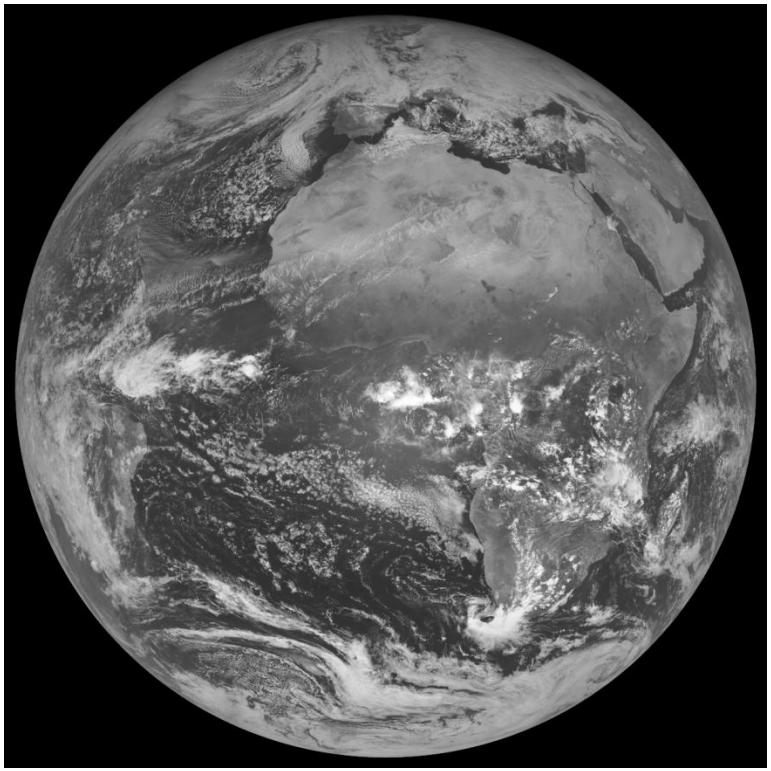
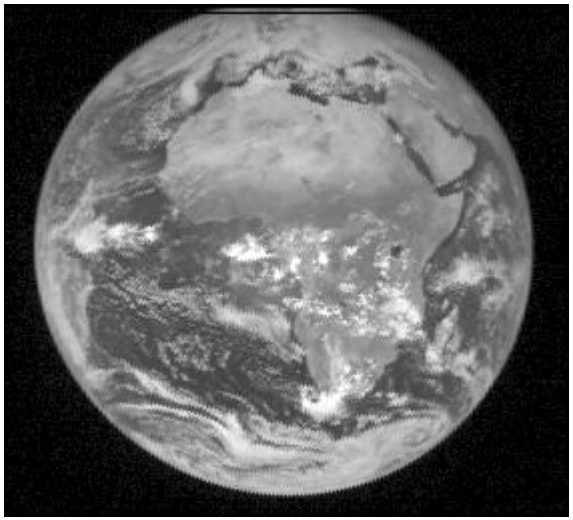
On the processing of G1 with SEV3

GERB technical session – ERB 2014 - Toulouse



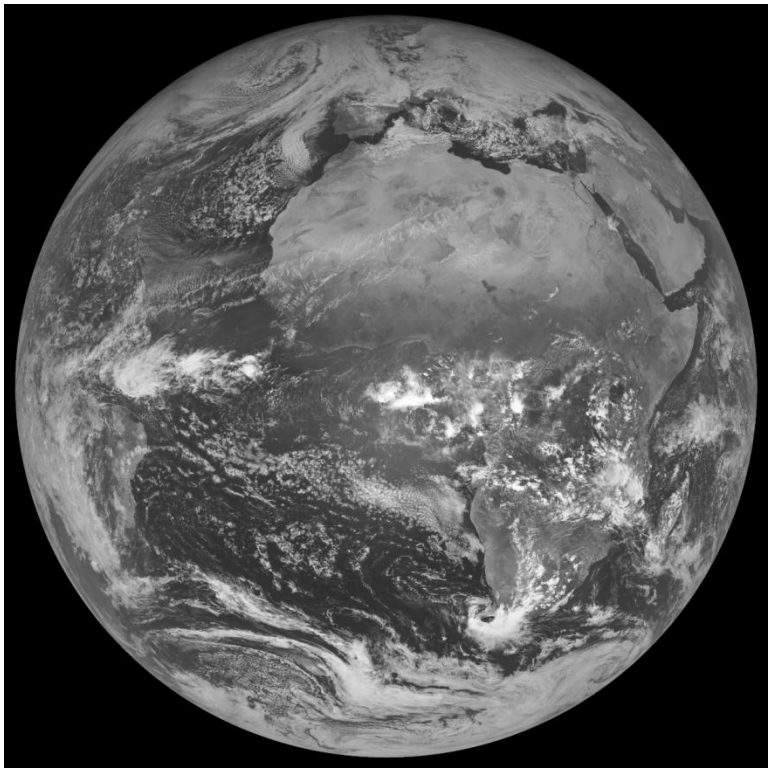
Full disk imagery from SEVIRI instrument on MSG-3 (Meteosat-10) located at 0° West



GERB-1 instrument on MSG-2 (Meteosat-9) located at 9.5°East

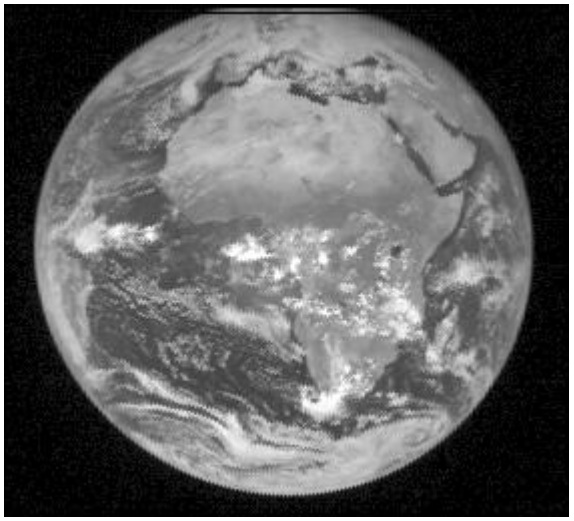
SEVIRI performs Rapid Scan Service over limited Northern sector -> cannot be used for GERB processing.

Why? G1_SEV3 could fill the gap in the GERB data record due to the failure of GERB-3



SEVIRI level 1.5 full disk imagery in 10 channels used for :

- Fine tuning of GERB geolocation
- GERB LW radiance filtering for LOS non-repeatability
- GERB unfiltering factors and contaminations ($L_{lw,sol}$ and $L_{sw,th}$)
- Scene identification (used for SW ADM sel.)
- Thermal ADM (through SEVIRI NB)
- GERB resolution enhancement
- GERB PSF correction
- Quality checks
- …



GERB-1 instrument level 1.5 used for :

- Calibrated filtered BB radiances (SW and TOT)

Initial results

- Use of RGP to process G1 (at 9.5°E) with SEV3 (at 0°W) : G1_SEV3
- Period: 8 to 13 Feb. 2013 (6 days)
- Compare with « reference » G1 data processed with SEV2 (both at 9.5°E) : G1_SEV2
- Initially the RGP supported only 1 satellite longitude. Both have been tried.
- For the GERB fluxes better results with 9.5°E

$$F_{gerb} = F_{gerblike} \left(L_{gerb}/L_{gerblike} \right)$$

$$= \left(F_{gerblike} /L_{gerblike}\right) L_{gerb}$$

$$= (\pi/R(SZA,VZA,RAA)) L_{gerb}$$

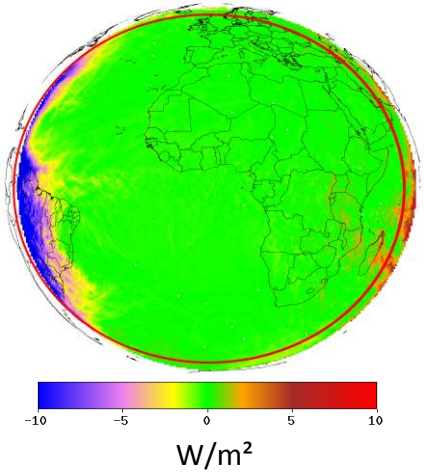
-> use GERB geometry

- Results presented at the GSAG in May 2014

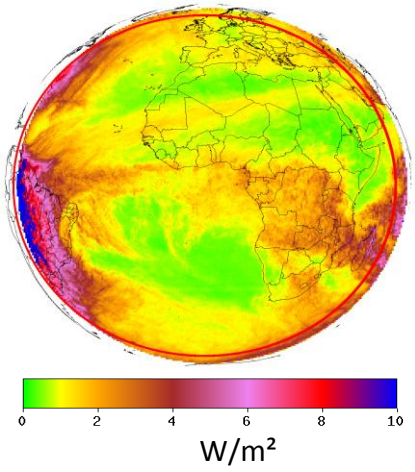
-> decide to put priority on thermal products to try to release something rapidly (contractual obligation with EUMETSAT)

-> decide to improve the thermal ADM

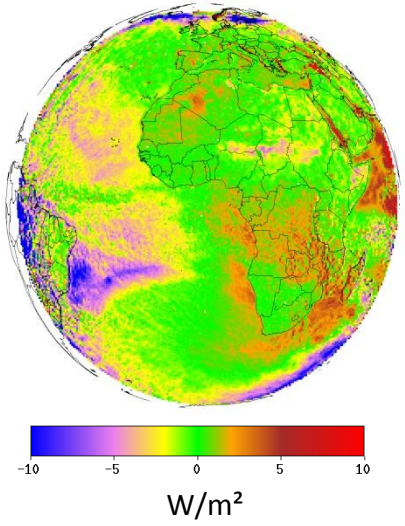
Thermal flux Bias
(G1_SEV3 - G1_SEV2)



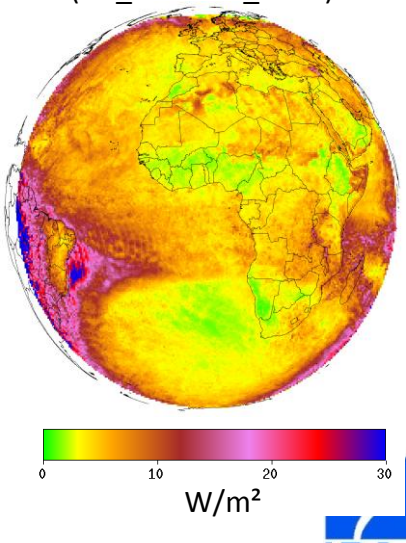
Thermal flux RMS
(G1_SEV3-G1_SEV2)



Solar flux Bias
(G1_SEV3 - G1_SEV2)

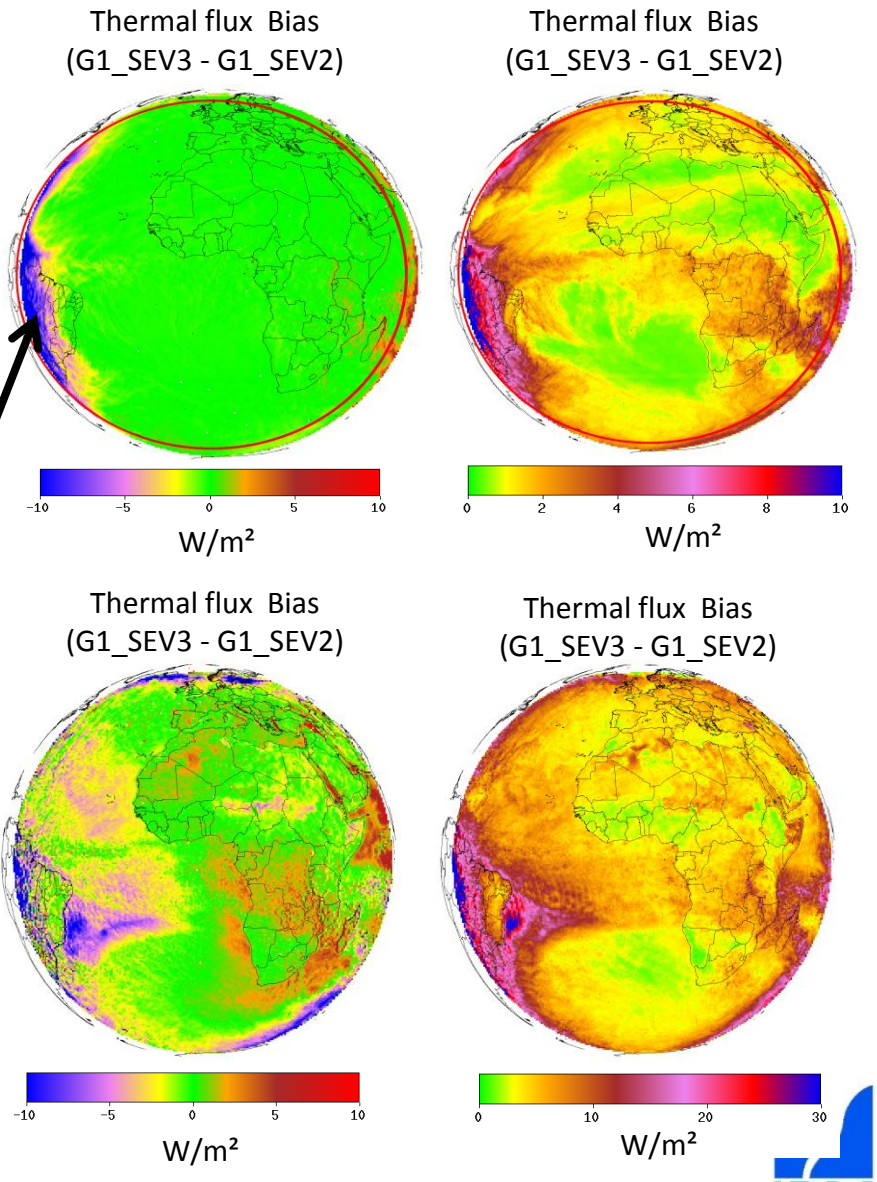


Solar flux RMS
(G1_SEV3-G1_SEV2)



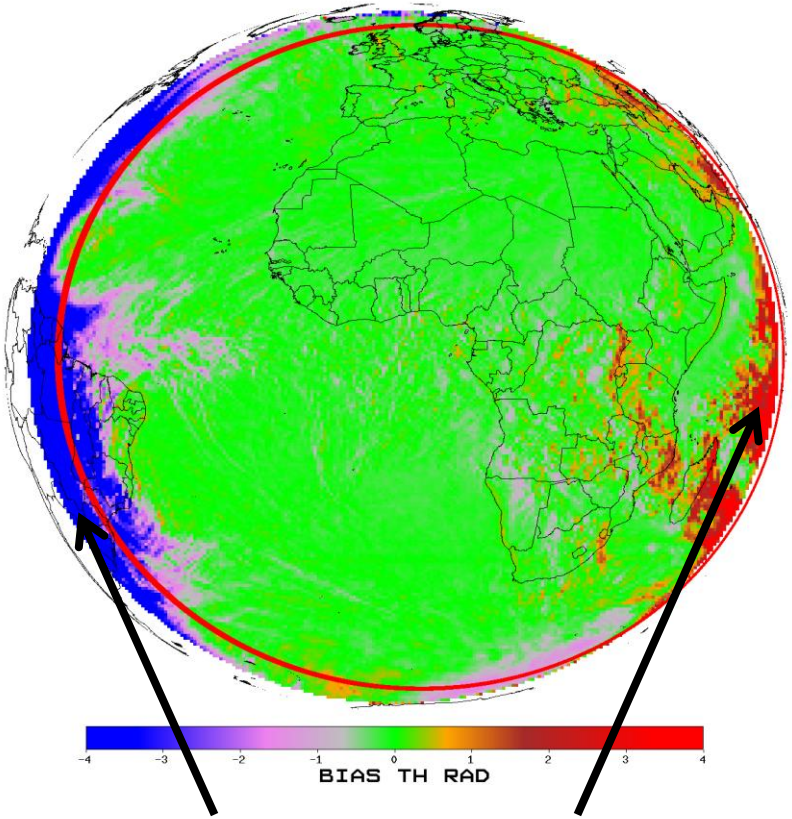
RGP modification to handle 2 geometries

- RGP changes needed to read the 2 positions, calculate VZA and RAA for both, and use the appropriate geometry in the processing:
  - •NB-2-BB and unfiltering : SEVIRI angles
  - •LW ADM : R = R(VZA_{sev}, VZA_{gerb}, {LNB})
  - •Scene id. : SEVIRI angles
  - •SW ADM : R = R(SZA, VZA_{gerb}, RAA_{gerb})
  - •Sun glint : 2 regions !
- It was still not satisfactory (see illustrations)
- The Thermal flux biases on the limb are still there

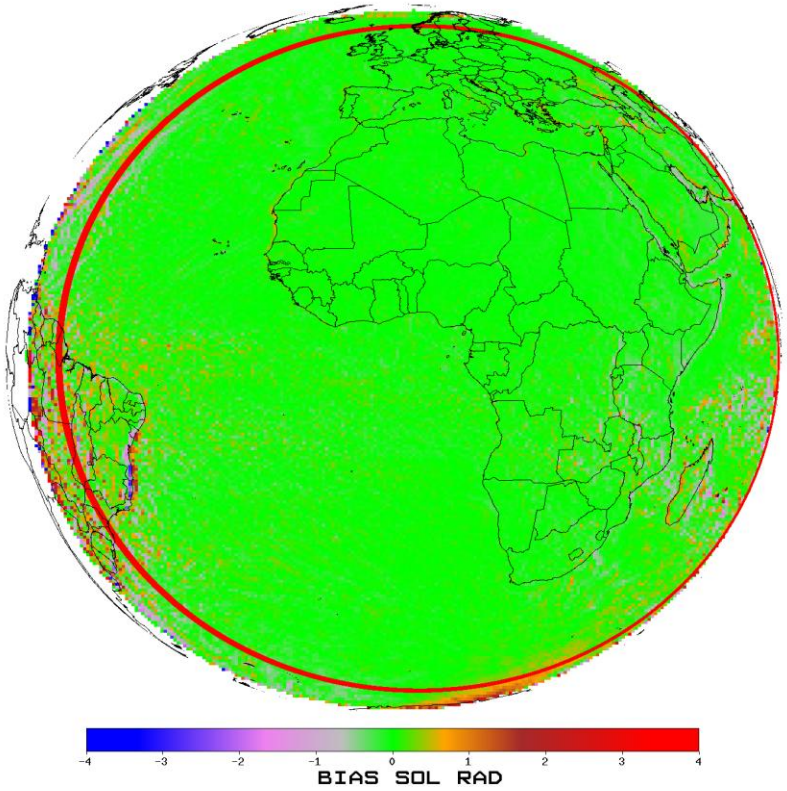


Looking at the thermal and solar radiances

Thermal radiance bias
(G1_SEV3 - G1_SEV2)



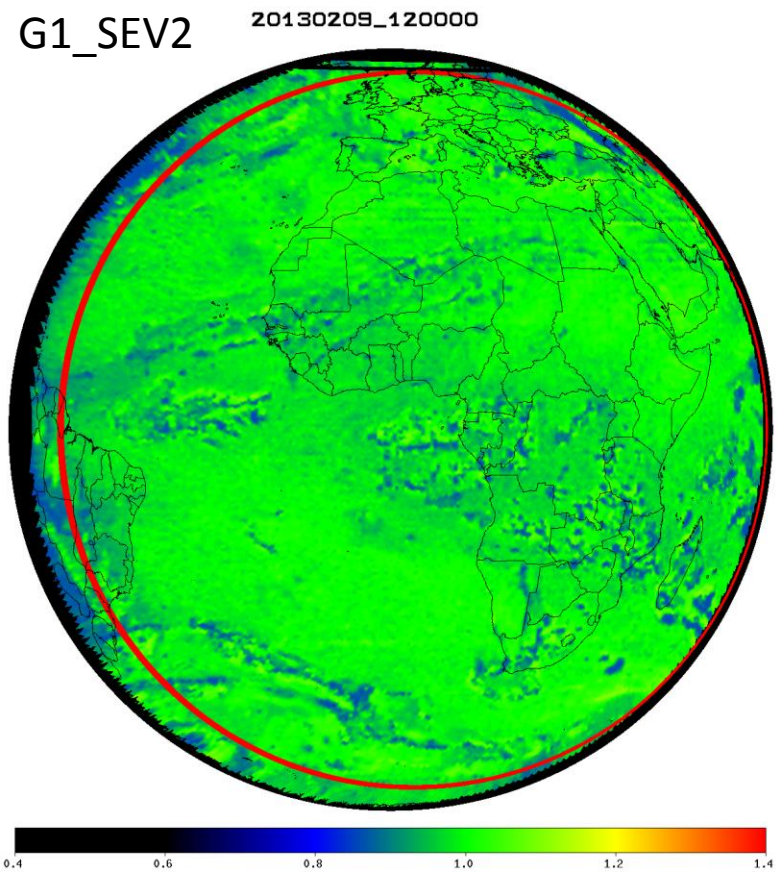
Solar radiance bias
(G1_SEV3 - G1_SEV2)

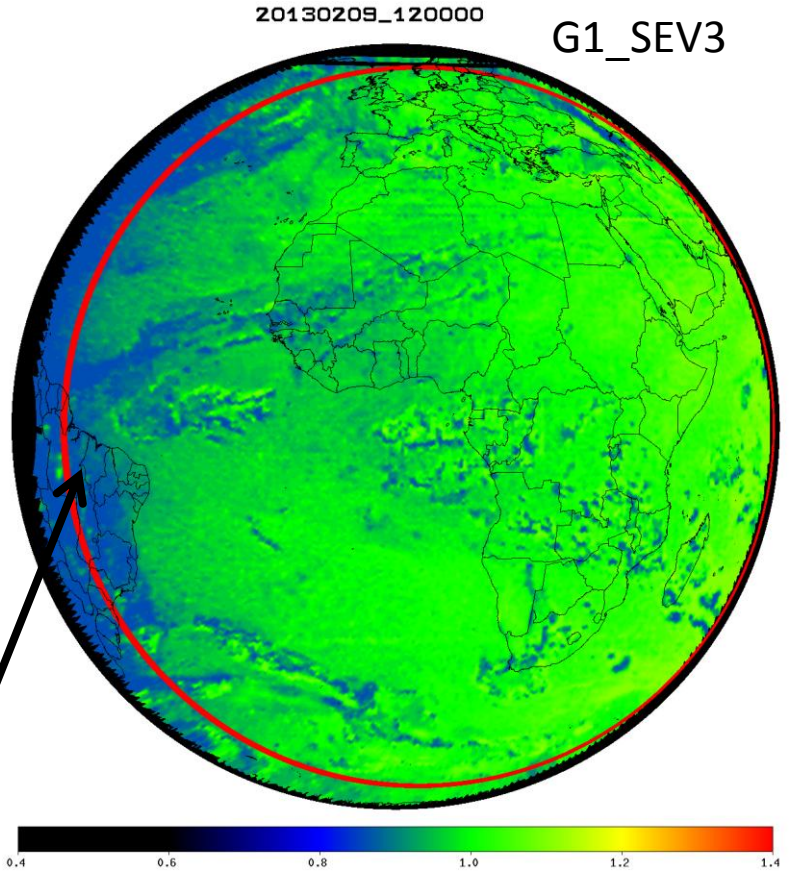


G1_SEV3 thermal radiances show bias of up to 4 W/m²/sr on the limbs !
(i.e. not an ADM effect)

G1_SEV3 solar radiances do not show bias

GERB field : « /Radiometry/Longwave Correction »





Saturation due to clamping (bracketing) between 0.94 and 1.06 wrt mean value

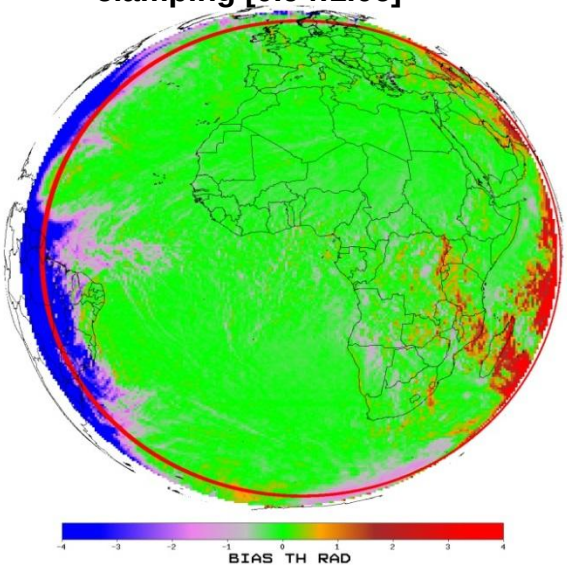
if val < mean – 0.06 -> val = mean – 0.06

if val > mean + 0.06 -> val = mean + 0.06

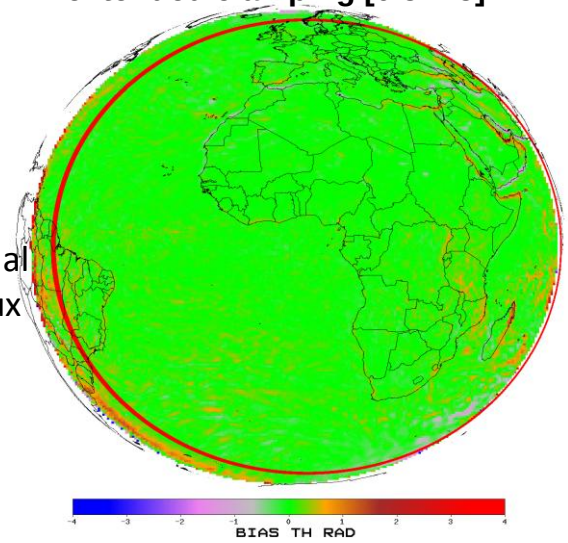
This « clamping » (as well as a median smoothing) was implemented in the RGP to limit the effect of the LOS non-repeatability.

Desactivate clamping and smoothing

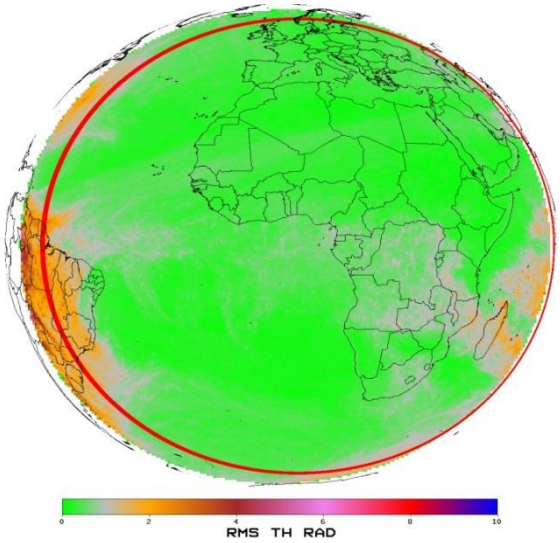
with smoothing and with clamping [0.94:1.06]



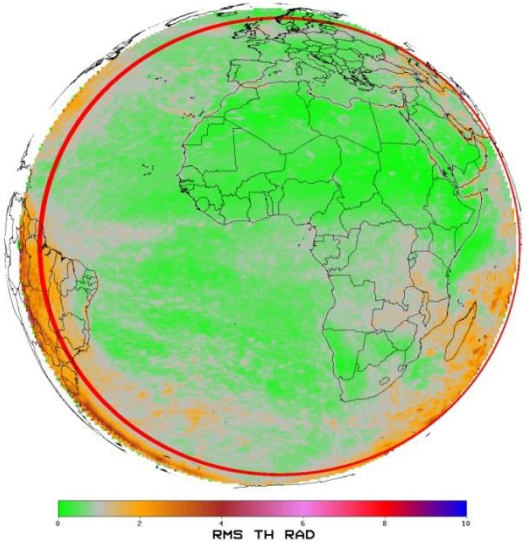
without smoothing and with extended clamping [0.5:1.5]



Solve the thermal radiance and flux bias problem ☺

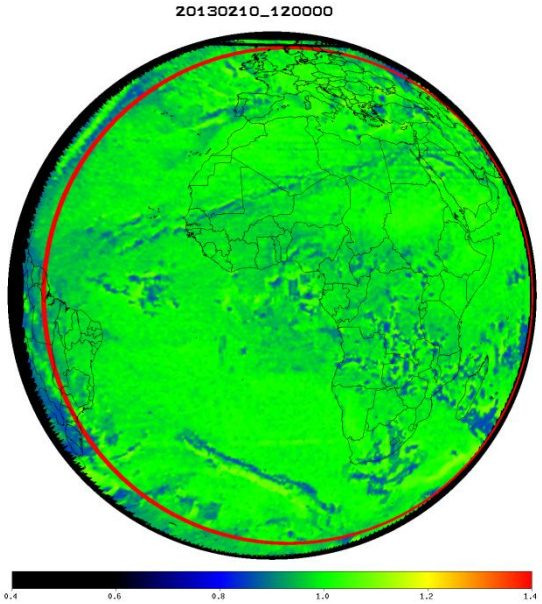


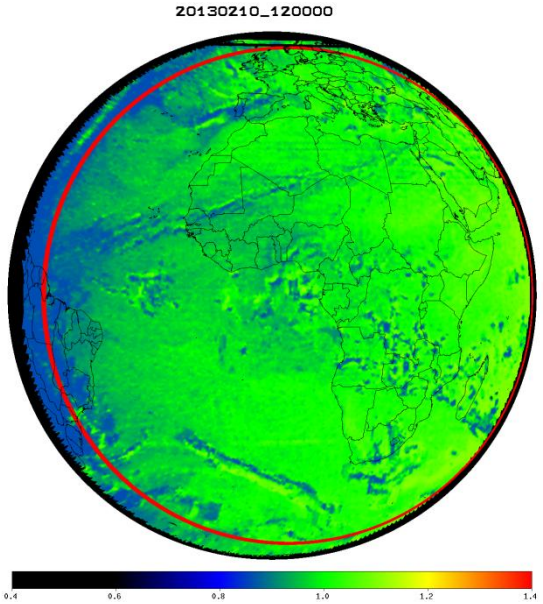
But introduce more noise in the thermal products ☹



GERB field : « /Radiometry/Longwave Correction »

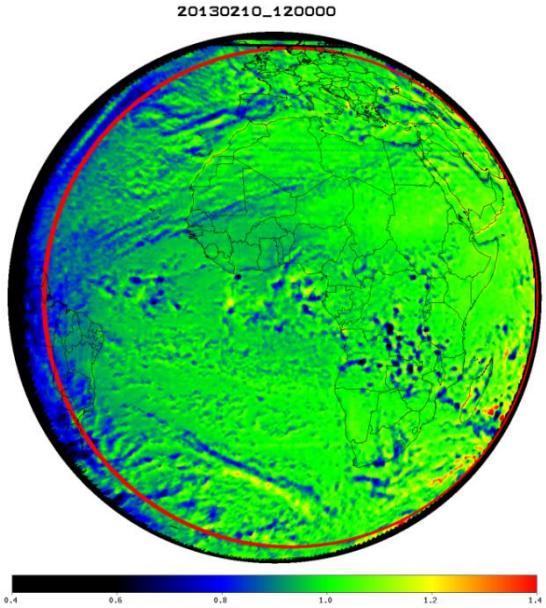
G1_SEV2 with clamping and smoothing

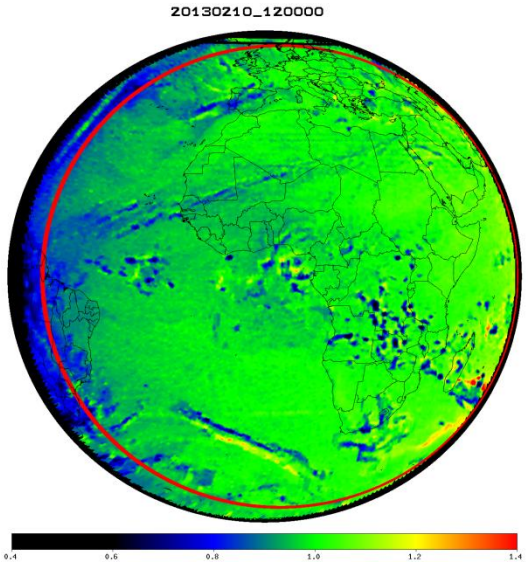




G1_SEV3 with clamping and smoothing

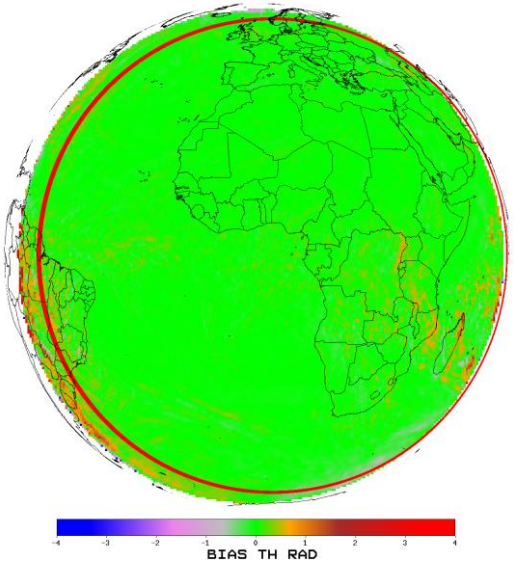
G1_SEV3 without clamping and without smoothing

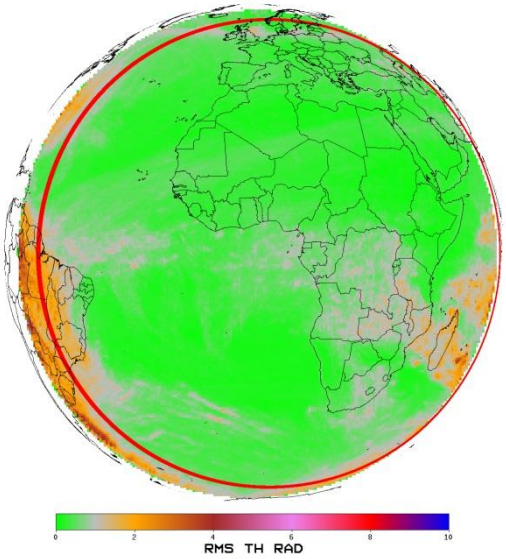


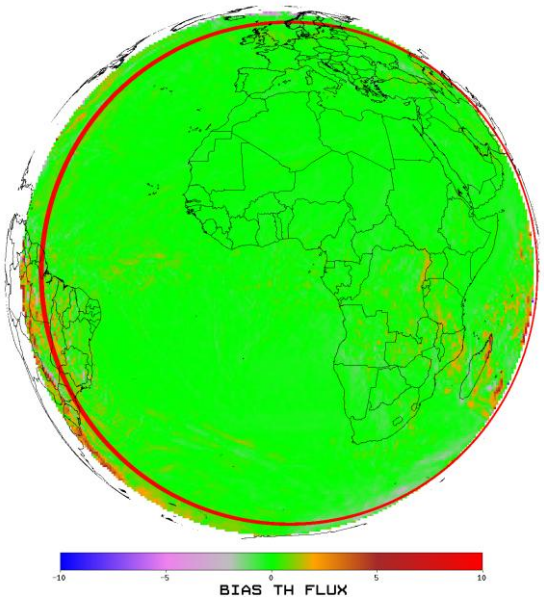


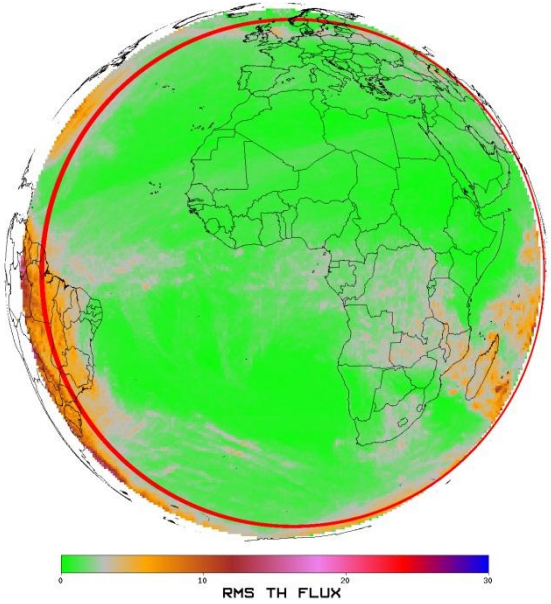
G1_SEV3 with without clamping and smoothing reactivated

Latest results - thermal

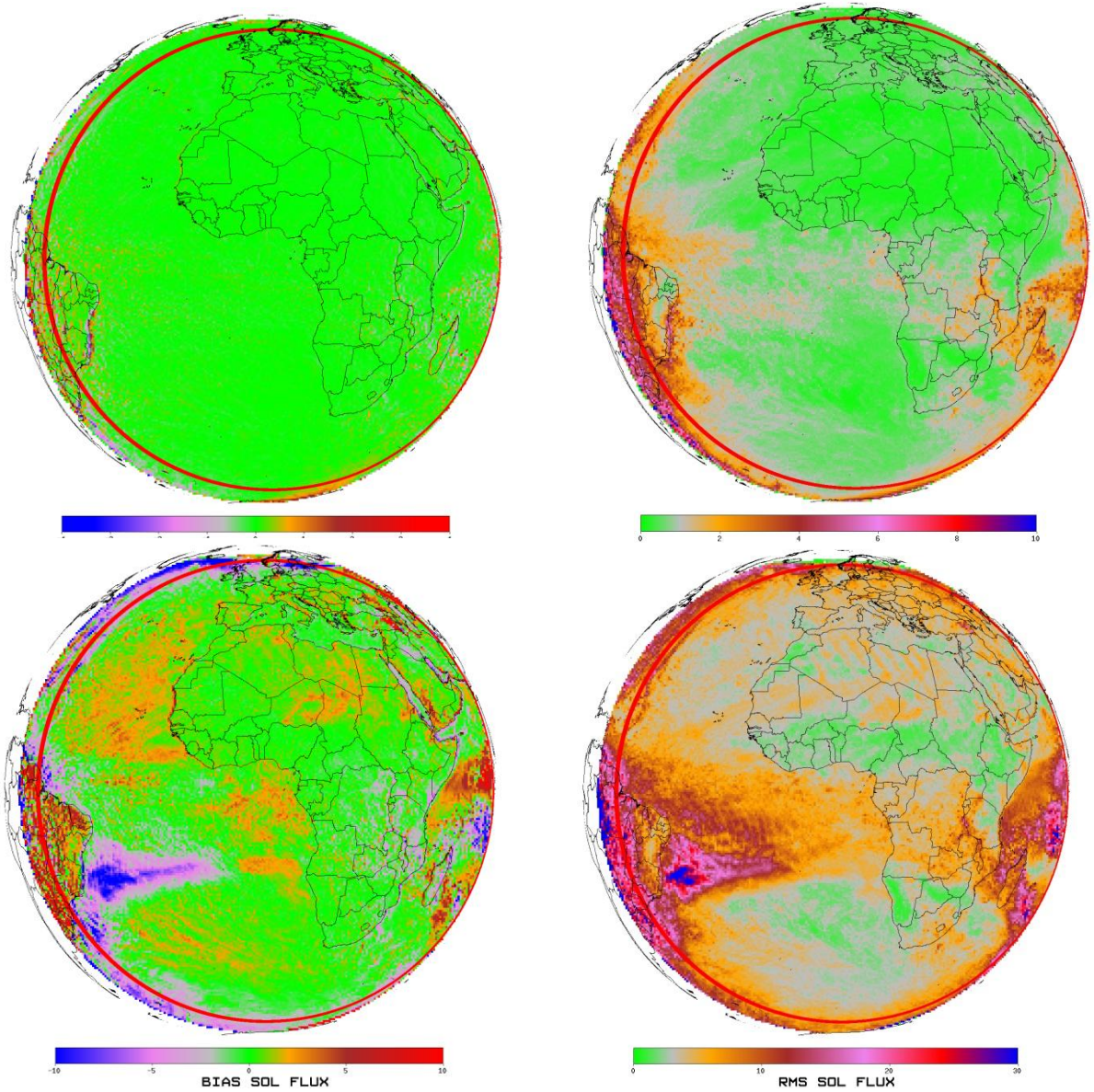




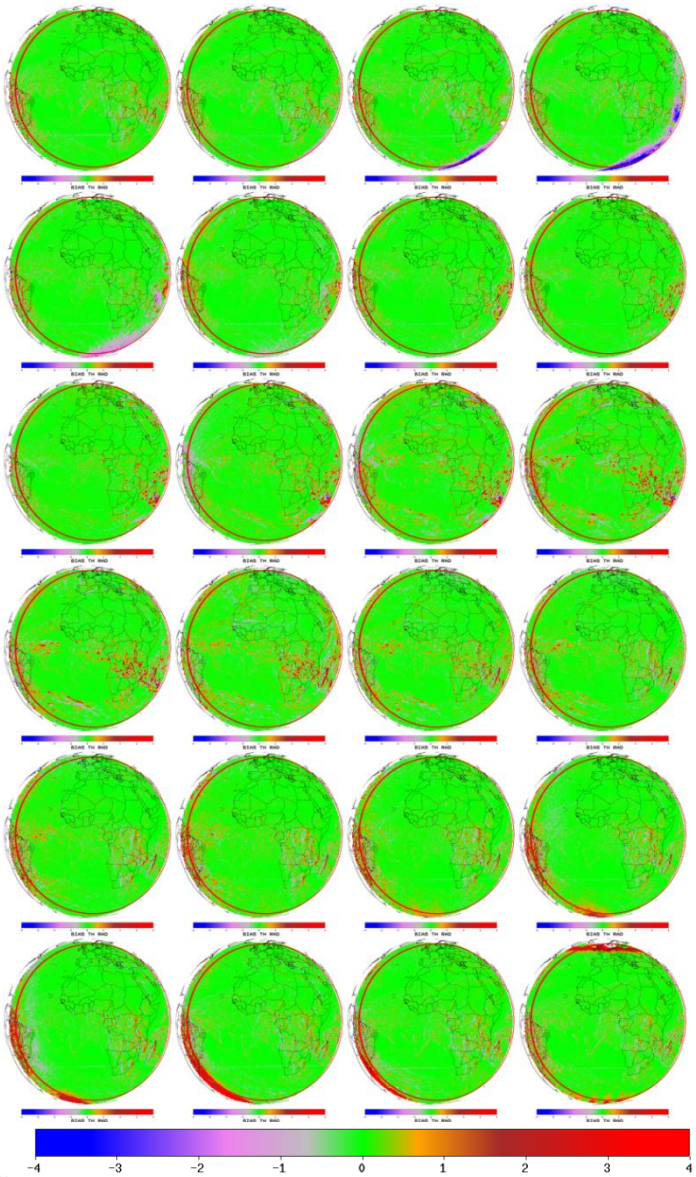


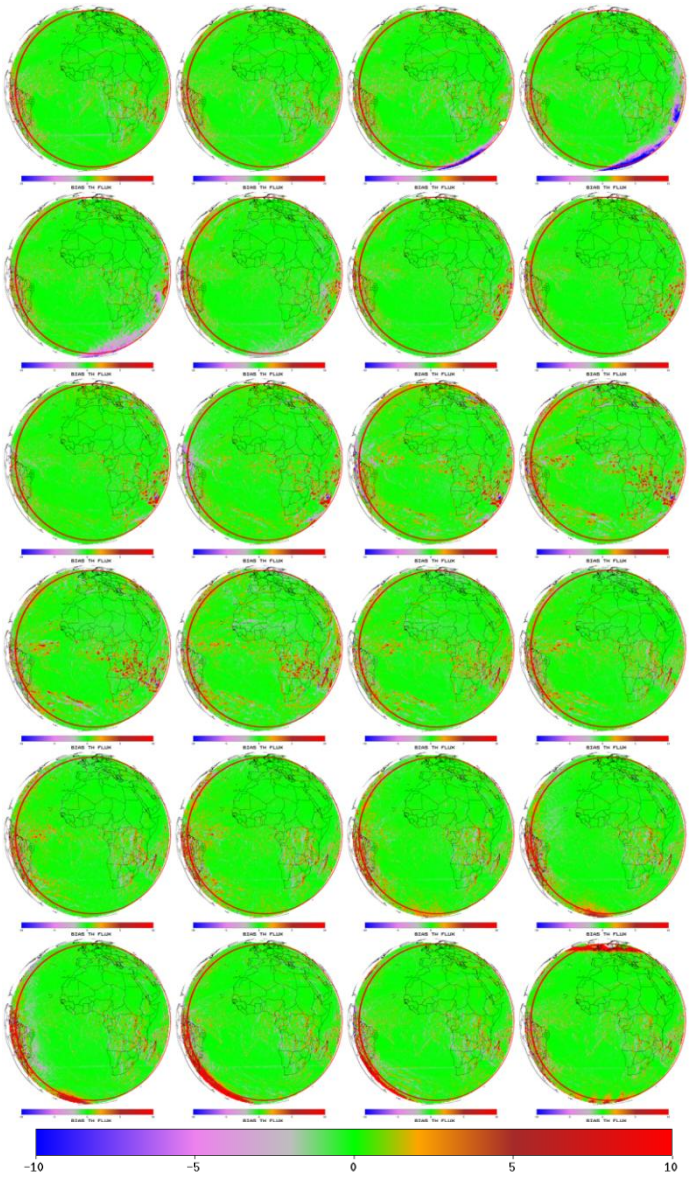


Latest results - solar



Diurnal cycle thermal radiance (left) and flux (right)

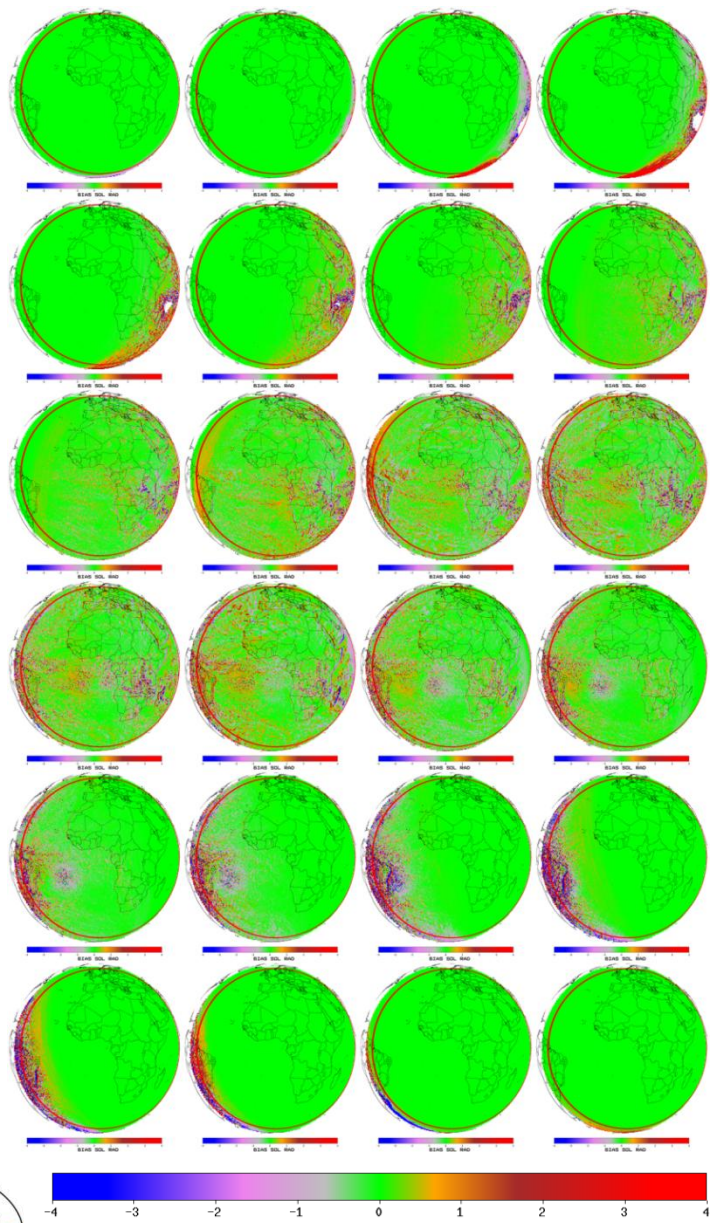


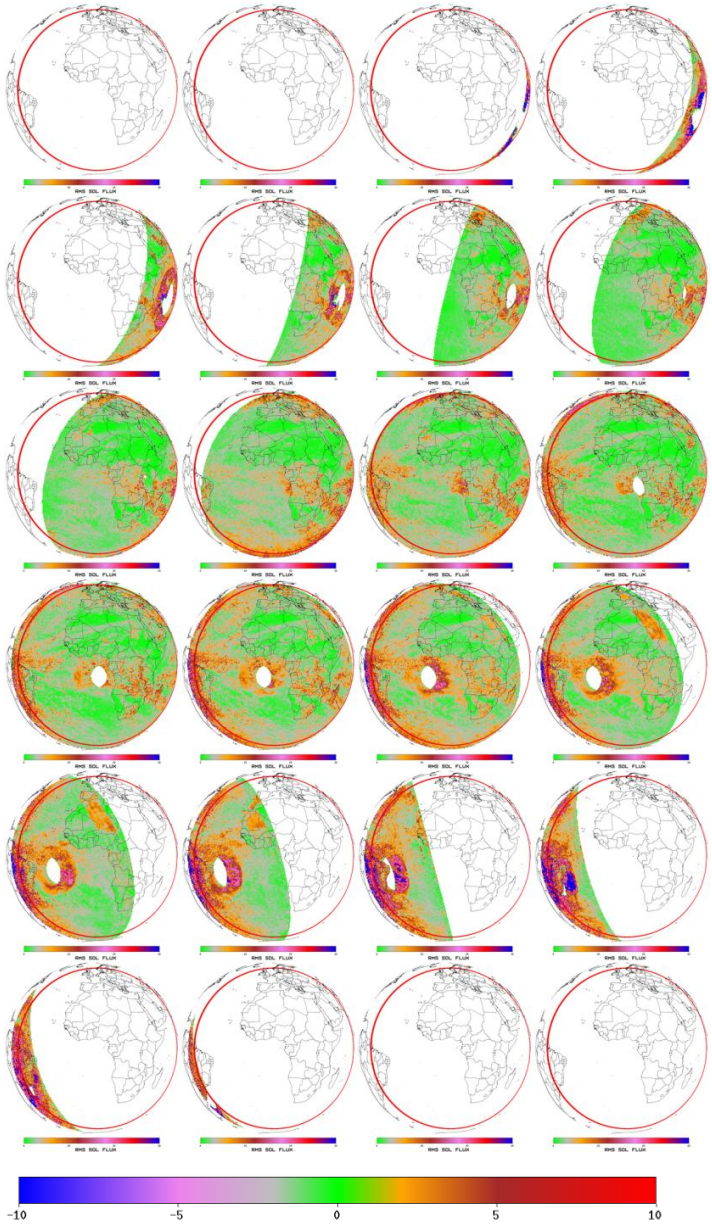


NB :artefacts probably due to straylight (data are from 8-13 Feb…)

NB2 : the G1_SEV2 product seem to have saturation for DCC

Diurnal cycle solar radiance (left) and flux (right)





NB: radiance problem close to sun glint may be due to “clear ocean unfiltering step”

Proposed next steps

- Try to correct the SEVIRI NB-2-BB estimates of BB radiances and fluxes to account for the angle differences :

$$L'_{lw}(9.5°E) = L'_{lw}(0°E) * R(9.5°E) / R(0°E)$$
$$L'_{th}(9.5°E) = L'_{th}(0°E) * R(9.5°E) / R(0°E)$$
$$F'_{th} = L'_{th}(0°E) * PI / R(0°E) \quad (= L'_{th}(9.5°E) * PI / R(9.5°E))$$

$$L'_{sw}(9.5°E) = L'_{sw}(0°E) * R(9.5°E) / R(0°E)$$
$$L'_{sol}(9.5°E) = L'_{sol}(0°E) * R(9.5°E) / R(0°E)$$
$$F'_{sol} = L'_{sol}(0°E) * PI / R(0°E) \quad (= L'_{sol}(9.5°E) * PI / R(9.5°E))$$

-> could reduce (remove) the systematic problem in the LW correction

- Use LW clamping as close as possible to the nominal value (i.e. +/- 6%) but without saturation on the limbs (at least for both VZA < 70°).

Summary

- Encouraging LW results but
  - Decide a way forward for the LOS non-repeatability and reassess results
  - Biases at the edge for some time slot to be better underdstood
  - Valid FOV : both GERB and SEVIRI < 70°
- SW results
  - Relatively unbiased solar radiance (but some effect close to sun glint)
  - Significant solar fluxes difference close to sun glint and a high solar zenith angle that need further investigations
  - Valid FOV :
    - VZA : both GERB and SEVIRI < 70° and
    - Sun glint angle : SGA SEVIRI > 15 for scene id and SGA GERB > than 25° for using the clear ocean radiance