Validation of permanent snow, fresh snow, and sea ice ADMs

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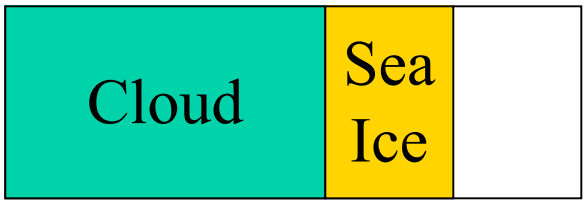
Purpose of this study

- Permanent snow ADMs were built from global data. Clear sky scenes are divided only two types (bright and dark snow). We need to do a consistency check with irradiances derived from regional ADMs (clear-sky scenes).
- Sea ice and fresh snow ADMs do not depend on snow/sea ice fractions underneath clouds. Because microwave instruments can retrieve snow/sea ice fractions under clouds, it can be tested if the assumption is reasonable.

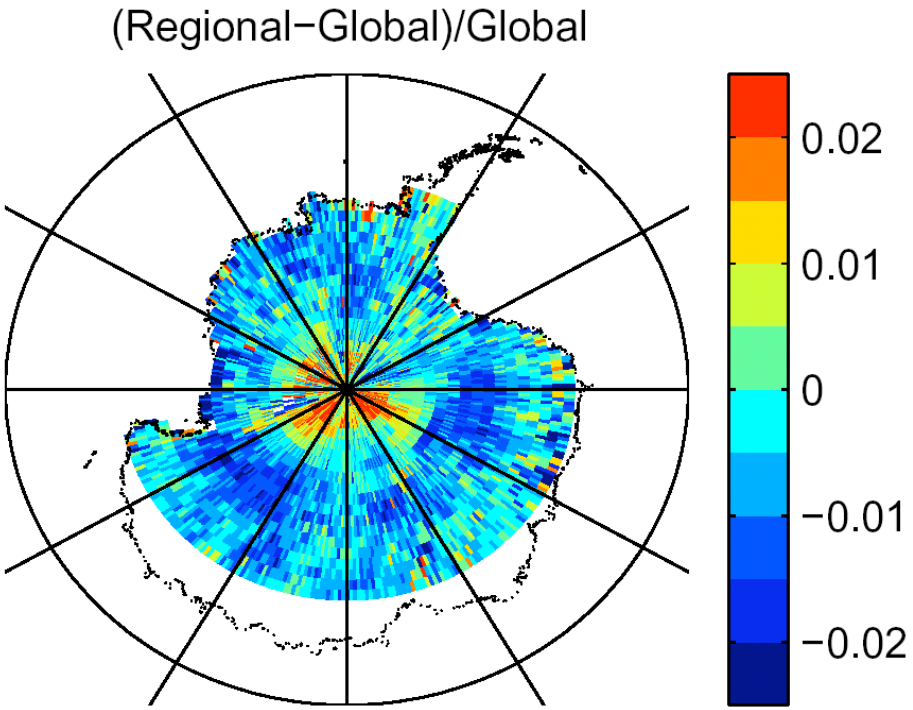


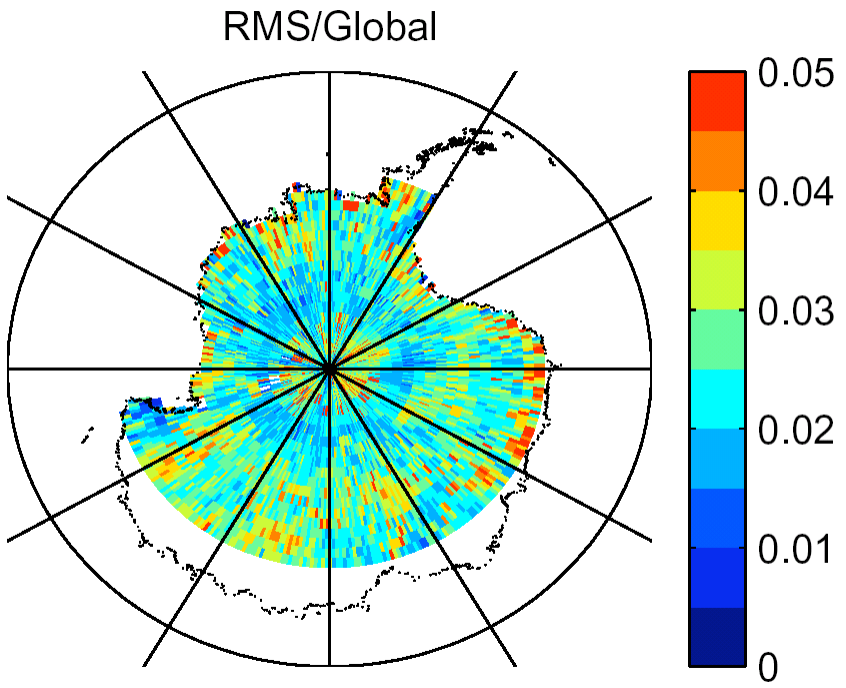
If cloud cover is 50%, sea ice cover changes from 0 to 50%
If clouds are overcast, the scene does not depend on sea ice fraction.

Method (permanent snow)

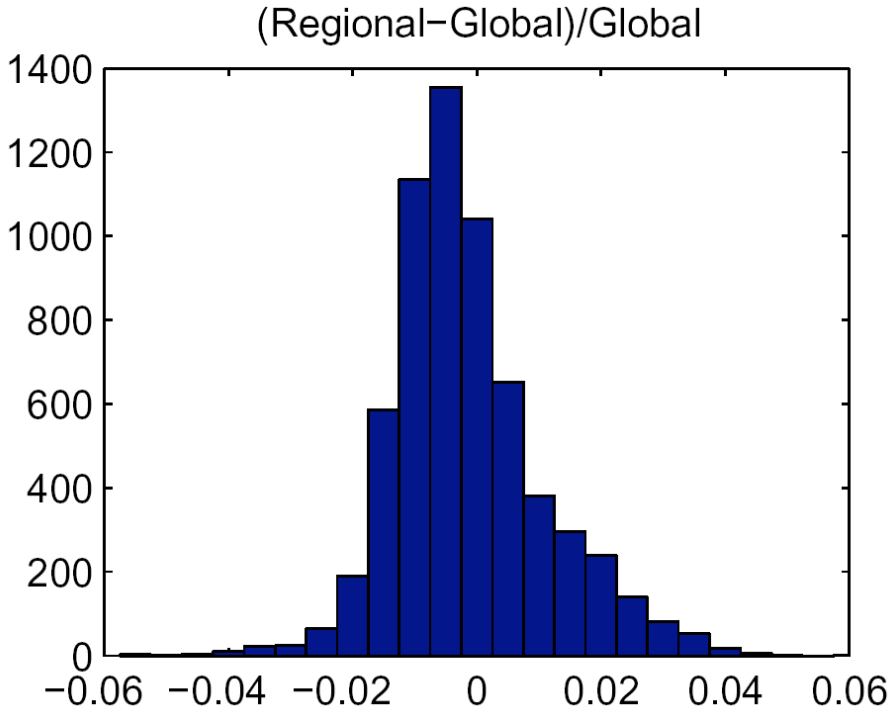
- Build clear permanent snow ADMs using technique used for clear-sky land ADMs. Clear-sky land ADMs are built from radiances taken over a 1 degree by 1 degree region over a month.
- Compare irradiances derived from clear-sky permanent snow global and regional ADMs.

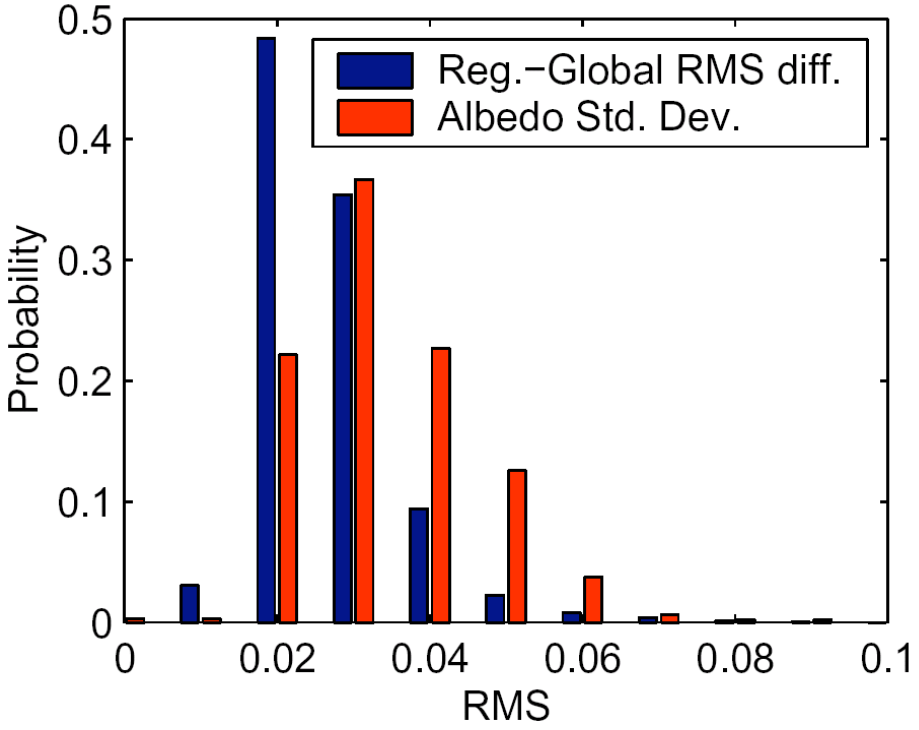
Permanent snow albedo relative differences





RMS difference vs. standard deviation of surface albedo





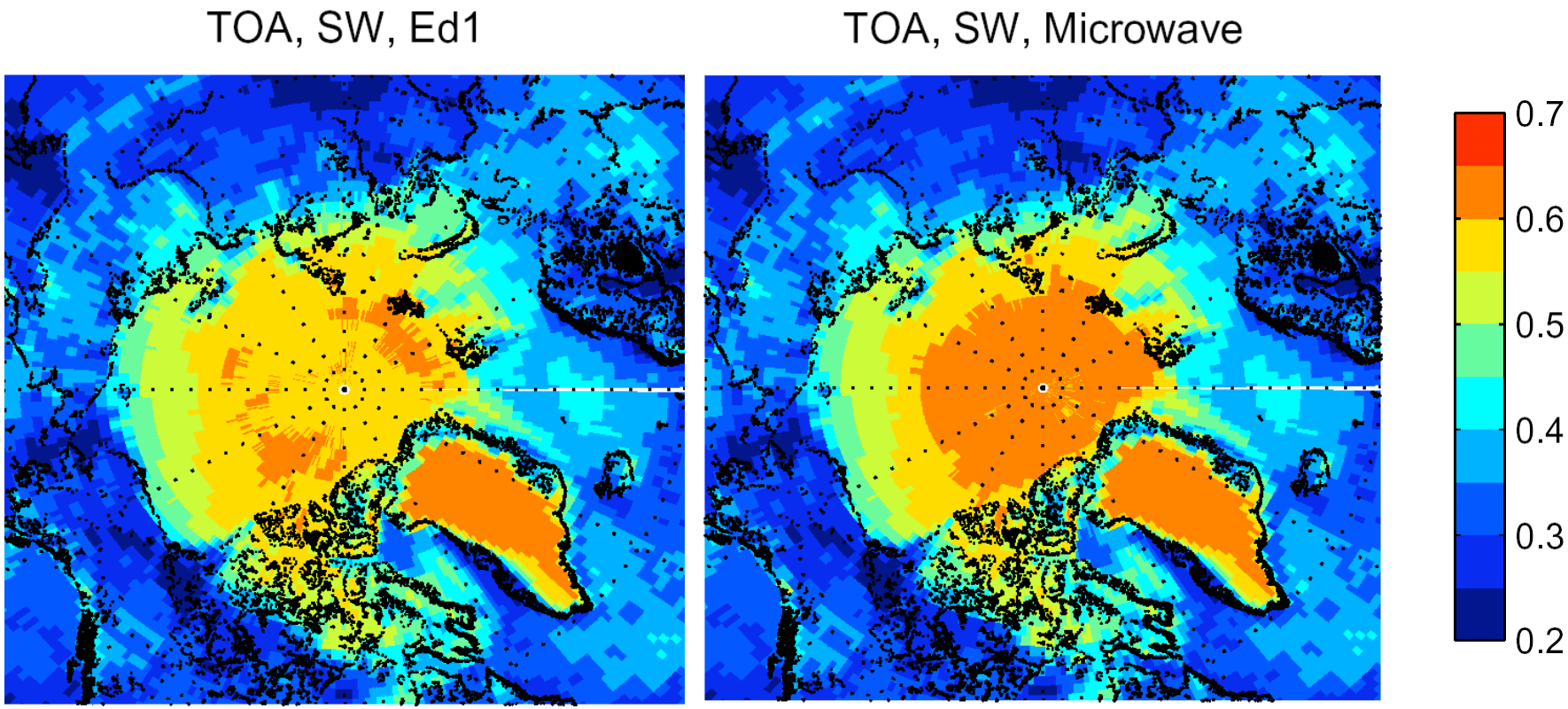
Summary: Clear-sky albedo over the Antarctica

	Mode diff.	Mean diff.	Standard Deviation	Mean RMS diff.
Reg. Global diff.	-0.005	-0.001	0.017	0.030
Albedo	———	———	0.038	———

Method (sea ice and fresh snow)

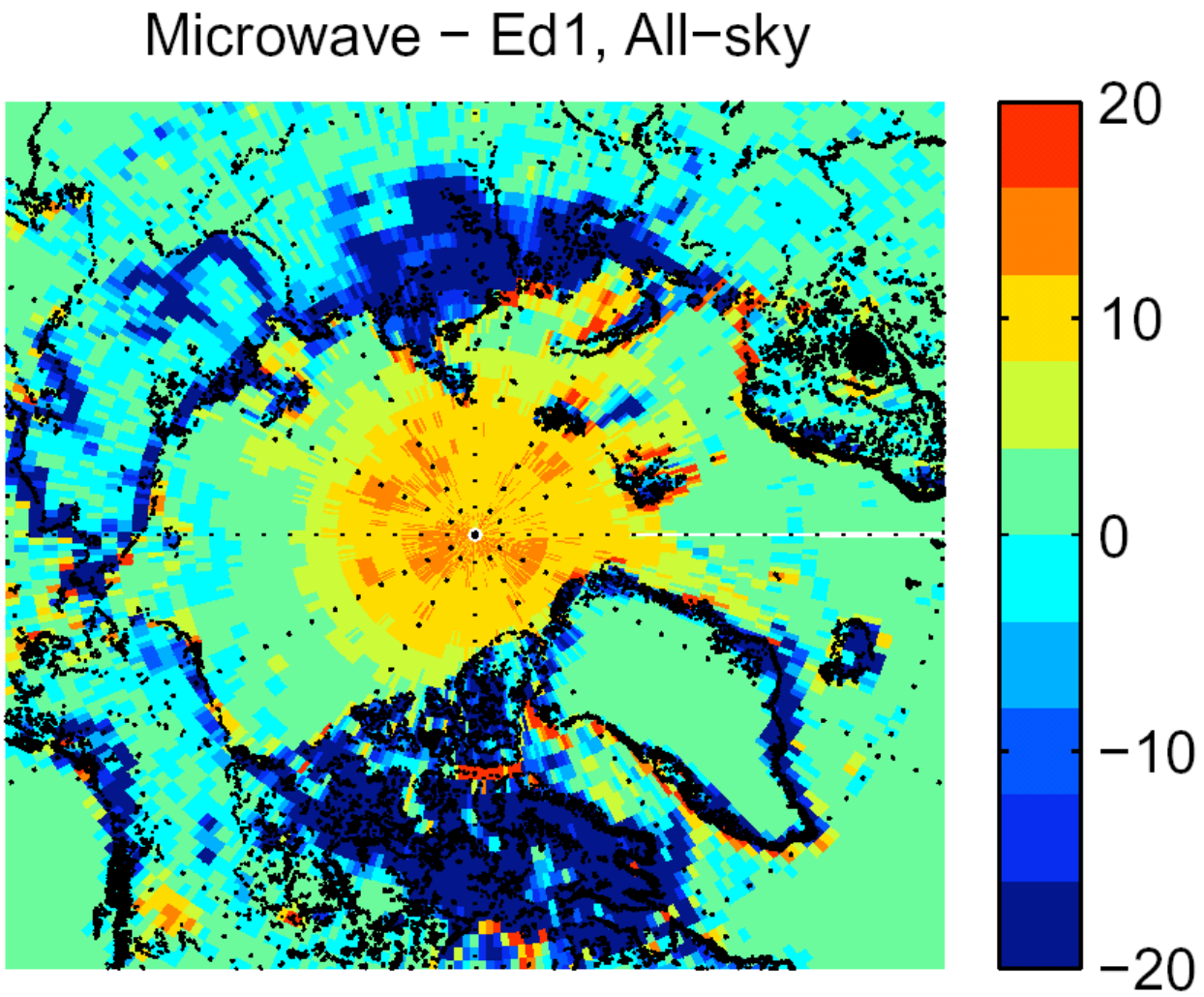
- Derive a new set of sea ice ADMs that depends on MODIS-derived cloud fraction and SSM/I-derived sea ice fraction using Aqua data.
- Compare irradiances derived from two sets of ADMs (Aqua ed1 and the newly developed ADMs).

TOA Albedo



June 2003, Aqua

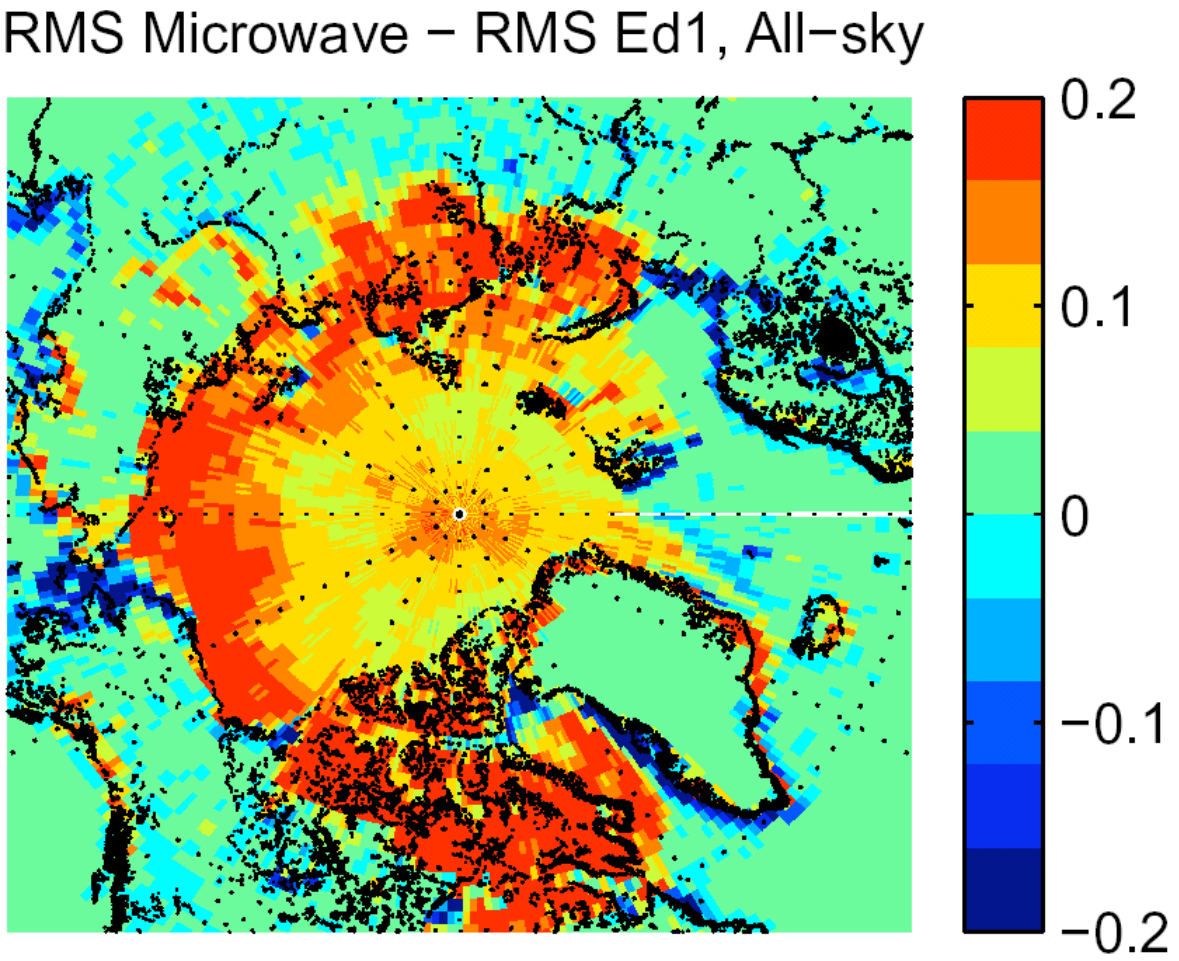
Flux difference



Radiance Comparison

- Compare the observed CERES SW radiance and radiance from ADMs.
- The radiance from ADMs is the mean radiance for a given scene type and viewing geometry.
- An underlying hypothesis is that a set of ADMs that predicts the radiance better can also predict the irradiance better.

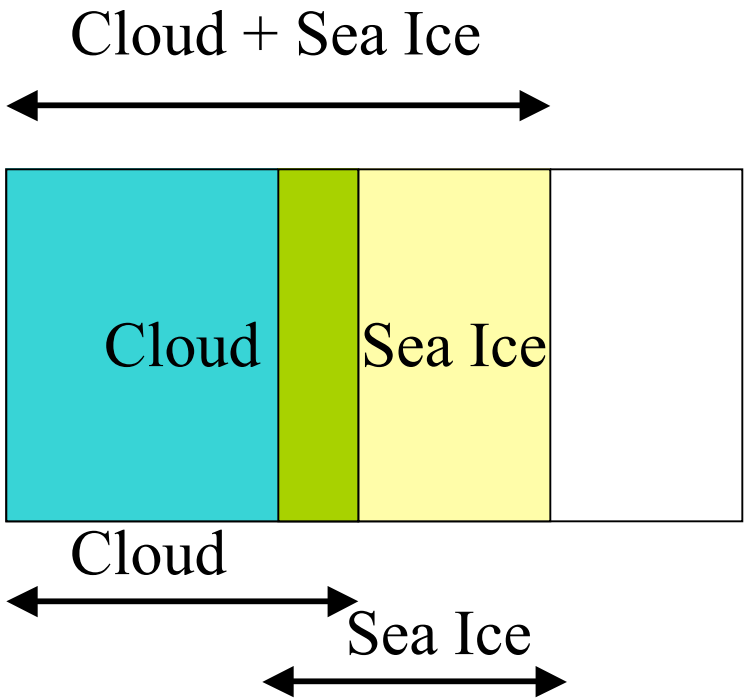
Radiance RMS difference



$$\Sigma\{[(I\_adm - I\_obs)^2]_{micro} - [(I\_adm - I\_obs)^2]_{ed1}\}/I\_obs$$

From Aqua ed1 June 2003 (result from other months is similar)

Reason



Operational ADMs: The sum of clouds and sea ice cover is fixed by scene type

MODIS-SSM/I ADMs: cloud and sea ice covers are fixed by scene type but not the sum.

Conclusions

- Relative RMS difference between albedos derived from global and regional ADMs averaged of the Antarctica is smaller than the mean relative standard deviation of 1^{o}by1^{o} albedos.
- Scene types used for the current operational sea ice and fresh snow ADMs (depends on the sum of cloud and sea ice fractions) are better than scene types that treat cloud fraction and sea ice fraction independently.
- Future work

  BRDF comparison over dome C

  Scene ID check by CALIPSO, CloudSat, MISR

Back-up slides

Flux difference (clear-sky)