Imperial College London

GERB Observations from 41.5ºE: Opportunities and Challenges

James Rufus,[1] Jacqueline Russell,[1] Helen Brindley[1] and Martin Bates[2]

[1]Space and Atmospheric Physics, South Kensington Campus, Imperial College London, SW7 2AZ UK

[2]RAL Space, STFC Rutherford Appleton Laboratory, Harwell Campus, Didcot OX11 0QX, UK

MSG-1 move to 41.5ºE

In early July EUMETSAT began the almost 11 week relocation of MSG-1 from 3.5ºE to 41.5ºE. SEVIRI on MSG-1 was imaging throughout the transition. The drift was completed on September 21st with two manoeuvres 12 hours apart. Two months of parallel observations with Meteosat-7 are planned as part of the validation before MSG-1 begins Indian Ocean Data Coverage (IODC) operational service early in 2017.

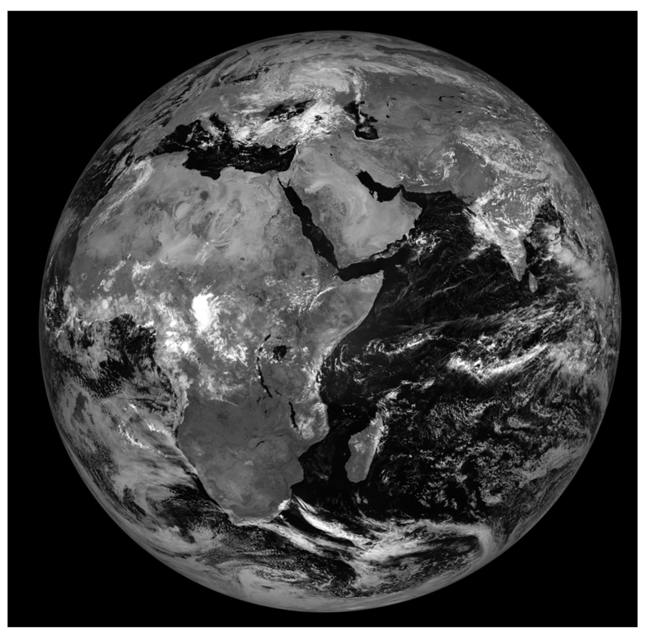


FIGURE 1 – SEVIRI at 41.5ºE

Drift Data from GERB-2 and the Influence of the SSU/ESU

GERB-2 made observations at the start of the move and from 09:00UTC to 12:00UTC the next day beginning on the 27th of July and the 4th of August. During the latter two periods of imaging the satellite was at approximately 13.8ºE and 17.5ºE respectively. Column locations in these images are subject to much greater random noise than other GERB instruments due to seasonal switching between the SSU (Sun Sensor Unit) and ESU (Earth Sensor Unit.) Each unit produces SOL (Start of Line) pulses which anchor GERB column acquisition. The ESU generated SOL is subject to two orders of magnitude greater random noise which leads to a 3 sigma position error range of 8 GERB columns. Further data from GERB-2 was prevented by the Autumn Sun avoidance season which began in mid August. GERB-2 will recommence data gathering at the end of the season on the 26th of October.

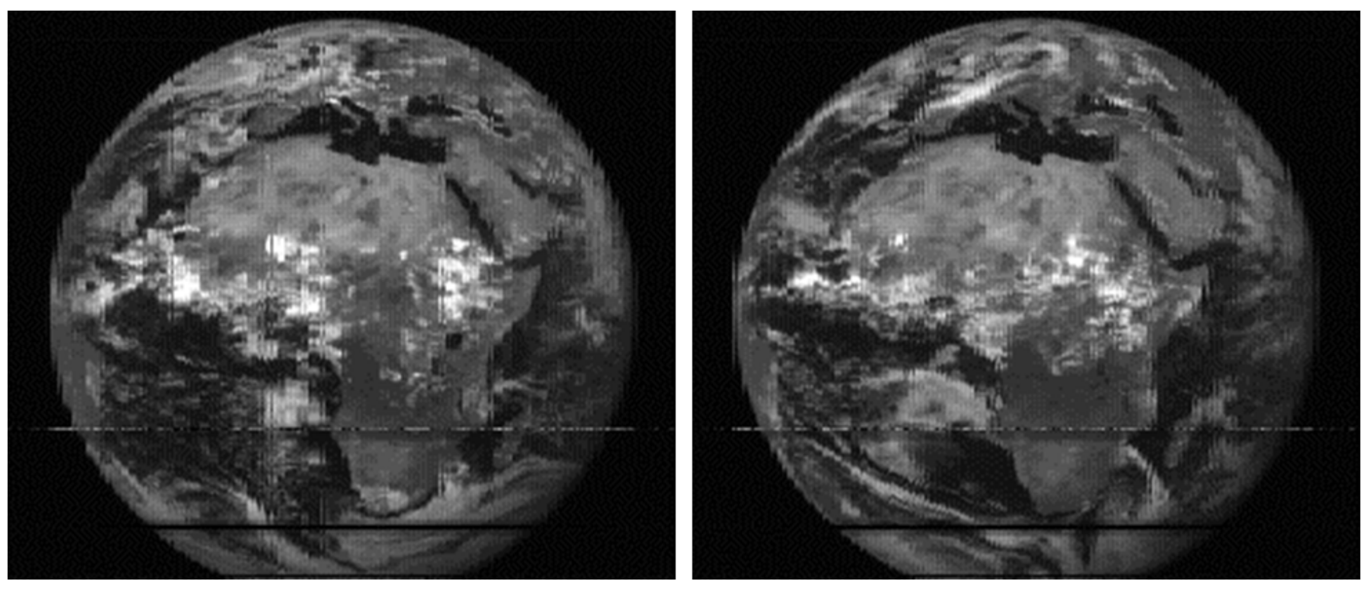


FIGURE 4 – GERB-2 Local Noon Drift Images on the ESU

Correcting Imaging on the ESU using GERB telemetry

A combination of standard 282 column and 846 column images with one third angular separation of columns were taken over 4 days in June 2015 on the ESU. Multiple schemes to correct these images with only the level 0 GERB telemetry, an ‘in situ’ correction, proved insufficient.

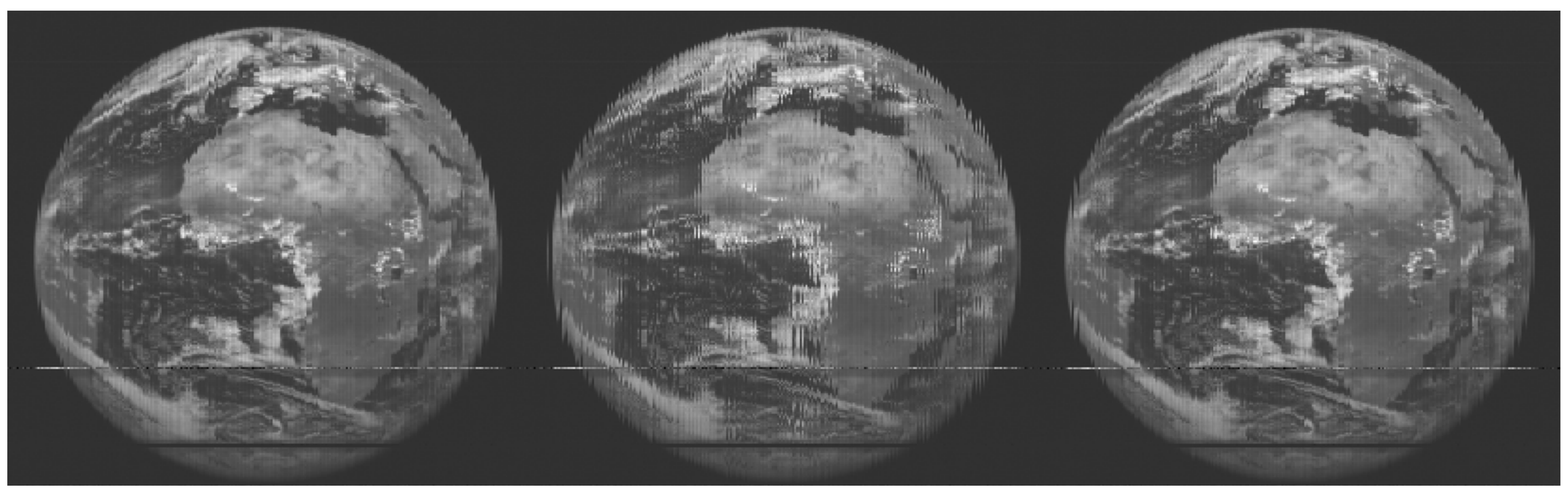


FIGURE 5 – In Situ Correction Attempts to GERB images on the ESU

Correcting Imaging on the ESU using TSOL Jitter and GERB telemetry

TSOL jitter values are supplied by EUMETSAT to the GGSPS and derived from the difference between satellite SOL measurements and the CSOL (corrected SOL derived from a spin model.) Using a combination of this data and GERB telemetry to reorder the 282 columns of images has qualitatively improved all 40 images tested in a two hour period around local noon on the 15th of June 2015.

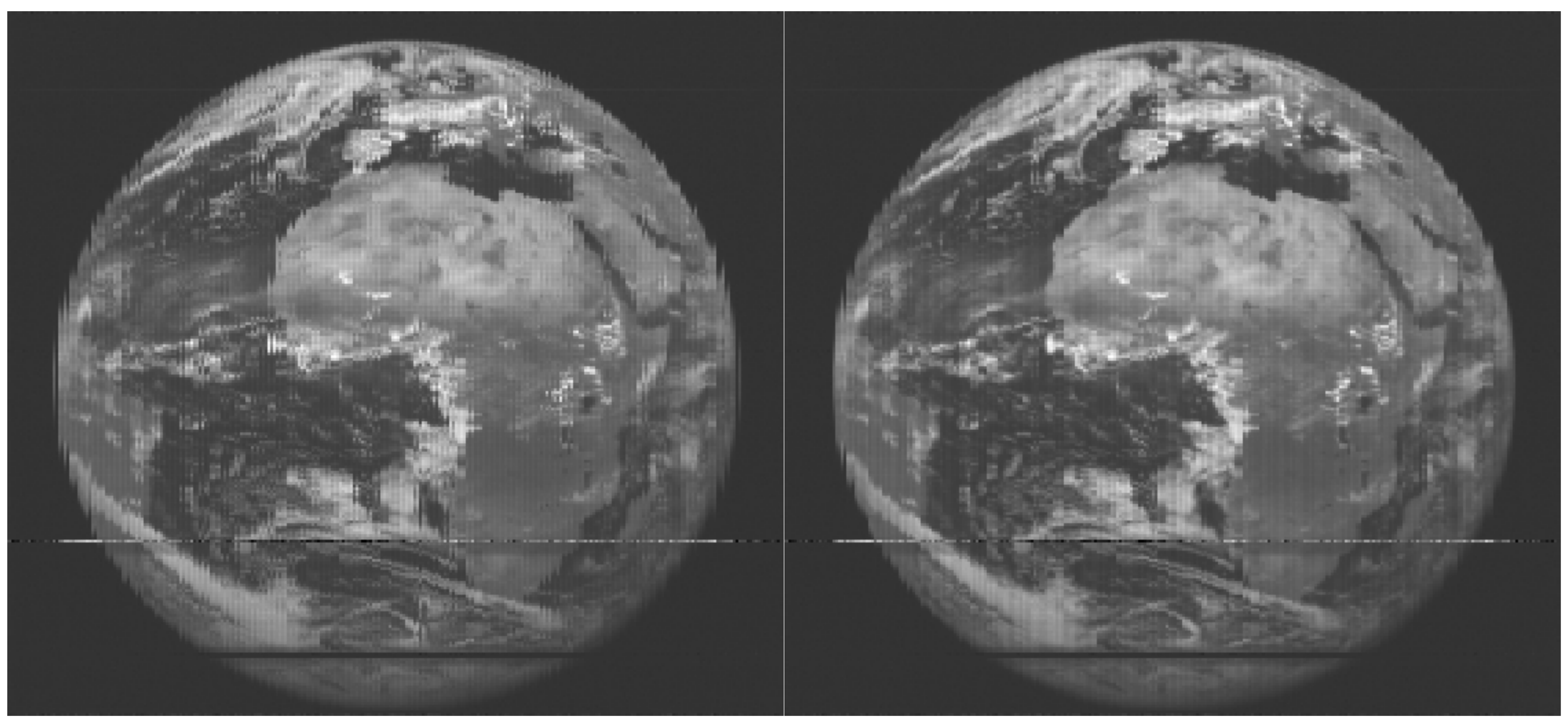


FIGURE 6 – GERB images on the ESU pre and post TSOL jitter reordering

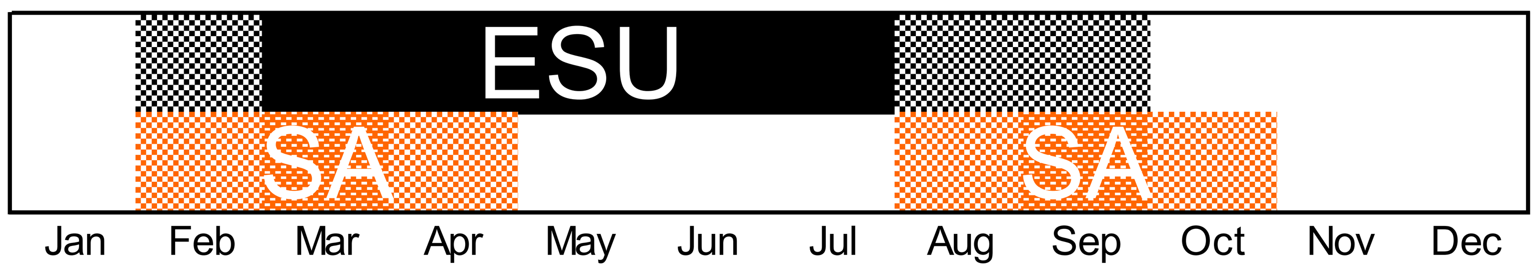


FIGURE 2 – Seasonal Extent of ESU Use and Sun Avoidance

Overlap Observations

Figure 3 shows the great circle at 65º for the locations of MSG-3 and MSG-1. In the second view the great circle from the prime meridian defining the overlap region between the two satellites is shown in yellow. There is significant scope for inter-comparison studies across Africa, the Middle East and the South Eastern Atlantic and testing of angular dependencies.

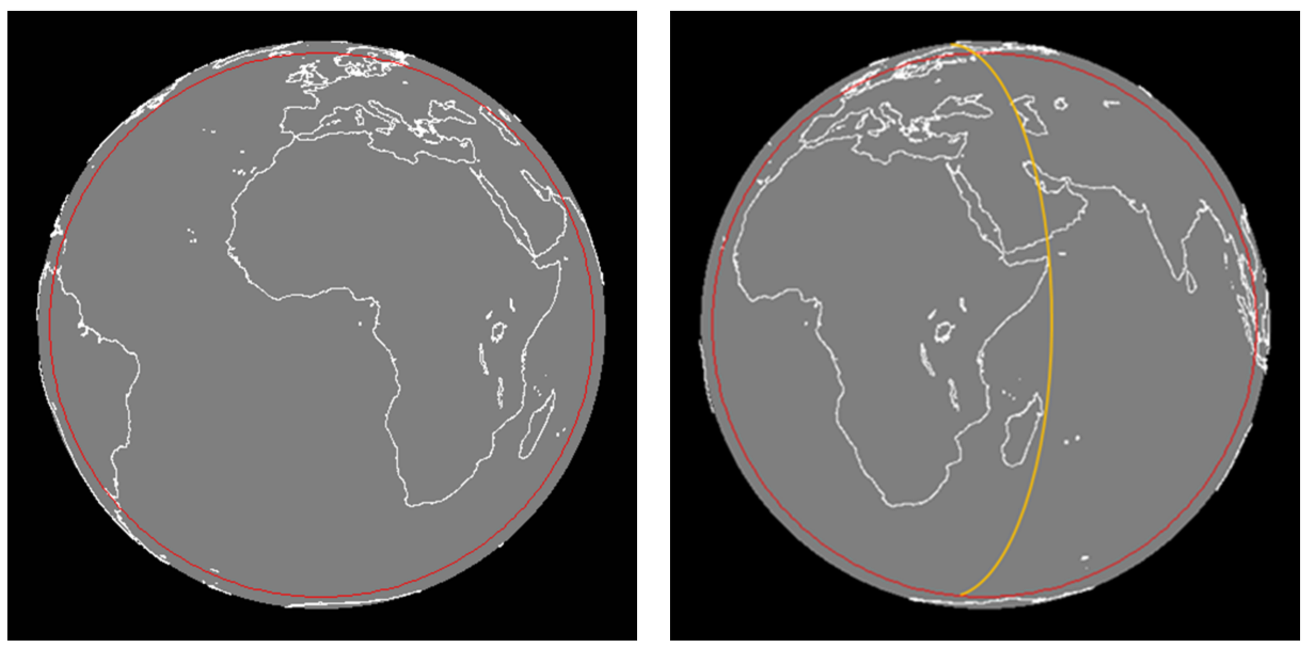
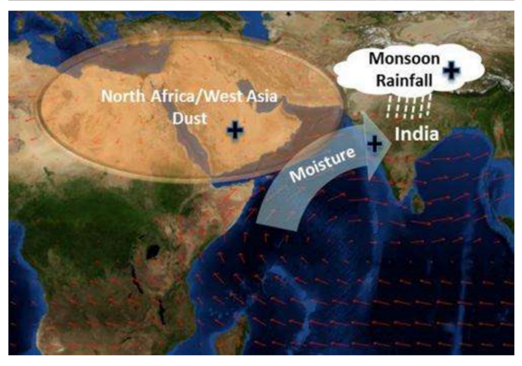


FIGURE 3 – View from Prime Meridian and 41.5ºE

Science Opportunities

- Evaluation of diurnal variability in cloud types, the associated radiative impact, and their influence on longer time scale variability
- High frequency coupling between the energy and water cycles: convection, humidity, radiation and precipitation
- Detection, tracking and quantification of dust events and their radiative effect
- Exploitation of viewing geometries for NB-BB, ADM etc. evaluation



Despin Mirror Face Darkening

Since being replaced as the prime instrument by GERB-1 in May 2007 GERB-2 has spent long periods in SAFE mode with the despin mirror parked at the home position. In this state the ‘back’ face of the double sided plane mirror is exposed to solar radiation at an angle of incidence of 33º. Figure 7 shows data from CALMON scans from October or November each year averaged by pixel and separated by mirror face. The black points represent the protected mirror face and those in colour the exposed one while the final panel shows the ratio of these responses. Given the measurements making up these ratios are taken almost contemporaneously and using the smoothly varying CALMON the dominant source of divergence is the performance of each mirror side. In future operations this change in mirror performance will have to be accounted for.

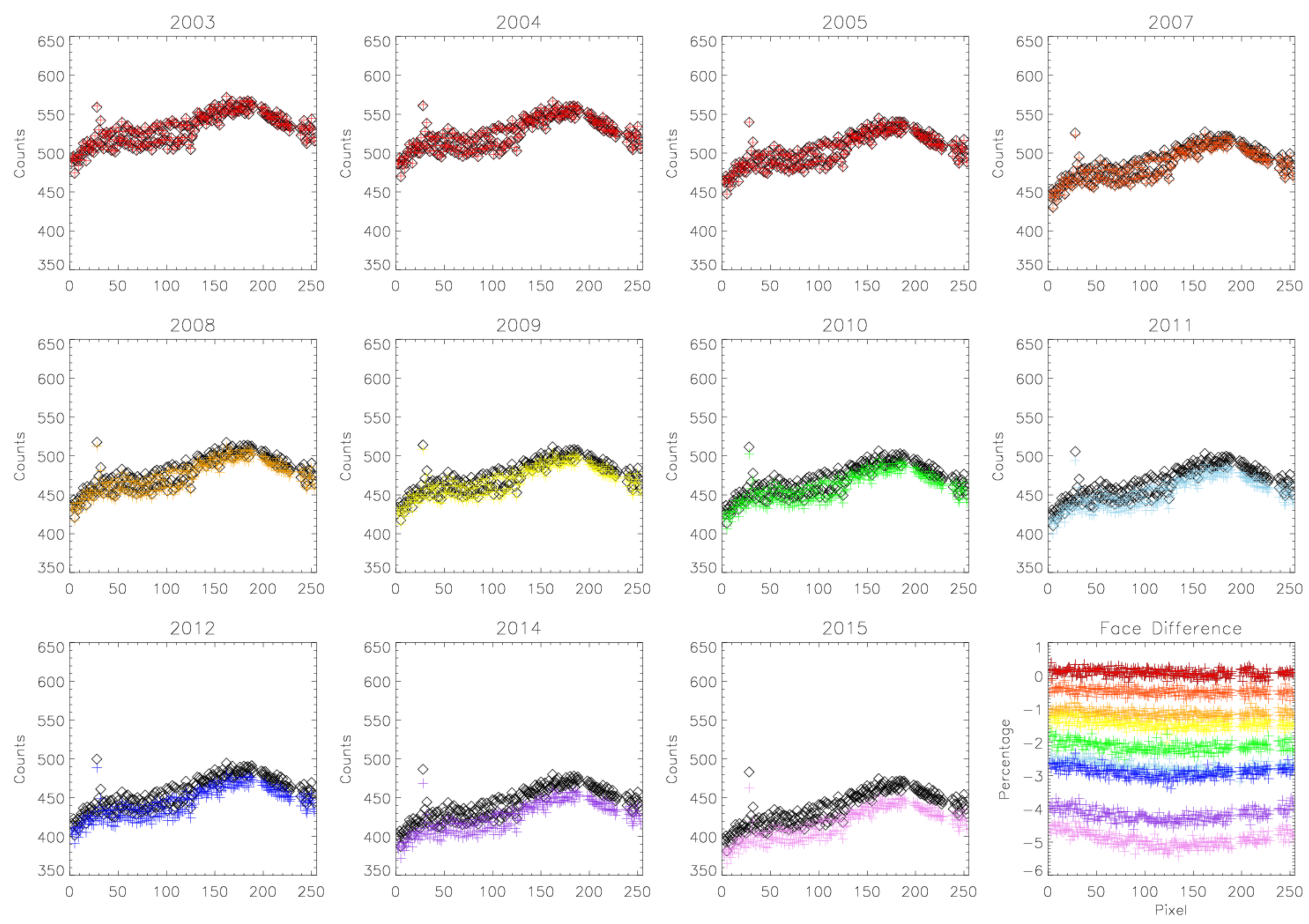


FIGURE 7 – GERB-2 Despin Mirror Face Darkening

ACKNOWLEDGEMENTS

This work was funded by EUMETSAT as part of the GERB programme