A perspective on aircraft icing weather research

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For Icing TIM
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The Dream

- A widget senses where icing is and relays that to a pilot who understands what that means and steers his plane safely away from it.

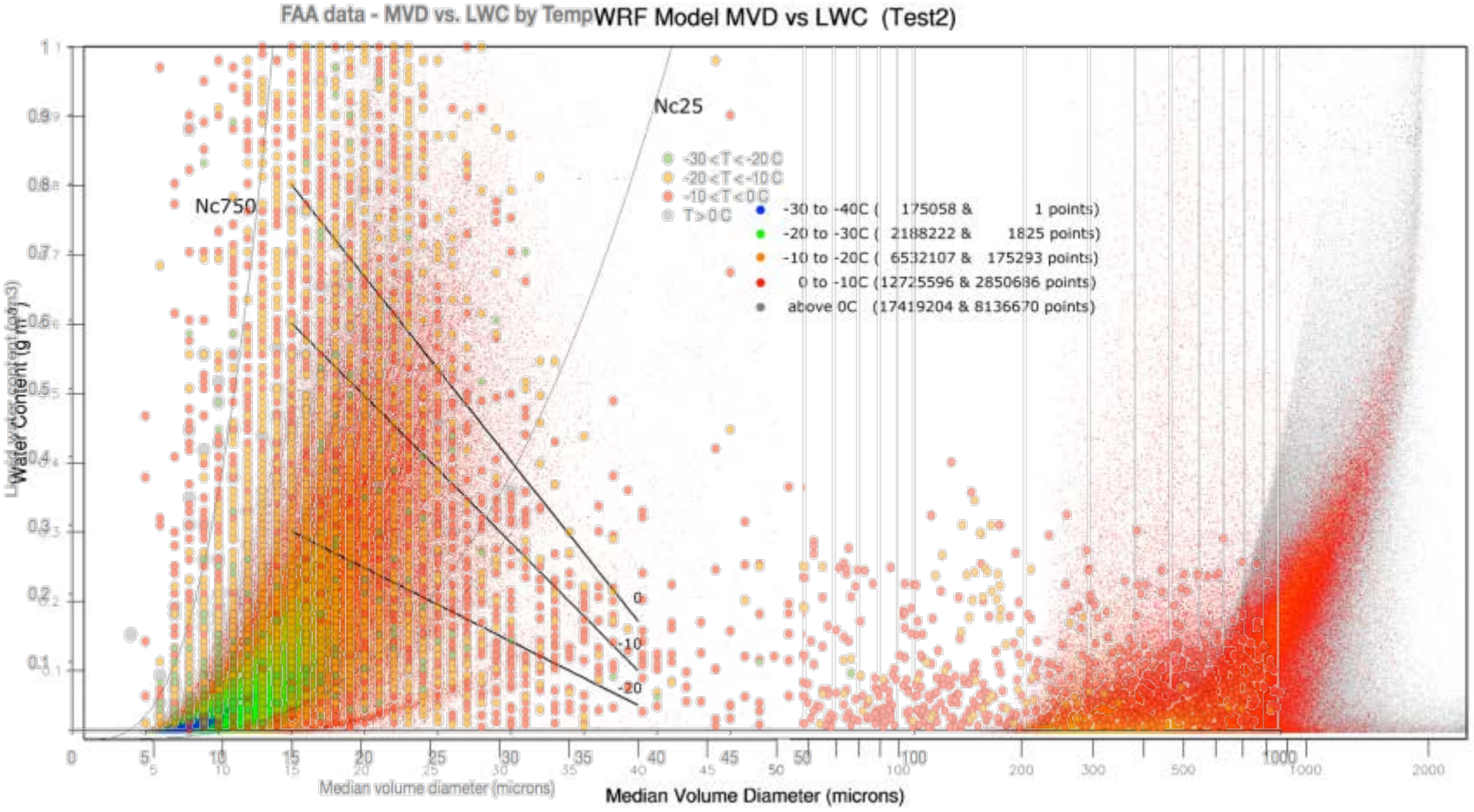
The Reality

Not only is there no such instrument, there is no such numerical weather prediction model.

Neither will there ever be.

Yet we should continue our research on weather, weather sensors, weather models, and fusion of these.

Cautious Optimism



Our toolbox

Information Source

- NWP models
- In situ sensors
  - On airplanes
  - On the ground
- Remote sensors
  - On airplanes
  - On the ground
  - In space

Status

- Current: pretty good!
  - 10s of km, 1000s of ft, ~hourly
- Future: More detail!
  - Explicit drop sizes, liquid water content
  - Higher resolution in time and space
  - Boldly go where no one has gone before

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Status

- Current
  - Operational models have improved liquid water content, precipitation type, information can be extracted on drop size
- Future
  - Explicit microphysics for full drop and ice size distribution
  - “Aerosol-aware” physics

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Status

- Current
  - AMDAR: excellent humidity sensor, plus T, winds
  - TAMDAR: icing indicator, T, RH, winds, turbulence
  - Other: icing sensors
- Future
  - Multi-use
  - Better access
  - Downlink current icing sensor information

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Status

- Current
  - Precipitation type and amount from METARS (ASOS/AWOS)
  - Precipitation type from PING (Precipitation Near the Ground)
- Future
  - Accurate precipitation type, especially for freezing drizzle and rain
  - Ingest PING information into icing algorithms

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Status

- Current
  - Onboard radars to stay out of severe weather
- Future
  - Transmit radar data to the gound
  - Increase radar capability – polarization? Dual-wavelength?
  - Passive sensing?

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Status

- Current
  - Dual-polarization NEXRAD
  - TDWR has higher update rate but less coverage
- Future
  - Improve Hydrometeor Classification Algorithms for winter precipitation
  - Make better use of TDWR in the terminal area, especially for feature tracking'
  - MPARS – no antenna!
  - Radiometer network?

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Status

- Current:
  - Geostationary and Polar Orbiter retrievals of icing-relevant parameters
  - Cloud-Sat radar
- Future:
  - GOES-R will have many more channels, and may open up possibilities for more and more accurate retrievals
  - Real-time use of Cloud-Sat

Climate

Will climate change increase (or decrease)the extent and/or severity of icing conditions?

Will we need to design airplanes and de/anti icing equipment differently? Migrate the fleet?

Components versus integration

The goal is not for one sensor to solve all the problems. The goal is improved icing forecasts.

Focus research on components – let those experts on those components do their work, as long as they understand the bigger picture.

Who are these people?

The bulk of direct funding for icing weather-related research is from Gov't agencies

- FAA, NOAA, NASA
- Also intl – Meteo France, UK Met Office, DLR

Considerable related and applicable research is also being done by other agencies, industry and universities.

Trust but verify

We must have detailed in situ data on the icing environment to make real progress.

Traditionally, this has been accomplished by using research aircraft.

You'll hear some other ideas today.

Summary

- Research on the atmosphere, instrumentation and NWP models has led us to where we are today: Pretty darned good forecasts!!!
- We've already heard from users and agencies about what more is needed and desired.
- Now you'll hear more on where we are, near and far-term potential, and limitations.