AIRS – CERES Window Radiance Comparison

AIRS-to-CERES Radiance Conversion

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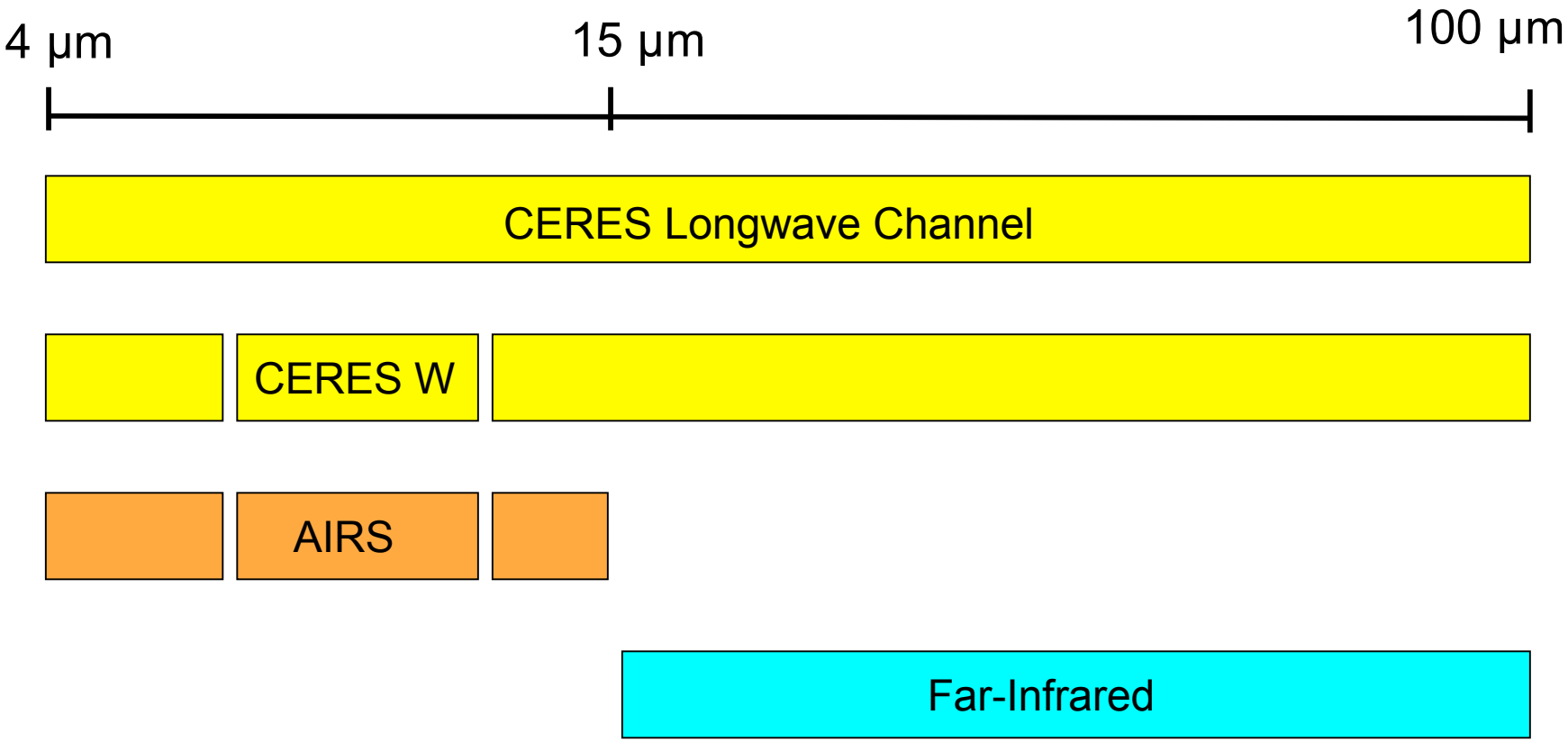
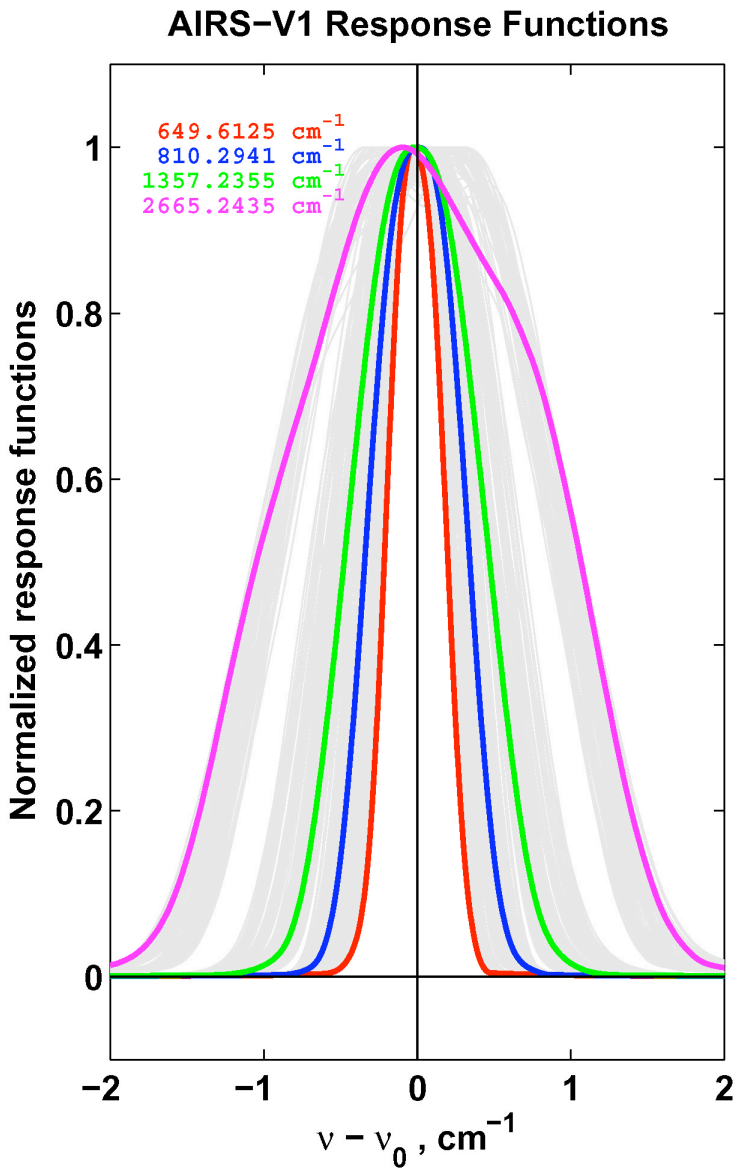
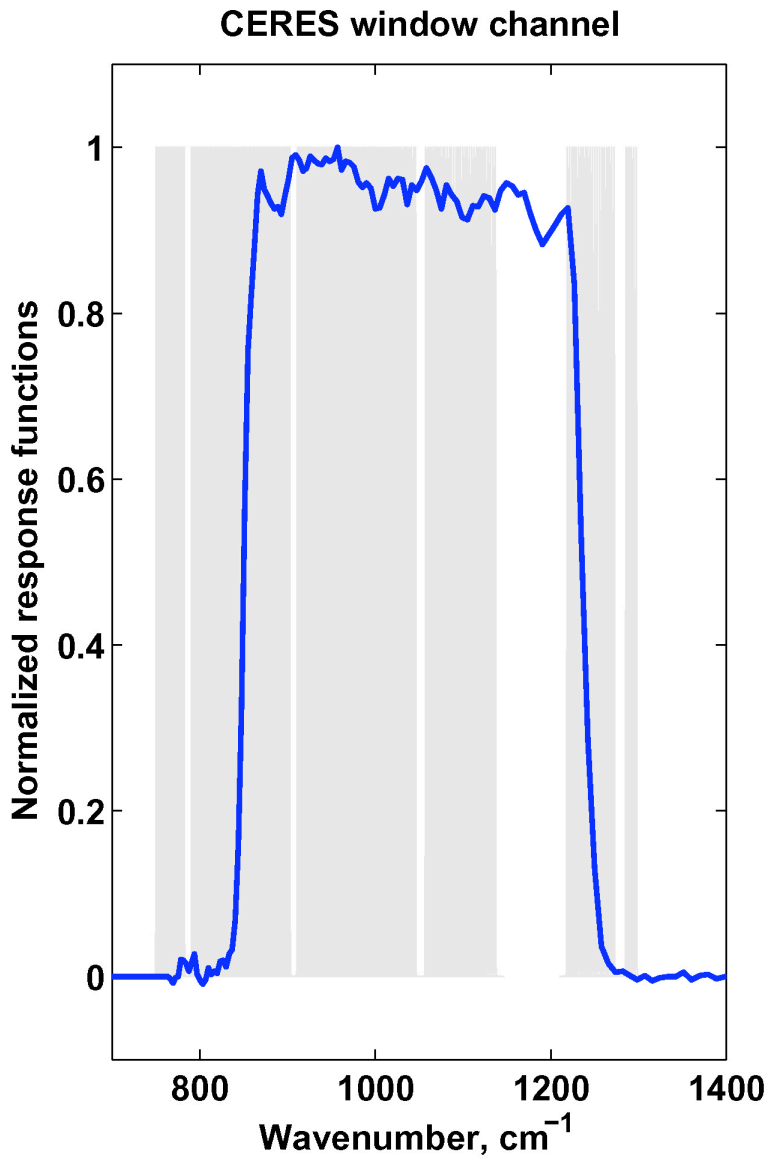
Far-Infrared Properties of Earth's Radiation Budget

Concept For Isolating the Far-IR with AQUA

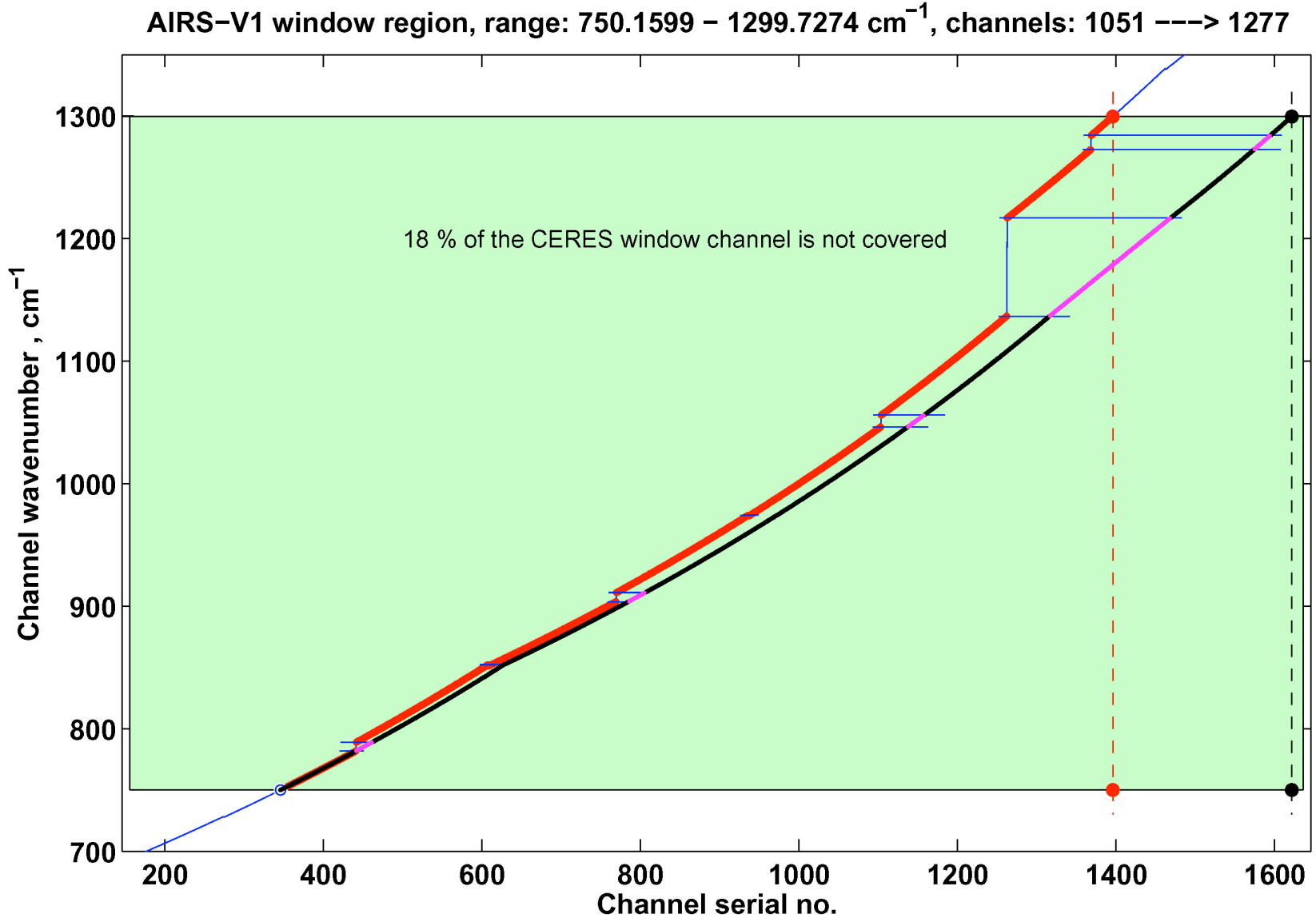


AIRS and CERES SRFs

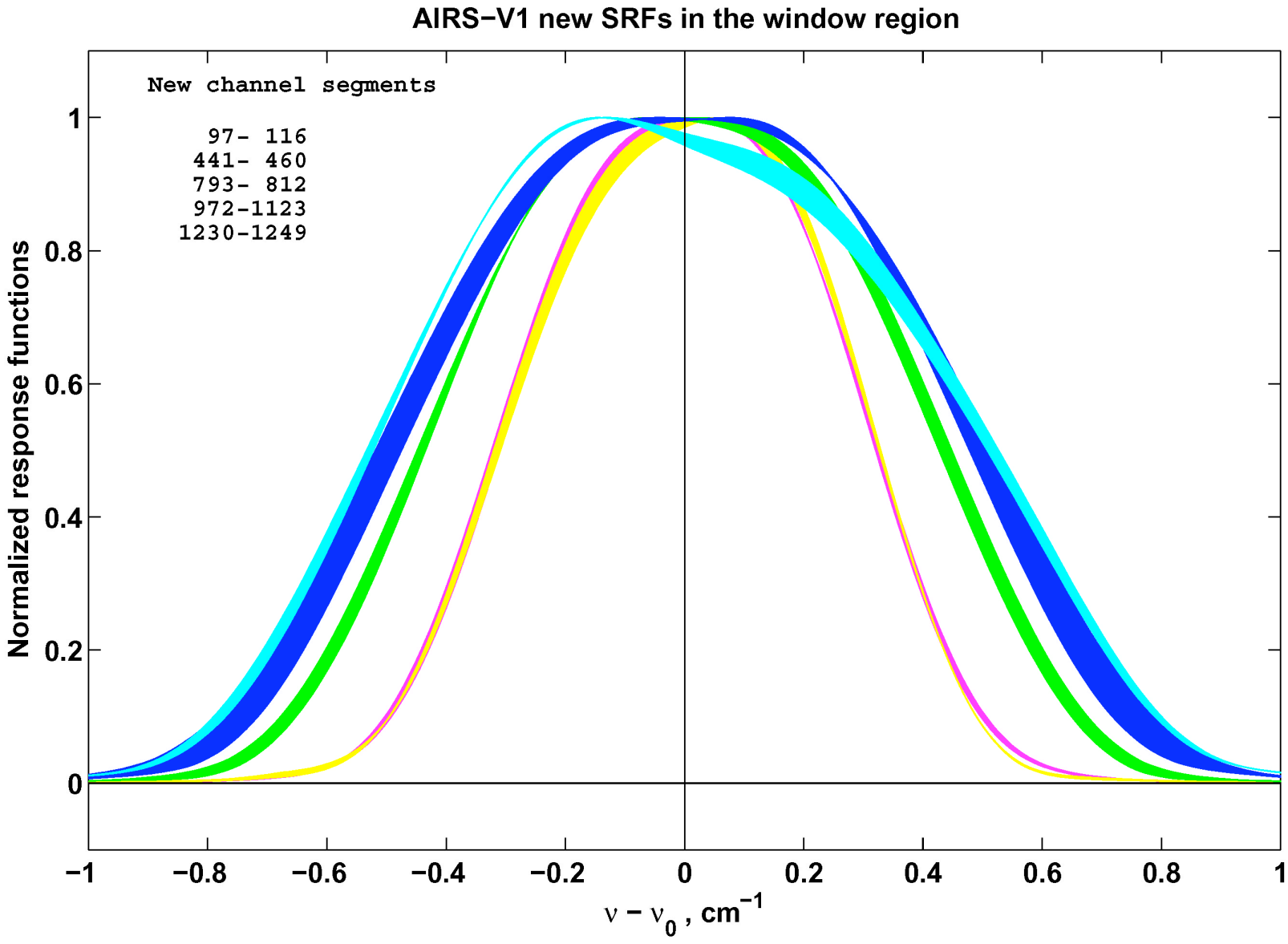




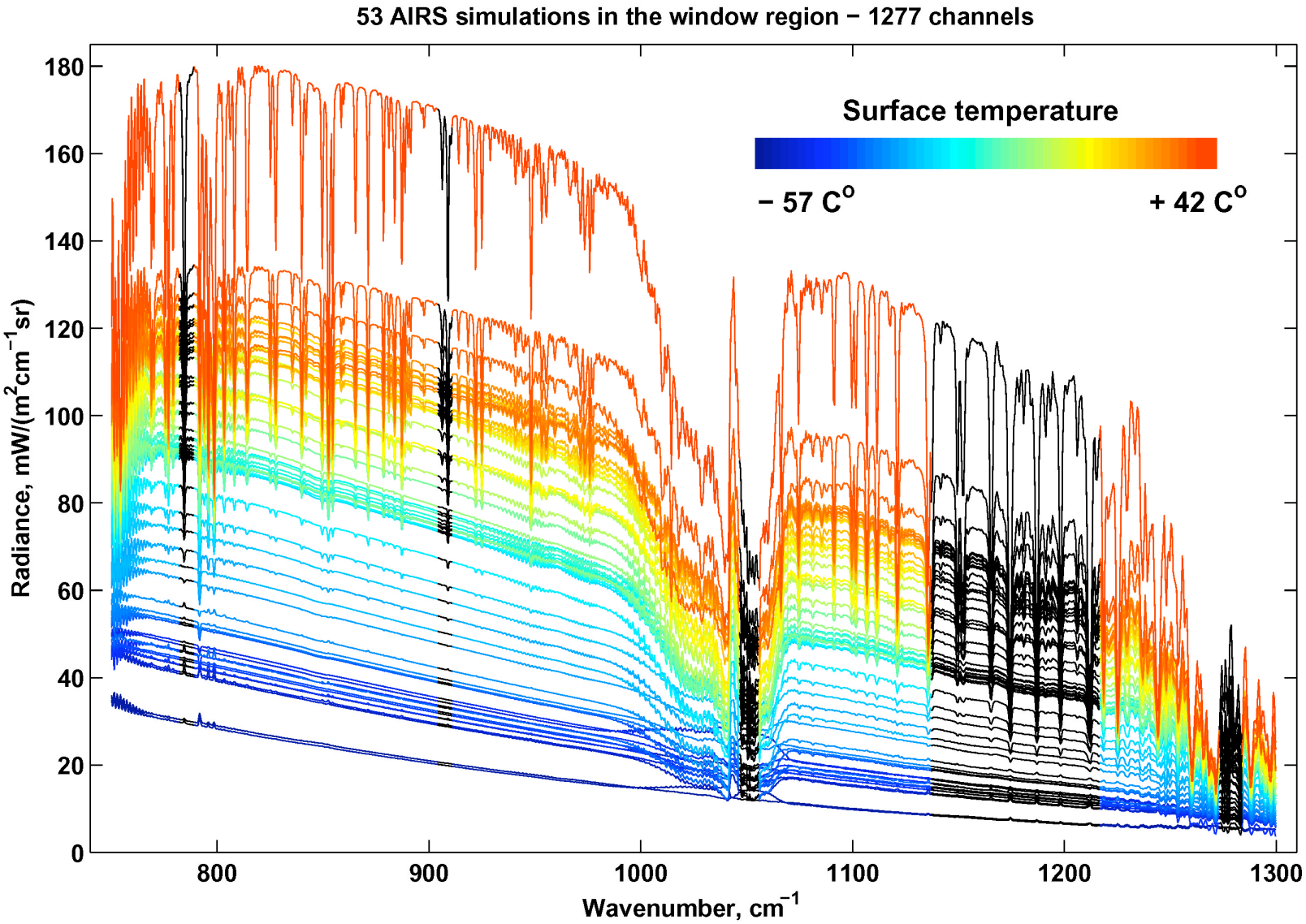
Continuous window channel domain (1277 channels)



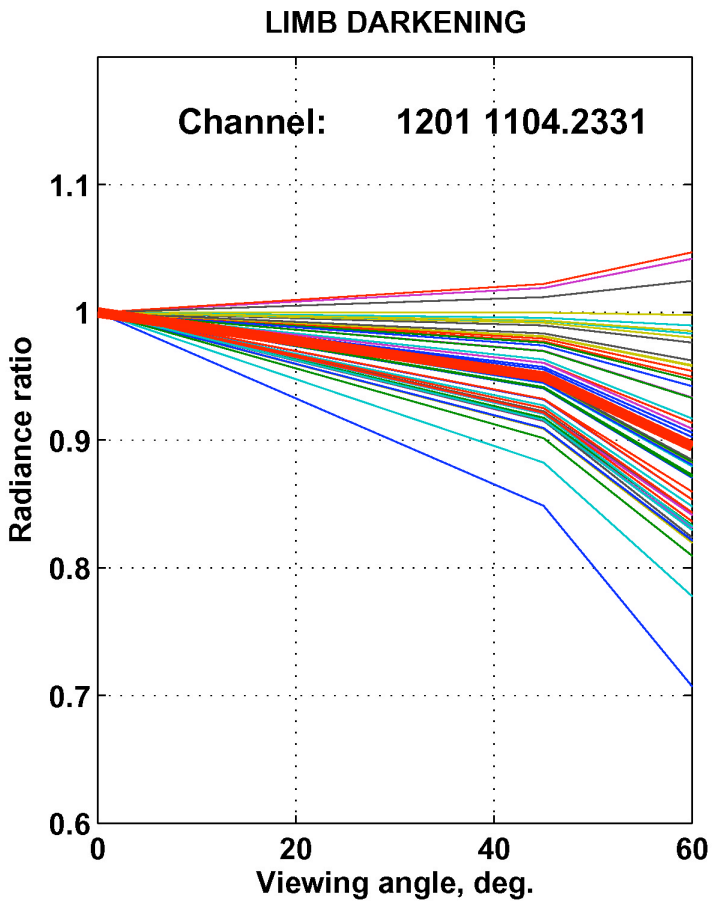
Interpolated SRFs for the un-covered regions

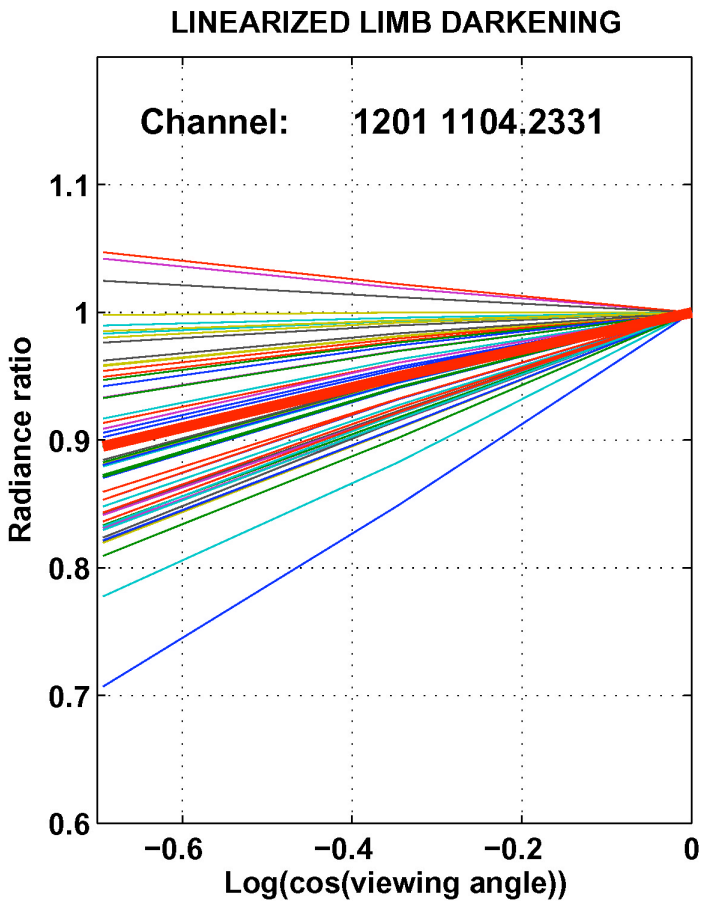


AIRS simulations (HARTCODE, ECMWF profile set)

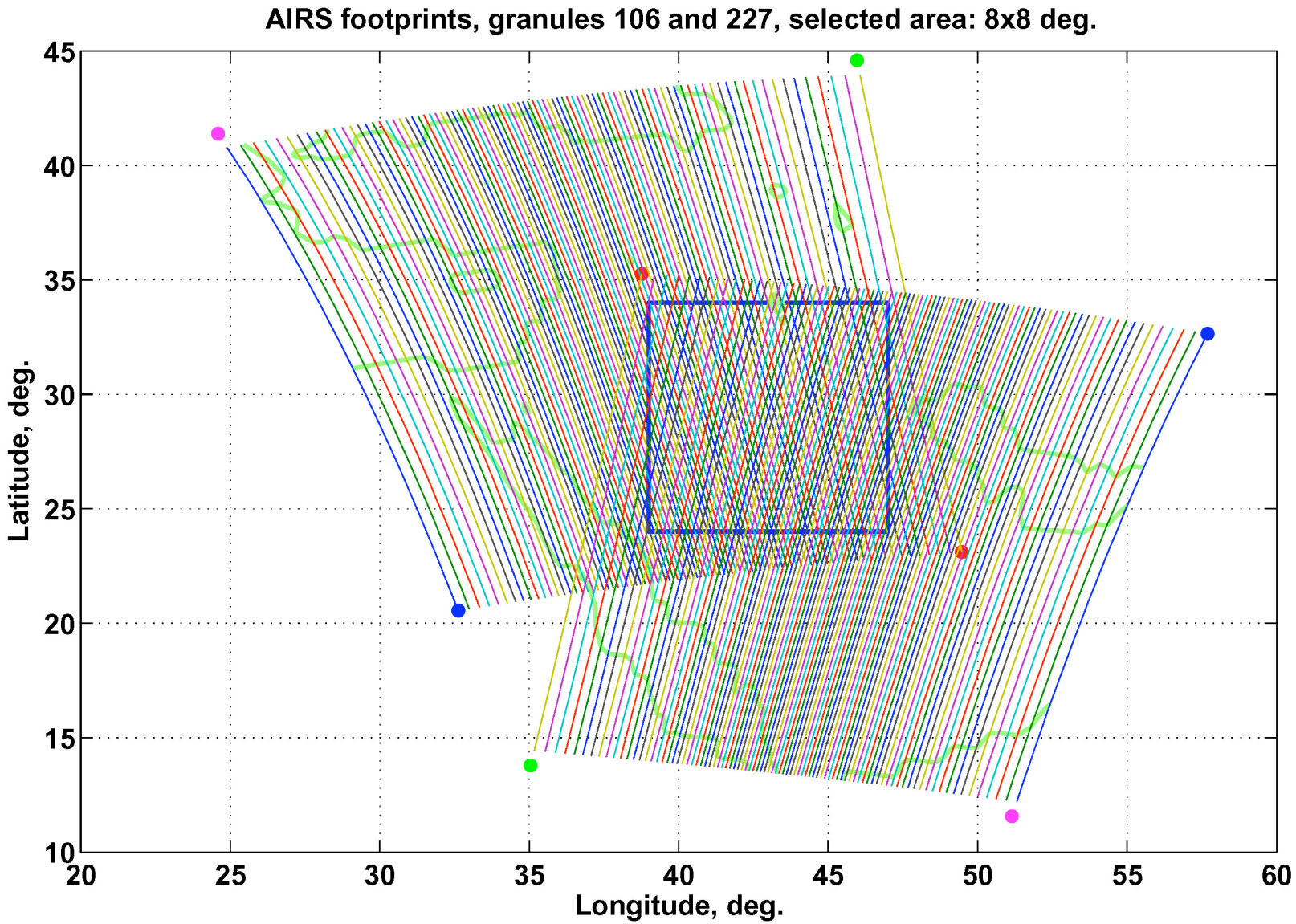


Limb darkening

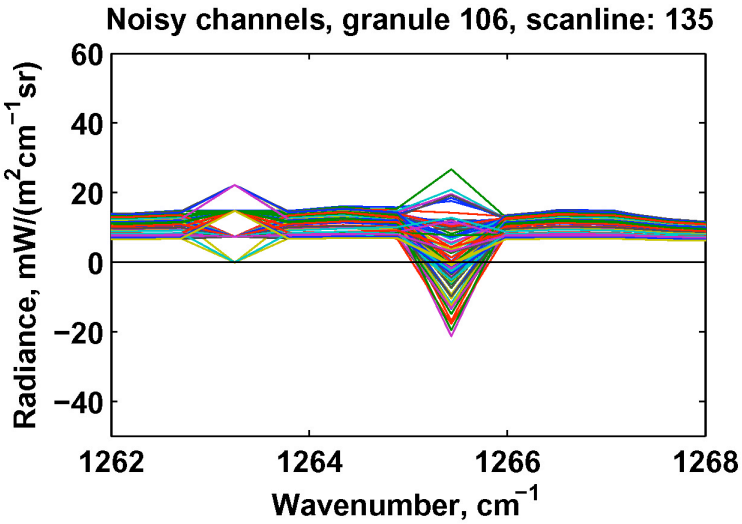


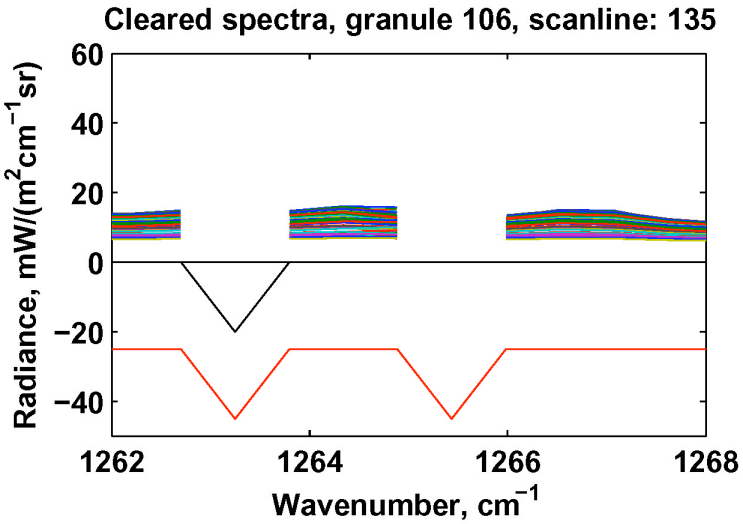


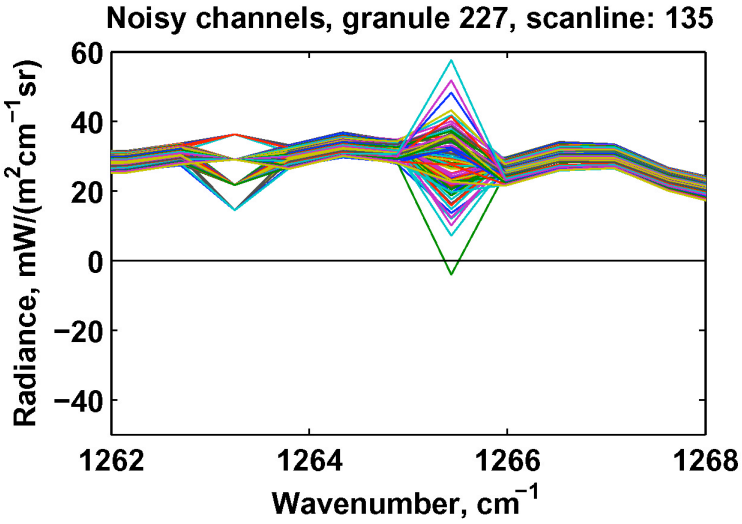
Selected AIRS granules from two different orbits

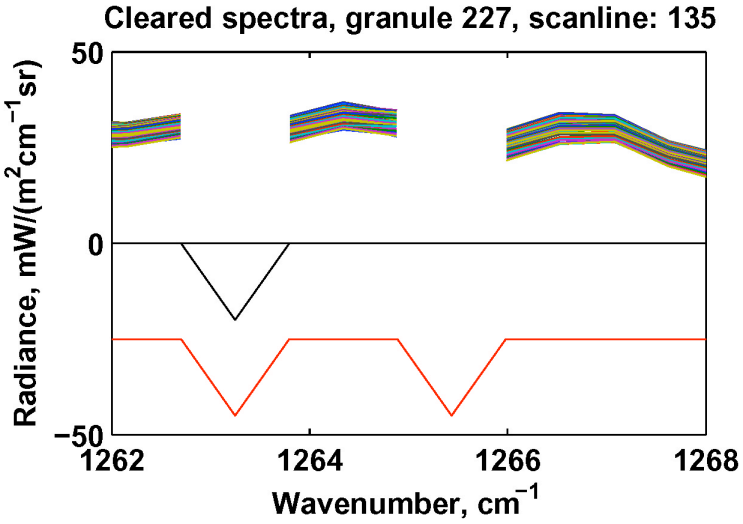


Typical flagged and un-flagged noisy channels

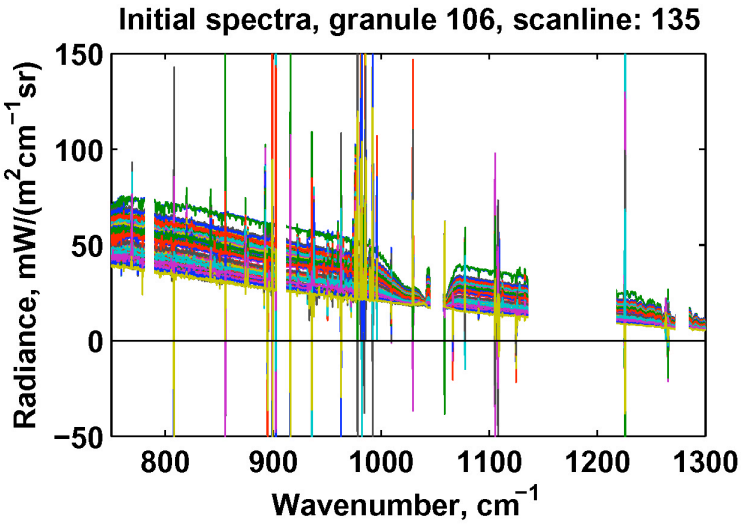


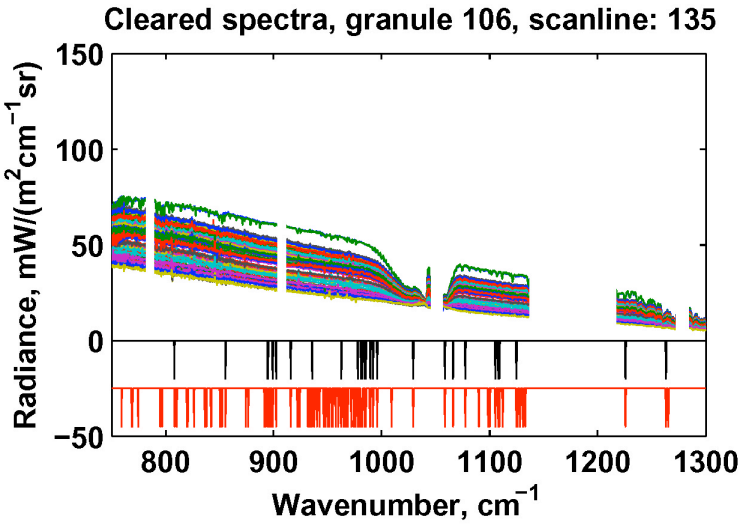


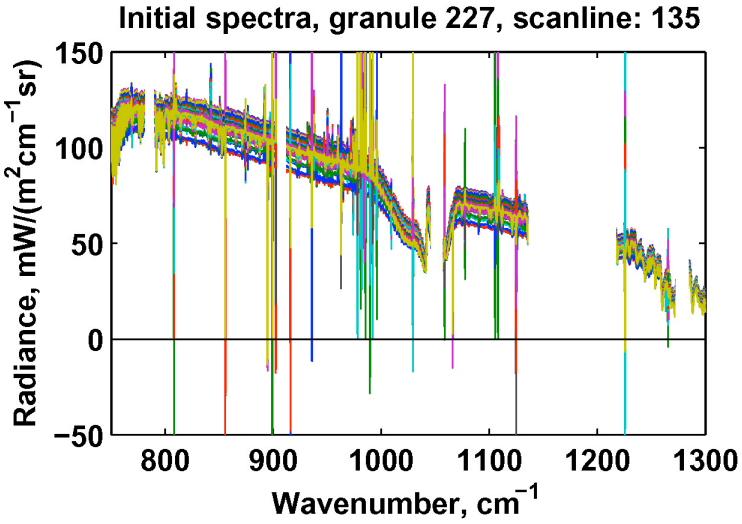


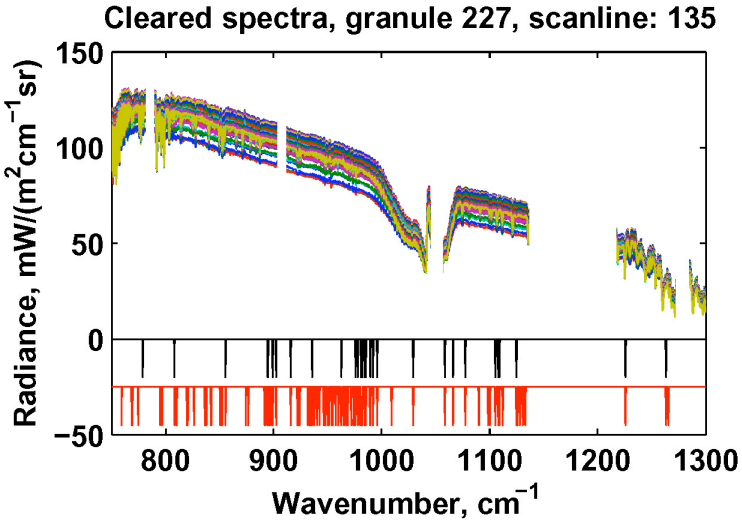


Noisy channels and spectral gaps (331 channels)









Solution for the 331 bad and missing channels

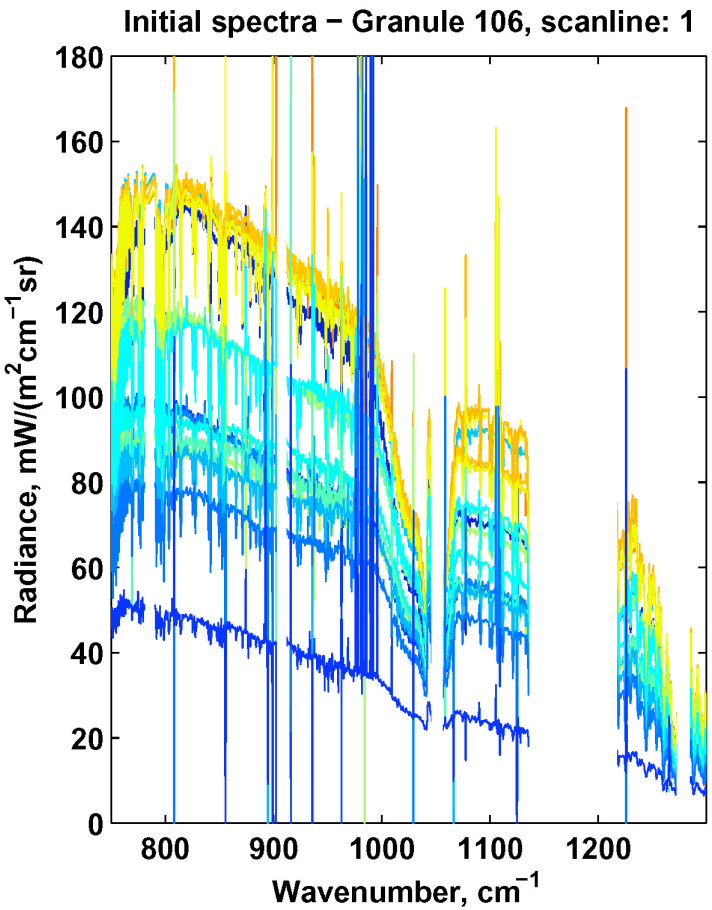
1 - From the theoretical reference spectra separate the bad and good channels, ($\underline{R}_B$ and $\underline{R}_G$), and solve the next over-determined least-square problem for a C regression matrix :

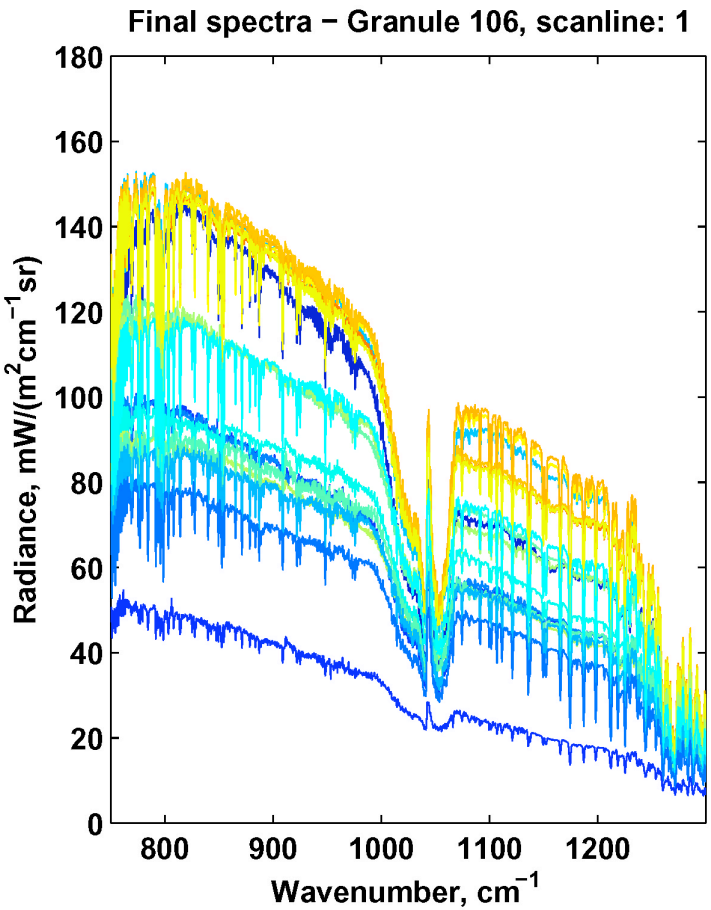
$$\| \underline{R}_B - C\, \underline{R}_G \|^2_{min}$$

2 - Apply the C matrix to the measured good channel radiances r_G :

$$\underline{r}_B = C\, \underline{r}_G$$

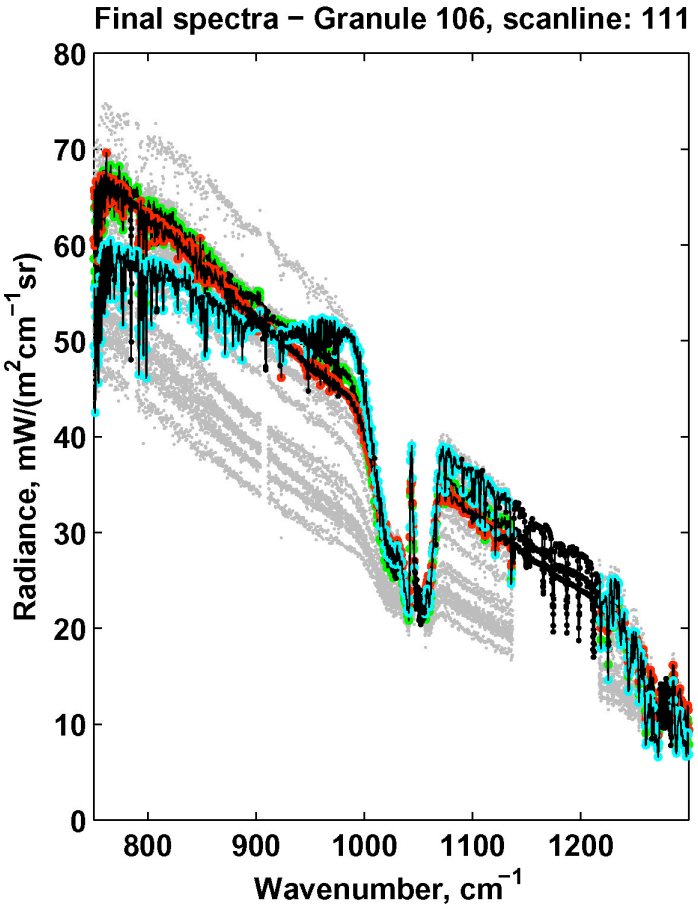
Initial and final spectra, granule 106 (50 OEFs)

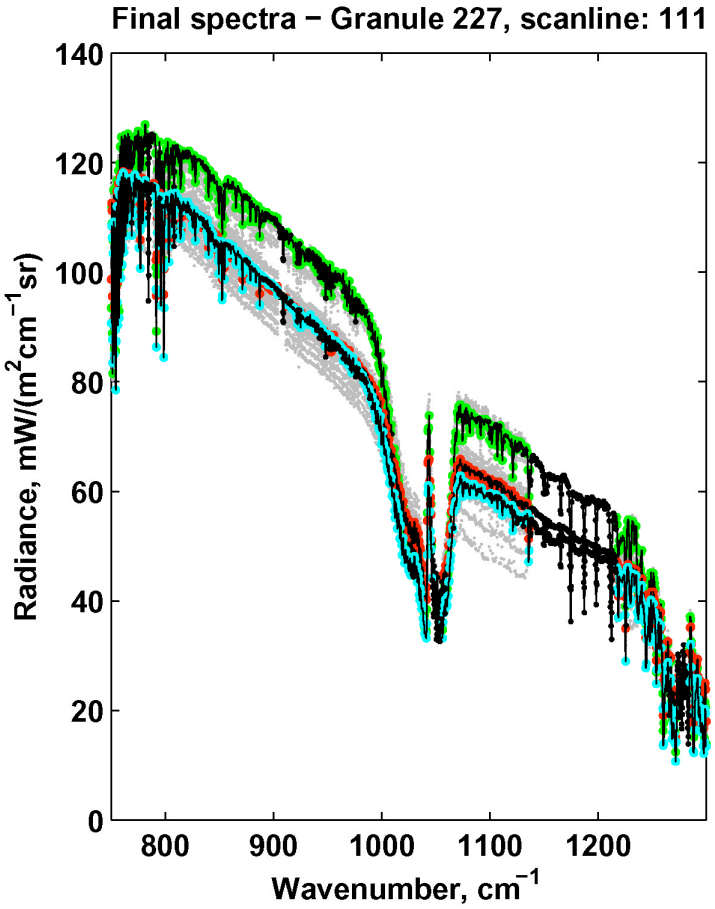




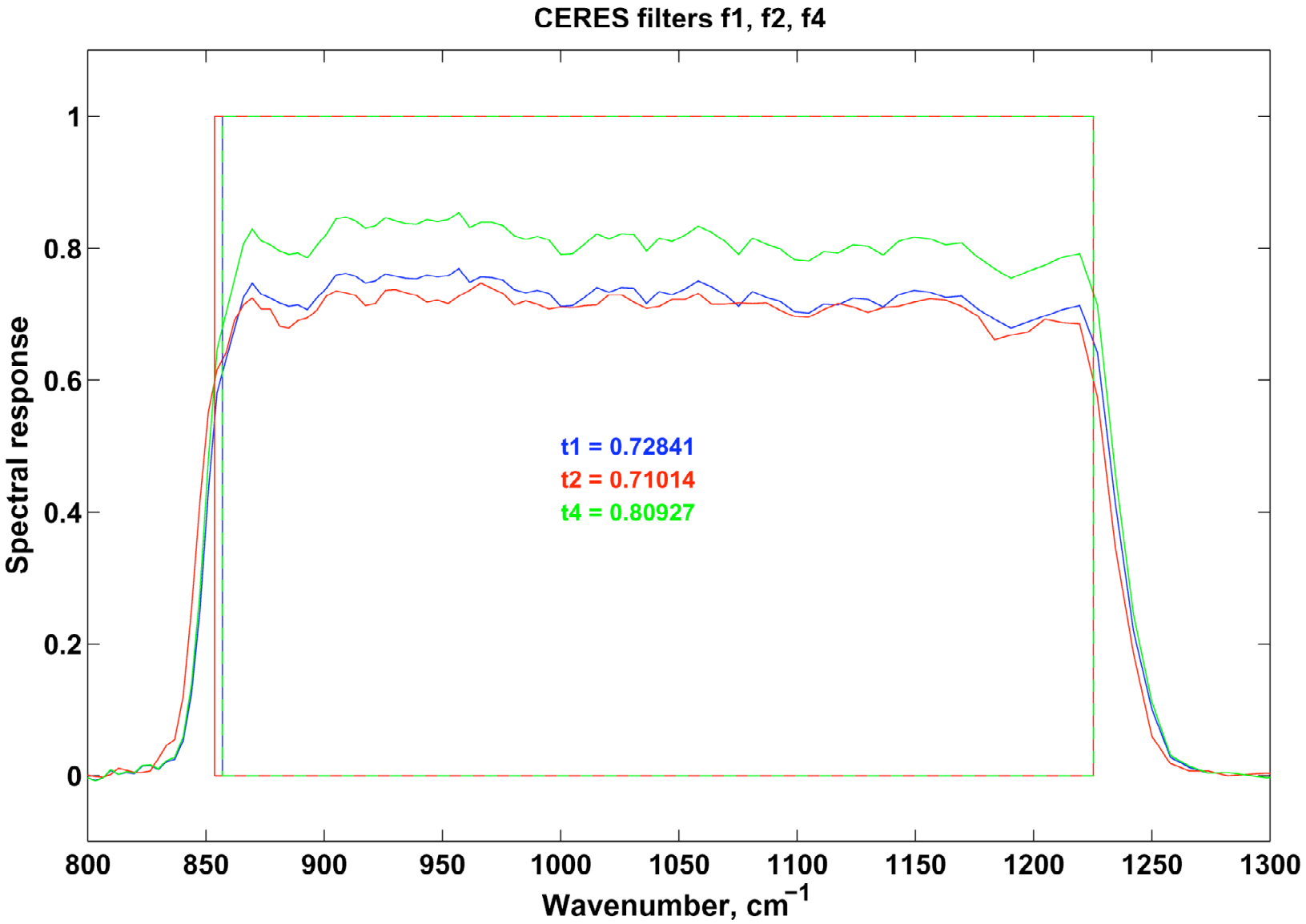
Viewing angle correction: $R=R_G*C'(\log(\cos(\_)))$, where is the corrected regression matrix.

Final spectra, granules 106 and 227 (same OEFs)

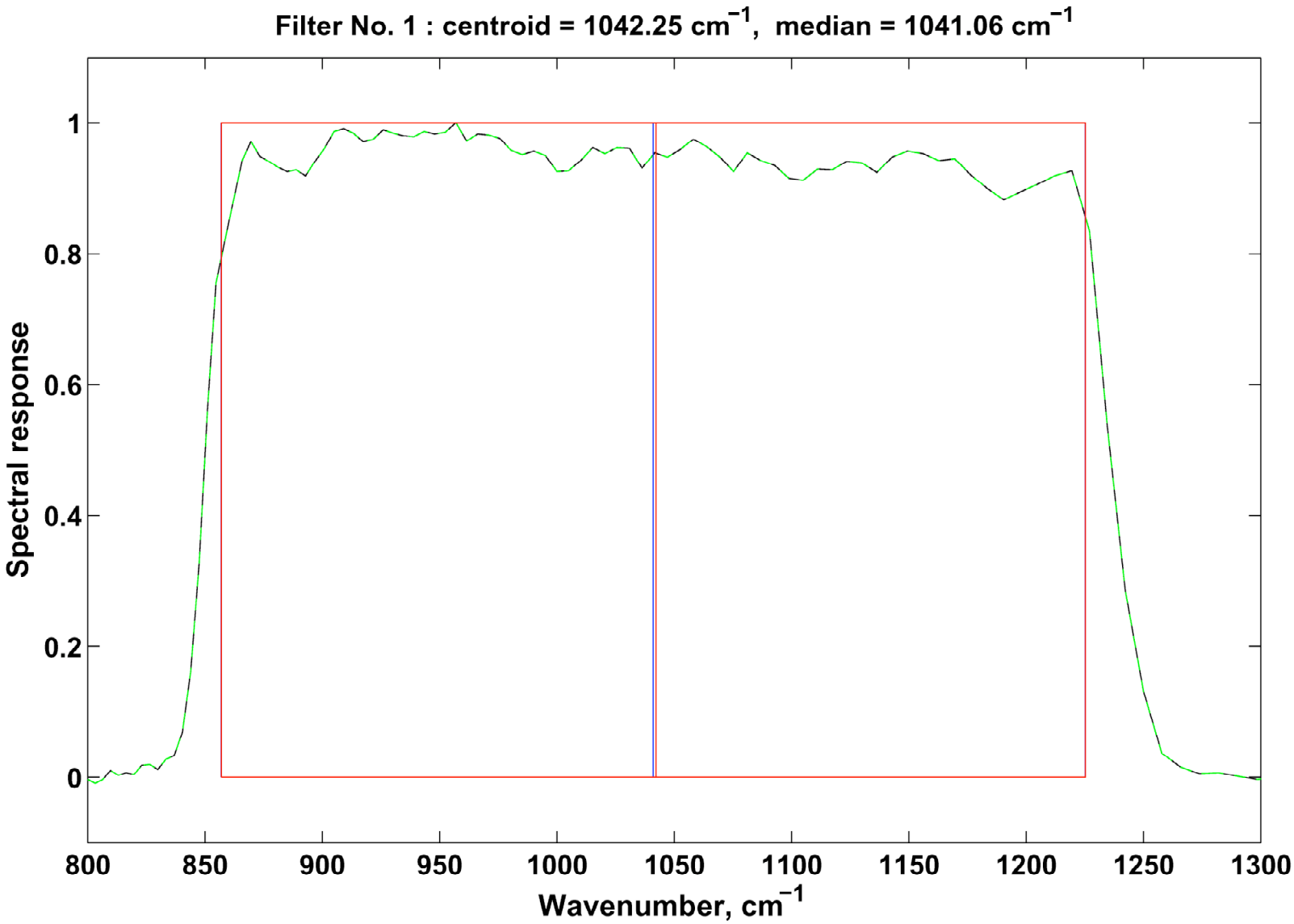




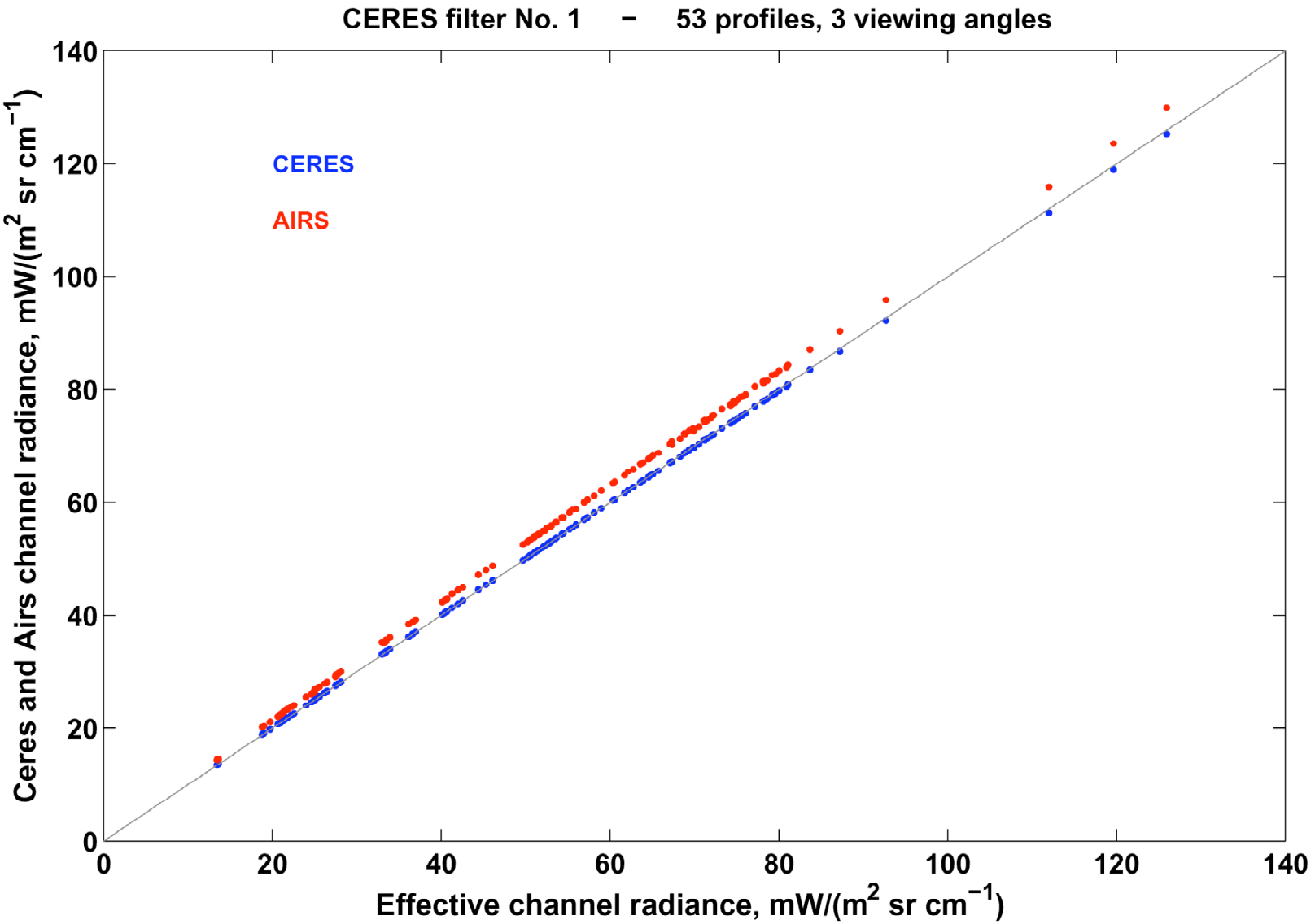
Equivalent widths and filter transmissions



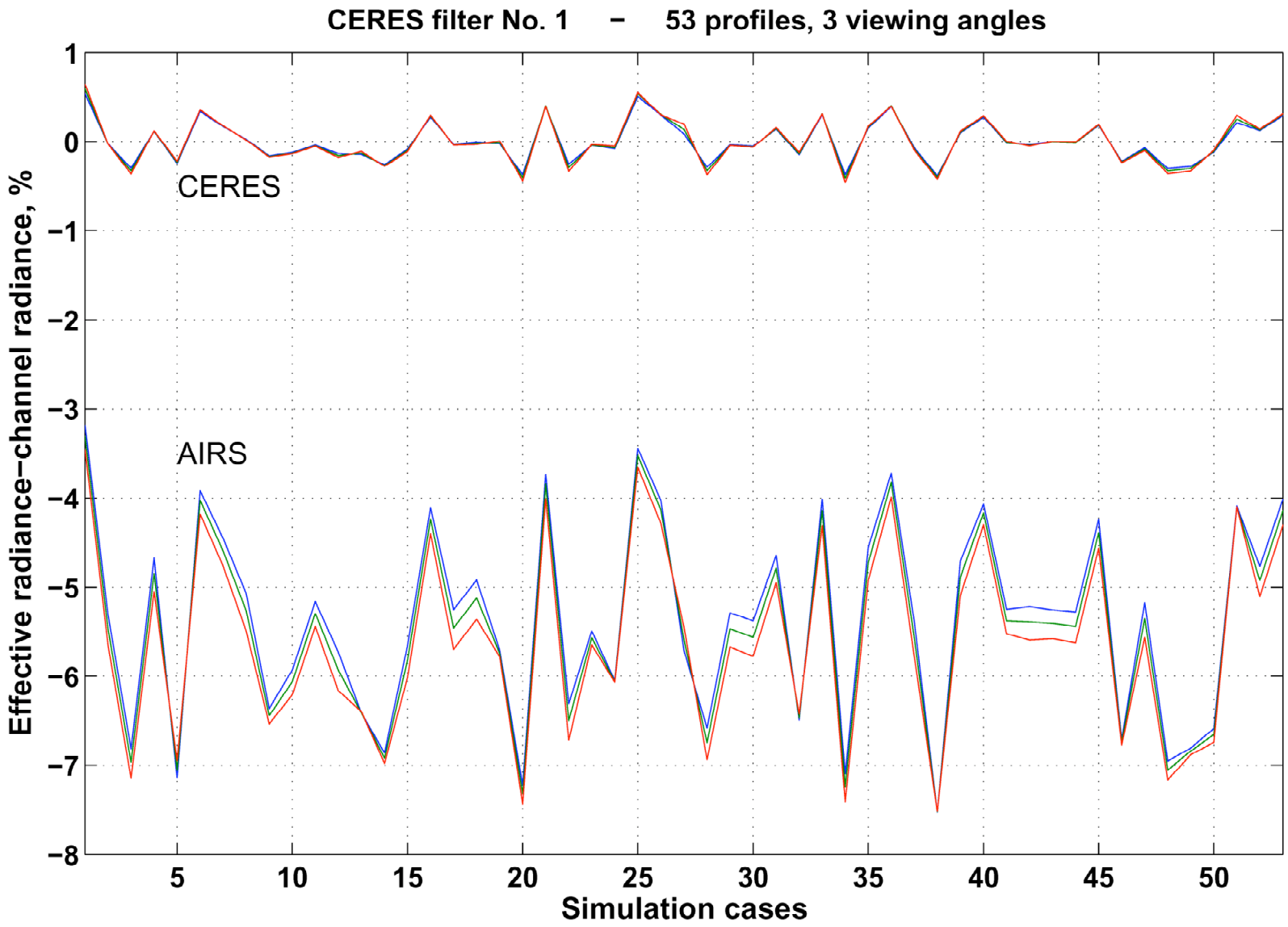
Effective wavenumbers



Filtered and unfiltered radiances

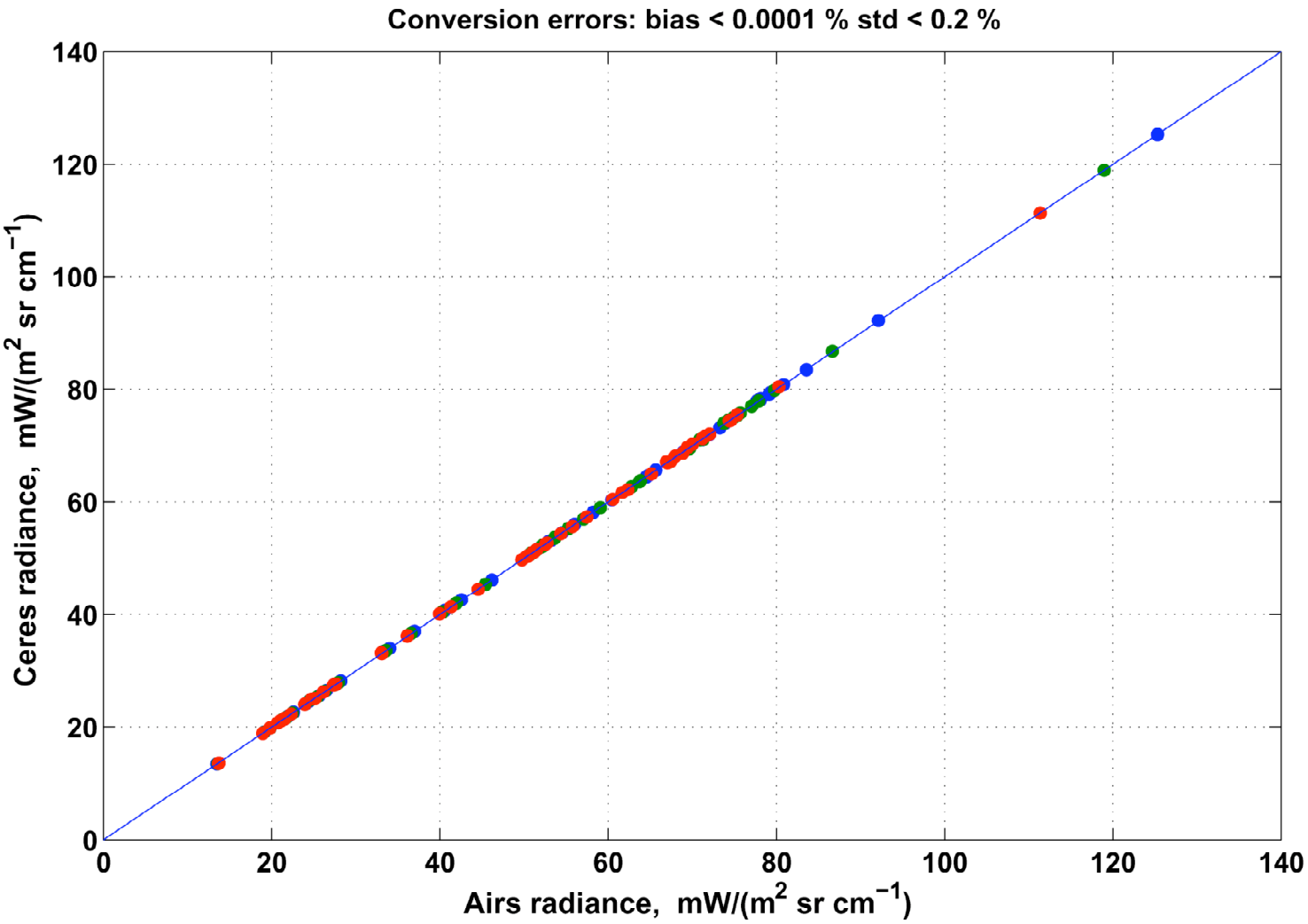


Viewing angle dependence



Filtered radiance conversion

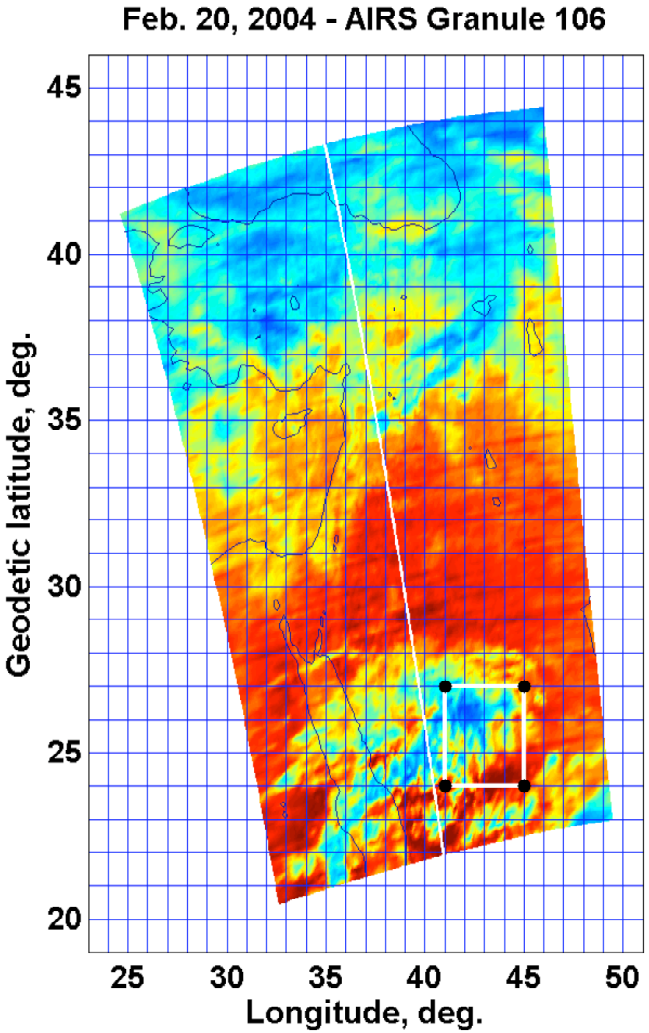
3rd order polynomial, coefficients are linear functions of log(cos(_))

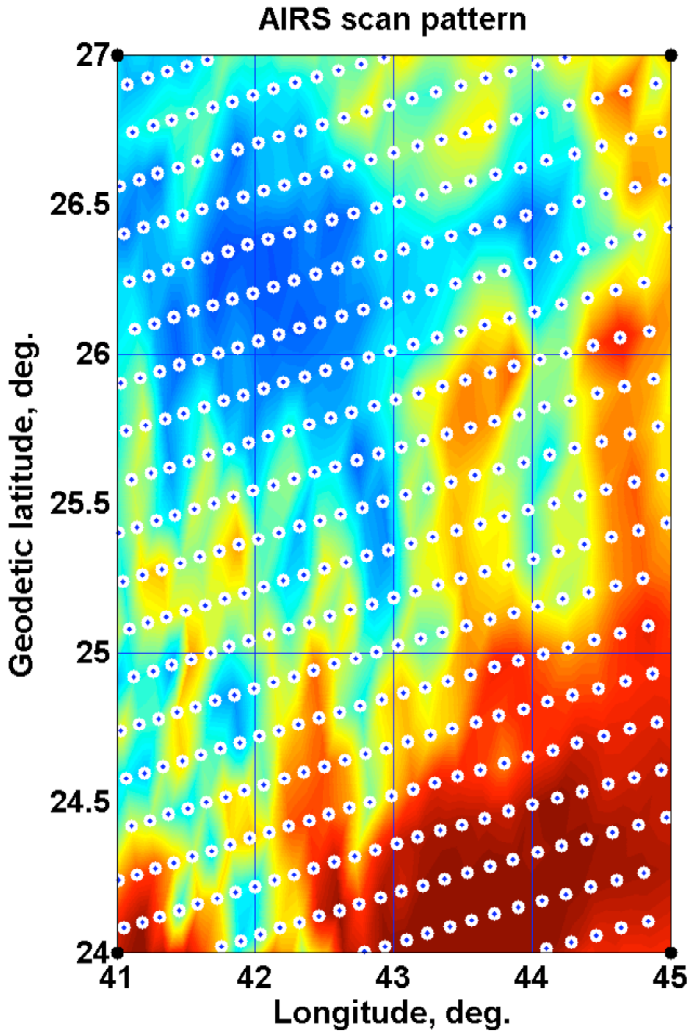


AIRS granule 106

Test data for AIRS-CERES windows radiance comparison - AIRS 922.0 cm^{-1} channel radiance

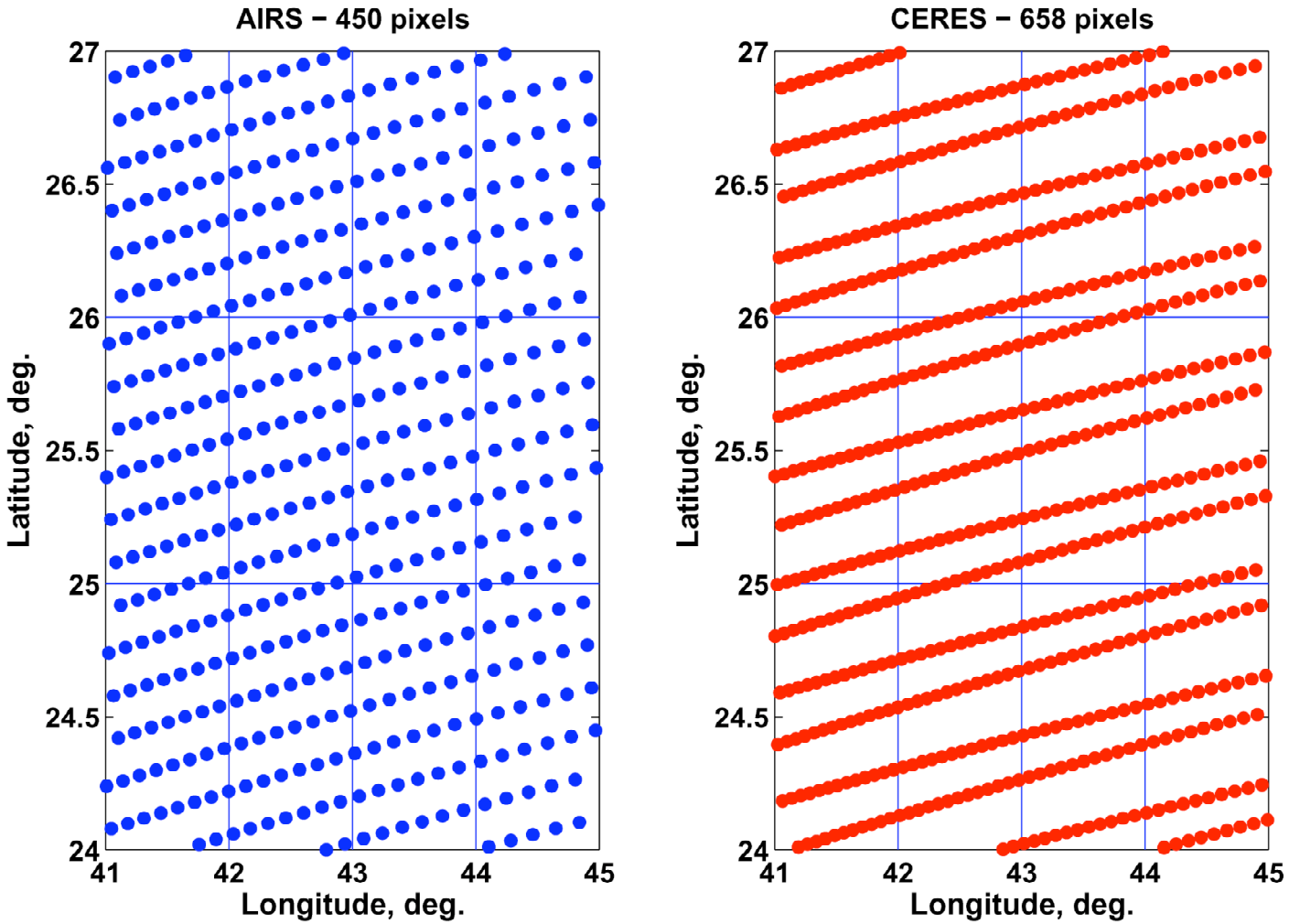
Selected $4^o x 3^o$ high contrast area - 450 footprints mean: 40.2 minimum: 20.3 maximum: 124.0 std: 30 - [$mW/(cm^2\ sr\ cm^{-1})$]





CERES has ~45% more footprints

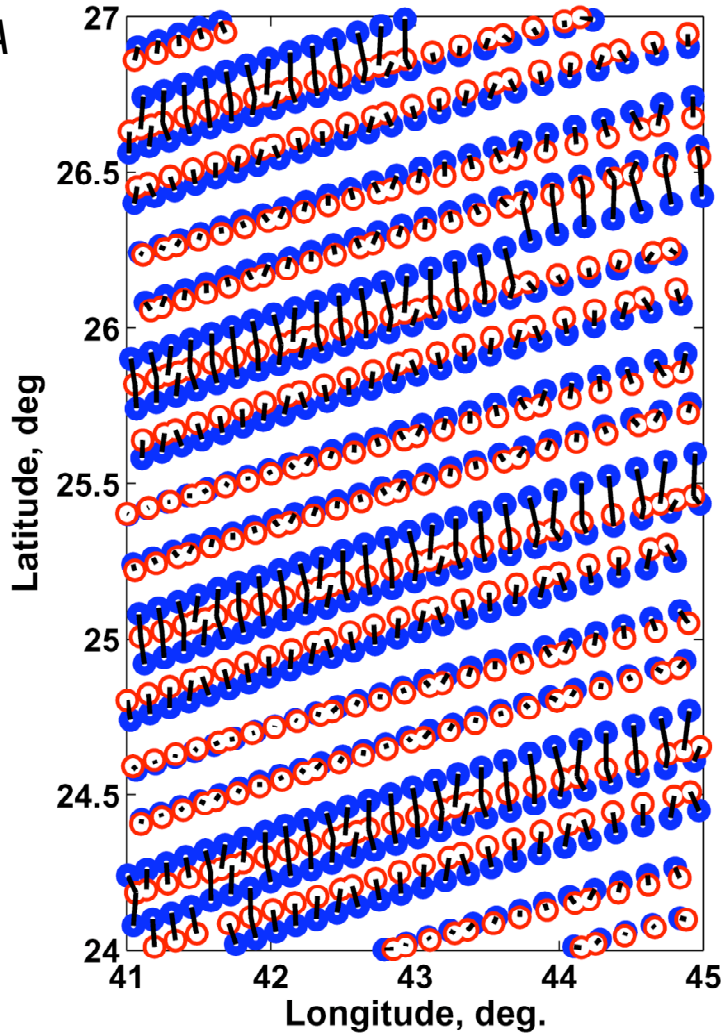
Scan patterns and footprints



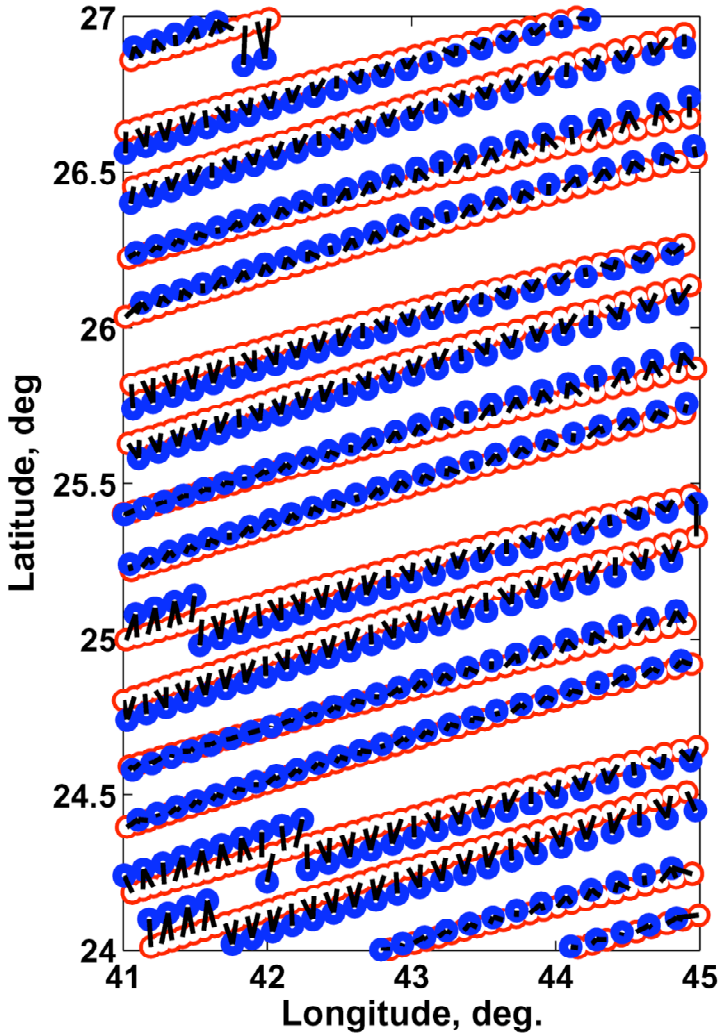
Footprint selection strategy I.

D(km)	W (deg)	R_{AIRS}	R_{CERES}	C_R	C_D	C_W	N_A	N_C	N
6.761246	0.8509869	14.98606	15.54228	0.9115856	−0.0417817	−0.05615241	450	658	450
6.755119	0.8684443	15.16313	15.56574	0.9130196	0.04170226	−0.02587796	450	658	658

A

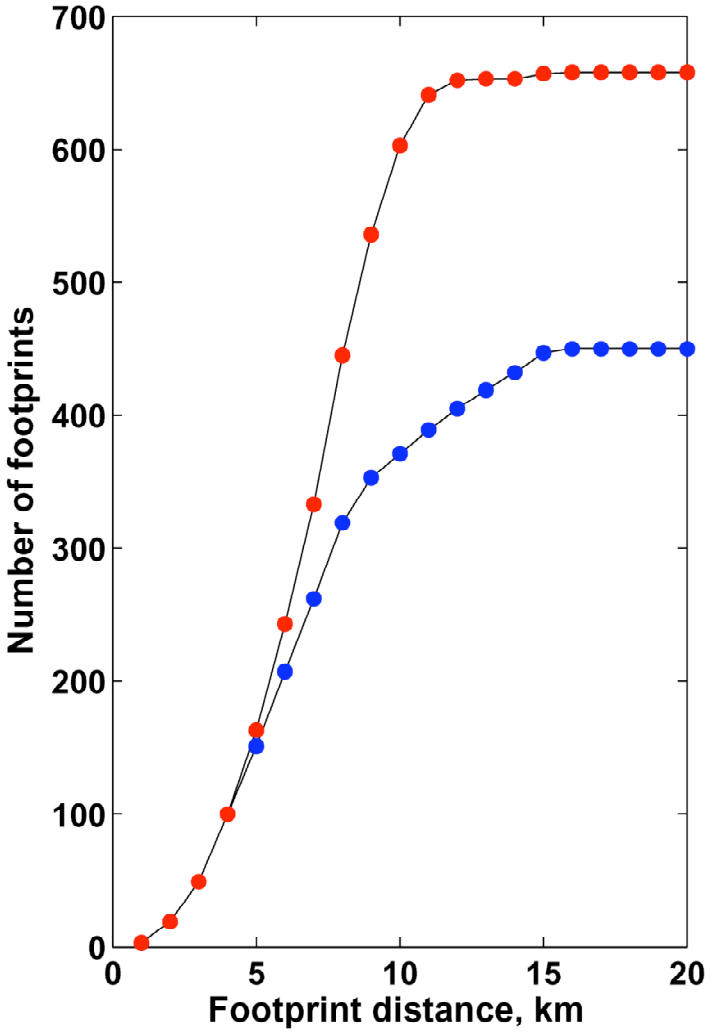


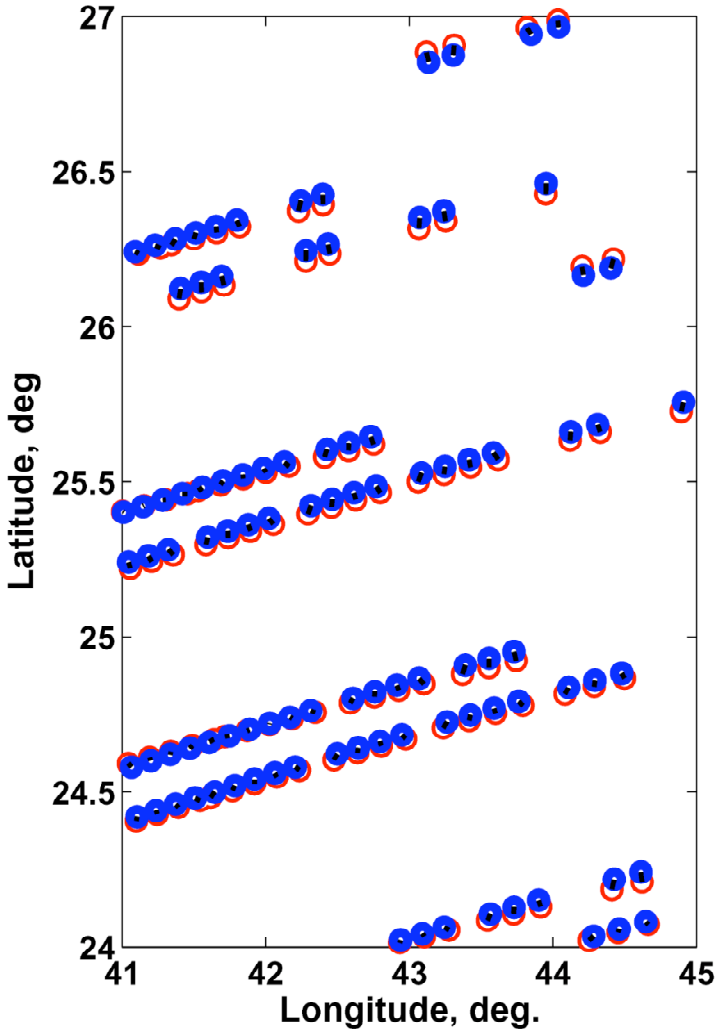
C



Footprint selection strategy II.

$D(km)$	$W(deg)$	R_{AIRS}	R_{CERES}	C_R	C_D	C_W	N_A	N_C	N
2.817749	0.7847104	14.88071	15.68621	0.9283074	0.03304586	−0.06811415	450	658	100

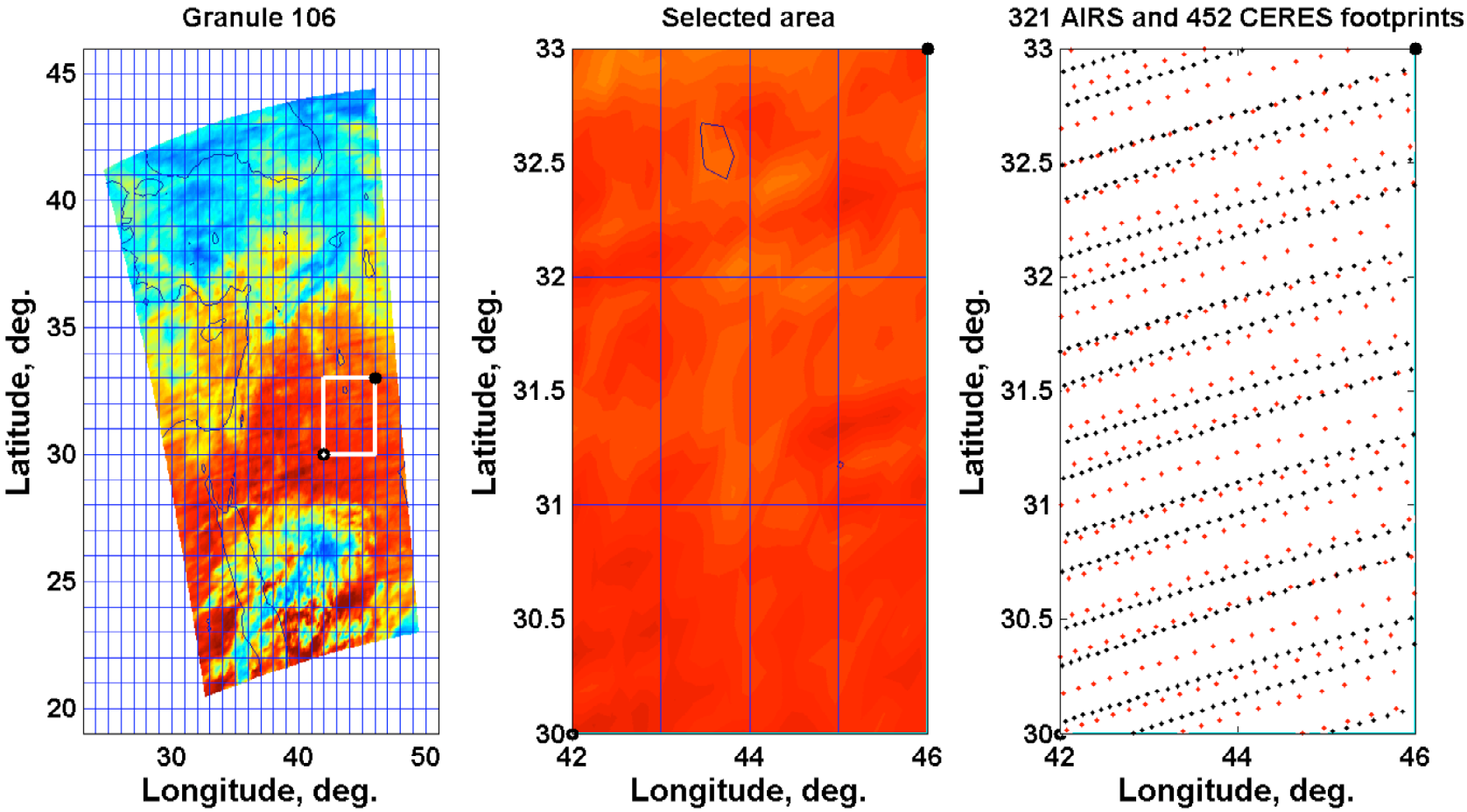




AIRS granule 106 – radiance and scan structures

Homogeneous warm surface

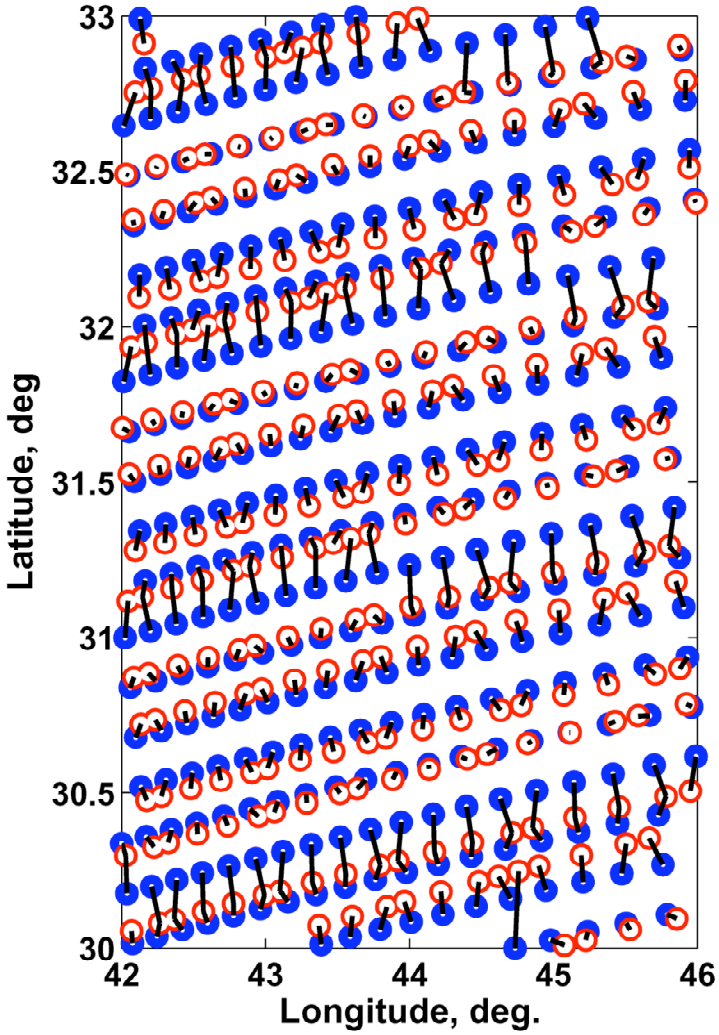
Mean: 85.1 mW/(cm^2 sr cm^{-1}), Std: 2.611 %



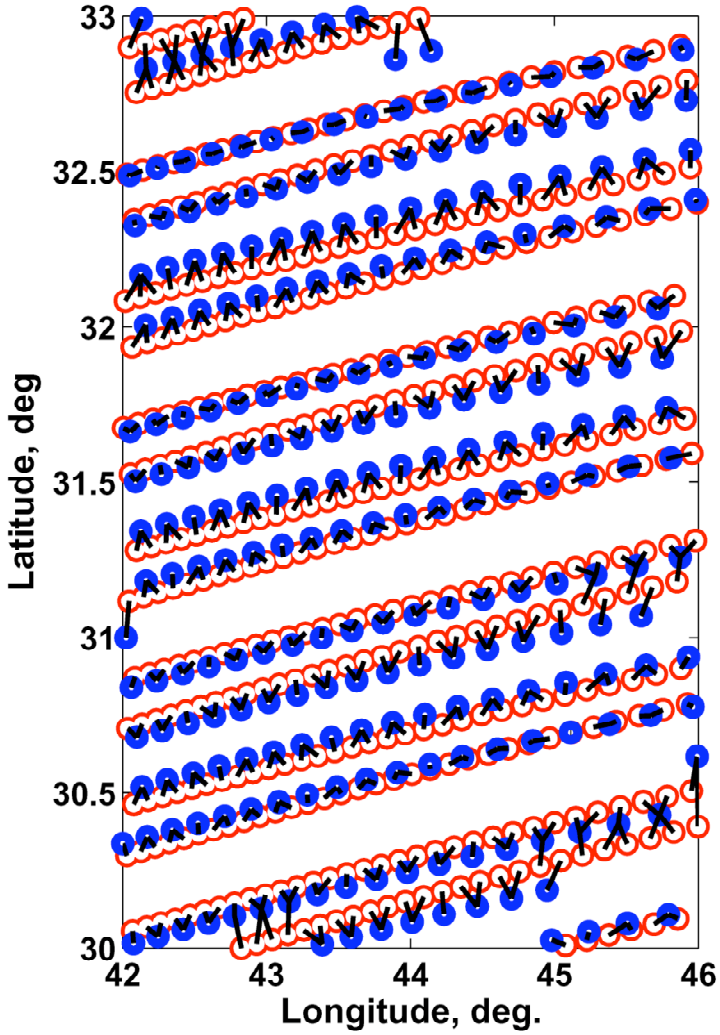
Footprint selection strategy I.

D(km)	W (deg)	R_{AIRS}	R_{CERES}	CR	CD	CW	NA	NC	N
7.700127	−0.2070775	23.29279	23.4384	0.9267924	0.1435197	0.09577701	321	452	321
7.824622	−0.2095599	23.26582	23.4229	0.9205361	0.04740091	0.05823755	321	452	452

A

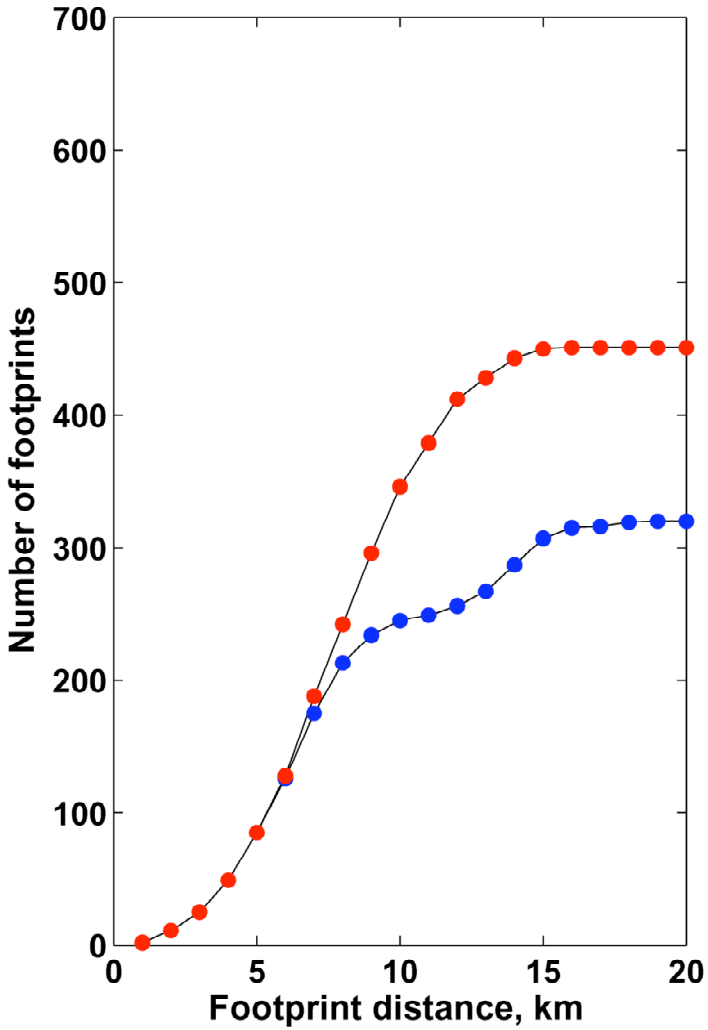


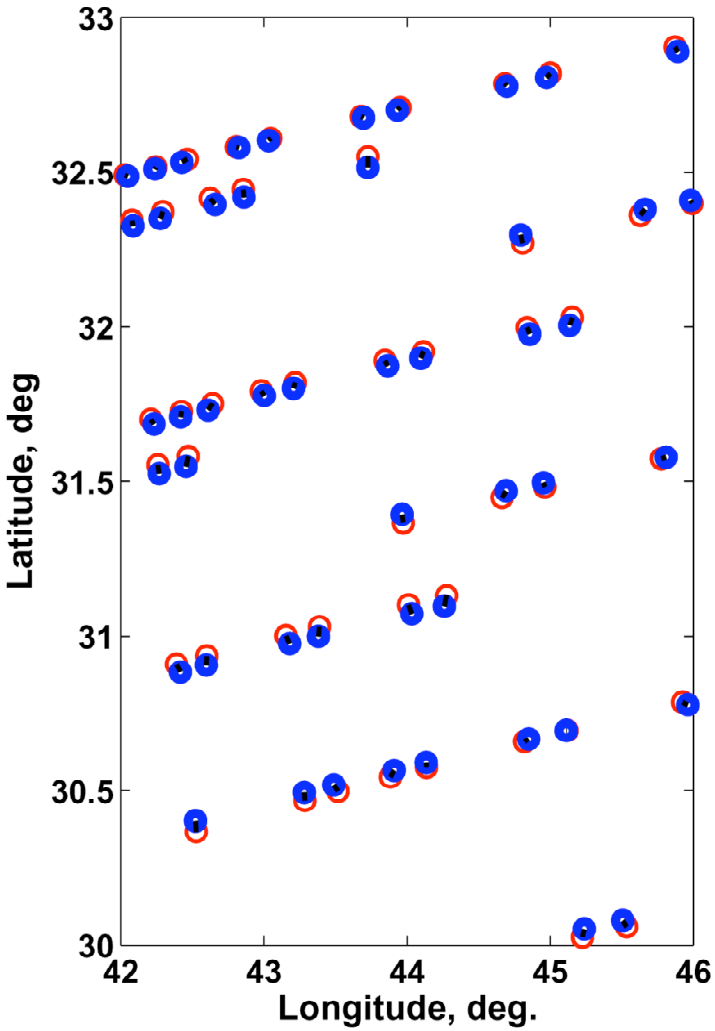
C



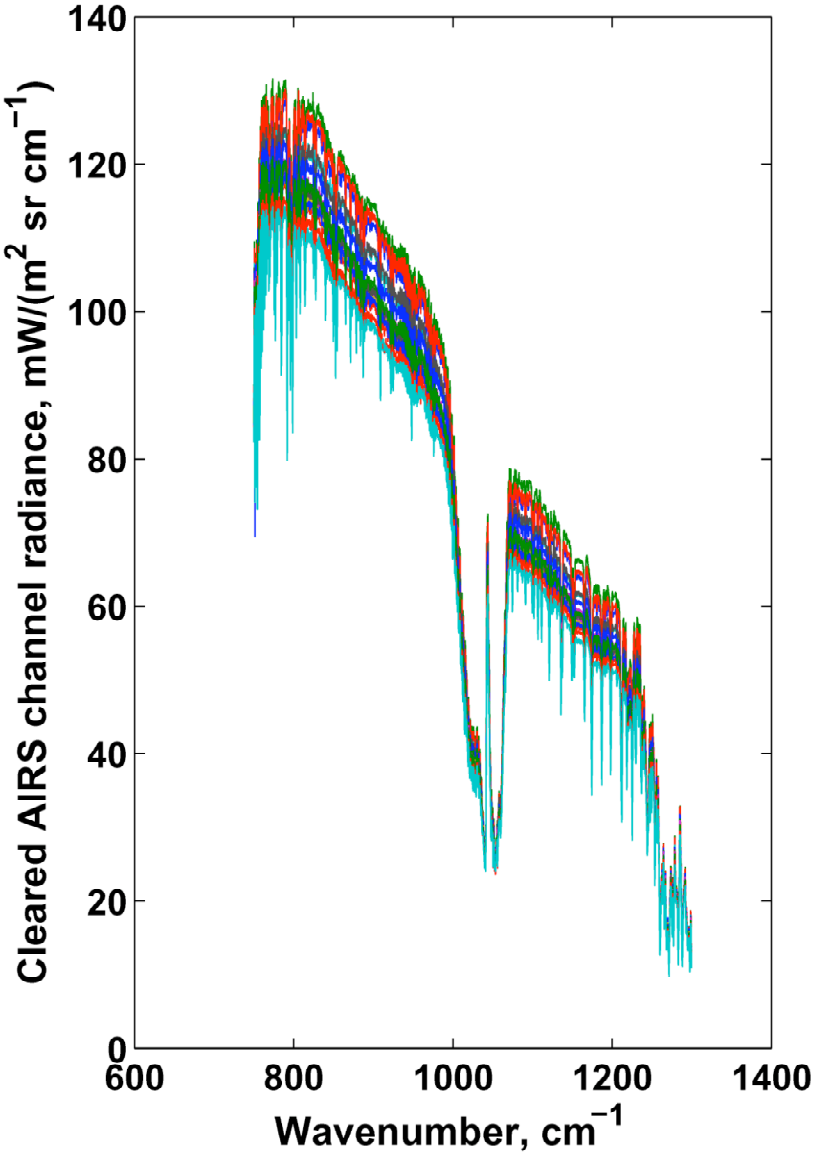
Footprint selection strategy II.

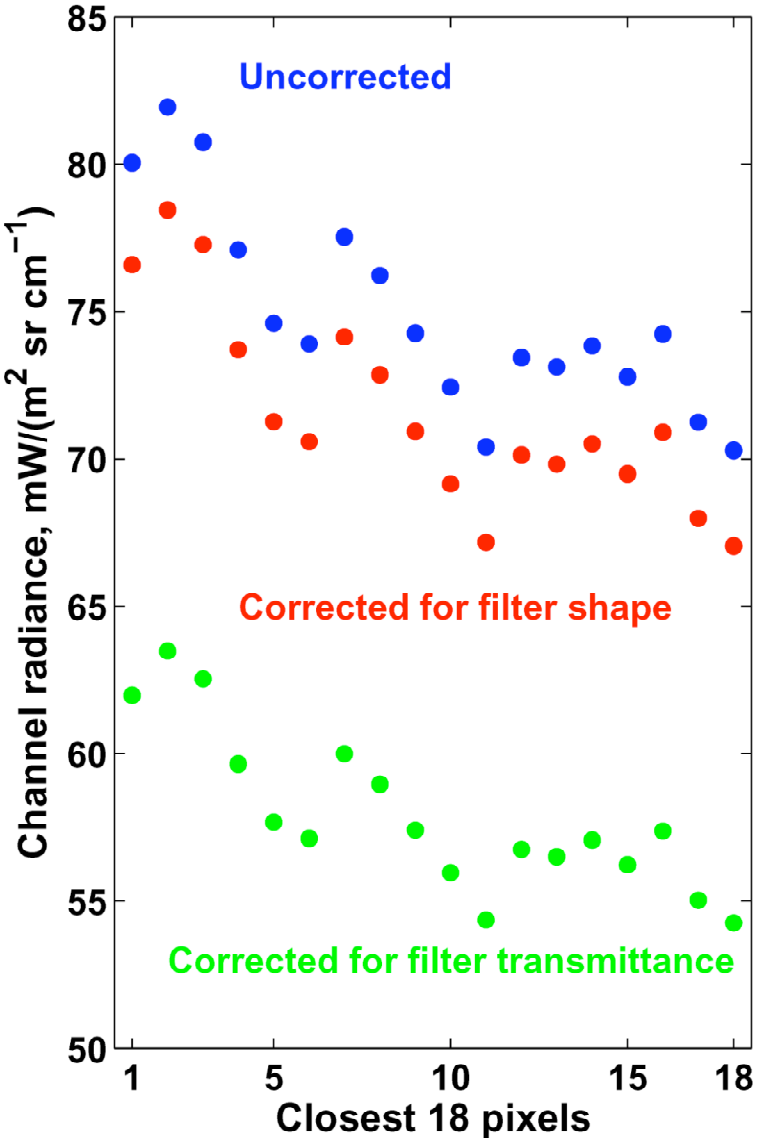
D(km)	W(deg)	R_{AIRS}	R_{CERES}	C_R	C_D	C_W	N_A	N_C	N
2.837574	−0.2163956	23.22745	23.38417	0.9313748	−0.07421869	0.04080909	321	452	49





1°x1° resolution, 18 AIRS footprints

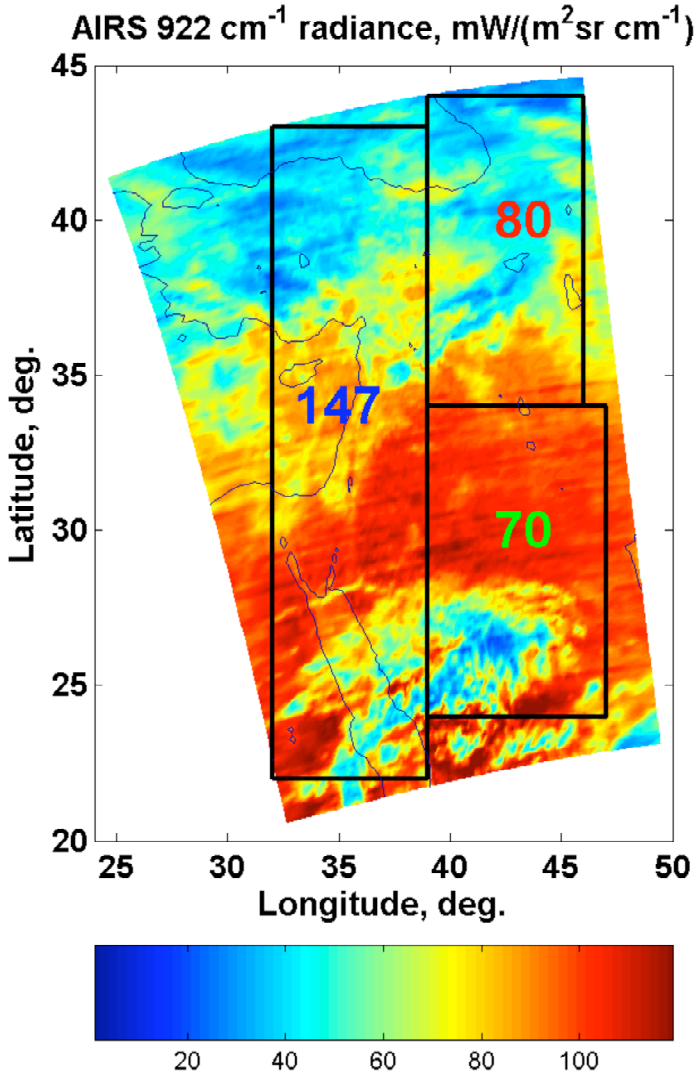


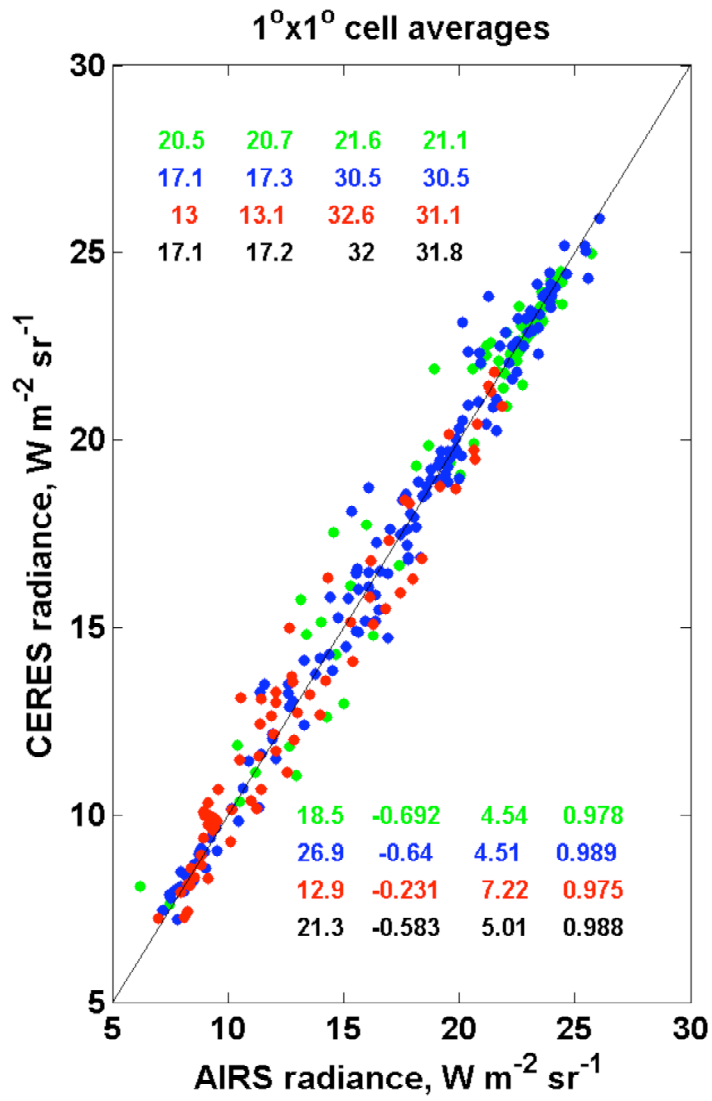


Summary - total of 297 1°x1° cells in 3 regions

AIRS and CERES filtered window radiance comparison, Feb. 20, 2004

Top: mean AIRS, CERES, std. AIRS, CERES; Bottom: footprints/cell, bias %, Rstd. %, correlation





CONCLUSIONS

1. The spectral correction and gap filling method works very well in the window region for the AIRS data.

2. The relationship between the convolved AIRS spectra and the filtered CERES window radiation can be evaluated by a simple polynomial regression scheme which incorporates the limb darkening.

3. Comparisons over selected test areas show that the method is robust.

4. A correction matrix computed for the full AIRS spectral range and the relationships between the un-filtered radiances are necessary for obtaining FAR IR estimates from AQUA.

SLIDE LIST