

GERB Edition 1 and CERES scene identification comparisons

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- GERB processing based on radiance-to-flux conversions using CERES TRMM ADMs (solar)
- SEVIRI must be used for basic scene identification to select proper ADM:
 - ▶ surface type
 - ▶ cloud phase
 - ▶ cloud optical depth
 - ▶ cloud fraction

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- Cloud thermodynamic phase retrieved using threshold on $10.8 \mu\text{m BT}$
- Cloud optical depth τ retrieved
 - ◆ using one visible channel (0.6 or $0.8 \mu\text{m}$)
 - ◆ through comparisons with reference composite TOA clearsky reflectances
 - ◆ using lookup tables from 1D radiative transfer computations (cutoff at 128)
- Cloud flag retrieved through thresholding of τ : cloudy if $\tau \geq \approx 0.6$

Flowchart

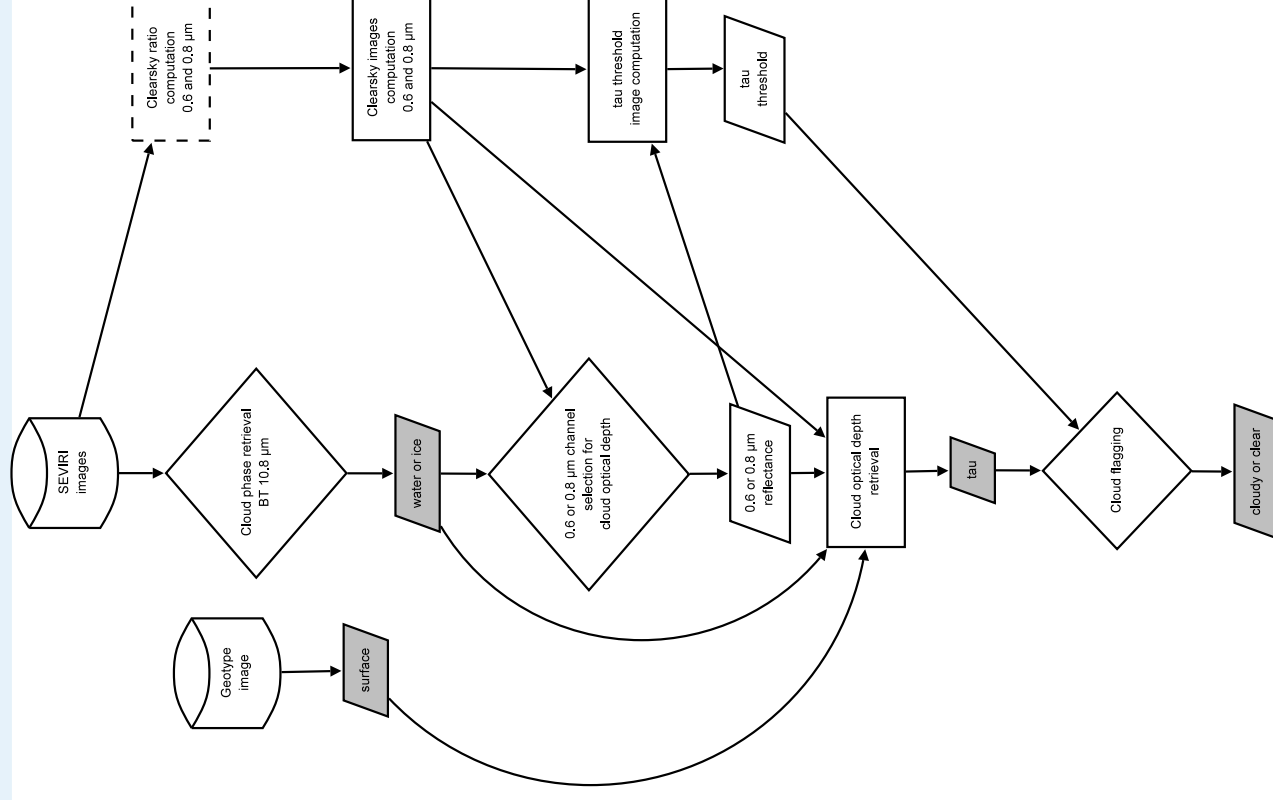
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Limitations

- Simplistic cloud thermodynamic phase retrieval:
supercooled water and thin cirrus clouds issues
- Reference composite TOA clearsky reflectances
images updated weekly
- Restricted number of lookup tables
- Uncertainty in lookup tables (DISORT) for
grazing solar and viewing zenith angles
- Large STREAMER bands compared to SEVIRI
channels
- Thin clouds with $\tau < 0.6$ falsely detected as
clearsky

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Further work

- Data for 11–17 March 2007 at 12:00 UTC
- GERB ED01 SEVIRI processing at 3 km
- CERES VISST SEVIRI processing at 3 km
- VISST data projected to SEVIRI FOV for one-to-one pixel comparisons

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Further work

- MT8V03.0.GERB_[1-8].2007071.1200.PX.03K
- VISST 0.6 μm reflectance at native resolution
- VISST reflectance projected to SEVIRI FOV according to longitude & latitude within file and EUMETSAT formula
- Correlation coefficient is then computed between GERB and VISST reflectances for varying sub-satellite pixel coordinates (C_x, C_y) for VISST projection
- ▶ **EUMETSAT prescribed values of (1856, 1856) associated to maximum correlation**

Calibrations offset (0.6 μm)

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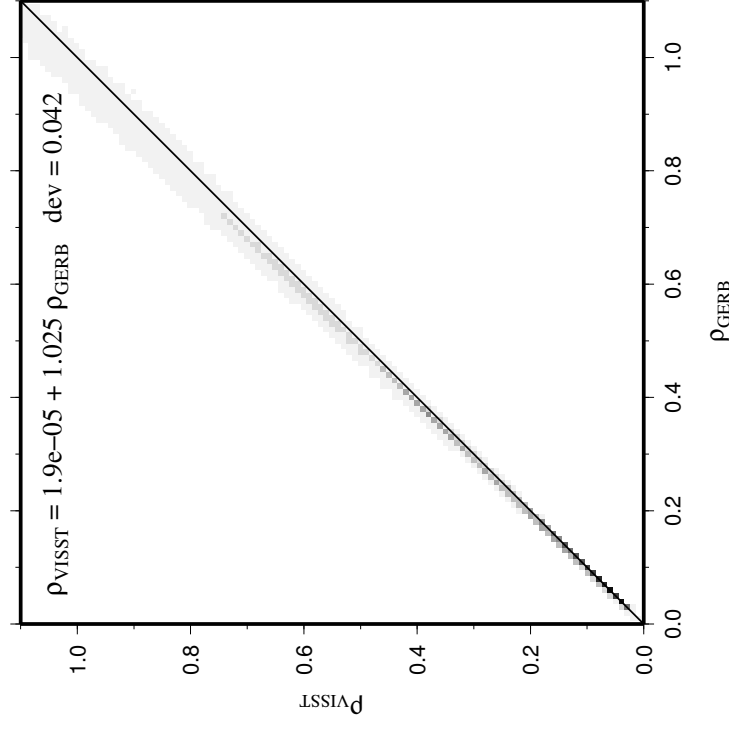
GERB-like fluxes

Further work

- GERB processing using EUMETSAT prescribed calibration
- VISST processing using cross-instruments inter-calibration

- VISST calibration 2.5% higher than GERB

- ▶ Expected discrepancies between schemes



Clearsky reflectances (temporal)

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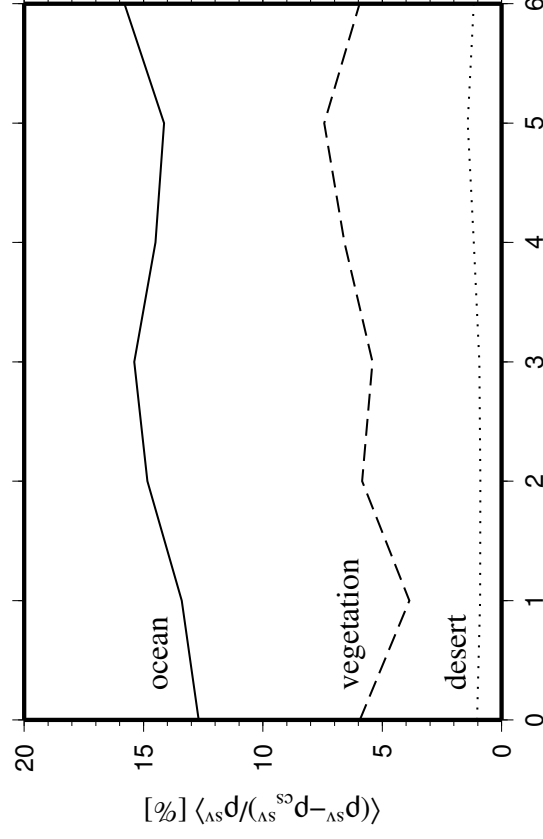
GERB-like fluxes

Further work

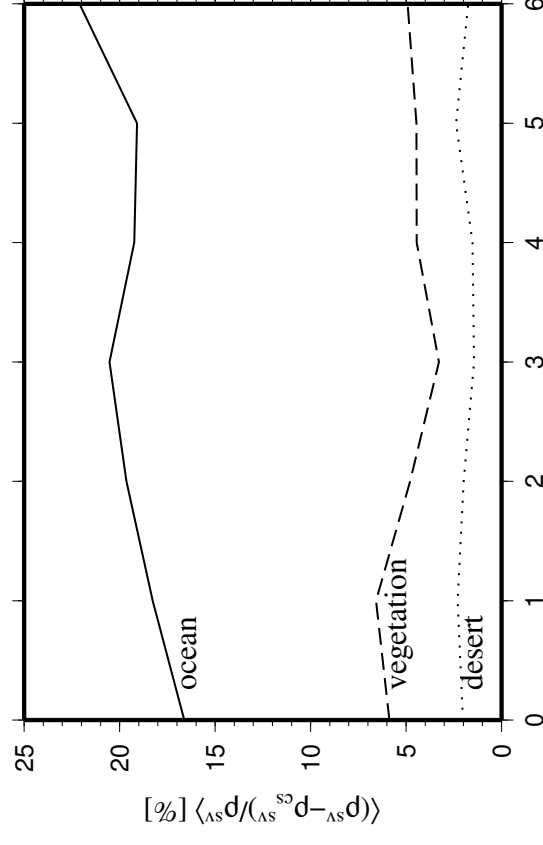
Mean of the relative clearsky reflectance errors for

VISST clearsky pixels:

- $\rho^{SV} = \text{true clearsky}$
- $\rho_{CS}^{SV} = \text{estimated clearsky}$



Age of clearsky [days]
0.6 μm



Age of clearsky [days]
0.8 μm

- Systematic underestimation of clearsky
- possible overestimation of cloud fraction & τ ?

Clearsky reflectances (overall)

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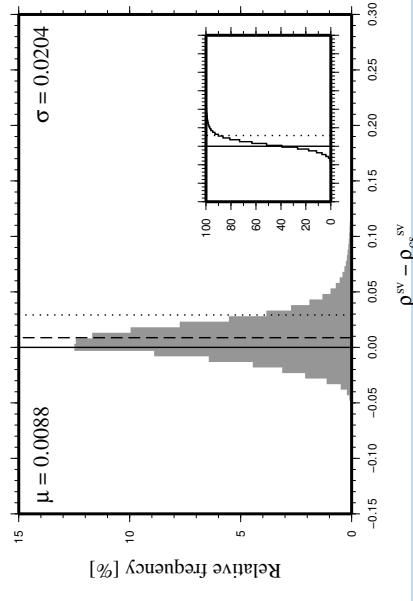
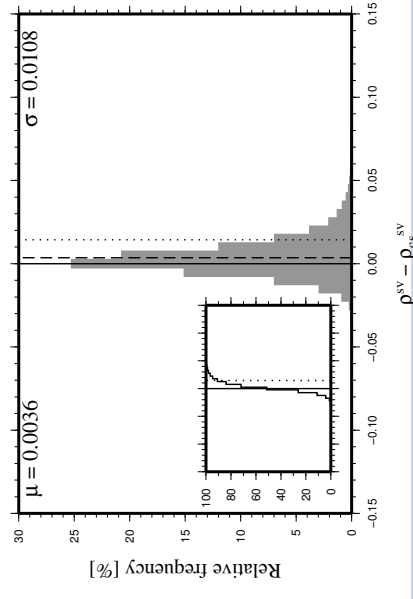
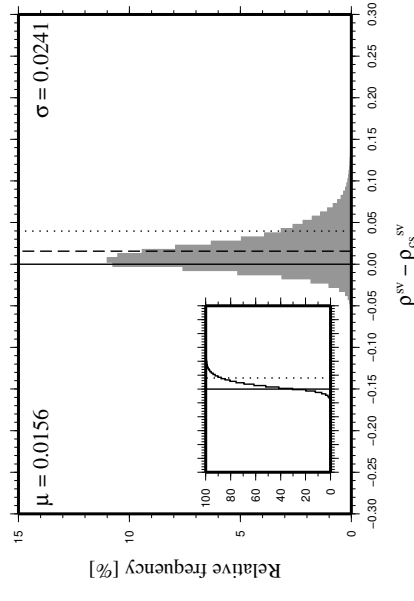
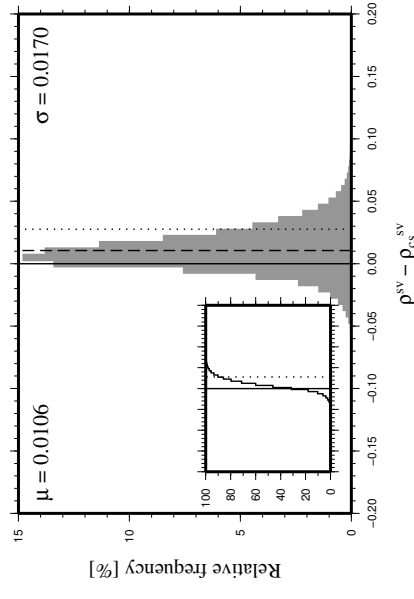
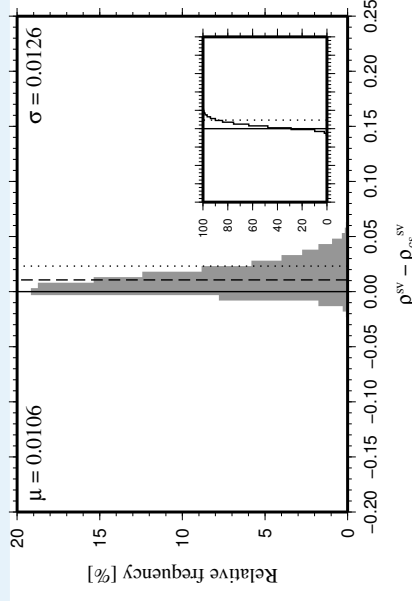
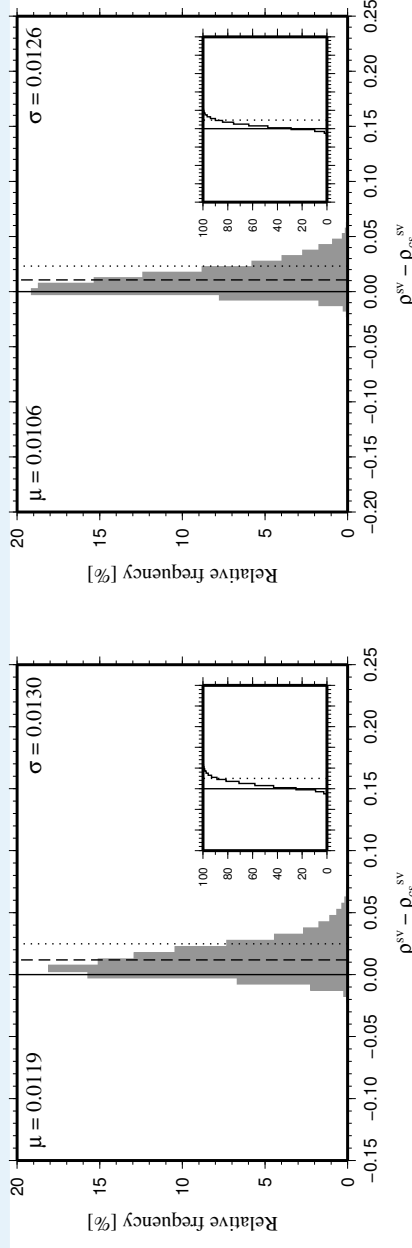
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Clearsky reflectances (overall)

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Empirical clearsky additive offset prior to retrieval:

■ $\Delta^{0.6} = 0.025$ does

■ $\Delta^{0.8} = 0$ **does not**

compensate clearsky underestimation

Clearsky reflectances (sunglint)

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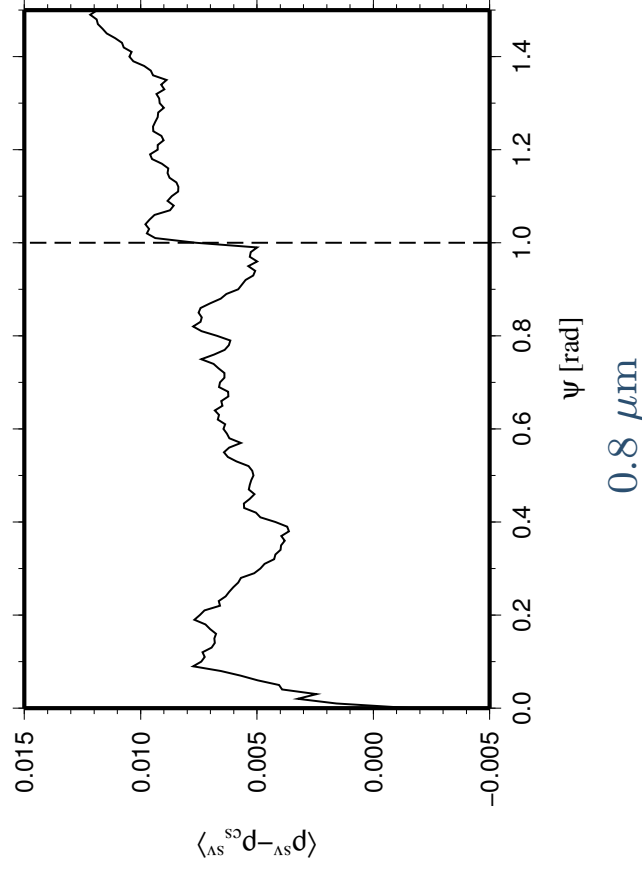
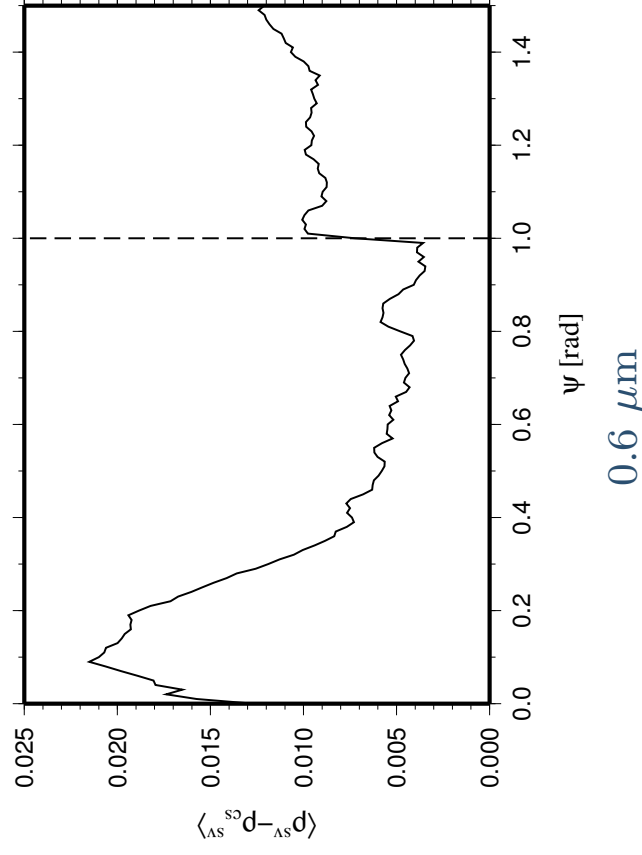
Cloud flag

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GERB-like fluxes

Further work



- Discontinuity around models transition $\Psi = 1$
- Rougher sunglint model variations
- ▲ **Explanation of cloud mask temporal artifacts**

Cloud flag (temporal)

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Statistics for the whole SEVIRI FOV:

Age [days]	GERB [%]	CERES [%]
0	56.89	54.15
1	56.01	52.68
2	56.56	53.34
3	59.46	58.47
4	59.02	59.22
5	61.08	60.09
6	60.19	60.16

- GERB overestimation ($\leq 3\%$)
- Limited dependency with age of clearsky

Cloud flag (temporal)

Misclassification statistics wrt CERES:

Age [days]	Ocean		Vegetation		Desert	
	CL/cs	cs/CL	CL/cs	cs/CL	CL/cs	cs/CL
0	8.96	1.27	3.97	9.61	2.28	7.89
1	9.92	1.43	4.97	9.89	1.68	8.19
2	10.04	1.67	4.69	9.97	1.57	7.71
3	7.97	1.63	3.23	11.82	2.39	9.55
4	7.13	1.71	3.93	13.34	2.45	12.70
5	7.74	1.69	4.91	11.95	2.10	10.76
6	6.54	2.07	3.99	11.16	1.65	9.82

GERB/CERES cl=clearsky, CL=cloudy

- Higher misclassification of clearsky ocean
(consistent with clearsky underestimation)
- Higher misclassification of thin clouds over
vegetation and desert (inconsistent with...)
- ▶ $\tau_{th} = 0.6$ too high for vegetation and desert ?

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Cloud flag (spatial)

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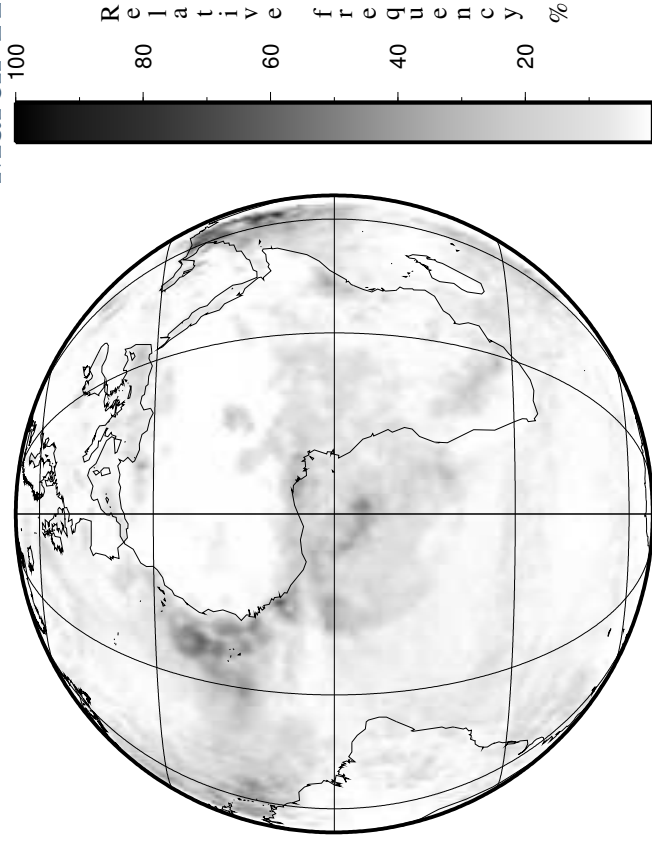
Cloud phase

Cloud optical depth

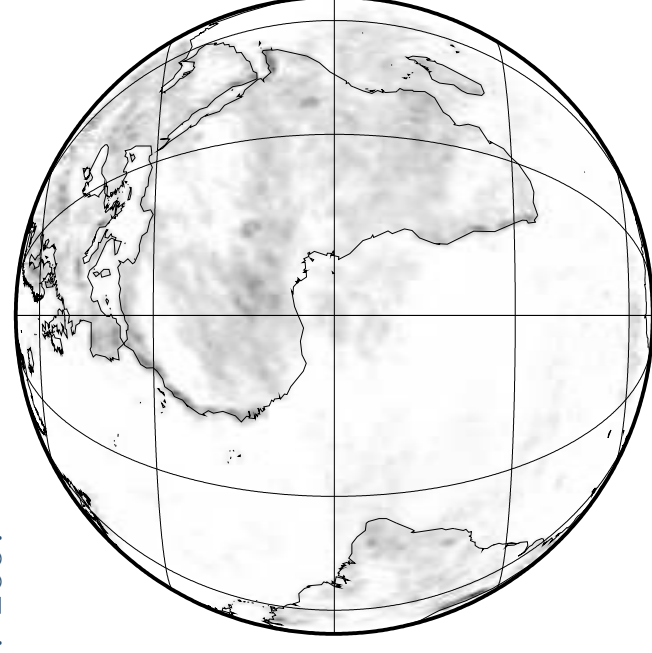
GERB-like fluxes

Further work

March 11–17 2007



CL/cs



cs/CL

Misclassification of:

- aerosols and sunglint as clouds over ocean
- clearsky equatorial forest due to persistent cloudiness
- thin clouds over land due to inadequate τ_{th}

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Ice cloud fraction over SEVIRI FOV:

Day	GERB [%]	CERES [%]	Rel. diff. [%]
11	20.52	32.60	37.05
12	19.96	32.56	38.72
13	16.81	29.22	42.47
14	18.72	32.06	41.60
15	19.45	34.11	42.99
16	19.91	33.47	40.53
17	21.30	37.00	42.43

- GERB underestimation of ice clouds ($\approx 40\%$)
- due to thin cirrus misclassified as water clouds
- Water supercooled clouds represents less than 2% of misclassification

Cloud phase (spatial)

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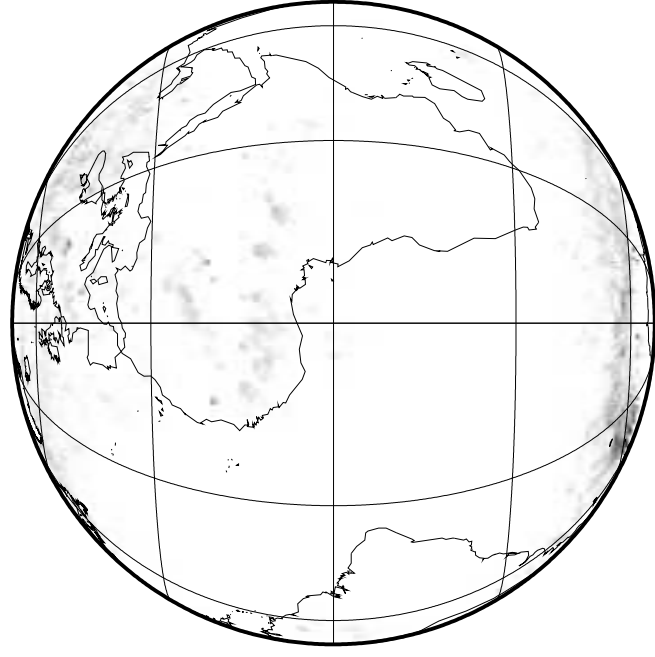
Cloud phase

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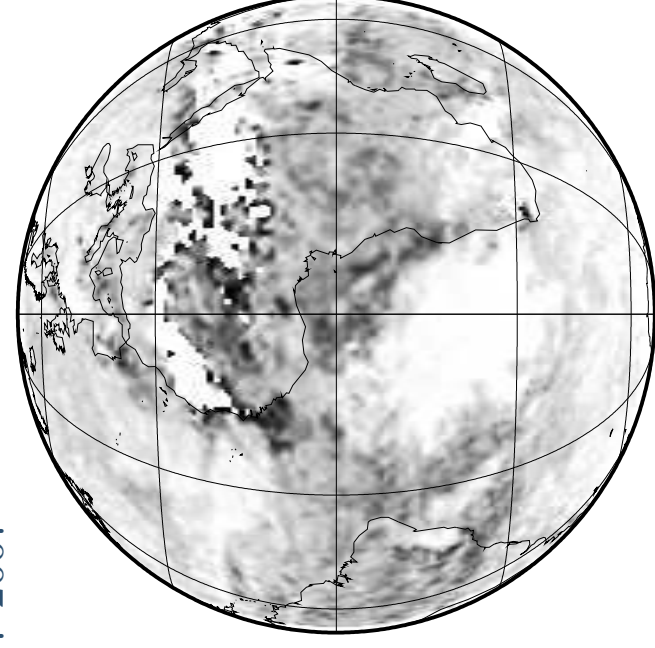
GERB-like fluxes

Further work

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i/w



w/i

Misclassification of:

- clearsky snow/ice surfaces over austral regions
- ice clouds over warm convective regions
- thin cirrus due to limited impact on BT_{10.8}

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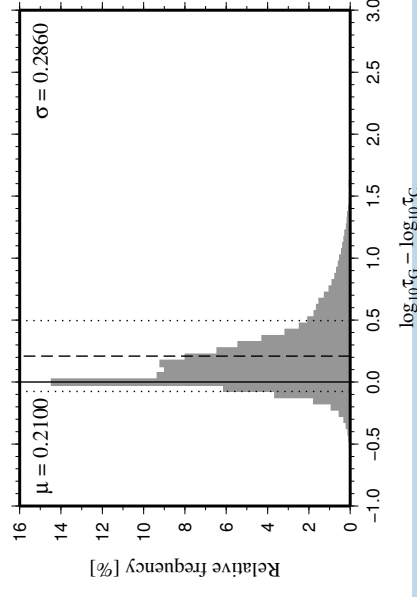
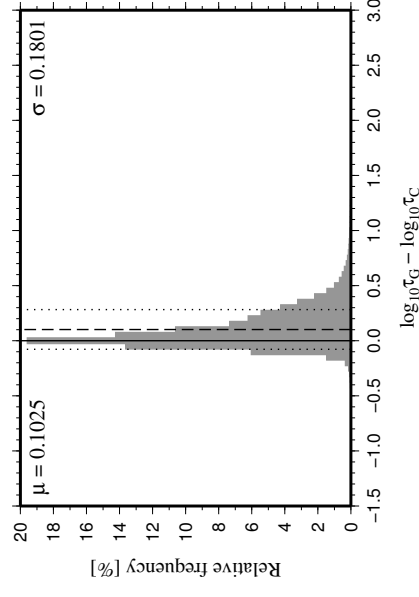
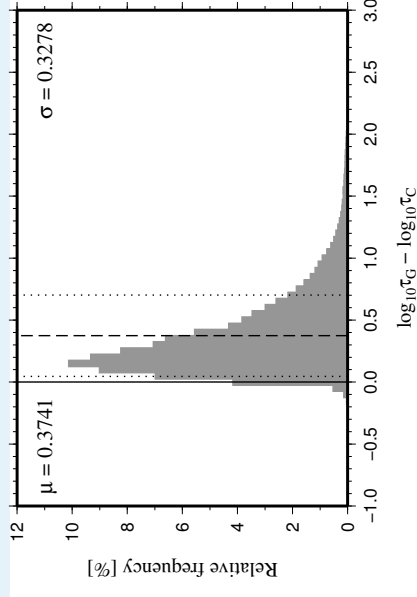
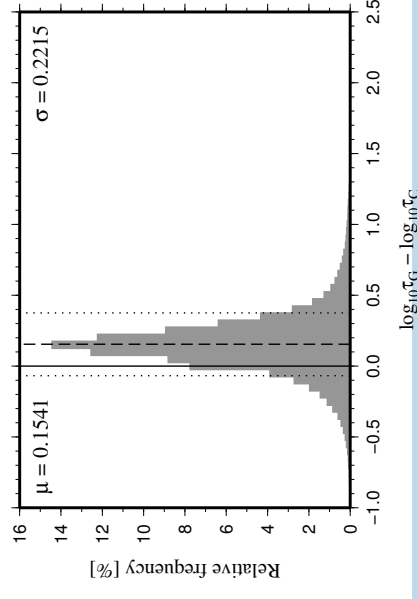
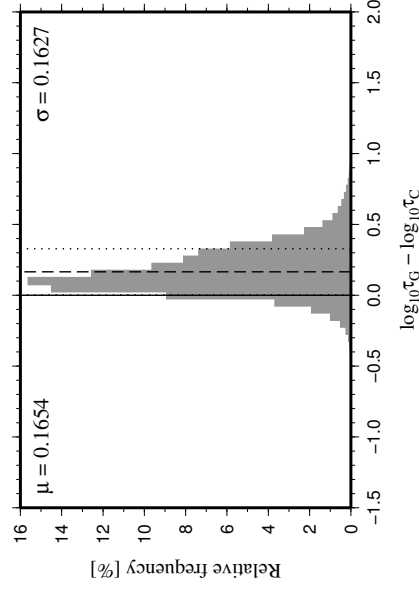
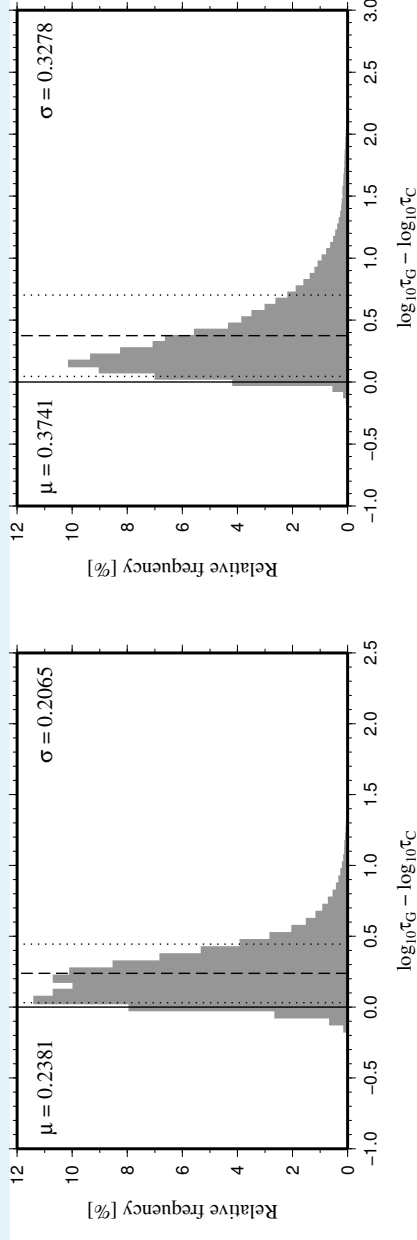
Cloud flag

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Cloud optical depth

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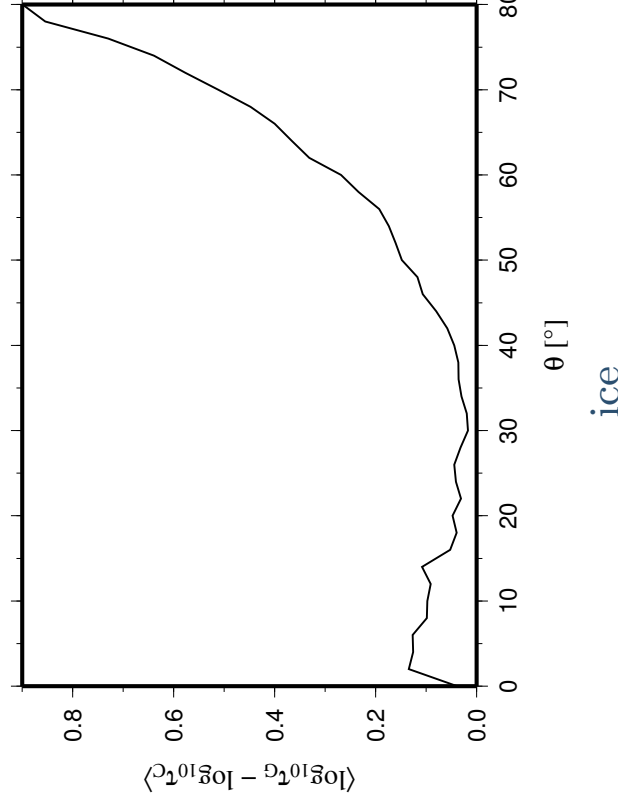
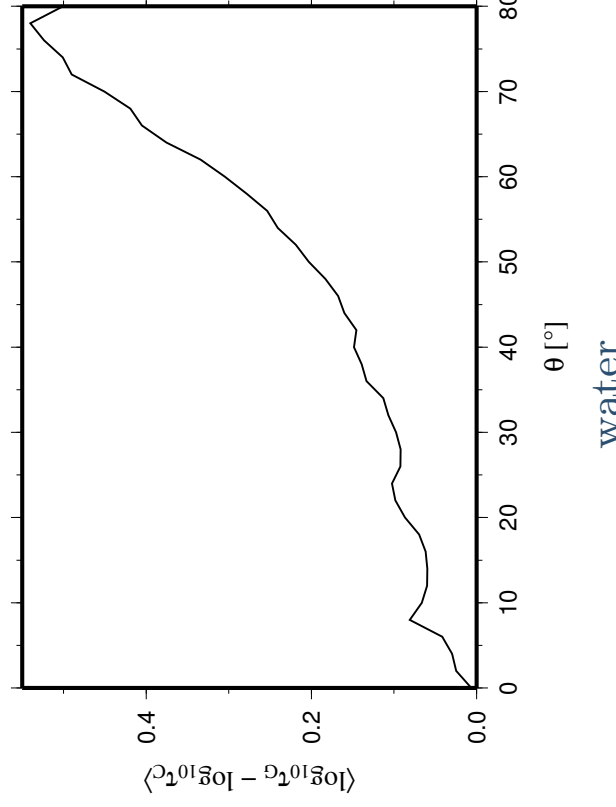
Cloud optical depth

GERB-like fluxes

Further work

GERB overestimation of τ :

- as expected from underestimation of clearsky
- higher for ocean due to higher clearsky underestimation (two modes due to sunglint and percentile clearsky models)
- increasing with solar and viewing zenith angles



GERB-like solar fluxes

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GERB-like fluxes

Further work

- GERB-like processing run on GERB and CERES cloud properties as input

- Allow to estimate relative flux errors $(F_G - F_C)/F_C$ due to ADMs misselection

Cloud fraction [%]	Ocean		Vegetation		Desert		All	
	mean	stddev	mean	stddev	mean	stddev	mean	stddev
0	0.56	4.84	0.38	14.24	0.19	8.27	0.39	9.55
0 – 10	-	-	-	-	-	-	-	-
10 – 20	-3.82	8.32	-1.71	8.81	-4.09	8.90	-3.26	8.56
20 – 30	-2.82	8.72	-3.09	8.51	-4.95	8.71	-3.06	8.68
30 – 40	-2.32	8.91	-0.30	8.53	-1.83	8.95	-1.73	8.85
40 – 50	-2.30	9.39	-1.11	8.33	-2.40	8.95	-1.96	9.08
50 – 60	-2.06	9.64	-1.20	7.57	-1.42	9.07	-1.78	9.08
60 – 70	-1.63	9.92	-2.08	7.49	-2.23	8.68	-1.79	9.24
70 – 80	-1.30	10.50	0.41	7.50	-0.09	9.07	-0.78	9.26
90 – 100	1.73	11.60	1.52	7.79	2.42	7.38	1.71	10.83
Overall	0.68	10.25	0.47	10.82	0.14	8.36	0.56	10.19

GERB-like solar fluxes

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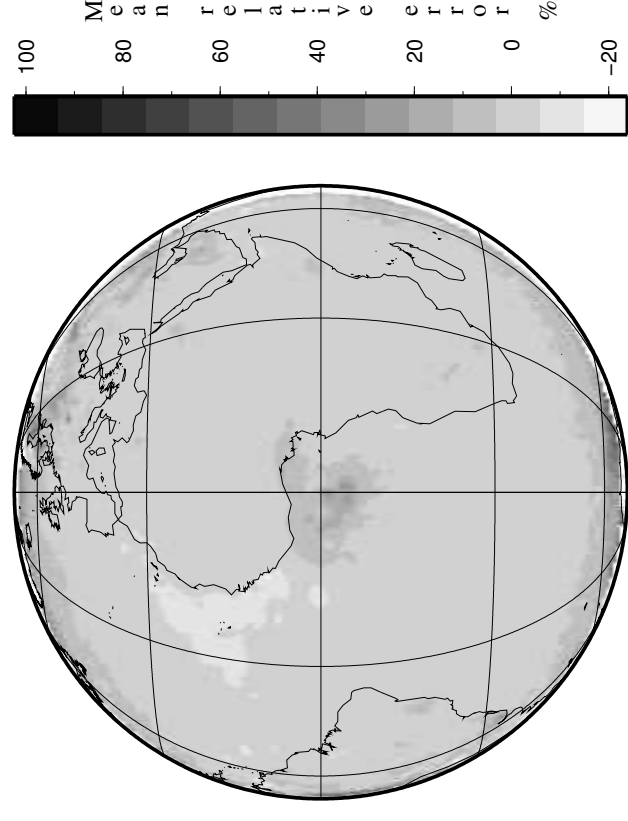
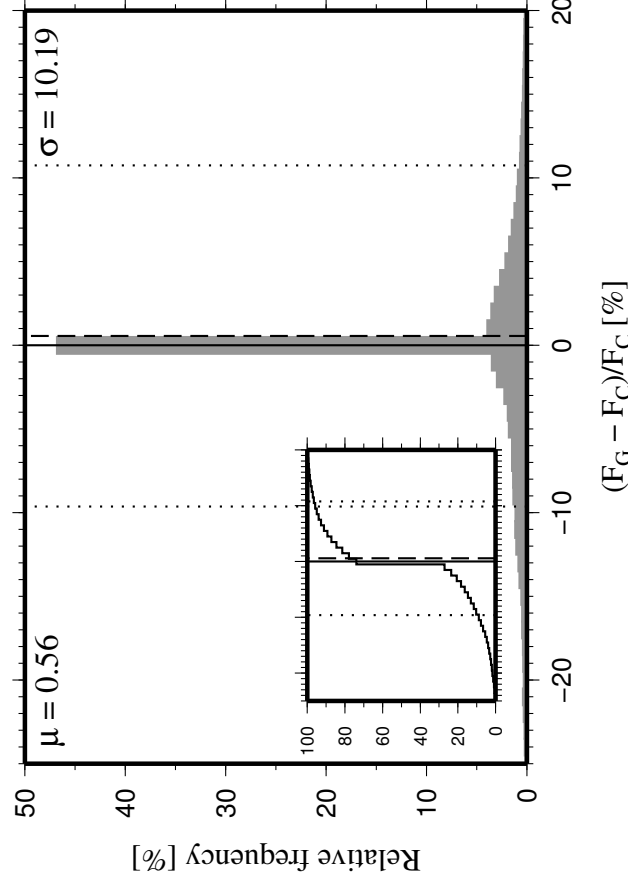
Cloud flag

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GERB-like fluxes

Further work



- Underestimation over aerosols (cloudy ADMs)
- Overestimation in sunglint regions
- Overestimation over clearsky snow/ice surfaces, but no ADMs yet
- Increased overestimation with viewing zenith angle

Further work for Edition 2

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Further work

- Clearsky
 - ◆ Benefit of realtime computation ?
 - ◆ Tuning of parameters to decrease error: sunglint model, percentile approach, $\Delta^{0.8}$
- Cloud phase
 - ◆ Multispectral detection: $\rho_{1.6}/\rho_{0.6}$, thermal bands ?
- Cloud flag
 - ◆ Retrieve dust and aerosols from cloudy flagged pixels (Helen's method)