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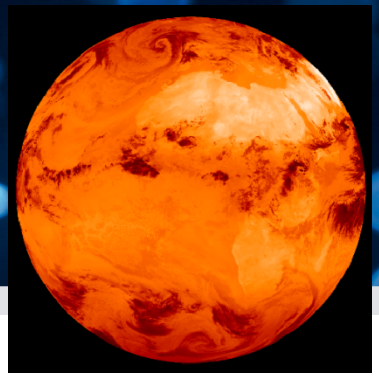
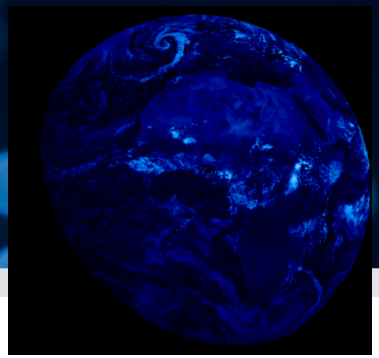
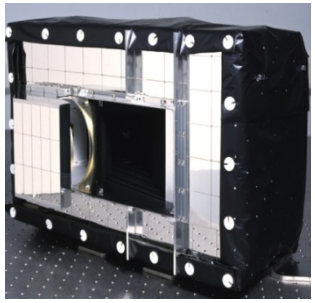
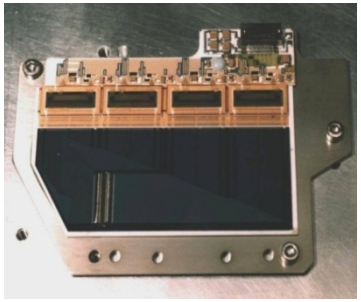
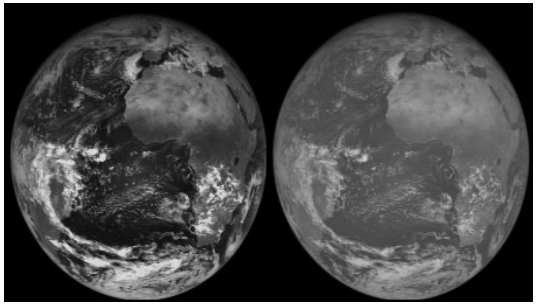




Edition 2 calibration homogenisation







Jacqui Russell, (GERB project scientist) Imperial College

Imperial College London

Edition 2 aims and background

- Background
  - Initial GERB 2 – GERB 1 inter-comparisons highlighted calibration differences as a function of scene for SW.
  - Scene dependent reduction in SW radiance from GERB 1 and GERB 2 observed over their life.
- Aims:
  - Characterise calibration differences between G1 and G2 and changes to each instruments calibration over operational life.
  - Define method to account for this in the Edition 2 processing to produce a single stable record for the period 2004 – 2012 from the two observational datasets.
  - Evaluation and correction performed on the GERB level 2 unfiltered products.

GERB 2 Dec 2002 – Jan 2004 comissioning at ssp -10.5°

G2 t_0 May 2004 ***GERB 2 May 2004 – April 2007 Operational record ssp -3.5°***

GERB 1 July 2006 – April 2007 comissioning at ssp 0°

G1 t_0 May 2007 ***GERB 1 May 2007 – December 2012 operational record ssp 0°***

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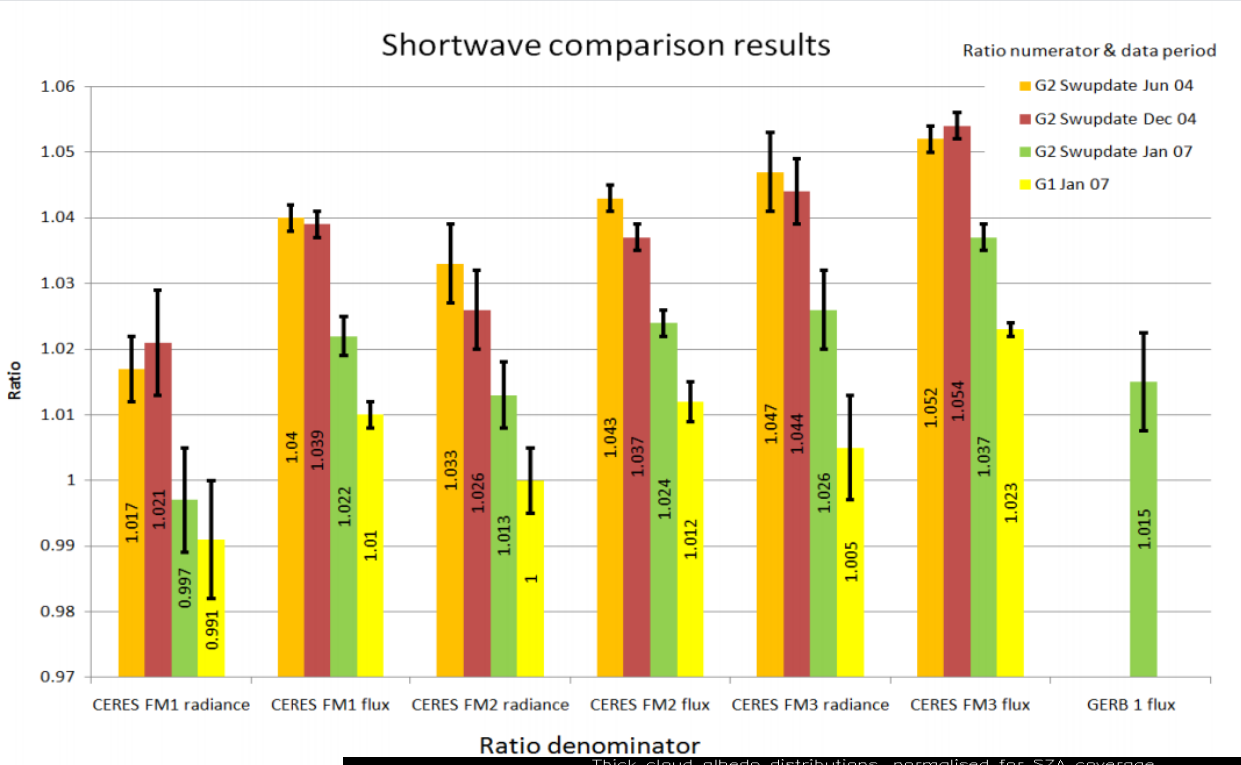
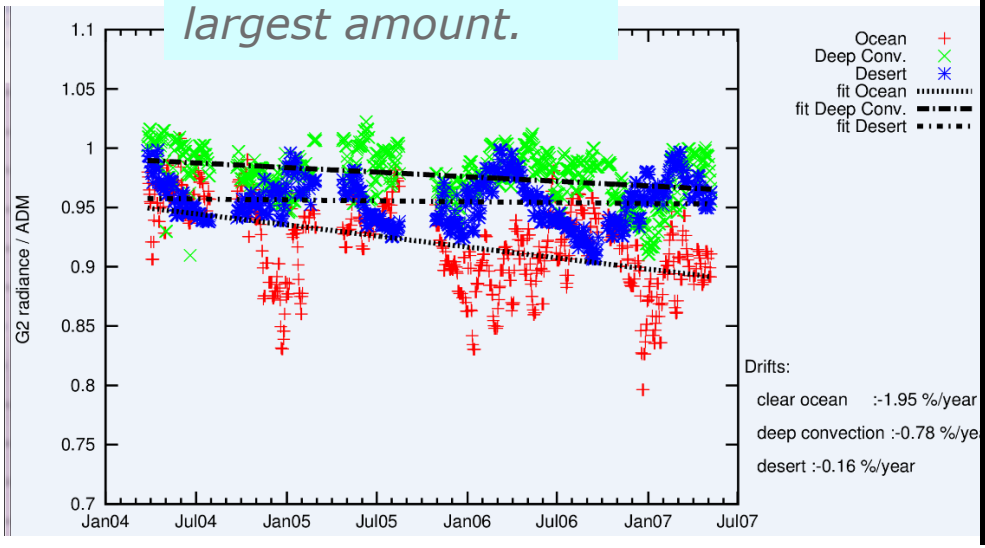
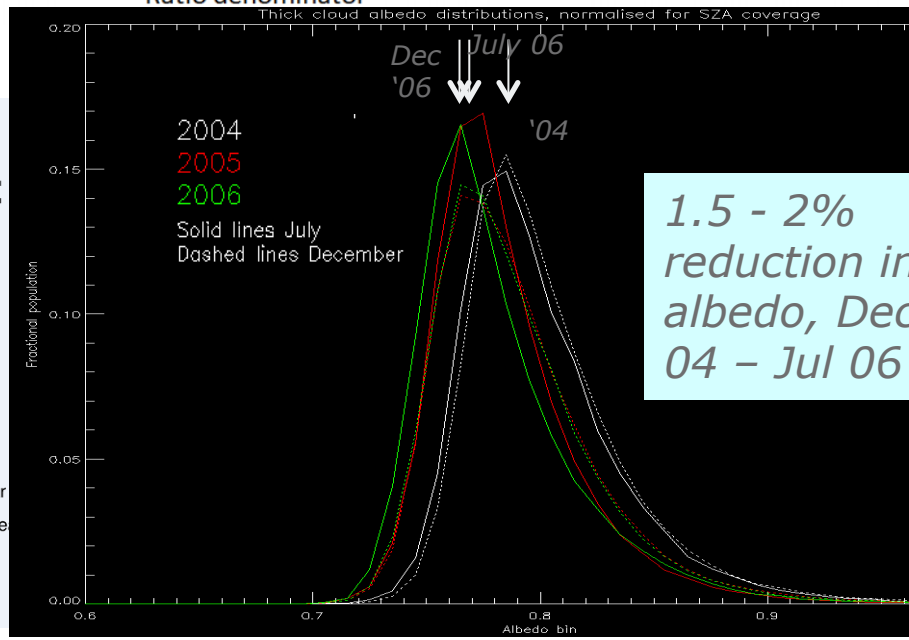
GERB 2 calibration change

Comparisons between GERB 2 and CERES ED2 in 2004 and 2007 showed a reduction in the ratio of their radiance and fluxes (1.6-2% change over 3 years)

Desert changes least, ocean the largest amount.







1.5 - 2% reduction in albedo, Dec 04 – Jul 06

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GERB CERES comparisons

- Linear regressions or simple scene classifications could not sufficiently separate the rate of change observed leading to apparently noisy results unless further separation by geomtry was made – leading to too few points.
- Using the ratio of the CERES unfiltered / filtered SW radiance as a proxy for scene colour enabled good number of points with the same spectral characteristics and same calibration changes to be grouped.
- Data from both GERB instruments over 2004 – 2012 was analyses in this way, mapping the relative calibration between CERES and GERB.
- Results shown here for FM1 CERES Ed3a and GERB Ed1 HR.

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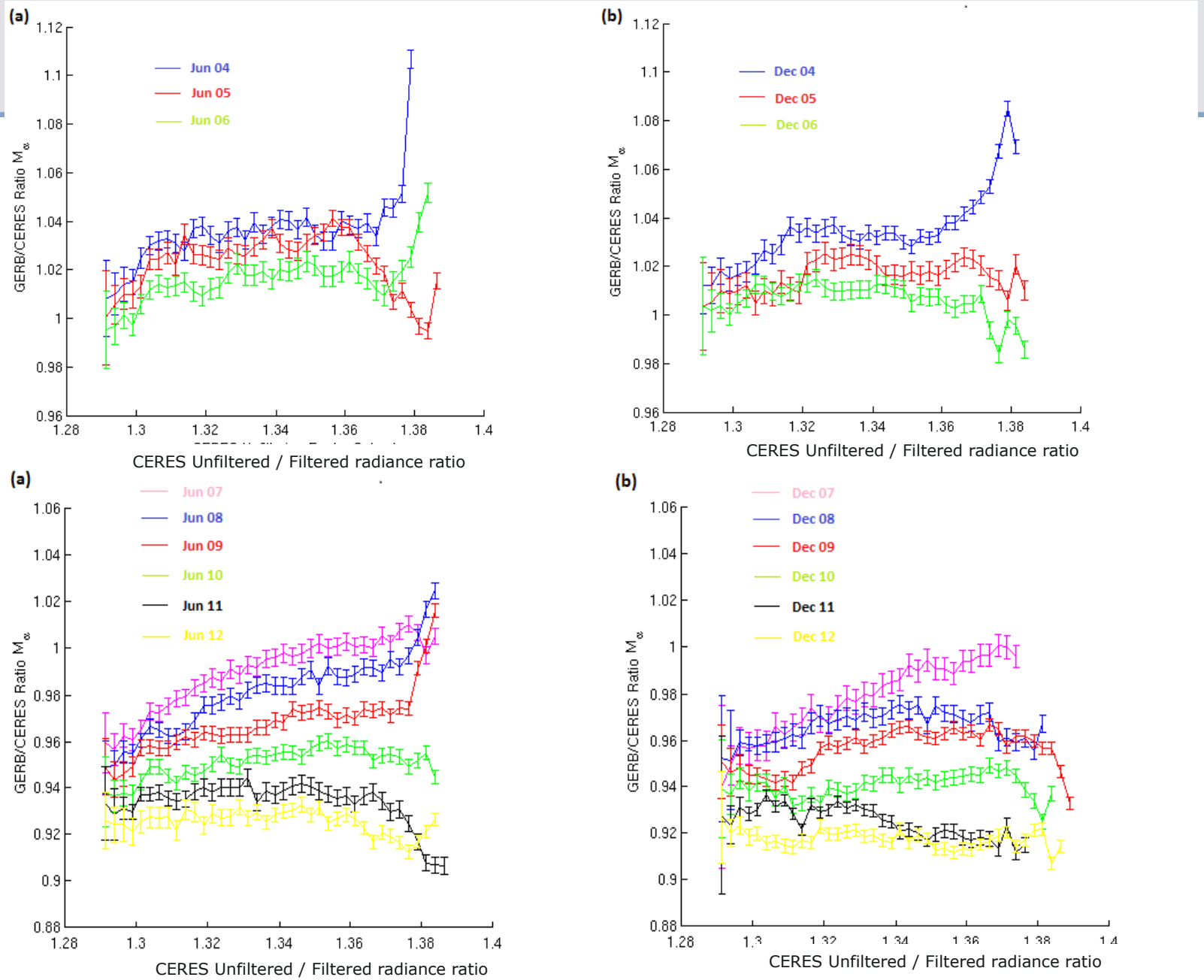
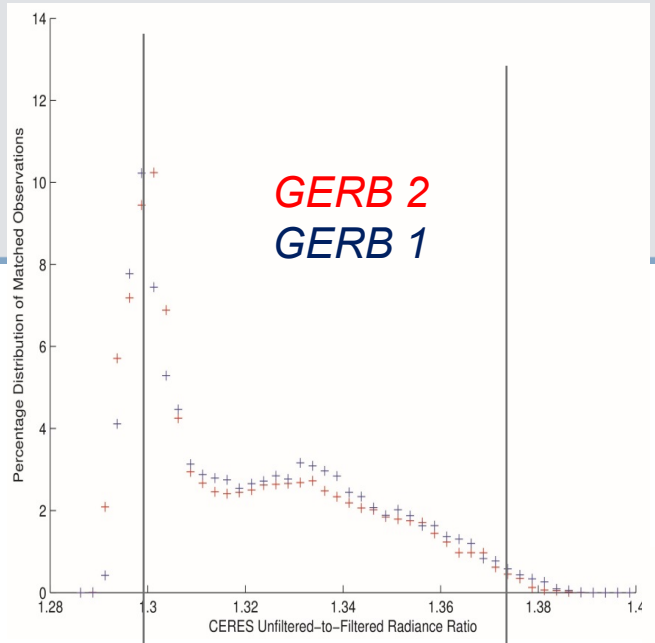
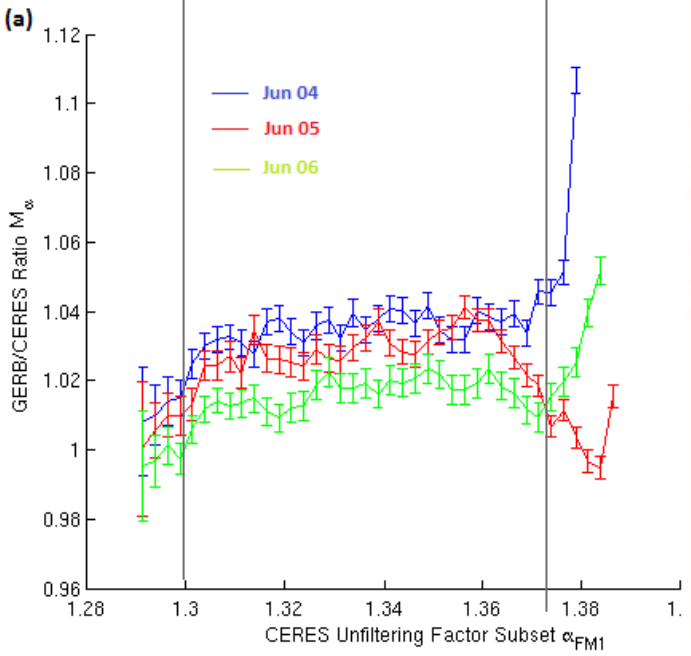
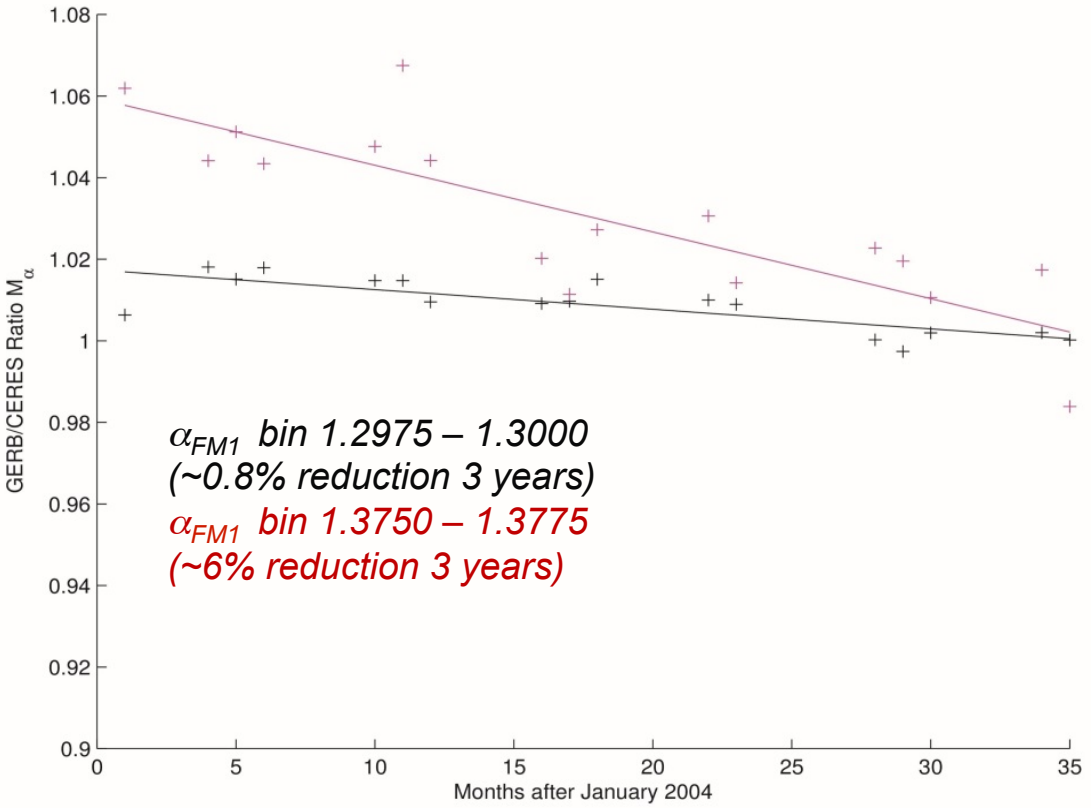
GERB / CERES FM1 SW radiance ratio evolution



GERB 2 / CERES FM1 SW radiance ratio evolution

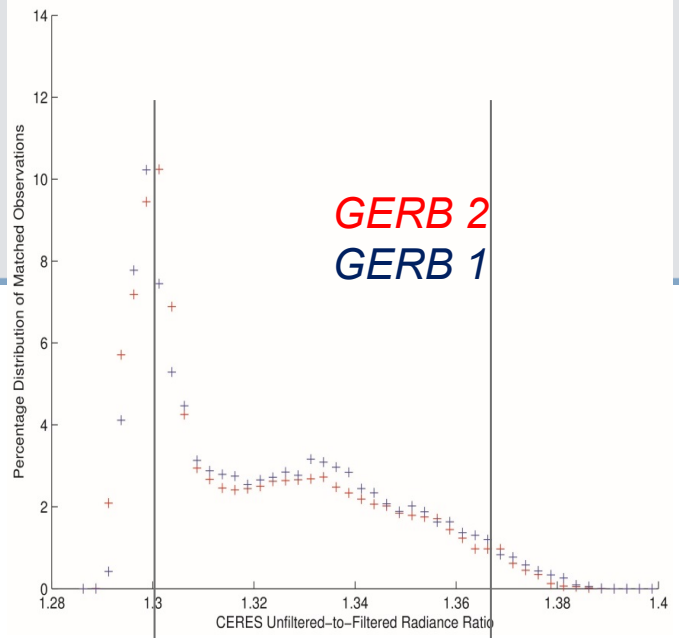


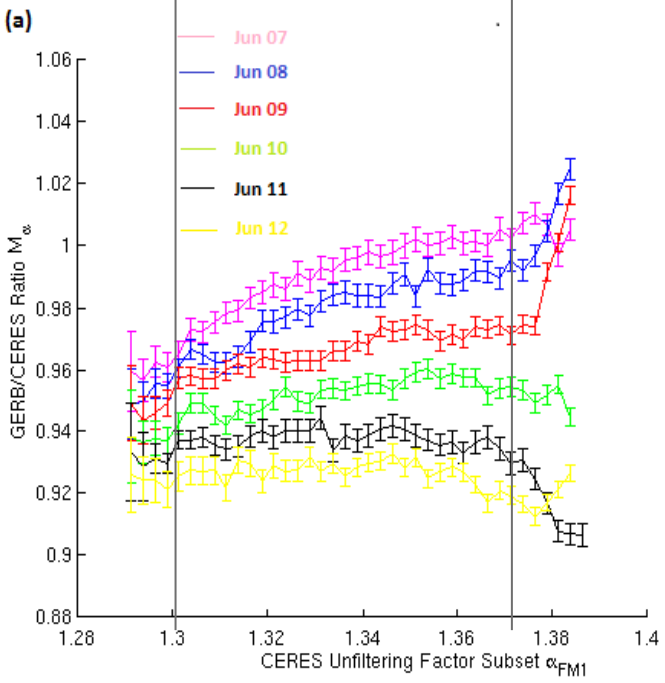




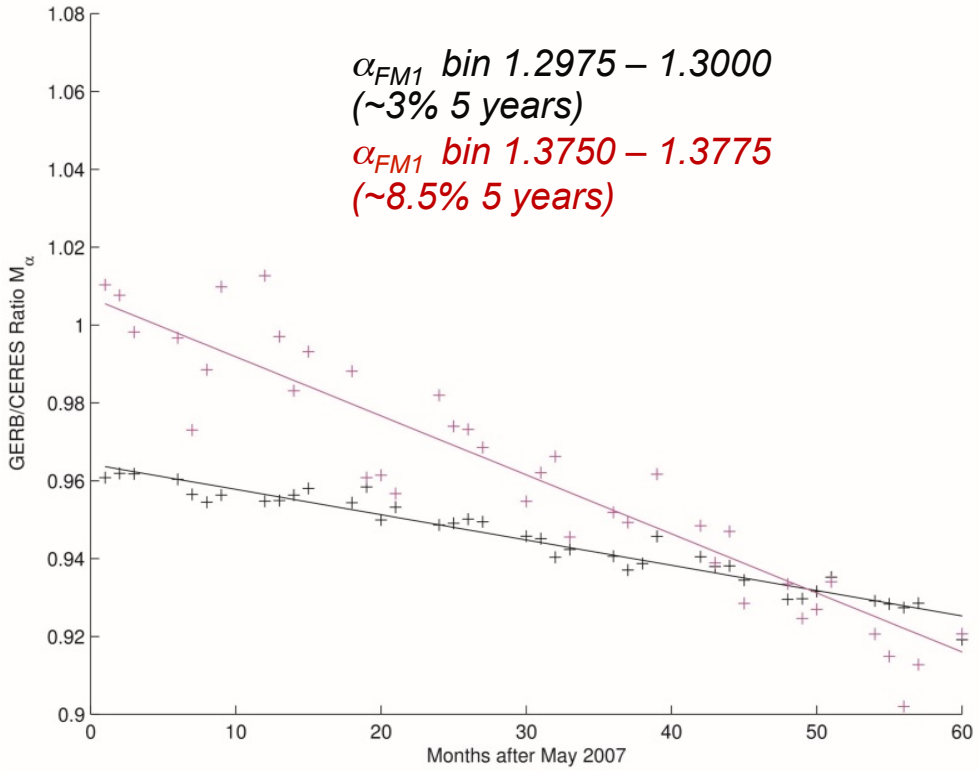
α_{FM1} *bin 1.2975 – 1.3000*
(~0.8% reduction 3 years)
α_{FM1} *bin 1.3750 – 1.3775*
(~6% reduction 3 years)

GERB 1 / CERES FM1 SW radiance ratio evolution





A given unfiltering factor shows roughly linear decrease in GERB/ CERES SW radiance ratio with time



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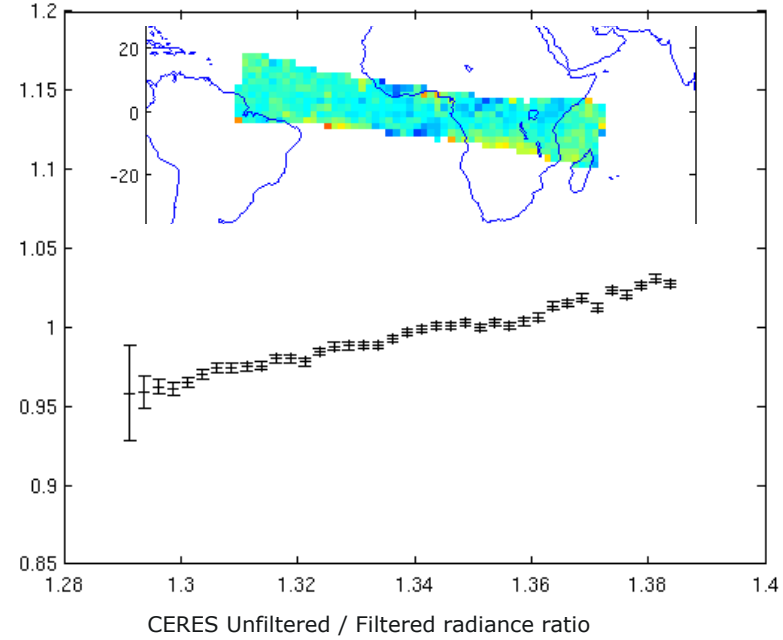
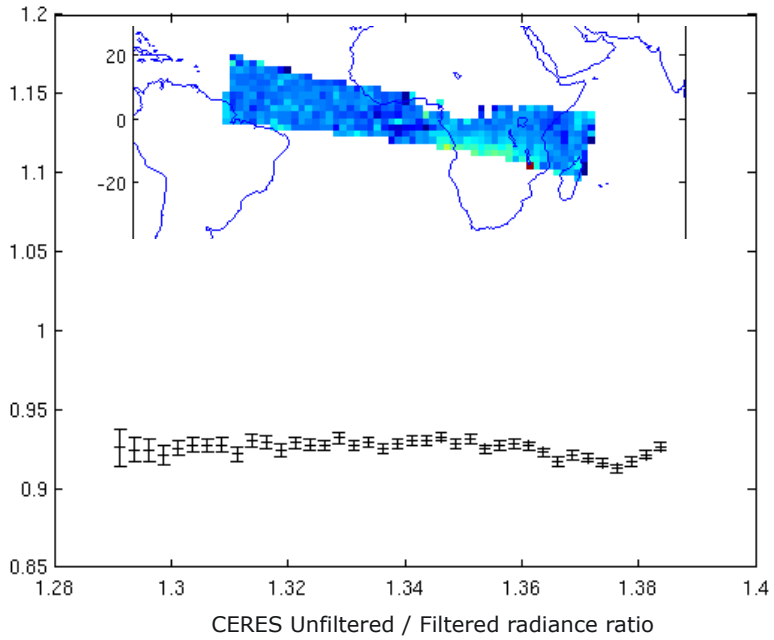
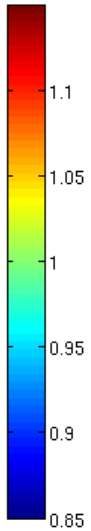
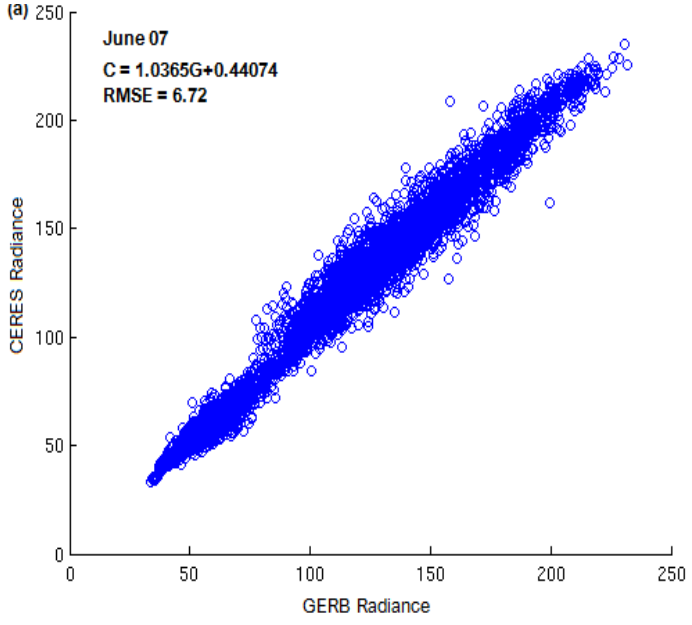
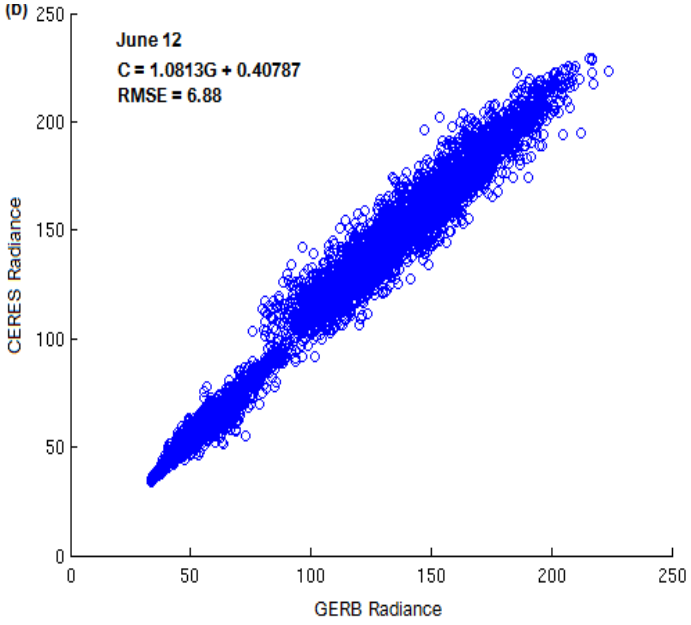
GERB 1 / FM1 change 2007 - 2012











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GERB 2 / GERB 1 SW flux ratio May 2007

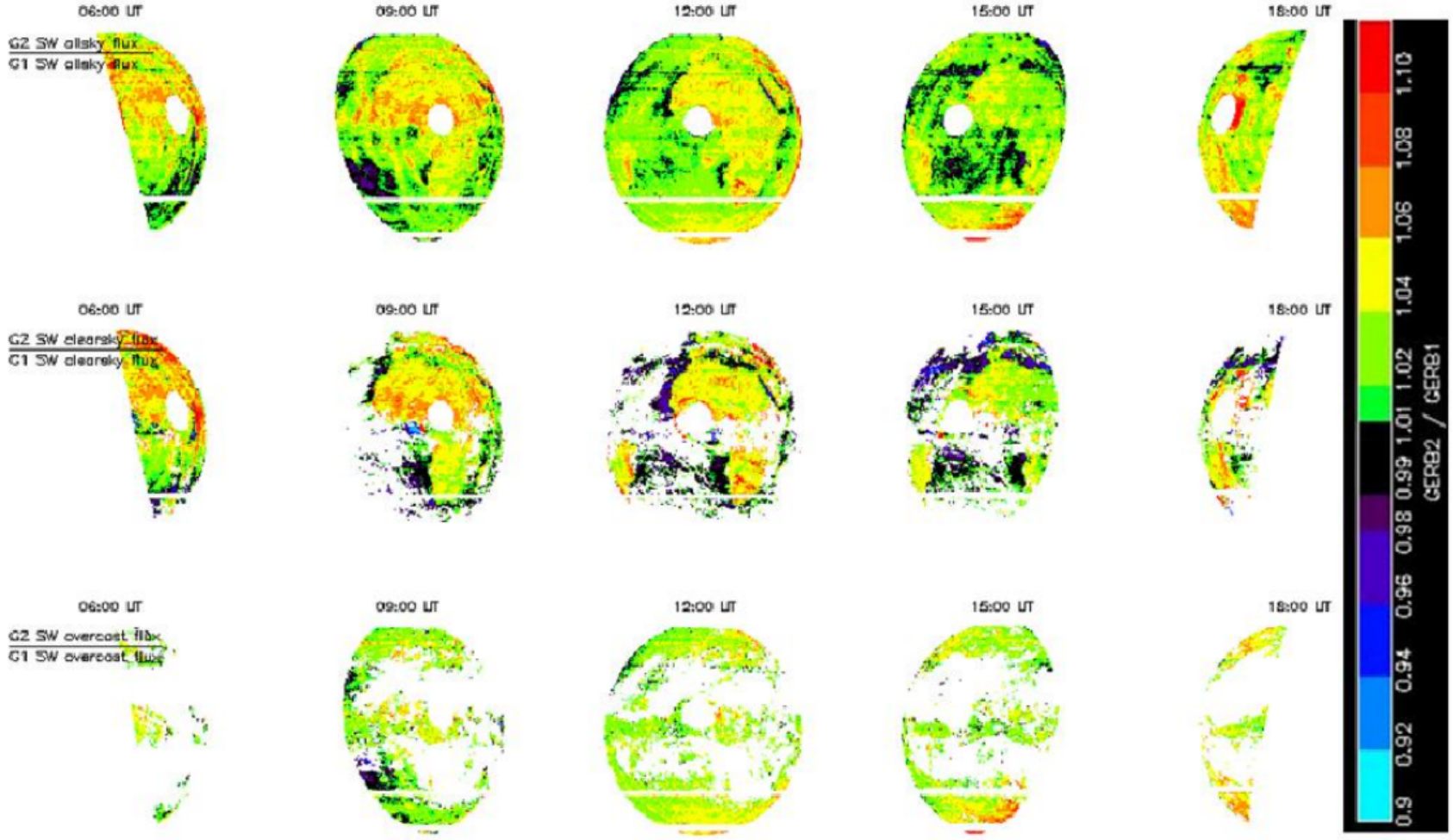
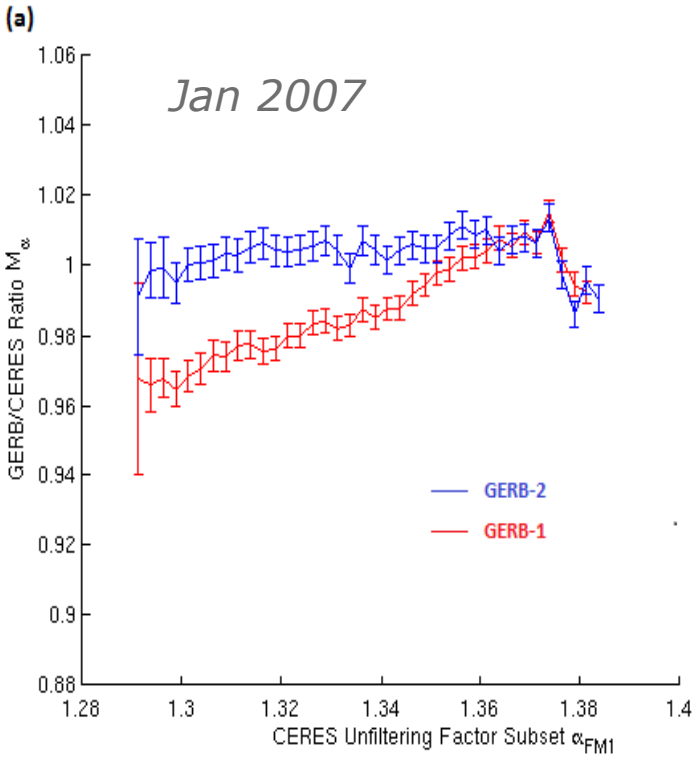
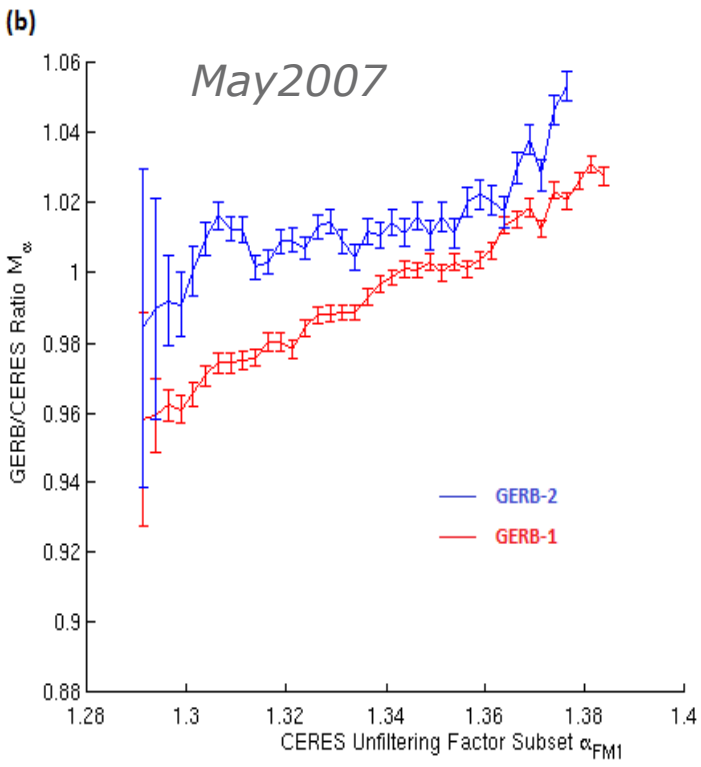


Figure 7. Shortwave G2/G1 average ratio plots for May 2007, for 5 times of day, decomposed according the GERB scene ID into allsky, clearsky and overcast.


(a)
Jan 2007
GERB/CERES Ratio M_α
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
0.88
1.28
1.3
1.32
1.34
1.36
1.38
1.4
CERES Unfiltering Factor Subset α_{FM1}
GERB-2
GERB-1


(b)
May2007
GERB/CERES Ratio M_α
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
0.88
1.28
1.3
1.32
1.34
1.36
1.38
1.4
CERES Unfiltering Factor Subset α_{FM1}
GERB-2
GERB-1

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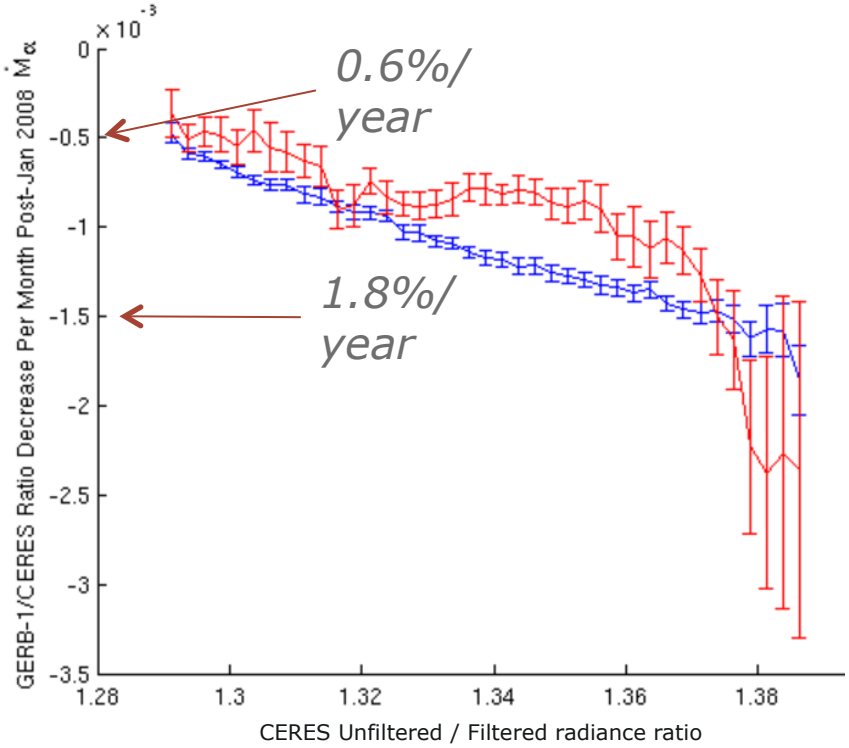
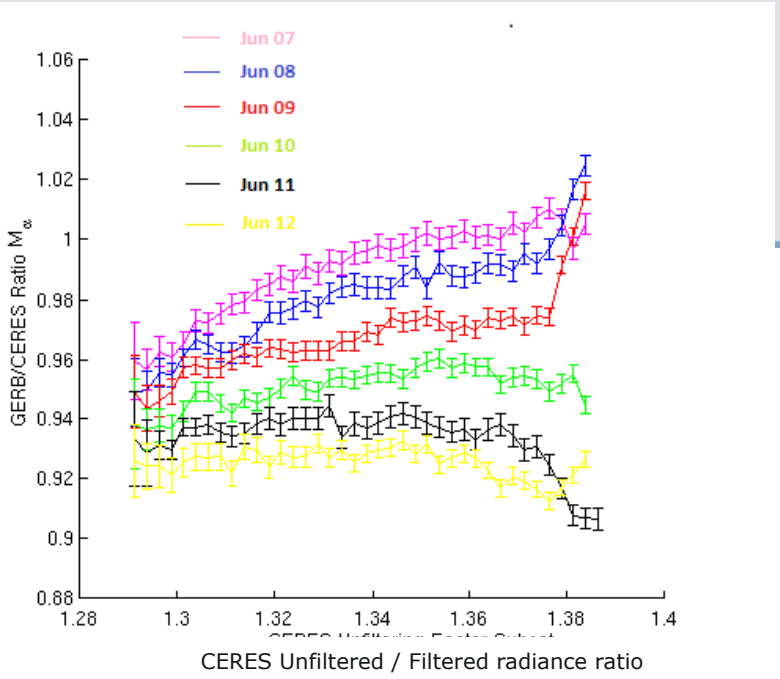
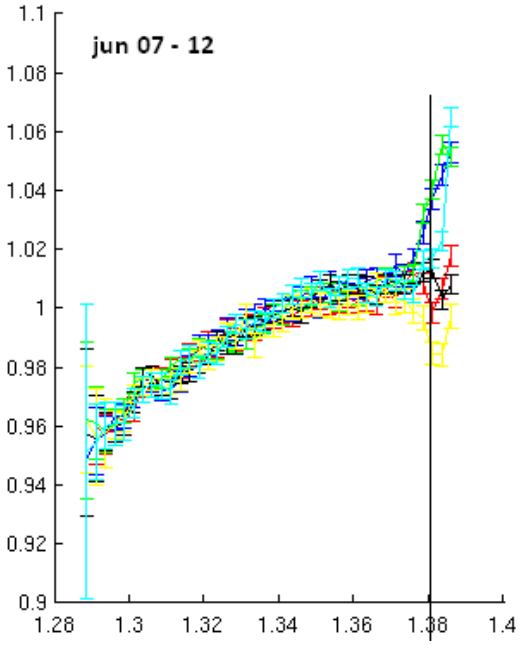
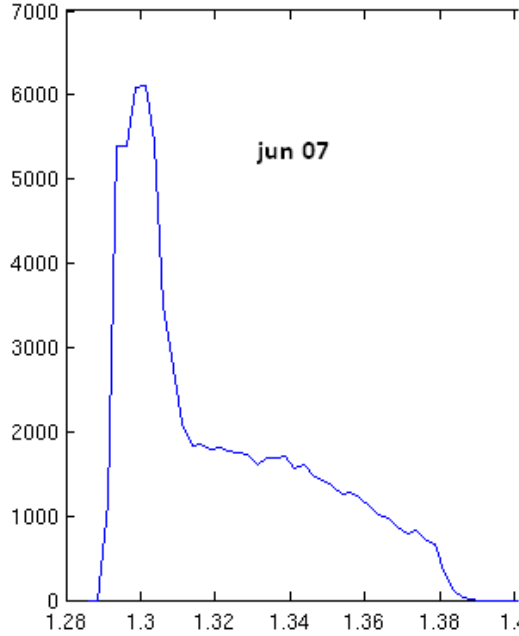
Calibration drift correction





Rate of decrease varies with unfiltering factor





CERES Unfiltered / Filtered radiance ratio

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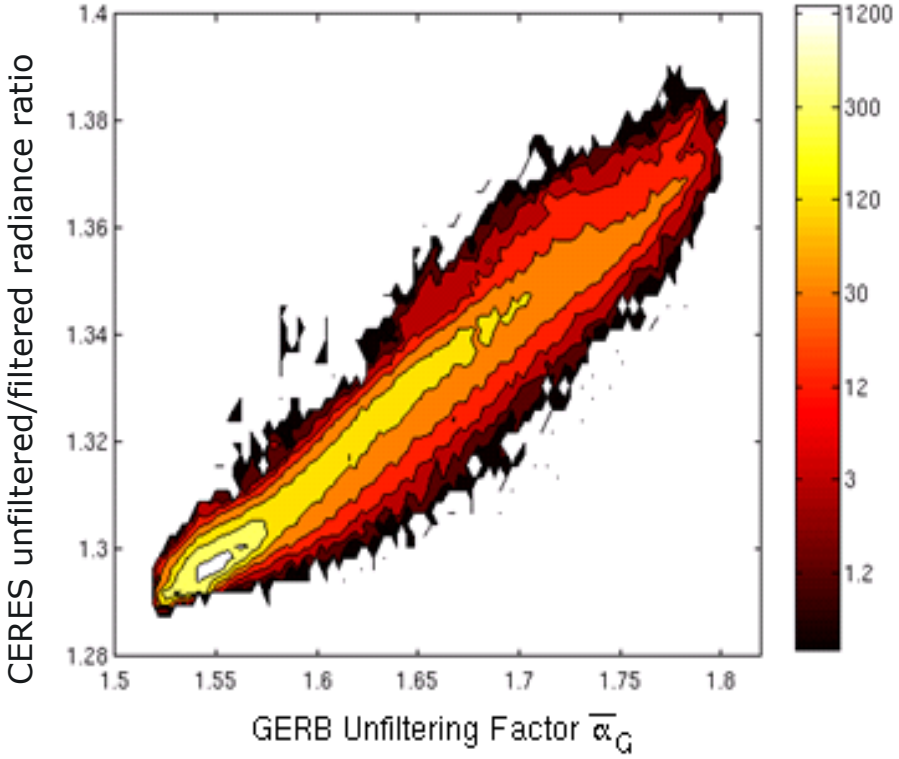
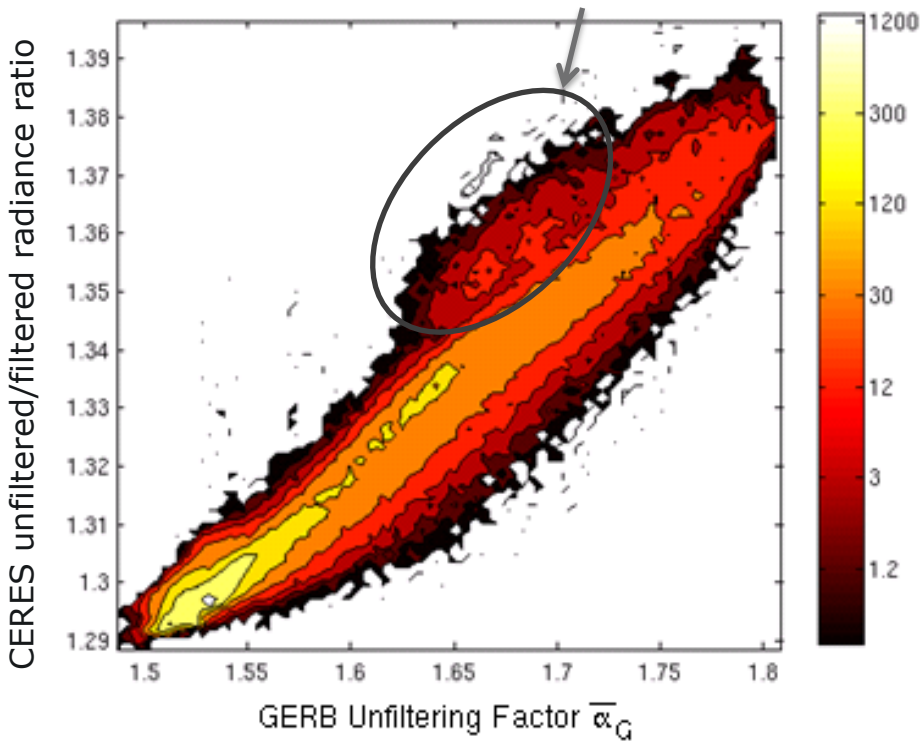
Mapping to GERB unfiltering factor

Anomalous scenes (VZA<10 where there is a mix of clear ocean and cloud over the CERES footprint being matched



$$\alpha_{FM1} = 0.310\overline{\alpha_G} + 0.818$$

GERB 2 June & Dec 2004



$$\alpha_{FM1} = 0.290\overline{\alpha_G} + 0.855$$

GERB 1 June '07 & Dec '08 2004

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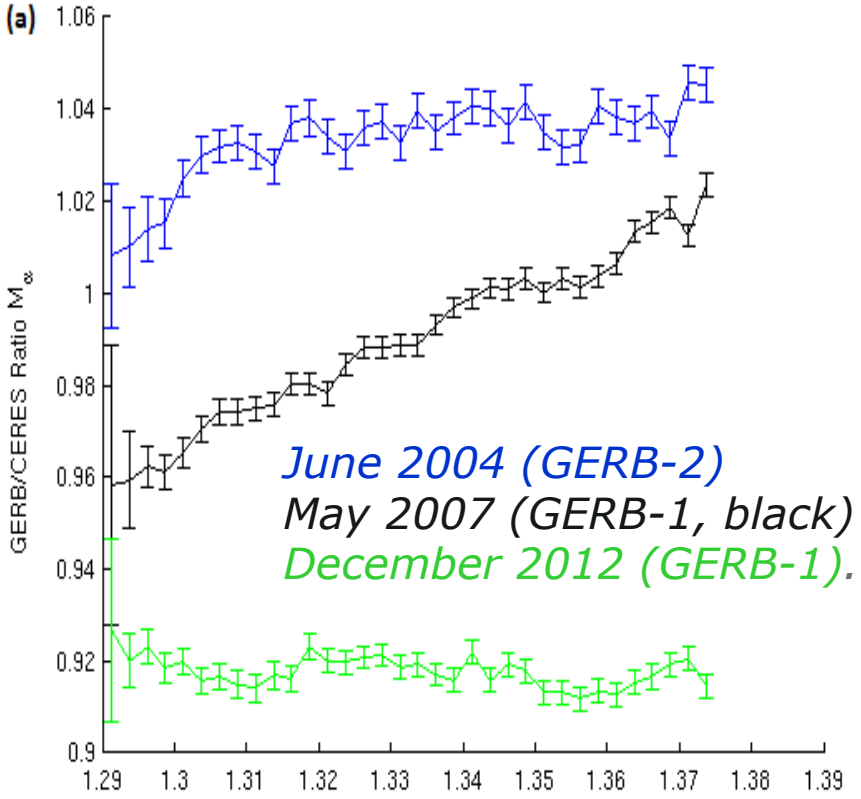
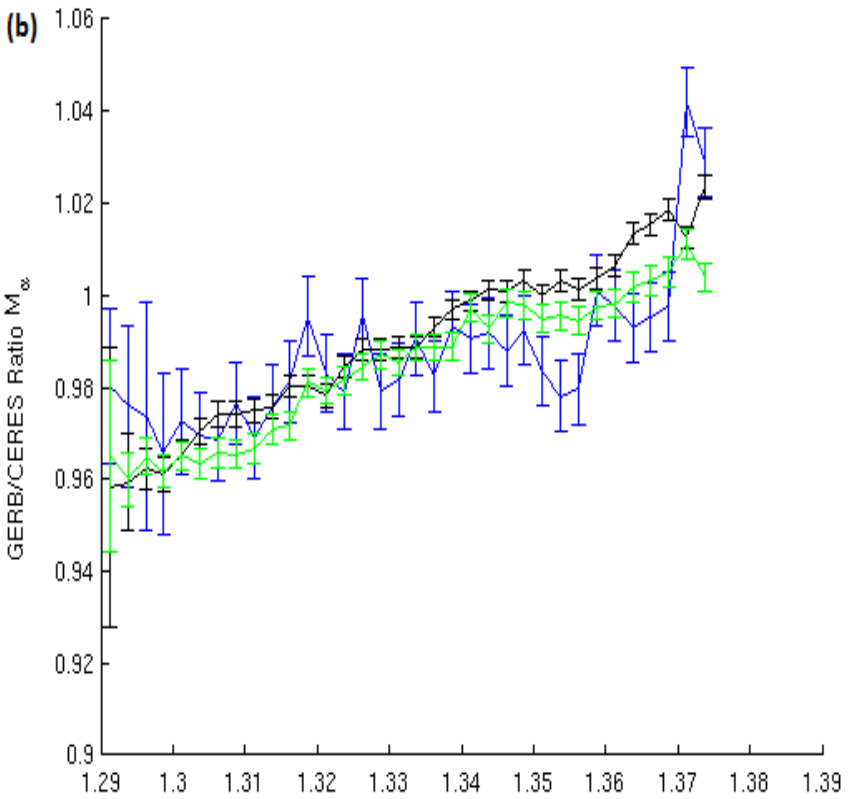
Applying correction derived from GERB unfiltering factor



CERES Unfiltered/Filtered ratio



CERES Unfiltered/Filtered ratio

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Summary

- GERB and CERES SW radiances compared as a function of the CERES unfiltered/filtered radiance ratio (proxy for spectral distribution of energy in scene).
- Calibration differences between GERB 2 and GERB 1 characterised as a function scene properties
- Evolution in relative GERB/CERES FM1 details between 2004-2012 (see poster)
- Linear decline in GERB/CERES SW radiance ratio with rate increasing for bluer scenes.
- CERES unfiltered / filtered radiance ratio mapped to GERB unfiltering factor.
- Assuming CERES a stable reference, GERB 1 and GERB 2 calibration corrected to GERB 1 SOL based on fit to GERB/CERES ratio and mapping between CERES unfiltered/filtered radiance and GERB unfiltering factor
- NEXT need to test over full diurnal range and check consistency between GERB 1 & GERB 2 when corrected in overlap
- Evaluate corrected radiances at different time points against the other metrics used to diagnose decrease in GERB SW response.