# Combination of Meteosat-5 and CERES/Terra data for SW fluxes over the Indian Ocean

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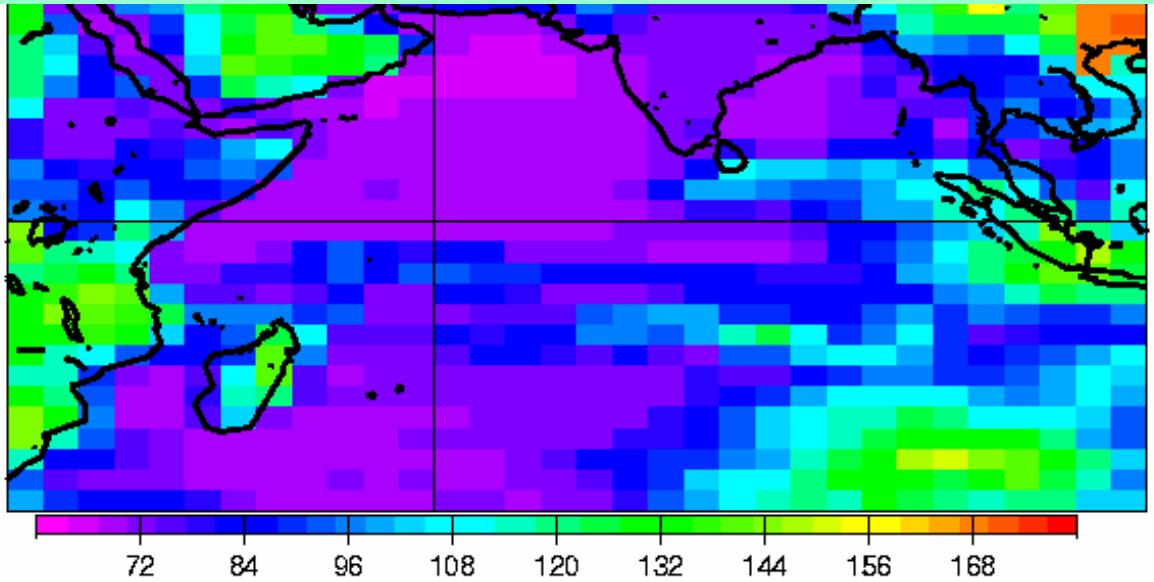
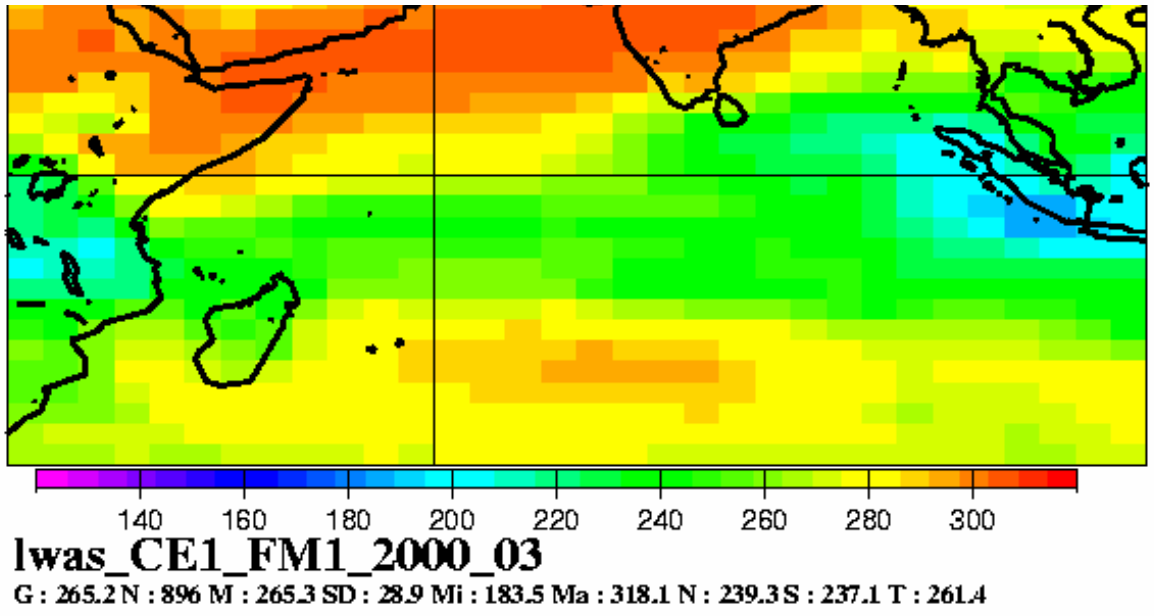
# INDOEX Area

**SW**

**March 2000**
**CERES/Terra**




**LW**

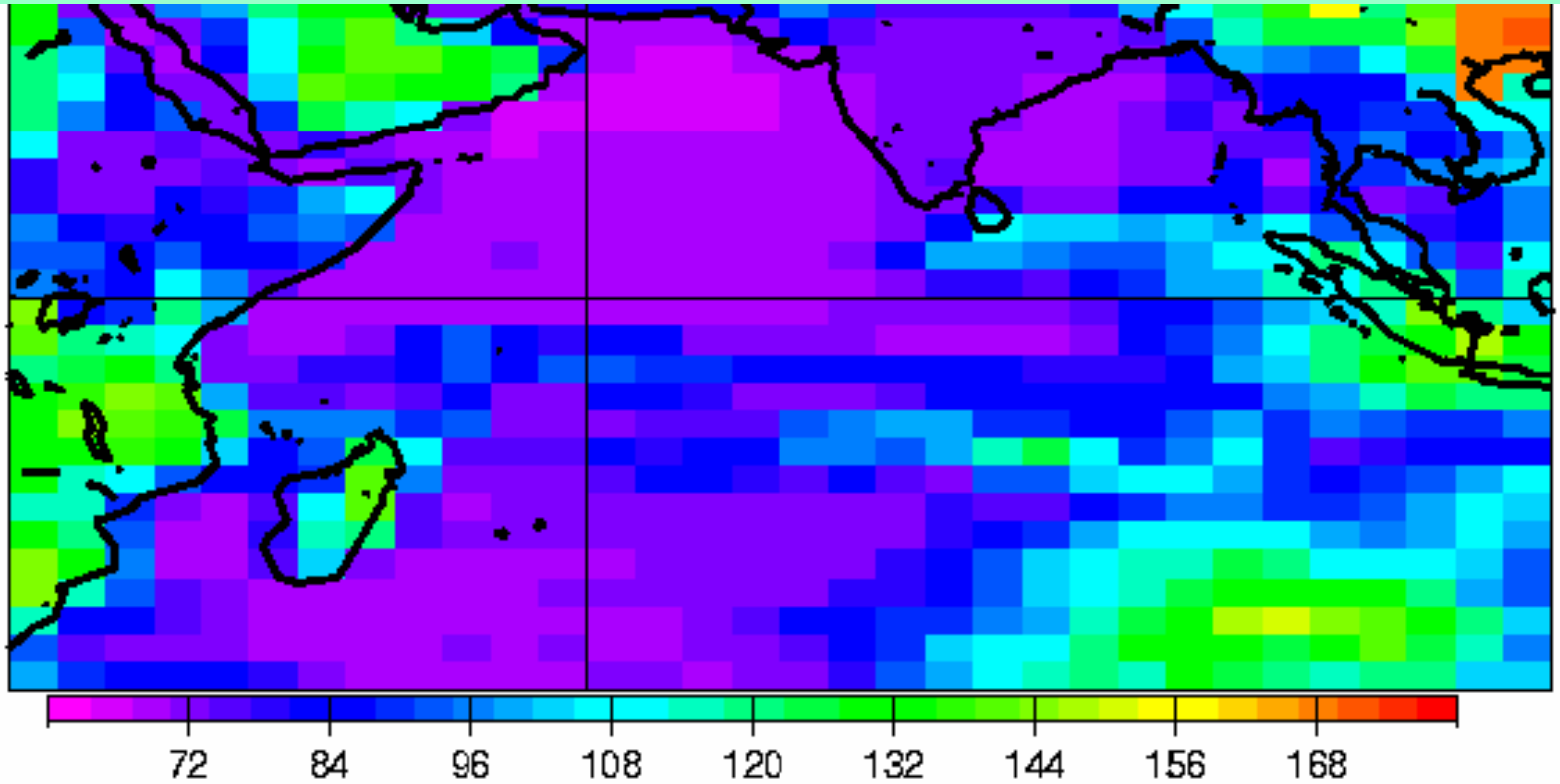



Sept. 2002

M. Viollier, P. Raberanto, R. Kandel

# INDOEX Area

## March 2000 CERES/Terra SW



# SW Flux from Meteosat-5

**Status as of the Williamsburg meeting :**
difficulties in finding Meteosat calibration and NB-BB conversion

After many attempts, we settled on the formula

$$F_{sw} = a_{scn} \left( [\, \pi S_{scn} \cdot N_{vis} \,] / R_{scn} \right) + b_{scn} \qquad (1)$$

$N_{vis}$ : Meteosat numerical count,

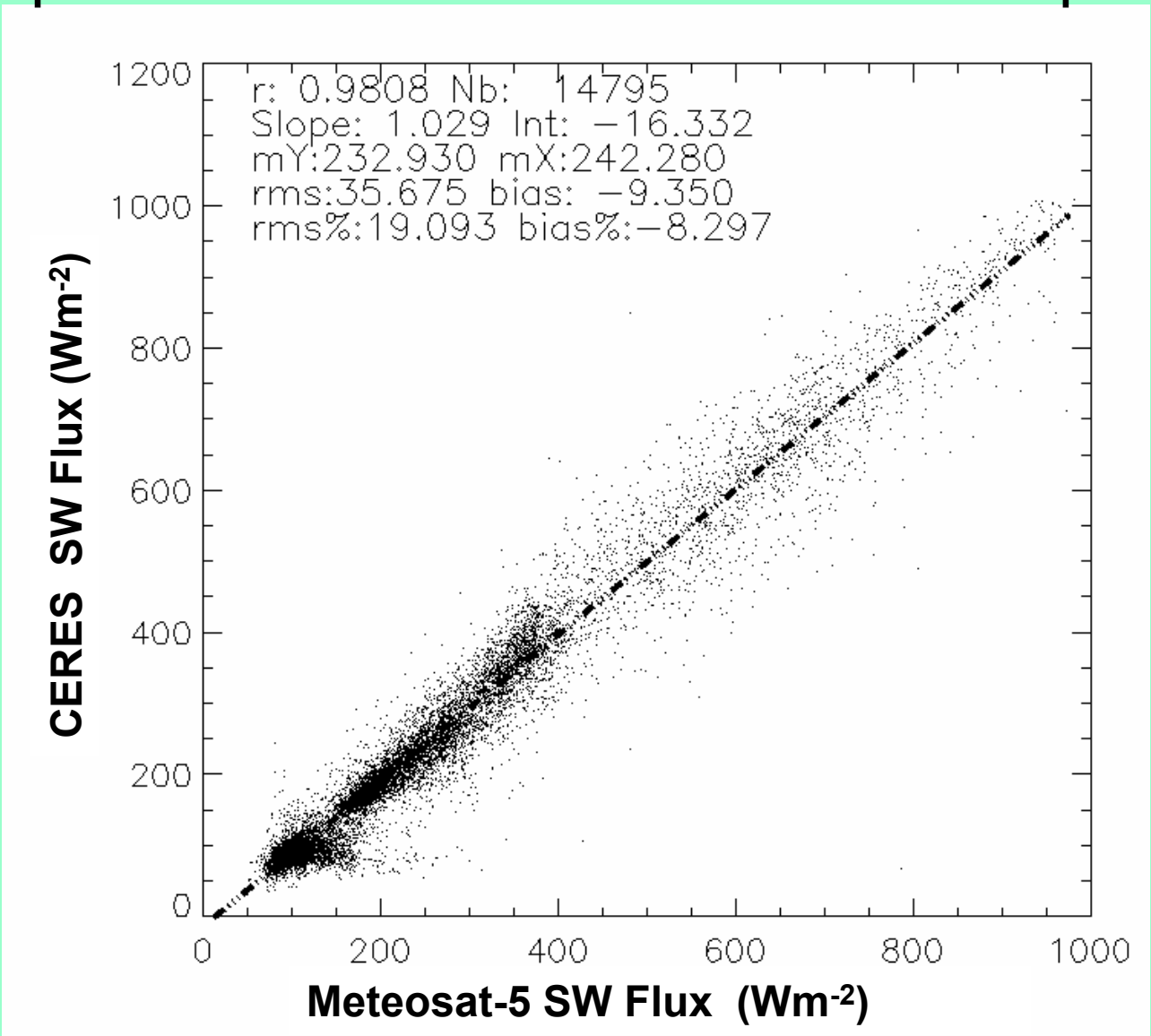
$R_{scn}$ : ERBE scene-dependent BRDF (Suttles et al. 1988),

$S_{scn}$ : spectral correction, depends on Geotype, Cloud Cover.

$a_{scn}$, $b_{scn}$ and $S_{scn}$ : depend on Geotype (ocean, land, desert)

Values determined by linear regression
between co-registered ScaRaB and CERES flux estimates.

# Example: CERES-FM2 Meteosat-5 Comparison



# Broad-Band (ScaRaB or CERES) – Narrow-Band (Meteosat-5) Comparison

| Instrument | Pop. Size | Mean Flux | R | Δ (BB-Ms5) | | Simple Regression | |
|---|---|---|---|---|---|---|---|
| | | $Wm^{-2}$ | | rms | Bias | R | rms |
| ScaRaB – March 1999 | 7909 | 207.1 | 0.984 | 43.2 | +0.82 | 0.982 | 44.0 |
| same, with homogeneity constraints | 3480 | 211.3 | 0.987 | 22.7 | -1.99 | 0.992 | 26.6 |
| CERES -TRMM March 1999 | 15456 | 192.0 | 0966 | 45.6 | -5.50 | 0.956 | 52.1 |
| -TRMM March 2000 (4 d) | 9334 | 217.8 | 0.976 | 41.7 | -7.84 | 0.969 | 48.0 |
| - TERRA FM1 (11 d) | 13962 | 218.9 | 0.975 | 38.4 | -9.40 | 0.955 | 51.2 |
| - TERRA FM2 (12 d) | 14795 | 232.9 | 0.981 | 35.7 | -9.35 | 0.971 | 43.4 |

**Differences a few percent 1999-2000 differences may be due to Meteosat degradation**

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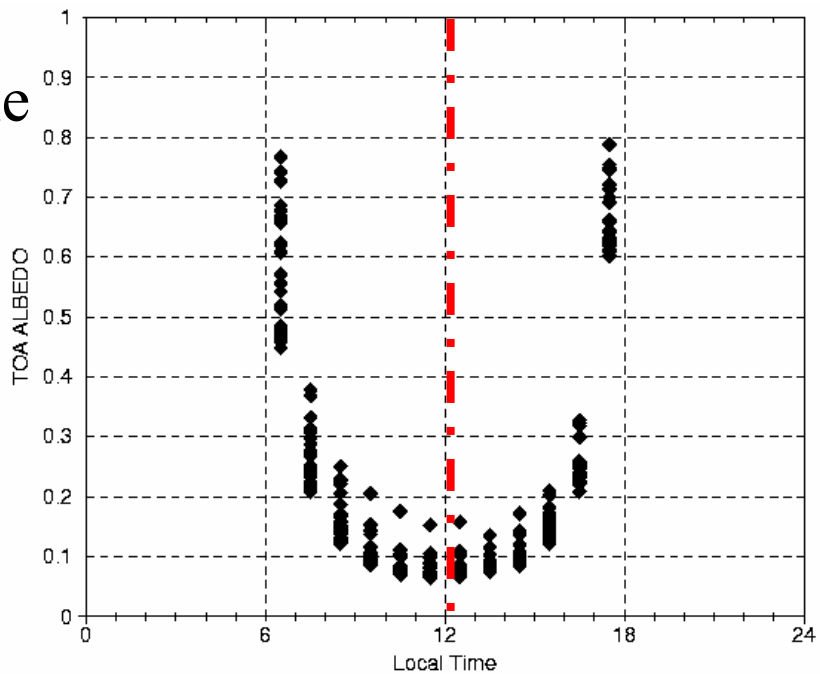
« Scene corrections » improve the correlations, but only very slightly !
( Mismatches, ADMs, NB-BB errors )

# Monthly Means Computations

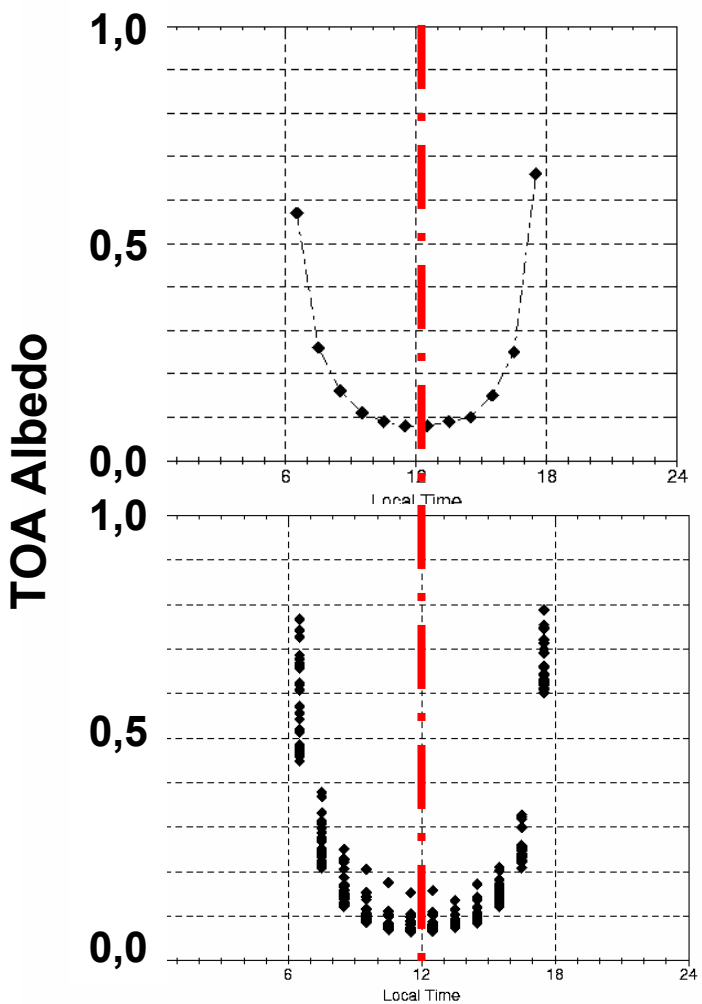
- compute instantaneous fluxes from Meteosat-5 (eq. 1)
- average the fluxes (2.5°x2.5°) and fill the 24x31 day-hour table (applying cos SZA corrections between observation time and local half-hour, eliminating spurious data, twilight and night-time data)
- use the ERBE-type code, with CERES flux estimates

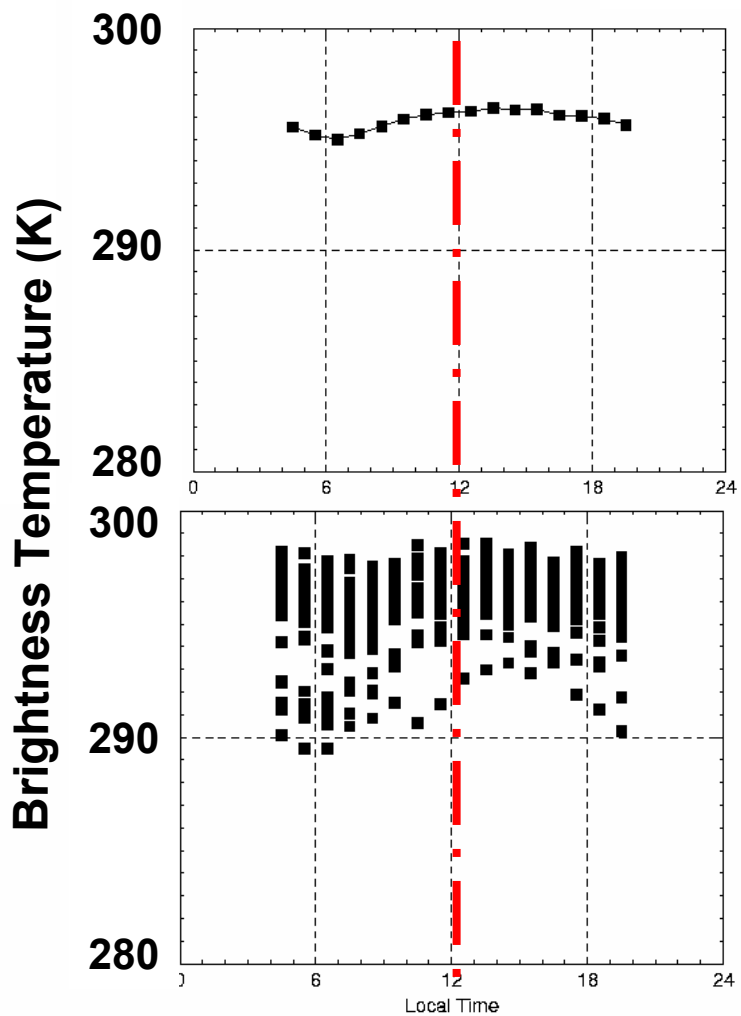



- use the GEO observed diurnal albedo variation shape in place of the ERBE modeled albedo

# Meteosat-5 diurnal albedo: clear sky

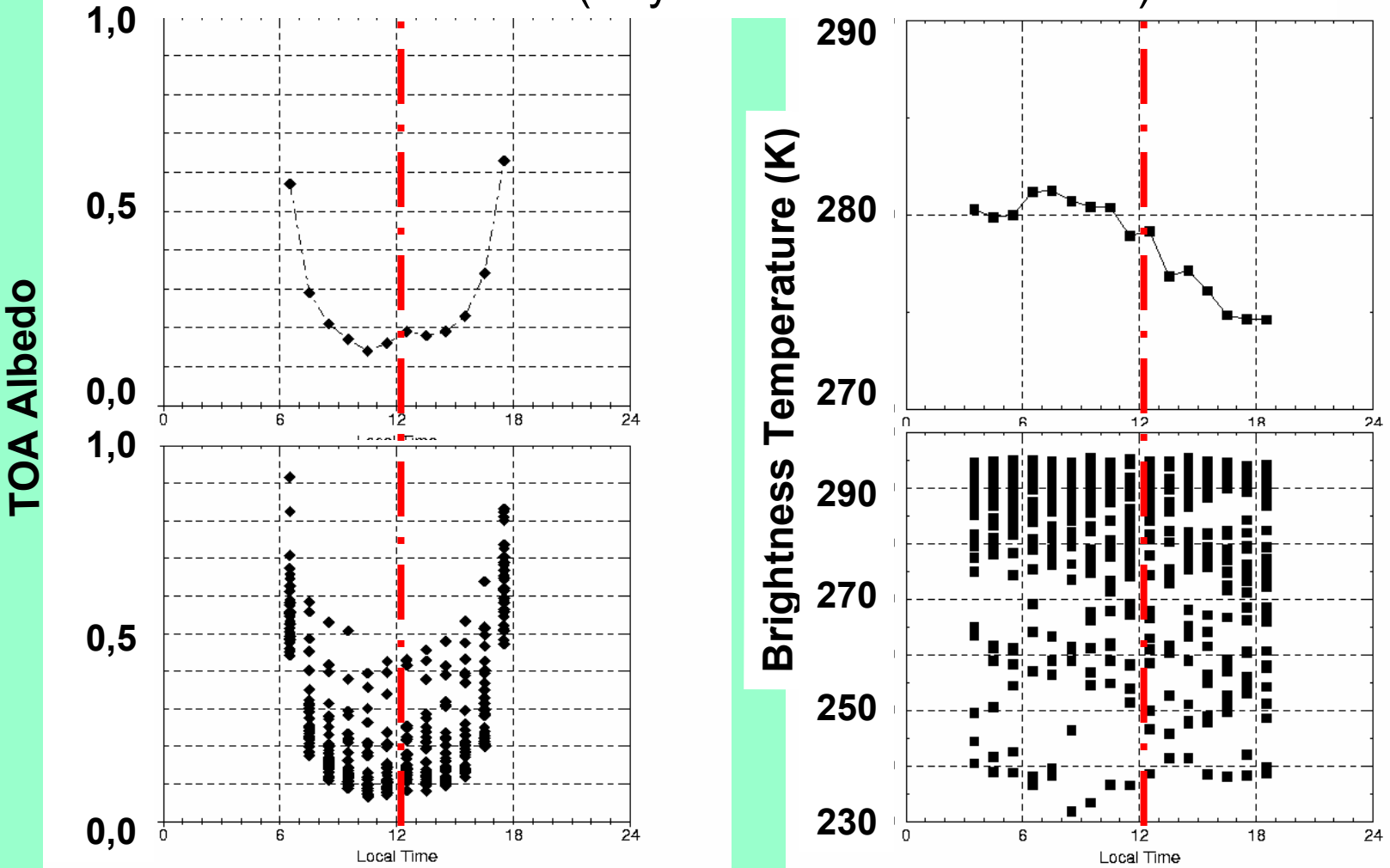
REGION 4748 (Clear Ocean) — Monthly Means



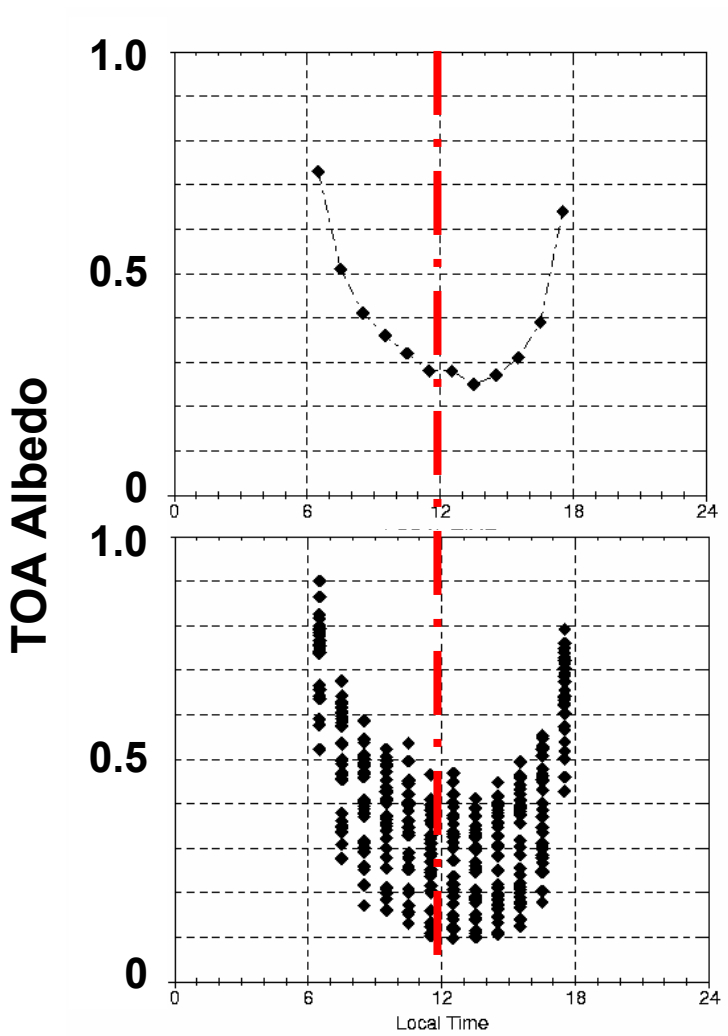
# Meteosat-5 diurnal albedo:
## dominant afternoon cloud

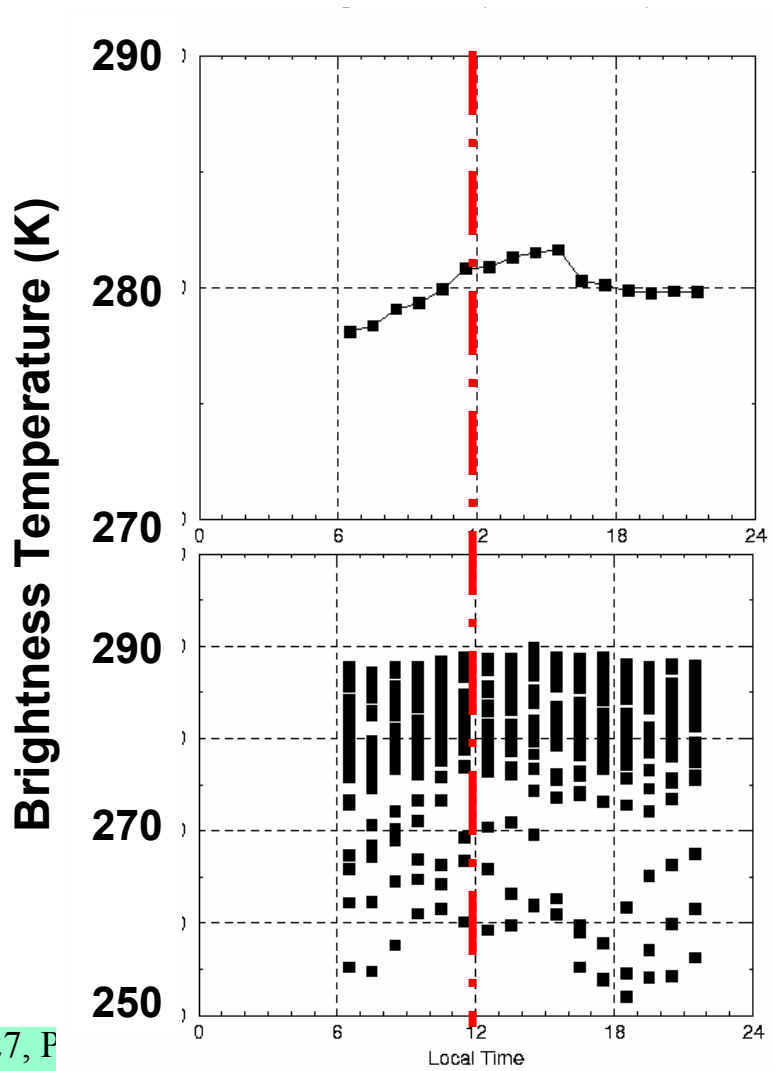
REGION 5494 (Seychelles – Indian Ocean)



# **Meteosat-5 diurnal albedo:**
# dominant morning cloud

REGION 6808 (Indian Ocean west of Australia)

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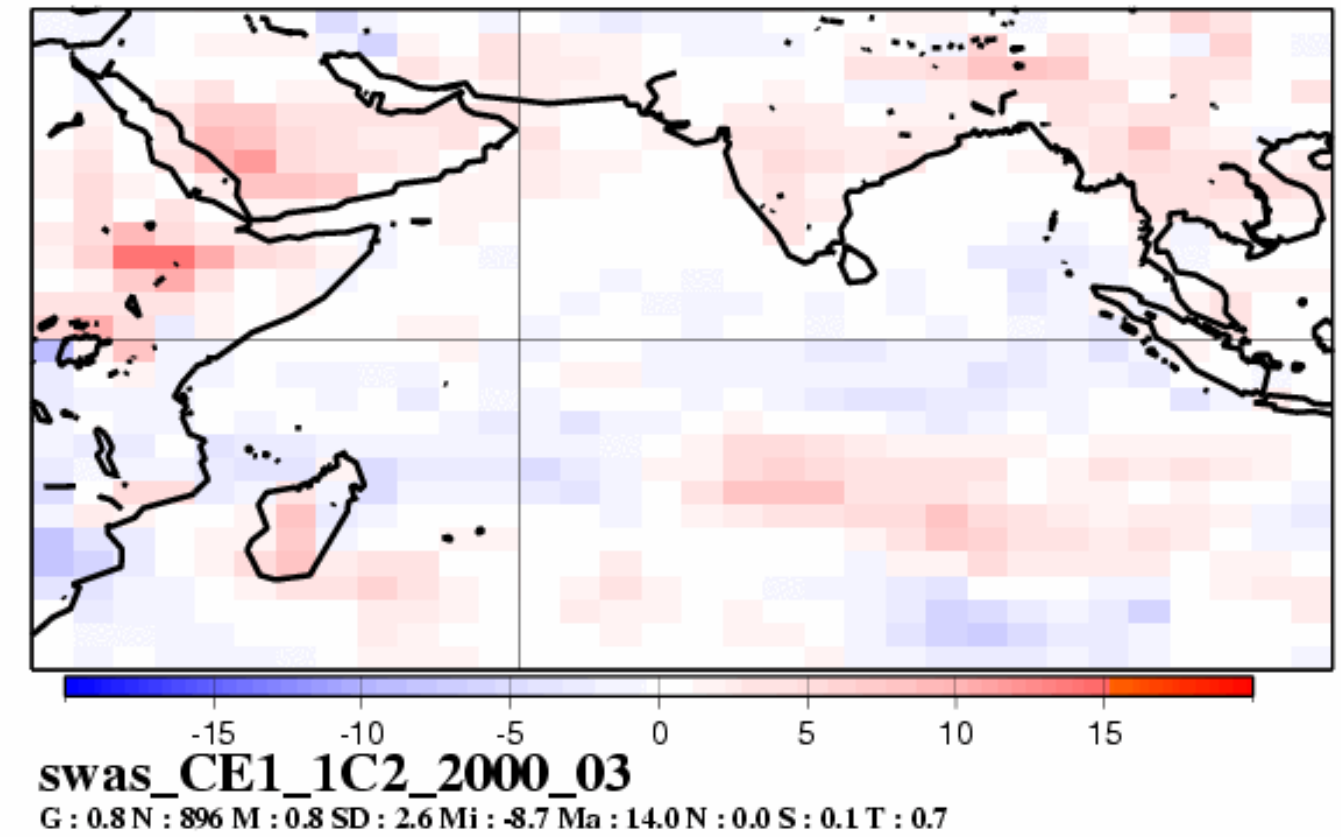
# New minus ERBE-type computations ($W/m^{-2}$ March 2000)

With correction based on "climatological" albedo diurnal cycle
(Standfuss et al., *J.Climate*, March 2001)

**Minimum**
**(-10 $Wm^{-2}$ )**
**Central Africa**

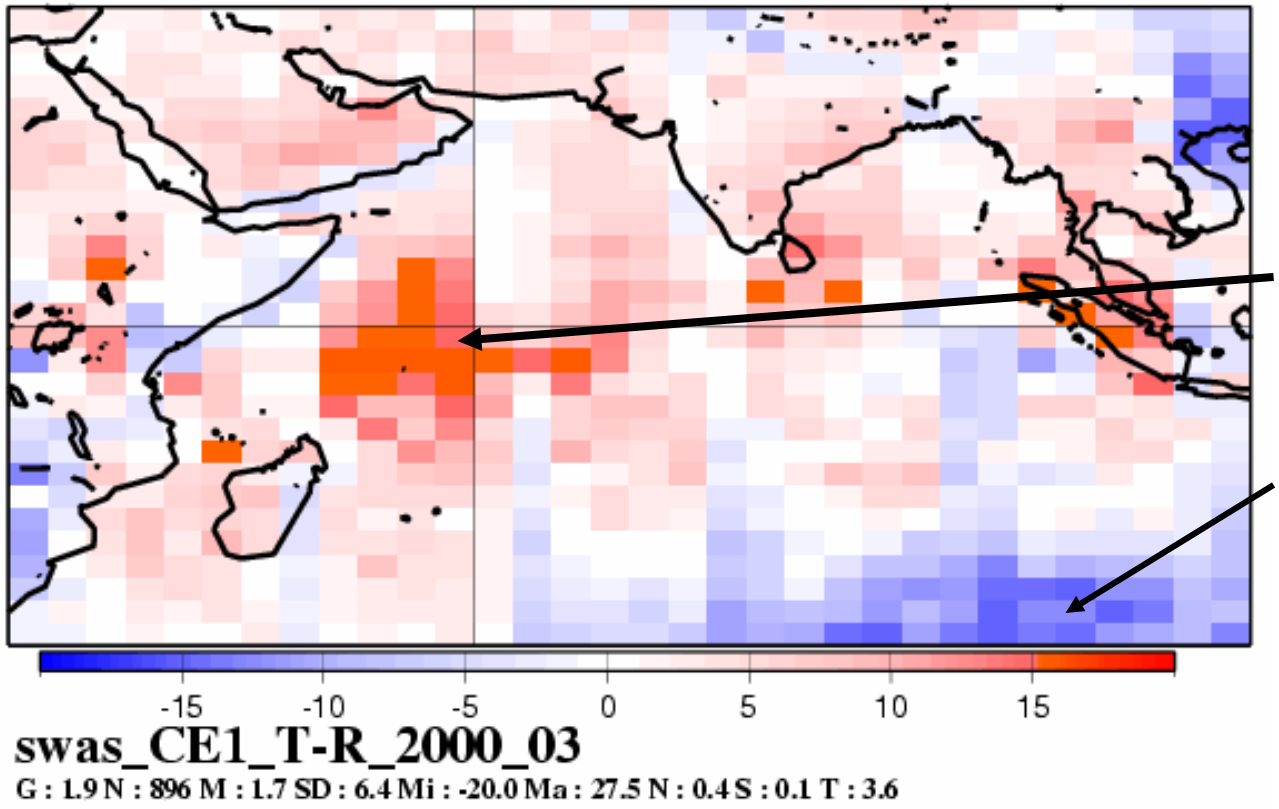
**Maximum**
**(+10 $Wm^{-2}$)**
**Lake Victoria**

**Tropical Mean**
**+0.7 $Wm^{-2}$**



# New minus ERBE-type computations ($W/m^{-2}$ March 2000)

Taking into account the 31*24 day-hour GEO observations




**Maximum**
**(+20 $Wm^{-2}$)**
**around Seychelles**

**Minimum**
**(-20 $Wm^{-2}$ )**
**ocean west of Australia**

**Tropical Mean**
**+ 3.5 $Wm^{-2}$**

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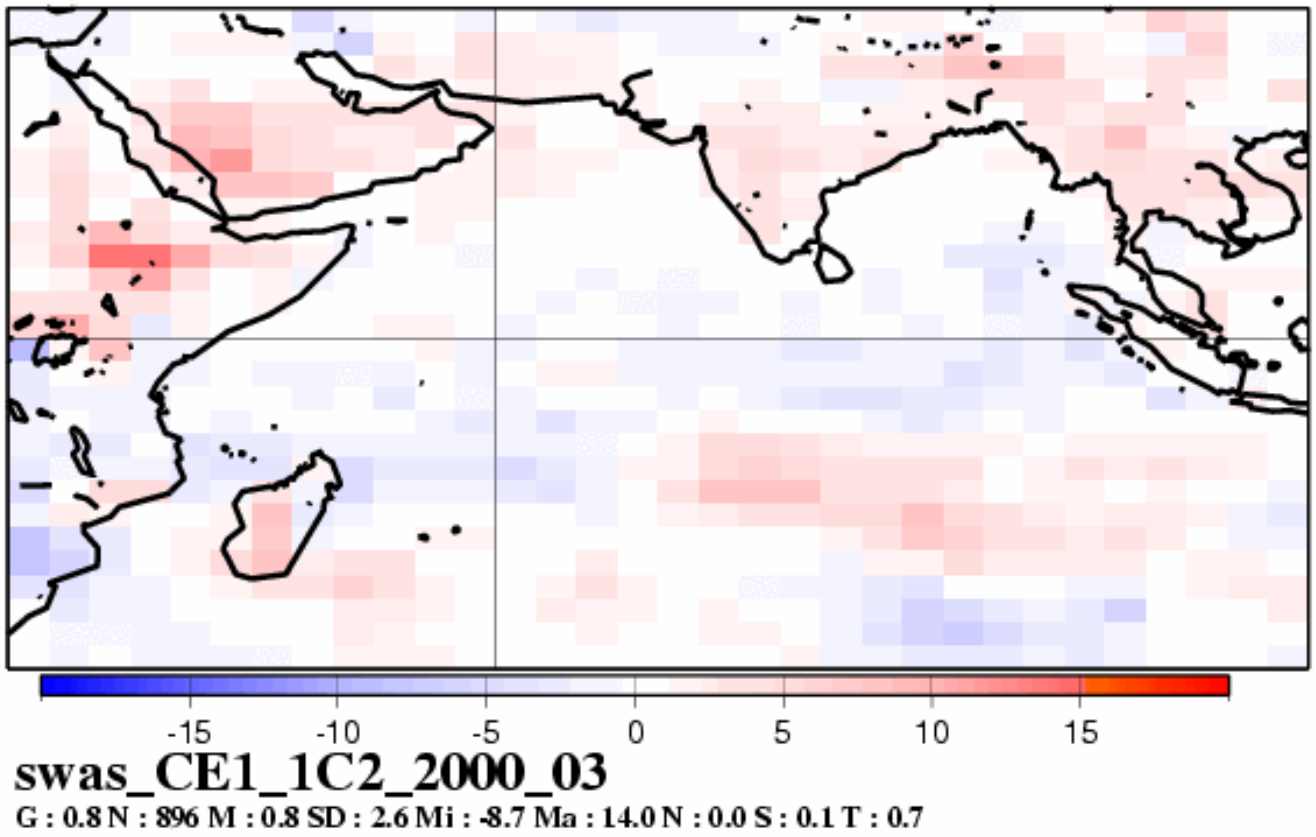
(Standfuss et al., *J.Climate*, March 2001)




**Minimum**
**(-10 $Wm^{-2}$ )**
**Central Africa**

**Maximum**
**(+10 $Wm^{-2}$)**
**Lake Victoria**

**Tropical Mean**
**+0.7 $Wm^{-2}$**

**Some similarity (over continent), but the 'Seychelles' correction is missing**

# Conclusions

- many difficult issues (calibration, NB-BB conversion, angular corrections)
- many potential bugs in coding combined GEO-CERES TISA

- use of the ERBE-type code with CERES fluxes and the GEO observed shape of the diurnal albedo variation should have reduced errors

- dominant afternoon cloud yields overall positive correction
- Tropical Mean (longitudes 30°-110° E) = +3.6 $Wm^{-2}$

- this study to be compared with the GGEO TISA (D. Young)