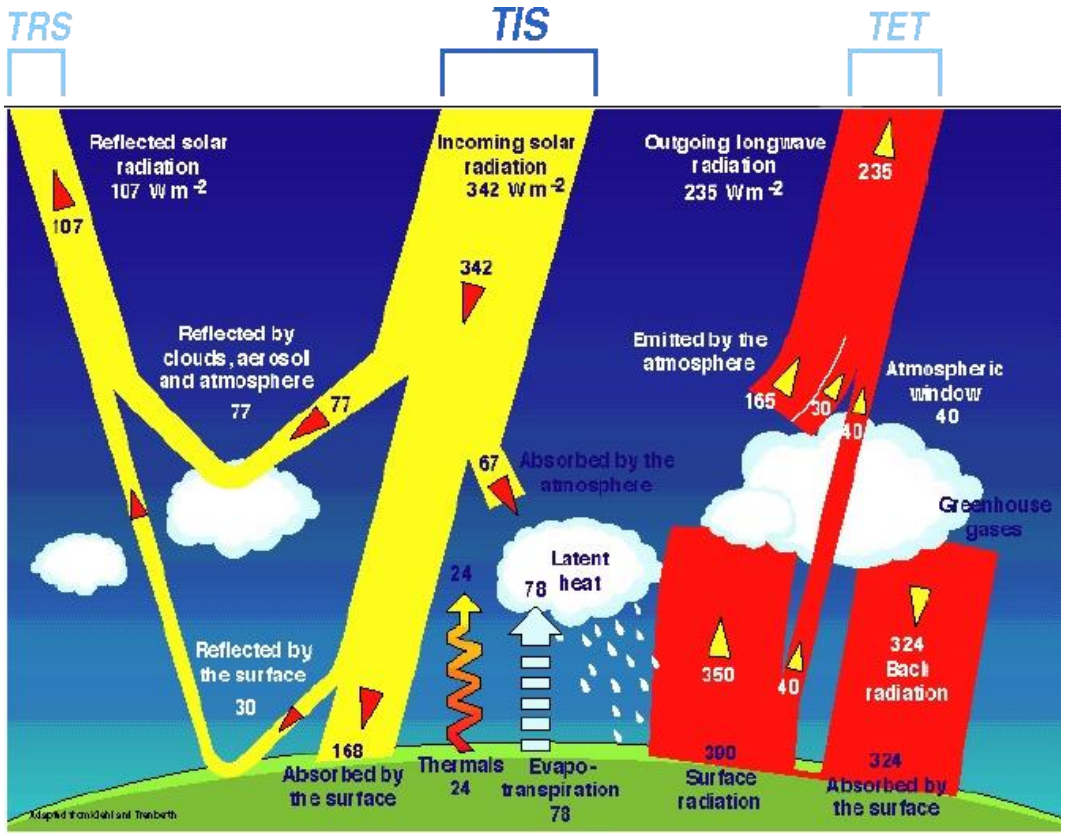
TOA Radiation GERB dataset – 2nd edition

Development Status



TRS : Top-Of-Atmosphere (TOA) Reflected Solar

TET : TOA Emitted Thermal (aka OLR)

TIS : TOA Incoming Solar (derived from the Total Solar Irradiance - TSI)

TOA Radiation Portfolio in CM SAF

type	products	Temp. cover	Grid / area	Inst.	status
EDR	TRS (CM-112) TET (CM-114) TIS (CM-116, discont.)	Feb. 2004 onward (NRT)	sinus. eq. area (45km)²	GERB, SEVIRI, CERES	operation nal
GERB dataset ed01	TRS (CM-13) TET (CM-115)	Feb. 2004 – Jan. 2011	sinus. eq. area (45km)²	GERB, SEVIRI, CERES	Released in 2013
GERB dataset ed02	CM-21301 :TRS all sky CM-21321 : TRS clear sky CM-21331 : TET all sky CM-21351 : TET clear sky	Feb. 2004 – Jan. 2014	Geo grid 3x3 SEVIRI pixels (9km subsat)	GERB, SEVIRI	RR 2.5 (summer 2014) PCR : Q2 2015 DRR: Q4 2015
MVIRI/SEVIRI/ GERB dataset ed01	CM-23301 :TRS all sky CM-23331 :TET all sky	Feb. 1982 – Jan. 2014	Regular lat-lon 0.05° resolution	MVIRI, SEVIRI	RR 2.6 PCR : Q2 2015 DRR: Q4 2015

For all products : Monthly mean, daily mean, monthly mean diurnal cycle

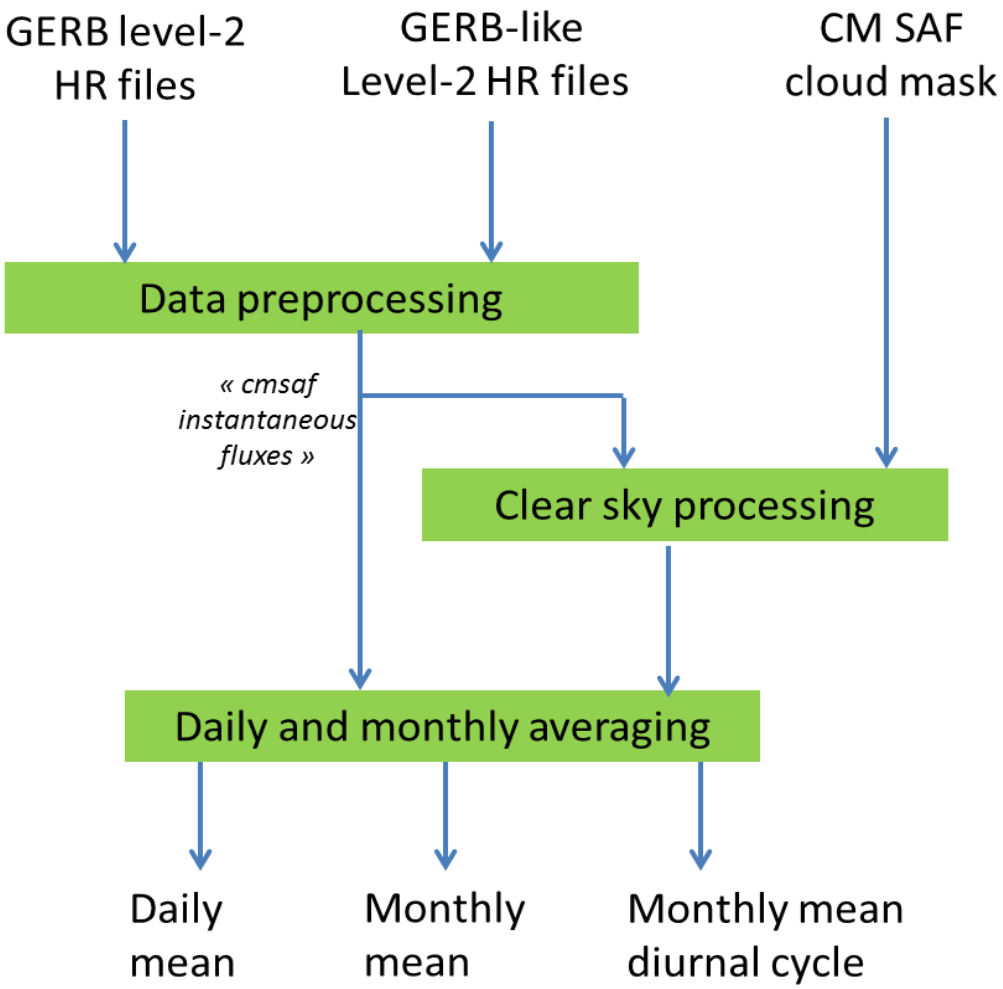
Requirement review – accuracy

Products	Threshold	Target	Optimal	CDOP-1 accuracy.	CERES accuracy.	remarks
TRS all sky MM TRS clearsky MM	8 W/m²	4 W/m²	2 W/m²	3.0 W/m²	4.2 W/m²	Requirements referring to error: - at 1 standard deviation (RMS error) - at 1° x 1° scale - taking only VZA<60° - not including bias due to the GERB absolute calibration.
TRS allsky DM TRS clearsky DM	16 W/m²	8 W/m²	4 W/m²	5.5 W/m²	7.8 W/m²	
TRS allsky MMDC TRS clearsky MMDC	16 W/m²	8 W/m²	4 W/m²	12.8W/m²	16.7 W/m²	
TET allsky MM TET clearsky MM	4 W/m²	2 W/m²	1 W/m²	2.0 W/m²	2.0 W/m²	
TET allsky DM TET clearsky DM	8 W/m²	4 W/m²	2 W/m²	3.6 W/m²	1.9 W/m²	
TET all sky MMDC TET clearsky MMDC	8 W/m²	4 W/m²	2 W/m²	3.1 W/m²	3.1 W/m²	

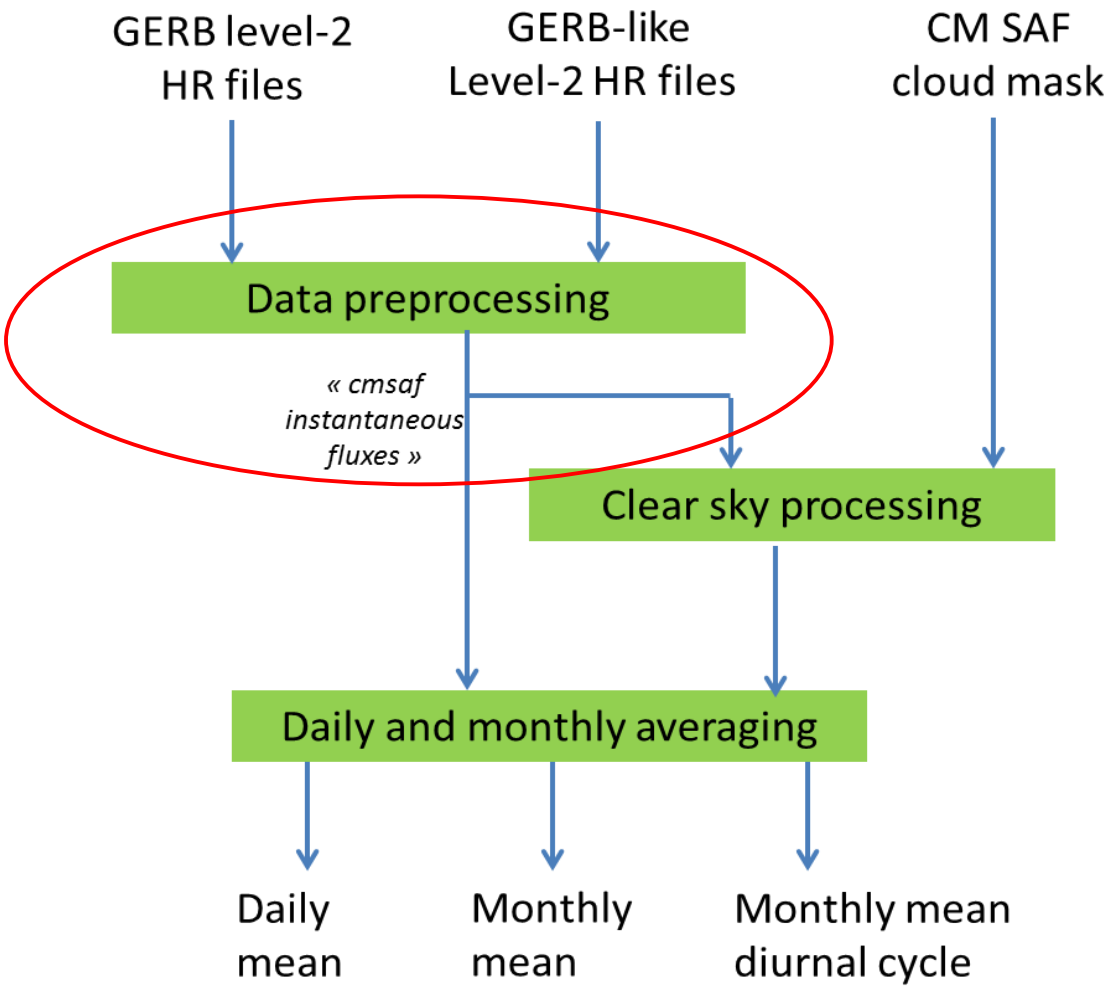
Requirement review – stability

Products	threshold	target	optimal	remarks
TRS all sky MM TRS clearsky MM	N/A	2 W/m²/dec	0.3 W/m²/dec	- at 1° x 1° scale - taking only VZA<60°
TET all sky MM TET clearsky MM	N/A	2 W/m²/dec	0.3 W/m²/dec	

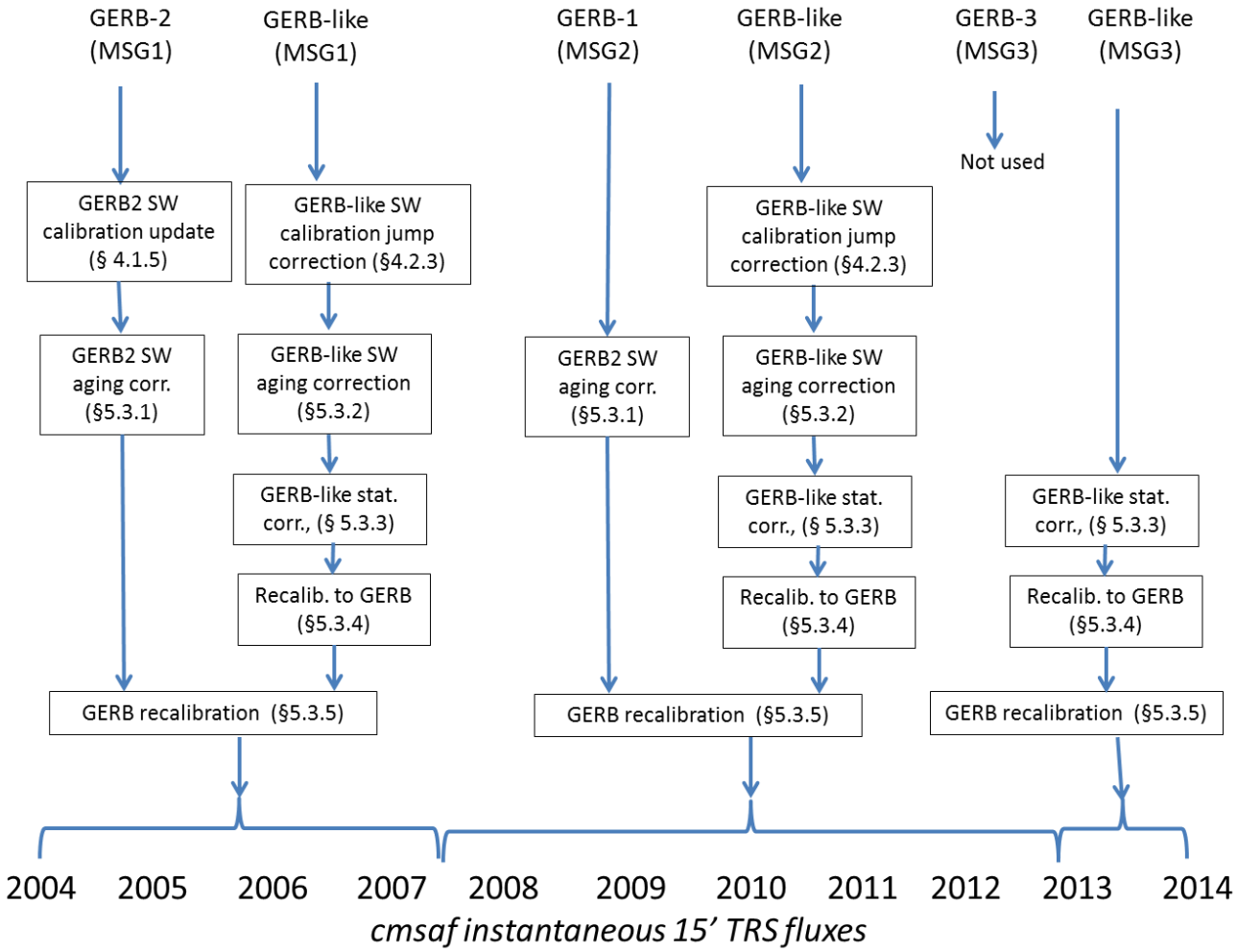
Processing flowchart



Processing flowchart

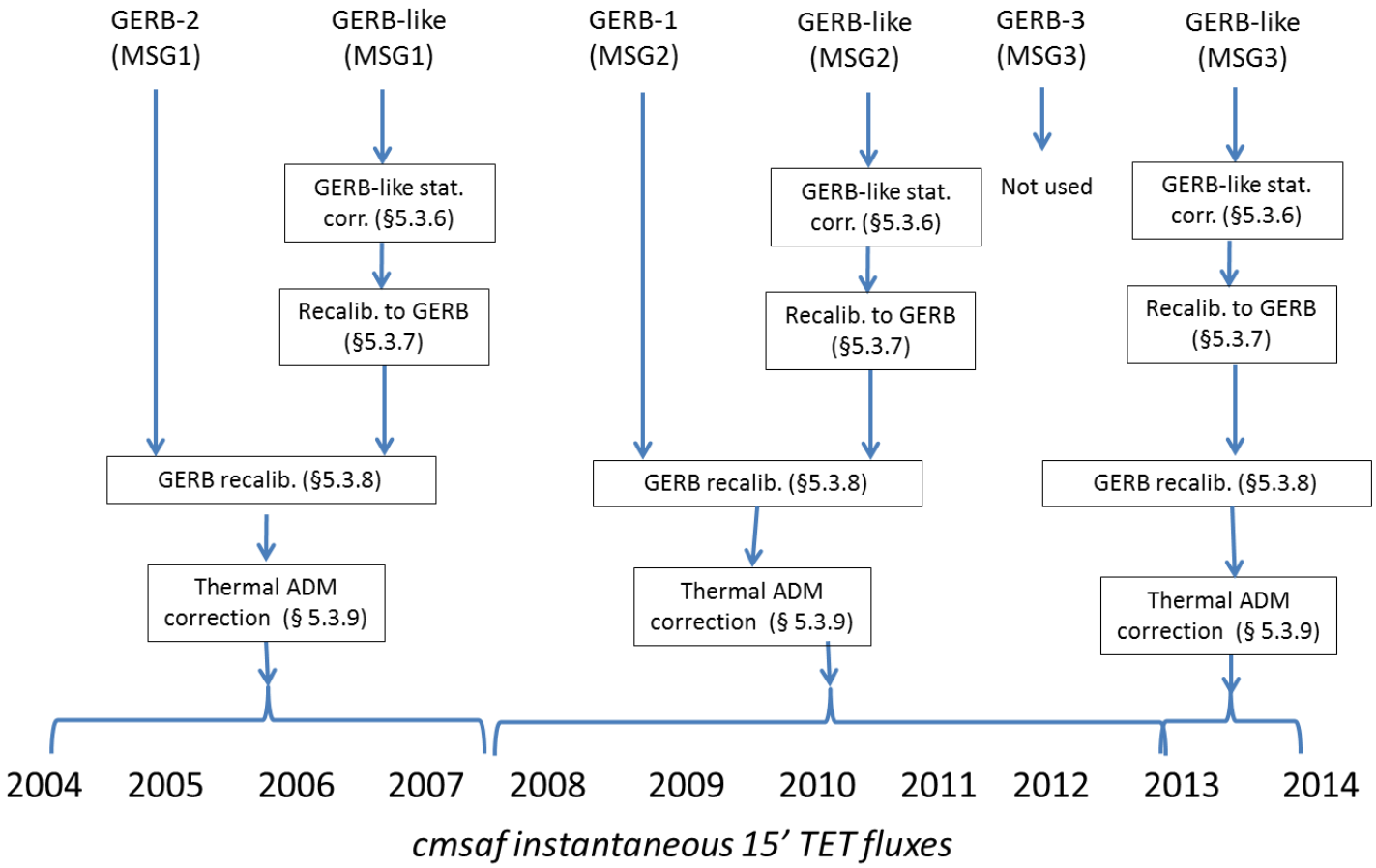


Preprocessing – flowchart for TRS



Note : not shown is the use of backup MSG satellite in case of failures, decontamination, ...

Preprocessing – flowchart TET

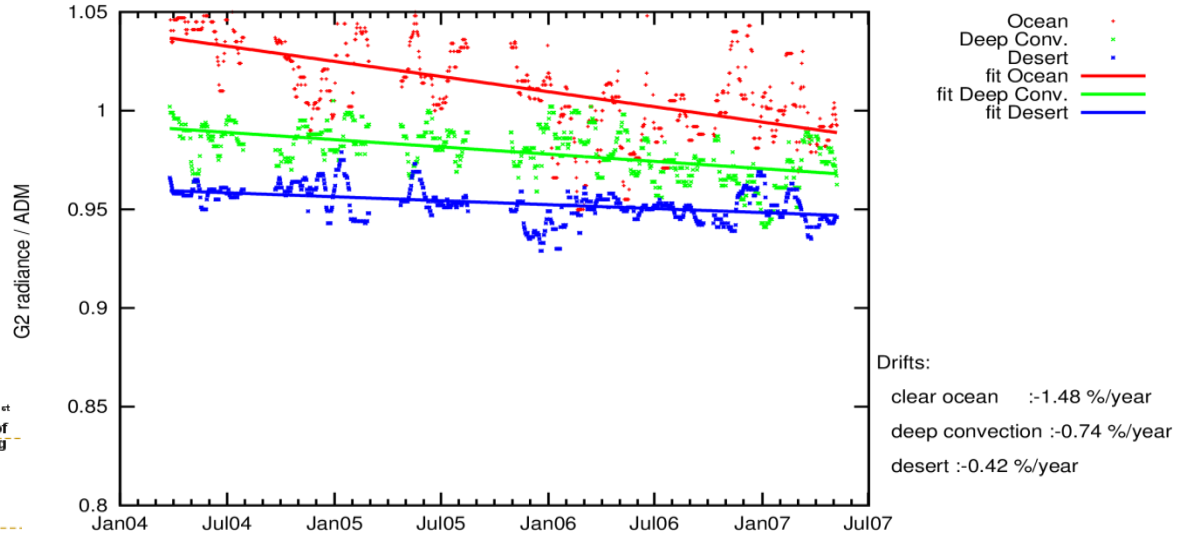


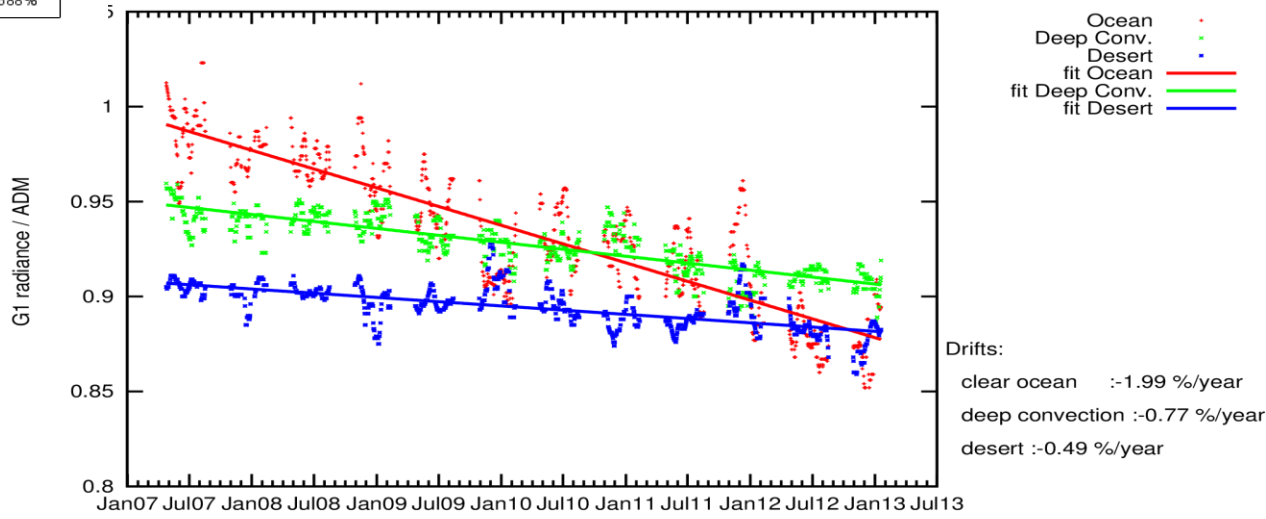
cmsaf instantaneous 15' TET fluxes

GERB SW channel aging correction

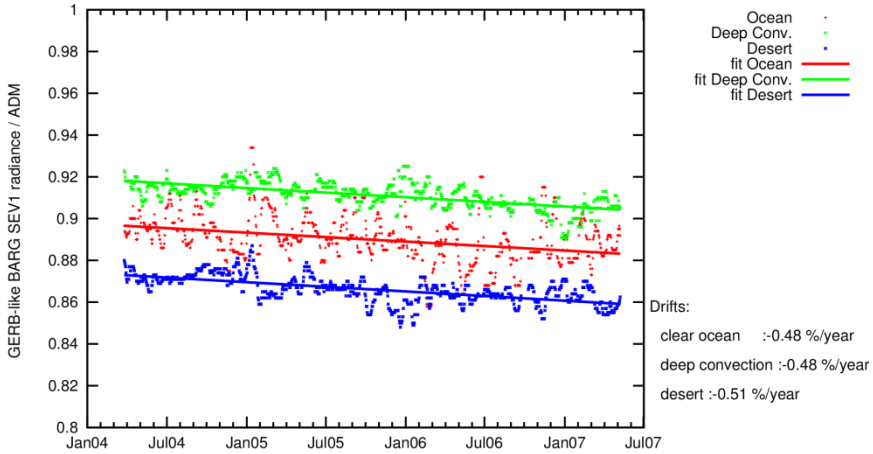
Table 7 : Aging and ratio to the model extrapolated on Feb. 1st 2004 for GERB-2 and May 1st 2007 for GERB-1. The last column gives the differences of level expressed as a percentage of the average of the 2 instruments. The DCC results are highlighted as they are used for aging correction in the CM SAF datasets.

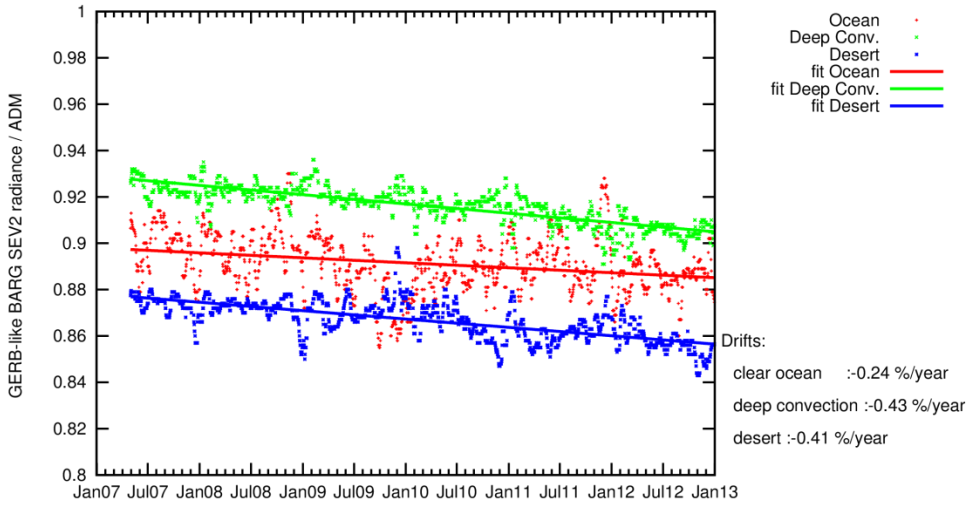
Scene type	G2 aging (α)	G1 aging (α)	G2 ratio @ t_0 = 20040201	G1 ratio @ t_0=20070501	Difference ((G2 – G1)/((G2+G1)/2))
Ocean	-1.48 %/year	-1.99 %/year	1.0391	0.9902	4.819%
DCC	**-0.74 %/year**	**-0.77 %/year**	**0.9920**	**0.9481**	**4.525%**
desert	-0.42 %/year	-0.49%/year	0.9601	0.9070	5.688%

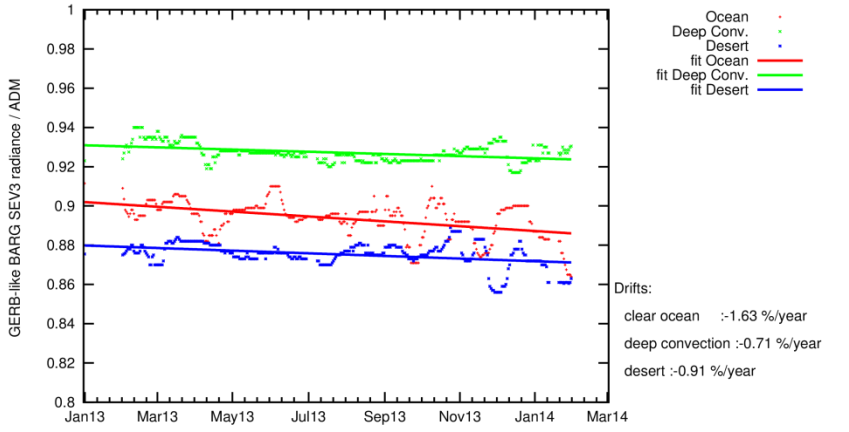




GERB-like TRS fluxes aging

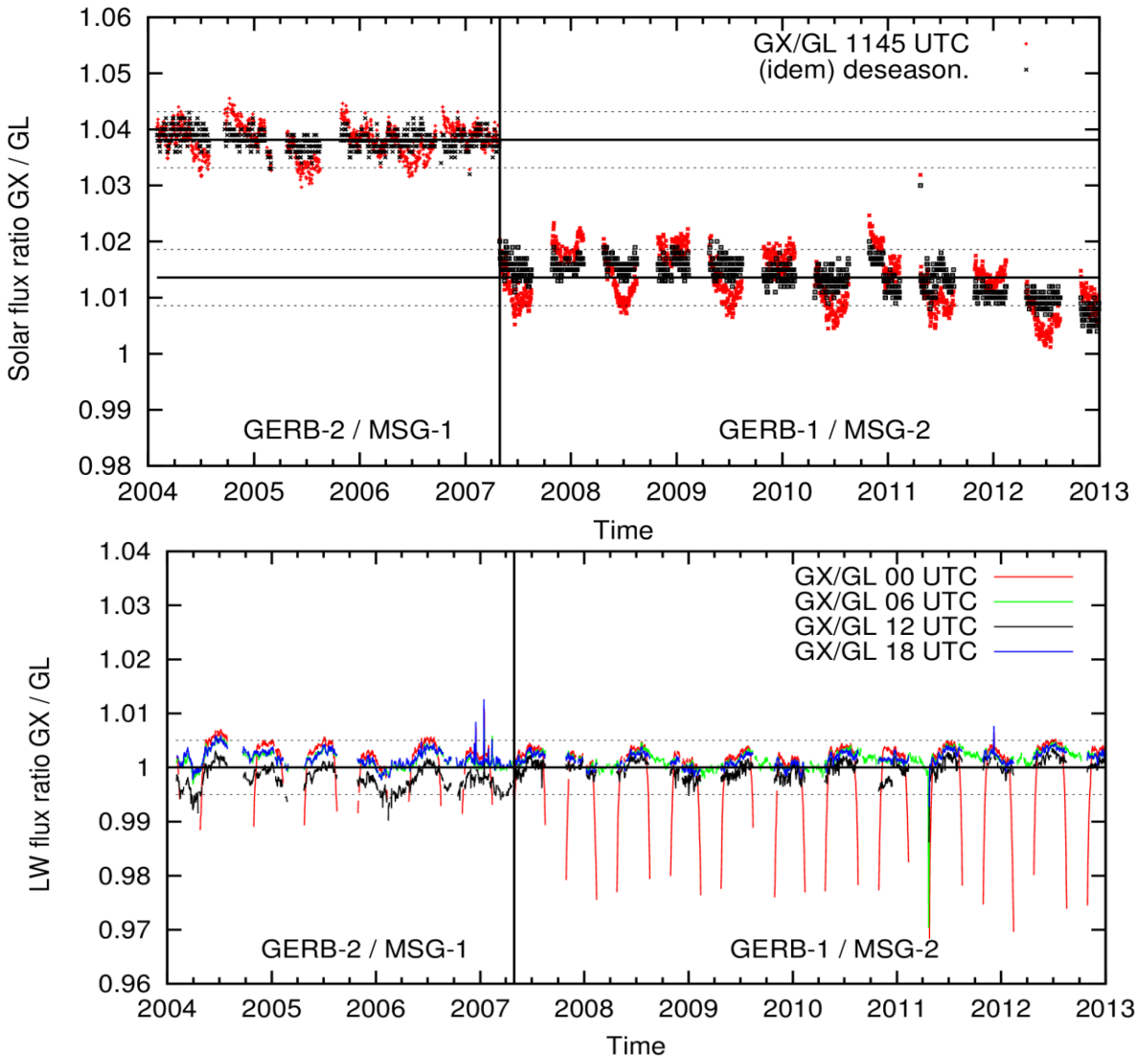






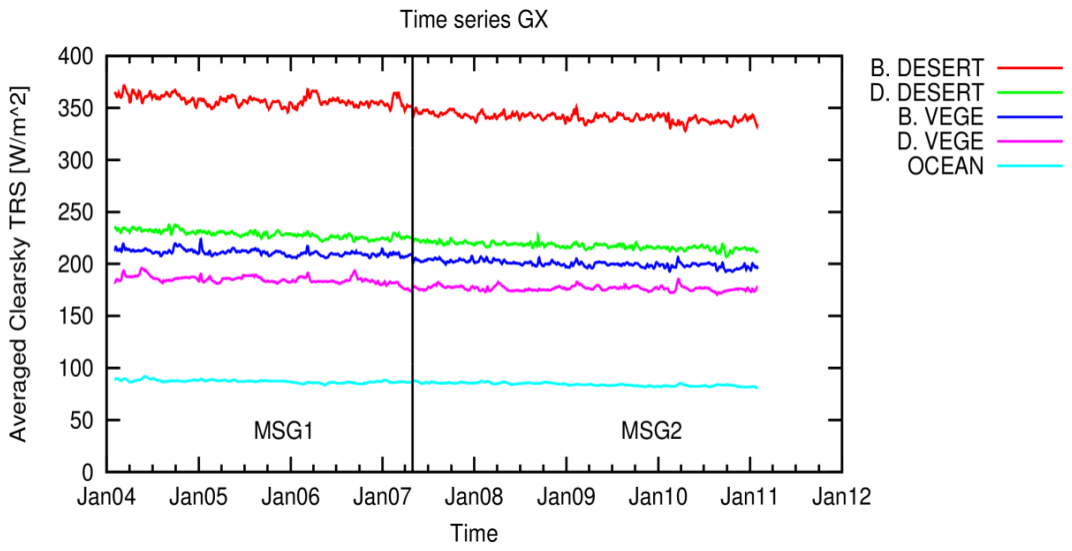
Mixing GERB and GERB-like

Once GERB and GERB-like corrected for aging →
simple factor to scale the GERB-like to the GERB level

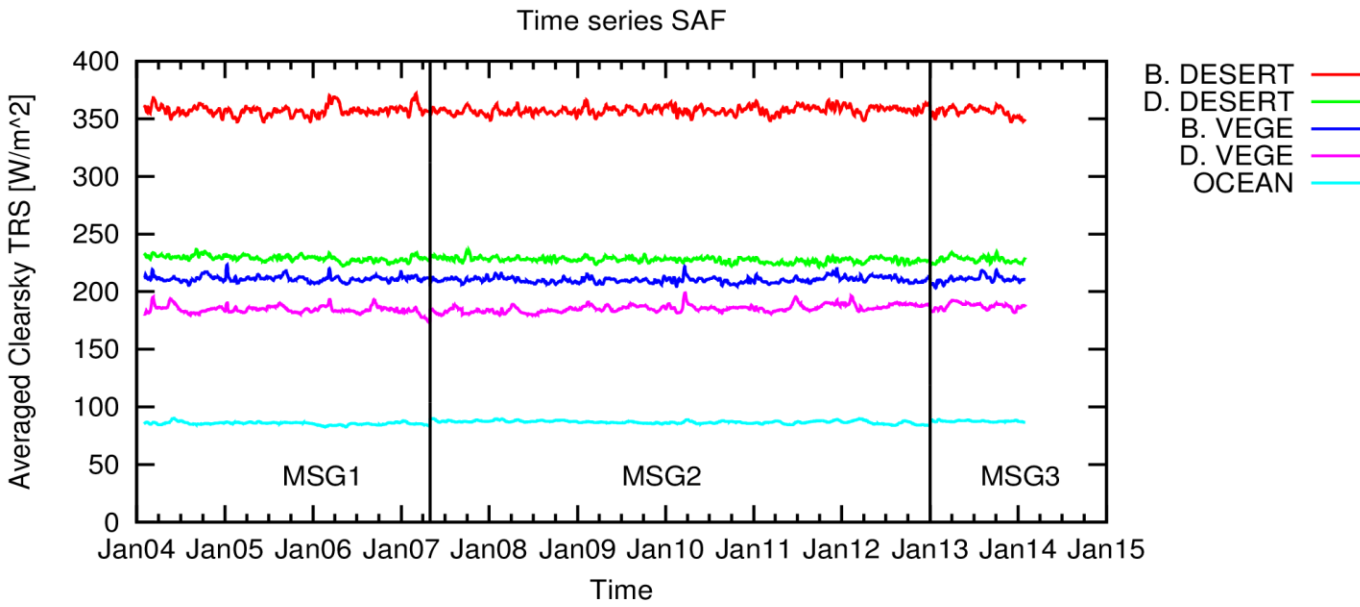


Validation on averaged TRS clear sky fluxes

- ed01

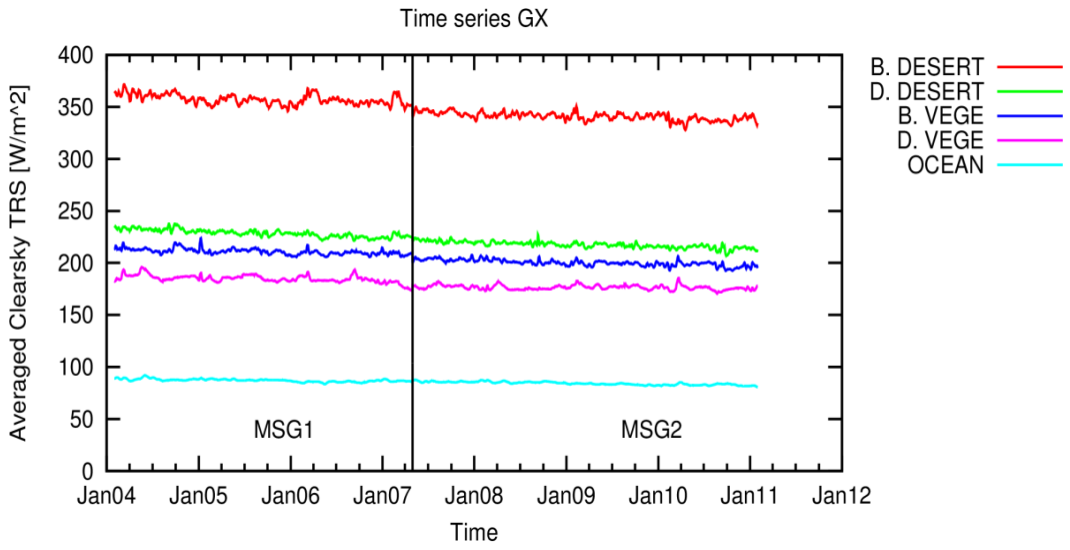


- ed02

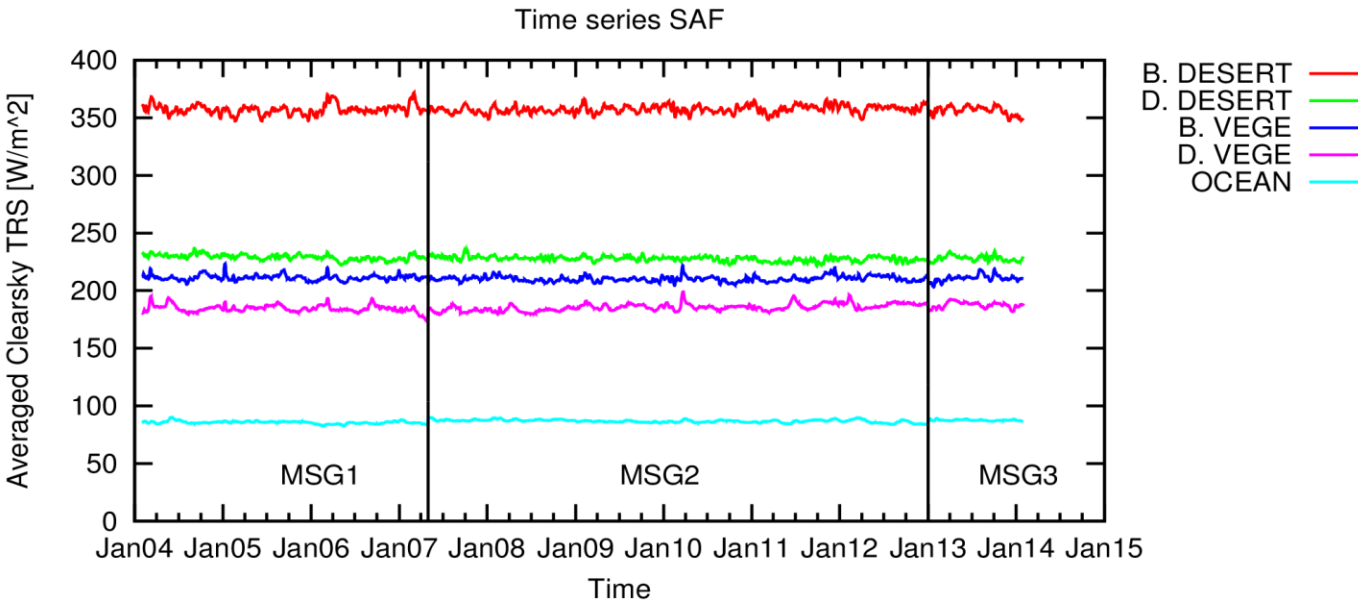


Validation of the aging correction : averaged TRS clear sky fluxes

- ed01

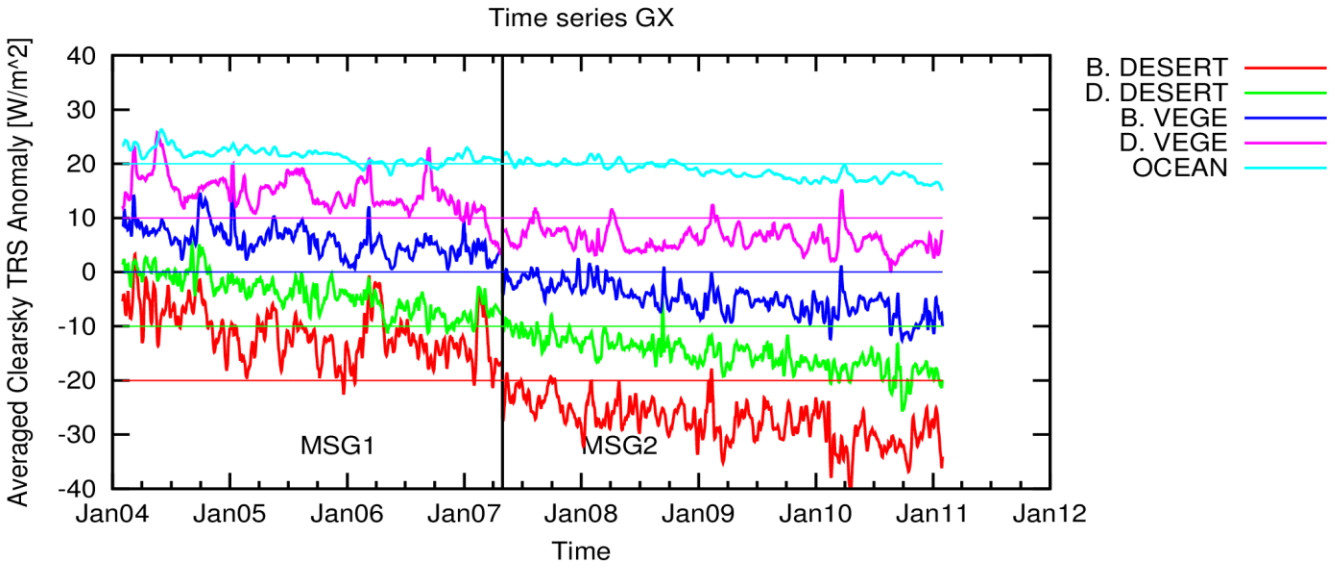


- ed02

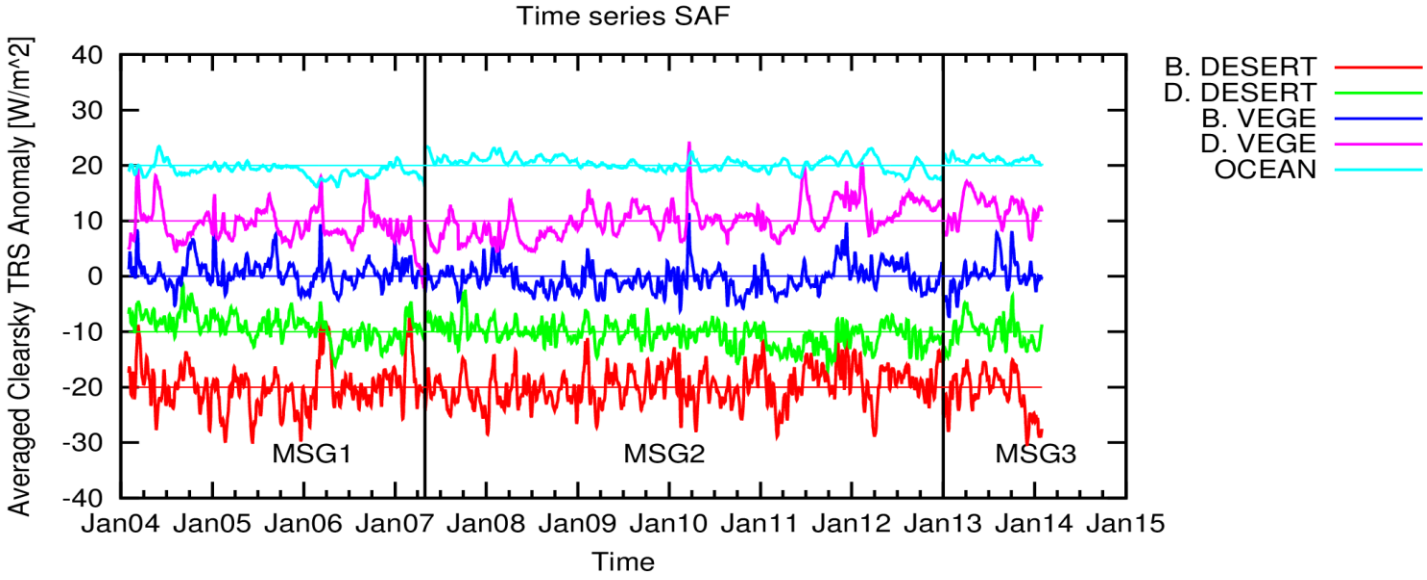


Validation of the aging correction clear sky images (full FOV)

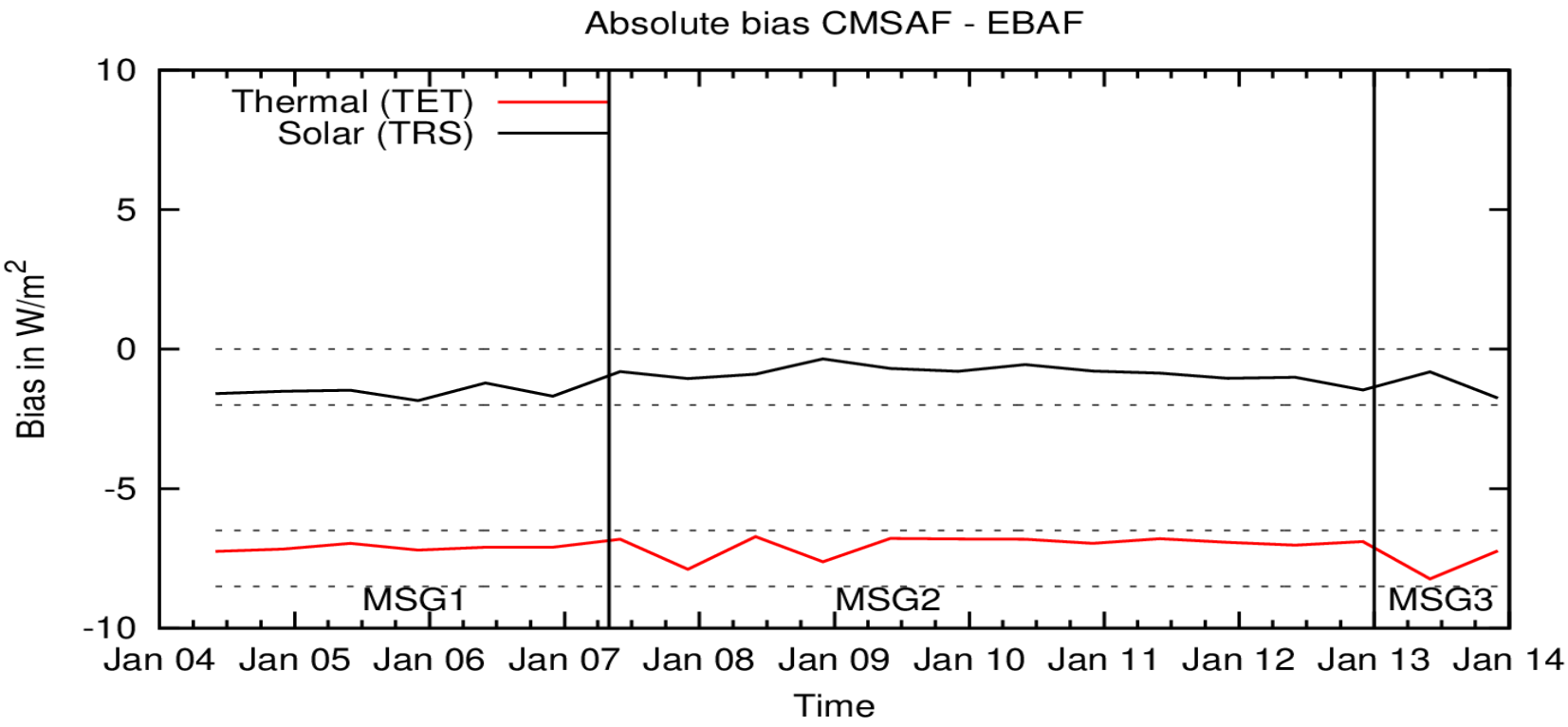
- ed01



- ed02



Validation aging correction: comparison with CERES EBAF (all sky)



Note : dashed lines are 2 W/m²/decade target stability

Reviewer's comments about pre-processing

- Concerns that the GERB aging/recalibration could be inconsistent with a future GERB ED02 (traceability problem) and suggest to wait availability of ED02.

→ *Not possible with a data release in CDOP-2*

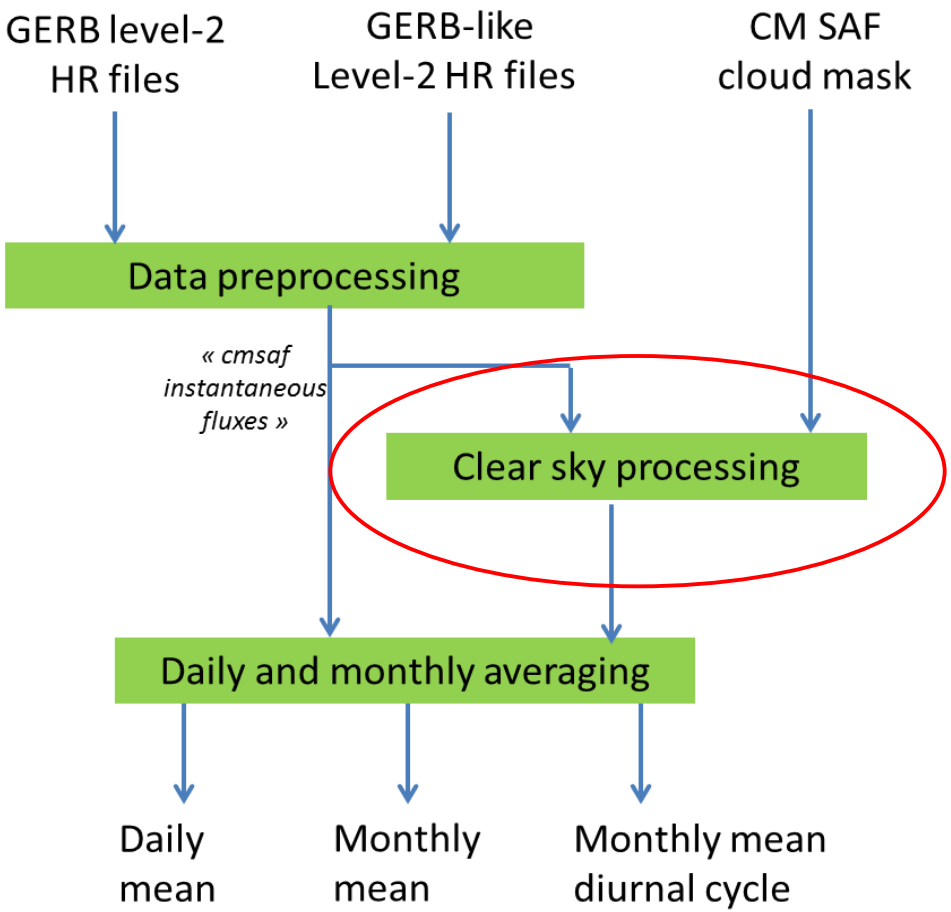
- Suggest that the GERB-like could be further improved within CM SAF and better handled in a full reprocessing.

→ *Indeed, this will be considered for CDOP-3*

- Suggest not to cover MSG-3 era (stop dataset on Dec. 31st 2012).

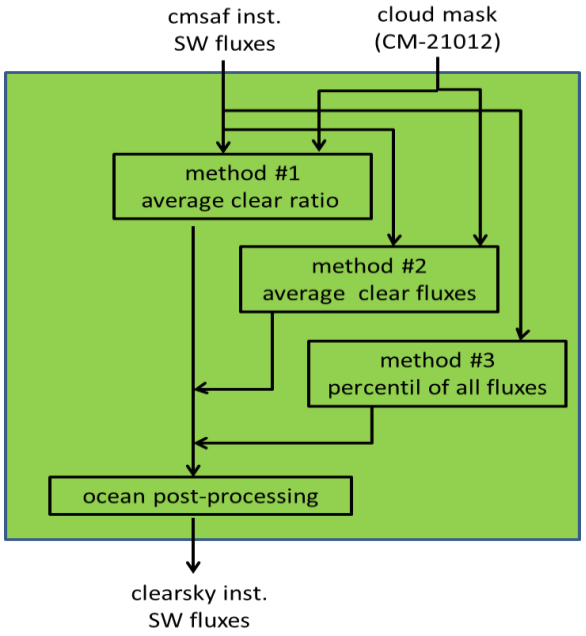
→ *We don't have evidence of problem affecting the GERB-like of MSG-3. Propose to postpone a decision to the DRR.*

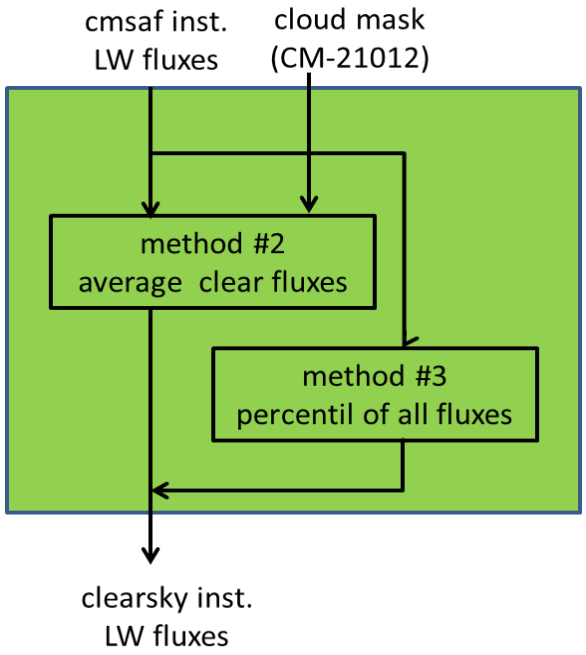
Processing part 2/3 : clear sky processing



clear sky processing

Method:
- at HR pixel level (9km),
- at repeat cycle level (hhmm),
- look for the N closest in time clear observations (based on CM-21012),
- method 1 : averaged of ratios of the TRS flux wrt to CERES TRMM clear surface fluxes.
- method 2 : averaged of the clear sky fluxes
- method 3 : percentil of all the fluxes





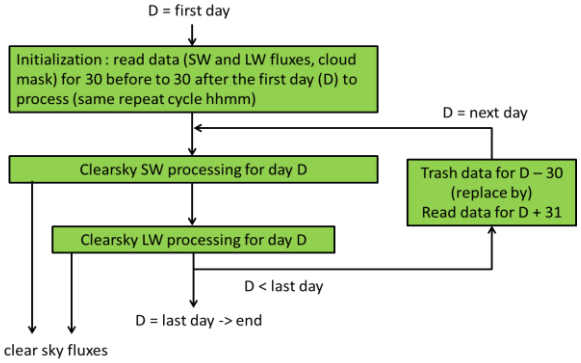


Illustration TRS clear sky processing

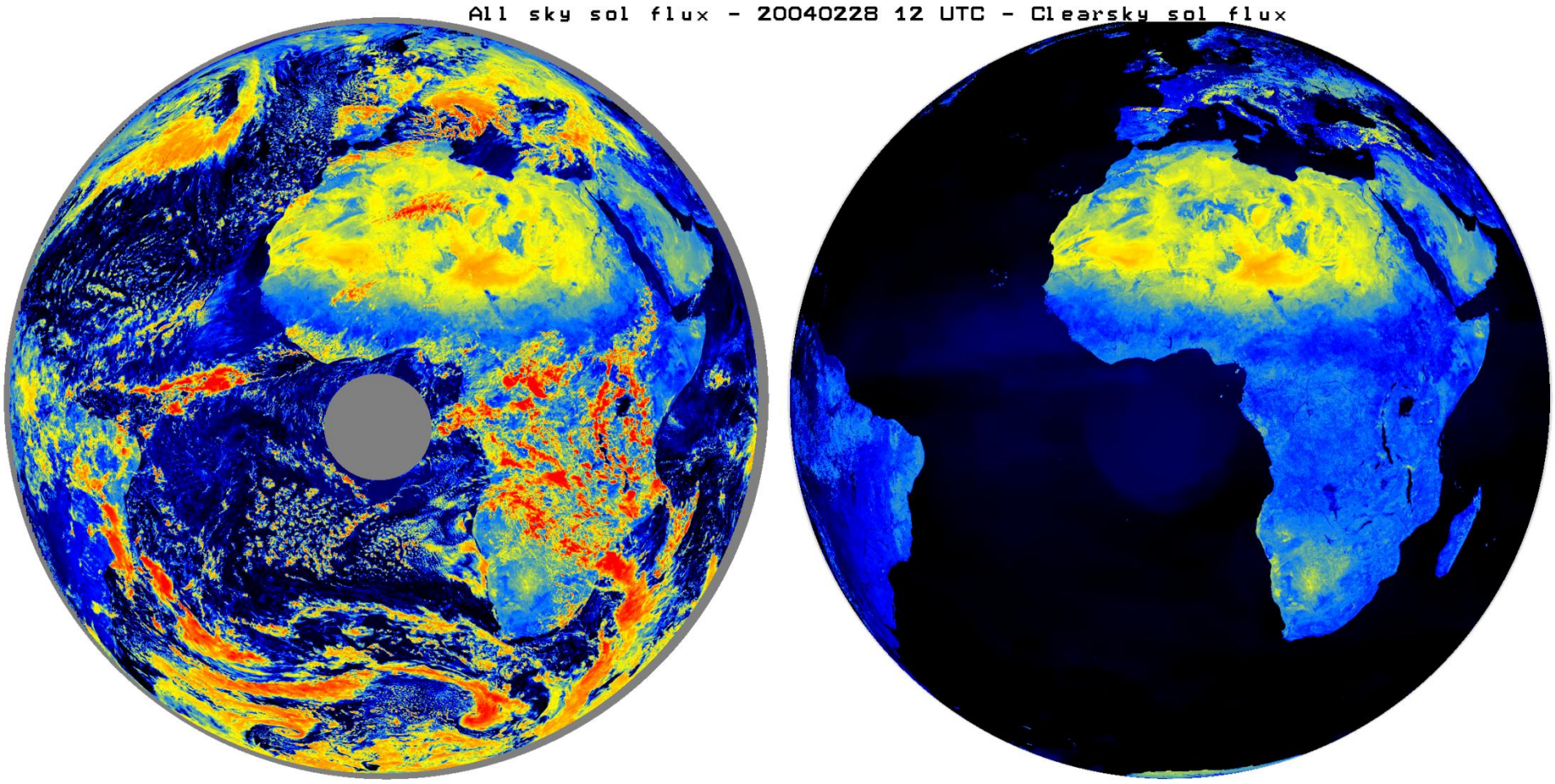
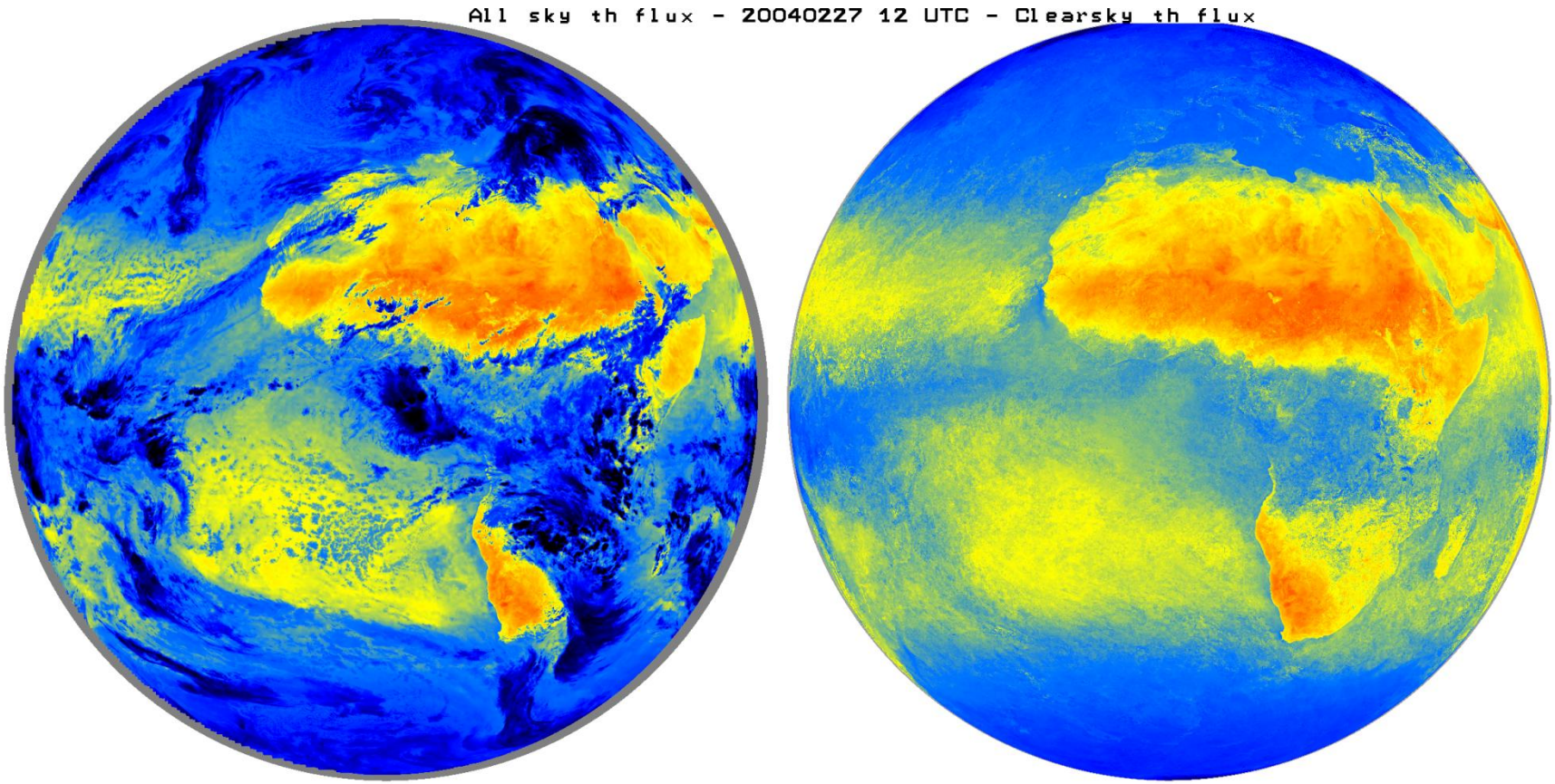


Illustration TET clear sky processing



Optimum number of observations to be averaged?

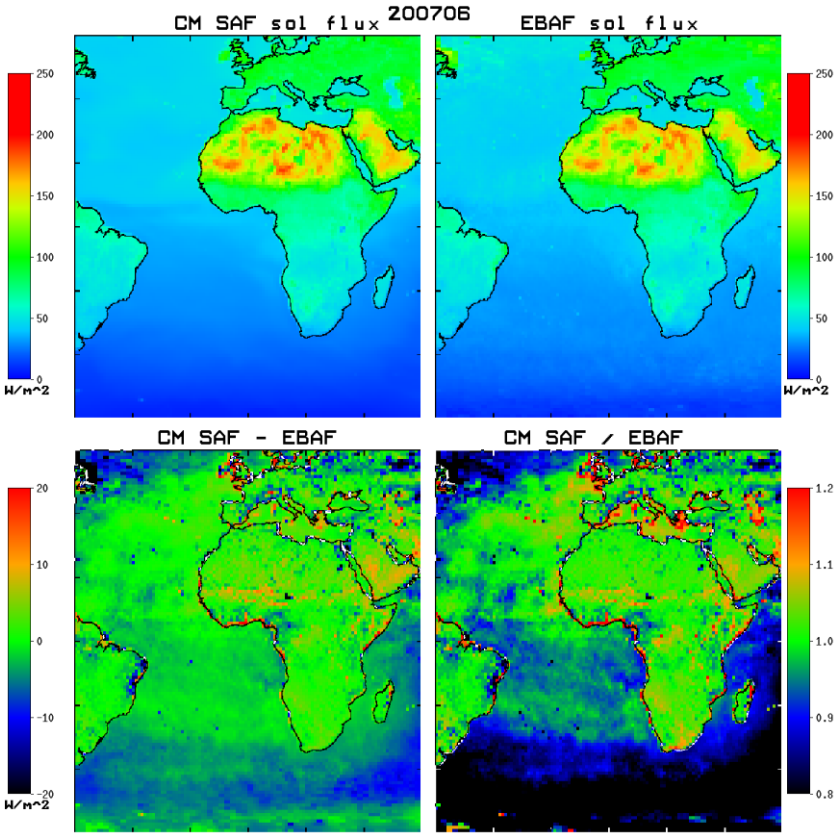
TRS :

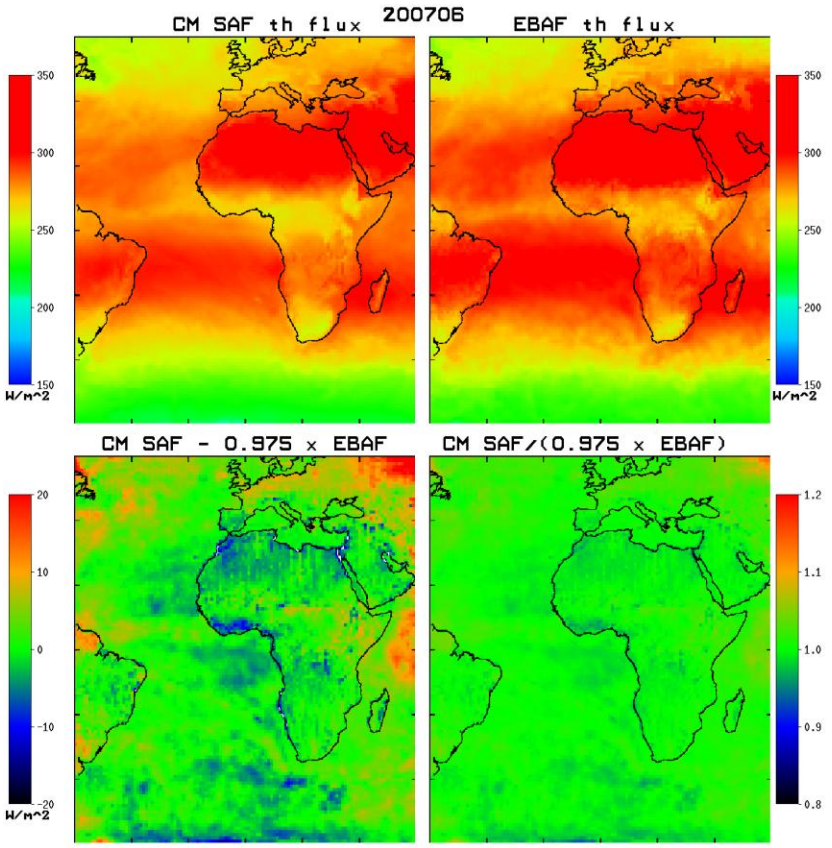
N	bias	RMS	RMS corrected
1	-1.287772	10.059398	9.976629
2	-0.754753	8.739850	8.707200
3	-0.694078	8.575695	8.547561
4	**-0.605873**	**8.378229**	**8.356293**
5	-0.581573	8.425612	8.405516
6	-0.508390	8.413248	8.397874
7	-0.458638	8.425915	8.413423
8	-0.489276	8.339220	8.324855
9	-0.442231	8.373984	8.362299

TET

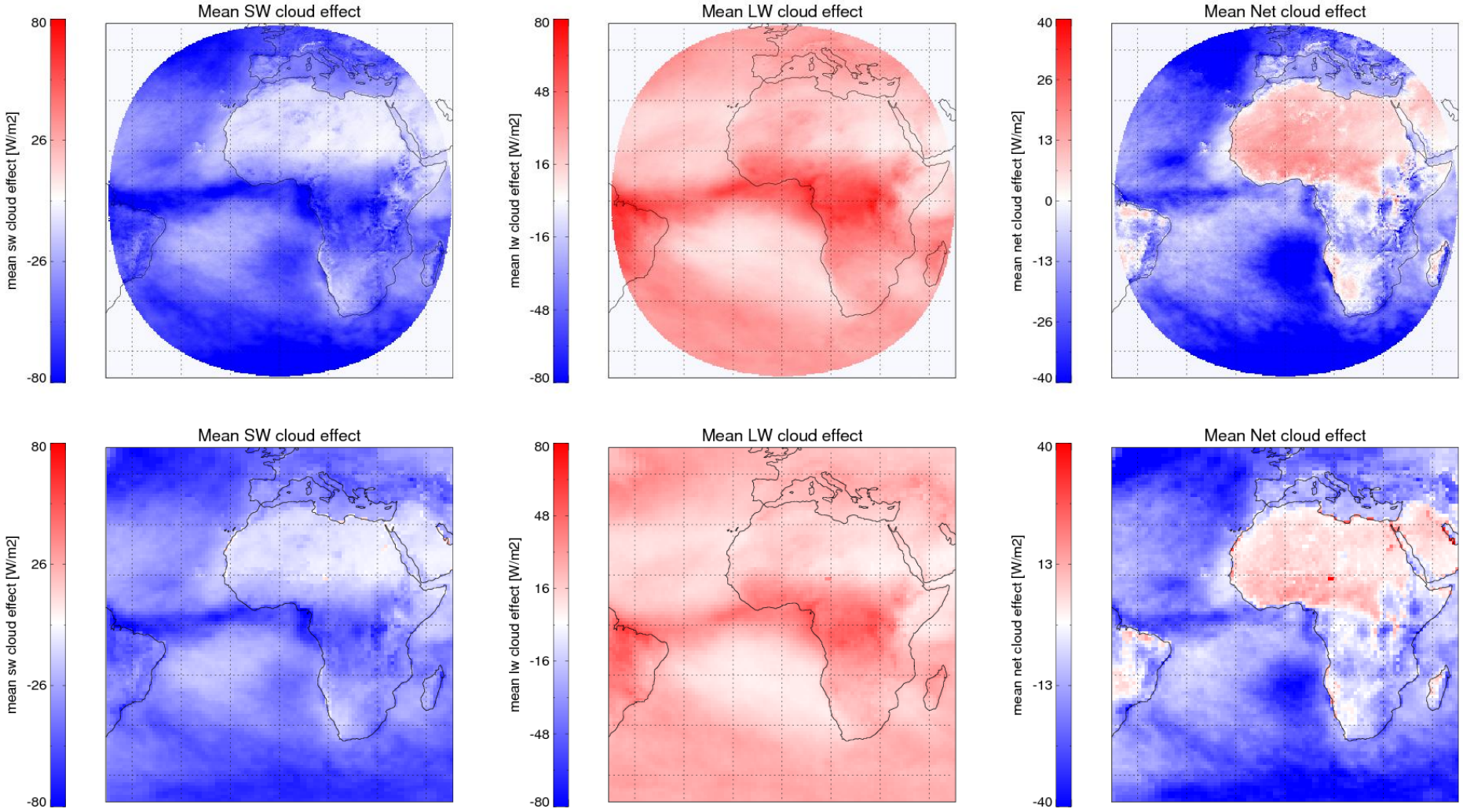
N	bias	RMS	RMS corrected
1	bias = -2.174323	8.300489	rms_corected = 8.010646
2	**bias = -1.148953**	**6.817482**	**rms_corected = 6.719968**
3	bias = -1.080976	7.027991	rms_corected = 6.944361
4	bias = -0.816596	6.954168	rms_corected = 6.906057
5	bias = -0.786153	7.158953	rms_corected = 7.115657
6	bias = -0.619915	7.017090	rms_corected = 6.989653
7	bias = -0.675800	7.118992	rms_corected = 7.086843
8	bias = -0.650571	7.121980	rms_corected = 7.092204
9	bias = -0.765046	7.248840	rms_corected = 7.208356

Comparison with EBAF





Comparison of CRE with CERES (courtesy Martin Stengel, DWD)



Review of clear sky algorithm

- Algorithm description not clear in the ATBD

  → *ATBD will be improved.*

- Strongly recommend ED02 GERB fluxes as better input (e.g. clear ocean ADM will depend on the aerosol content).

  → *Yes, for ocean but the land fluxes would be the same in ED01 and ED02. It is still possible in CM SAF to recompute the clear ocean fluxes from the radiance using the Loeb et al. method (was already done for DAF product)*

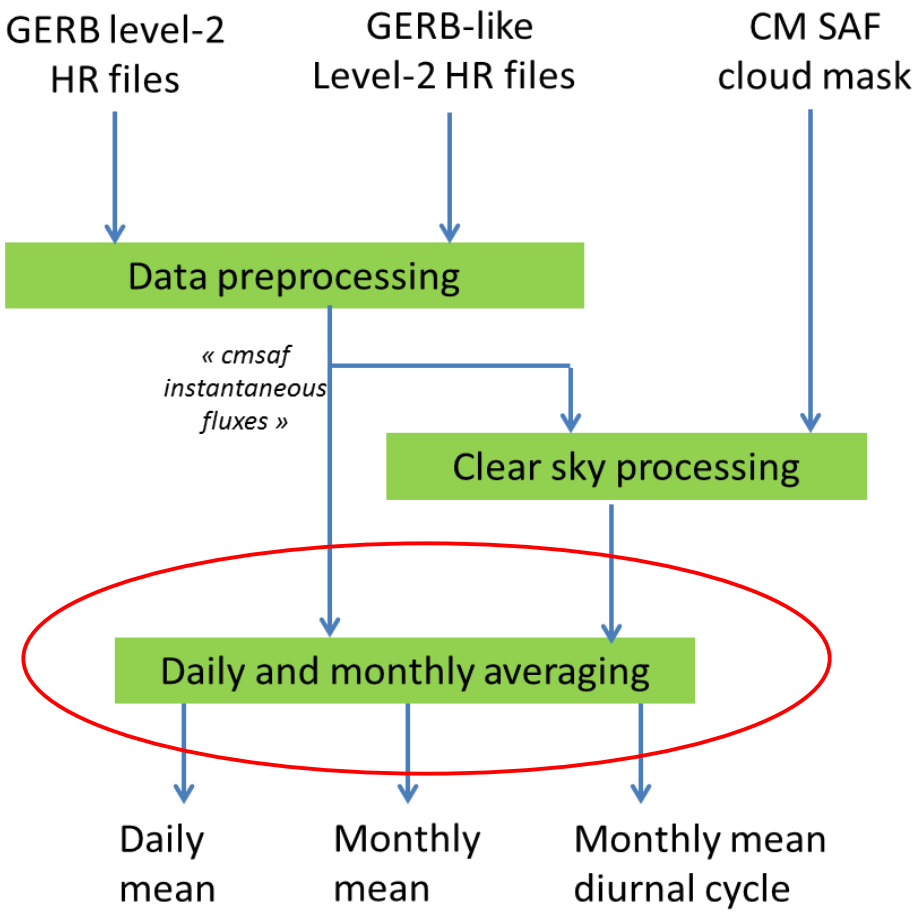
- Seems that this is not what the GERB team is thinking appropriate for GERB users.

  → *effect of cross-month contamination will be quantified*

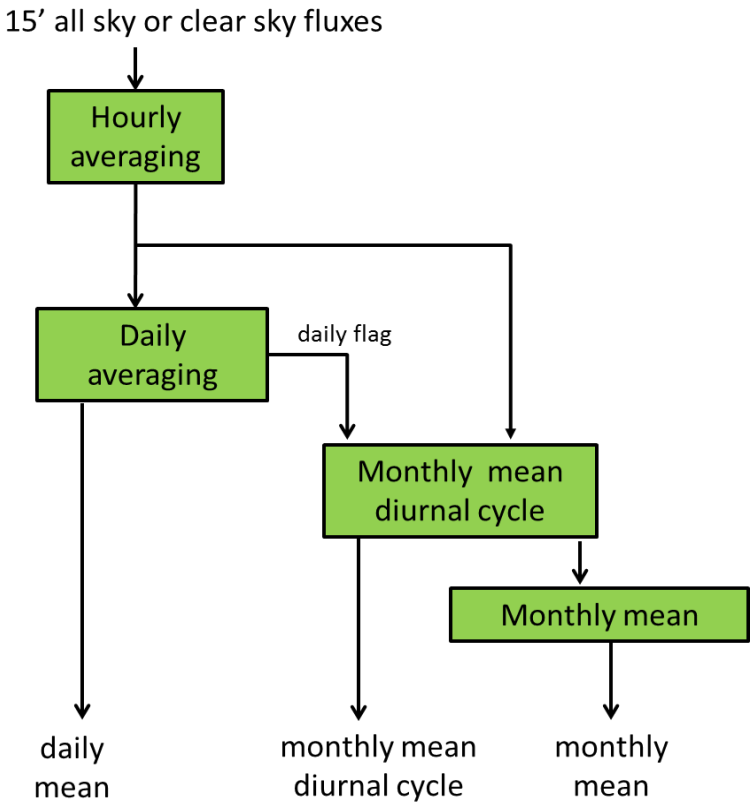
- Justification of not working at 3km judged not convincing.

  → *ATBD will be improved.*

Processing part 3/3 : daily and monthly averaging



Daily and monthly averaging



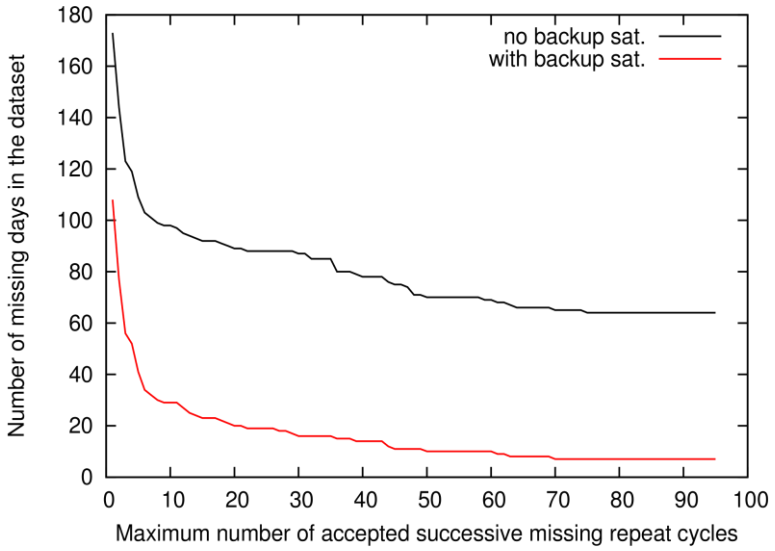


Table 15: Effect of successive missing repeat cycle on daily mean TRS and TET.

Number of successive missing re-peat cycles	TRS mean Bias W/m²	TRS mean abs. bias W/m²	TRS RMS W/m²	TET mean Bias W/m²	TET mean abs. bias W/m²	TET RMS W/m²
3	-0.0155	0.0372	0.5220	-0.0005	0.0005	0.1991
6	-0.0787	0.1790	1.3863	0.0008	0.0008	0.5008
9	-0.2295	0.4605	2.5884	0.0017	0.0017	0.8680
12	-0.5115	0.9630	4.1190	0.0049	0.0049	1.2865
15	**-0.9686**	**1.6298**	**5.9550**	**0.0086**	**0.0086**	**1.7490**
18	-1.5665	2.5190	8.0909	0.0239	0.0239	2.2697
21	-2.3092	3.6872	10.4854	0.0457	0.0457	2.8475

Review of the averaging algorithm

- Seems to be a mis-understanding of the acceptable number of successive missing repeat cycles / interpolation method

→ *ATBD will be improved.*

•- Recommend use model (alb(SZA), half-sine) to interpolate missing flux. Currently linear interpolation of TOA solar albedo and TOA thermal flux.

→ *Ok, but would need a scene identification for the model selection.*

- Concerns about the consistency of the averaged clear sky and all sky.

→ *Do the reviewer suggests to "simulate" the missing data in the clear sky fluxes stream?*