



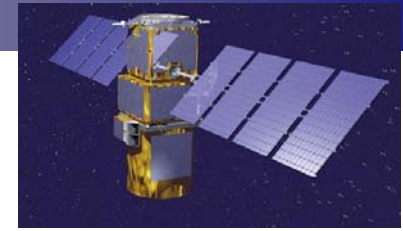
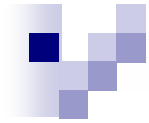
Kick-Off EUCLIPSE

21-22 April 2010

# GCM Oriented Calipso Cloud Product (GOCCP)

G. Cesana, H. Chepfer, S. Bony  
LMD / IPSL





# Introduction

- CFMIP-OBS: <http://climserv.ipsl.polytechnique.fr/cfmip-obs.html>

- CLOUDSAT / CFAD → R. Marchand (JISAO)
- CALIPSO-GOCCP → G. Cesana, H. Chepfer (LMD/IPSL)
- PARASOL → D. Tanré (LOA)
- ISCCP → Y. Zhan (LLNL),
- MISR → R. Marchand (JISAO)

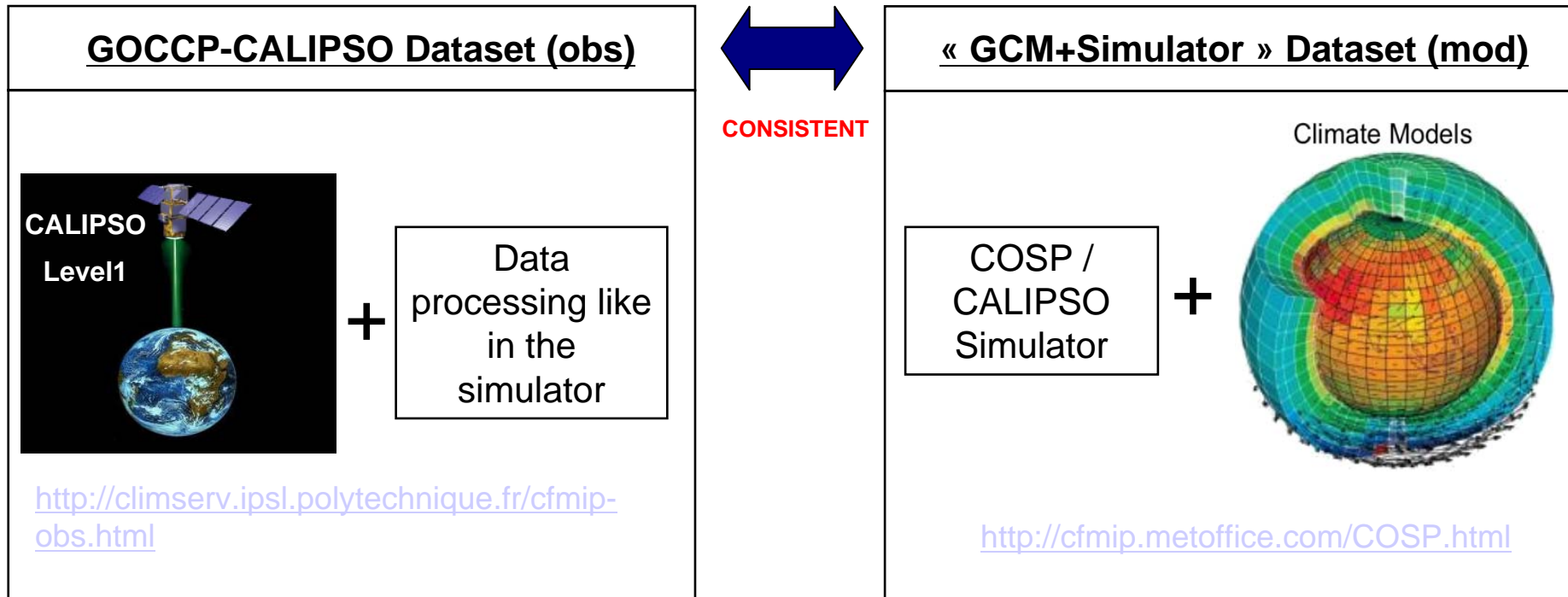
To be completed with MODIS (R. Pincus, UCB)

- CERES / EBAF (N.G. Loeb, LaRC)

- GOCCP, GCMs Oriented CALIPSO Cloud Product, from Level1 CALIPSO

- « instant\_SR »
  - « 3D\_CloudFraction »
  - « MapLowMidHigh »
  - « SR\_histograms »
- 4 different files containing Cloud variables

# GOCCP: GCMs Oriented CALIPSO Cloud Product



H. Chepfer, S. Bony, D. Winker, G. Cesana, J.L. Dufresne, P. Minnis, C. J. Stubenrauch, S. Zeng, 2010 : « The GCM Oriented CALIPSO Cloud Product (CALIPSO-GOCCP) », J. Geophys. Res, 135, D00H16.

H. Chepfer, S. Bony, D. M. Winker, M. Chiriaco, J.-L. Dufresne, and G. Seze, 2008 : « Use of CALIPSO lidar observations to evaluate the cloudiness simulated by a climate model », Geophys. Res. Lett., vol. 35, L15704

➔ **GOCCP-CALIPSO** is directly comparable to « GCM+Simulator » outputs, it is used by several climate models in the framework of the Cloud Feedback Model Intercomparison Program (CFMIP).



# Description of Calipso-GOCCP files

**1) Scattering Ratio : Definition**

**2) File : « instant SR »**

**3) Scene classification**

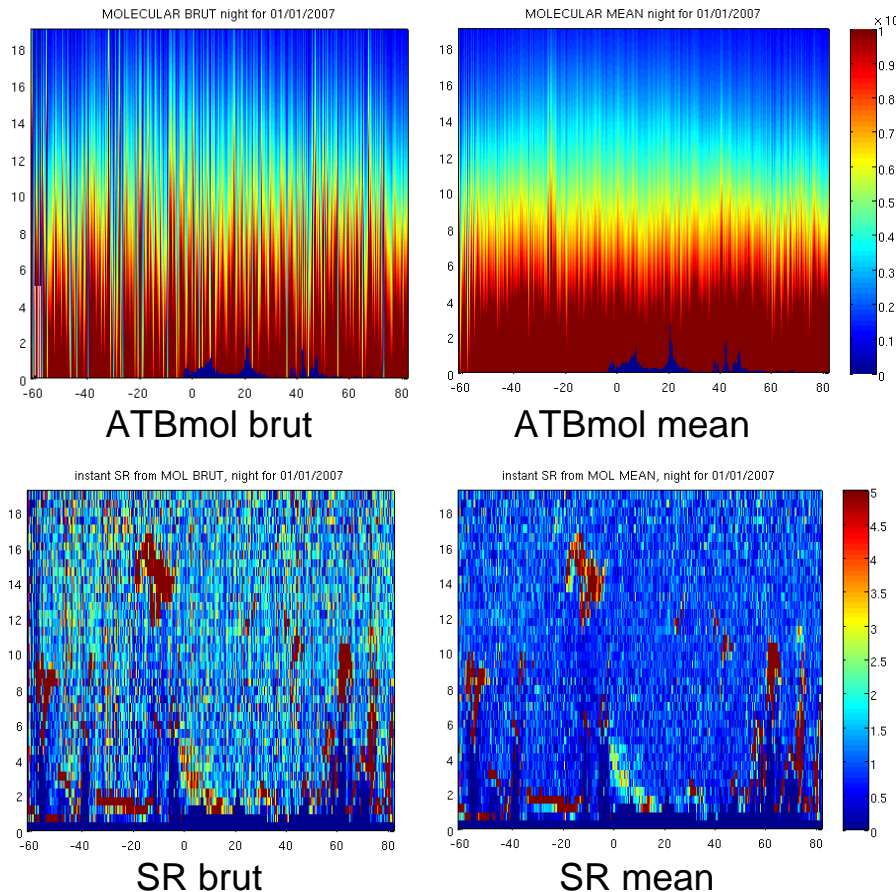
**4) File : « 3D\_CloudFraction »**

**5) File : « MapLowMidHigh »**

**6) File : « SR\_histograms »**

# Description of Calipso- GOCCP files

## 1) Scattering Ratio : Definition

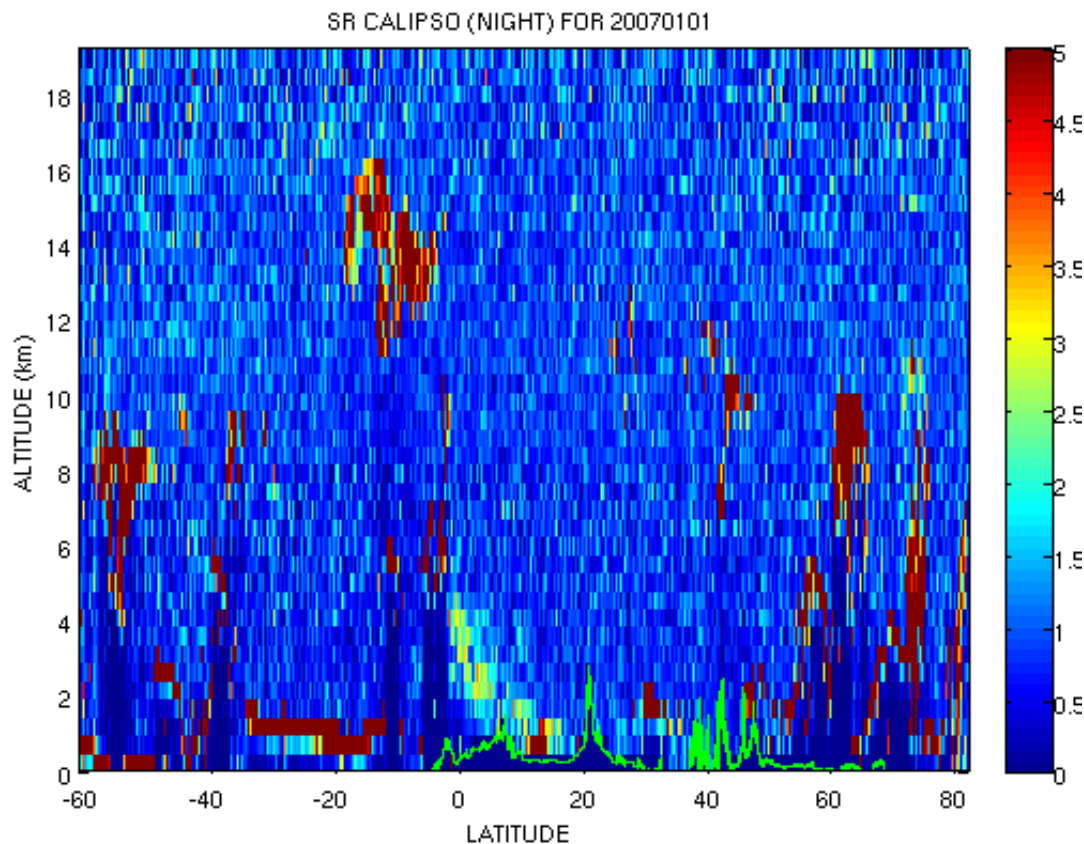


- SR : computed from the ATB and the ATBmol
- Calculation of the ratio ( $\langle \text{ATB} \rangle / \langle \text{MD} \rangle$ ) with a sliding average:
  - Different altitude day/night
  - PSC filter
- Calculation of the new ATBmolecular
- $\text{SR} = \text{ATB} / \text{ATBmol}$

→ The Scattering Ratio is an indicator of clouds presence

# Description of Calipso-GOCCP files

## 2) File : « instant SR »

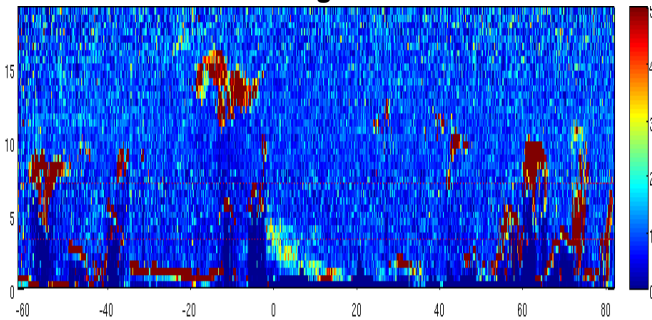


- SR value each 330m vertically averaged on 40 predefined vertical levels.
- Variables kept :
  - latitude
  - longitude
  - altitude
  - hour
  - surface elevation
- One file for each orbit (match with NASA CALIPSO level1 files).
- Reduction of noise

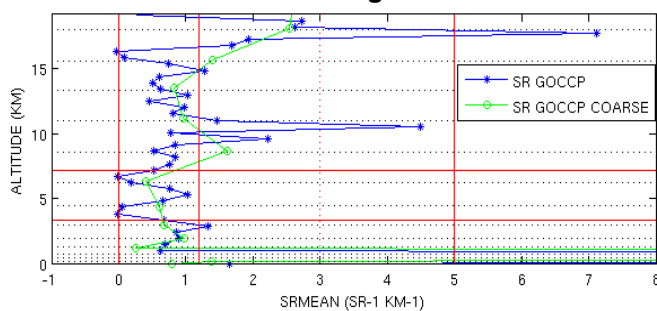
# Description of Calipso-GOCCP files

## 3) Scene classification

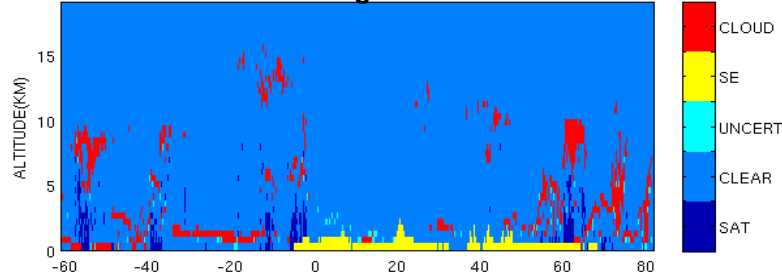
Instant SR 20070101 night CALIPSO-GOCCP



Profil of SR 20070101 night CALIPSO-GOCCP



FLAG SR 20070101 night CALIPSO-GOCCP



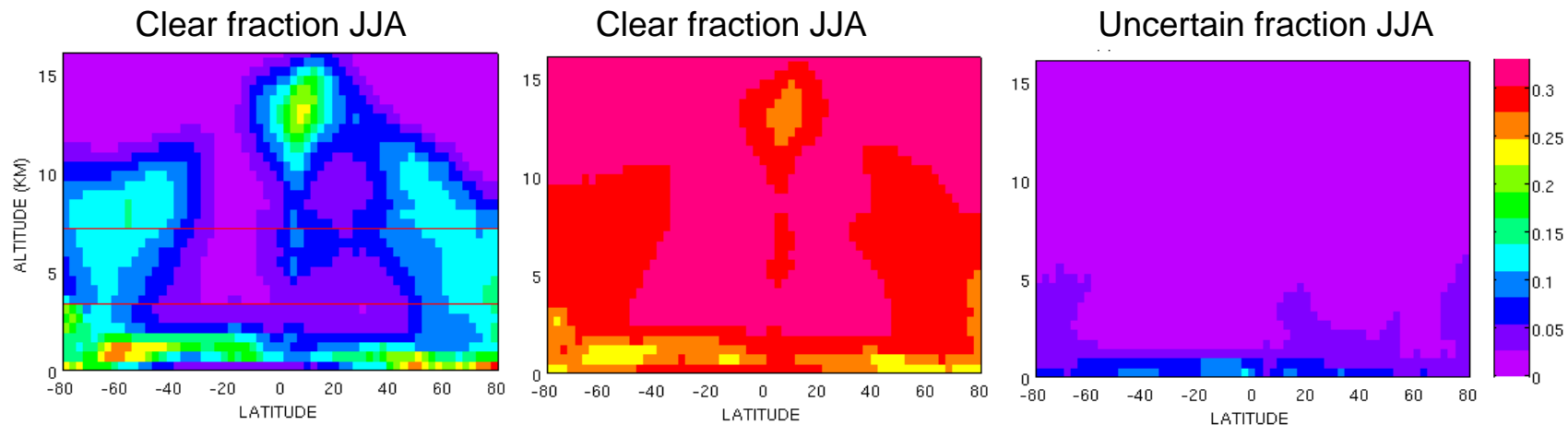
- 4 classes are defined :
  - $SR \geq 5$  → cloud
  - $1.2 < SR < 5$  → undefined
  - $0.01 < SR < 1.2$  → clear
  - $SR < 0.01$  → Fully attenuated

- Other thresholds do not have their counterpart in the simulator outputs
  - Rejected point →  $SR = -777$
  - Surface point →  $SR = -888$
  - Not a Number →  $SR = -9999$

→ This classification is used to build statistics (next slides)

# Description of Calipso-GOCCP files

## 4) File : « 3D\_CloudFraction »



- 3D dataset grids :
  - CFMIP2 :  $2^{\circ} \times 2^{\circ}$  (lon/lat) & 40levels (official CFMIP-2 experiment)
  - CFMIP2.5 :  $2.5^{\circ} \times 2.5^{\circ} \times L40$
  - CFMIP1 :  $1^{\circ} \times 1^{\circ} \times L40$
  - CFMIP :  $3.5^{\circ} \times 2.5^{\circ} \times L40$  (LMDZ horizontal grid)
- 3 monthly variables : cloud, clear, uncertain fractions
- Information about vertical distribution of clouds
- daily & monthly fields + monthly climatology

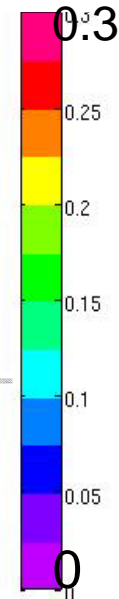
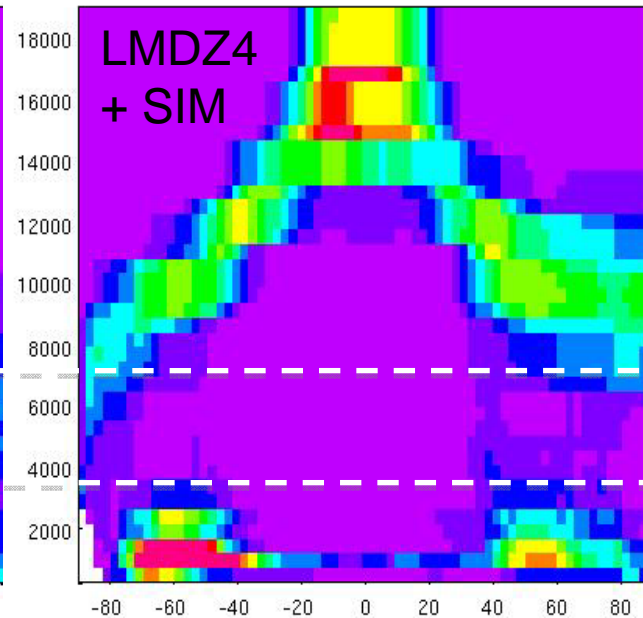
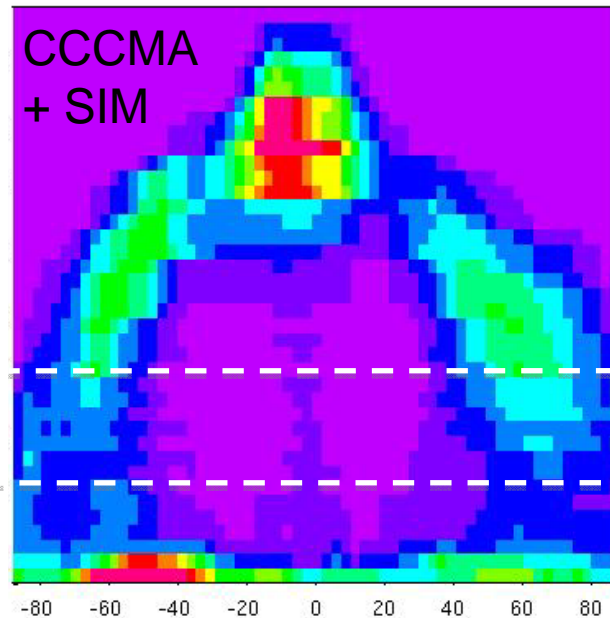
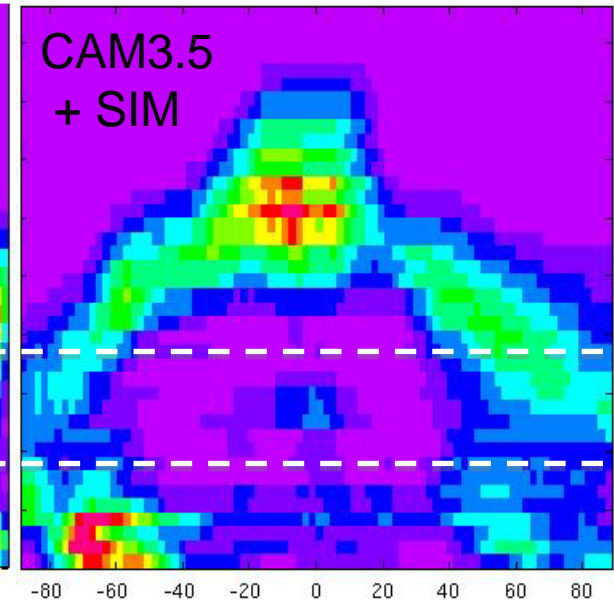
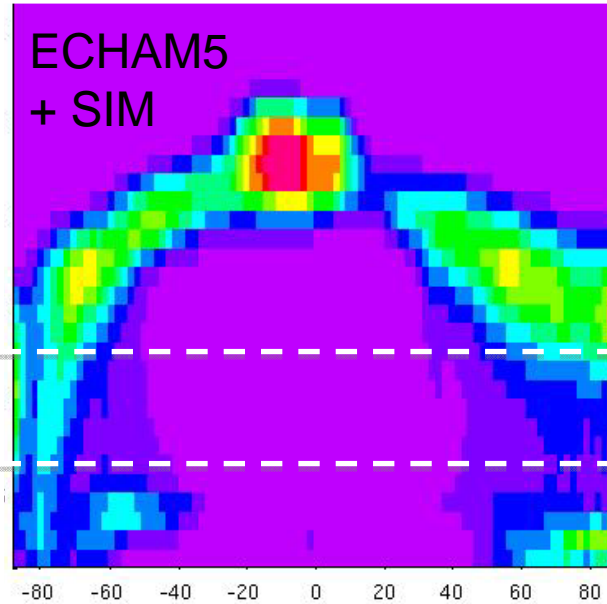
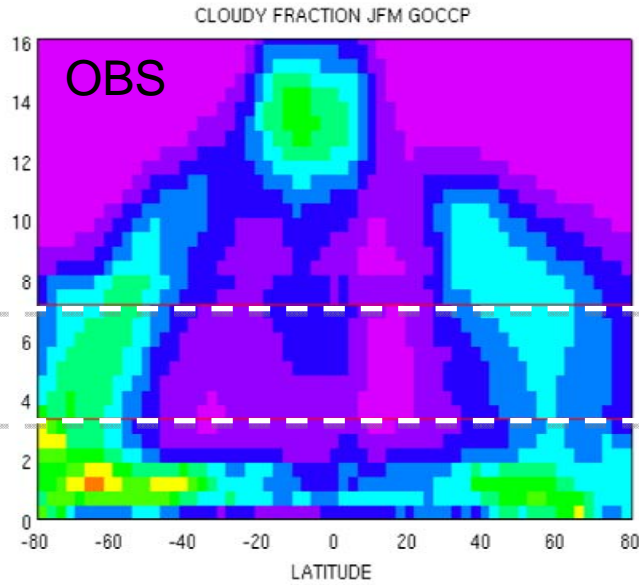


# Example : evaluation of Cloud Vertical Distribution

## CALIPSO-GOCCP

ECHAM5 + LIDAR SIMULATOR - JFM

LLNL + LIDAR SIMULATOR - JFM



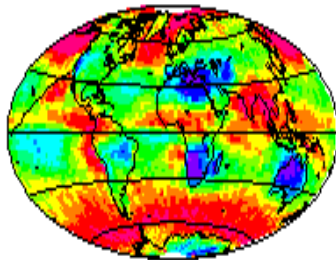
Overestimate:  
- High clouds

Underestimate:  
- Tropical low clouds  
- Congestus  
- Mid level mid lat

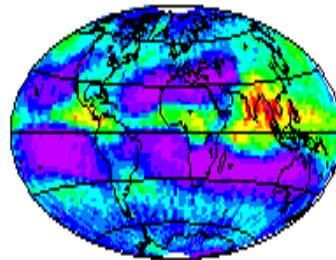
# Description of Calipso-GOCCP files

## 5) File : « MapLowMidHigh »

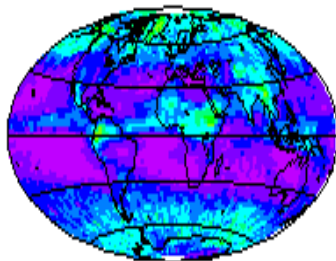
(a) TOTAL CLOUD GOCCP JJA



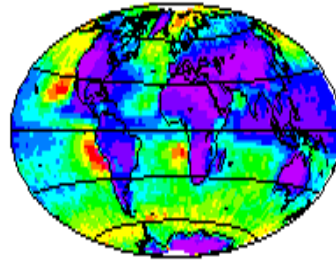
(b) HIGH CLOUD GOCCP JJA



(c) MID CLOUD GOCCP JJA



(d) LOW CLOUD GOCCP JJA

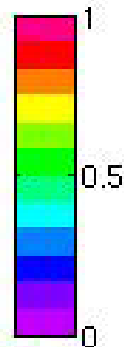
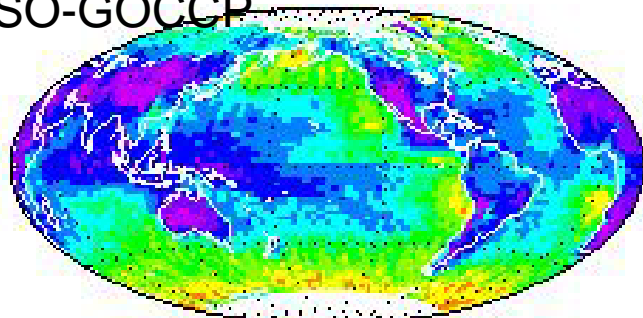


- 2D dataset, on grids :
  - CFMIP2 :  $2^{\circ} \times 2^{\circ}$  (lon/lat) (official CFMIP-2 experiment)
  - CFMIP2.5 :  $2.5^{\circ} \times 2.5^{\circ}$
  - CFMIP1 :  $1^{\circ} \times 1^{\circ}$
  - CFMIP :  $3.5^{\circ} \times 2.5^{\circ}$  (LMDZ horizontal grid)
- Variables classified according to the 3 ISCCP levels :
  - Low clouds :  $P^{\circ} < 680$  hPa
  - Mid clouds :  $680$  hPa  $< P^{\circ} < 440$  hPa
  - High clouds :  $P^{\circ} > 440$  hPa
- 2 other variables recorded :
  - Total cloud fraction
  - Clear-sky fraction

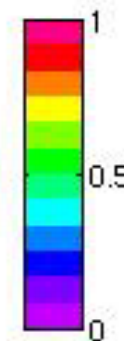
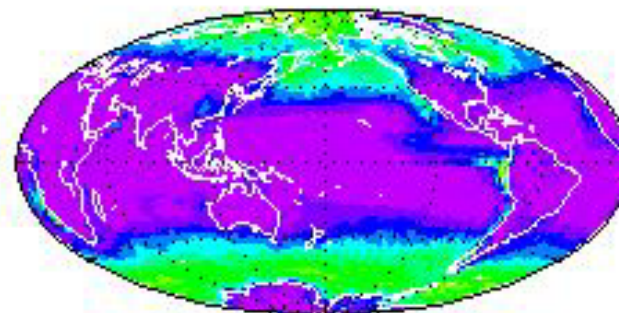


# Example: Low clouds model evaluation

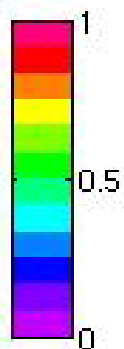
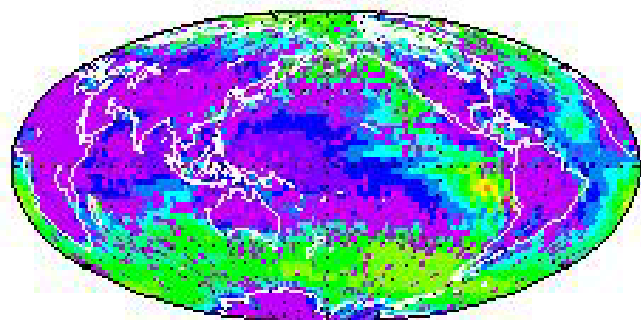
LOW CLOUD COVER: OBSERVATIONS  
CALIPSO-GOCCP



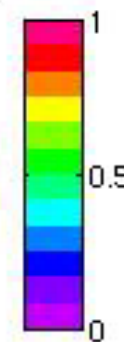
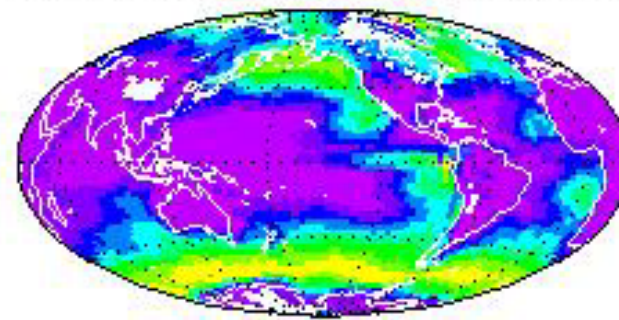
LOW CLOUD COVER: ECHAM5 + LIDAR SIMULATOR



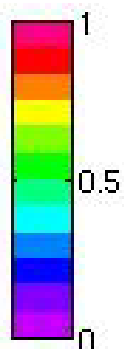
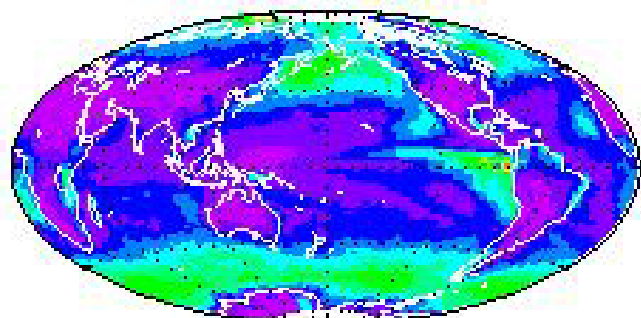
LOW CLOUD COVER: CCMA + LIDAR SIMULATOR



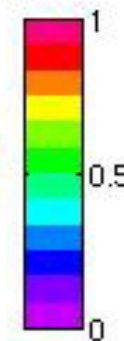
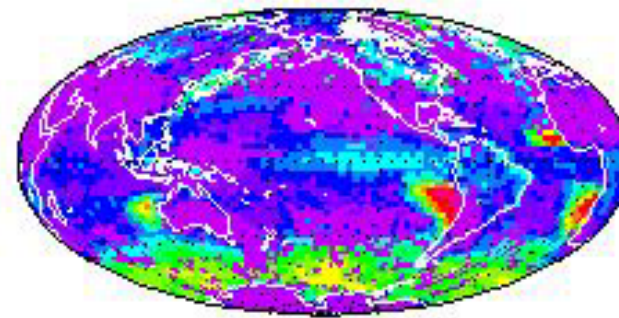
LOW CLOUD COVER: IPSL + LIDAR SIMULATOR



LOW CLOUD COVER: LLNL + LIDAR SIMULATOR

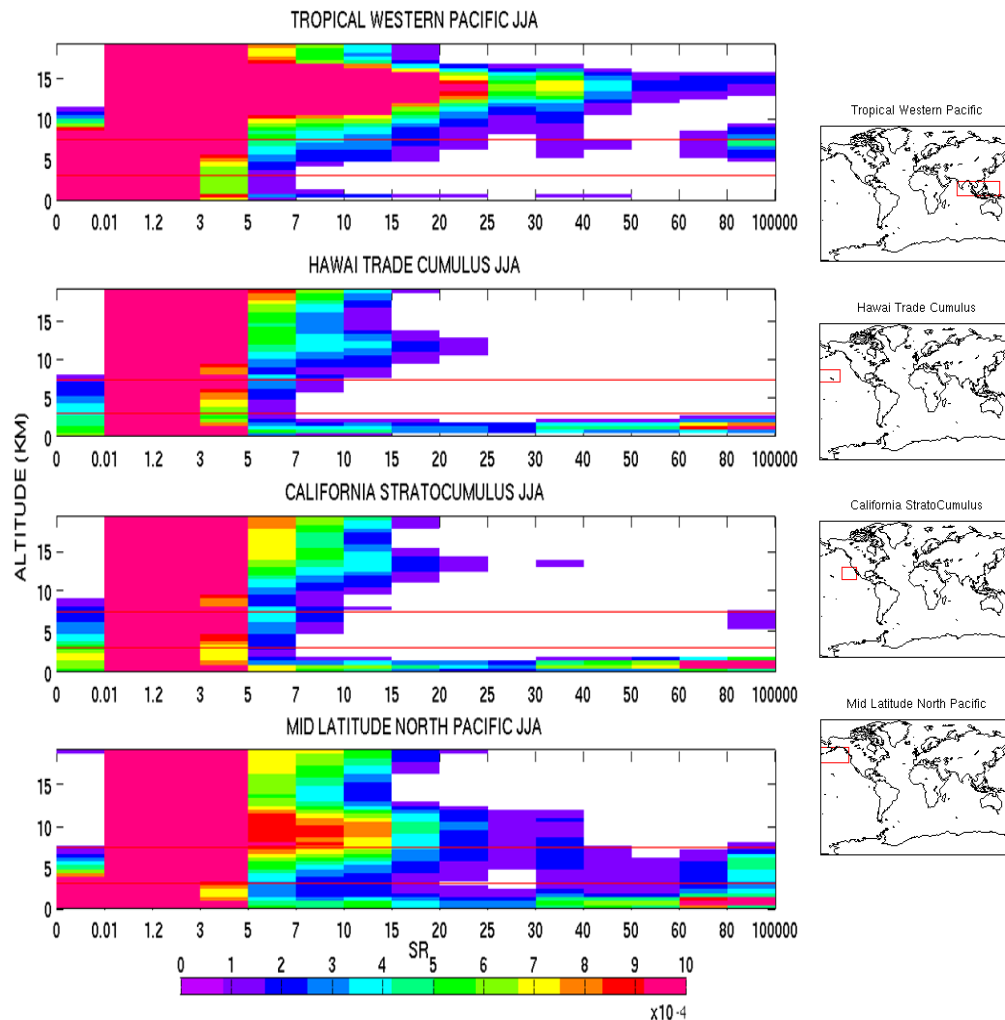


LOW CLOUD COVER: IPSL-new physics + LIDAR SIMULATOR



# Description of Calipso-GOCCP files

## 6a) File : « SR\_histograms »

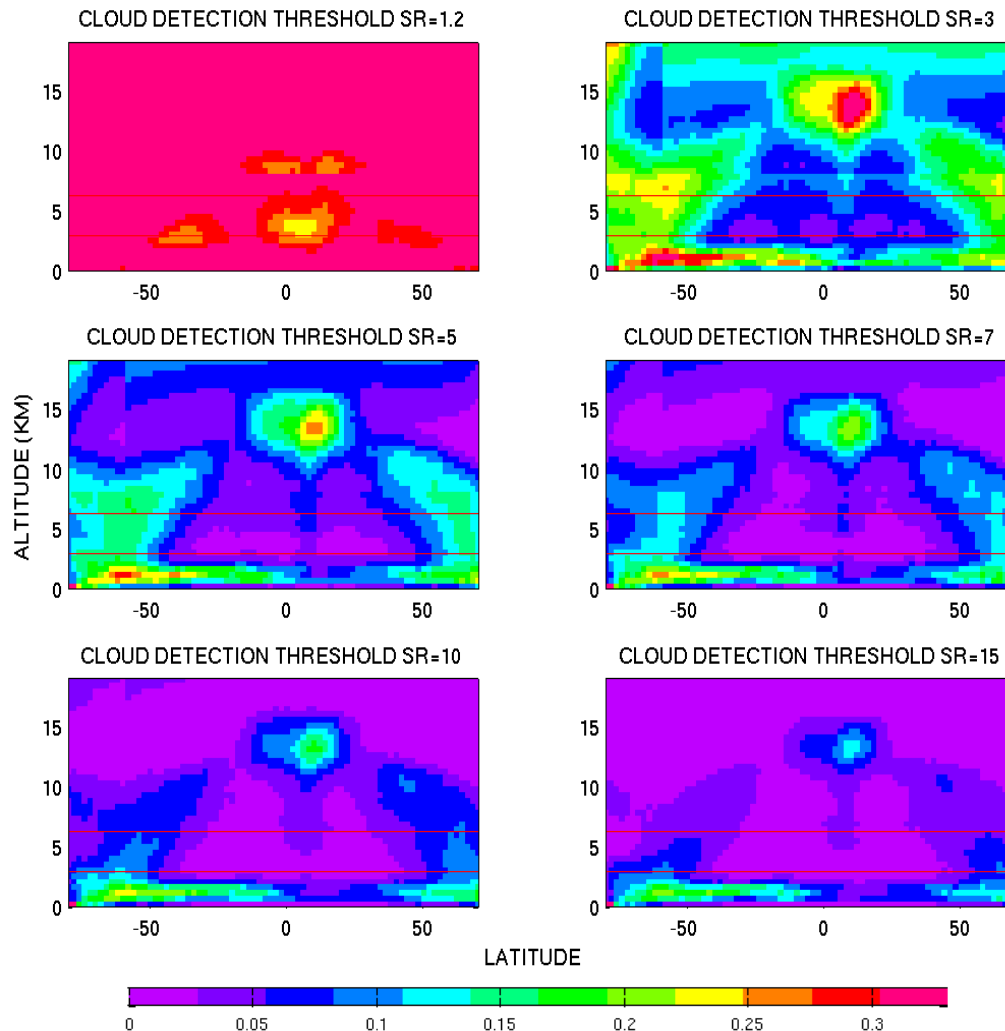


- Dimension of monthly variables  
SR\_histo = 4D (lon,lat,alt,srbox=15)
- Allows us to discriminate the different types of clouds

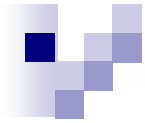
Used in Mark Webb talk

# Description of Calipso-GOCCP files

## 6b) File : « SR\_histograms »



- Reconstitution of 3D\_CloudFraction for different cloud detection threshold, SR=3, SR=5, SR=7... (except in the stratosphere, where an additional criteria is needed to diagnose the cloud fraction)
- All the SR values are stored, contrary to the 3D\_CF files (data rejected, point below the surface...)



# Comparison between CALIPSO-GOCCP and CALIPSO-ST cloud cover

We do not expect the two datasets to give similar results !

Aim of this comparison: to quantify & to understand the difference

**1) Map LowMidHigh**

**2) Map zonal Mean**

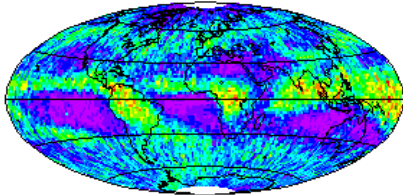
**3) 3D Cloud Fraction**

# Comparison

## 1) Map LowMidHigh

CALIPSO-GOCCP

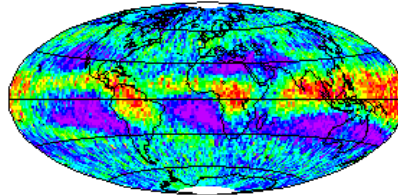
HIGH CLOUD GOCCP SON 06



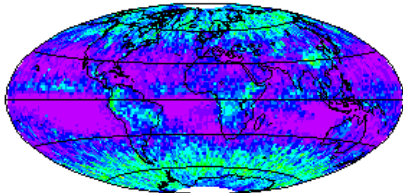
HIGH

CALIPSO-ST

HIGH CLOUD NASA SON 06

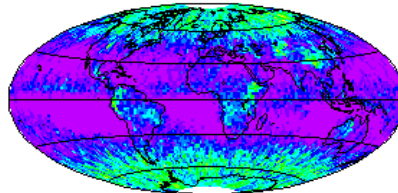


MID CLOUD GOCCP SON 06

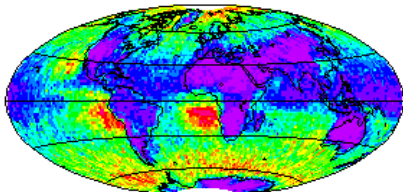


MID

MID CLOUD NASA SON 06

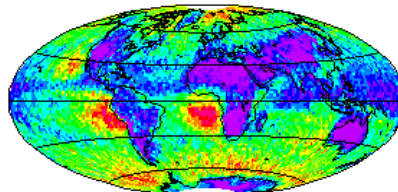


LOW CLOUD GOCCP SON 06



LOW

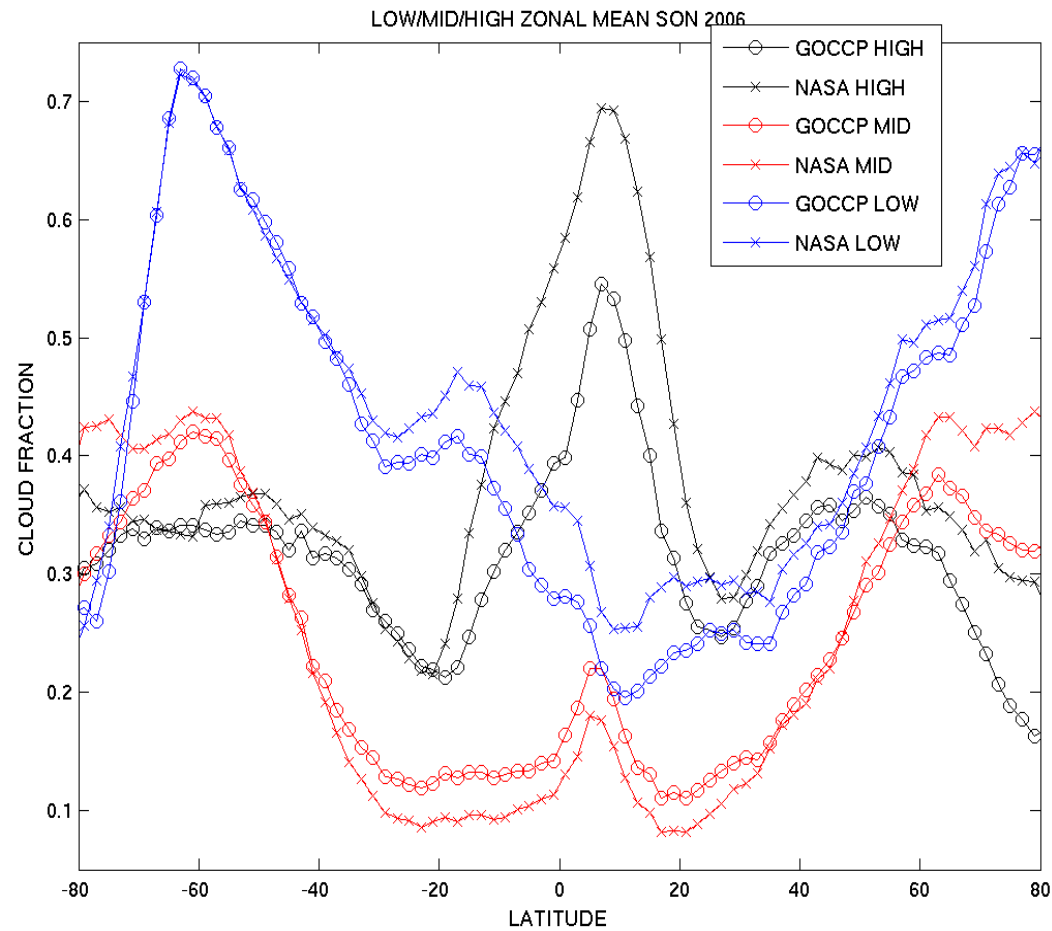
LOW CLOUD NASA SON 06



- Horizontal averaging
- Vertical averaging
- Cloud detection threshold

# Comparison

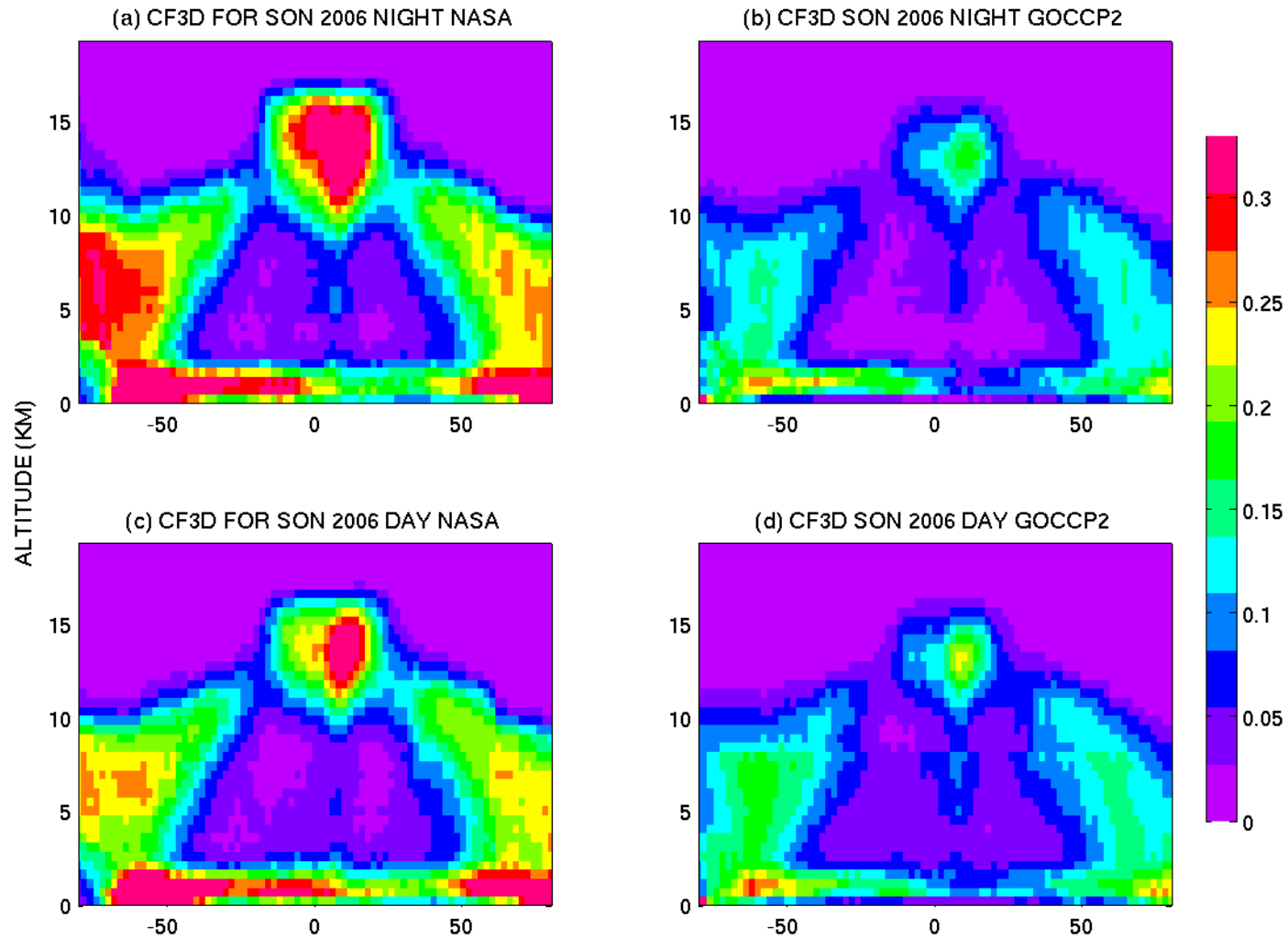
## 2) Map zonal Mean



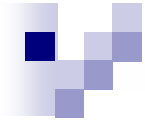


# Comparison

## 3) 3D Cloud Fraction



« Comparison of two different cloud climatologies derived from CALIOP-Level 1 observations: CALIPSO-ST and CALIPSO-GOCCP », G. Cesana, H. Chepfer, D. Winker, B. Getzewich, in preparation



# CFMIP-OBS database

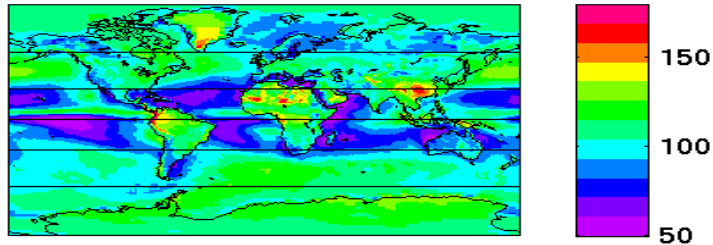
- Actual observations with data processing like in COSP -

- **CLOUDSAT**
- **CALIPSO-GOCCP**
- **CERES-EBAF**
- **ISCCP**
- **MISR (soon)**
- **MODIS (soon)**
- **PARASOL**

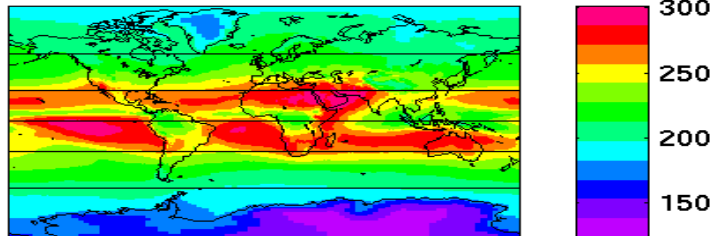
# CFMIP-OBS database

## CERES - EBAF

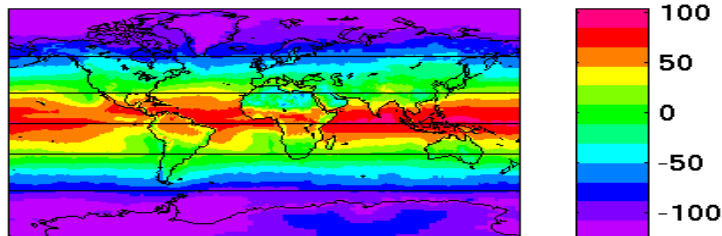
CERES-EBAF SW for 200003-200510



CERES-EBAF LW for 200003-200510



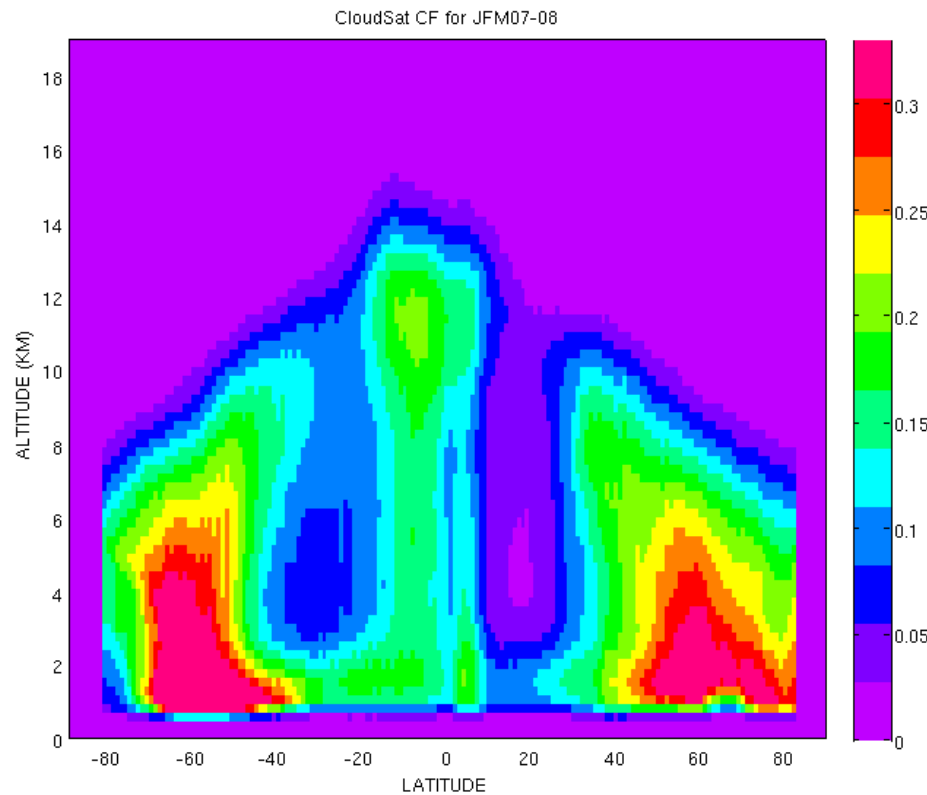
CERES-EBAF TOT for 200003-200510



- Information about the short and long wave TOA fluxes
- Period 200003\_200510 (courtesy of Norman G. Loeb LaRC)
- *"Towards Optimal Closure of the Earth's Top of- Atmosphere Radiation Budget", N.G.Loeb, B. A.Wielicki, D.R.Doelling, G.L.Smith, D.F.Keyes, S.Kato, N.Manalo-Smith, T.Wong, Journal of Climate, Vol 22, Issue 3 (February 2009) pp. 748 766 ,DOI: 10.1175/2008JCLI2637.1*

# CFMIP-OBS database

## CLOUDSAT - CFAD



- Information about the cloud fraction
- Period 200606\_200806 (courtesy of Roger Marchand, JISAO)

- "A comparison of simulated cloud radar output from the multiscale modeling framework global climate model with CloudSat cloud radar observations", R. Marchand, J. Haynes, G. G. Mace, T. Ackerman, G. Stephens, *JOURNAL OF GEOPHYSICAL RESEARCH*, VOL. 114, D00A20, doi:10.1029/2008JD009790, 2009



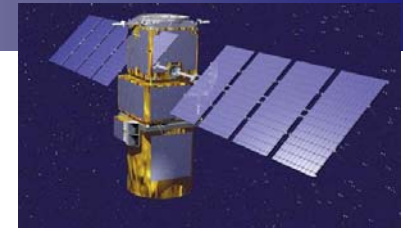
# CFMIP-OBS database

## PARASOL Reflectance 1dir



- Information about the reflectance **in** 1 direction
- Period 200503\_200812 (courtesy of D.Tanré, LOA)

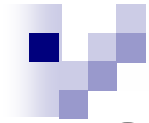
# Summary



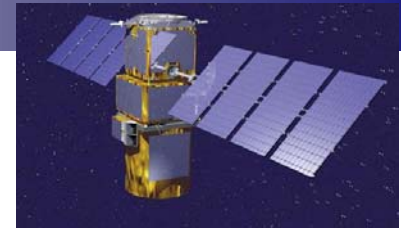
- Web site : <http://climserv.ipsl.polytechnique.fr/cfmip-obs.html>
- CALIPSO-GOCCP netCDF monthly files (GIECCMIP5 standard) for the period 200606 to 200906
- PARASOL netCDF monthly files (GIECCMIP5 standard) for the period 200503 to 200812
- CLOUDSAT netCDF monthly files (GIECCMIP5 standard) for the period 200606 to 200807
- CERES-EBAF single netCDF file for the period 200003 to 200510.
- ISCCP netCDF files

All the data are regularly updated.

**Questions:** [goccp@lmd.polytechnique.fr](mailto:goccp@lmd.polytechnique.fr)



# Summary'



Coming soon in CFMIP-OBS

- New observations in the database:  
MODIS (R. Pincus, UCB) and MISR (R. Marchand)
- Development of a Cloud phase diagnostic in COSP and CALIPSO-GOCCP
- Merged CALIPSO-GOCCP / CloudSat consistent with COSP radar/lidar outputs

Complementary informations:

- CFMIP-OBS : will be accessible from to the PCMDI
- CALIPSO-GOCCP is part of the GEWEX Cloud Assessment

