The De-Icing Comparison Experiment (D-ICE):

A Campaign for Improving Data Retention Rates of Radiometric Measurements Under Icing Conditions in Cold Regions

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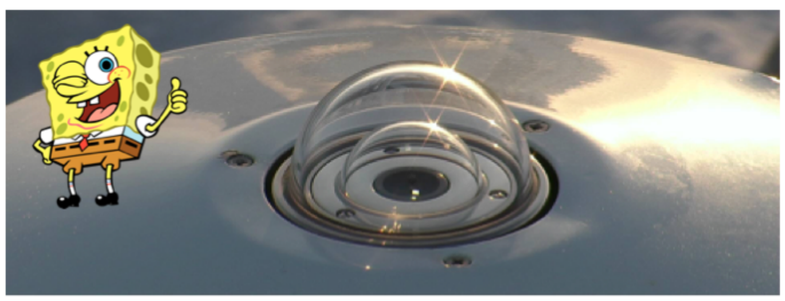
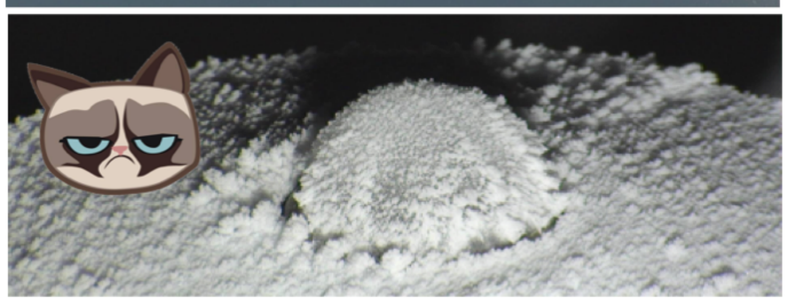
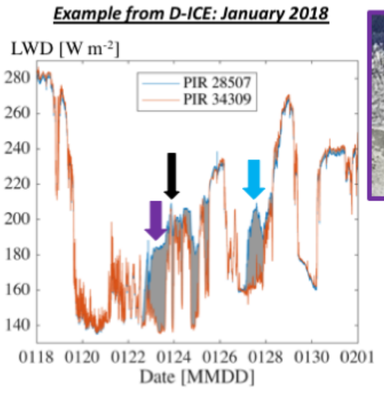
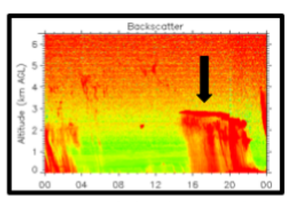
The Problem: Biased broadband radiometric measurements when ice builds on instrument domes. The biases are + or -, affect SW and LW and have signals similar to clouds. D-ICE is evaluating ventilation and heating technology designed to mitigate icing at Barrow: data and images of 26 radiometers. Also, all 4 upward-facing radiometers at both NSA and OLI (ARM campaign "DICEXACO").





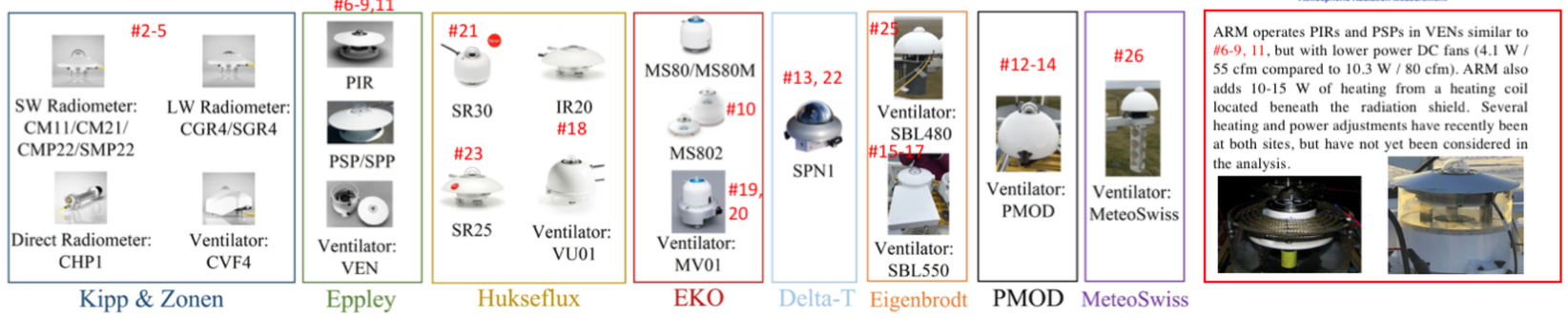
Example from D-ICE: January 2018

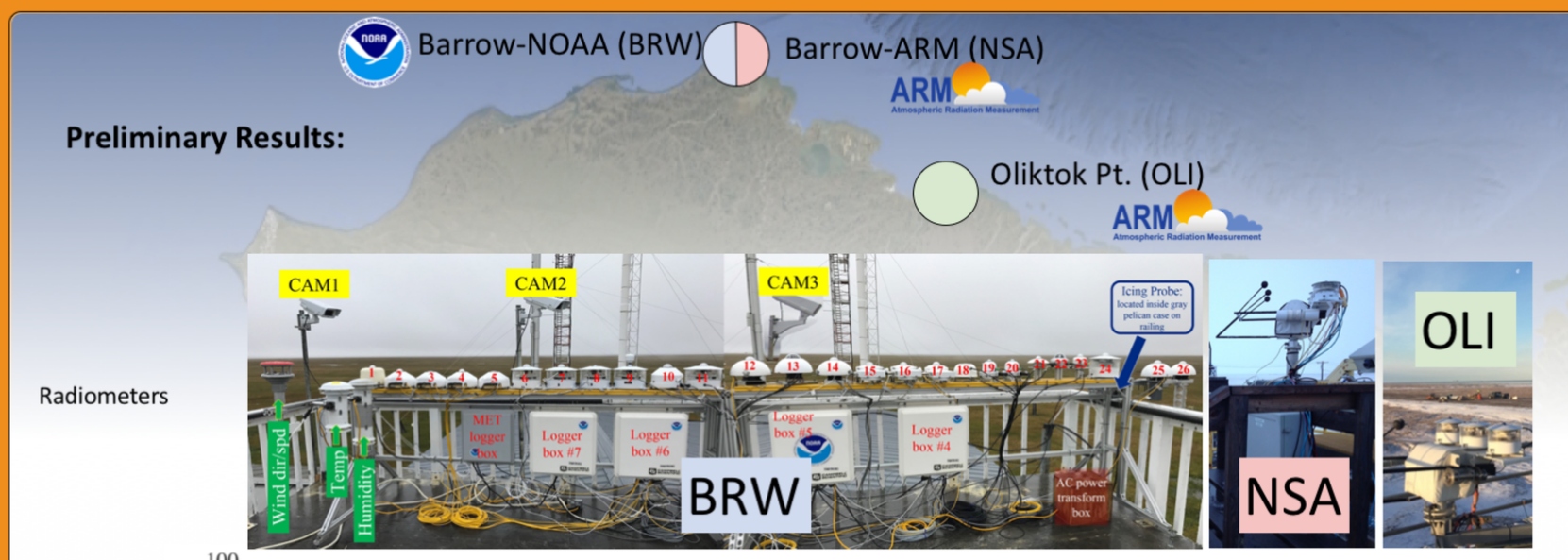


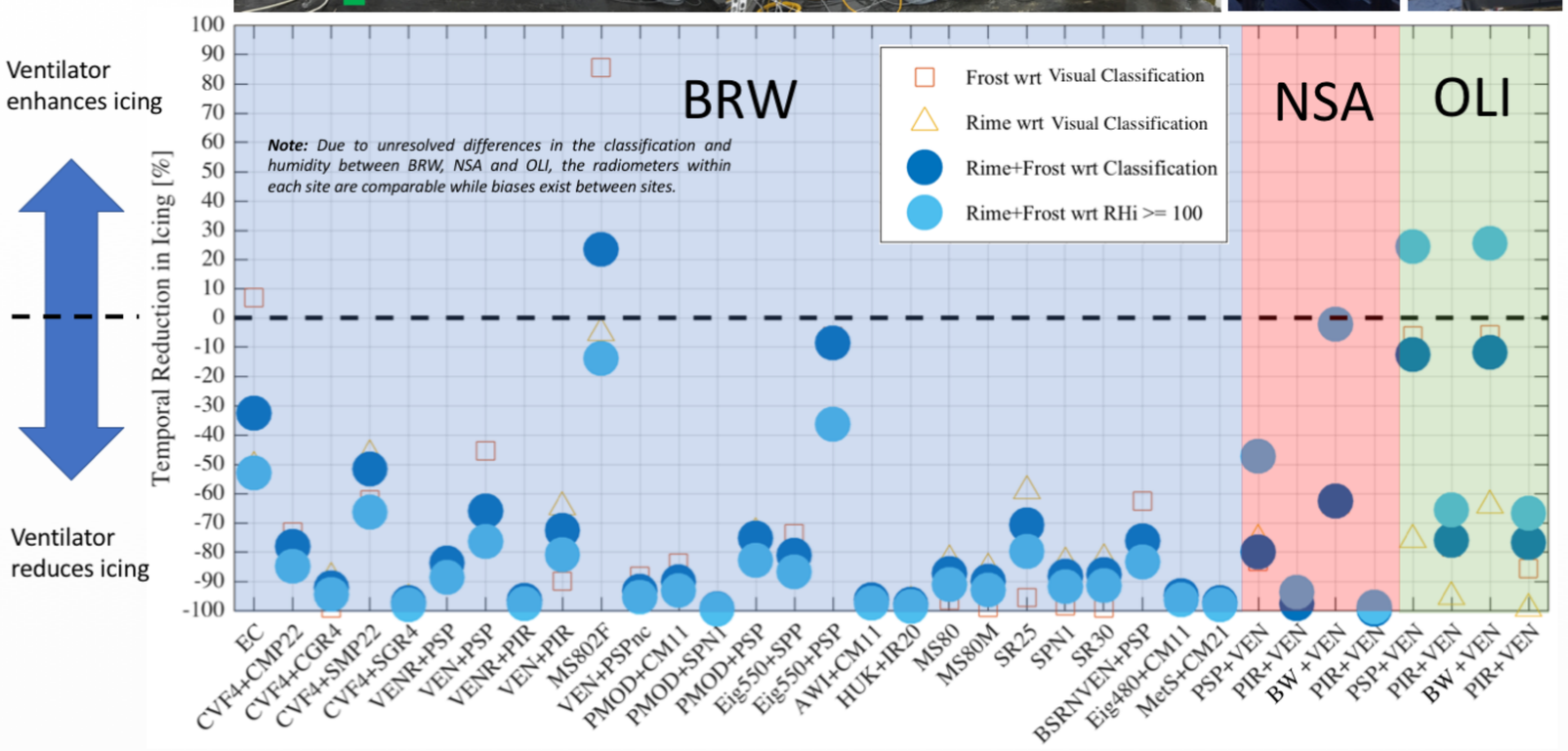


Biases for iced pyrgeometers were ~50 W m^{-2}, yet the mean LWD for Jan was **202 W m^{-2}** and **198 W m^{-2}**, a relatively small difference that is the result of the integrated influence of cloud cover (which reduces the bias, as in the **example, ~63% in Jan [CEILO]**), in addition to the frequency (**4.7%** vs **34.5%**) and severity of icing. **PIR 34309** was iced less frequently because of a very subtle ventilator variation – just a 2 mm lift in the radiation shield!

Details from the main platform







Analysis of > 400,000 images of radiometer domes acquired November 2017 through February 2018: 76 ± 29% reduction in ice caused by rime and frost when averaged across 26 **BRW** systems; 85% ± 17% at **NSA** and 44% ± 37% at **OLI**.

Conclusions:

- Initial results support anecdotal reports that ventilation without additional heating is a viable option for preventing ice from developing on radiometer domes.
- The average improvement against rime/frost was 73 ± 31% amongst all systems; better for pyrgeometers than pyranometers, likely due to lower-profile domes.
- Monthly mean downwelling longwave flux (Jan 2018) using a common pyrgeometer setup was biased high by only ~4 Wm^{-2} compared to ice-free measurements.
- PSPs at NSA and OLI are frequently iced, but PIRs perform well in the current system.
- Compared to a best-estimate downwelling longwave flux derived from the five D-ICE pyrgeometers, the NSA "iced" qcrad LW fluxes, are unbiased (-0.2 ± 1.4 Wm^{-2}).
- We consider all results to be ***preliminary.***

Acknowledgments

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