

Multiangle cloud remote sensing from POLDER1 and POLDER2

The Earth Radiation Budget, Water Vapor and Cloud Products

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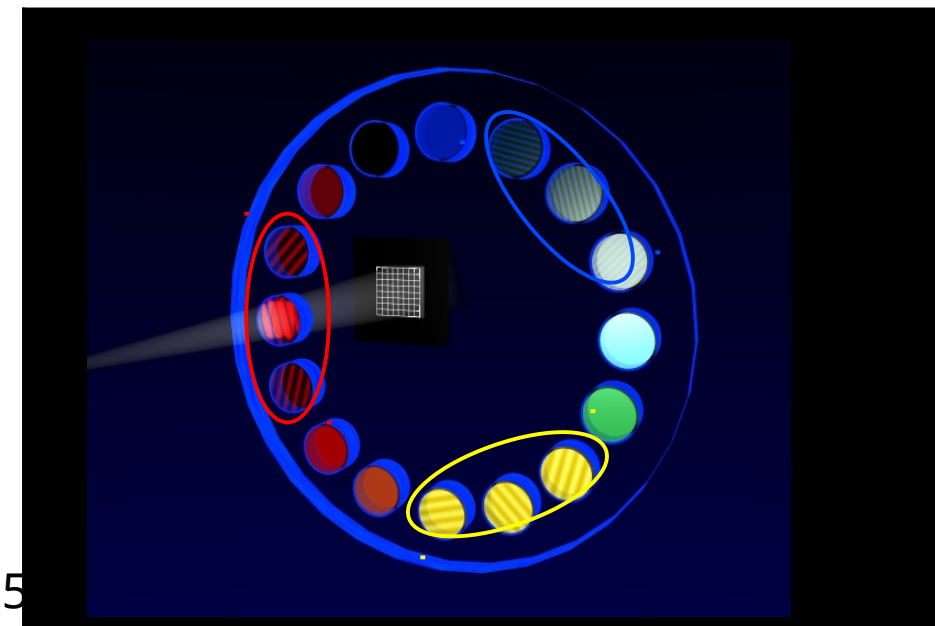
Multiangle cloud remote sensing from POLDER1 and POLDER2

The Earth Radiation Budget, Water Vapor and Cloud Products

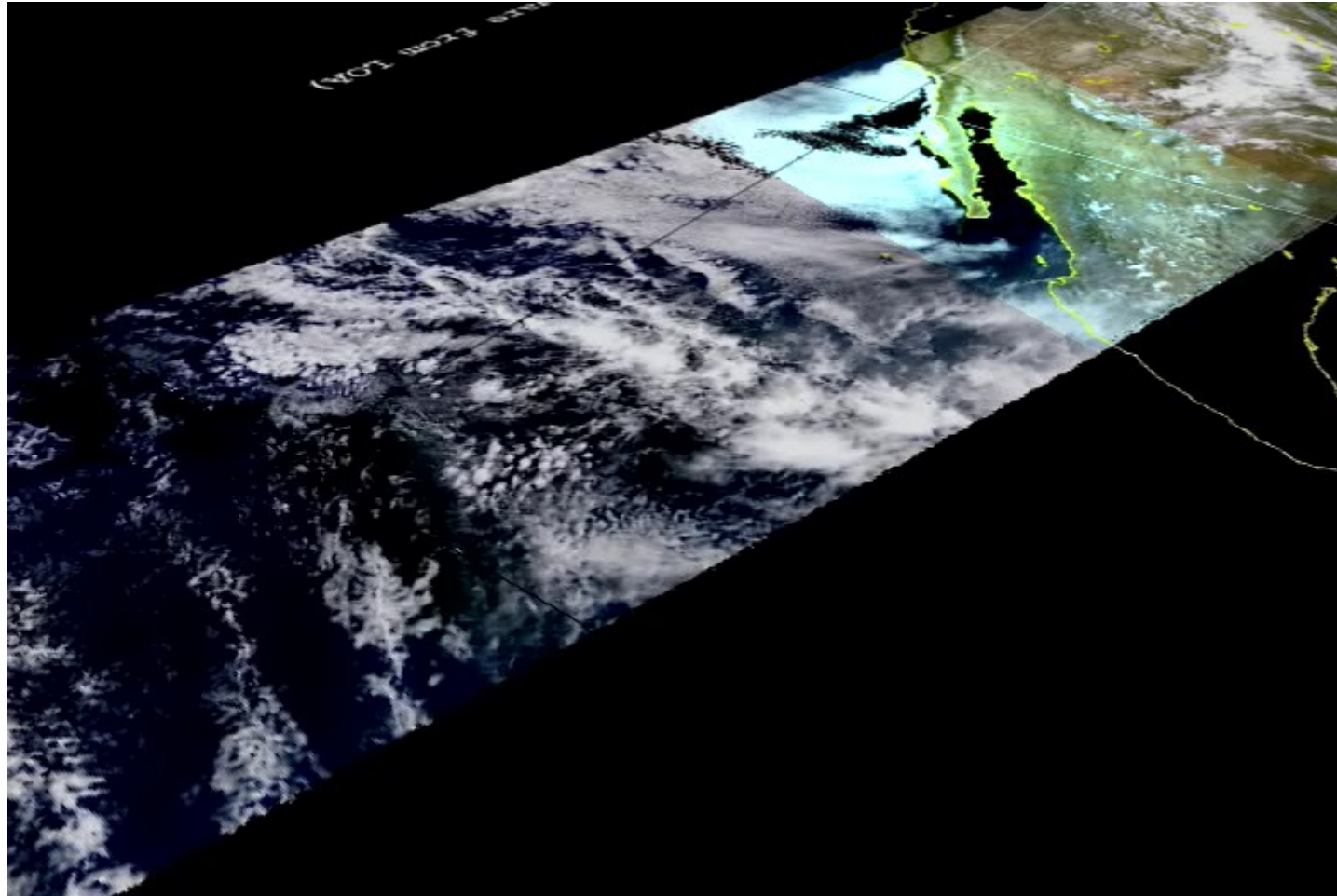
- POLDER concept and capabilities
 - Polarisation capabilities
 - Multiangle observation
- POLDER ERB, WV and Clouds Products
 - Outline of Processing line and products
 - Level 2, Level 3 and Joint Atmosphere Product
- Data availability and Tools

POLDER concept and capabilities

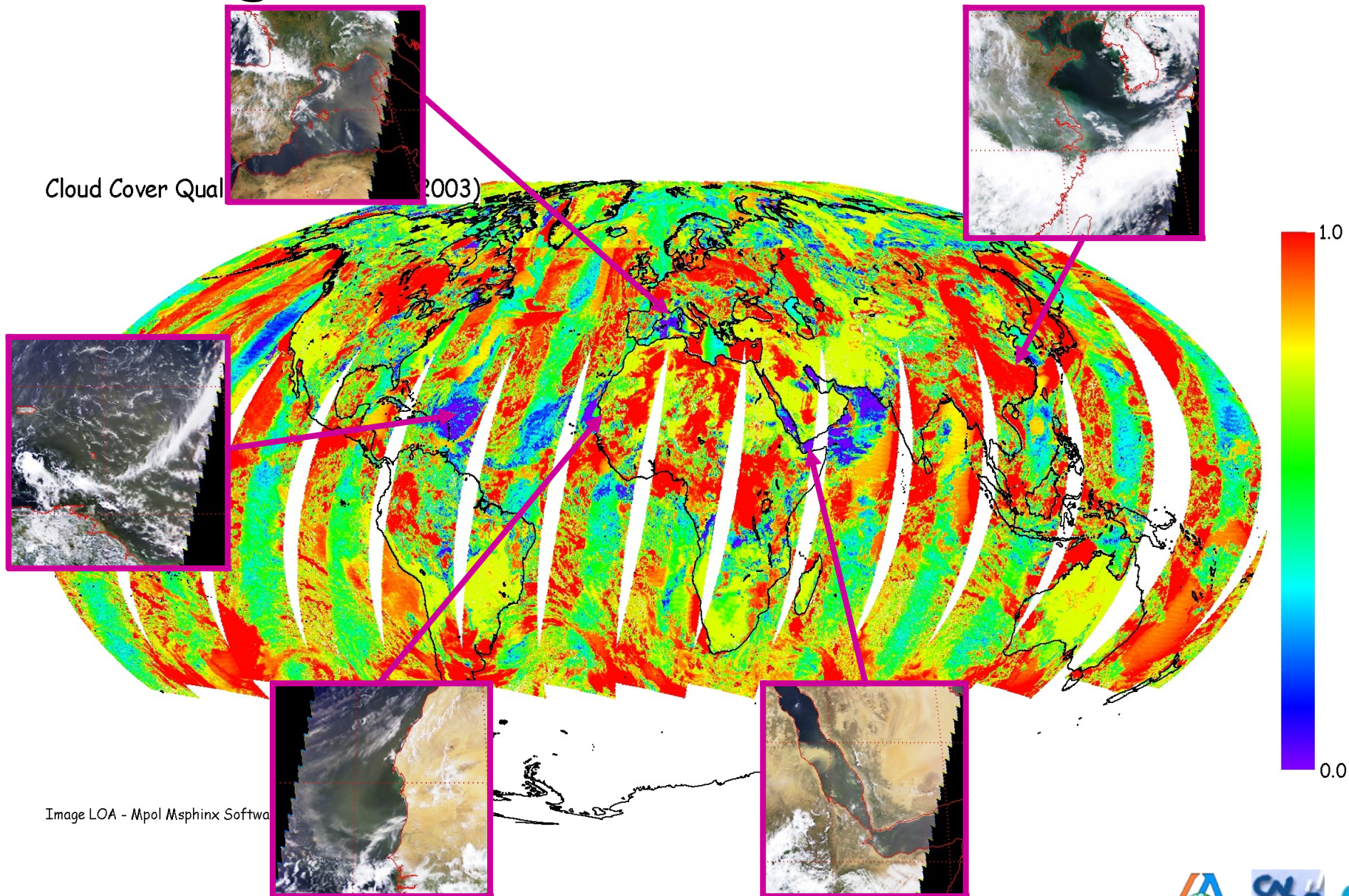
- POLDER instrument LOA/CNES
- Platform Adeos 1 – Adeos 2
- Mission
 - POLDER 1 : Nov 1997 – June 1997
 - POLDER 2 : Jan 2003 – Oct 2003
- Main characteristics :
 - Wide field of view + CCD array
 - Multispectral : 443 nm - 910 nm
 - Multidirectionality
 - Polarisation in 3 bands : 443, 670, 865



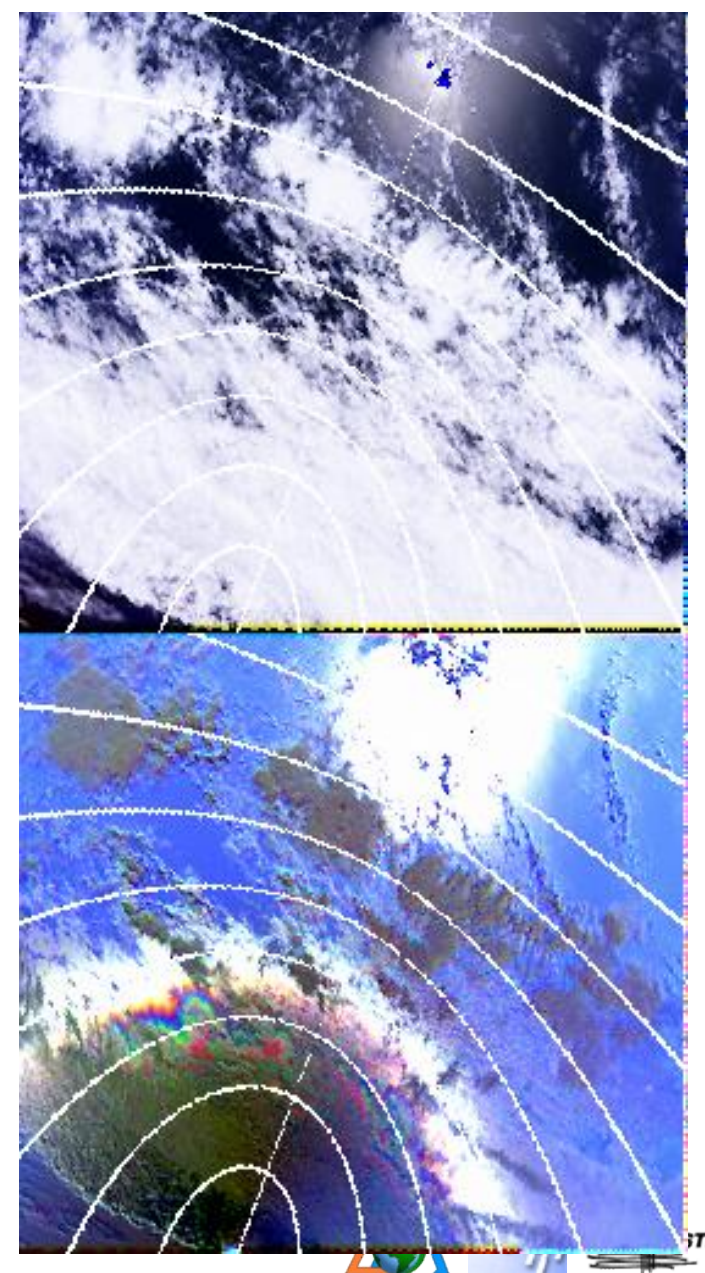
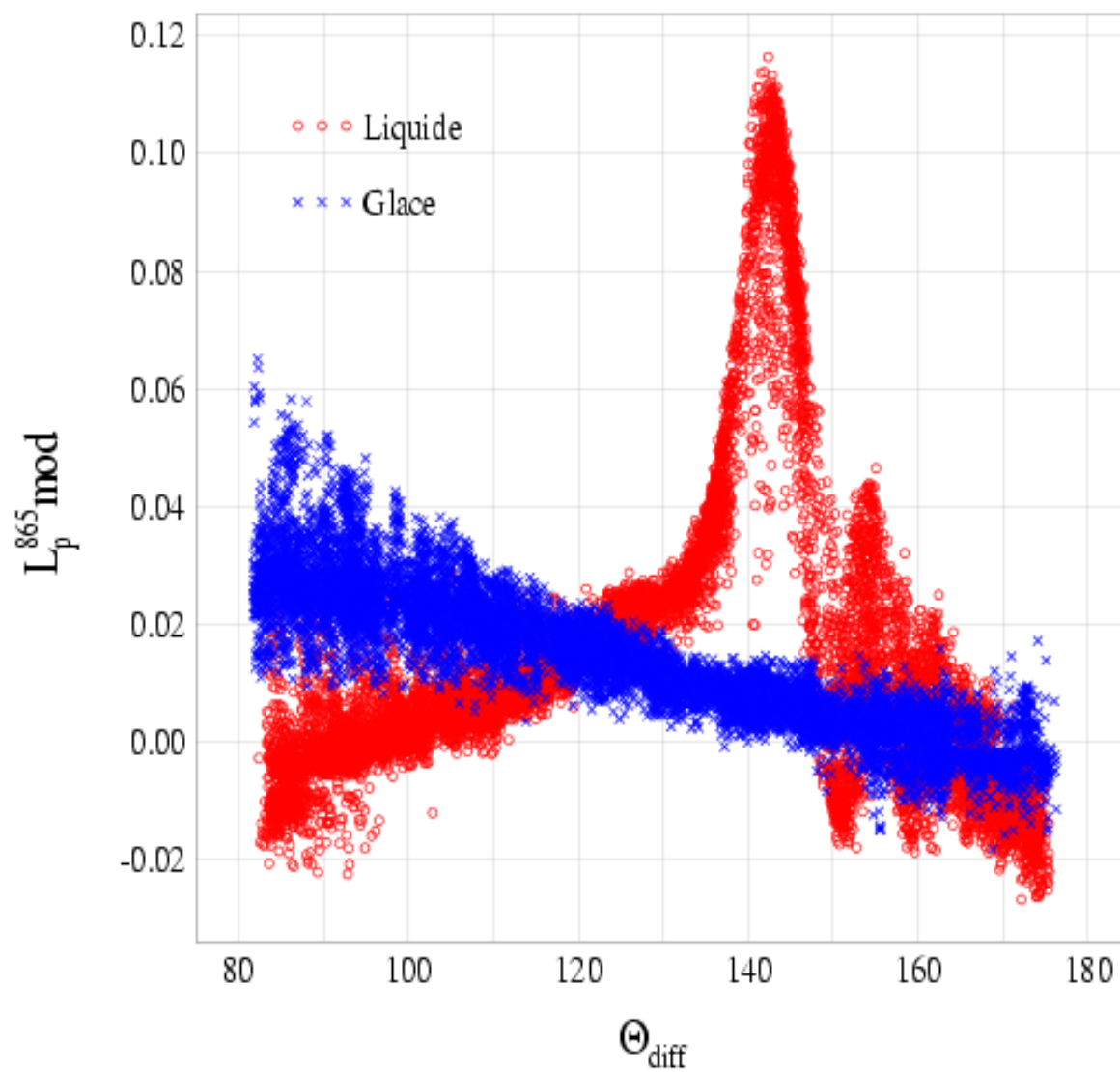
POLDER concept and capabilities



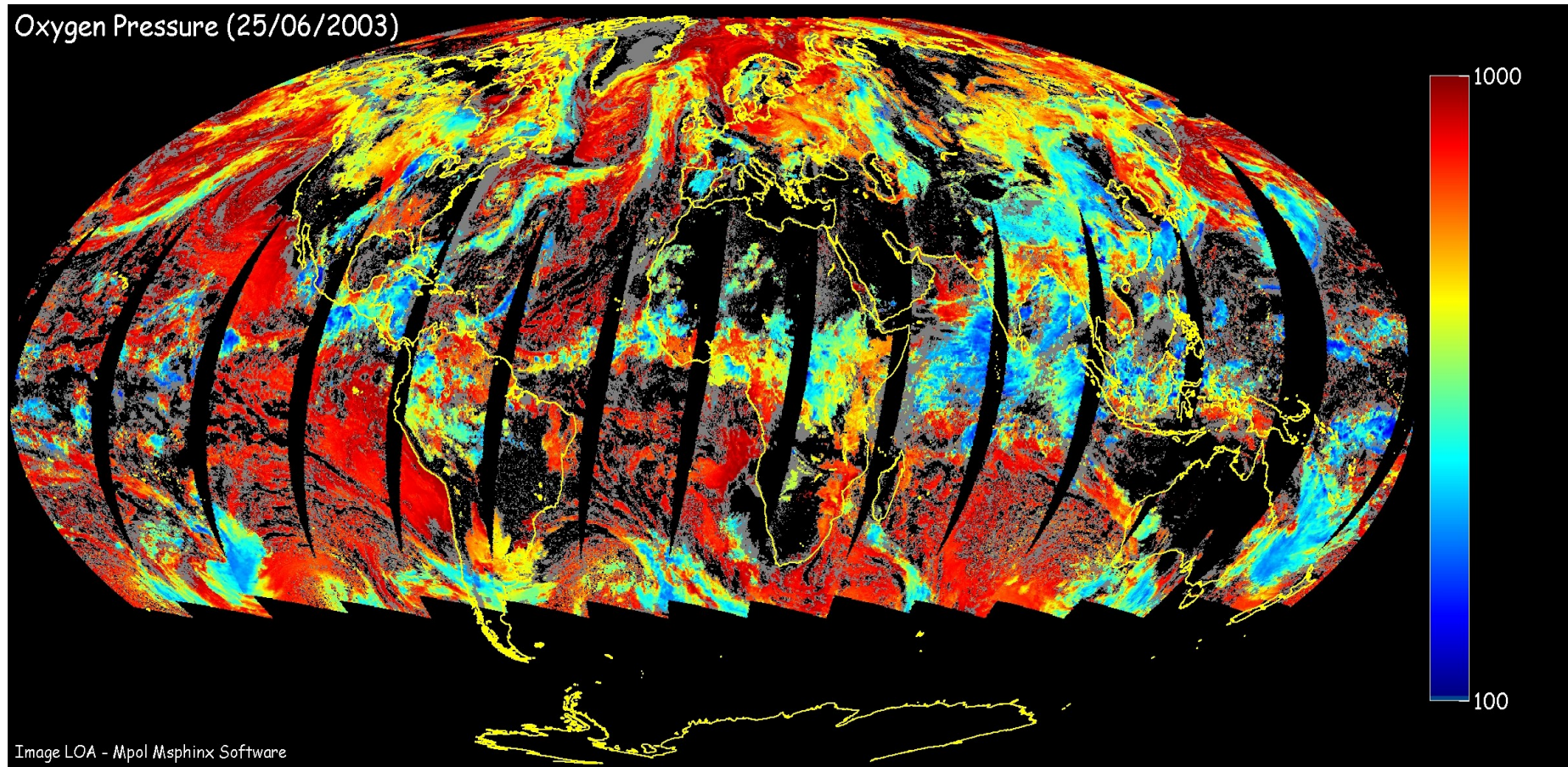
Multiangle measurements and Cloud detection



Multiangle polarisation measurements and Cloud Phase



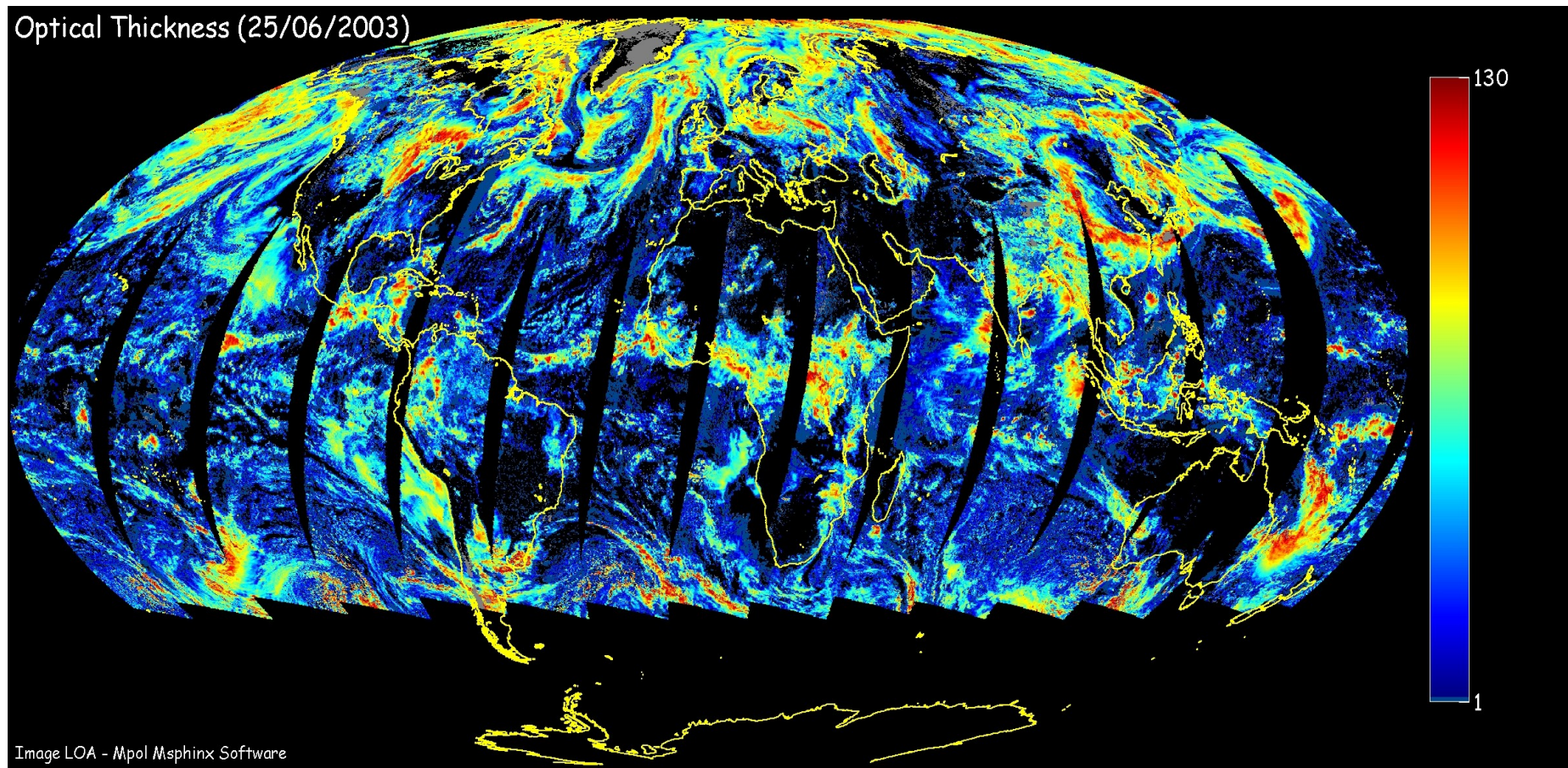
Multiangle multispectral measurements



Differential absorption is used to infer cloud top (middle) pressure - 763nm and 765 nm

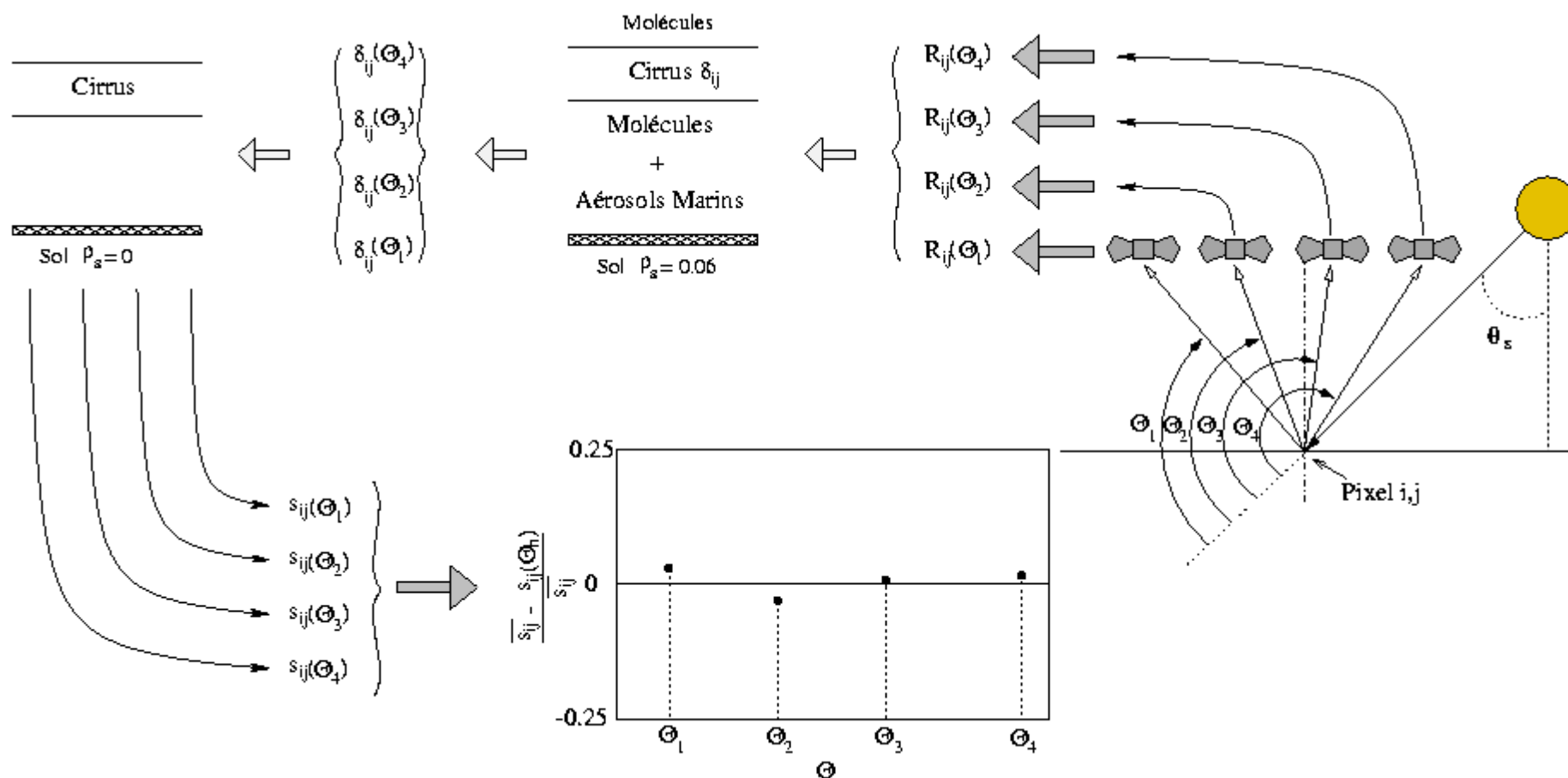
Directional product - Retrieval is performed in up to 14 directions

Multiangle multispectral measurements

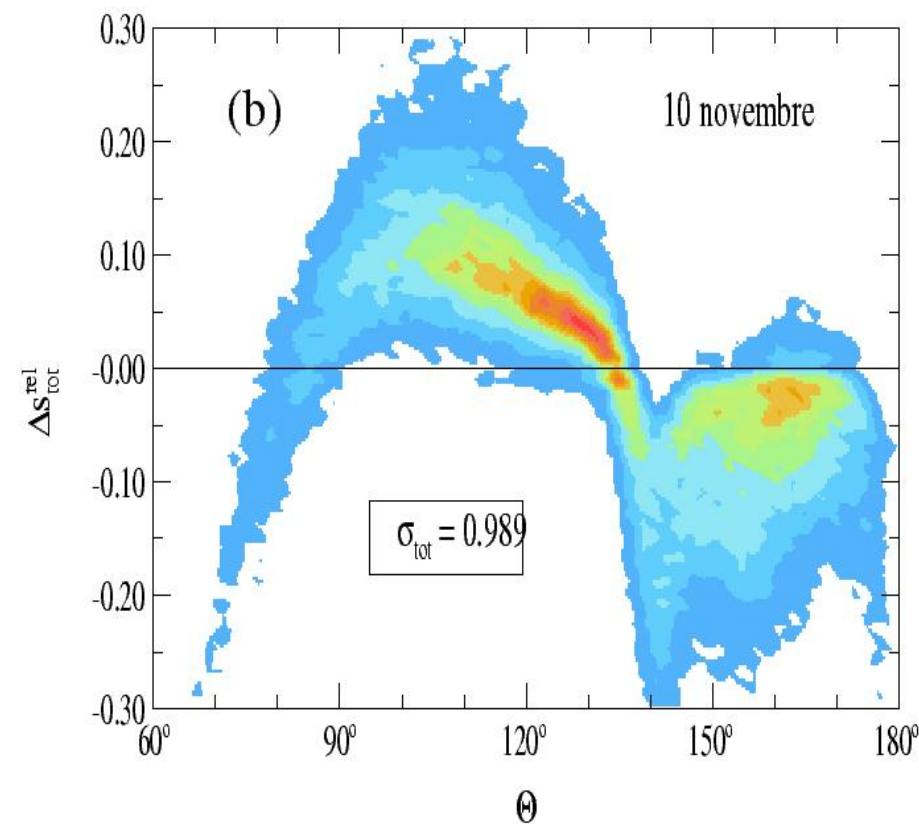
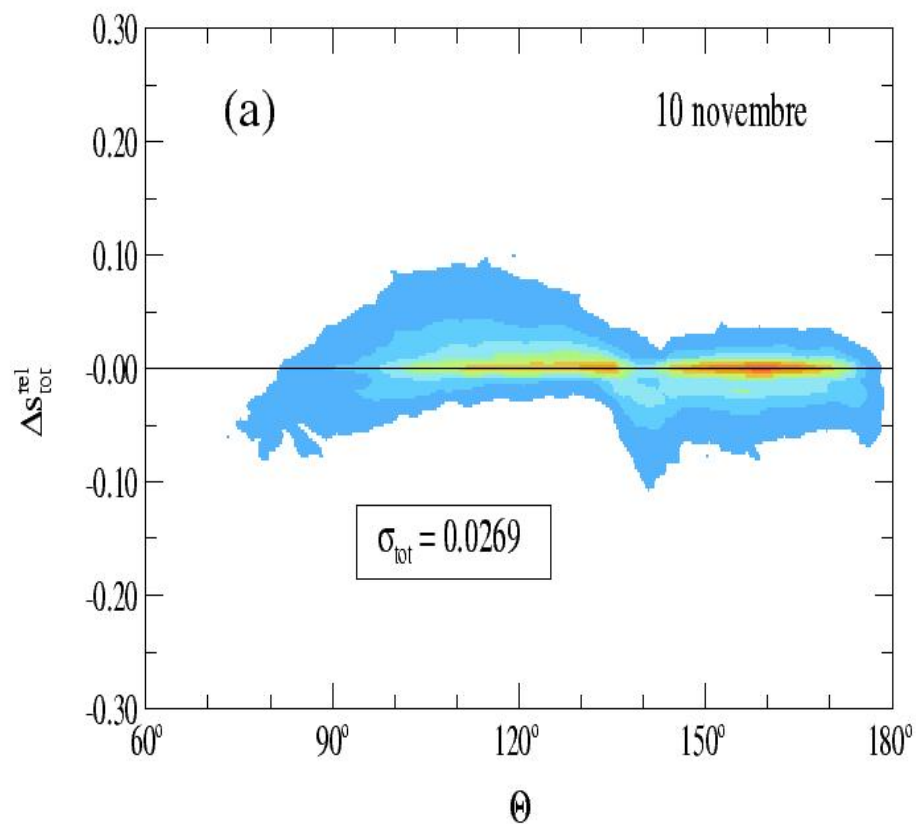


Cloud optical thickness is retrieved under up to 14 directions
Directional product provided at 670nm (land) and 865 nm
(ocean)

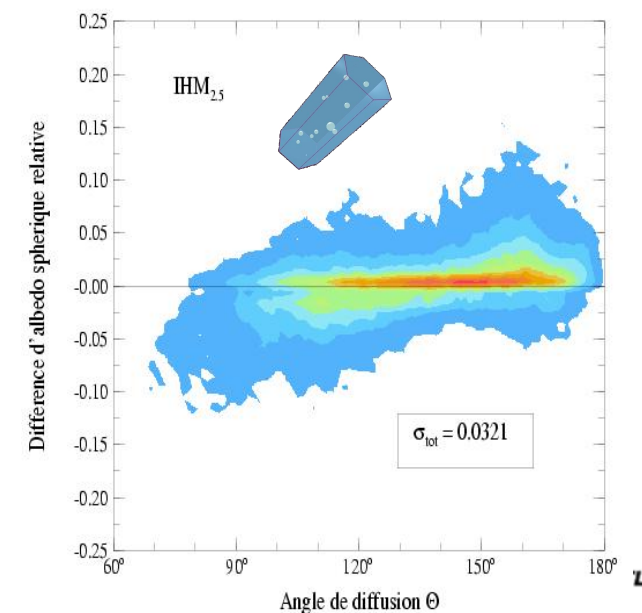
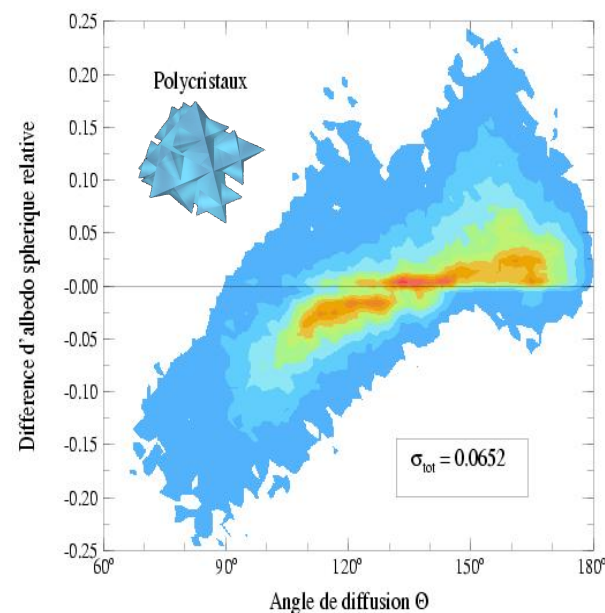
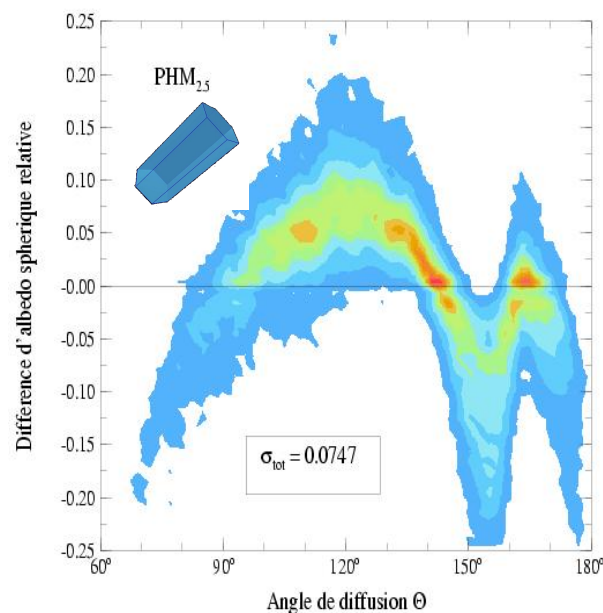
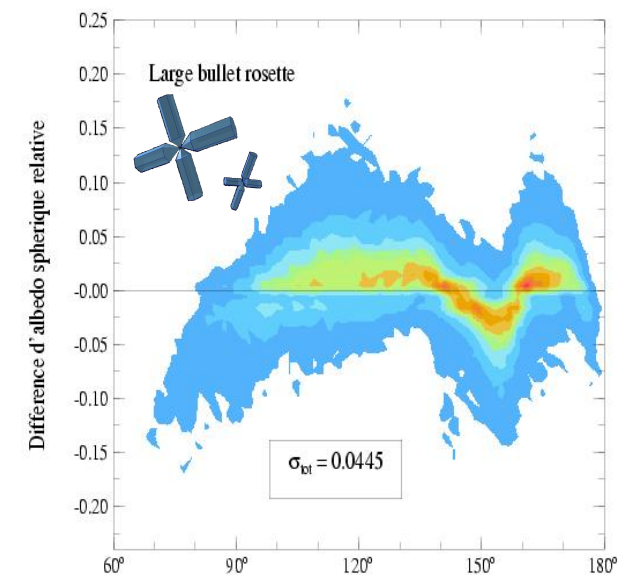
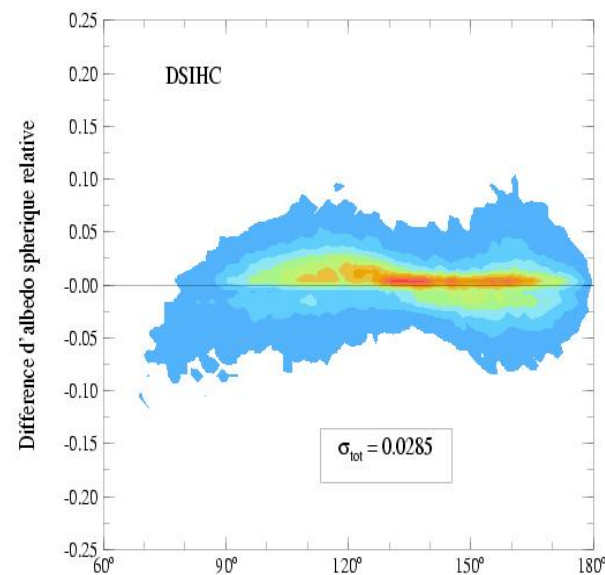
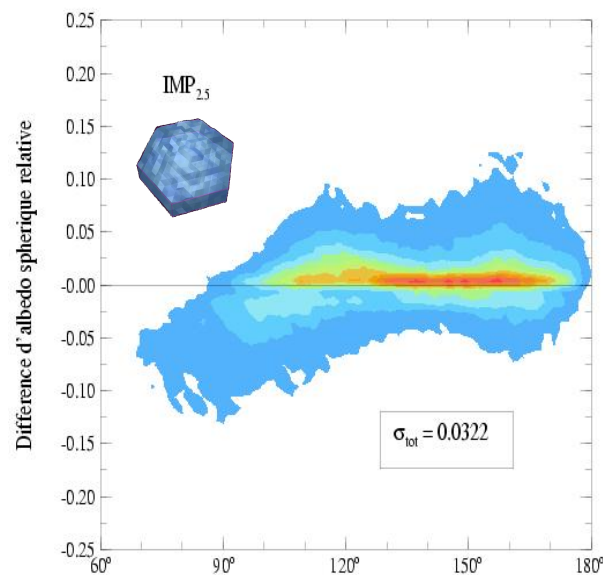
Testing cloud models from multiangle observation



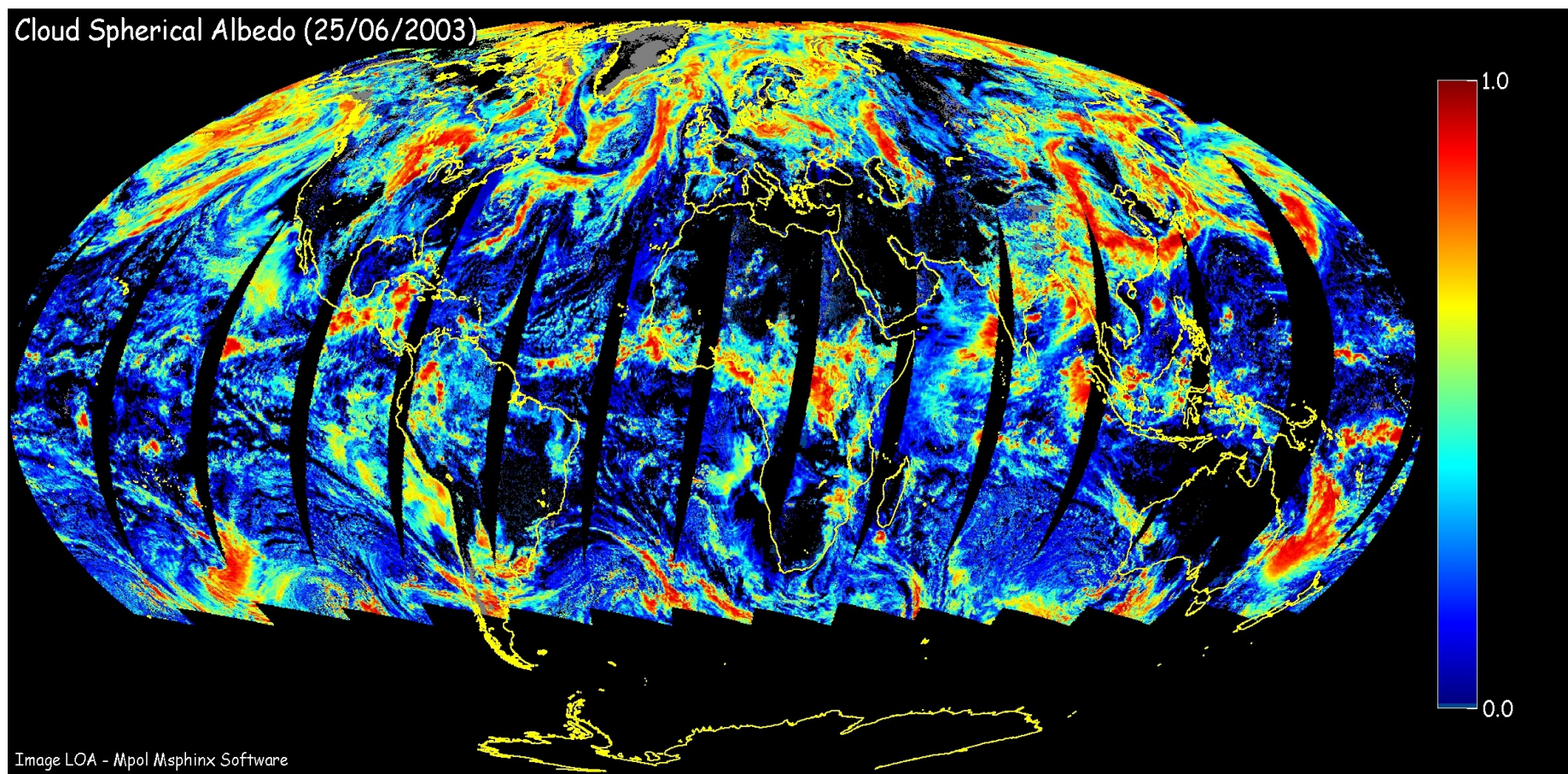
Testing cloud models from multiangle observation



Testing cloud models from multiangle observation



Multiangle multispectral measurements

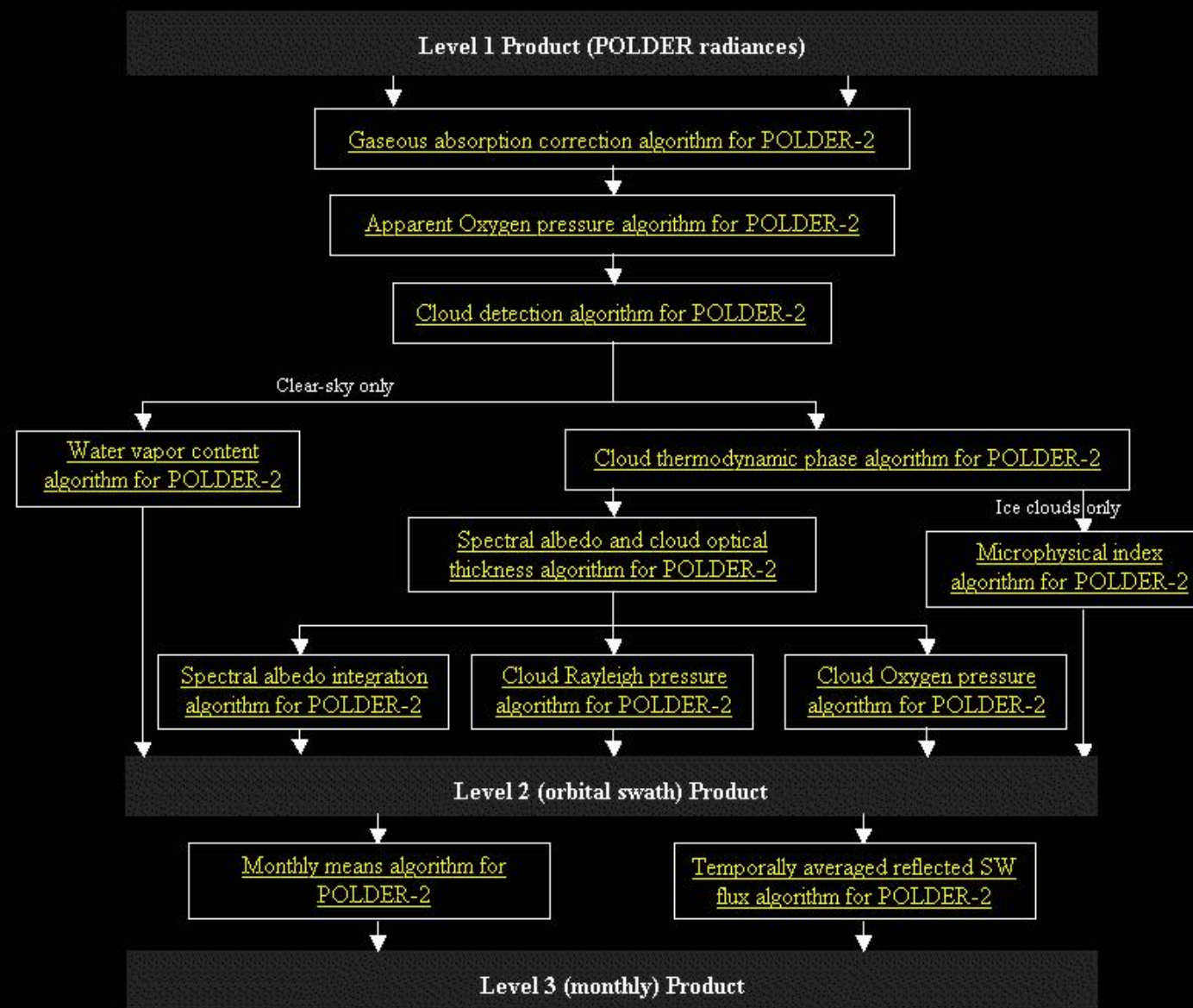


- 3 Spectral Cloud Albedo
- = 443 nm → 200 – 550 nm
 - = 670 nm → 550 – 700 nm
 - = 865 nm → 700 – 4000 nm
- SW CLOUD ALBEDO



"ERB, WV & Clouds" algorithm documents for POLDER 2

All files available for download on this page are stored in the PDF format.



Outlin

ES
Products

POLDER ERB, WV and Clouds Products

Cloud Cover (25/06/2003)

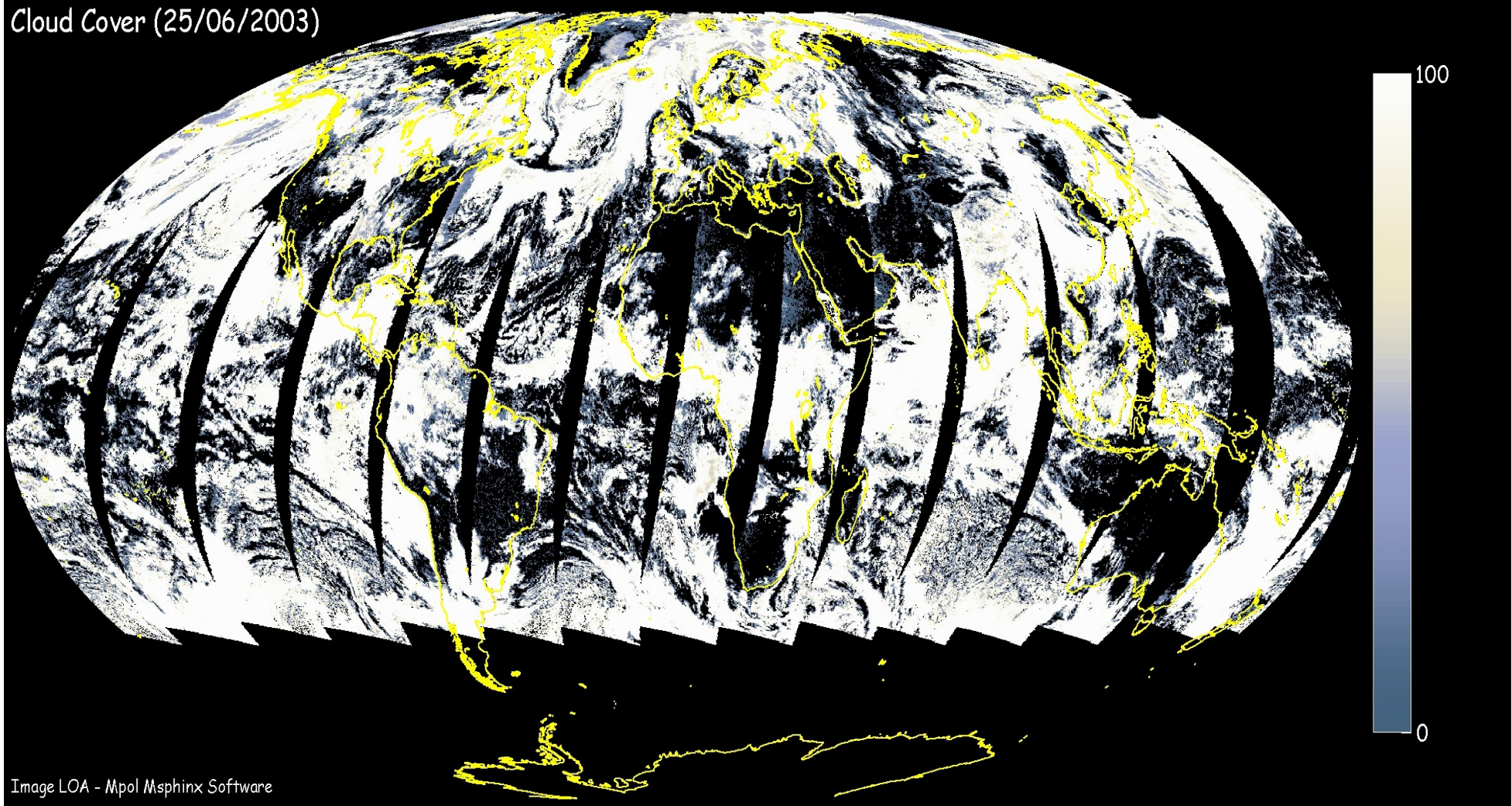


Image LOA - Mpol Mspinx Software

POLDER ERB, WV and Clouds Products

Cloud Phase (25/06/2003)

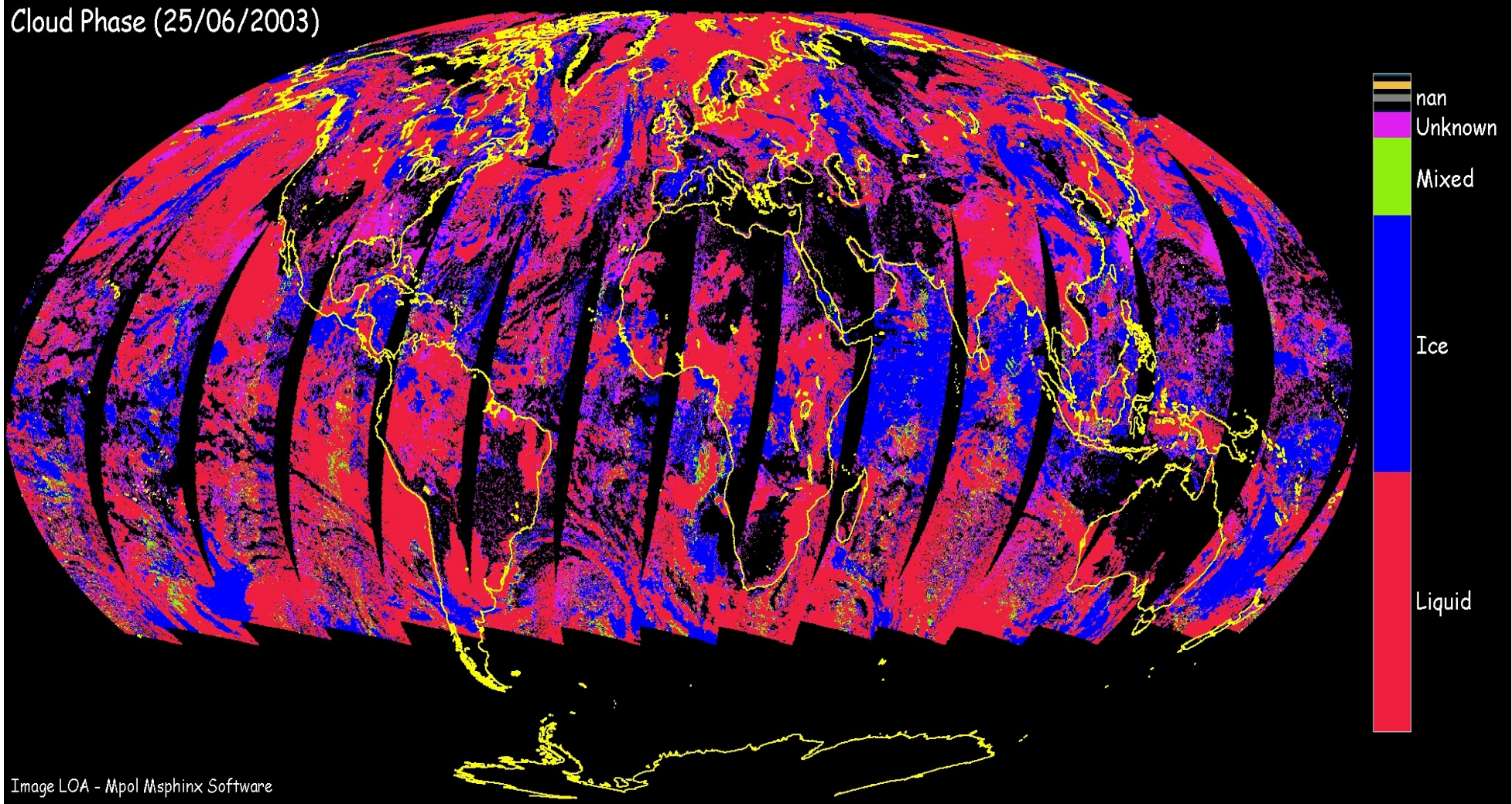


Image LOA - Mpol Mspinx Software

POLDER ERB, WV and Clouds Products

Optical Thickness (25/06/2003)

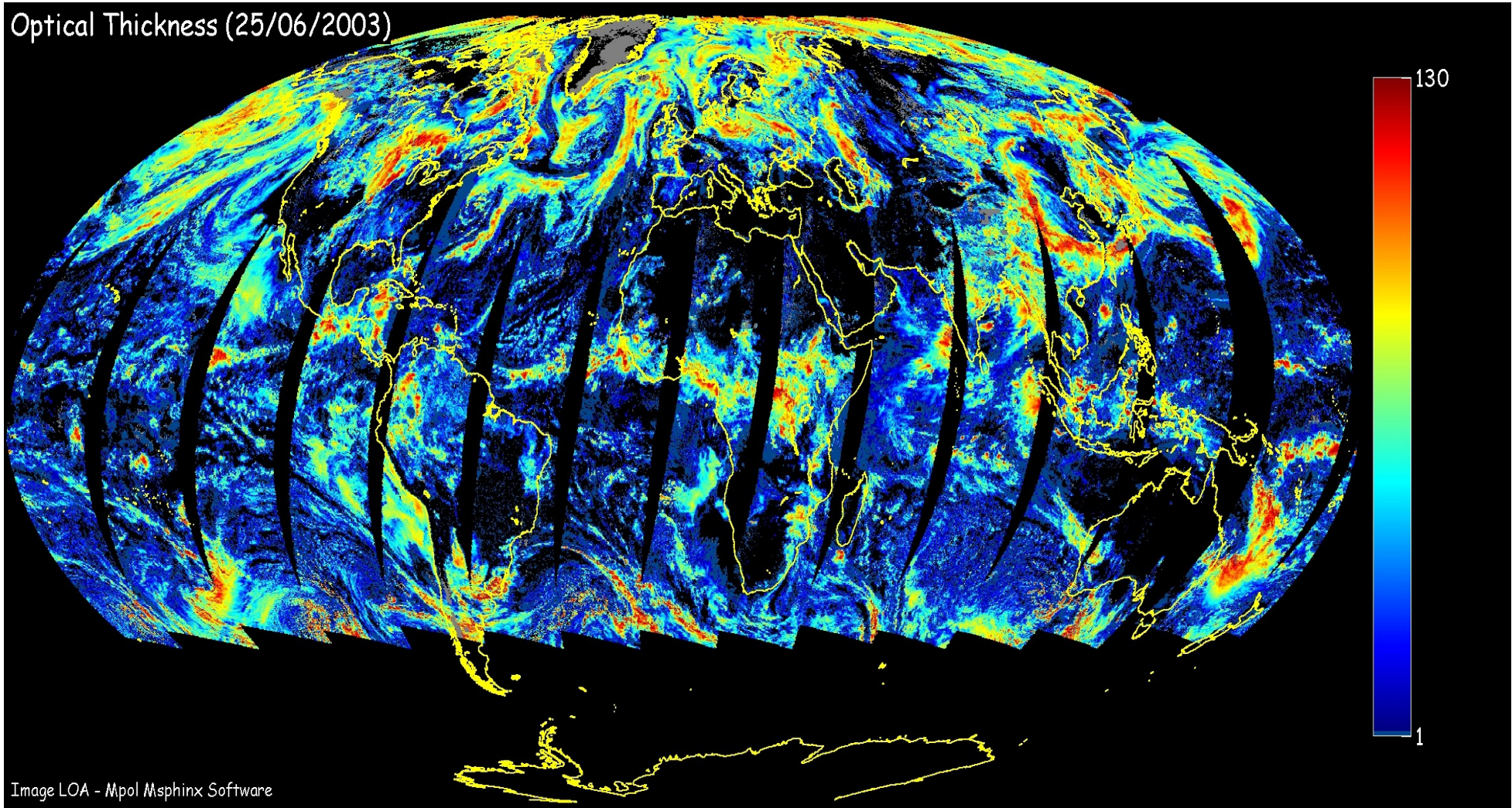


Image LOA - Mpol Mispinx Software

POLDER ERB, WV and Clouds Products

Oxygen Pressure (25/06/2003)

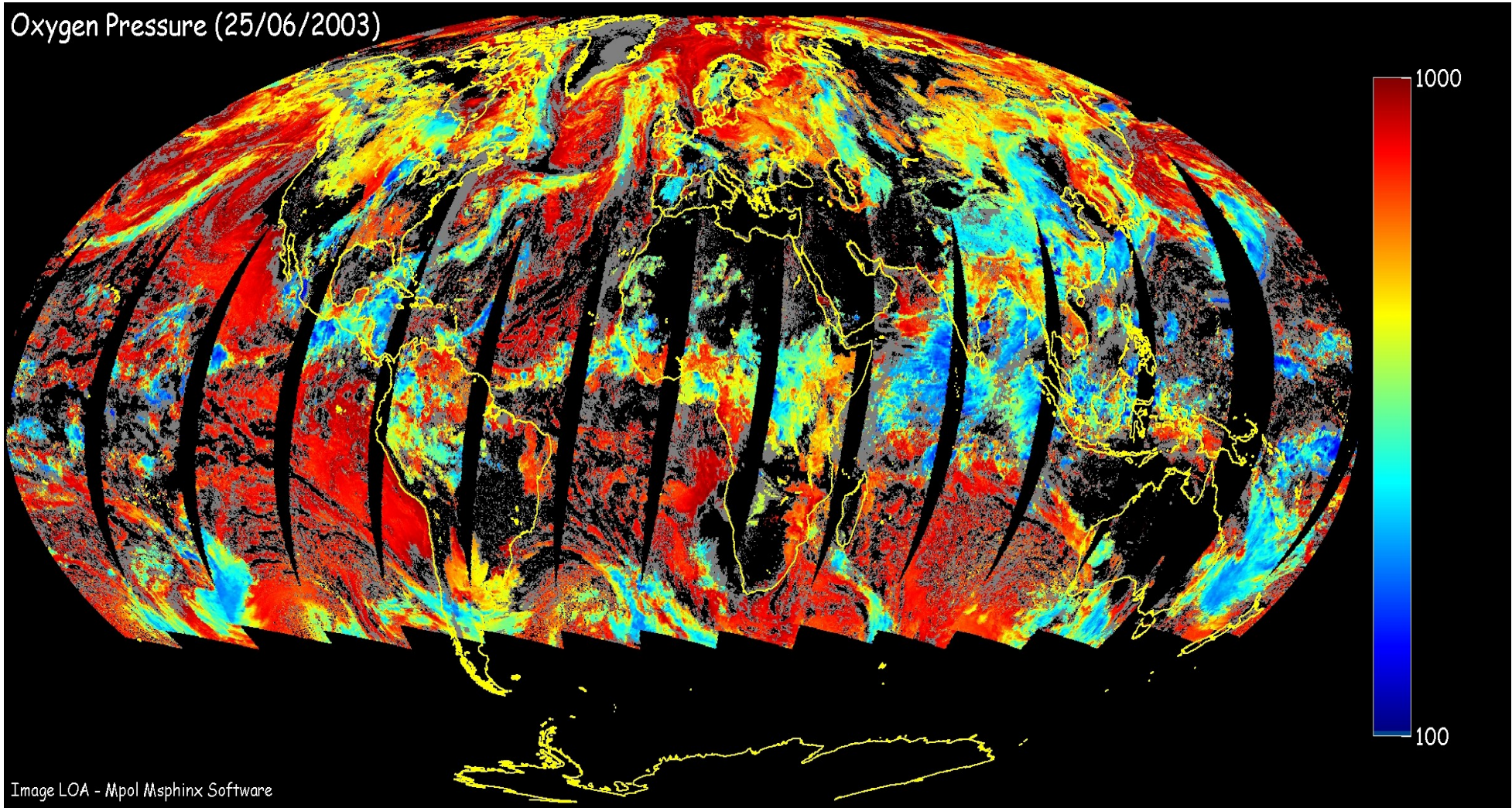


Image LOA - Mpol Mispinx Software

POLDER ERB, WV and Clouds Products

Mean Spectral Albedo (25/06/2003)

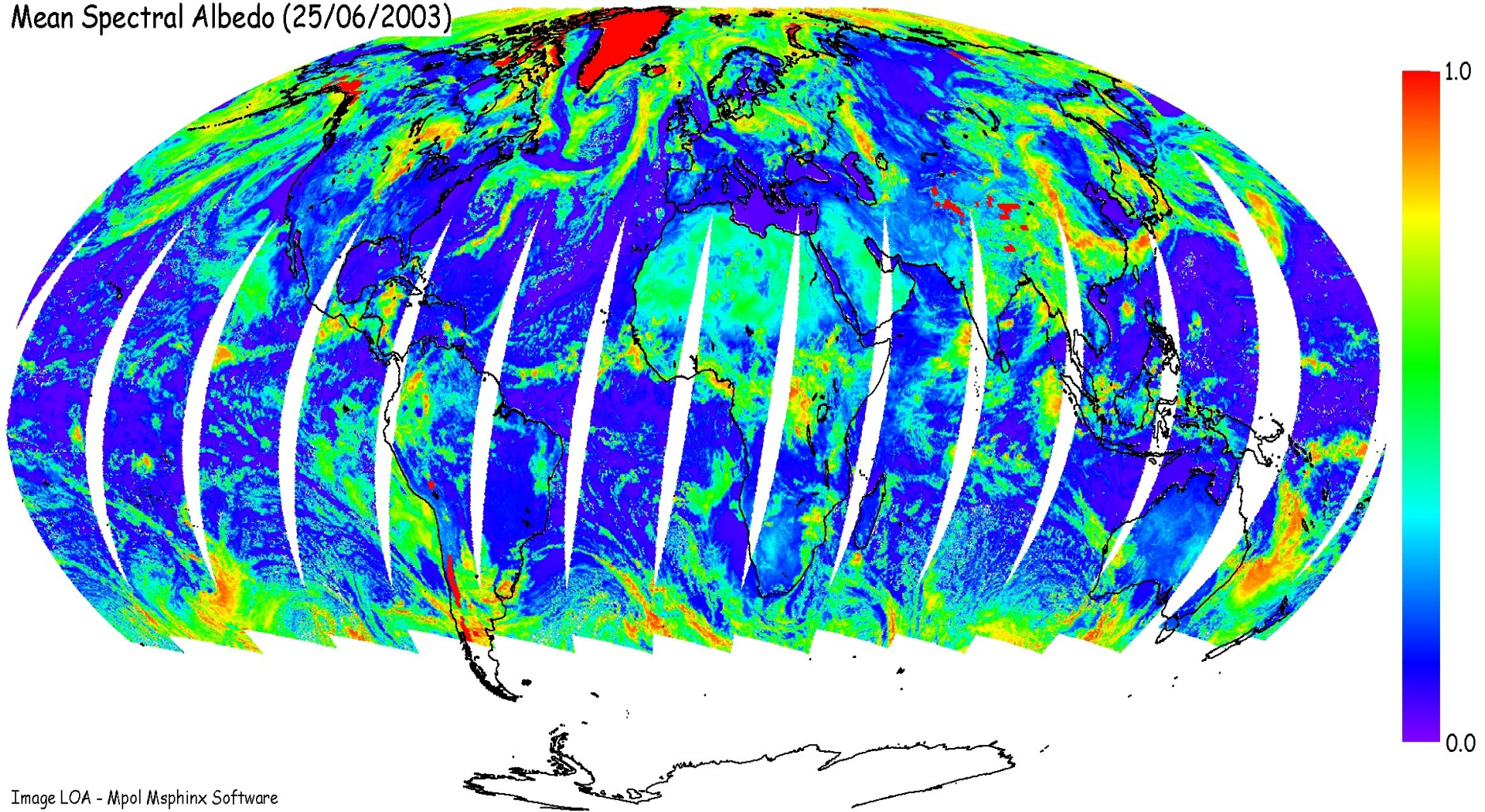


Image LOA - Mpol Msphinx Software

POLDER ERB, WV and Clouds Products

Relative Angular Deviation of Spectral Albedo (25/06/2003)

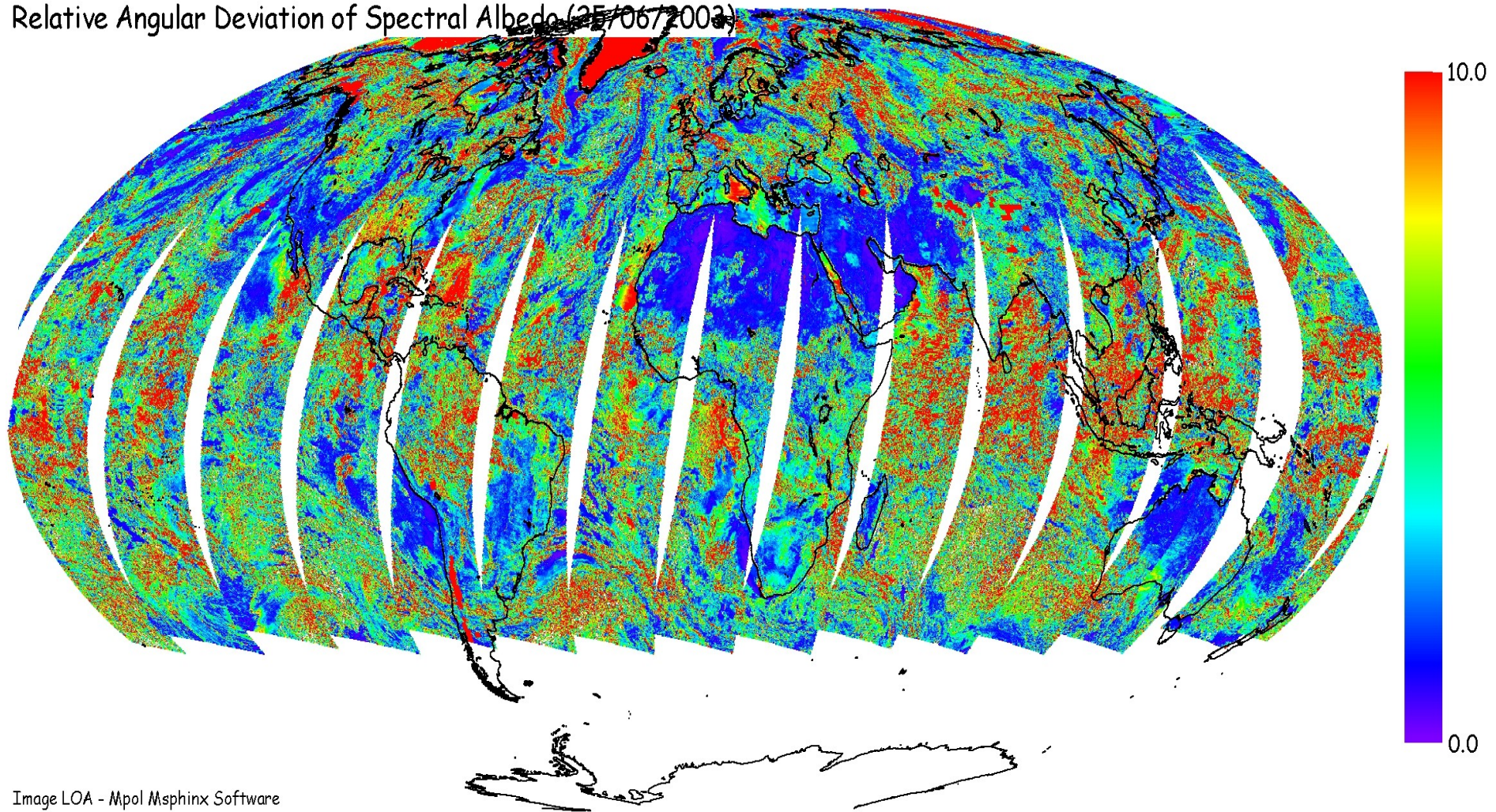


Image LOA - Mpol Msphinx Software

POLDER ERB, WV and Clouds Products

Shortwave Albedo (25/06/2003)

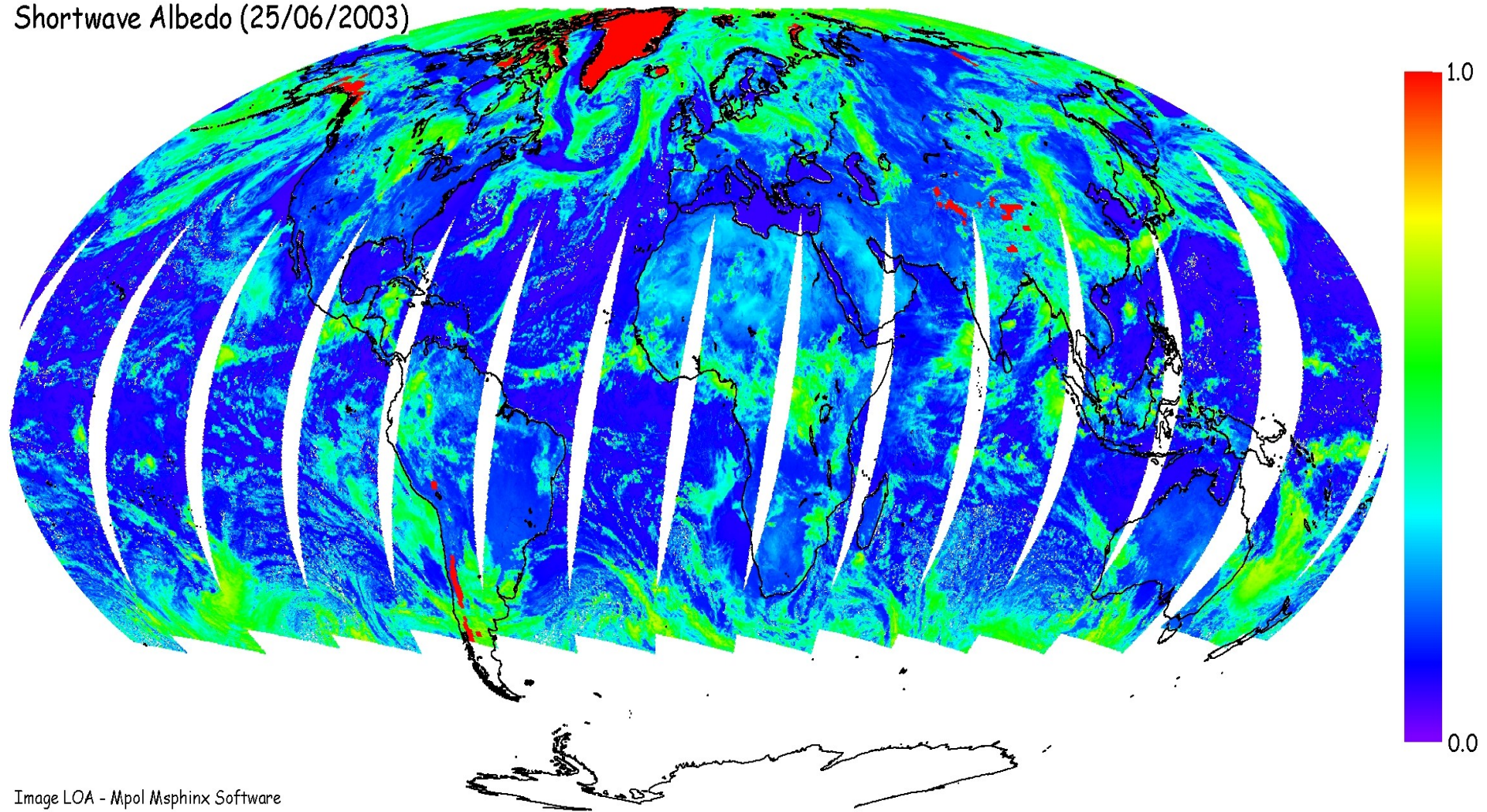


Image LOA - Mpol Msphinx Software

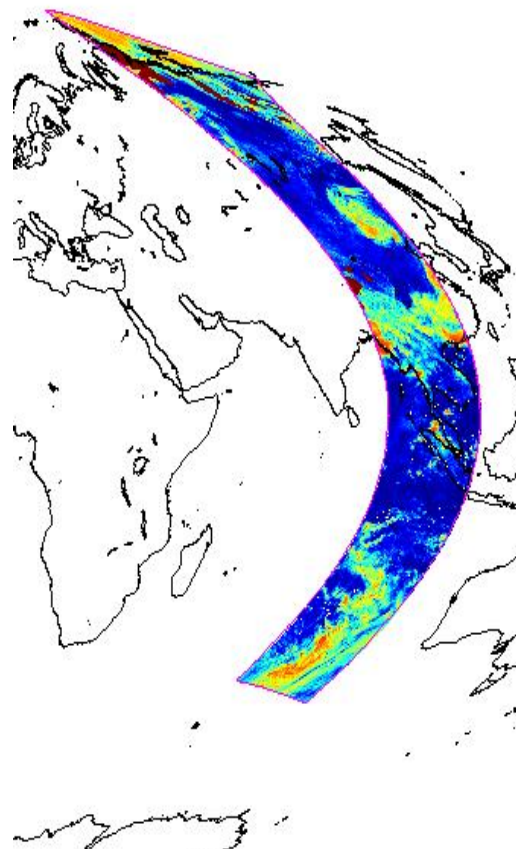
Level 2, Level 3 and Joint Atmosphere Product

An improved version of the algorithms have been applied to ADEOS 2 - POLDER data. The major improvements of collection 2 algorithms are :

- a better spatial resolution of the "ERB, WV & clouds" products
- a better cloud detection, especially in presence of dust events and over ice/snow surfaces.
- a reduction of the bias in total water vapor content by determining the reflectance ratio to water vapor parameterization directly with respect to SSMI water vapor observations and by taking into account the effect of surface spectral variability.
- a more complete determination of the cloud thermodynamic phase
- a better retrieval of the ice cloud optical thickness
- a drastic reduction of the number of abnormally high values of retrieved cloud top pressure.
- a more accurate derivation of the spectral albedoes and the calculation of a monthly averaged reflected shortwave flux.



Level 2, Level 3 and Joint Atmosphere Product



The level 2 (orbital swath) products contain about thirty non-directional parameters and ten directional parameters (for each of the 14 viewing directions).

Non Directional Parameters: Select all

- 9[CHU]: Observation UT time hours
- 10[CHU]: Observation UT time minutes
- 11[CHU]: Number of available viewing directions
- 12[CHU]: Number of directions used for Rayleigh pressure
- 13[CHU]: Indices of the first / last direction containing
- 14[CHU]: Cosine of solar zenith angle for the central pixel
- 15[SHU]: Mean spectral albedo at 670 nm [land] and 865 nm [ocean]
- 16[CHU]: Relative Spatial dispersion of the albedo (base on 14 viewing directions)
- 17[CHU]: Relative Angular dispersion of the albedo (base on 14 viewing directions)
- 18[CHU]: Albedo quality index (0;bad 1;excellent)
- 19[SHU]: Scene albedo
- 20[CHU]: Relative Angular dispersion of the scene albedo
- 21[CHU]: Clear albedo (modeled, independent of POLDER measurements)
- 22[SHU]: Shortwave albedo
- 23[CHU]: Clear shortwave albedo (modeled, independent of measurements)
- 24[CHU]: Cloud Cover
- 25[CHU]: Fraction of obs classification from uncertain.
- 26[CHU]: Cloud cover quality index (0;bad 1;excellent)
- 27[CHU]: Water vapor column (g,cm-2)
- 28[CHU]: Standard deviation of water vapor estimates (g,cm-2)
- 29[CHU]: Cloud pressure derived from Oxygen channels. (hPa)

Directional Parameters: Select all

- 65[CHU]: Relative azimuth angle (for the central pixel)
- 66[SHU]: Reflectance corrected for gas absorption at 670 nm
- 67[SHU]: Spectral albedo estimated from the above reflectance
- 68[SHU]: Reflectance corrected for gas absorption at 865 nm
- 69[SHU]: Shortwave albedo
- 70[CHU]: Polarized normalized radiance at 865 nm, corrected for gas absorption
- 71[CHU]: Number of cloudy / clear pixels
- 72[CHU]: Directional apparent cloud cover
- 73[CHU]: Spectral cloud albedo (mean on cloudy pixels)

Level 2, Level 3 and Joint Atmosphere Product

The level 3 (monthly) products contain about forty parameters.

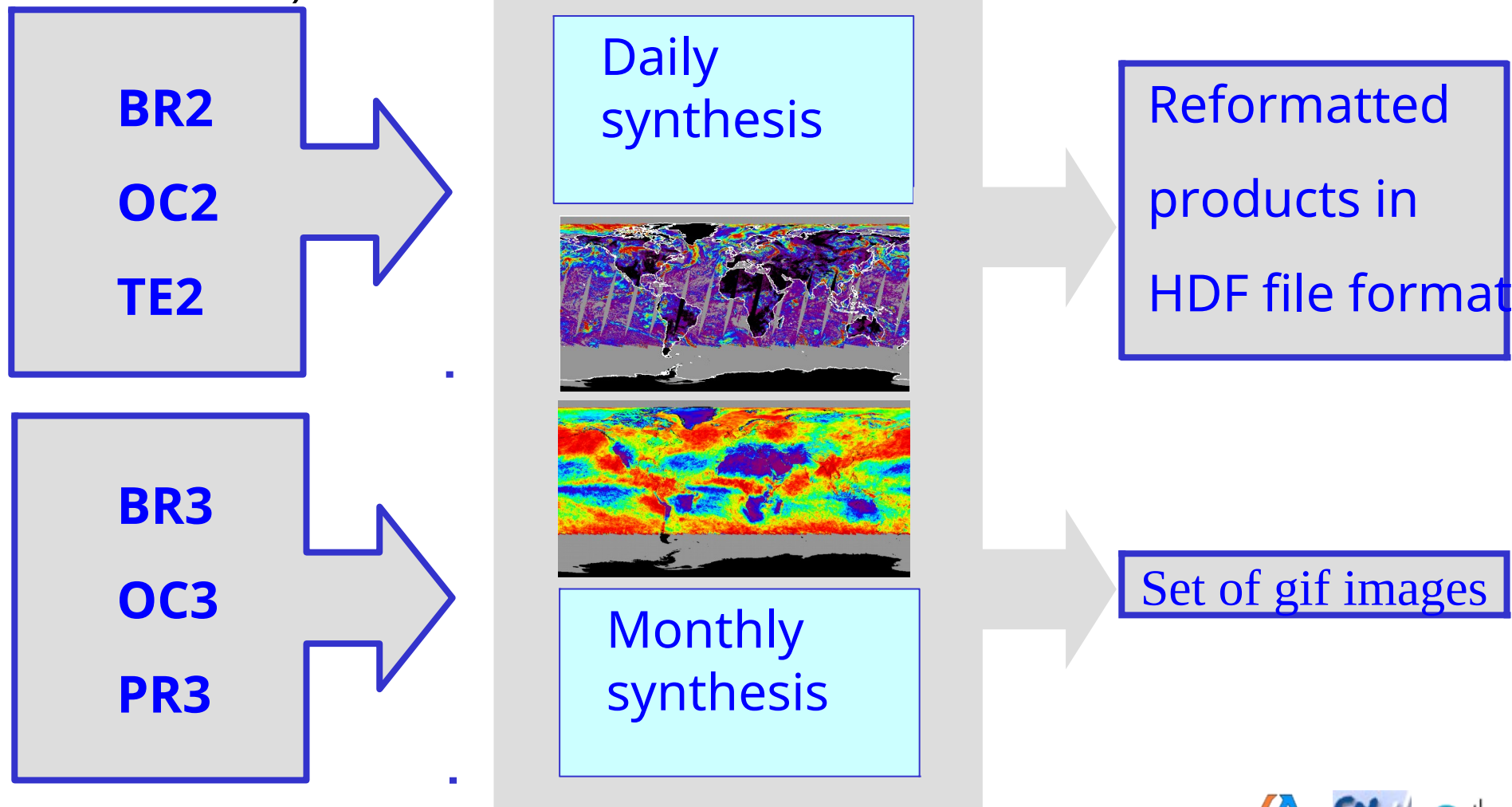
Record Number in the file : $2 \leq \text{RecNum} \leq \text{Nrec} + 1$	Standard Deviation of the Clear Sky SW Albedo
Length of this record (bytes): 84	Monthly mean of the Clear SW albedo, based on radiative transfer simulations only
Line Num. of the pix. in POLDER medium res. grid	TOA monthly-mean incoming solar Flux [W.m^{-2}]
Col. Num. of the pix. in POLDER medium res. grid	TOA monthly-mean reflected Flux [W.m^{-2}]
Mean pixel altitude from the DEM in the 3x3 super pixel (meters)	Monthly-mean SW cloud forcing [W.m^{-2}]
Land, Water, Mixed indicator ¹¹	Monthly mean cloud cover
Number of days with POLDER measurements	Standard Deviation of cloud cover estimates
Number of observations (there may be several observation within a single day at high latitudes)	CN ₊ : Fraction of observations classified from "uncertain" to "cloudy"
Number of observations with snow/ice indicator	CN ₋ : Fraction of observations classified from "uncertain" to "clear"
Number of observations with clear sky	Four bit each: One byte contains 16 CN ₊ + CN ₋ .
Number of observations with cloud presence.	Monthly mean water vapor column [g cm^{-2}]
Number of cloud optical thickness estimates	Std. deviation water vapor column [g cm^{-2}]
Number of oxygen pressure estimates	Cloud pressure based on oxygen channels (monthly mean weighted by cloud cover) [hPa]
Number of Rayleigh pressure estimates.	Standard Deviation of Oxygen Cloud pressure [hPa]
Number of cloud phase estimates	Cloud pressure based on Rayleigh method (monthly mean weighted by cloud cover) [hPa]
Number of water vapor column estimates	Std. deviation of Rayleigh cloud pressure [hPa]
Monthly mean of the cosine of the solar zenith angle	Mean cloud optical thickness
Monthly mean of the spectral ¹² Albedo	Relative dispersion of cloud optical thickness [%]
Standard Deviation of the spectral Albedo	Mean cloud optical thick., liquid phase occurrences
Monthly Mean Clear Sky spectral Albedo	Mean cloud optical thick., ice phase occurrences
Standard Dev. of the Clear Sky spectral Albedo	Mean cloud optical thick., mixed phase occurrences
Monthly mean of the Clear spectral albedo, based on radiative transfer simulations only	Mean Spherical Albedo
Monthly mean of the SW Albedo	Standard deviation on spherical albedo
	Relative frequency of phase [%]. Bins are "Unknown", "Liquid", "Ice" and "Mixed" ¹³ .
	Relative frequency of ice cristal shapes [%]



Level 2, Level 3 and Joint Atmosphere Product

Projection Lat-Lon 1080*2160 (1/6°)

Local Daily Synthesis (observation ~ 10h30 H solar local time)



Level 2, Level 3 and **Joint Atmosphere Product**

UT	Universal Time	D		TOTFRE	Percent. of successful Phase retrievals		M
MASK	Coastline			LIQFRE	Liquid Phase Frequency		M
CC	Cloud Cover	D	M	ICEFRE	Ice Phase Frequency		M
QCC	Cloud Cover Quality Index	D		MIXFRE	Mixed Phase Frequency		M
WV	Total precipitable Water Vapor	D	M	LIQTAU	Liquid Water Cloud Optical Thickness		M
SDWV	Standard Deviation of Water Vapor	D		ICETAU	Ice Cloud Optical Thickness		M
PHASE	Cloud thermodynamic Phase	D		MIXTAU	Mixed-phase Cloud Optical Thickness		M
TAU	Cloud Optical Thickness	D		FINC	Shortwave Incident flux		M
PRAY	Cloud Rayleigh Pressure	D	M	FREFL	Shortwave Reflected flux		M
POXY	Cloud Oxygen Pressure	D	M	FCLEAR	Clear-sky Shortwave Reflected Flux		M
AVIS	Albedo at 670/865 nm	D	M	TAUA	Aerosol Optical Thickness at 865 nm	D	M
QAVIS	Albedo Quality index	D		ANG	Angstrom Coefficient	D	M
AVISCL	Clear-sky Albedo at 670/865 nm		M	TAUAFM	Aerosol Opt. Thick. (865nm Fine Mode)	D	M
ASW	Shortwave Albedo	D	M	ANGFM	Angstrom Coefficient for Fine Mode	D	M
ASWCL	Clear-sky Shortwave Albedo		M	INDA	Aerosol Index	D	M
				IQAI	Aerosol Inversion Quality Index	D	

Products availability

POLDER1 : November 1996 to June 1997

POLDER2 : April 2003 to October 2004

Level1 : calibrated georeferenced data

Level2 : daily products – one file per orbit swath

Level3 : monthly products

Joint Atmosphere product (selected daily and monthly products)

Data processed with collection 2 algorithms for POLDER 2 and under reprocessing for POLDER 1

Data ordering interface from the CNES POLDER web portal ...

Web POLDER

Multiple angle ... and multiple web portal

POLDER - Mozilla
<http://smc.cnes.fr/POLDER/index.htm>

POLDER Atmosphere, Land and Ocean mission
 Climate Research and Environment Monitoring

HOME | VERSION FRANCAISE | PRACTICAL INFORMATION | RIGHTS | WEBMASTER | HELP | OTHER SITES

WELCOME | NEWS | OBJECTIVES | SATELLITE | INSTRUMENT | GROUND SEGMENT | ORGANIZATION | CONTACTS | GALLERY | RELATED SITES

CALIBRATION | SCIENTIFIC PRODUCTS | PUBLICATIONS | POLDER USER SERVICES

The project main steps

1 Studies 2 Development 3 In flight operation 4 Scientific data use

POLDER-1 08/96 05/97

POLDER-2 12/02 10/03

CHARACTERISTICS

POLDER 2 Instrument set up on board JAXA ADEOS-2 Satellite.

Wide field of view imaging radiometer.

To observe/measure:

- aerosols
- land surfaces
- clouds and oceans

Altitude of the ADEOS-2 satellite: 802.8 km

Launch on the 14/12/2002

Useful lifetime of the POLDER-2 instrument: 7 months

POLDER 1 Instrument set up on board JAXA ADEOS Satellite.

Altitude of the ADEOS satellite: 736.75 km

Useful lifetime of the POLDER-1 instrument: 8 months

NEWS

- 2004/08 : Start of POLDER 2 data distribution.
- 2004/07 : POLDER 2 Scientific Validation Review.
- 2004/01 : Calibration Summary Report.
- 2003/10 : Loss of ADEOS-2 satellite.
- 2003/07 : 2 months of POLDER 2 data.
- 2003/04 : First POLDER 2 Daily Syntheses.
- 2003/02 : First POLDER 2 images.

POLARIZATION and Directionality of the Earth's Reflectances

The French space agency, CNES, has developed the POLDER instrument, which flew on ADEOS (Advanced Earth Observation Satellite), developed by the Japanese space agency, JAXA. This was the first French/Japanese cooperative project in the area of Earth observation.

A second, identical instrument flew on ADEOS-2, successor to ADEOS, until October 2003.

POLDER is a wide field of view imaging radiometer that has provided the first global, systematic measurements of spectral, directional and polarized characteristics of the solar radiation reflected by the Earth/atmosphere system. Its original observation capabilities have opened up new perspectives for discriminating the radiation scattered in the atmosphere from the radiation actually reflected by the surface.

Pictures of POLDER 2 sensor integration phase on ADEOS-2.

Polder Home - Mozilla
<http://polder.cnes.fr/en/index.htm>

Home Information Fields Products User Desk Contact

Glossary ? polder@cst.cnes.fr

POLARIZATION and Directionality of the Earth's Reflectances

LATEST POLDER NEWS

- Start of POLDER 2 data distribution
- Calibration Summary Report
- Loss of ADEOS-2 satellite
- [More news...](#)

Select a field of interest to access POLDER products

- ERB, WV AND CLOUDS
- AEROSOLS
- LEVEL 1 DATA
- OCEAN COLOR
- LAND SURFACES

Gallery

Latest website news [Opening of the POLDER Website...](#)

© CNES 2004

[Site Security Policy](#) Latest update: July 19th, 2004

javascript:top.Clouds.loadWelcomePage()

<http://smc.cnes.fr/POLDER/index.htm>

<http://polder.cnes.fr>

"POLDER Single Orbit Browsers" - Mozilla

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop http://www-loa.univ-lille1.fr/recherche/polder/BROWSES_N1P1/199611/14/index.html Search Print

Home Bookmarks Red Hat, Inc. Red Hat Network Support Shop Products Training

Single Orbit Browse Gallery : Thu 14 Nov 1996



The gallery displays 14 satellite images of Earth, arranged in two rows of seven. Each image shows a different view of the Earth's surface and atmosphere, illustrating the multi-angle capability of the POLDER sensors. The images are displayed against a dark background with a grid pattern.


<http://www-loa.univ-lille1.fr/recherche/polder>

"POLDER Single Orbit Browsers" - Mozilla

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop http://www-loa.univ-lille1.fr/recherche/polder/BROWSES_N1P1/199611/14/003164/index.html Search Print

Home Bookmarks Red Hat, Inc. Red Hat Network Support Shop Products Training

 P1L1TBG1003164HD
14/11/1996

polder1 on Adposi (CNRS NASDA)
(polder software from loa)

Quicklook for orbit 003164

M003164_070.JPG (JPEG Image, 274x414)



Data format and Tools

Mpol

Visualize/Extract data from POLDER file (binary format)

Sequence creator/navigator

Dump data to bin/hdf file

Full support for every L1, L2 and L3 products

Command line converter to HDF-EOS format for all products

Mpol (version 4.0Beta)
Mpol: a multi functional analysis and interpretation tool

Download now

Generalities

- [Introduction](#)
- [Platforms](#)
- [Glossary](#)

Level 1 data

- [Visualisation](#)
- [Super pixel value](#)
- [Multiangular data analysis](#)
 - [features over clouds](#)
 - [Sun glint](#)

Direct link with the AERONET data base

- [Msky](#)

Level 2 and 3 data

- [Visualisation](#)

HDF EOS data extractions

- [HDFEOS](#)

Command line capabilities

- [Keywords](#)
- [Build a browse](#)
- [Build a browse \(Auto crop option\)](#)
- [POLDER to HDF-EOS Customized\(1\)](#)
- [POLDER to HDF-EOS Customized\(2\)](#)
- [Product parameters list](#)

Previous version...

- [POLDER data with Mspinx](#)

Sequence no: 57 over 116

RGB composite from Radiances and Polarization effects

POLDER Main window and zoom capabilities (data main geometry is integerized sinusoidal)

A true color composite quick look image can be displayed for the orbit to help in data interpretation and scene selection.

Both orbit and sequences true color images are built from atmospheric corrected reflectances for an improved view of land, aerosols and cloud features.

P2L1TBG1038033AL, P2L1TBG1038033AD

File Selection Window Color Plot Projections Misc Help

4,9167 86,1803

Conclusions / Perspectives

The bad news :

Not many users

No long time serie available

The good news :

Quality users !!

One more chance to go in December
to join A-Train

(Parasol, MODIS, Cloudsat, Calipso)

Very nice research instrument and still no equivalent