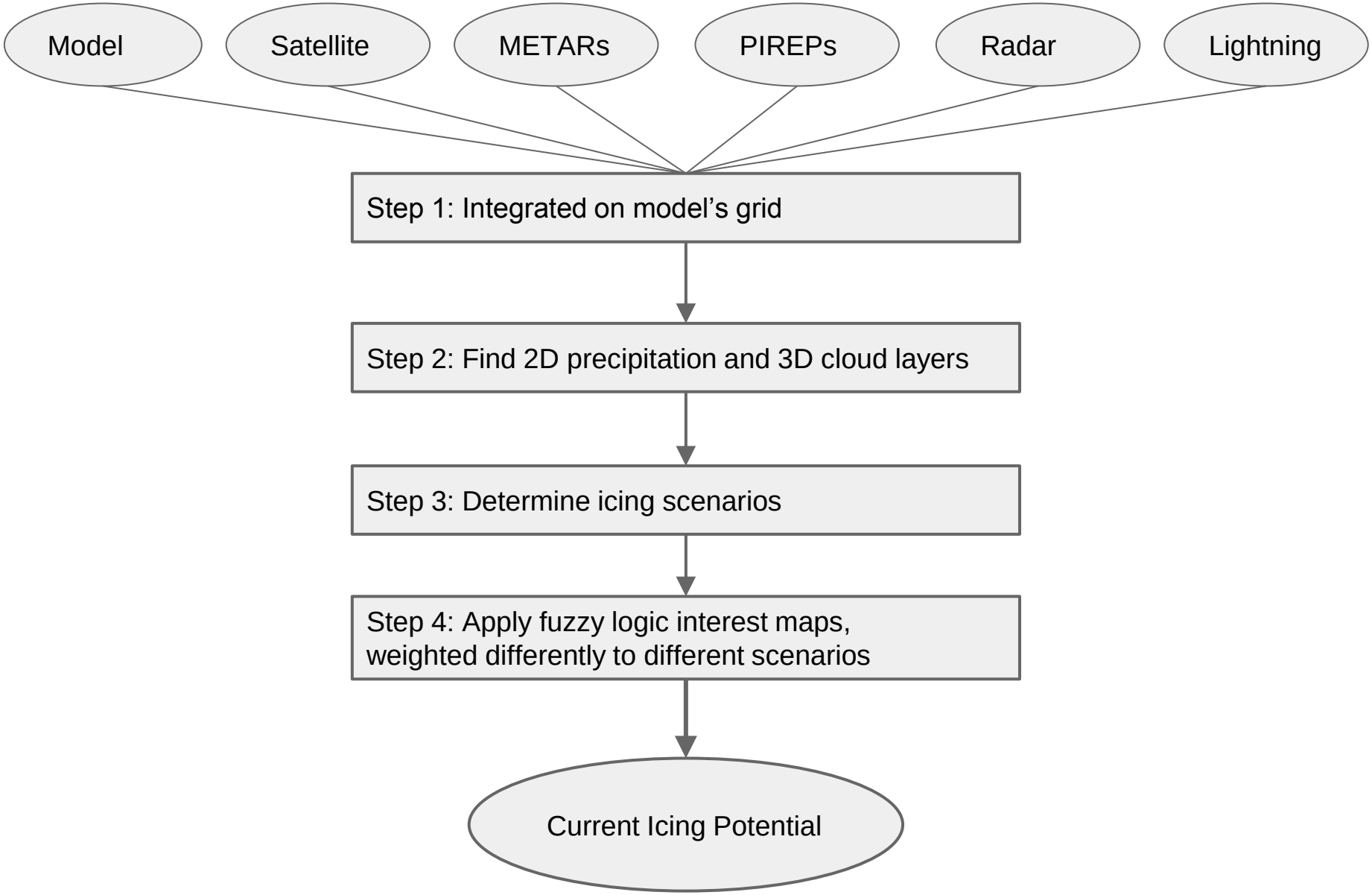
Icing Occurrence

Convection

Temperature
Pressure
Geopotential Height
Relative Humidity
Specific Humidity
Vertical Velocity
Cloud Water Mixing Ratio

Precipitation

Cloud Cover
Cloud Height
Precipitation



Flow Chart for CIP Algorithm

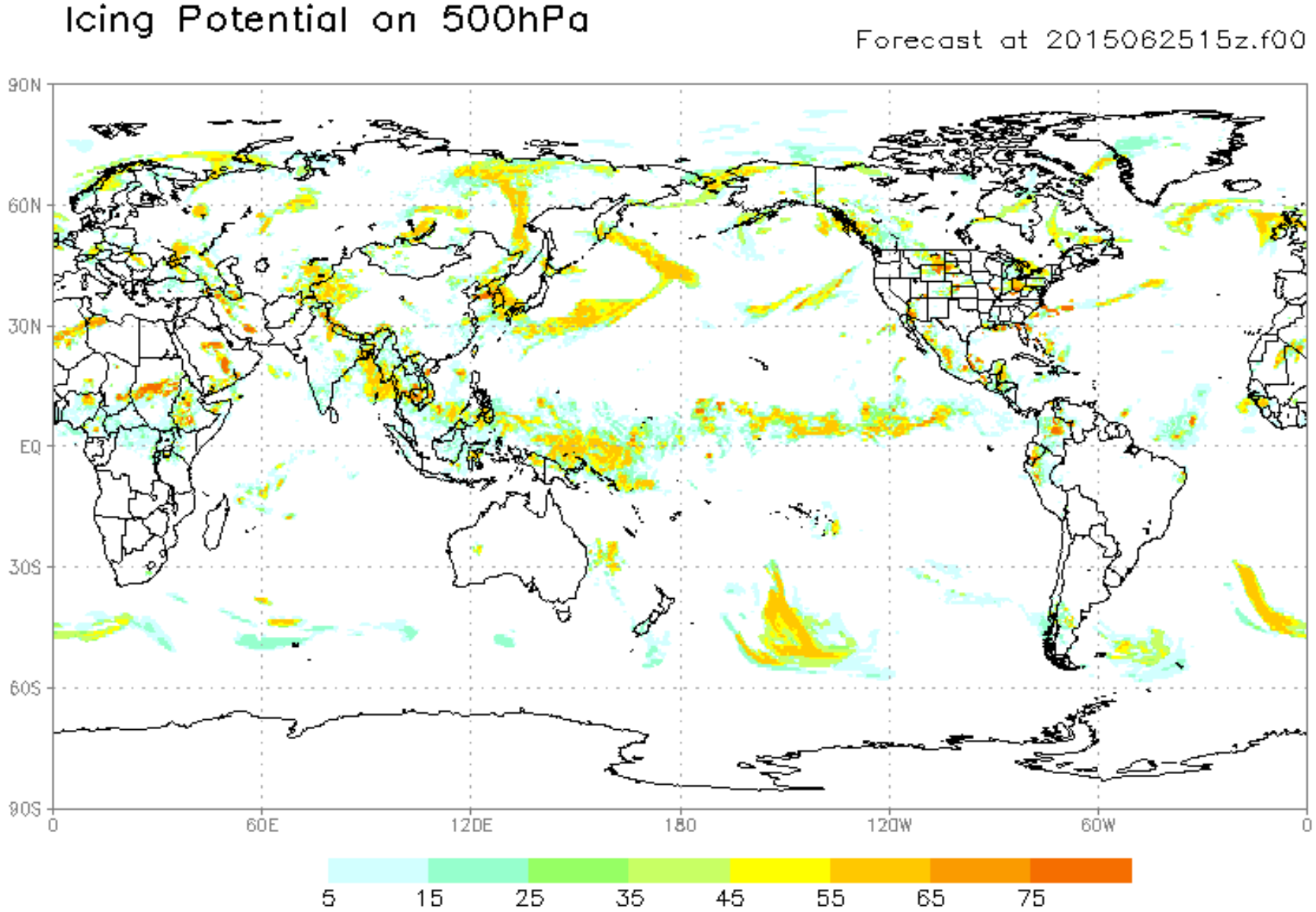
Parallel Runs and Users' Feedback

- EMC has been generating experimental G-CIP product since June 2014, using test global satellite composite data provided by NESDIS
- EMC also has been verifying WAFS Icing forecast globally using these experimental G-CIP data and display verification results on web site for users' feedback and evaluation
- Verification methodology and results were presented at WAFS Science Meeting

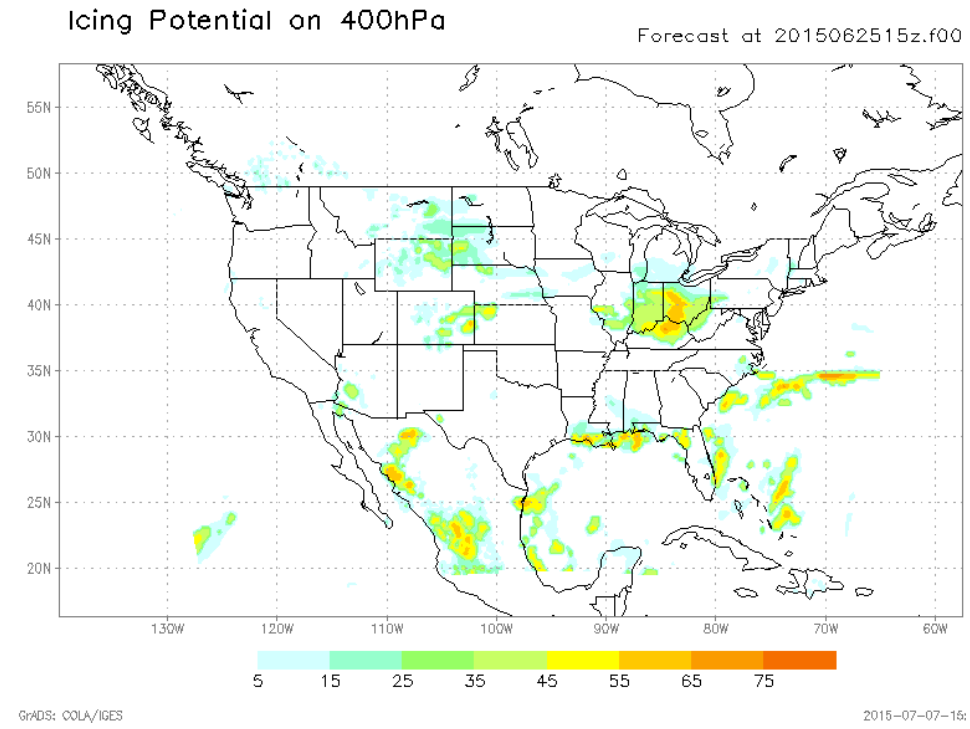
Goal #1

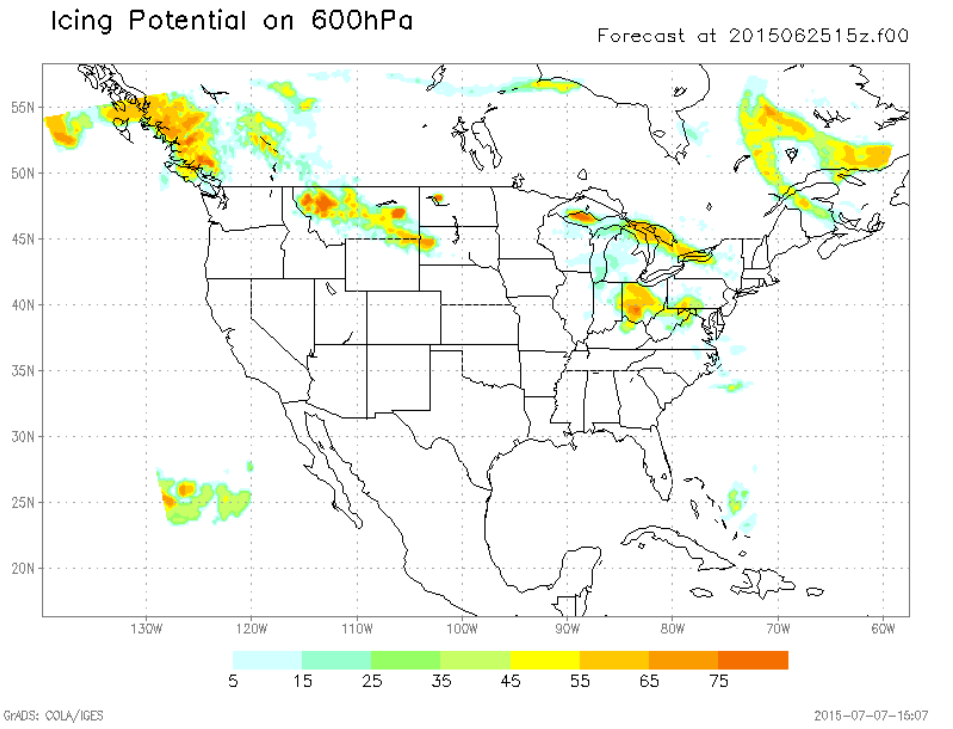
Global Icing analysis

G-CIP example at 500 mb

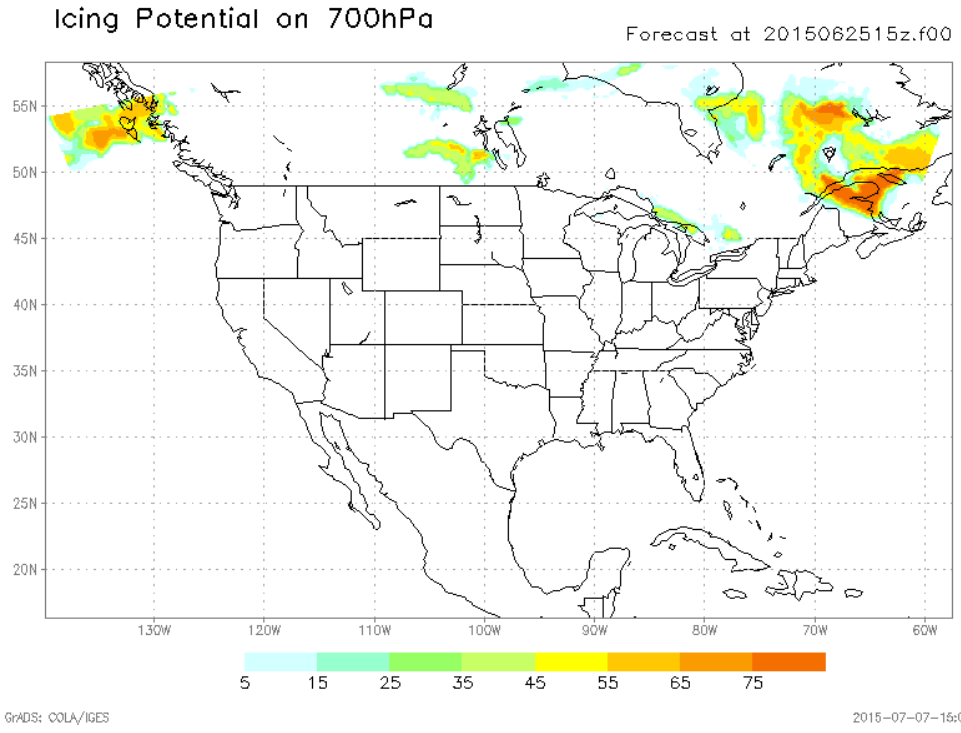


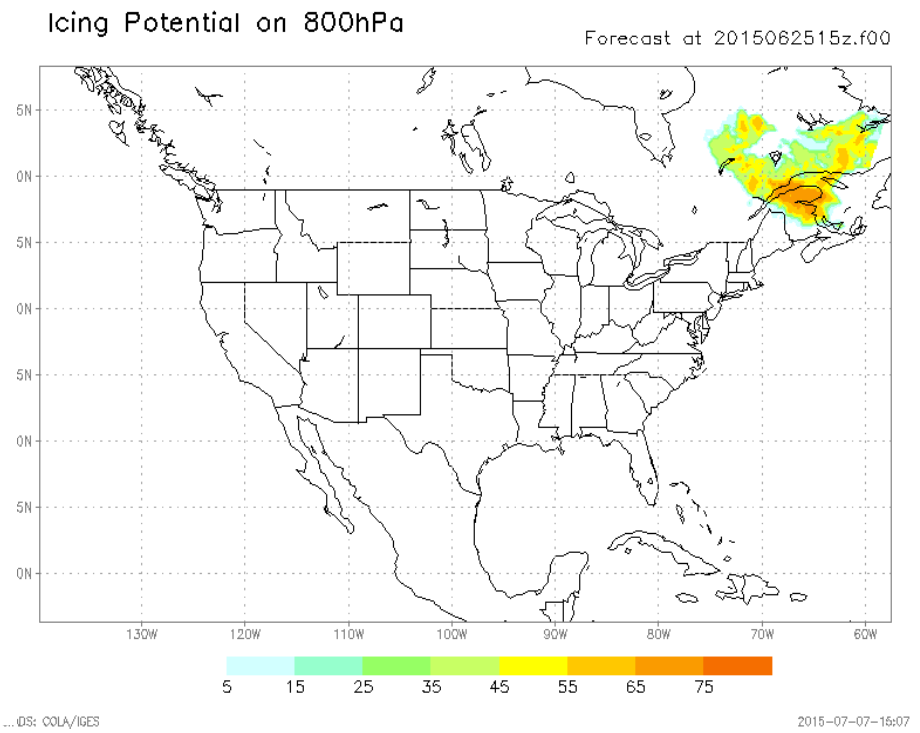
Same G-CIP examples over CONUS at 400 mb (L) and 600 mb (R)





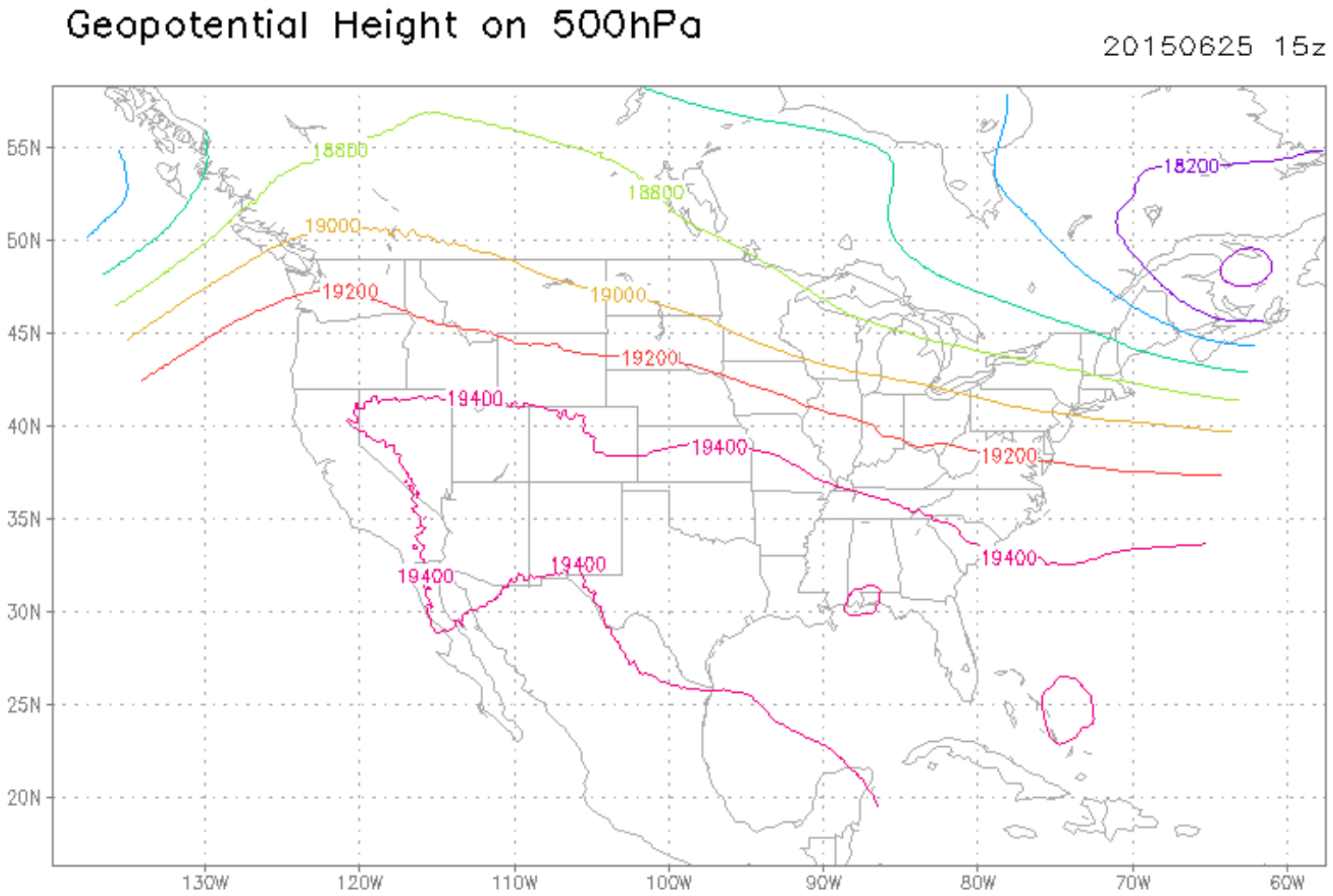
Same G-CIP examples over CONUS at 700 mb (L) and 800 mb (R)



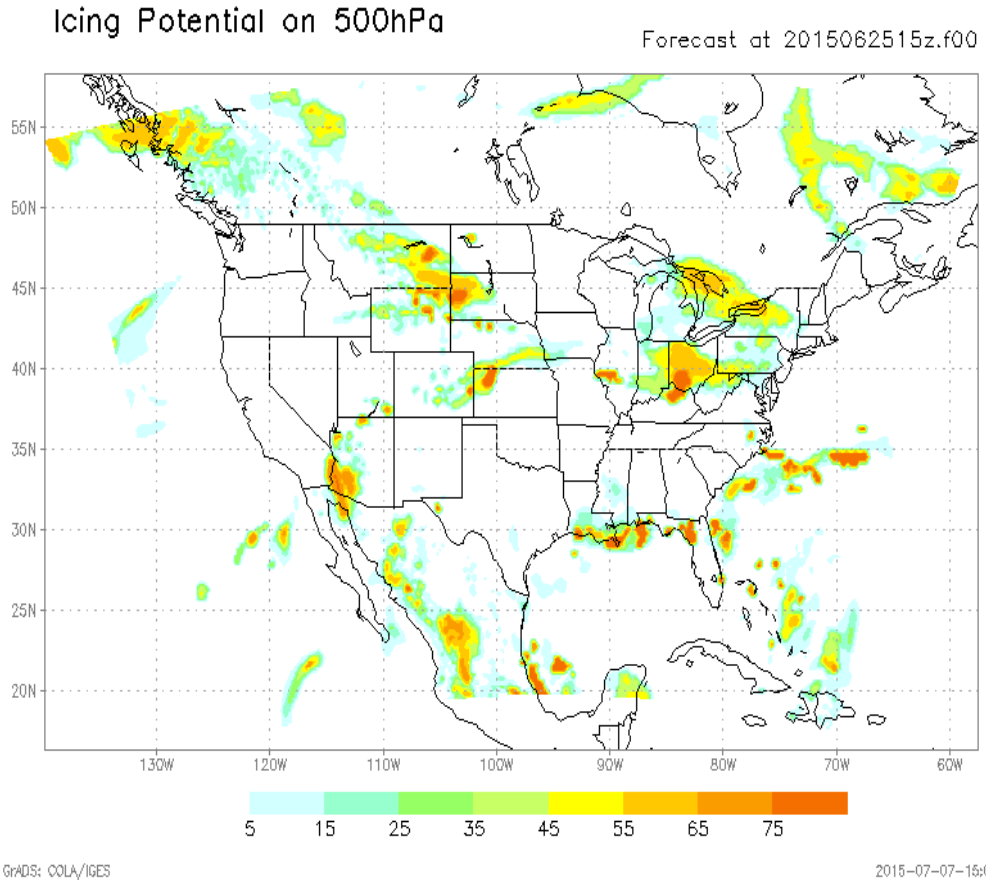


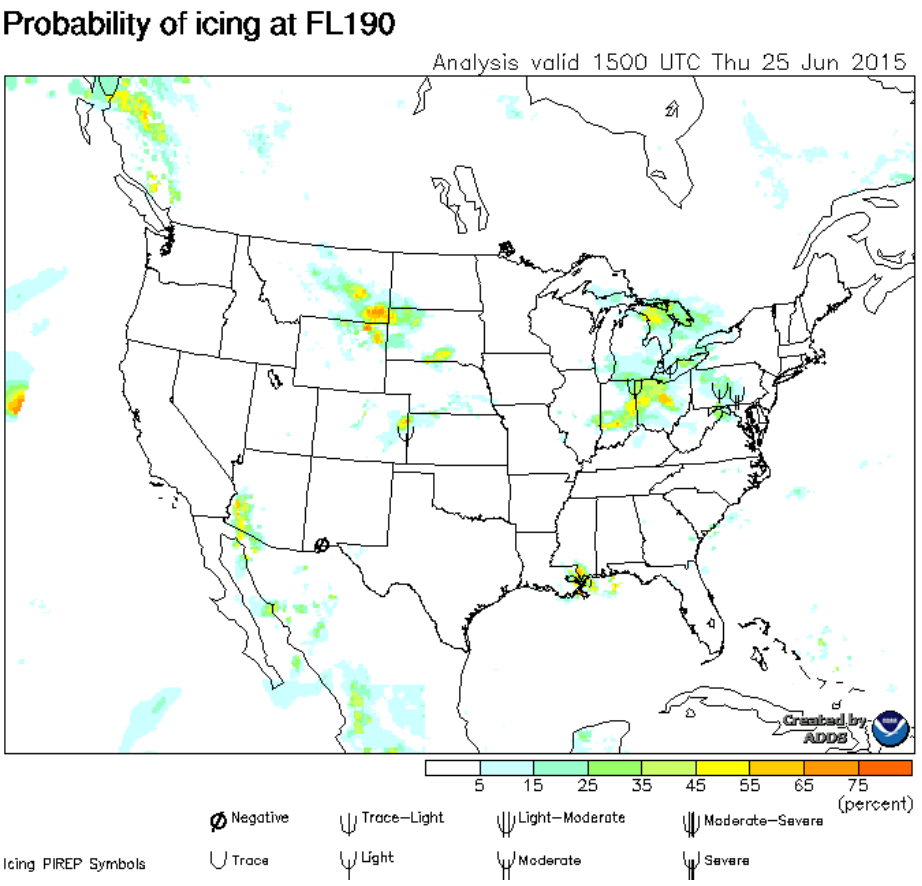
Comparison of GCIP to operational CIP Icing Potential over CONUS

(choosing an approximate level)

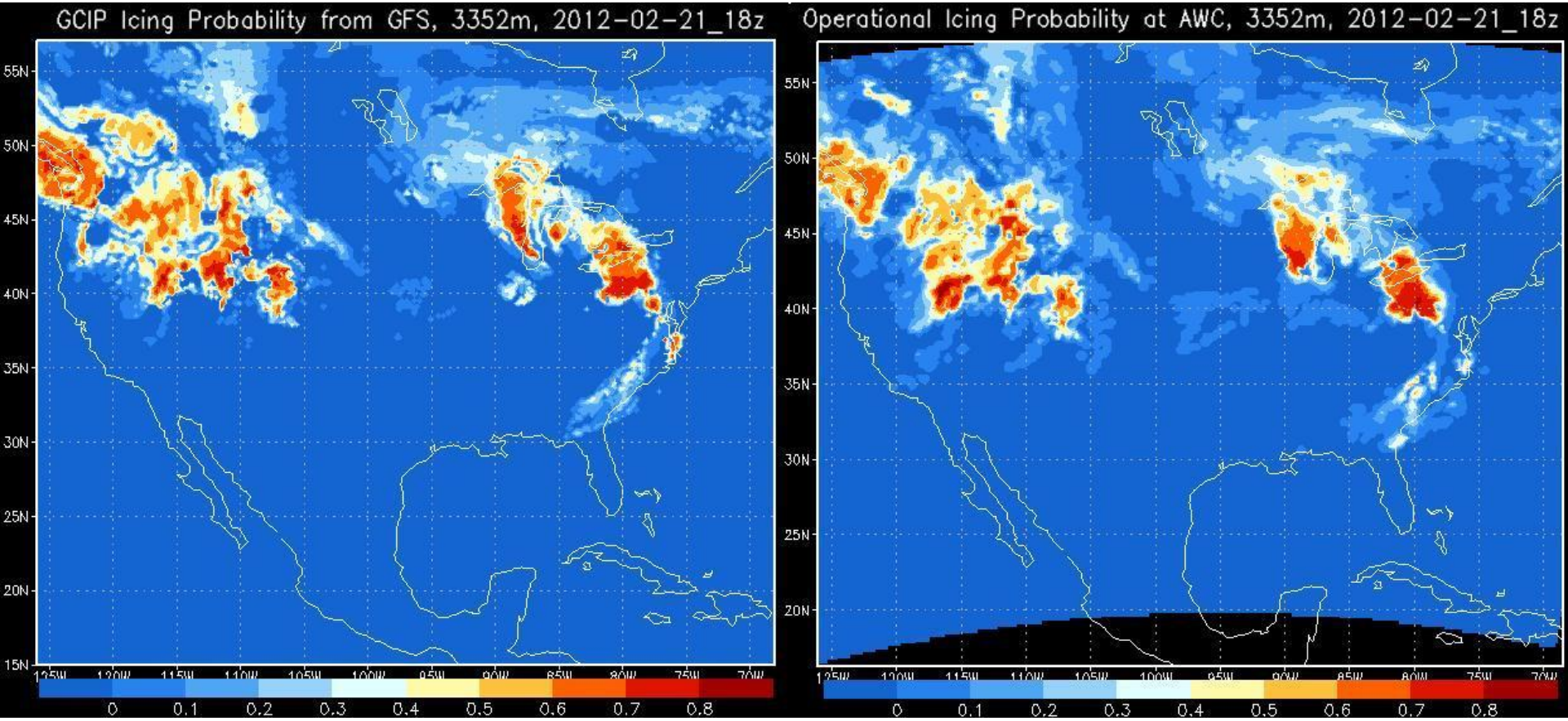


Comparison of GFS based G-CIP (L) with RAP based CONUS CIP (R)





Comparison of GFS based G-CIP (L) with RAP based CONUS CIP (R)



Goal #2

WAFS Global Icing Forecast verification

Products to be verified

- **WAFS Blended Icing**: mean and max (low resolution 1.25 degree)
- **WAFS UK Icing**: mean and max (low resolution 1.25 degree)
- **WAFS US FIP**: mean and max (low resolution 1.25 degree)

Verification score types - Category (event)

- ROC (Receiver Operating Characteristic)
- Categorical Bias

Cycles, levels and domains

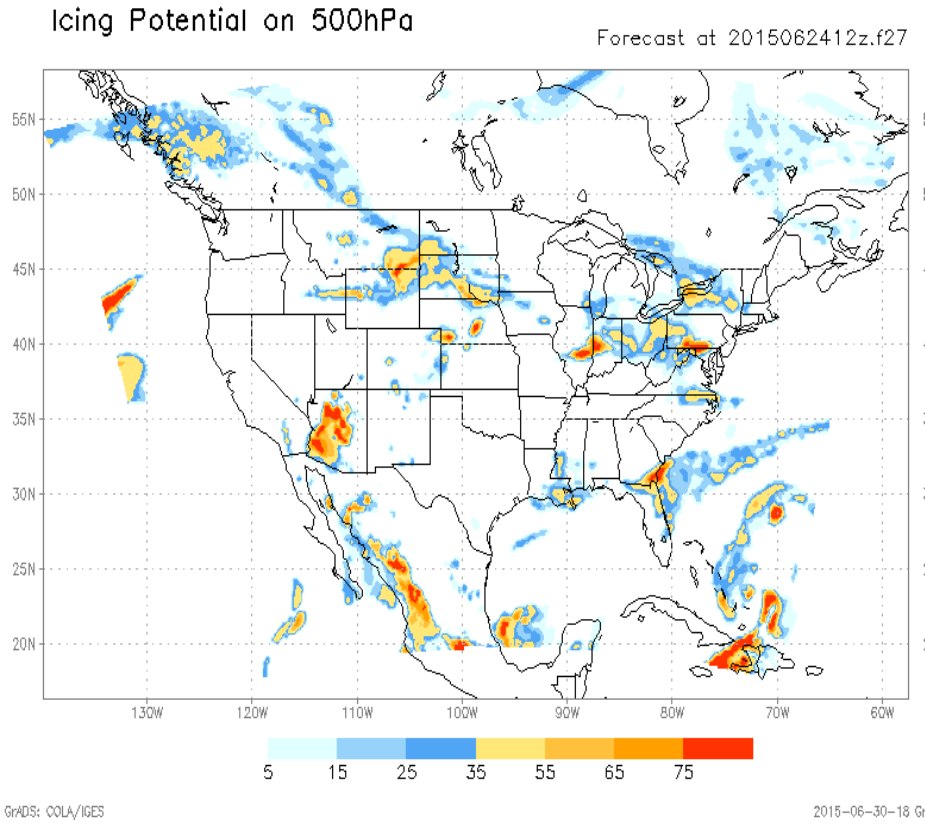
Cycles: 4 runs (00 03, 06 09, 12 15, 18 21 Z)/day
6-36 forecast hours (6, 9, 12, … 36 hr)

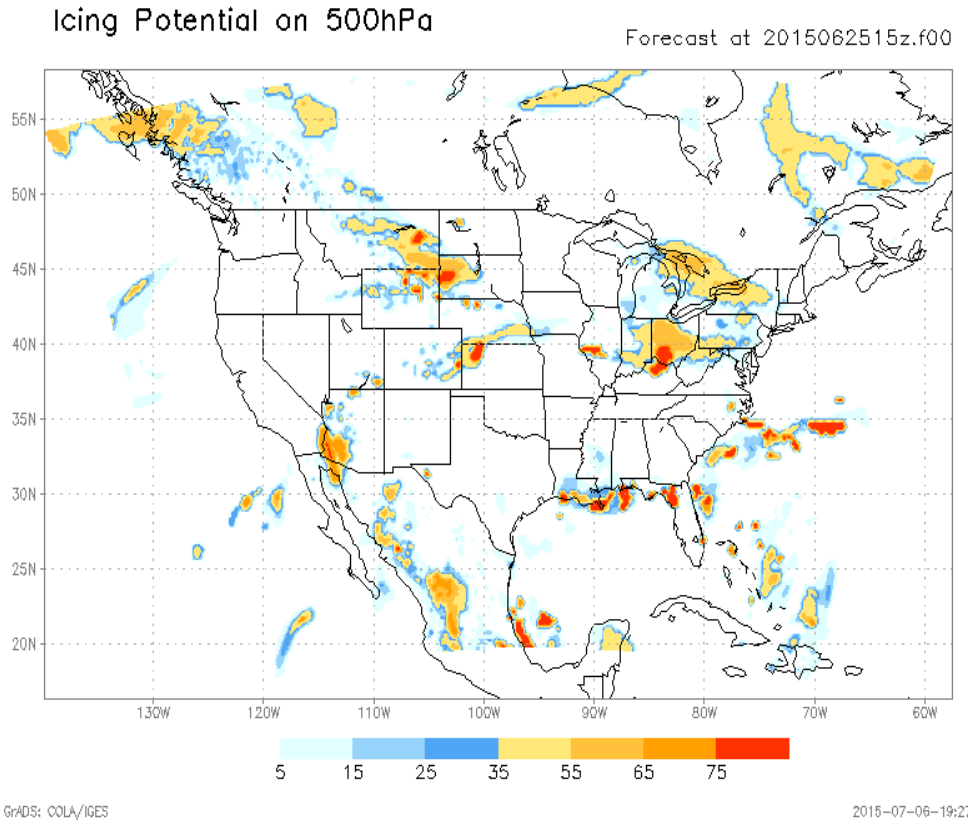
Validation time: 00, 03,06,09,12…, 18, 21Z
-- One GCIP is used to verify multi-previous icing forecasts

Levels: 400, 500, 600, 700, 800hPa (pressure levels)
FL240, 180, 140, 100, 060 (flight levels)

Domains: Global, Northern Hemisphere, Tropics, Southern Hemisphere, North Atlantic - Area 2, Asia, North Pacific, Australia and North America

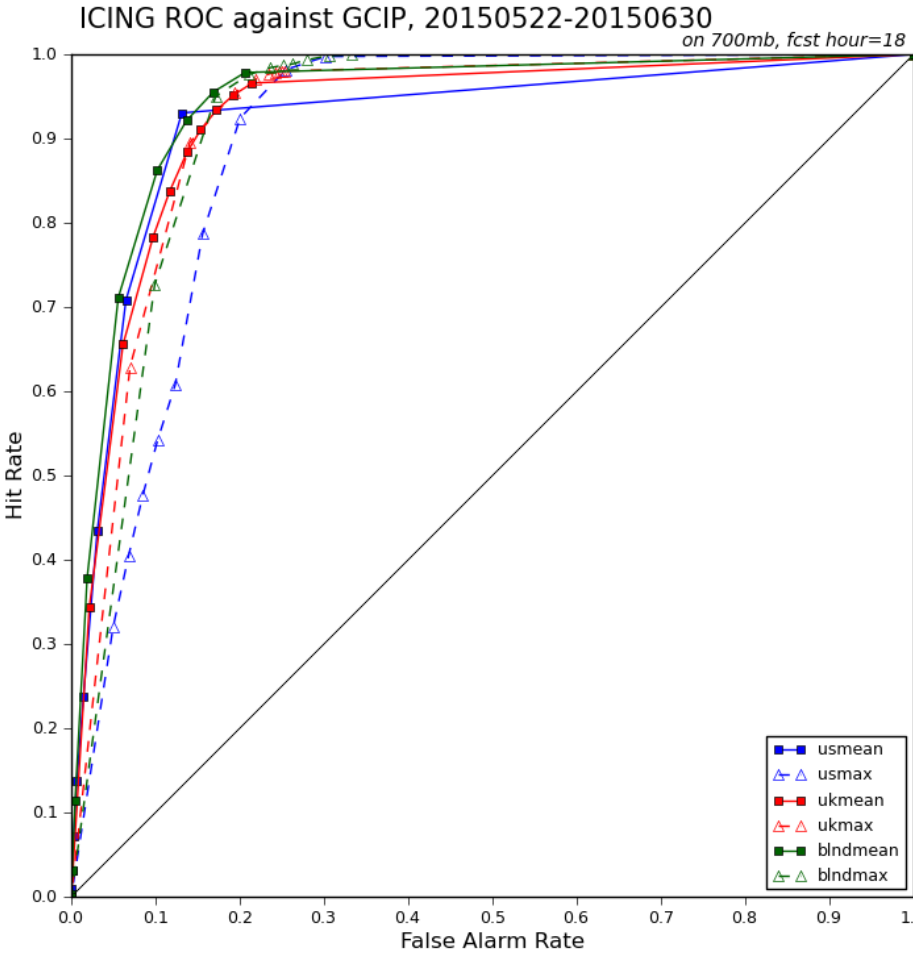
Validation of 27 hr GFIP Forecast (L) with GCIP (R) at 500 mb

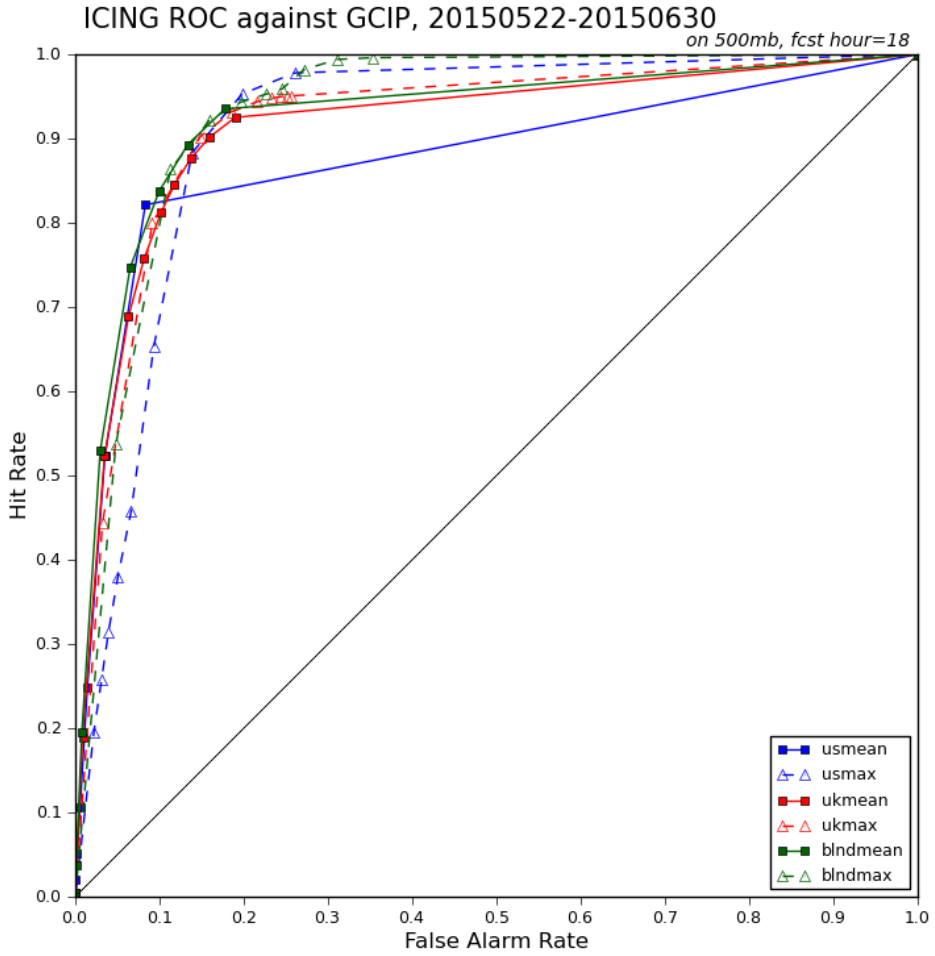




ROC

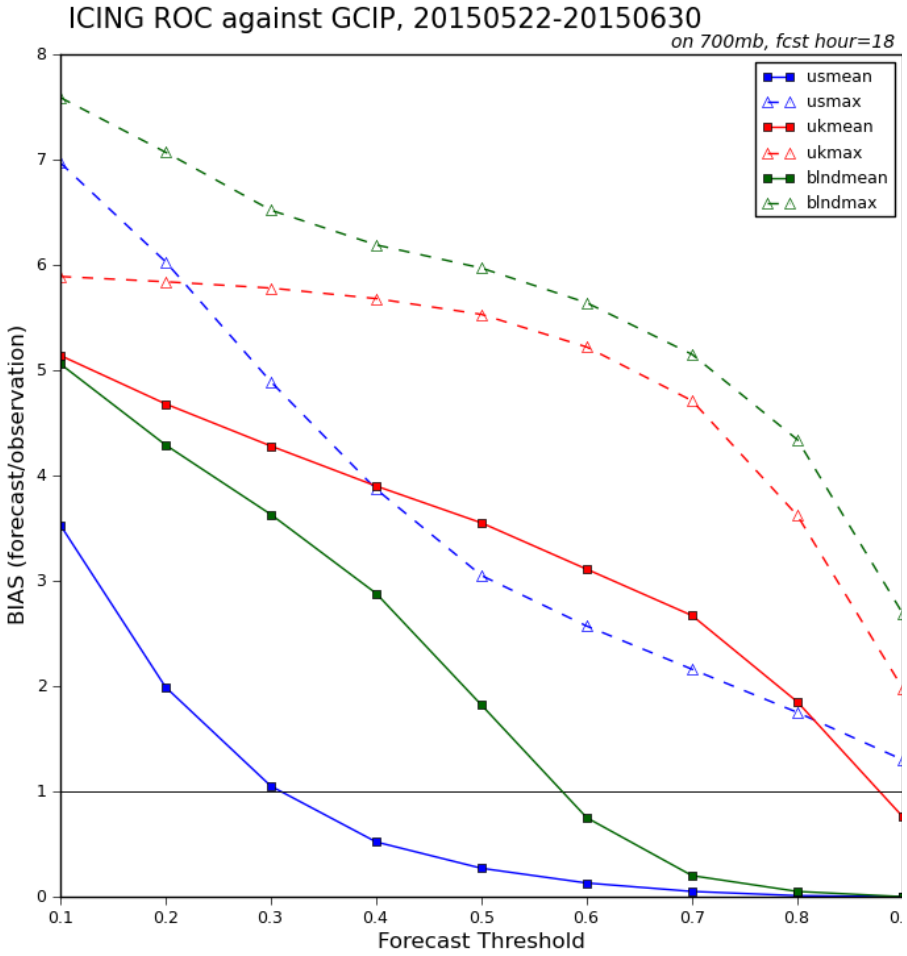
blended has better score than US/UK

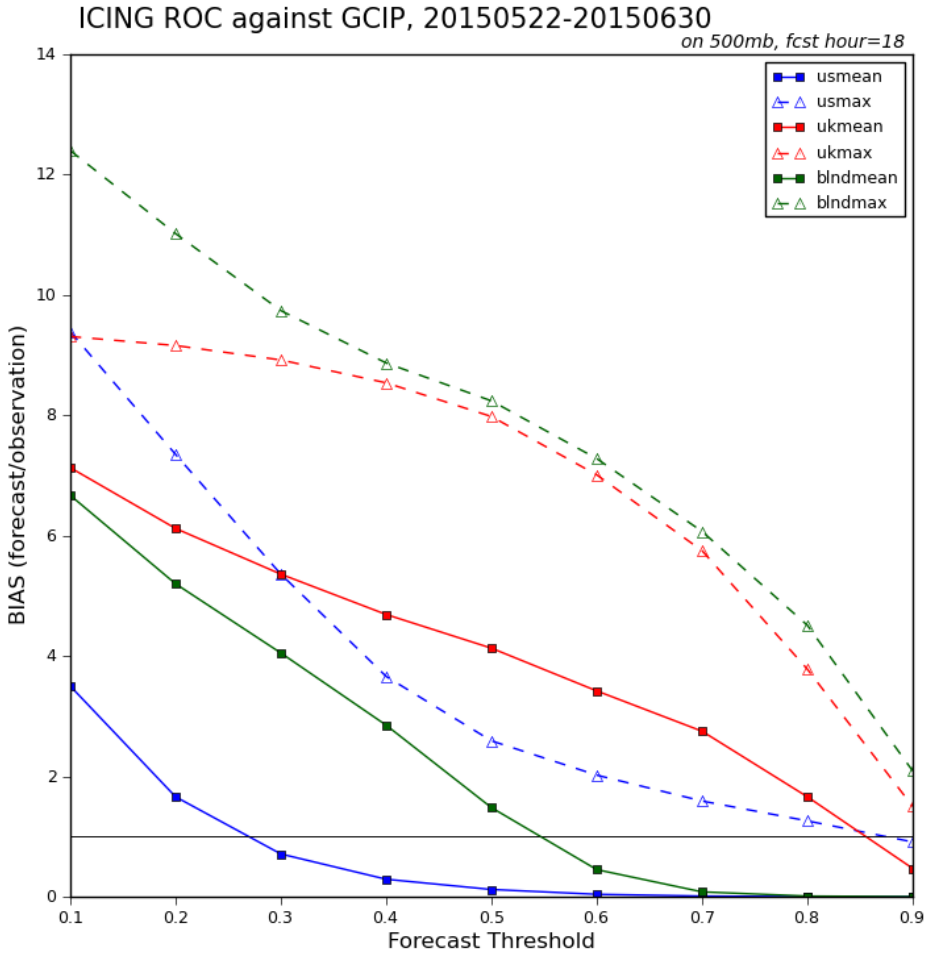




web site: http://www.emc.ncep.noaa.gov/gmb/icao

Categorical Bias





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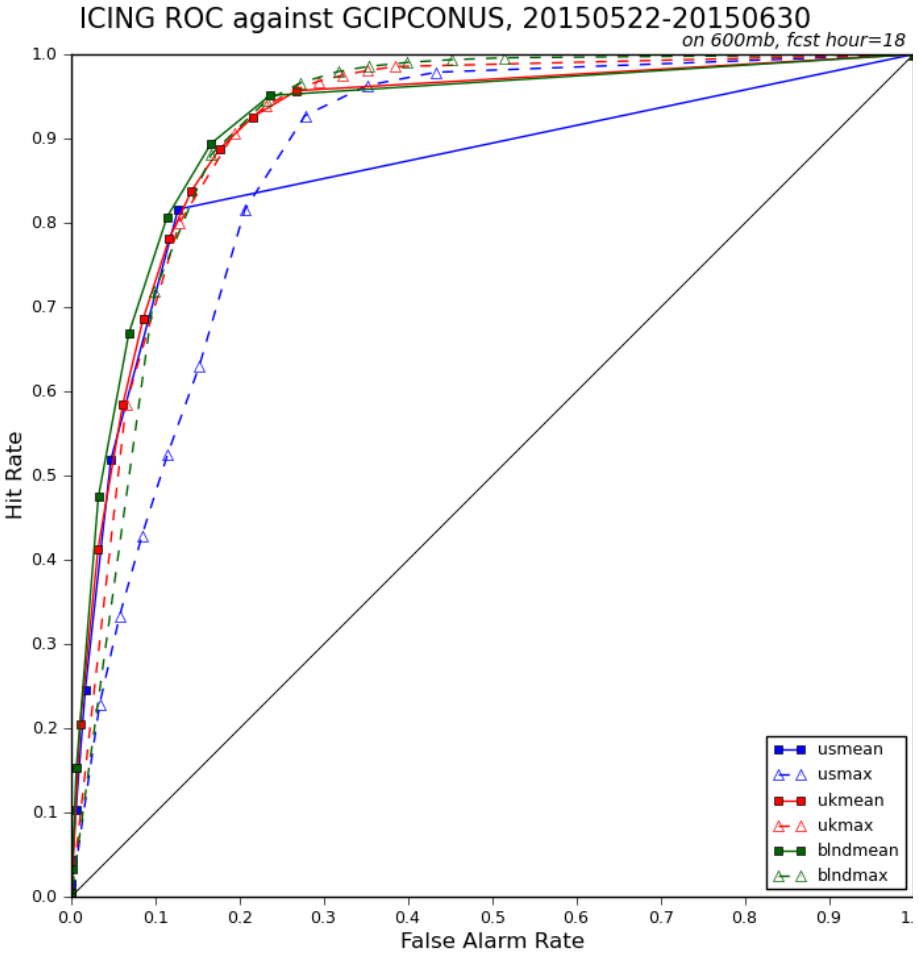
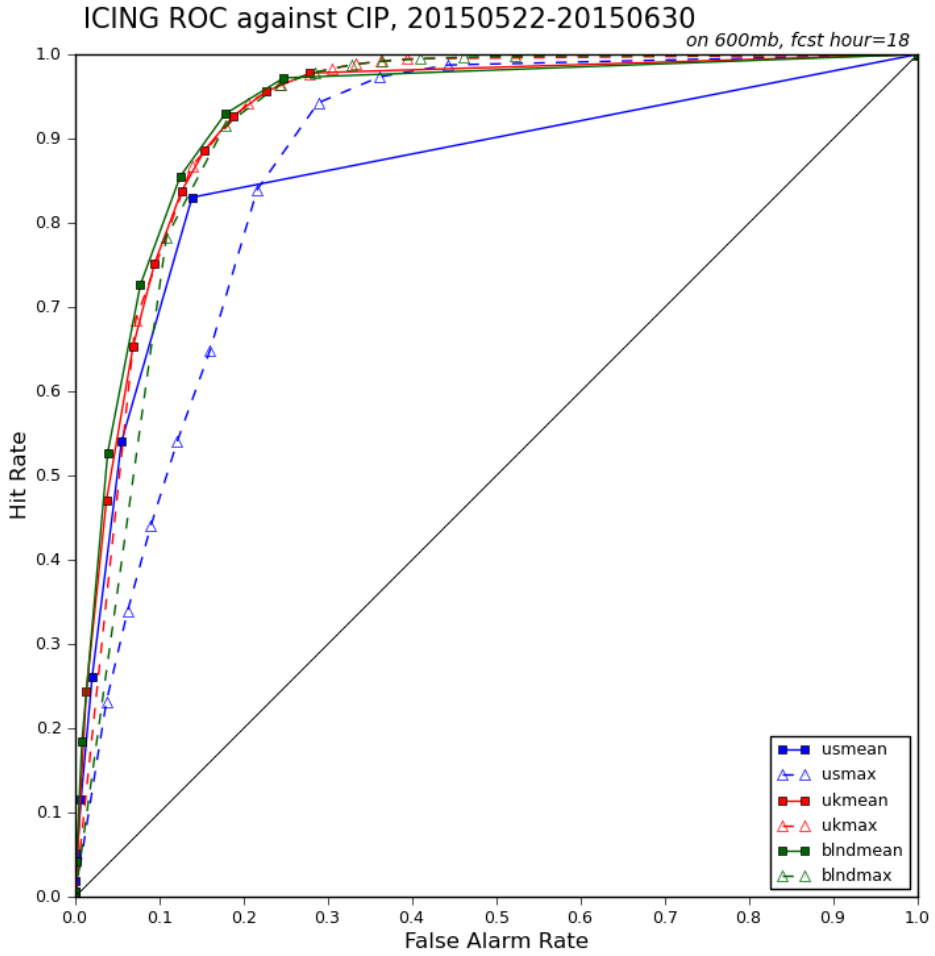
Verification against GCIP (L) VS. against CIP

On most levels except for 400hPa, the verification results are consistent. Conclusion: CIP can be replaced by and expanded to GCIP





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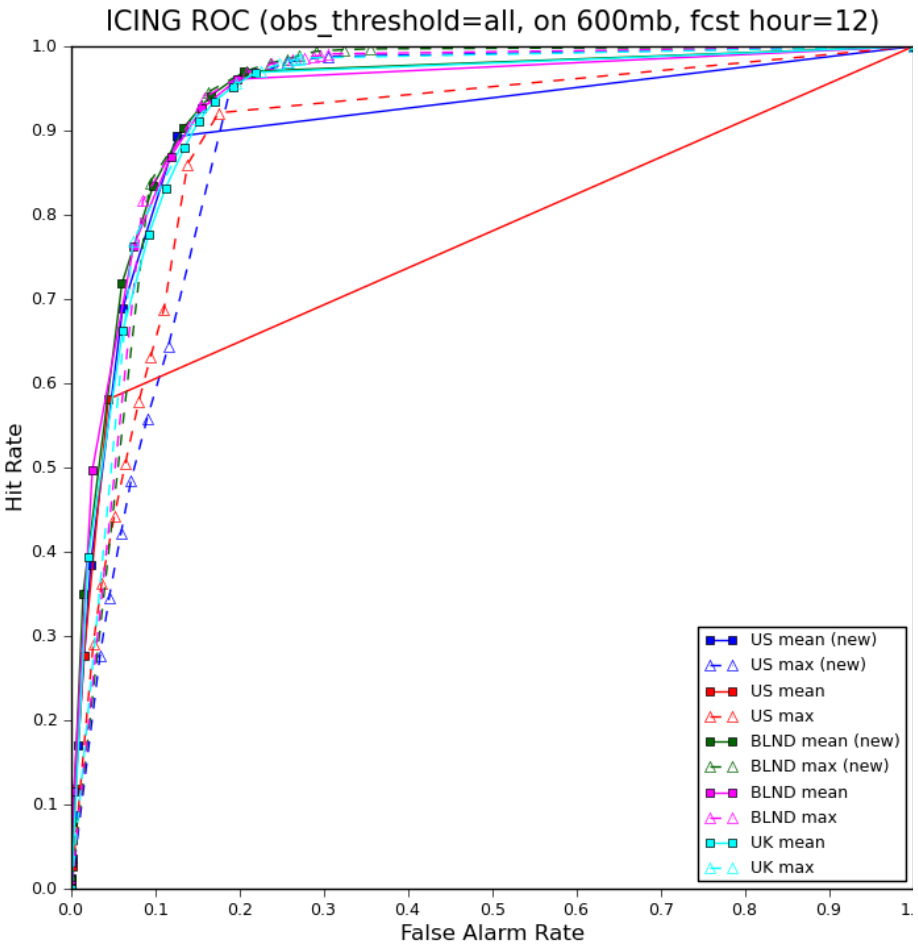
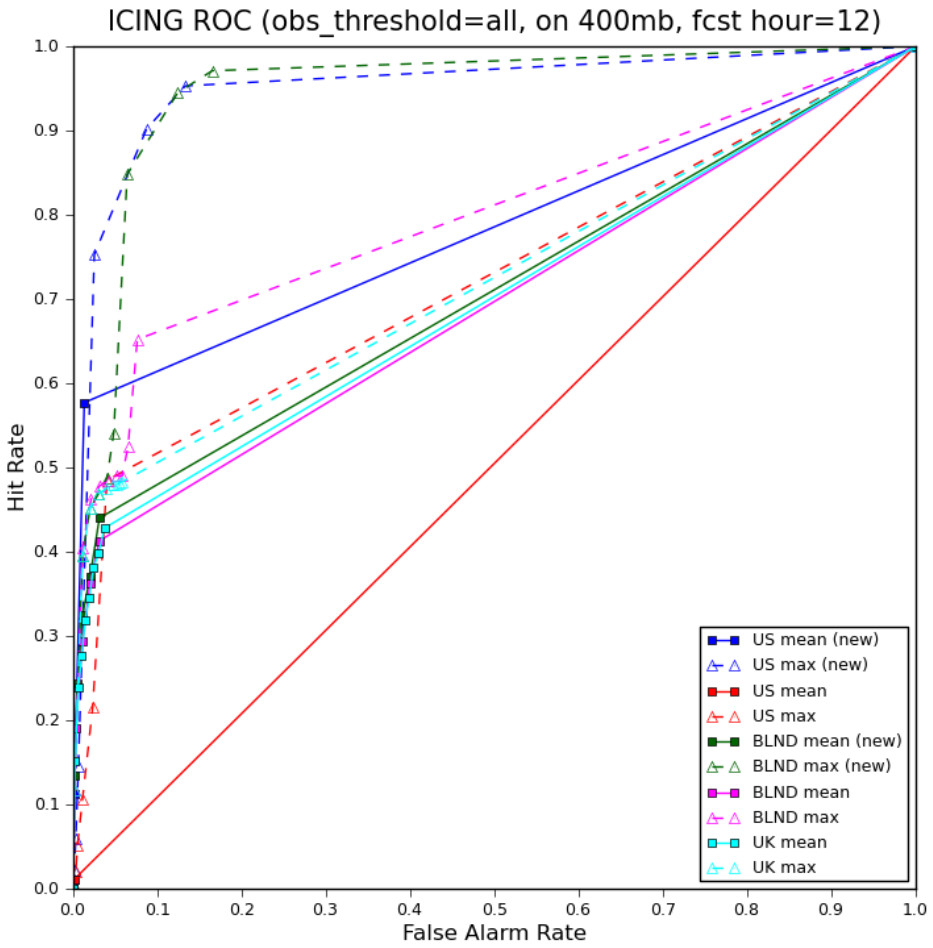
Verification results using G-CIP showed G-FIP outperforms previous US icing during 2014 GFS parallel run





Summary

- Limitation on icing observation data presents challenges for verifying global icing forecast
- AWC has been using CONUS CIP as Icing analysis truth for their aviation decision making
- EMC expanded CONUS CIP to Global CIP (G-CIP) by replacing RAP with GFS, and GOES with NESDIS' new global satellite mosaic product
- EMC has been generating experimental G-CIP since June 2014
- EMC has been also using this data to verify WAFS icing forecast

Summary (Continued)

- EMC presented G-CIP methodology and verification results at WAFS Science meetings and was urged to implement G-CIP soon by AWC
- NESDIS has scheduled early September implementation for their Global Satellite Mosaic data
- EMC is ready to hand off the code for G-CIP implementation