

Wind Tunnel Investigation on the Response Characteristics of Particle Spectrometers and LWC/TWC Devices in SLD Cloud Conditions

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19 May: impromptu and reserved breakout meetings

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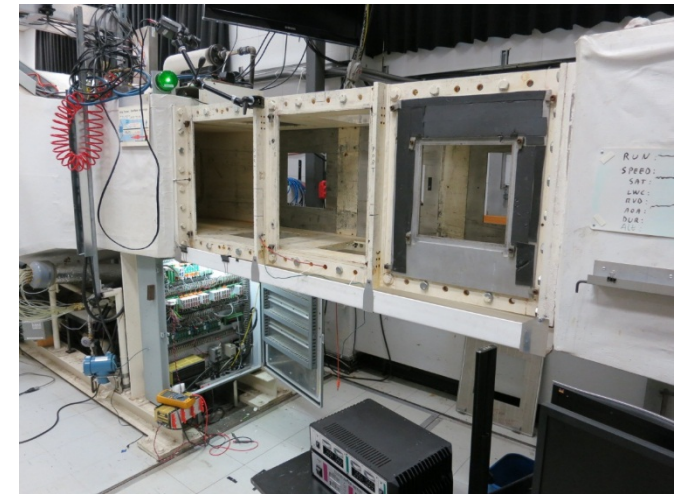
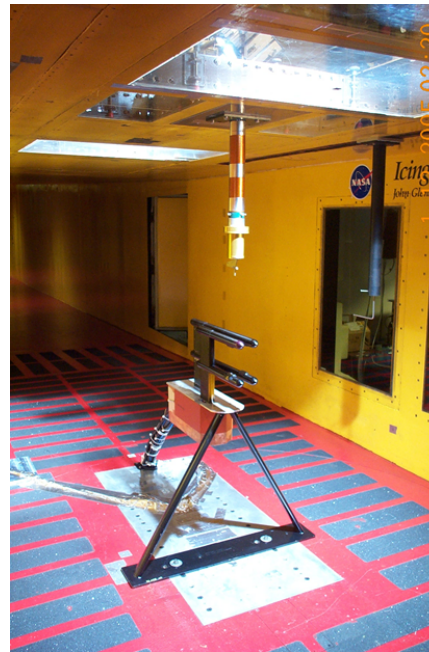
Updates

- CIRA management decided to freeze the program for the next year, waiting to decide which slot will be more suitable for CIRA IWT schedule foreseen on 2017.
- Although the CIRA slot is still not secured, the preliminary measurements will be performed on Dec. 2016 in order to extend the CIRA SLD calibration to additional freezing drizzles conditions.
- On April 19, 2016 a telecom between CIRA/NRC/NASA/FAA starts to re-define the project's objectives for testing due to the potential involvement of NASA IRT
- The multiple facilities involvement (CIRA-IWT, NASA-IRT, NRC-AIWT), allow to better split the targets in two areas:
 - ❑ Common studies (target #1)
 - ❑ Specialised studies (target #2)

Updates

- The objectives for target #1 on «common» study are based on:
 - Facility inter-comparison vs. nominal conditions using their own instrumentation «standard»
 - Use of new technologies and some legacy instruments, to assess accuracy, and provide information on the potential differences in the community's tunnel calibrations
 - Data processing methodologies used for LWC and Size instruments
- The objectives for target #2 on the «specialised» study are for the test facility that can be able to generate specific conditions through which it will be:
 - Improve understanding of capabilities of instrumentation to separate of ice and liquid components in mixed-phase conditions
 - Assess the instrumentation response in «critical» 50 μm – 150 μm region for better characterization of SLD conditions with bi-modal PSDs

Icing Wind Tunnels



CIRA IWT

T/S size (HxW)	Max speed	SAT	Altitude
2,25 m x 1,15 m	225 ms ⁻¹	-40 °C	23,000ft

Target #1 Facility's std instruments & new technologies (IKP-2, HSI...)

Target #2 For b-modal PSDs: CDP-2, 2D-S ...

NASA IRT

T/S size (HxW)	Max speed	SAT	Altitude
1,8 m x 2,7 m	150 ms ⁻¹	-35 °C	s.l.

Target #1 Facility's std instruments & new technologies (IKP-2, HSI...)

Target #2 For b-modal PSDs: CDP-2, PDI-4, 2D-S

NRC Altitude Icing Wind Tunnel

T/S size (HxW)	Max speed	SAT	Altitude
0.57 mx 0.57 m	100 ms ⁻¹	-35 °C	30,000 ft

Target #1 Facility's std instruments & new technologies (IKP-2, HSI...)

Target #2 For mixed-phase: CPSPD, PDI-4, ...

CIRA std approach used for MVDs, PSDs calibration

Used 3 Instruments

- ADA small range ($1 \mu\text{m} - 147 \mu\text{m}$)
- ADA large range ($2 \mu\text{m} - 664 \mu\text{m}$)
- OAP 2DC-G ($15 \mu\text{m} - 970 \mu\text{m}$)



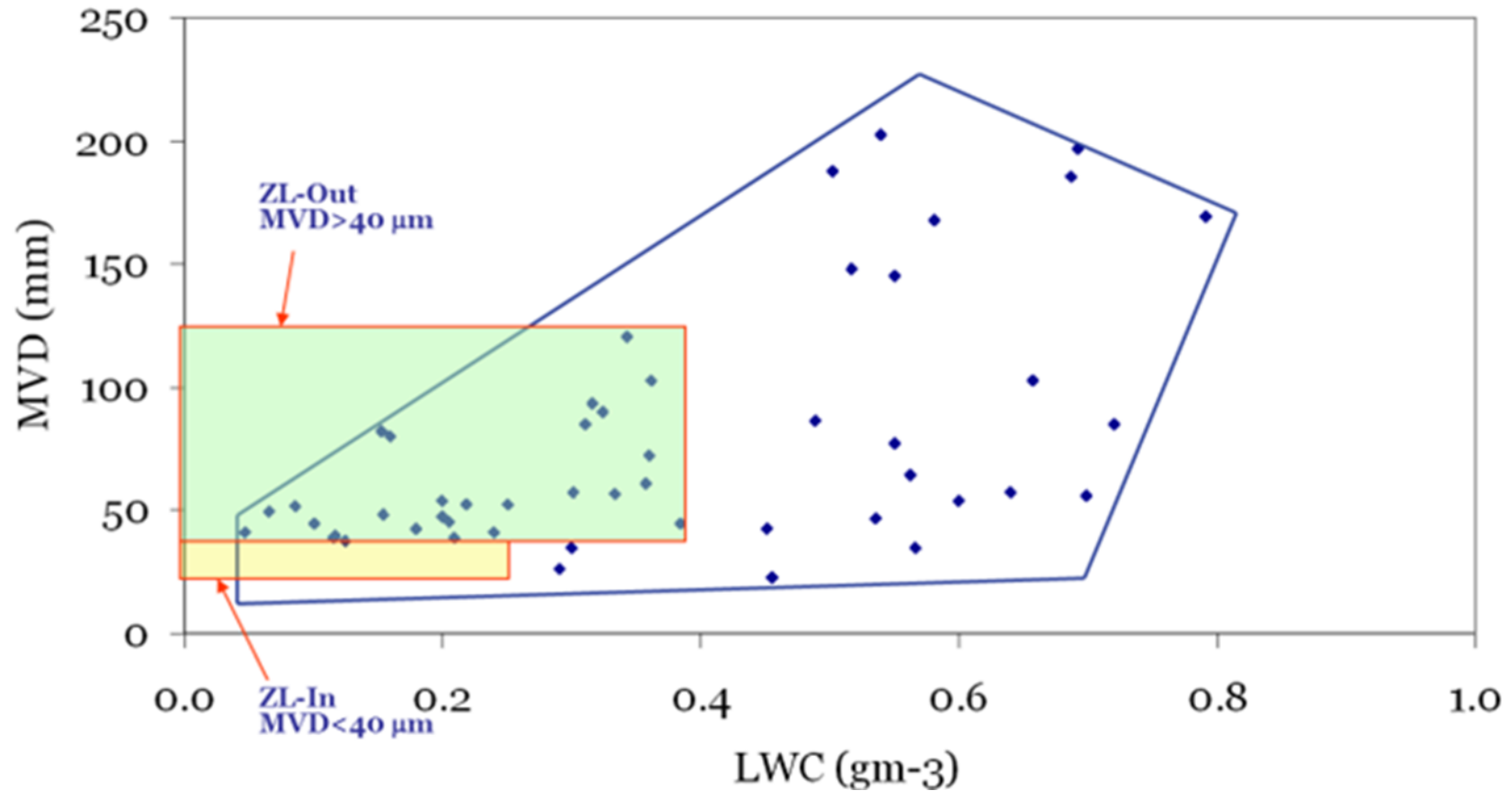
CIRA std approach used for MVDs, PSDs calibration

Used 3 Instruments

- Icing Blade
- SEA 2 mm hot-ware sensor head
- SEA Robust probe with concave element



Preliminary ATS envelope in SLD conditions at 60 m/s



Conclusions

- The LD envelope achieved with previous CIRA SLD calibration needs to be improved with generation of more SLD conditions with bi-modals PSDs characteristics
- As preparatory activities further investigation need to be performed to better address both MVD and LWC distribution and coverage in larger IWT test section (2,35 m H x 3,6 m W).
- The uncertainty on the LWC measurements must be also resolved due to the lack of absolute reference system for LWC calibration in SLD conditions (the iso-kinetic evaporator probe will be useful during the instrumentation comparison to assess this issue).
- A new spray nozzle setup is in developing phase to improve the bi-modality cloud characteristics.