Combination of POLDER with CERES for ADM studies: broadband conversion checking

M. Viollier, P. Raberanto
Laboratoire de Météorologie Dynamique , IPSL/CNRS, Ecole Polytechnique
Palaiseau, France

J.C. Buriez F. Parol
Laboratoire d'Optique Atmosphérique,
Université des Sciences et Technologies de Lille, France

P. Couvert, Z. Poussi
Laboratoire des Sciences du Climat et de l'Environnement, CEA, Gif sur Yvette, France

LMD general ERB concerns

the LMD CERES co-investigation:
time interpolation studies (CERES-Meteosat combinations)
(my presentation on Friday, April 2nd, GIST-21)

other current ERB concerns :
- ScaRaB following-on (MeghaTropiques*)
- ADM BBR EarthCARE* studies (E. Lopez-Baeza presentation)
- POLDER, ERB and clouds processing line : this presentation
- links with IPSL climate modeling activities

(*however, MeghaTropiques and EarthCARE projects
face severe budget and selection issues)

Combination of POLDER with CERES for ADM studies: broadband conversion checking

Objectives

- contribution to multi-angle observations for the radiance-to-flux conversion studies

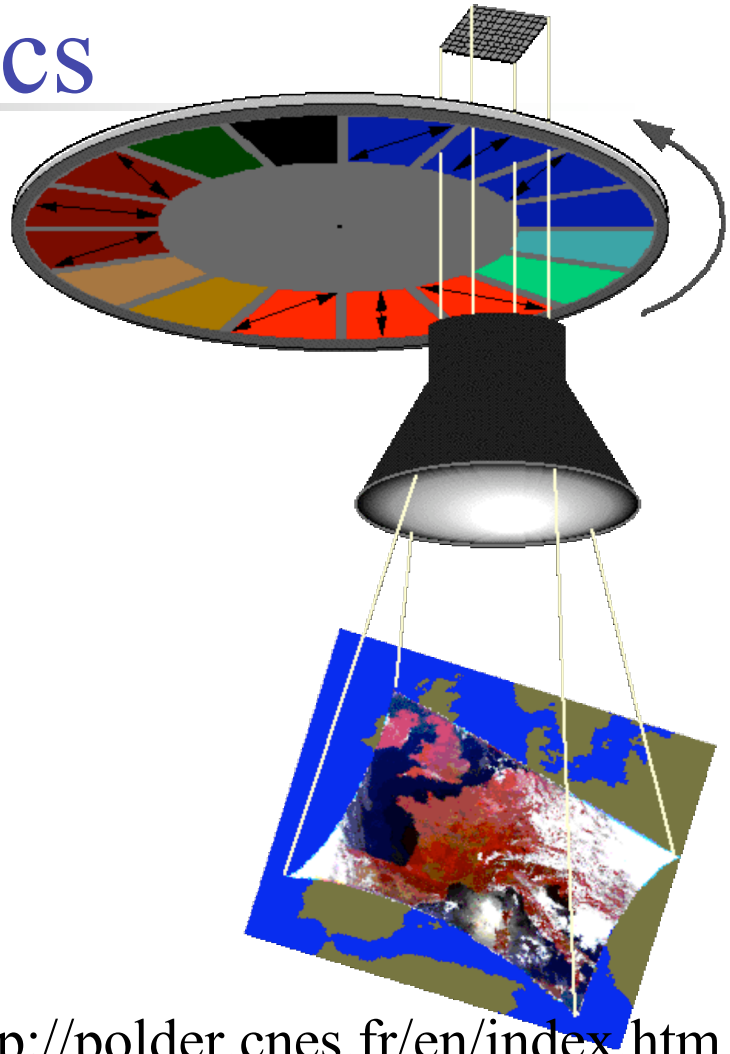
- contribution to the validation of the GERB radiance-to-flux conversion

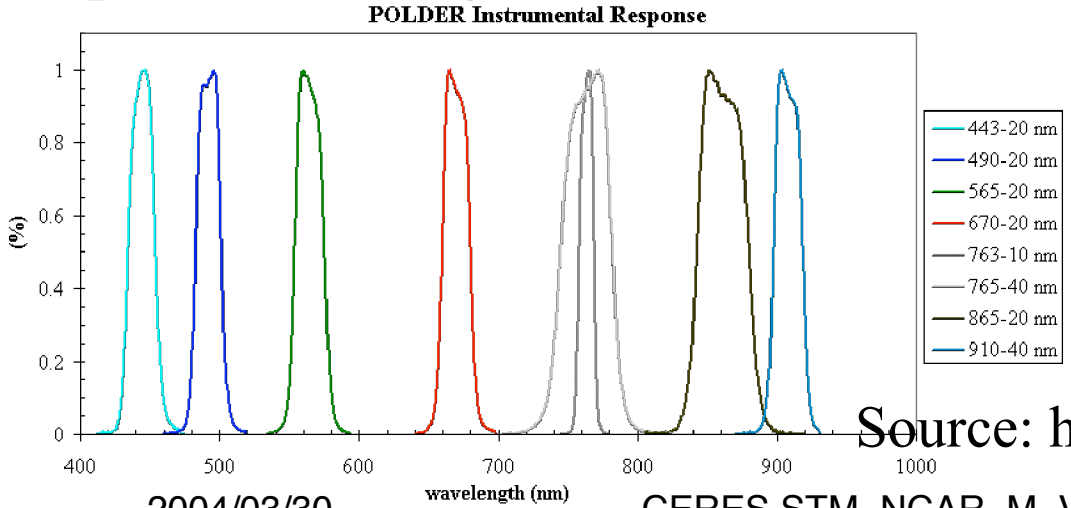
- contribution to the Aqua train studies (CERES-Parasol)

- development of radiance-to-flux conversion for specific instrument such as the along-track BBR/EarthCARE (Bodas-Salcedo et al., 2003): can fluxes be retrieved by using 3 along-track directions (nadir, 53° fore and aft) ? (SW MISR conversion also useful for 'along-track' simulations)

Polder Characteristics

- narrow bands between 443 and 910 nm
- vicarious calibration
- 6 km resolution
- 2400x1800 km CDD matrix
- TFOV –60° to 60°
- up to 14 viewing directions





Source: http://polder.cnes.fr/en/index.htm

Polder level 2

- application : vegetation, aerosol, ocean color, clouds and RB
- Clouds and RB over a fixed geographic grid of 18x18 km
- POLDER/ADEOS-2 : only Feb to October 2003,
  7 months of continuous acquisition (April to October)
- 'beta' products for June 2003 are available on
  http://polder.cnes.fr/en/index.htm
- 'validated' products on September 2004

POLDER multi-angle observation

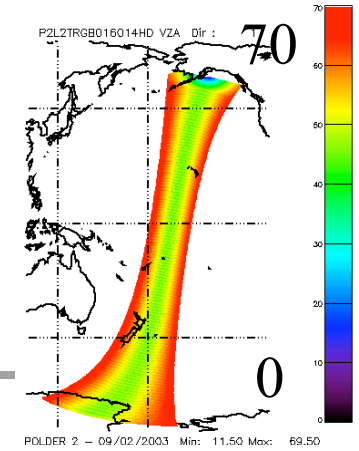
VZA

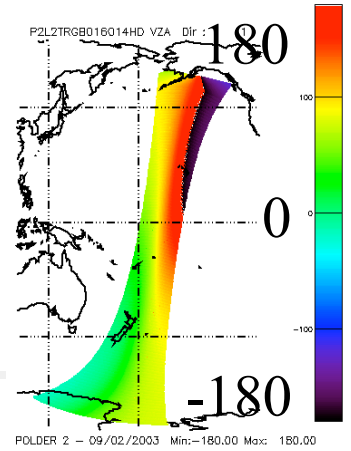
Relative Azimuth

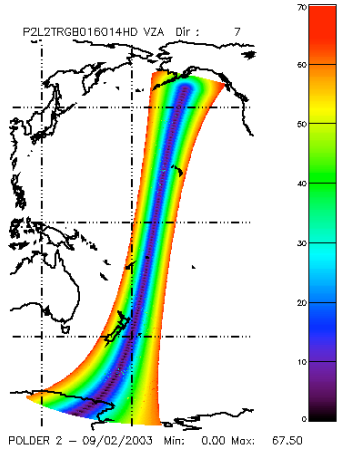
Direction 1
Oblique fore

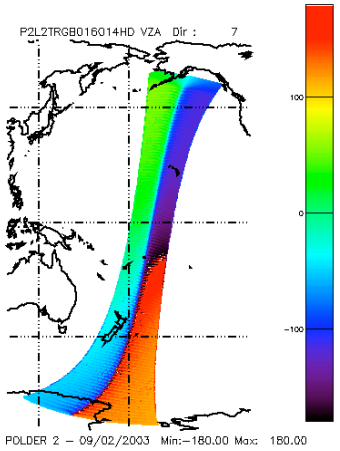
Direction 5
Nadir

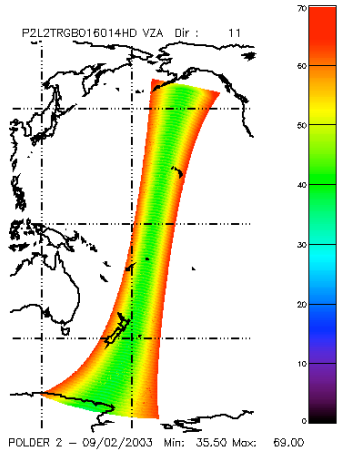
Direction 11
Oblique aft

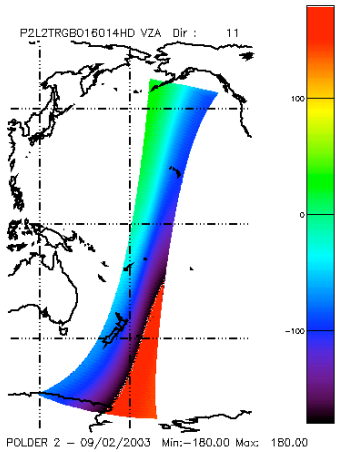




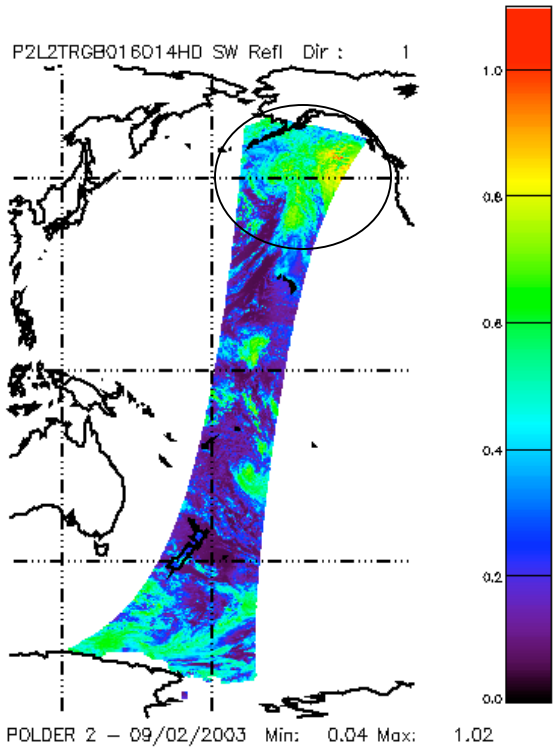


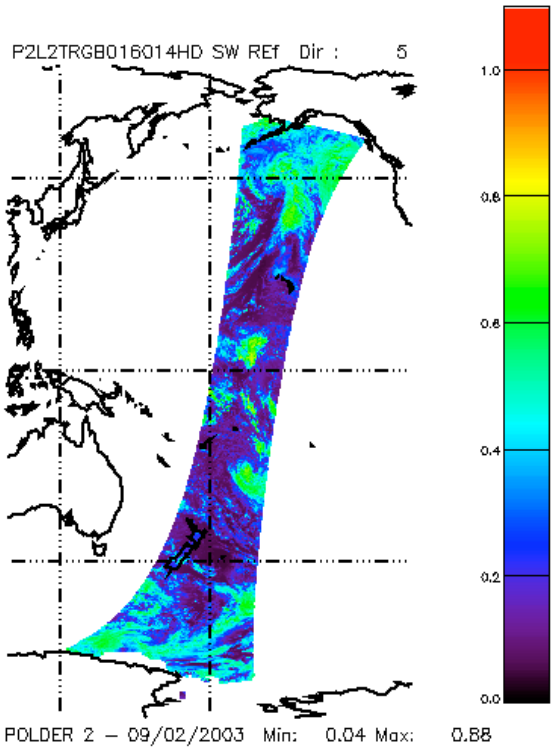






POLDER multi-angular reflectances





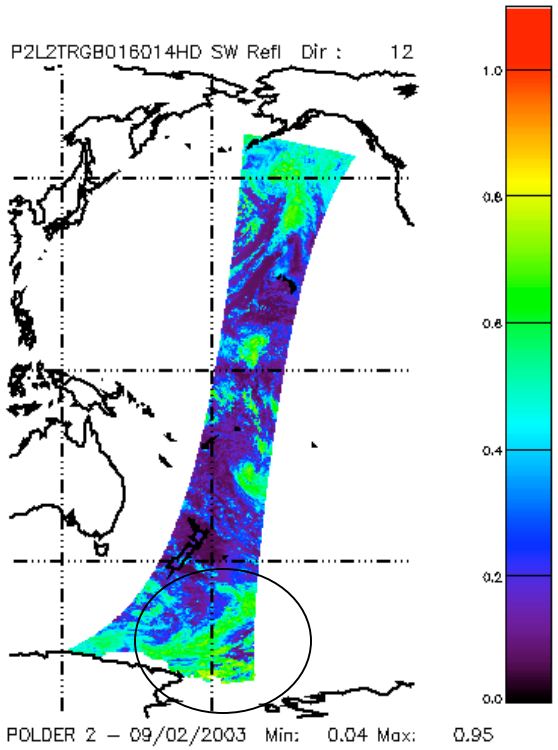


Image : 1
Oblique

5
Nadir

12
Oblique

Polder NB-BB conversions

(Buriez et al., IJRS, 1997)

$$Rsw(\mu_s,\mu_v,\phi) = C_1\ T1(mU_{03})\ R443(\mu_s,\mu_v,\phi) + C_2\ T2(mU_{03})\ R670(\mu_s,\mu_v,\phi) + C_3\ T3(R_{910}(\mu_s,\mu_v,\phi)/R_{865}(\mu_s,\mu_v,\phi))\ R865(\mu_s,\mu_v,\phi) + C_4 + C_5/\mu_s$$

H2O transmission

Cx : coefficients from multi-regression analysis

At present : based on theoretical models (same C_i as for POLDER-1)

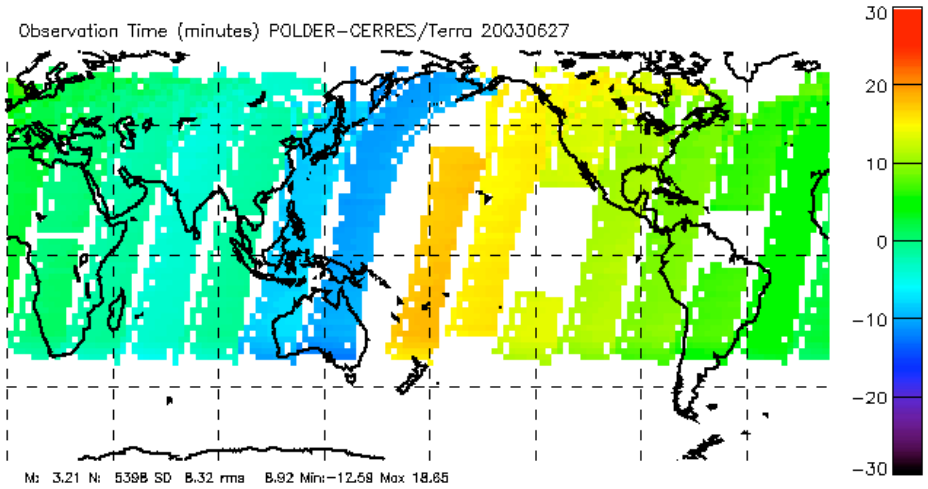
Future plan : based on simultaneous comparisons with CERES

CERES / POLDER-2 orbit and coverage

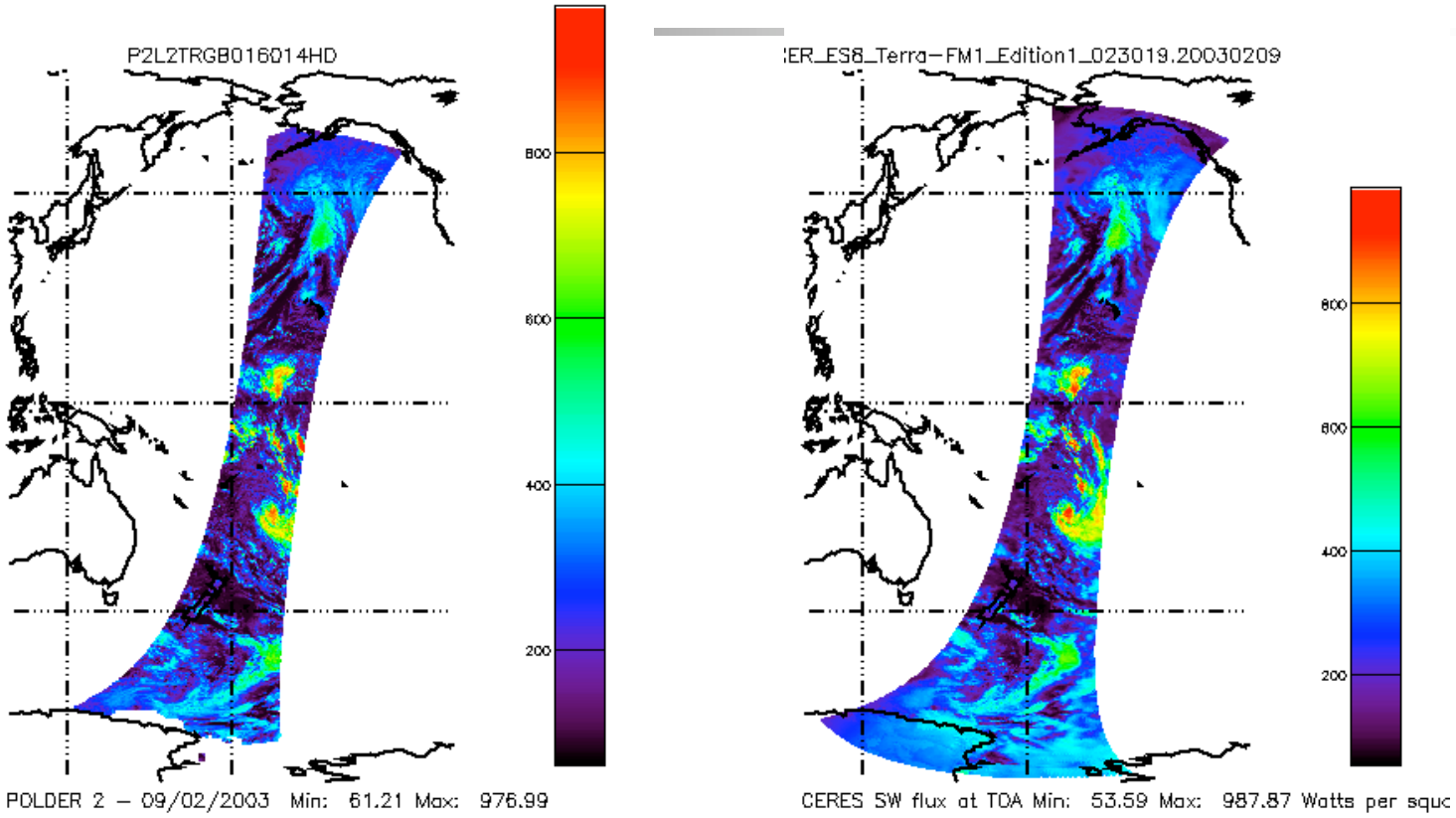
- ADEOS-2 ascending node : 22:20 (Terra:22:30)
- Altitude ADEOS-2: 803 km (Terra:705 km)
- Ground track repeat cycle ADEOS-2= 4 days ; Terra=16 days

◊ almost coincident POLDER-2 CERES observations ($\Delta t < 3$ mn) for certain orbits

time difference (minutes) 2003, 6, 27



POLDER-2 and CERES, 9 February 2003



($\Delta t < 3mn$)

Inter-comparison method

- time condition : ± 5 minutes

-VZA condition : < 20° , to reduce angular radiance variation

- average data over 2.5 x 2.5° region (about possible 100 observations)

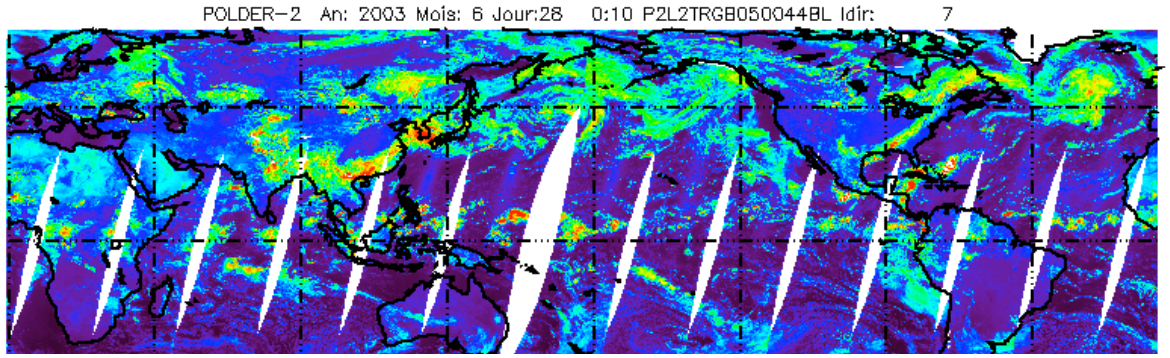
- keep regions with more than 80 observations

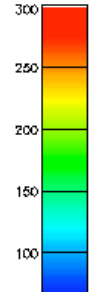
- comparisons with 1x1° region

- second approach : match the FOVs and select the co-angled observations

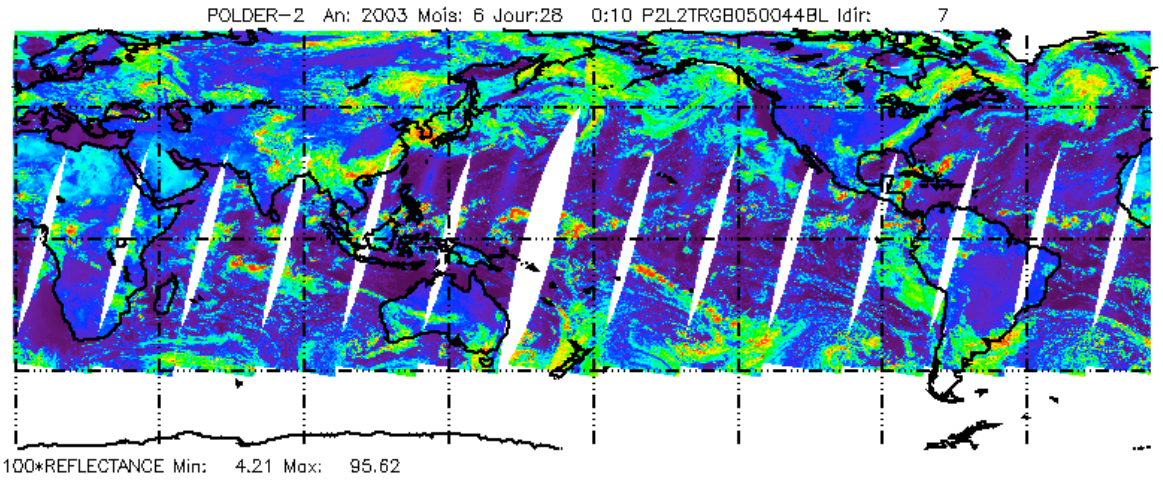
Reflectance = π Radiance /(F_{inc} cos (SZA)) with =1368 C(d_y)

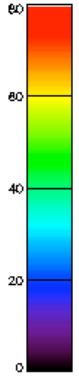
June, 27





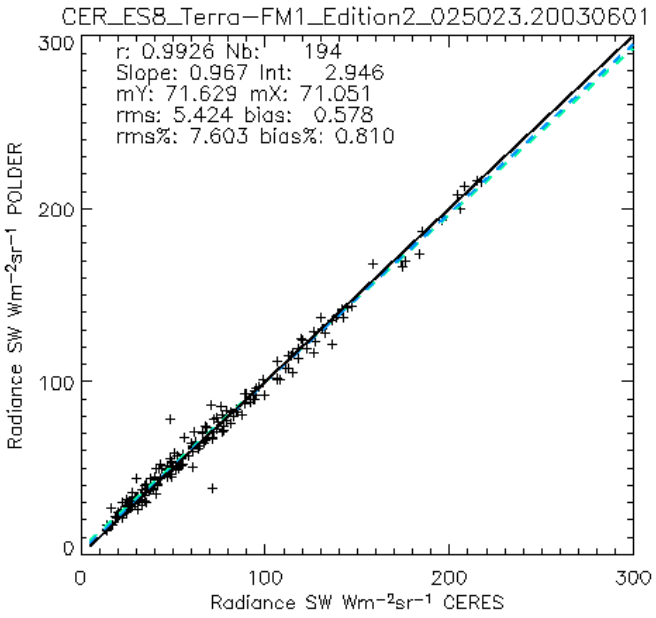
Radiance
$Wm^{-2}sr^{-1}$

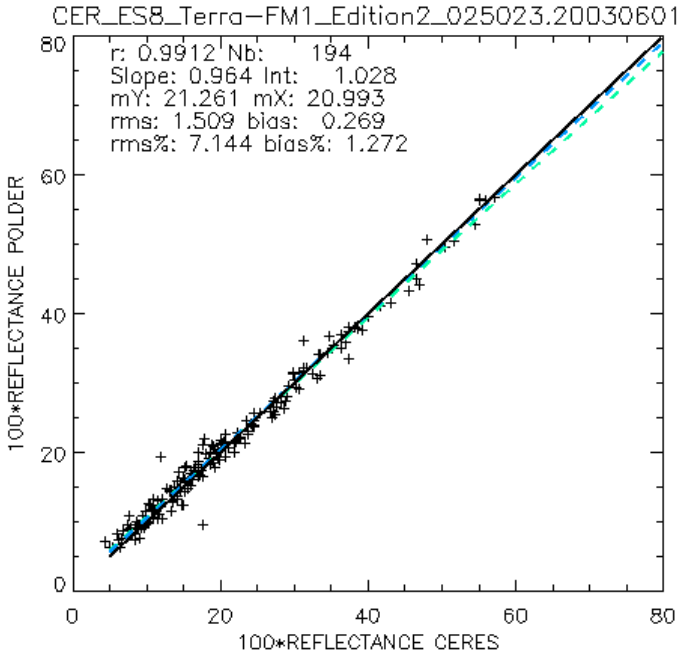




Reflectance
x 100

POLDER/CERES: radiance comparison (VZA < 20°) , 2003 June 1st

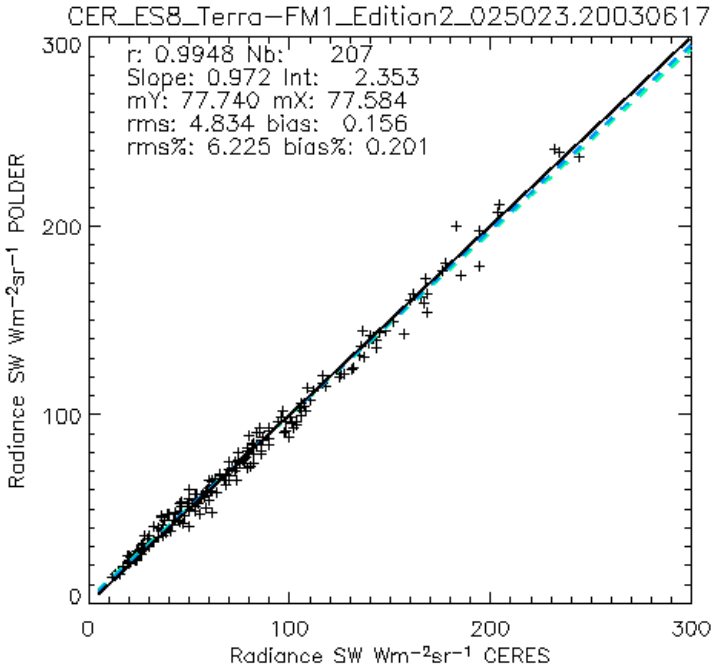


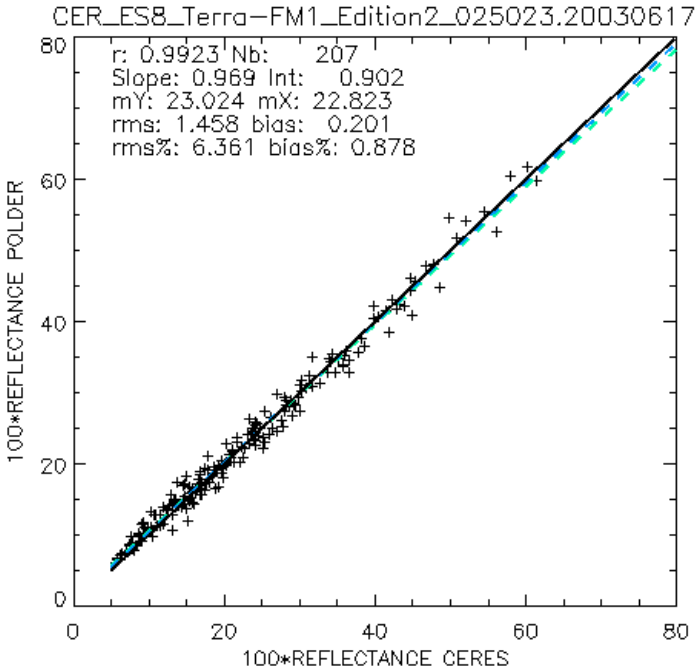


Radiance
Mean difference 0.8 %

Reflectance

POLDER/CERES: radiance comparison (VZA < 20°) , 2003 June 17



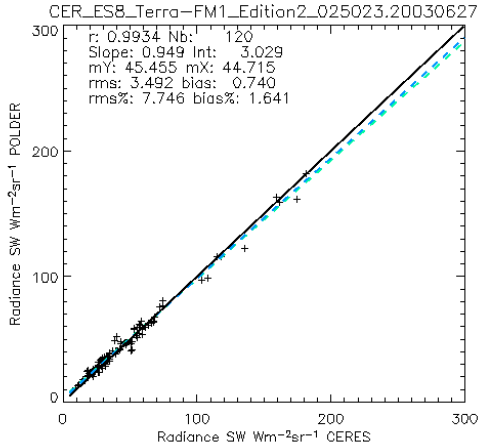


Radiance

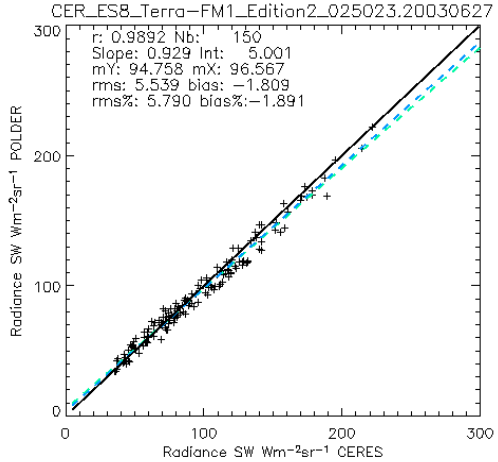
Mean difference 0.2 %

Reflectance

POLDER/CERES: radiance comparison (VZA < 20°) , 2003 June 27

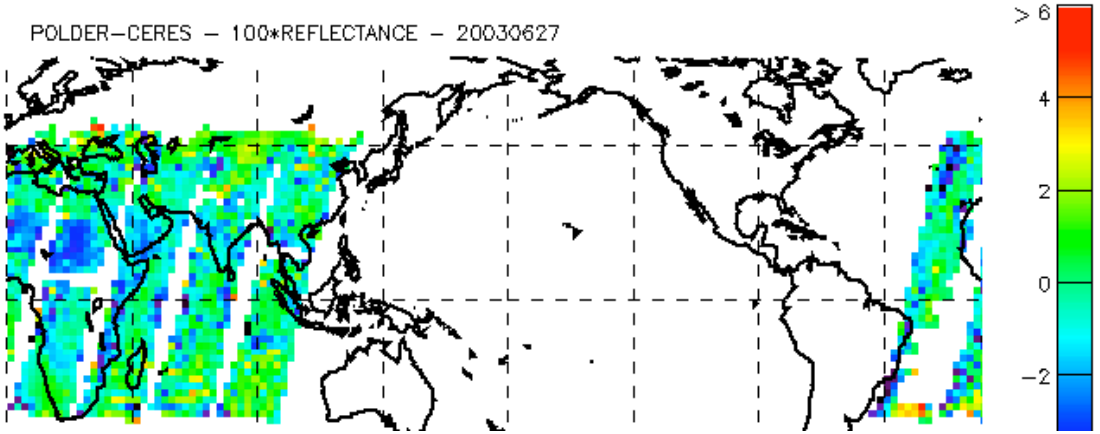


OCEAN

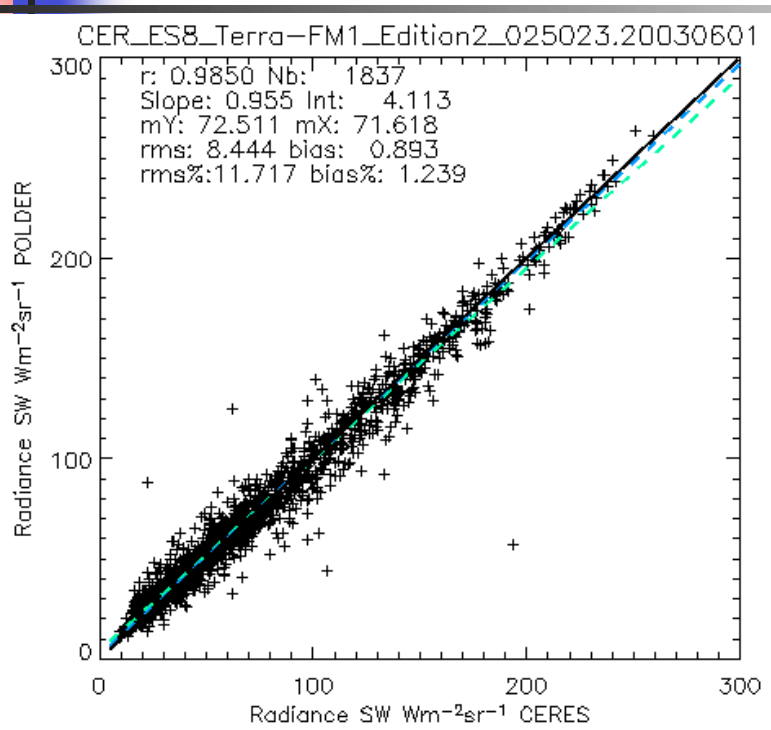


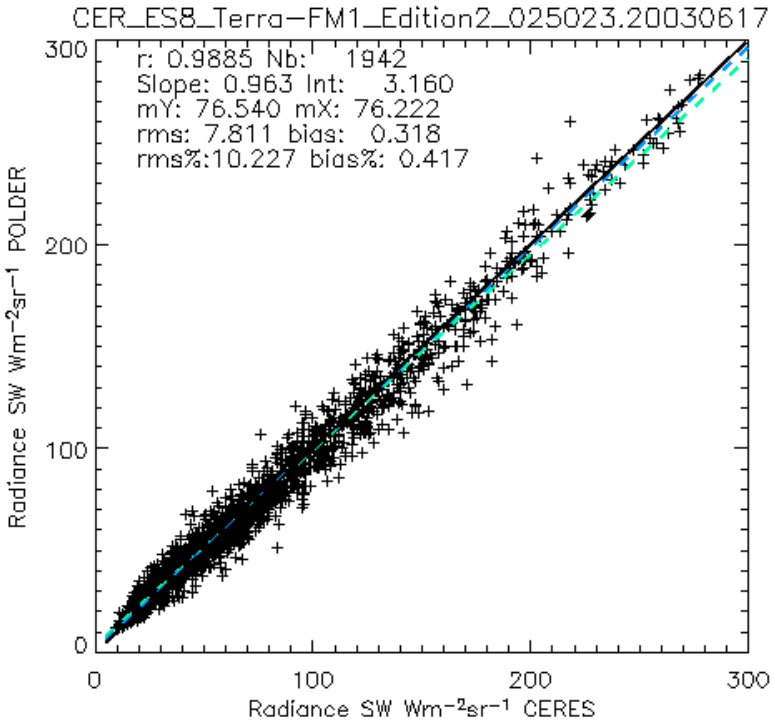
CONTINENT

small underestimation over land



POLDER/CERES: radiance comparison averaging area : 1°x1°

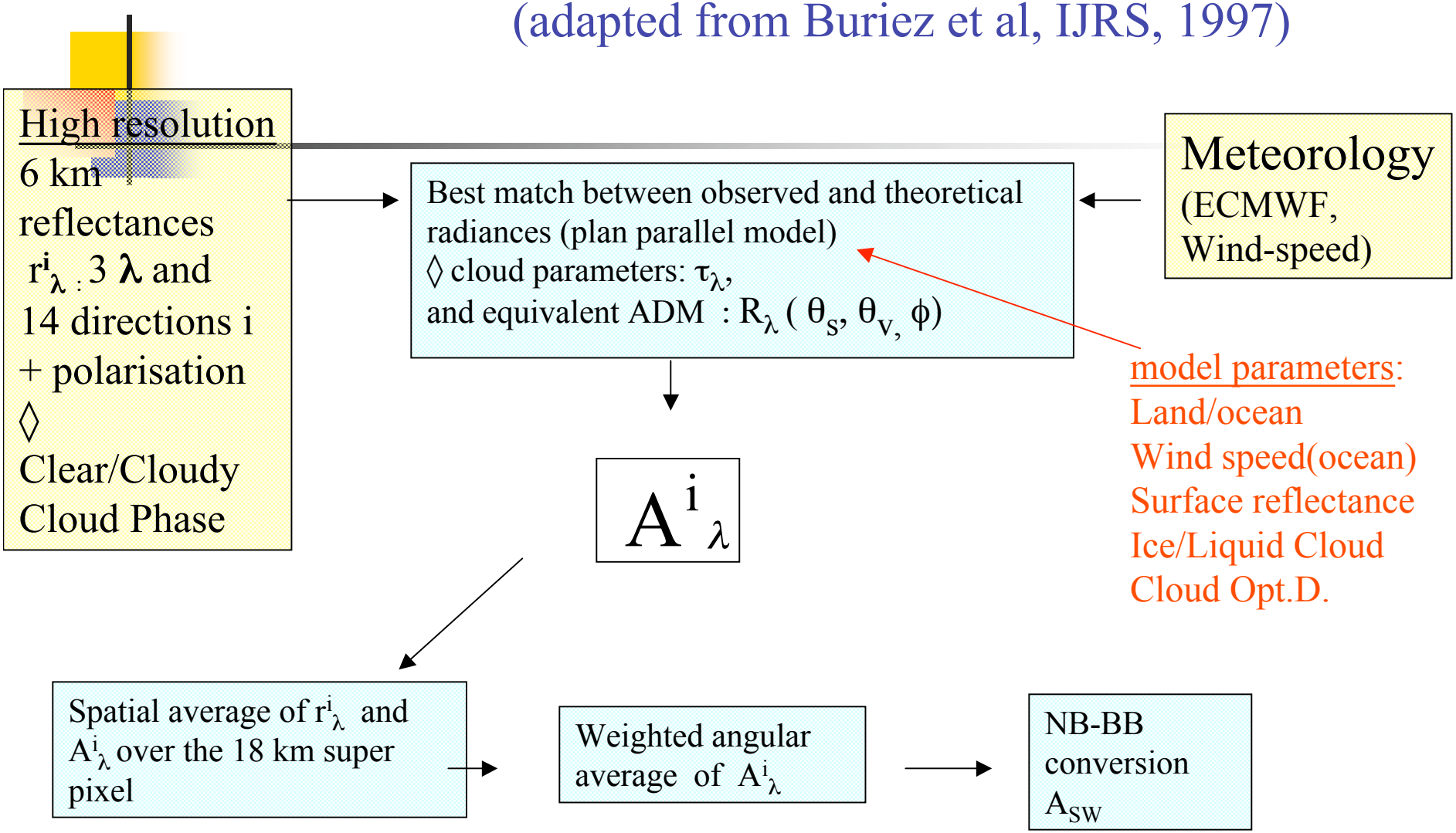




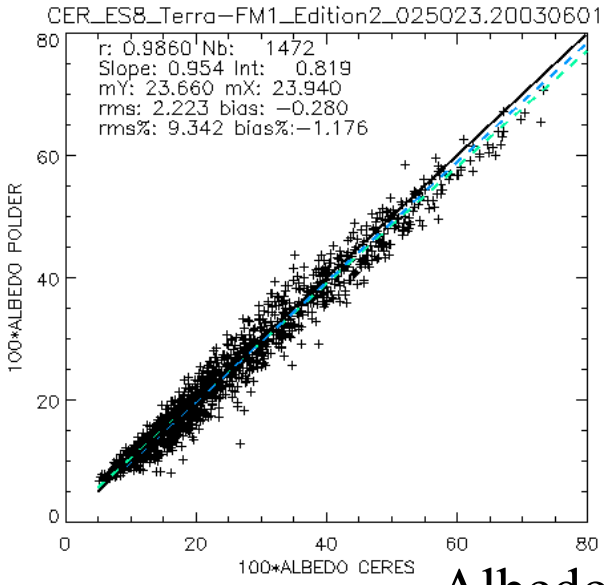
(VZA < 20°) , 2003 June 1st and 17

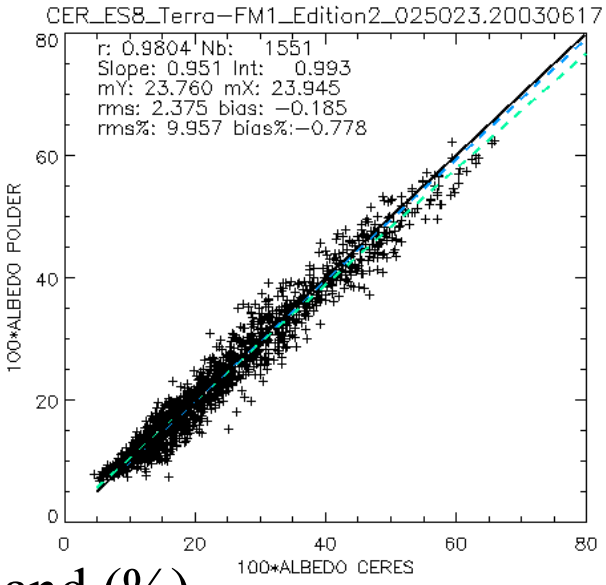
POLDER cloud and albedo

(adapted from Buriez et al, IJRS, 1997)



POLDER/CERES: albedo comparison all VZA





Albedo x 100 and (%)

Average over 2.5x2.5°;	POLDER-CERES	R	rms of residuals	N
June, 1	-0.3 (-1.2)	0.9860	2.2 (9.3))	1472
June, 17	-0.18 (-0.8)	0.9804	2.4 (9.9)	1551
June, 27	-0.8 (-3.5)	0.9717	2.6 (11.1)	1552

Intercomparison statistics

Radiances Wm^{-2} sr^{-1} and (%) for VZA < 20°

Average over 2.5x2.5°;	POLDER-CERES	R	rms of residuals	N
June, 1	0.6 (0.8)	0.9926	5.4 (7.6))	194
June, 17	0.16 (0.2)	0.9948	4.8 (6.2)	207
June, 27	-0.7 (-0.9)	0.9937	4.7 (6.5)	270

Average over 1° x 1°	POLDER-CERES	R	rms of residuals	N
June, 1	0.9 (1,2)	0.9850	8.4 (11.7))	1837
June, 17	0.3 (0.4)	0.9885	7.8 (10.2)	1942
June, 27	-0.3 (-0.5)	0.9885	7.1 (9.6)	2557

Conclusions based on June 2003 data and 'beta' version products.

- current POLDER-2 data provides SW radiances and fluxes close to the CERES results (on average)
- mean radiance difference ~ - 1% over ocean (-2 % over continent)
- investigations to continue : understand local differences
- further conclusions are expected by matching over small areas and by tuning the SW radiance computations using CERES
- if satisfying: SW POLDER radiances could be used to study angular corrections and to simulate nadir and oblique along-track observations