# CM-SAF TOA radiation science report

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# What are we going to talk about...



- Brief reminder on ops status.
- Comparison CMSAF TOA products with CERES ones.
  - Instantaneous data: GERB/CERES SSF.
  - Monthly mean data: CMSAF/CERES ES9.
  - Summary.
- (new) Aerosol products:
  - What are they ?
  - How to produce them ?
  - First results and perspectives.

# Brief reminder on ops status



- GERB current situation:
  - Data available till today (um!!!)
  - Actually, from 14th of February: only available at night i.e. from 2am till 7am
  - Data processed till December 2007
- CERES current situation:
  - ES9 data available till August 2007

No CMSAF TOA data available since August 2007 !!!

# How do we do ?



We compute :

$$\text{ratio} = \frac{< \text{Flux}_{CMSAF/GERB} >}{< \text{Flux}_{CERES} >}$$

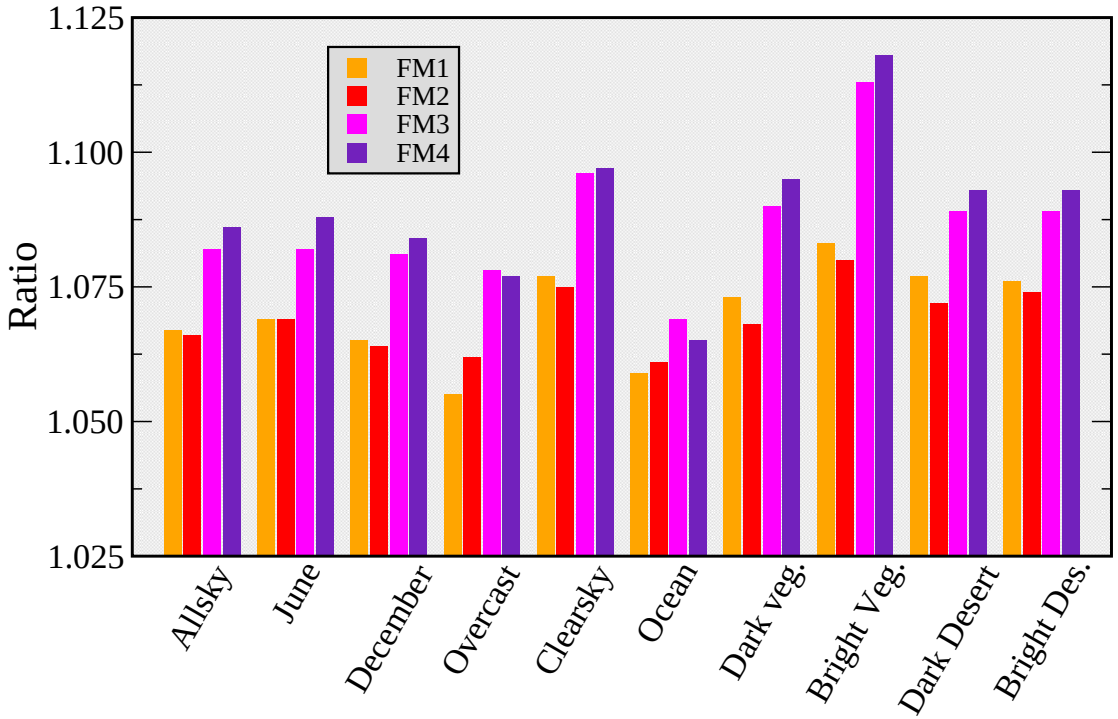
Only for viewing angle $< 70°$

- Instantaneous:
  - CERES SSF -Edition 2- revision 1 for FM1, FM2, FM3, FM4
  - GERB HR Version 3
  - June and December 2004
- Monthly mean:
  - CERES ES9 Edition 1 for FM1, FM2 ,FM3, FM4
  - CMSAF 120
  - From February 2004 till December 2006

# GERB vs CERES



## Shortwave:

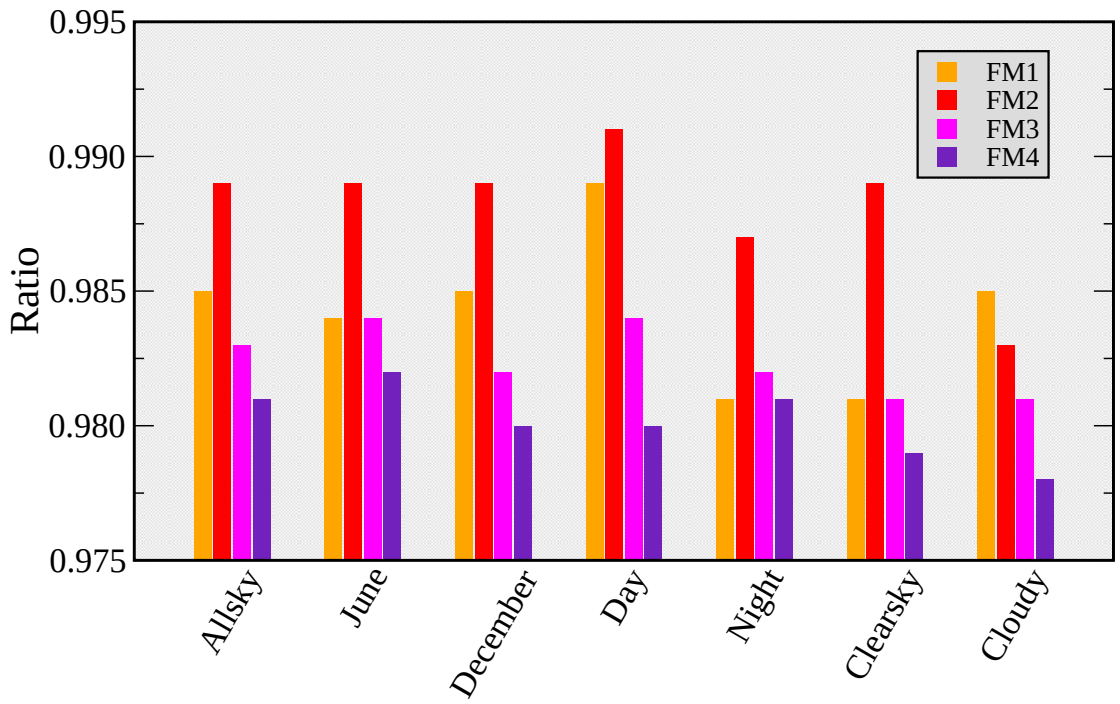



(cf. N. Clerbaux *et al.* to be submitted)

# GERB vs CERES



## Longwave:



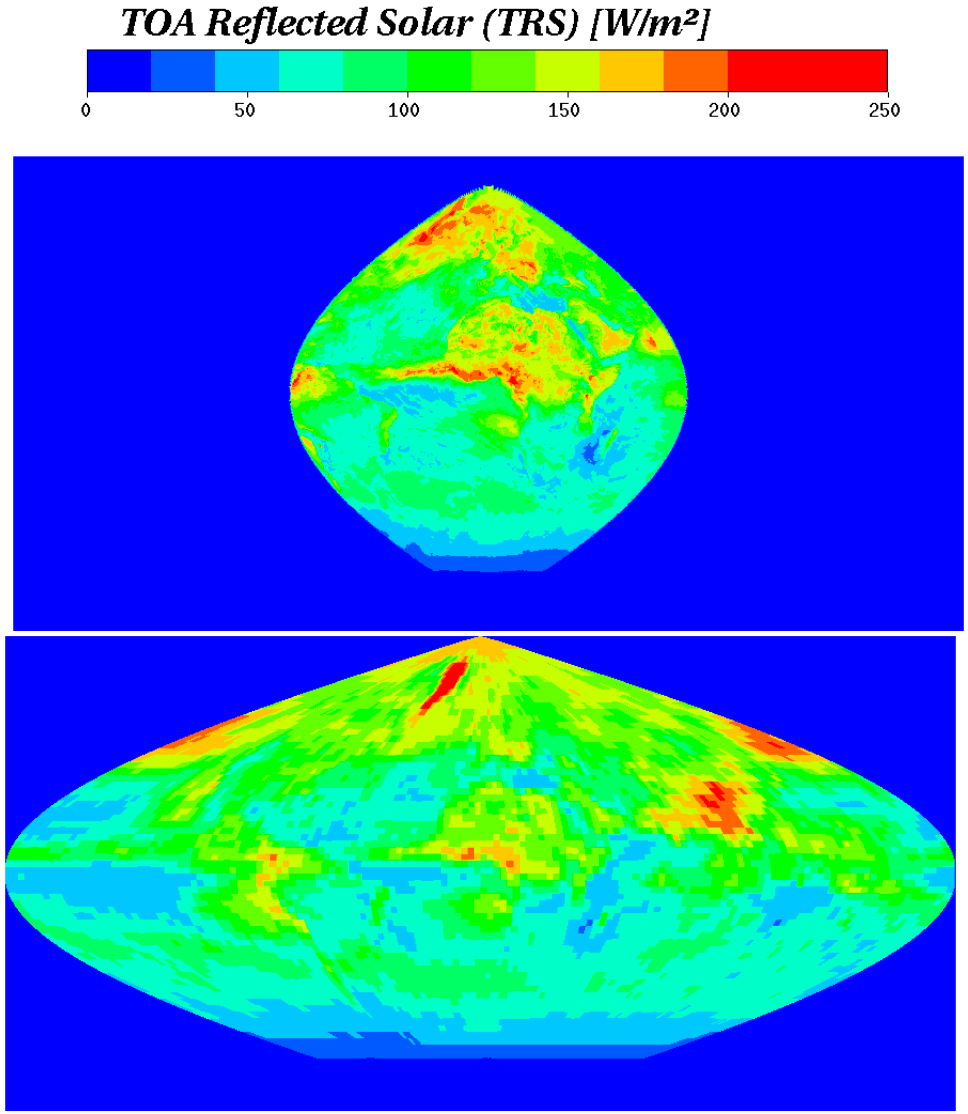

(cf. N. Clerbaux *et al.* to be submitted)

# CMSAF vs CERES

## Comparisons of monthly means: CMSAF vs CERES ES9



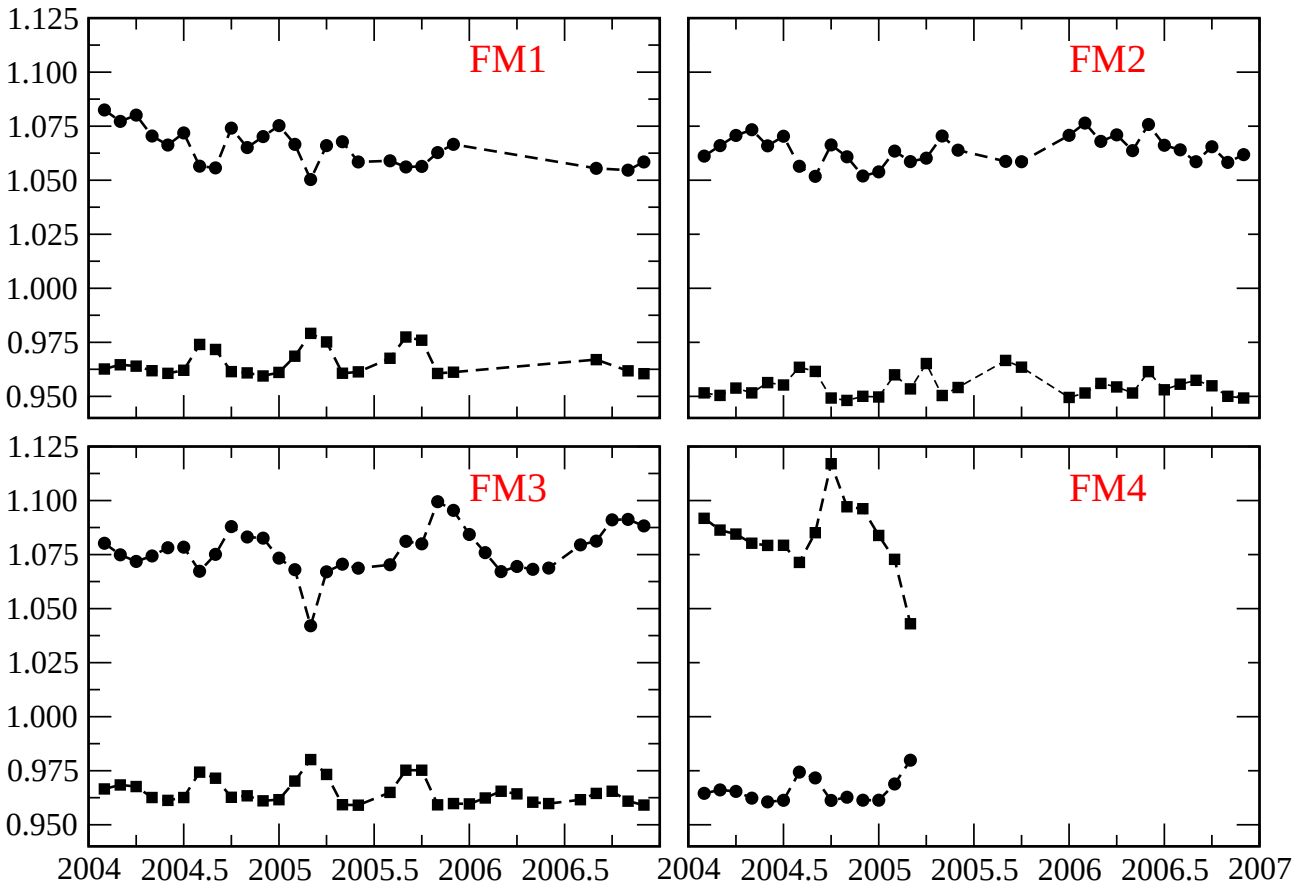
example: Total Reflected Solar flux, Monthly mean August 2005.



# CMSAF vs CERES



## Results:



# CMSAF vs CERES



Where do the bumps (in thermal ratio) come from ?

ECLIPSE season $\Rightarrow$ very few GERB data, mainly GERB-like

| Month | % GERB files |
|---|---|
| Sept. 2004 | 18.6 |
| April 2005 | 21.4 |
| Sept. 2005 | 0 |

# CMSAF vs CERES



To sum up:

- Shortwave: CMSAF higher than CERES of about 7%
- Longwave: CMSAF lower than CERES of about 3%
- GERB-like: closer to CERES than GERB (even with corrections), they affect the mean products !

Left to do:

- Comparison with SRBAVG (better product ?!?)
- Comparison for daily mean and monthly mean diurnal cycle
- Build GERB-like data tuned on GERB rather than CERES

# What do we want ?

Simply get:

- ★ Direct Radiative Effect:
  $\langle \Phi \rangle = \langle F_{\text{aerosol free}} - F_{\text{measured}} \rangle$
- ★ Aerosol Optical Depth retrieved from SEVIRI

with

$$F_{\text{aerosol free}} = \frac{\text{albedo} \times \text{Solar}_{\text{const}} \times \cos(\theta_{\text{solar}})}{d^2}$$

and

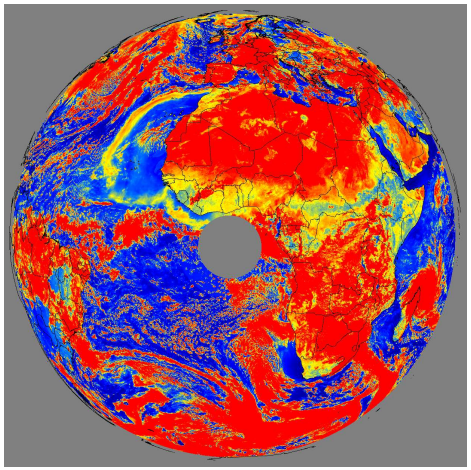
$$\langle A \rangle = \frac{1}{N_{\text{meas}}} \sum_{i=1}^{N_{\text{meas}}} A_i \times \text{ratio}_{\text{day/night}}$$

# What do we have as input data ?

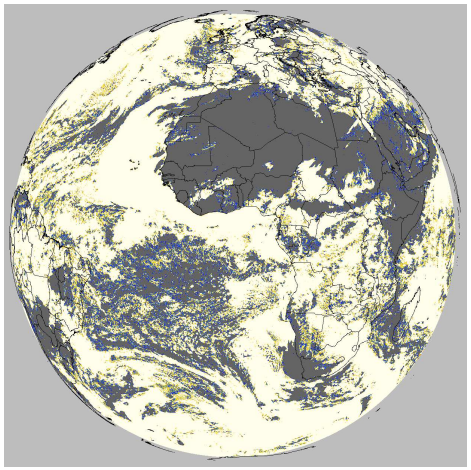
Data from 06/03/2004:



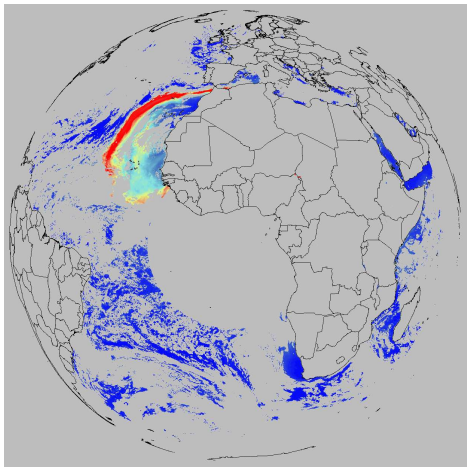
## Solar flux



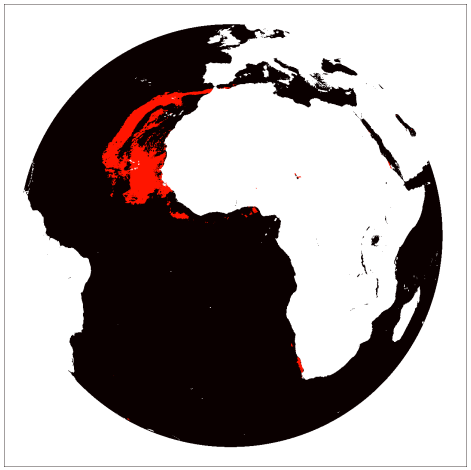
## Cloud Cover



## Aerosol optical depth $\tau$



## Dust flag



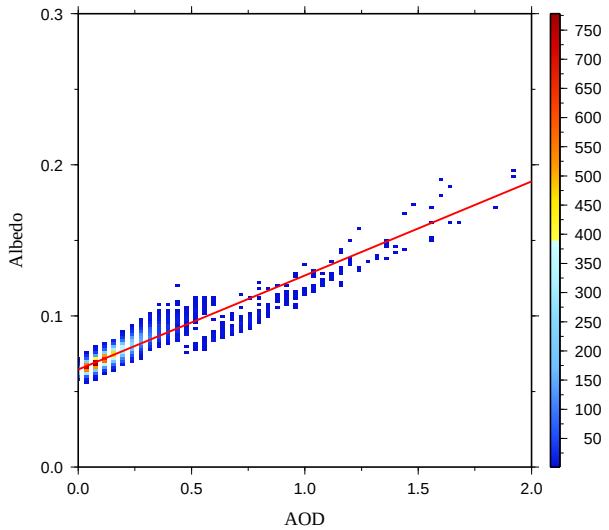
# Computing albedo



For each pixel, over a whole year, we only select clearsky or dust conditions, then:

$\mathrm{albedo_{free}} = \mathrm{albedo\,extrapolated\,for}\,\tau = 0$

example pixel over Atlantic Ocean ($31°\mathrm{W}, 24.6°\mathrm{N}$), $\theta_{solar} = 10°$, 2004:



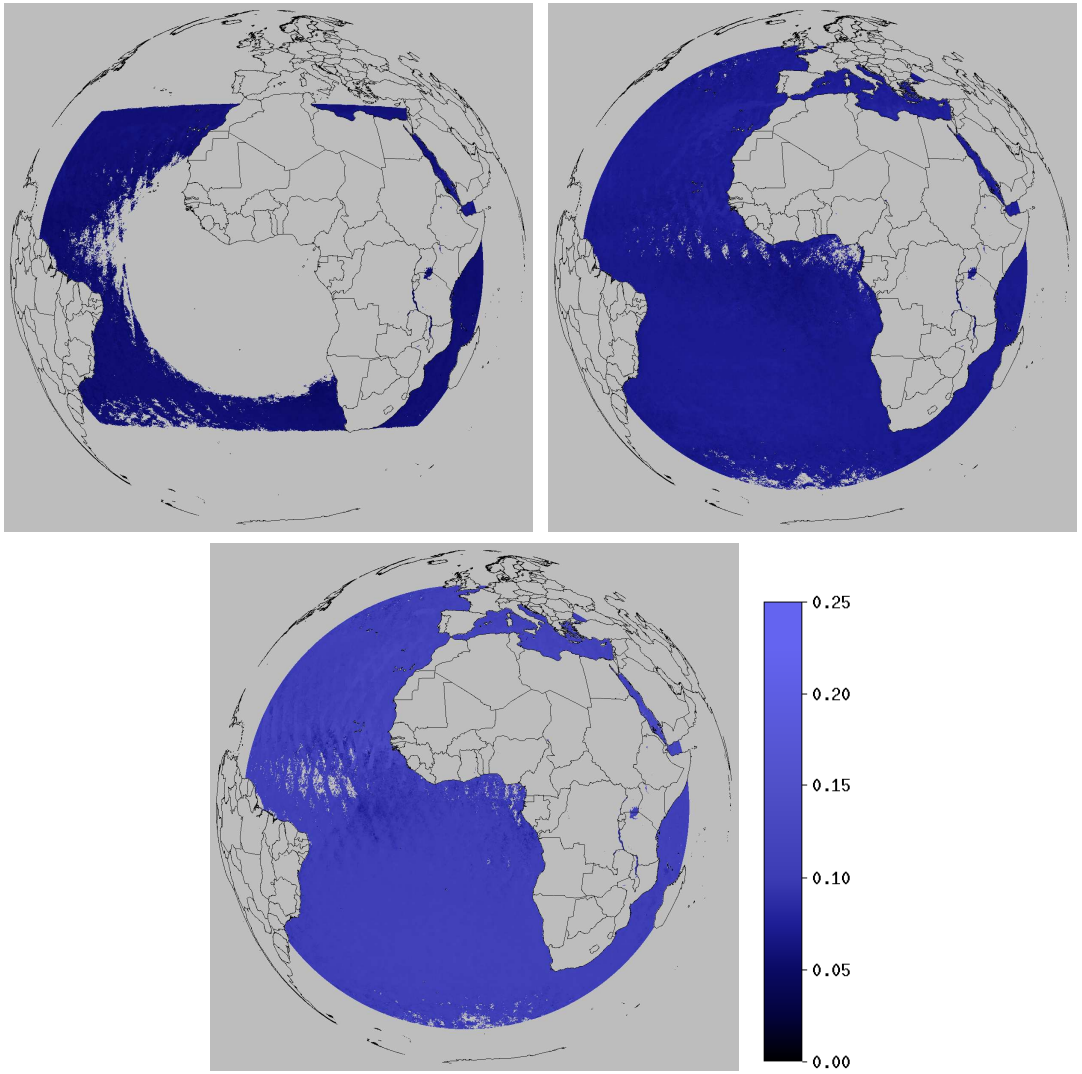

We have then 210 maps per year corresponding to

* 70 solar angles ($1°$ of resolution)
* 3 bands of retrieval: $0.6$, $0.8$ and $1.6\mu m$

# Albedo maps

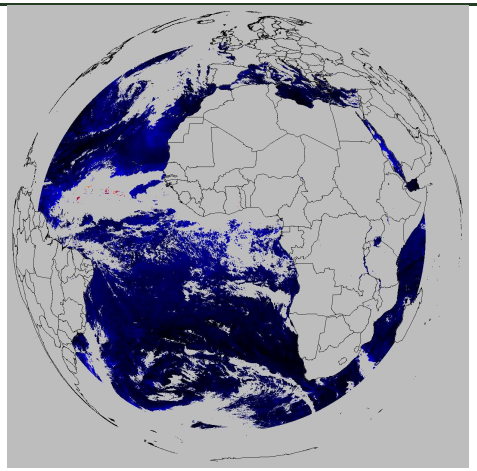
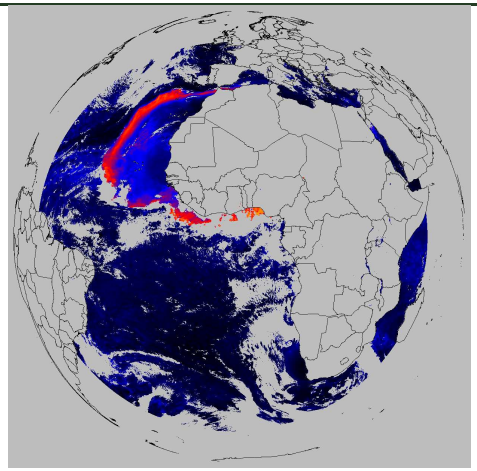
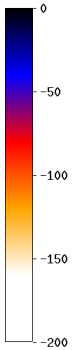
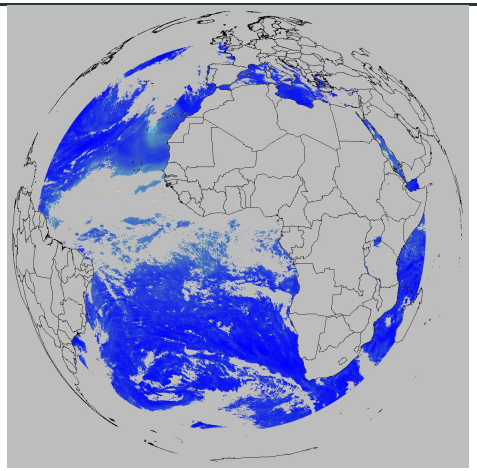
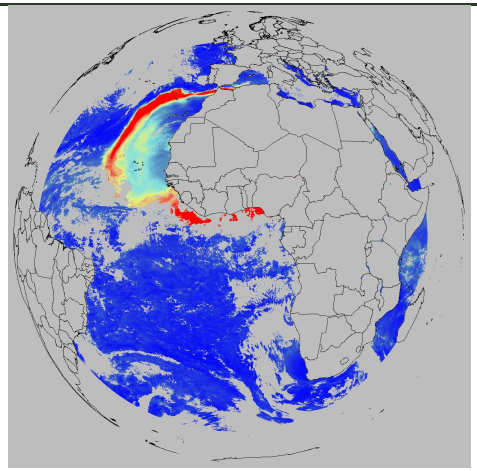
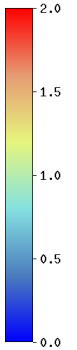
Examples for solar zenithal angle of $10°$, $40°$ and $60°$





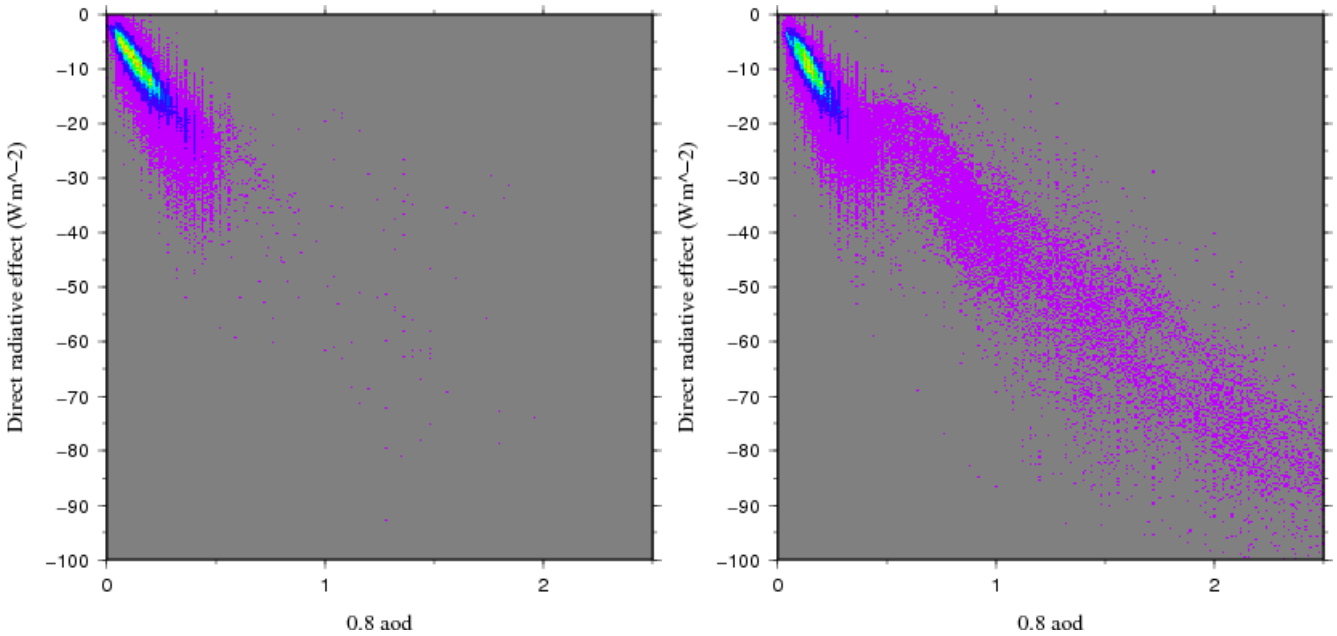
# Direct radiative effect: first results

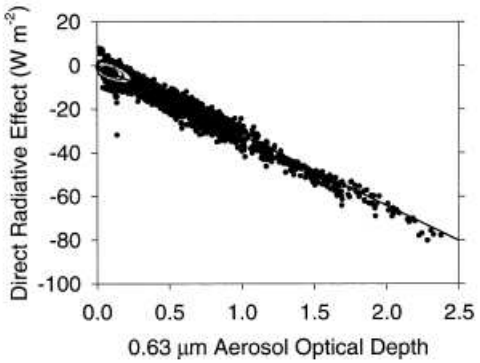


| 15/02/2004 | 06/03/2004 | |
|---|---|---|
| Direct Radiative Effect Daily Mean | | |
|  |  |   |
| Aerosol Optical Depth Daily Mean | | |
|  |  |   |

# Direct radiative effect: comparisons






from N. Loeb and S. Kato, J. of Climate **15**, 1474 (2002)

# Perspectives



- ★ Reduction of *cloud* contamination
- ★ Processing from february 2004 till now
- ★ Implementation of Monthly and Yearly mean
- ★ Direct radiative effect due to clouds