Goal

A gridded depiction of inflight icing based on integration of operational model output with real-time sensor data with highest possible temporal and spatial resolution depicting icing characteristics such as severity and type with probabilistic depiction and sensitive to operational requirements
Your Friendly IFIPDT

Funded Participants
NCAR (RAP, ATD, MMM)
NOAA ETL
NOAA FSL
CRREL
U. Alaska Fairbanks
Colorado State U.
FAA Tech Center
   (BFGoodrich)

Close Collaborators
AWC
FAA Tech Center
NASA Glenn
NTSB
MSC (Canada)
Meteo France
Radiometrics, Inc.
Committees
   FAA Icing Steering Comm
   SAE AC-9C Icing
   AIAA Atmos. Environment
FAA IFIPDT Tasking

Total FY02 funding: $2.2M
IIDA: Basic Concept

Conceptual diagram of data used in IIDA. Precipitation types: snow (stars), rain (open, large circles), freezing drizzle (small, grey circles).
IIDA Output

Runs hourly, ready ~12 min after the hour
GRIB format, ~600Kbytes
40-km resolution
   To continue after 20-km RUC comes on line
   Upgrade to 20-km resolution in FY03
Flight levels
   FL000 to FL300
   Substantially decreases final file size
   Most users map to flight levels anyway
IIDA displays

Plan view

Or vertical cross-section
Disclaimer

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Planned IIDA/IIFA Upgrades

Icing severity field
Calibration of likelihood scale
20-km resolution
Finer resolution for smaller areas of interest
   What are the requirements?
   Test version ready for AIRS-2?
“Threat” index
   Combines likelihood, intensity, intermittency, type
How is severity defined?

**Trace:** Ice becomes noticeable. Rate of accumulation is slightly greater than the rate of sublimation.

**Light:** The rate of ice accumulation may require occasional use of ice protection systems to remove/prevent accumulation.

**Moderate:** The rate of ice accumulation is such that frequent use of ice protection systems is necessary.

**Severe:** The rate of ice accumulation is such that ice protection systems fail to remove the accumulation of ice.

These are not forecaster friendly
Possibilities for Severity Forecasting

Strictly LWC-based
ITFA-type forecast
Scenario approach
Attempts at Defining Intensity: The Atmospheric Condition, Part 1

Lewis, Newton, Jeck, Politovich:

- **trace**: \( \leq 0.1 \text{ g m}^{-3} \)
- **light**: \( 0.11 - 0.6 \text{ g m}^{-3} \)
- **moderate**: \( 0.61 - 1.2 \text{ g m}^{-3} \)
- **severe**: \( >1.2 \text{ g m}^{-3} \)

Note: these are REALLY HIGH liquid water contents!!!!!
Attempts at Defining Intensity: The Atmospheric Condition, Part 2

Jeck’s proposal: consider the time it takes to accumulate ¼ inch of ice on wing’s leading edge

- Trace: > 1 hour
- Light: 15 min – 1 hour
- Moderate: 5 – 15 min
- Severe: <5 min

Do-able IF:
- collection characteristics of a wing are known
- difference between aircraft can be accounted for
- LWC is known
For B1900

Glaze conditions

- Light
- Moderate
- Severe

LWC (g/m³) vs. Drop diameter (microns)
And for many aircraft
ITFA-type Forecast

Is there anything special about different icing severities as reported by pilots
Are they statistically related to model outputs or observables?
Or are they random?

If there is a relationship we ought to be able to track that dynamically

Also can use extreme value methods
Icing is a relatively rare event
Scenarios

Patterned after current IIDA/IIFA
Recognize that there are weather and cloud situations conducive to high liquid water amounts
Use moderate and severe icing as “break points”
Support

IPHWG: Icing climatology – extents, frequency, LWC, drop sizes
NTSB: Investigate likely LWC, drop sizes for Comair incident at PBI
S-Pol$K_a$

Joint FAA/NSF Project

Pairs new $K_a$-band radar with existing S-Pol

Goal is to pair $K$-band with NEXRAD or TDWR
GRIDS

Deploy at icing-sensitive airports
Design document is complete - request a copy!
AIRS-2 Update

Will take place winter ‘03 - ’04
Location is Mirabel Airport, Montreal
Participation by “a cast of thousands”
France will join through WWRP
France and NASA will have new aircraft
GRIDS, SPolKa, new radiometer channels, local-scale IIDA, etc.
Alaska

Currently running Eta-based IIFA at NCAR
Working with AAWU to evaluate, improve and try new ideas
Will implement at AAWU when ready
Upcoming Meetings

AIAA Science Meeting and Exhibit
  2 $\frac{1}{2}$ days of icing sessions!
AMS Aviation, Range and Aerospace
Weather Conference
  ≥ dozen icing papers!
SAE AC-9C InFlight Icing
Subcommittee
  presentations by 3 PDT members!
Awards!

DOC **Gold Medal** to ETL for GRIDS

NASA "Turning Goals into Reality" award to NASA GRC Icing Branch and 3 NCAR IFIPDT members

2 NCAR IFIPDT members nominated for NCAR Education award
Icing on the Web

**NCAR**

http://www.rap.ucar.edu/iida/

http://www.rap.ucar.edu/iifa/

**NWS-AWC**

http://adds.aviationweather.noaa.gov/