

# Terra-Aqua Radiance and Irradiance Comparisons

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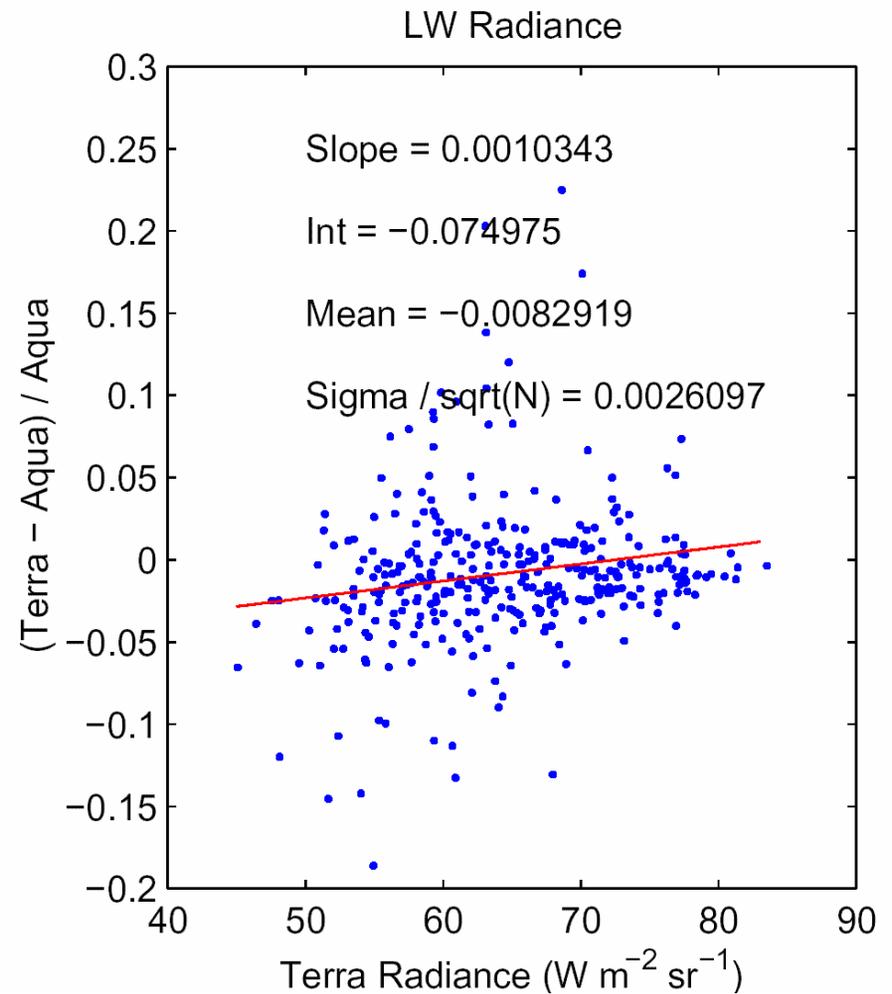
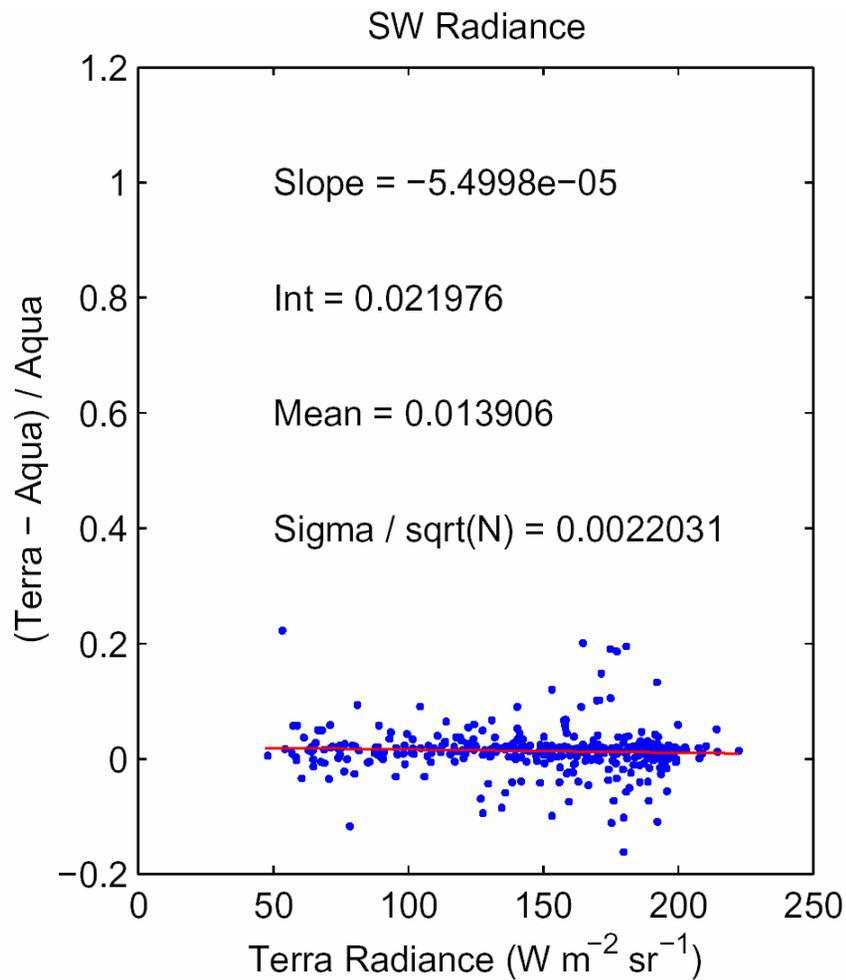
# Outline

- Terra (FM1) and Aqua (FM4) radiance comparison from 60N-75N (calibration difference).
- Comparison of SW flux over permanent snow, fresh snow, and sea ice.
- Comparison of nighttime LW flux over permanent snow.

## FM1-FM4 Comparison Method

- Use 10 months (3, 4, 5, 6, 7, 8, 2003, and 3, 4, 5, 6 2004) of Terra and Aqua data collected over Greenland between 65 N and 75 N.
- Average nadir view ( $vz < 5$  degree) radiance over a 1 degree by 3 degree region.
- Select grids when the average FOV time difference is less than 15 min.
- Correct slight average solar zenith angle difference by dividing by the cosine of the solar zenith angle and by multiplying the cosine of the average solar zenith angle of Terra and Aqua.

# FM1 – FM4 Radiance Comparison



# FM1-FM4 Calibration difference

## (FM1 – FM4) / FM4

	Bias	$\sigma/\text{sqrt}(n)$	Instrument Group's estimate
SW (with Rev1 Correction)	0.014	0.0022	0.018
LW (Day)	-0.008	0.0026	-0.006
LW (Night)	-0.003	0.0014	-0.001

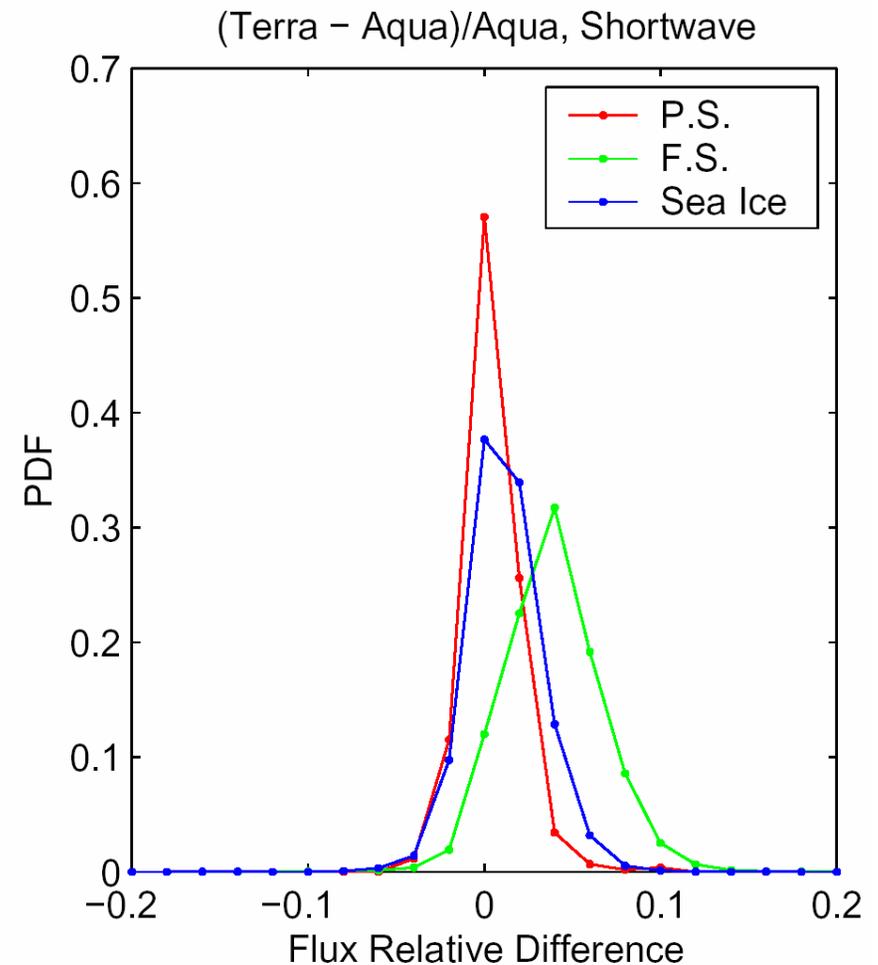
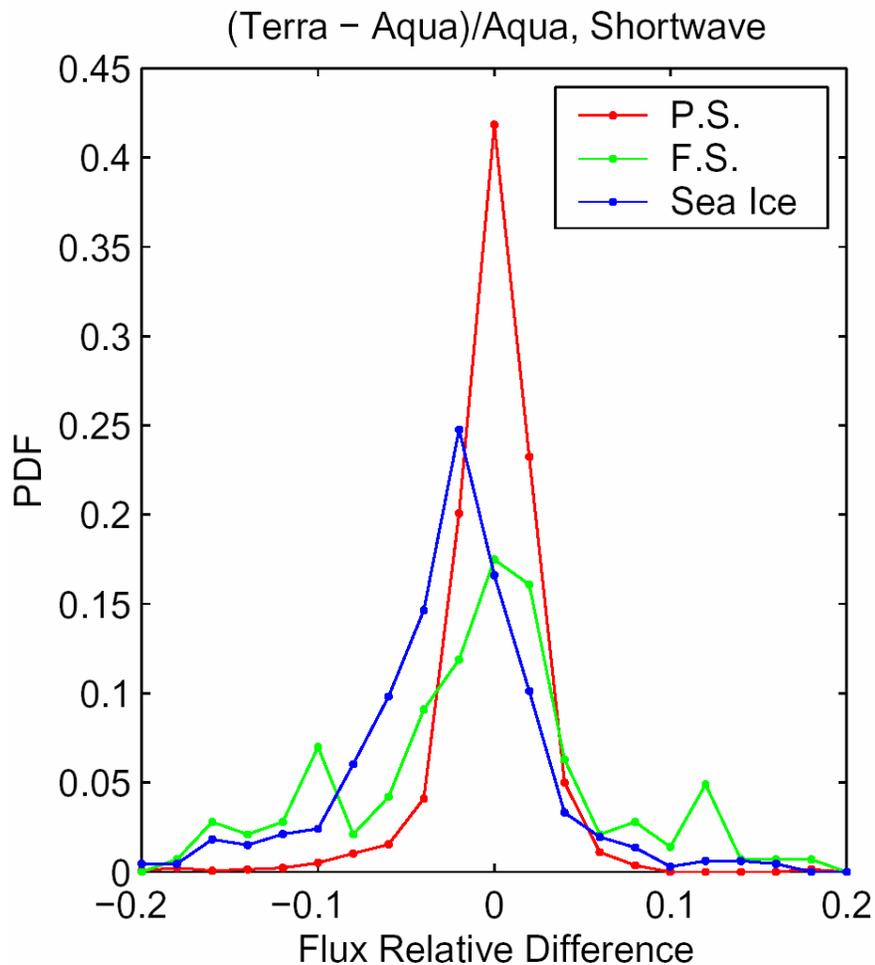
# Terra-Aqua Flux Comparison Method

- Use two seasons (Summer, 6,7, and 8, 2003, and Spring, 3, 4, and 5, 2004) of Terra and Aqua data collected between 65 N and 75 N.
- Average flux over a 1 degree by 3 degree region.
- Select grids when the average FOV time difference is less than 7.5 min.
- Correct FM1 and FM4 calibration difference.
- Correct slight average solar zenith angle difference by dividing by the cosine of the solar zenith angle and by multiplying the cosine of the average solar zenith angle of Terra and Aqua.

# SW Flux Difference by Snow Surface Type

June, July, and August 2003

March, April, and May, 2004

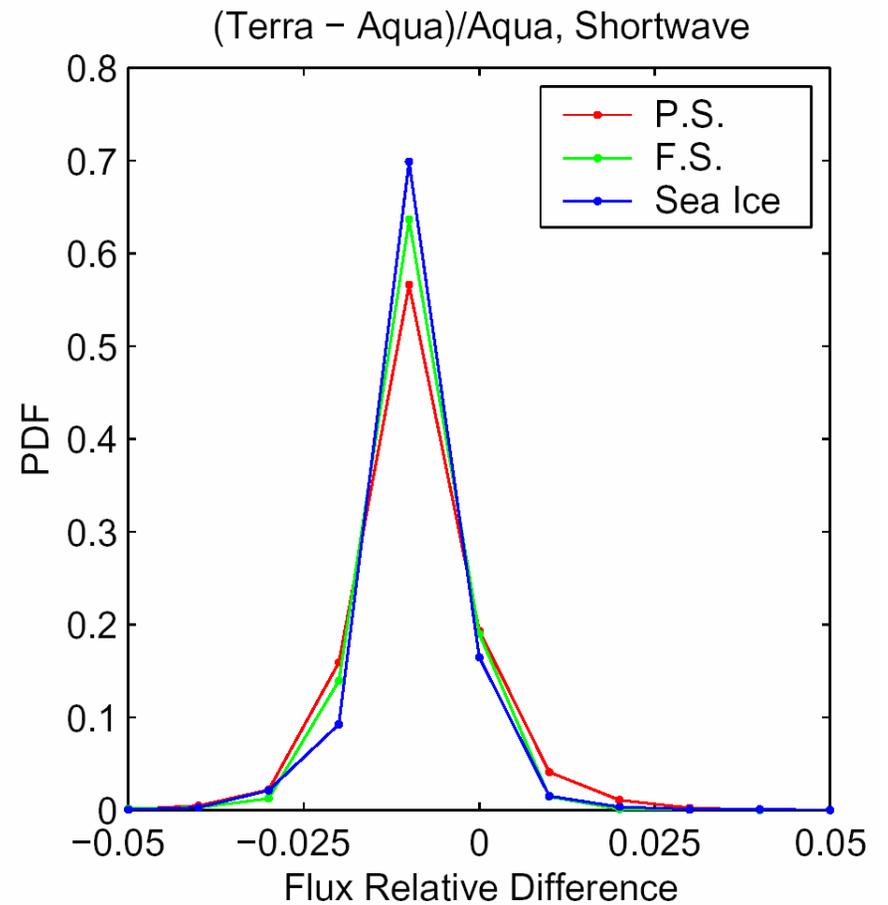
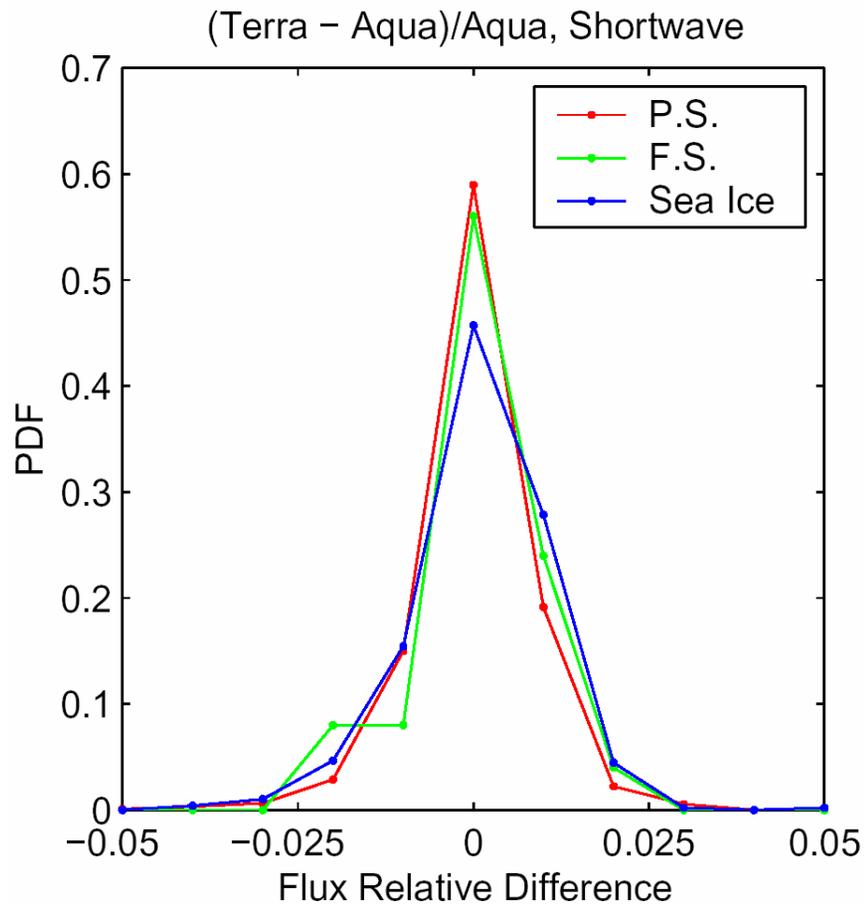


Calibration difference of 0.014 is corrected

# LW Flux Difference by Snow Surface Type

June, July and August, 2003

March, April, and May, 2004



Calibration difference of  $-0.008$  is corrected

# Terra Aqua SW Flux Difference

	Bias (Terra – Aqua)/Aqua	Std. Dev.	Number of Samples	$\sigma/\sqrt{N}$
Permanent Snow	-0.0020	0.0276	1318	0.0008
	0.0049	0.0154	1598	0.0004
Fresh Snow	-0.0106	0.0796	134	0.0068
	0.0390	0.0261	7035	0.0003
Sea Ice	-0.0261	0.0534	660	0.0021
	0.0115	0.0214	3530	0.0004

Top: June, July, August, 2003, Bottom: March, April, May, 2004

## Terra Aqua LW Flux Difference

	Bias (Terra – Aqua)/Aqua	Std. Dev.	Number of Samples	$\sigma/\sqrt{N}$
Permanent Snow	0.0004	0.0082	1216	0.0002
	-0.0094	0.0085	1640	0.0002
Fresh Snow	0.0021	0.0075	48	0.0011
	-0.0096	0.0066	7044	0.0001
Sea Ice	0.0007	0.0096	490	0.0004
	-0.0093	0.0065	3628	0.0001

Top: June, July, August, 2003, Bottom: March, April, May, 2004

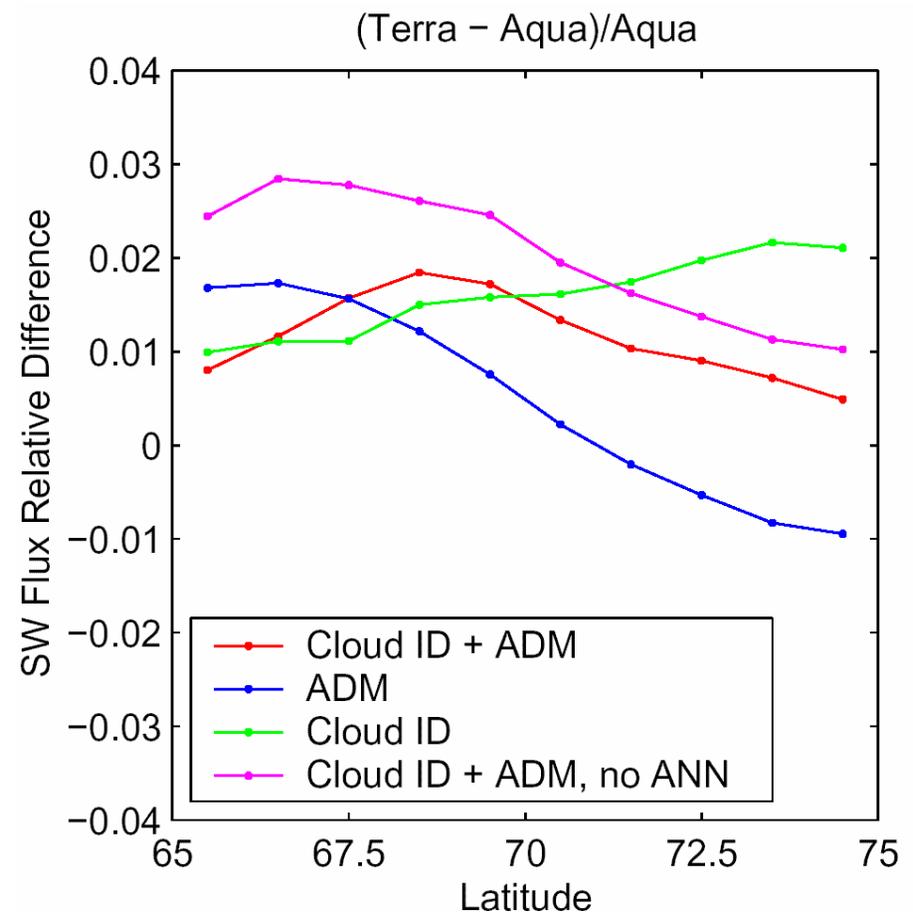
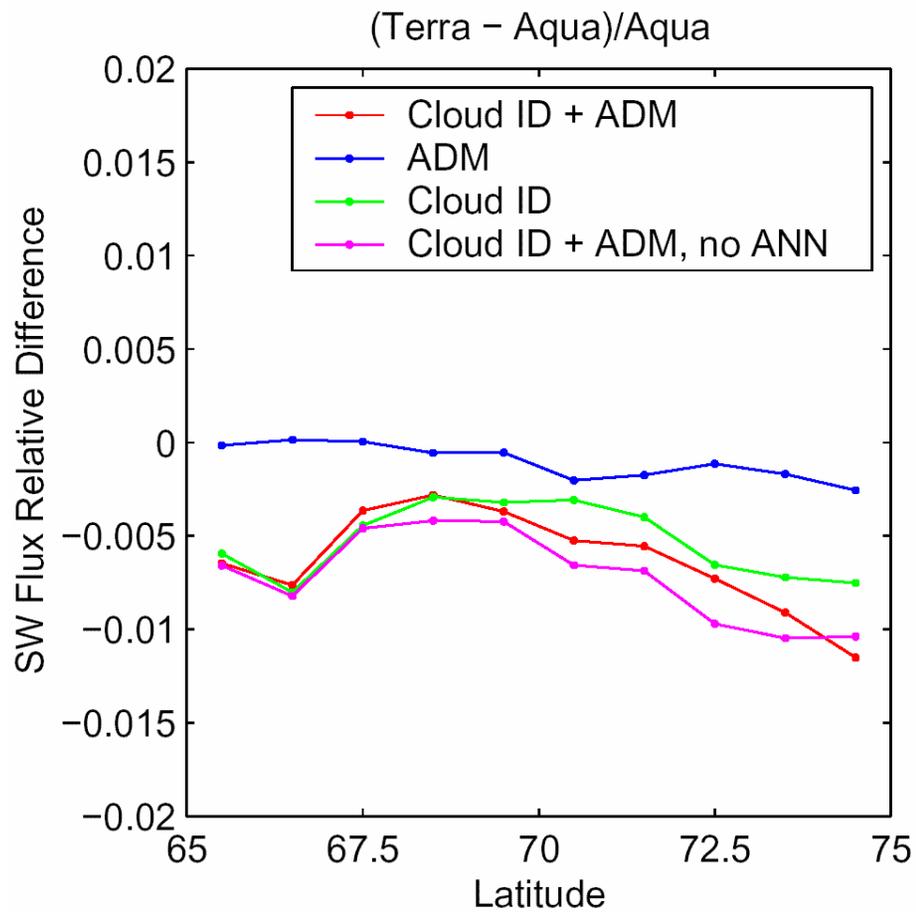
# Terra – Aqua Flux Difference

Scene I.D.	Terra	Aqua	Terra
ADM Table	Aqua	Terra	Terra
Difference Compared to Aqua Scene I.D. + Aqua ADM Table	Scene I.D. + Sampling	ADM Table + ADM Error	Scene I.D. + Sampling + ADM table + ADM Error

# Terra-Aqua SW Zonal Flux Difference due to Snow ADMs

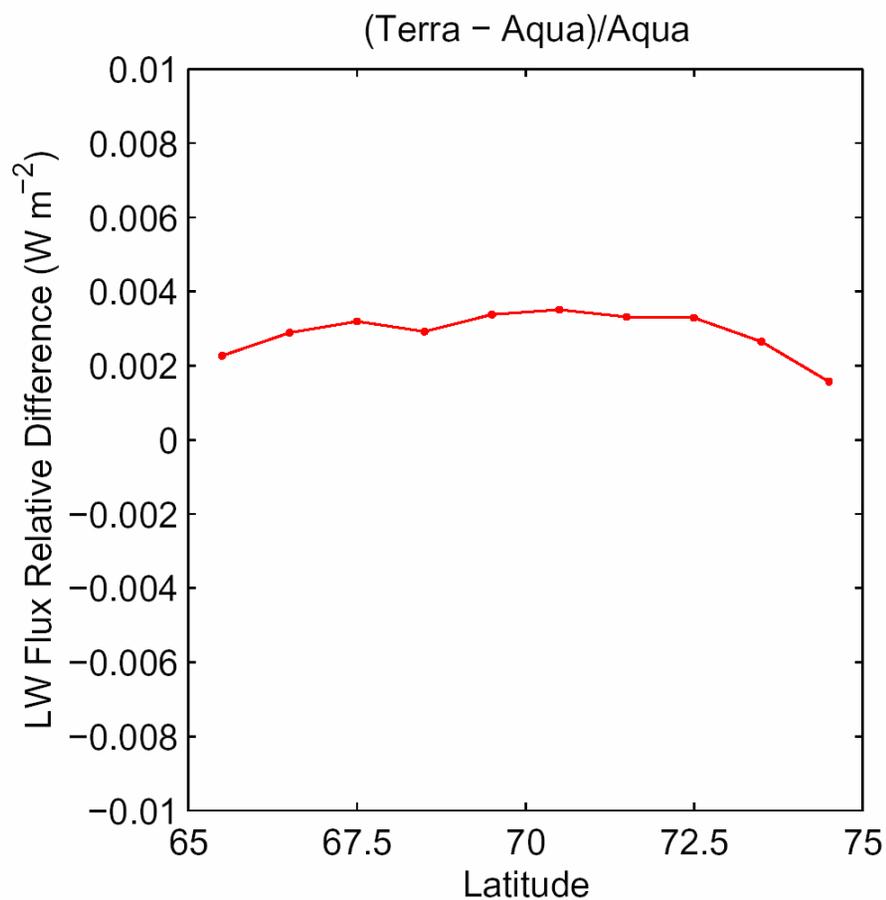
June, July, August, 2003

March, April, May, 2004

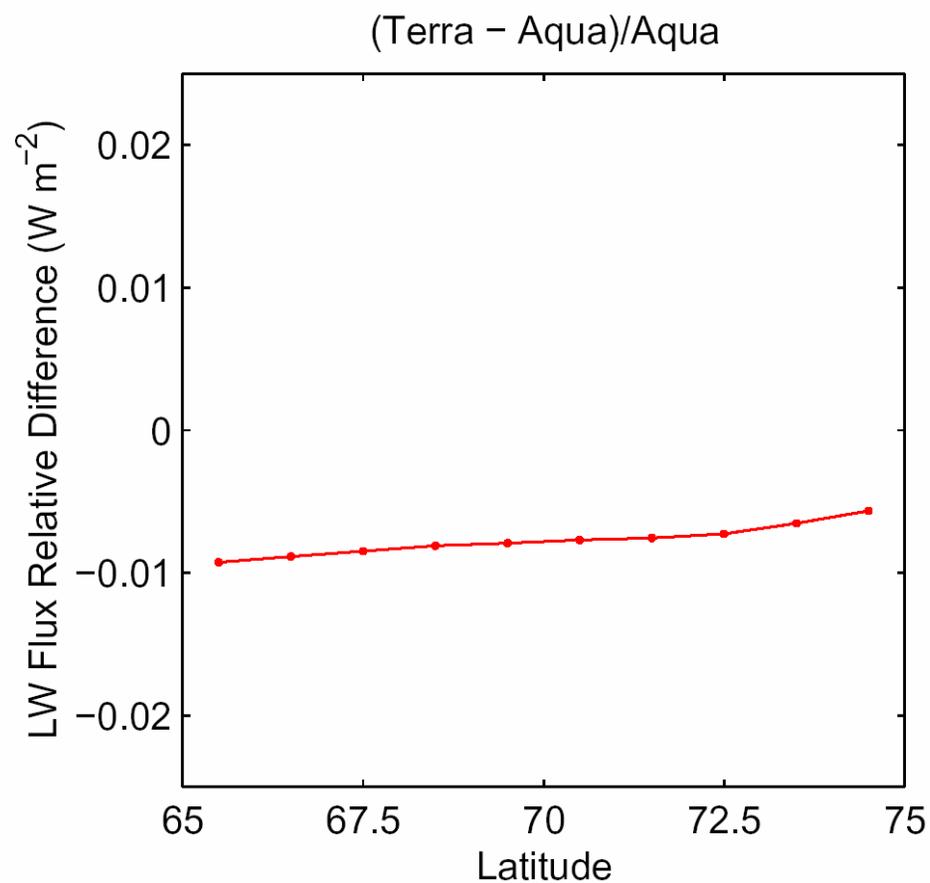


# Terra-Aqua LW Zonal Flux Difference over Snow and Sea Ice Surfaces

June, July and August, 2003

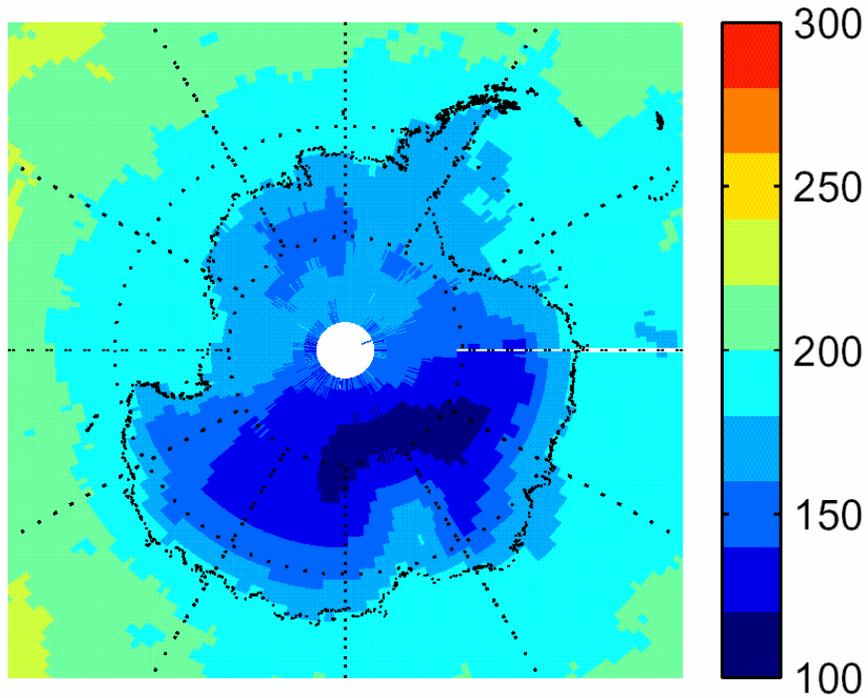


March, April, and May, 2004

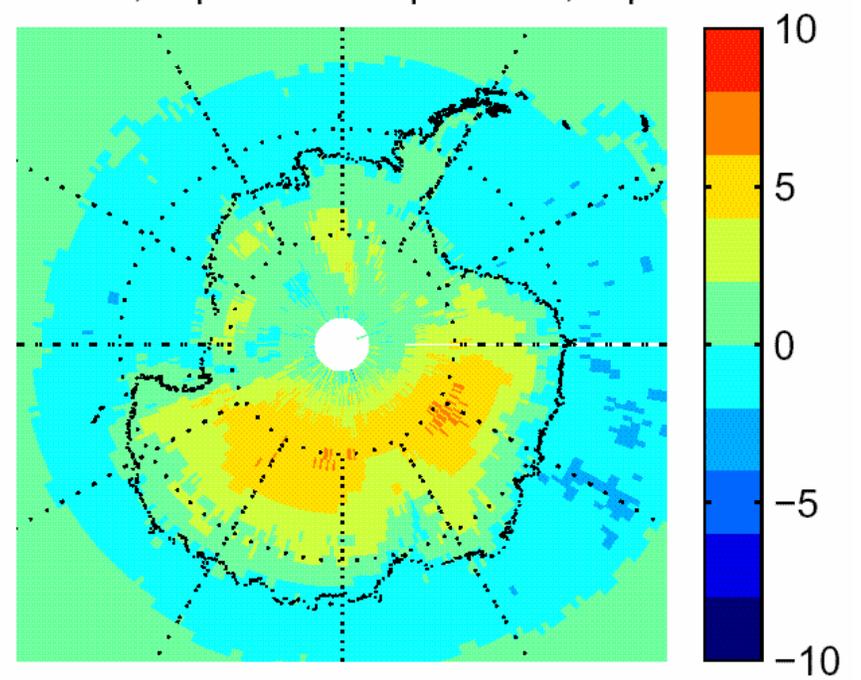


# LW Night Flux over Antarctic

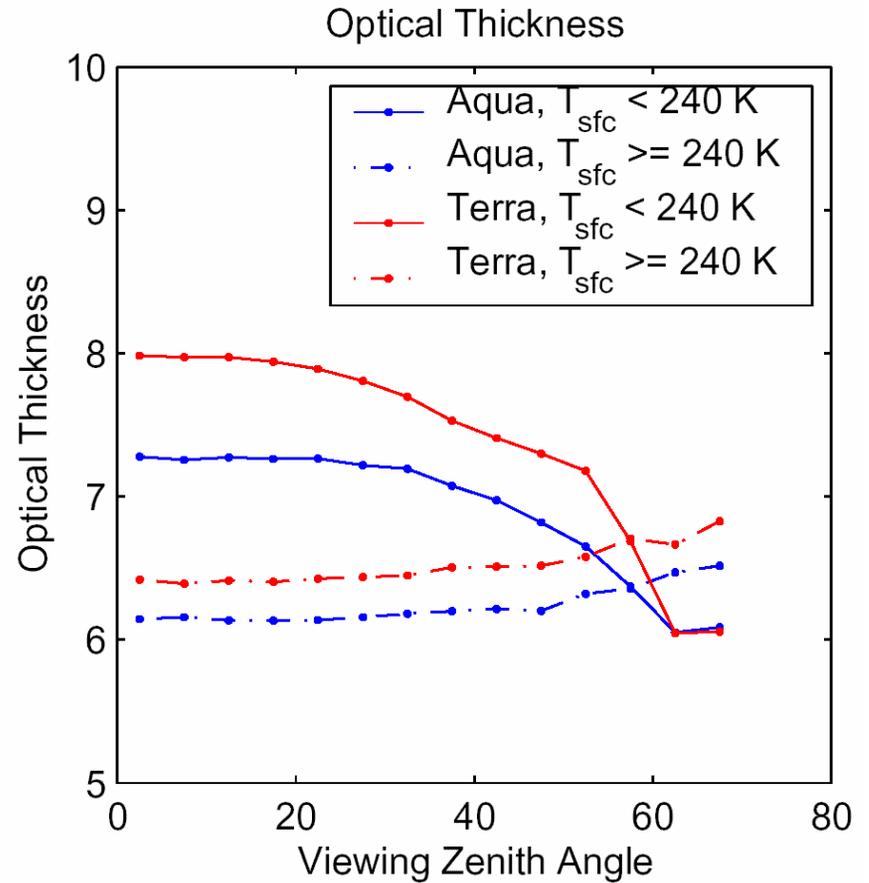
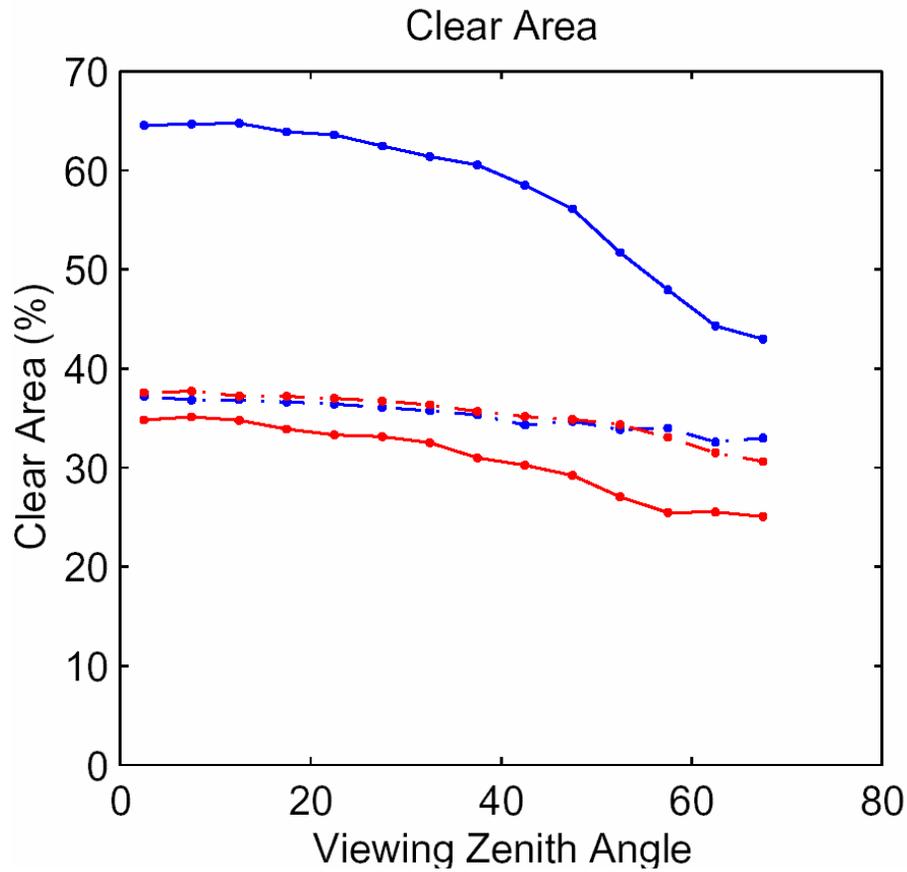
LW Flux, Aqua ADM, Aqua I.D.



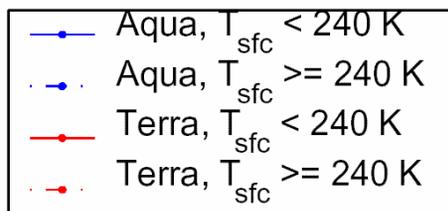
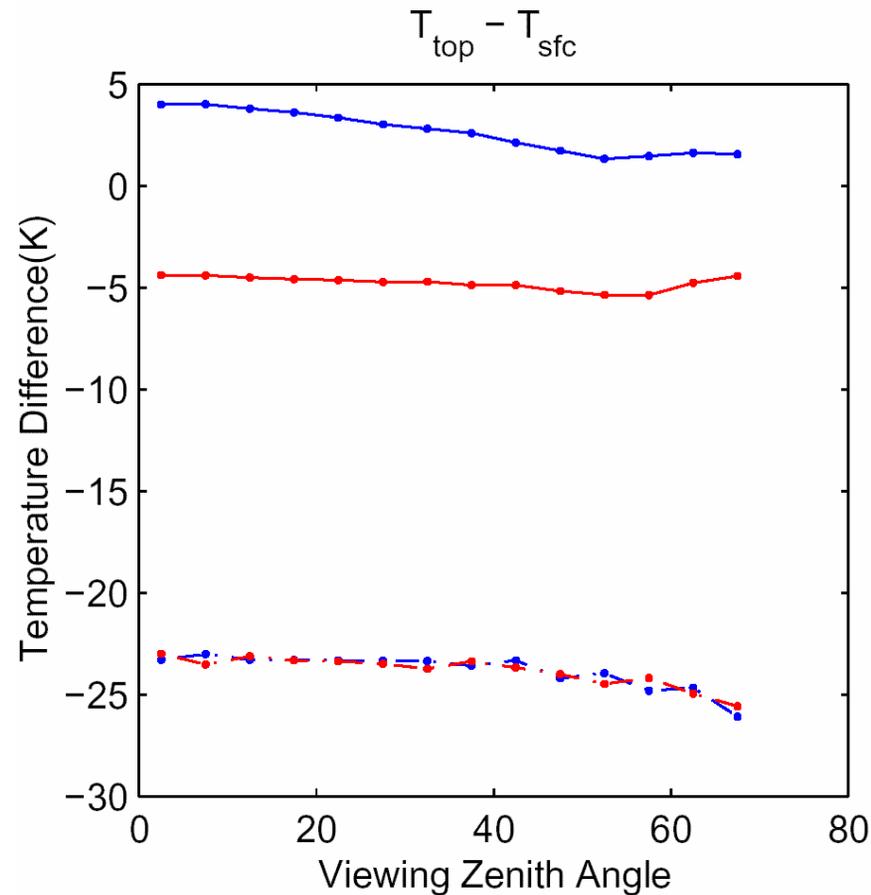
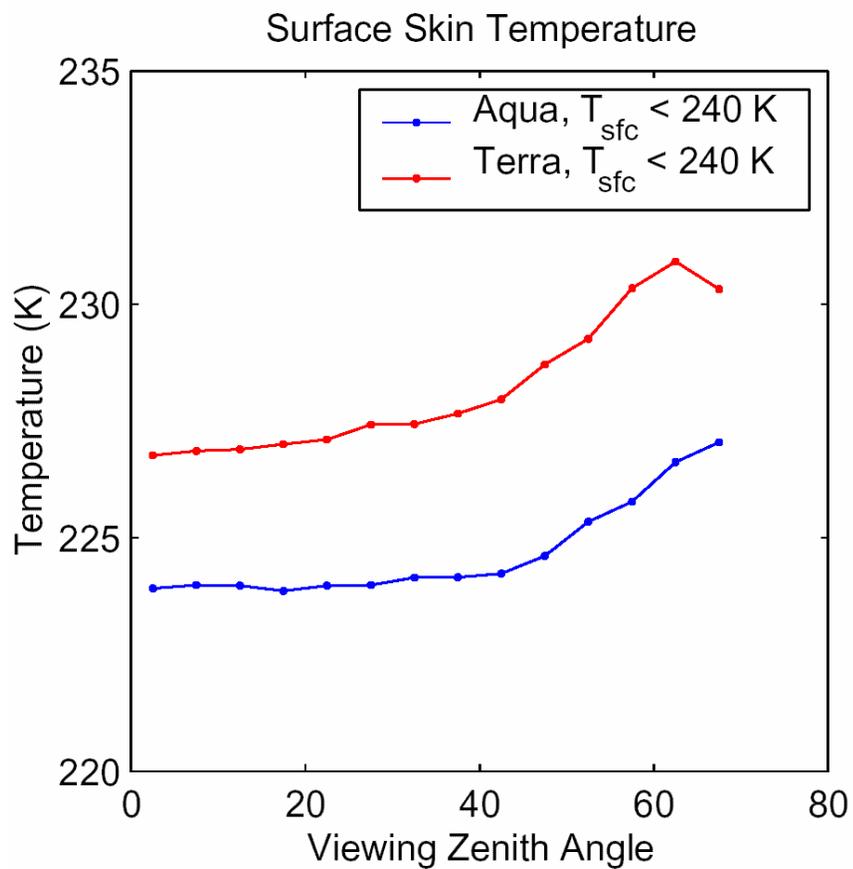
Terra ADM, Aqua I.D. – Aqua ADM, Aqua I.D.



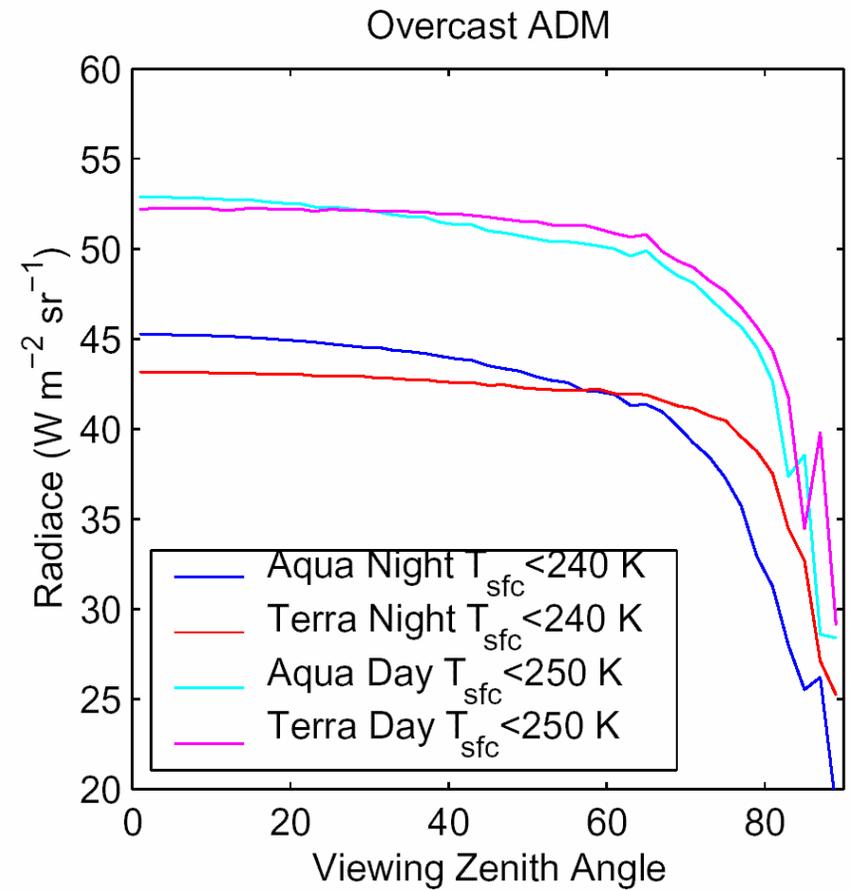
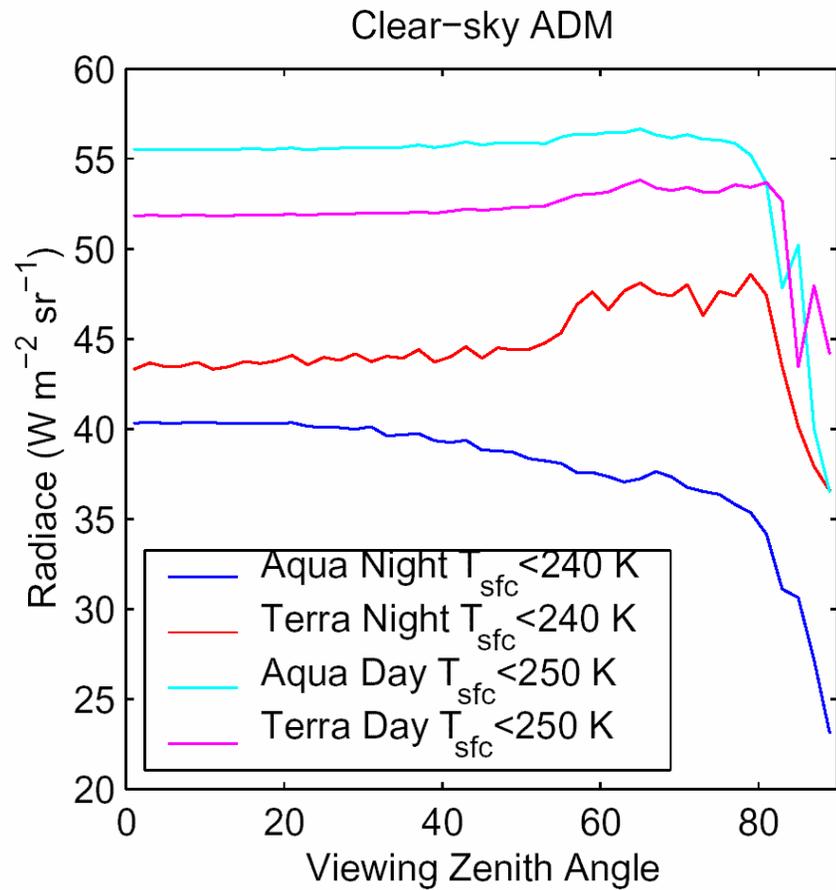
# Cloud I.D. Difference



# Cloud I.D. Difference 2



# LW ADM Difference



# Summary and Conclusions

- FM-1 SW radiance is 1.4% larger than FM-4 SW.
- Daytime (nighttime) longwave radiance derived from FM1 is 0.8% (0.3%) lower than daytime longwave radiance derived from FM-4.
- Scene I.D. difference in Terra and Aqua data sets leads to up to a 4% shortwave flux difference over Arctic snow and sea ice surfaces.
- Terra and Aqua nighttime longwave flux over cold ( $T_{\text{surf}} < 240\text{K}$ ) differ by up to  $5 \text{ W m}^{-2}$  due to scene I.D. difference.