INFRARED CLOUD IMAGER MEASUREMENTS AT BARROW, ALASKA

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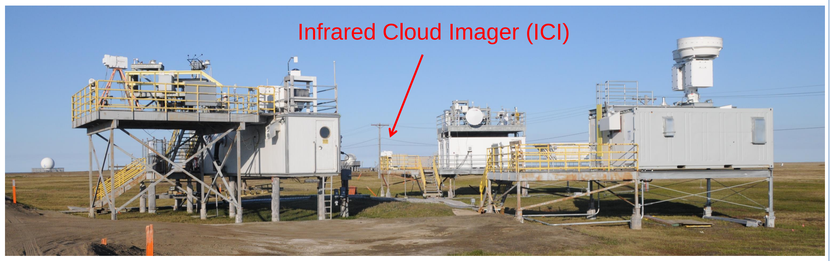
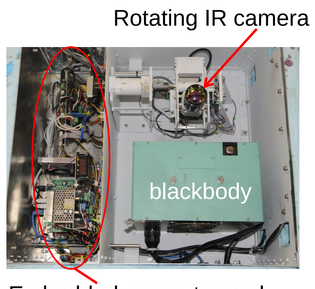
Objective: measure cloud distribution and optical depth during day and night for a full annual cycle in Barrow, Alaska and refine Infrared Cloud Imager design for deployment as part of Arctic Observing Network.

1. Infrared Cloud Imager (ICI) at Barrow, Alaska

ICI systems use compact, uncooled, long-wave IR cameras (λ~8-13 μm) and custom calibration algorithms. The ICI-3 with large-area blackbody calibration source was deployed at Barrow in July 2012.

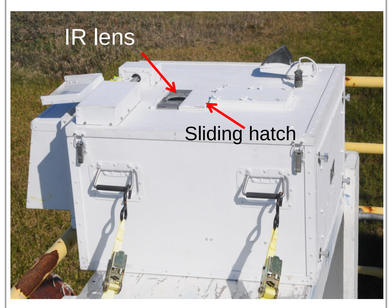


ICI-3 interior



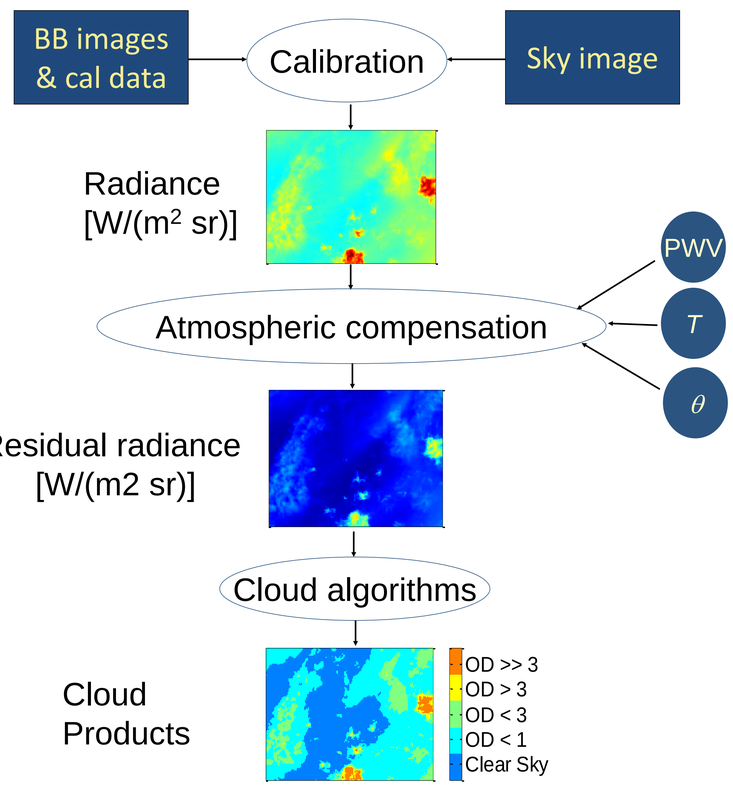
Embedded computer and electronics (Ethernet control)

ICI-3 exterior

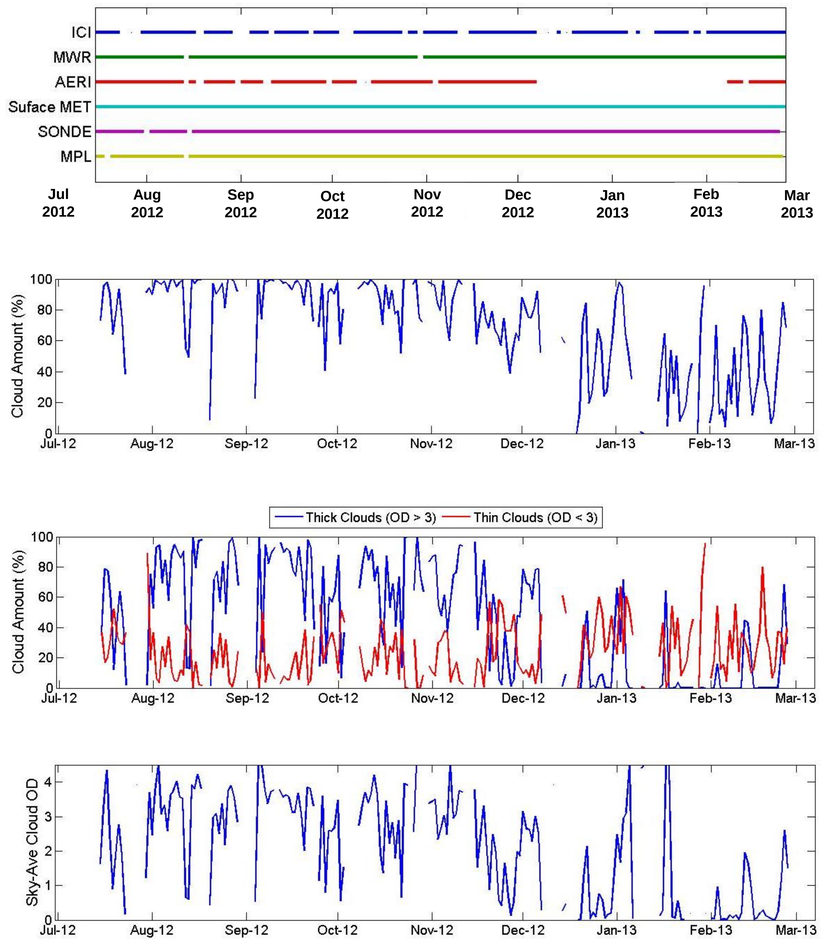


ICI-3 with 110° diagonal field of view

2. ICI image processing



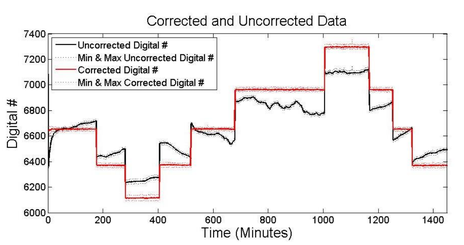
3. ICI operates continuously in precipitation-free periods, acquiring 1 image each 5 minutes

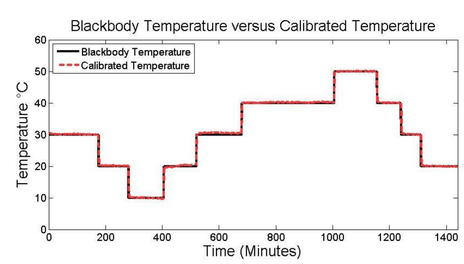


4. Calibration method may enable deployment of compact ICI with no blackbody source

Camera digital # with and without correction based on camera temperature …

compact ICI in Montana



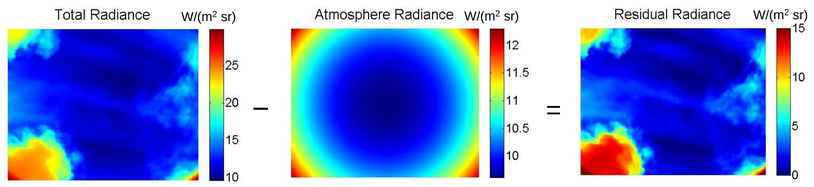


Calibrated camera output compared with blackbody at different temperatures (rms ΔT = 0.25 K at 300 K)

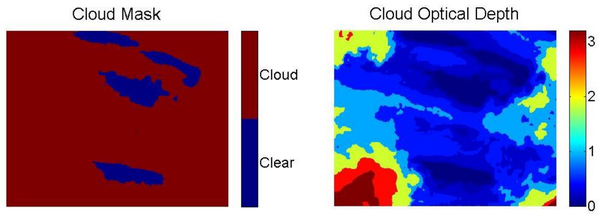
Barrow ICI data will be processed with & without blackbody data to determine long-term stability & accuracy of compact ICI method.

5. ICI measures spatial distribution of radiance, from which it isolates and classifies clouds.

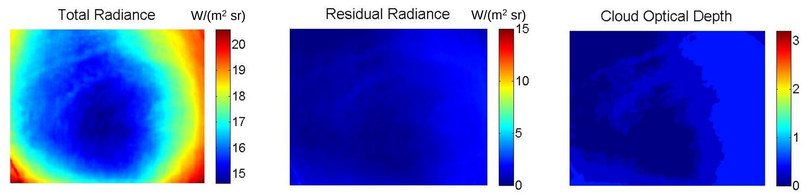
Measured – clear sky = residual radiance



Example cloud products



Another example … thin clouds



Many other options exist for spatio-temporal cloud statistics

6. Summary

IR cloud imaging provides consistent day and night cloud detection throughout night and day;

Measured radiance can be processed to determine spatio-temporal statistics of cloud presence, cloud optical depth…

Unique calibration methods allow long-term deployment with or without onboard blackbody source.

References

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