



# GERB: project status & validation

## Imperial Team – latest status!

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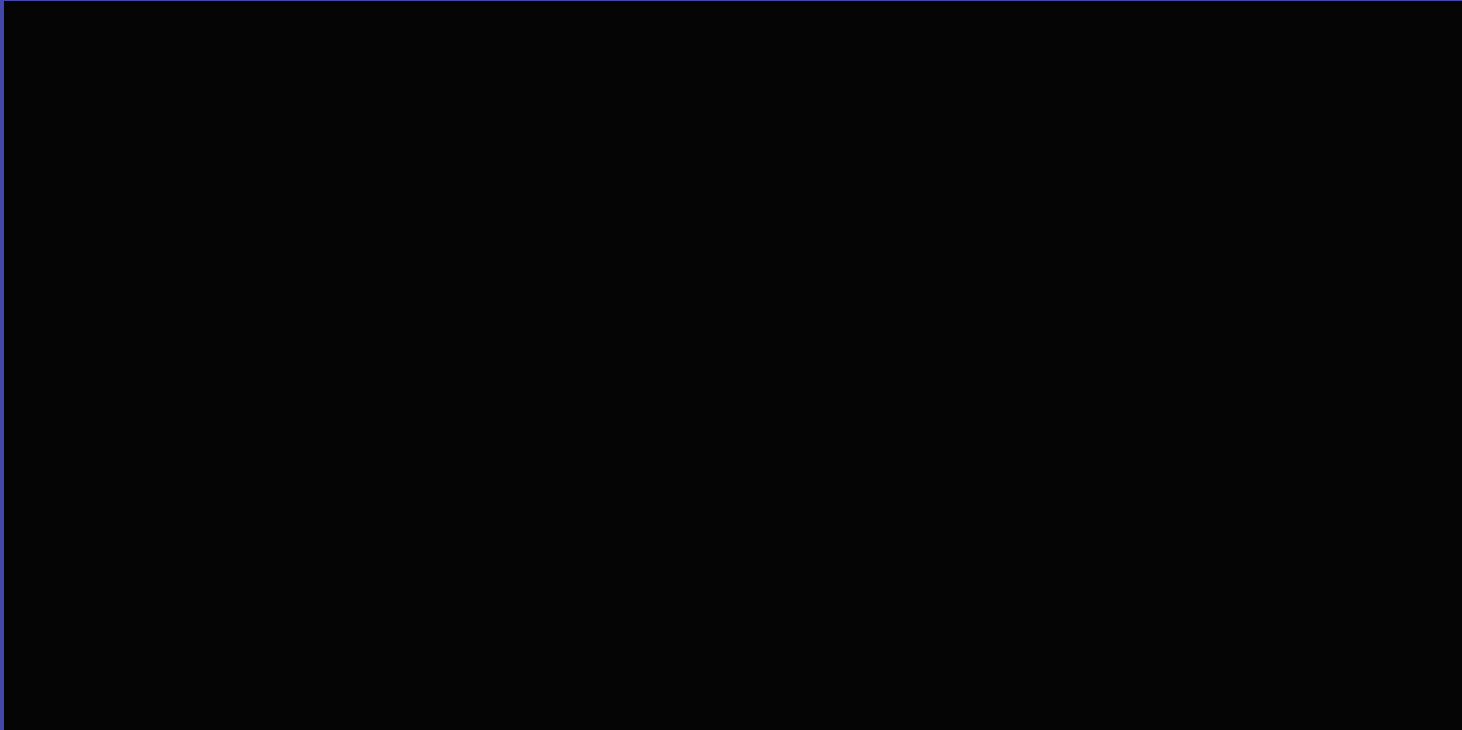
# Instrument status

- GERB 2 (Meteosat-8) and GERB 1 (Meteosat-9) are currently in orbit
  - Edition data are currently available from GERB 2 for the period March 04 to May 07, GERB 1 became the operational instrument after May last year, data still undergoing validation
- GERB 3 is at Imperial undergoing re-calibration before satellite integration
- GERB 4 is expected for calibration at Imperial later this year, unit level measurements of the mirrors and detector are currently on-going

# Instrument status: in orbit G1 & G2

- GERB 2 (Meteosat-8) and GERB 1 (Meteosat-9) are currently in orbit
  - GERB 1 (Met-9) is now the operational instrument, (since May 07), although the data are yet to complete validation so are not released as Edition products yet.
  - Mirror behaviour on GERB 1 has been poorer than for GERB 2 and thus the instrument has only been operated for very limited periods during the 'eclipse' seasons (two months around each equinox), due to concern about detector damage from mis-pointing events at these times.
  - GERB 2 is in 'SAFE' non-data collecting mode, with occasional activation for bearing movement and calibration checks.
  - Funding to carry out the studies to cross calibrate GERB 2 and GERB 1 has now been secured and work on this is due to start this month (May 08)
  - GERB 2 edition 1 ARG data is available for the time period March 04 to May 07. Validation of the BARG in anticipation of release is mostly completed, and these data should be released later this year.

# GERB-1 Operations summary



GERB1 has been operating, Sun avoidance permitting, as the primary instrument since 10<sup>th</sup> May 2007.

Because of mirror bearing anomalies GERB1 did not run during the Autumn '07 season and ran in a reduced window [01:55-07:02 daily] during the Spring '08 season.

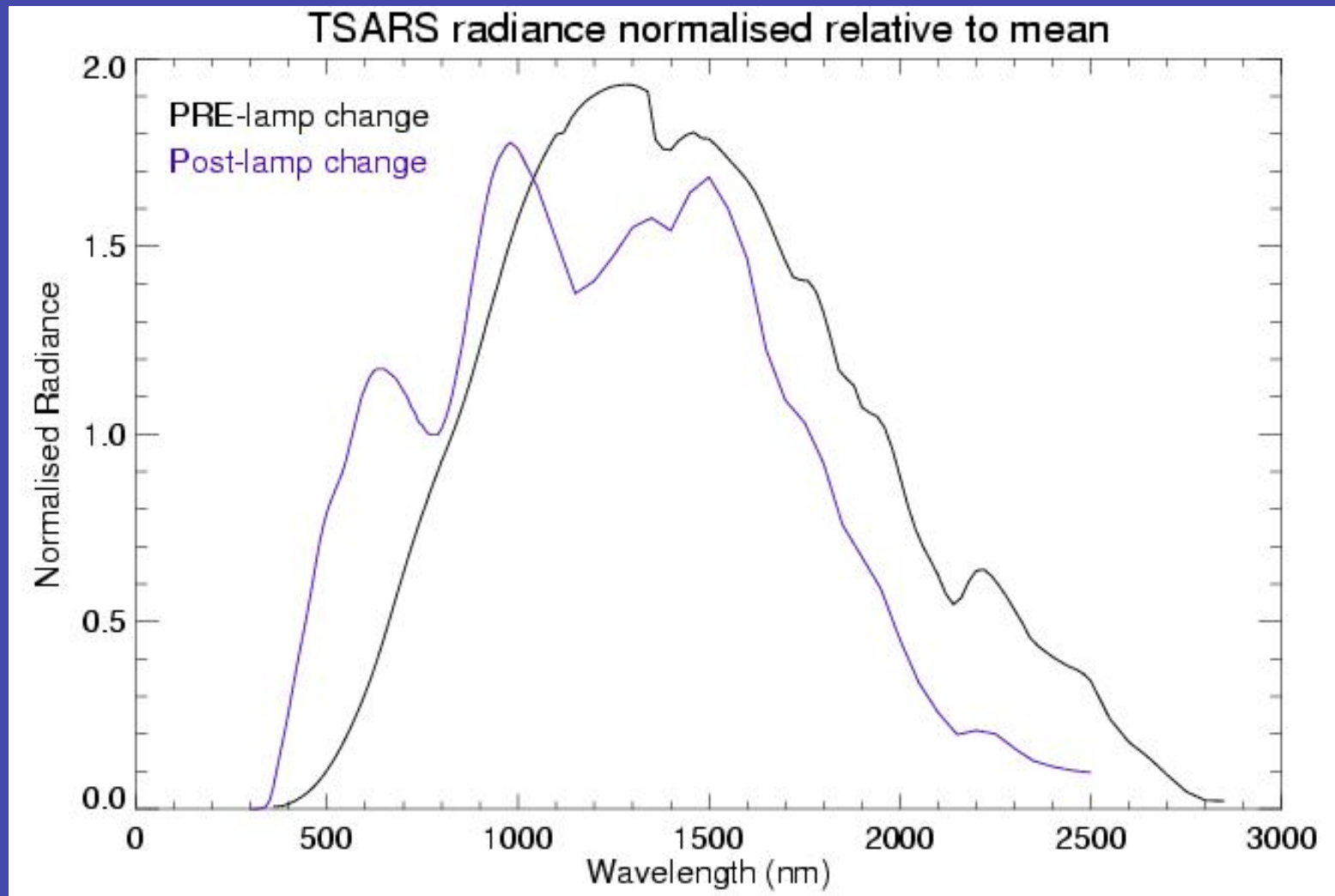
GERB2 has remained in SAFE for the majority of the last year with brief periods in a rotating mode to exercise the bearing.

## Instrument status: G3 in calibration

- GERB 3 is at Imperial undergoing re-calibration (due to length of time since first calibration) before satellite integration
  - Additions and improvements to the original calibration procedure include:
    - A wider range of temperature for the warm black body calibration source (now minus 250 to + 345K, previous minimum temperature was 280K), greater pixel coverage
    - Improved pixel coverage of the spectral response spot checks, achieved by modifying the instrument mounting within the calibration chamber, and additional wavelengths by using more filters and a higher output source. A new window for the IR to allow IR spot checks to be made in vacuum
    - A shortwave calibration source with much more energy at shorter wavelengths

# Updated VISCS spectra

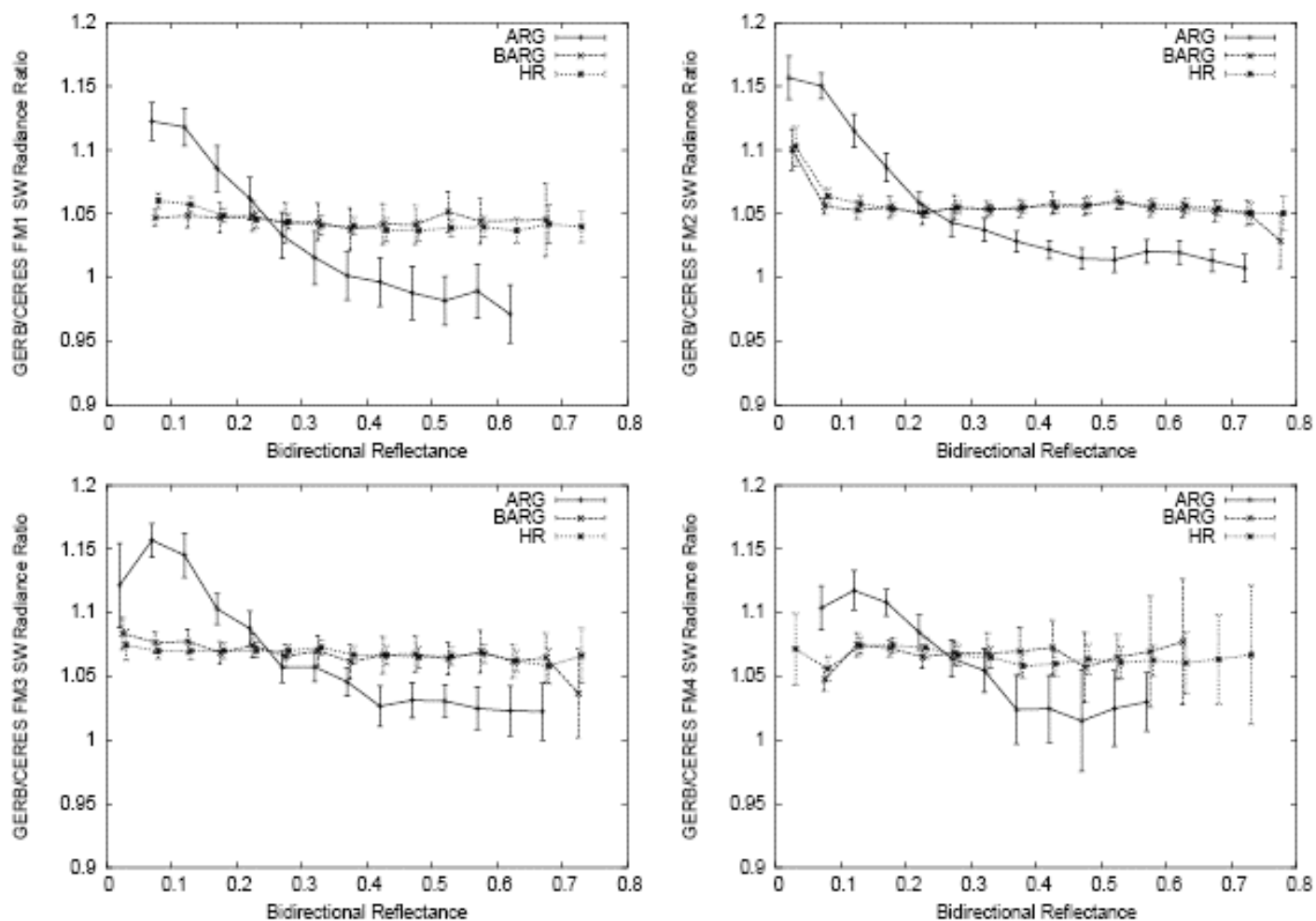
- Changes to the shortwave calibration source for GERB 3 (and 4) calibration



# Latest validation results (GERB 2)

- Following on from the GERB ARG-CERES SSF Ed2 rev 1 comparisons, the GERB BARG and HR data formats have been compared to CERES
  - Overall (average) results are the same as for the ARG (GERB around 5% higher in SW and 1% lower in LW than CERES), but the scene dependency present in the ARG is not exhibited for the BARG comparisons.
  - It is thought that the apparent scene dependency in the ARG comparisons comes not from differences between CERES and GERB spectral response but is present in ARG because:
    - (a) the uncorrected PSF - the comparison method only matches CERES points to the centre of the ARG PSF and applies no weighting, thus the wings of the PSF are ignored;
    - (b) the rectification of the data to the ARG grid is by linear interpolation;
    - (c) geolocation errors result in occasional contamination leading to bias in the extreme scenes,
  - the BARG processing attempts to correct each of the issues thus the scene dependence is eliminated

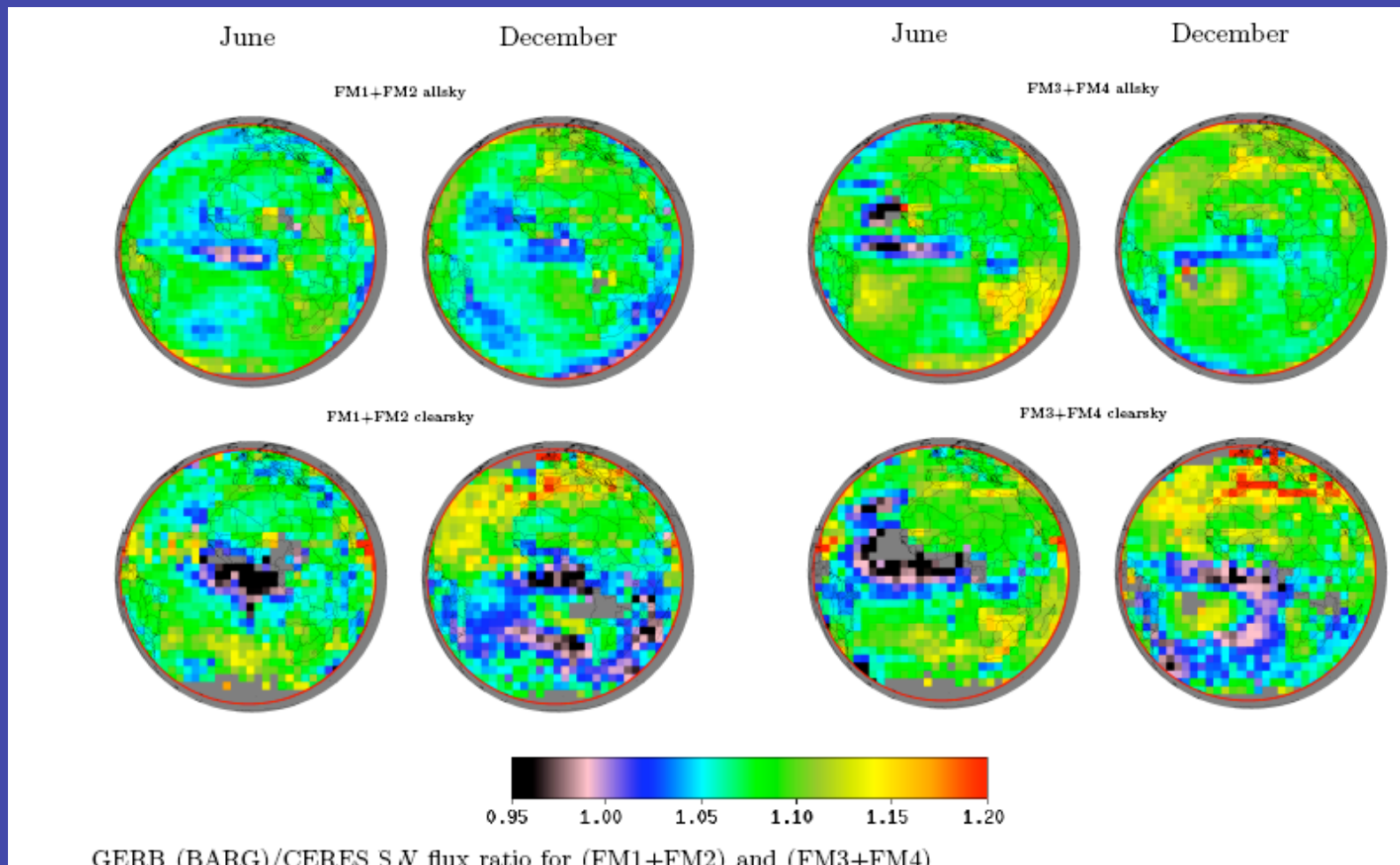
# Latest validation results: SW radiance



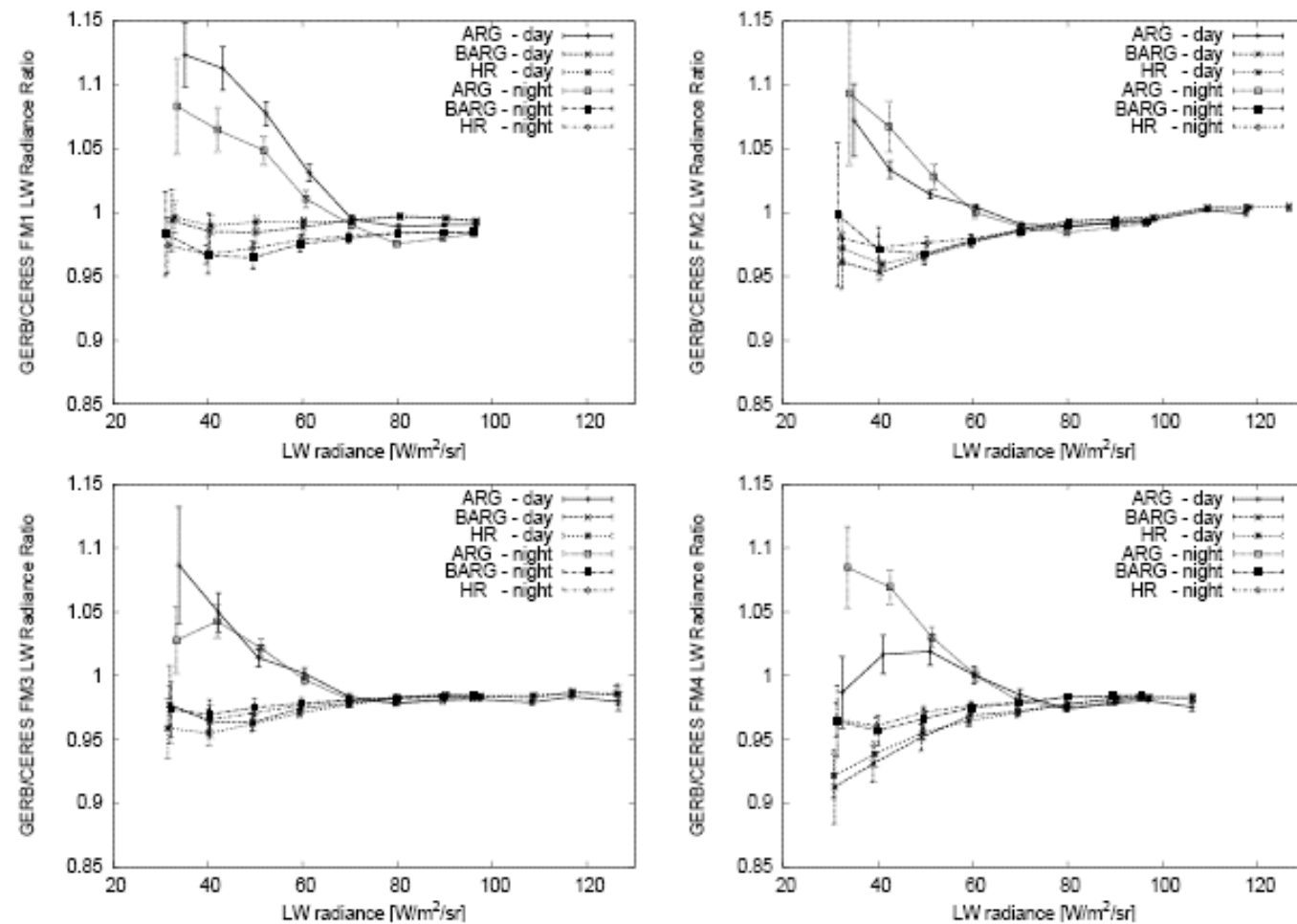
GERB/CERES SW radiance ratio  $m$  and uncertainty in reflectance bins for  $\alpha < 5^\circ$ .



# Latest validation results: SW flux



# Latest validation results: LW radiance



GERB/CERES LW radiance ratio in radiance bins.

# Latest validation results: LW flux

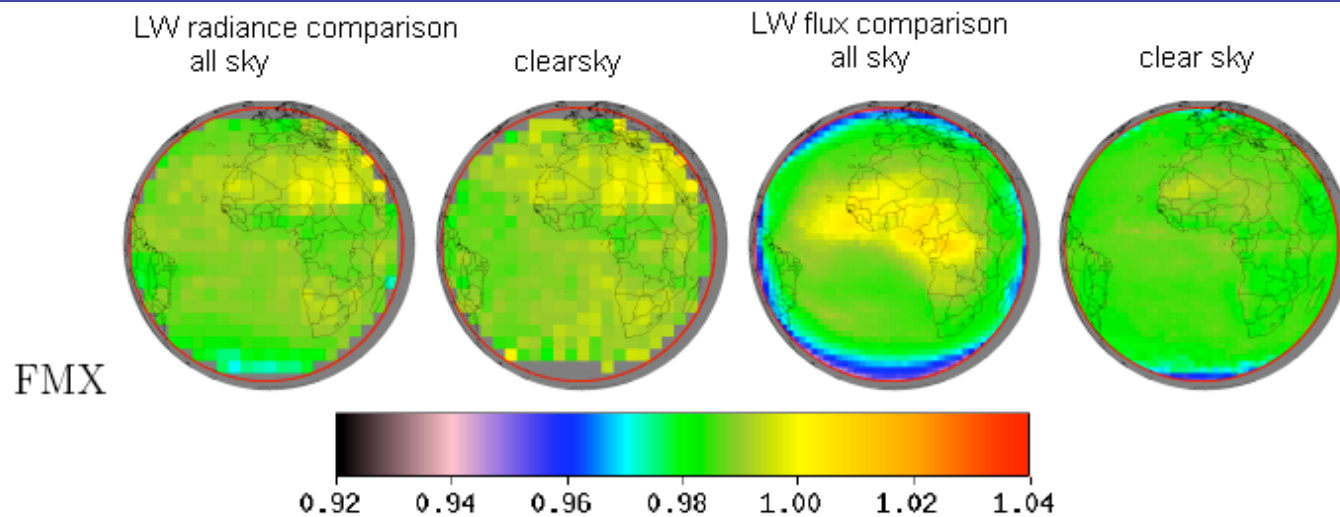


Fig. 7. GERB (BARG)/CERES LW ratio for all the CERES instruments  
The red circle indicates  $VZA = 70^\circ$ .

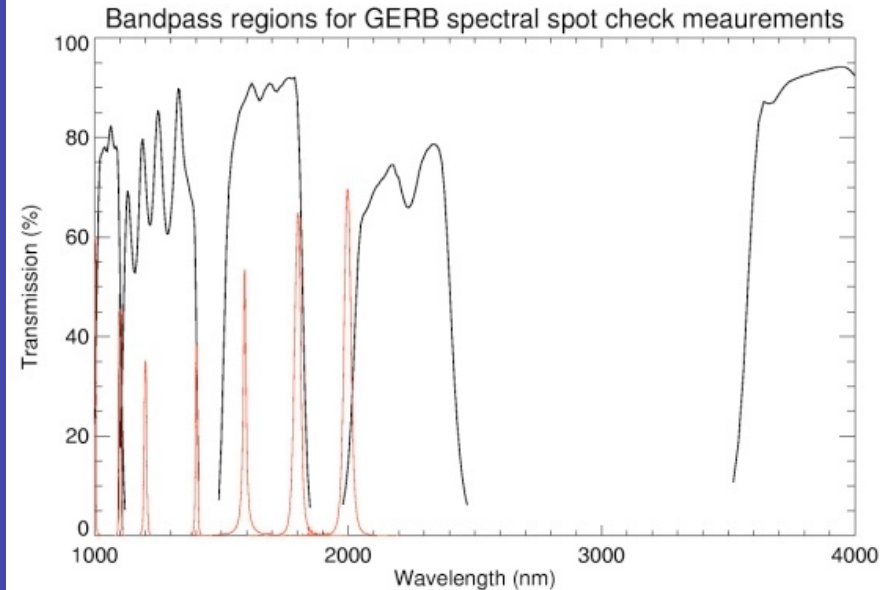
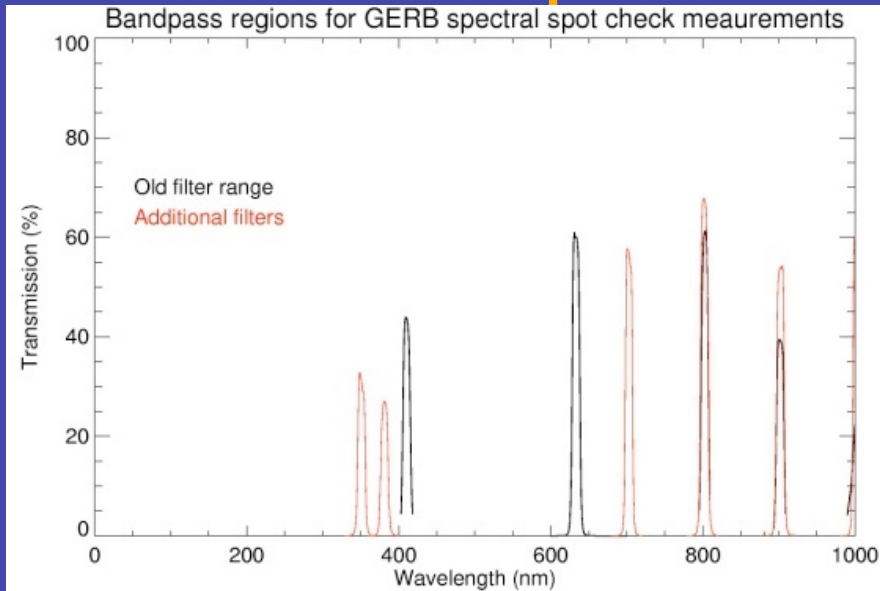
# Future plans

- BARG release ED1 (March 04-May 07)
  - Complete validation of the BARG processing: PSF removal and averaging procedures
  - Finalise strategies for providing estimates of missing data: terminator, sunglint, LW night for Sun avoidance period (20:30 – 01.30)
- GERB 1 validation
  - Intercomparison between GERB 1 and GERB 2 (work begun)
  - Comparison of GERB 1 and CERES
  - Analysis of the flight spare detector calibration results

# Summary

- GERB 2 (MET-8) edition 1 data available from March 04 to May 07
- GERB 1 (MET-9) is now the operational instrument since May 07, data undergoing validation
- GERB 3 undergoing system level re-calibration at Imperial
- GERB 4 at unit level calibration prior to full assembly, will have system calibration later this year
- New validation results for GERB BARG (PSF removed) data, in contrast to ARG products comparison with CERES SSF Ed 2 rev 1 shows no scene dependency for BARG. Overall difference (5% SW, 1% LW radiance) same as for ARG. Results submitted for publication.
- Estimates for missing data are planned for inclusion in a data fill field in the BARG edition products, expected release this year

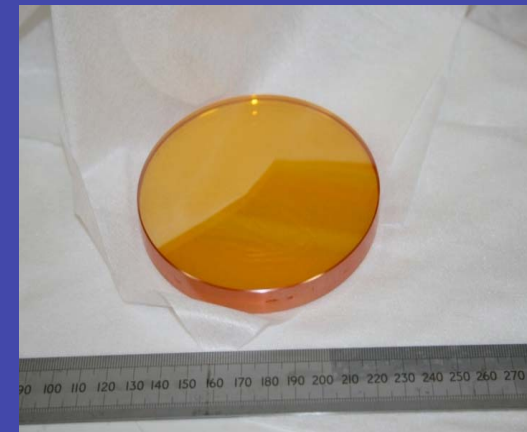
# Enhanced Spectral response spot checks



Additional narrow bandpass filters have been acquired to enhance knowledge of the IOU spectral response (10  $\mu\text{m}$  and 20  $\mu\text{m}$  filters are also used but not shown on this plot)

The additional filters improve the resolution and number of samples of the spectral response spot check measurements

A window change (to ZnSe) is also made in this calibration to allow infrared measurements to take place under vacuum



A ZnSe vacuum window (600 nm – 20  $\mu\text{m}$ ) for use with the longwave filters beyond 2.5  $\mu\text{m}$ . Allows for operation of the instrument under vacuum

# Instrument status: G4 'in build'

- GERB 4 is currently under unit level calibration, with measurements on-going on the detector (now the flight spare from the GERB1-2 batch) and the sample mirrors.
  - IEU current circuit modification completed and inspected, undergoing functional tests
  - IOU in storage awaiting completion of detector calibration to allow FPA integration
  - Detector on the FPA being calibrated at LU expected completion in July. Improved calibration procedures include characterisation of within beam variation in intensity with wavelength and redefinition of measurement wavelengths
  - Re-specification of wavelengths for mirror measurements, so as to better characterise the shortwave drop-off region ( $<0.5\mu\text{m}$ ) changes in beam. It is expected at Imperial later this year for system level calibration.

# GERB BARG release: data additions

- Recovered 'sun glint' SW fluxes over land
- A 'fill' field to contain estimates for the most significant missing data:
  - SW flux for ocean glint region
    - Estimate by holding scene constant through glint period when scene ID is not available
  - terminator region (SZA 80-90°) and twilight (SZA 90-105°) SW fluxes
    - Terminator fluxes estimated using an average ADM and measured radiances
    - CERES twilight values adjusted for consistency with GERB flux (GERB/CERES radiance ratio)
  - LW flux for 5 hour outage (20.30-01.30) during sun avoidance period
    - Estimated from GERB-like data with the application of a grid point specific correction based on the previous 30 days (all available hours) of GERB and GERB observations