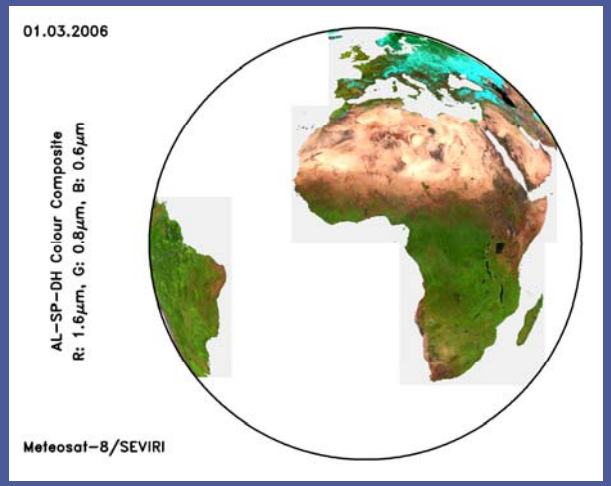
LAND SURFACE ALBEDO FROM MSG GEOSTATIONARY SATELLITE

(METHOD FOR RETRIEVAL, VALIDATION, AND APPLICATION FOR WEATHER FORECAST)



D. Carrer, B. Geiger, J.L. Roujean, O. Hautecoeur, J. Cedilnik, J.F. Mahfouf, C. Meurey, and L. Franchistéguy

METEO FRANCE
Toujours un temps d'avance

OUTLINE

- Land SAF project
- Surface Albedo Products
  - *method for retrieval*
  - *evaluation*
  - *application for weather forecast*
- Perspectives

OUTLINE

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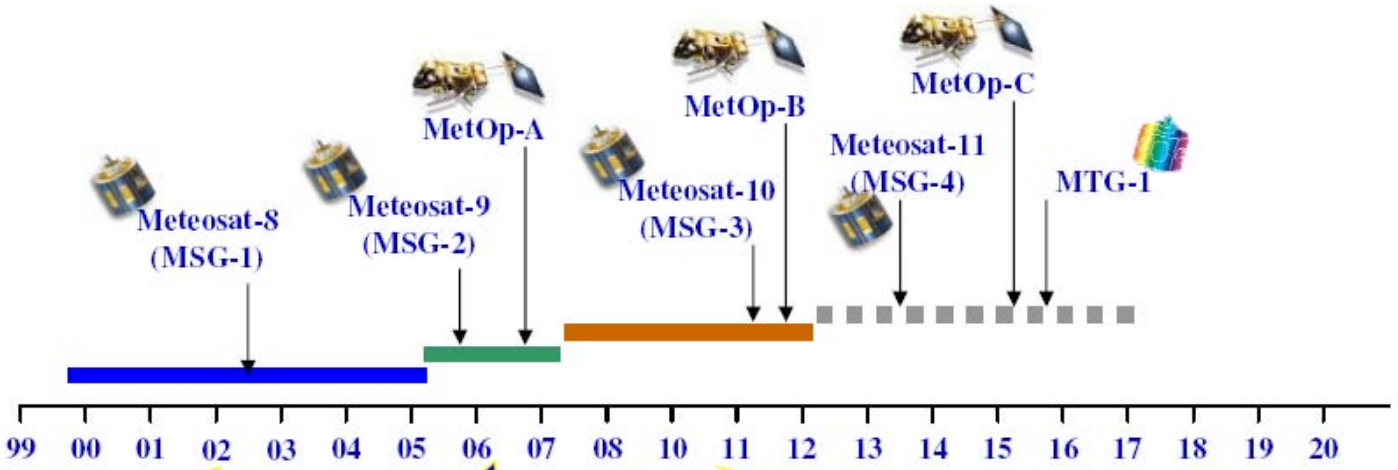
Land-SAF CHRONOGRAM



Development Phase: Sep 1999

Initial Operations Phase: Feb 2005

Continuous Development & Operations Phase Mar 2007

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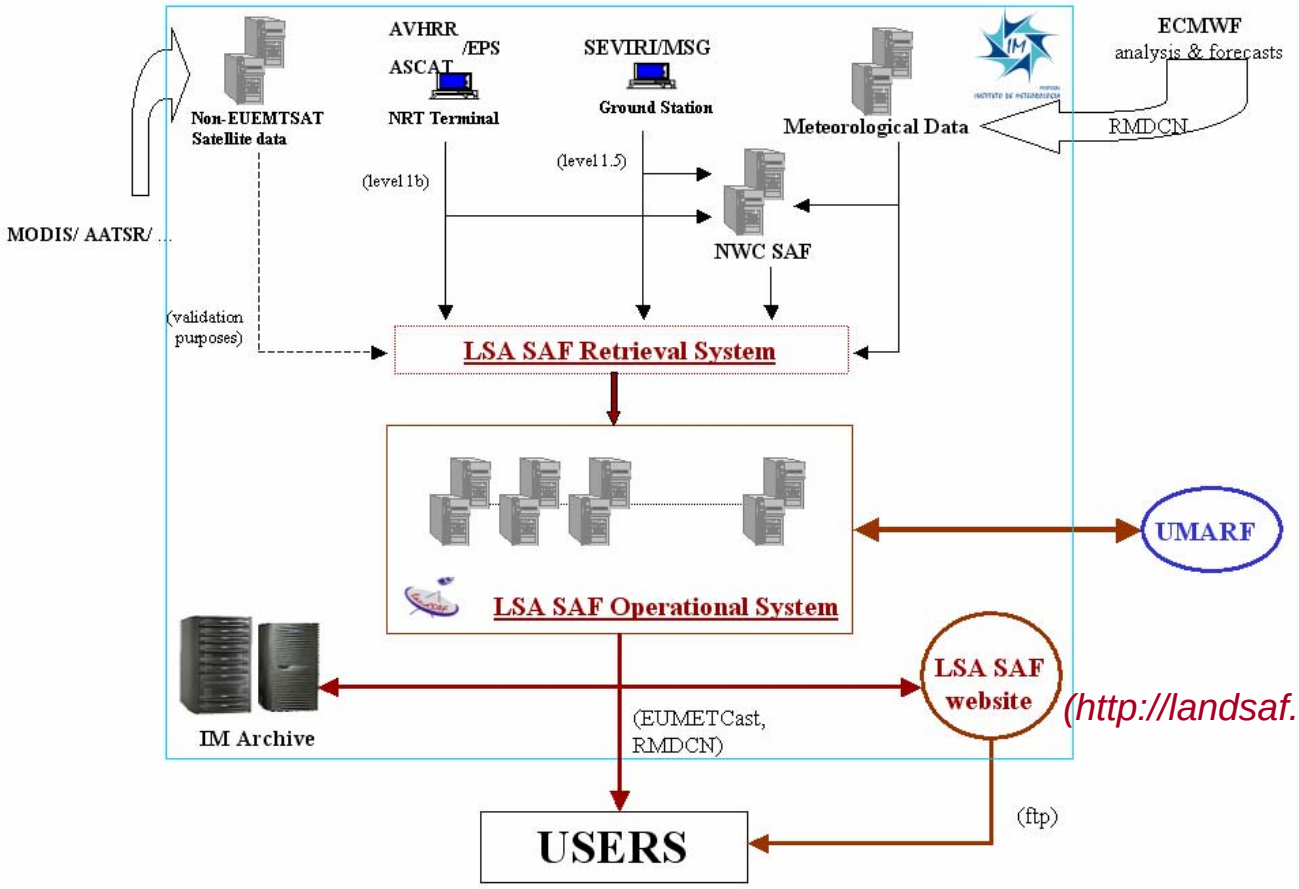
METEO FRANCE
Toujours un temps d'avance

OPERATIONAL SYSTEM



THE Land-SAF CONSORTIUM (2009)

- Instituto de Meteorologia (IM), Portugal
- Meteo-France (MF), France
- Royal Meteorological Institute (RMI), Belgium
- Finnish Meteorological Institute (FMI), Finland
- IMK, University of Karlsruhe
- IDL, University of Lisbon
- UV, University of Valencia

- Organisation principles
  - Algorithms developped at one of the participating Institutes
  - Algorithms handed over to IM for integration and production

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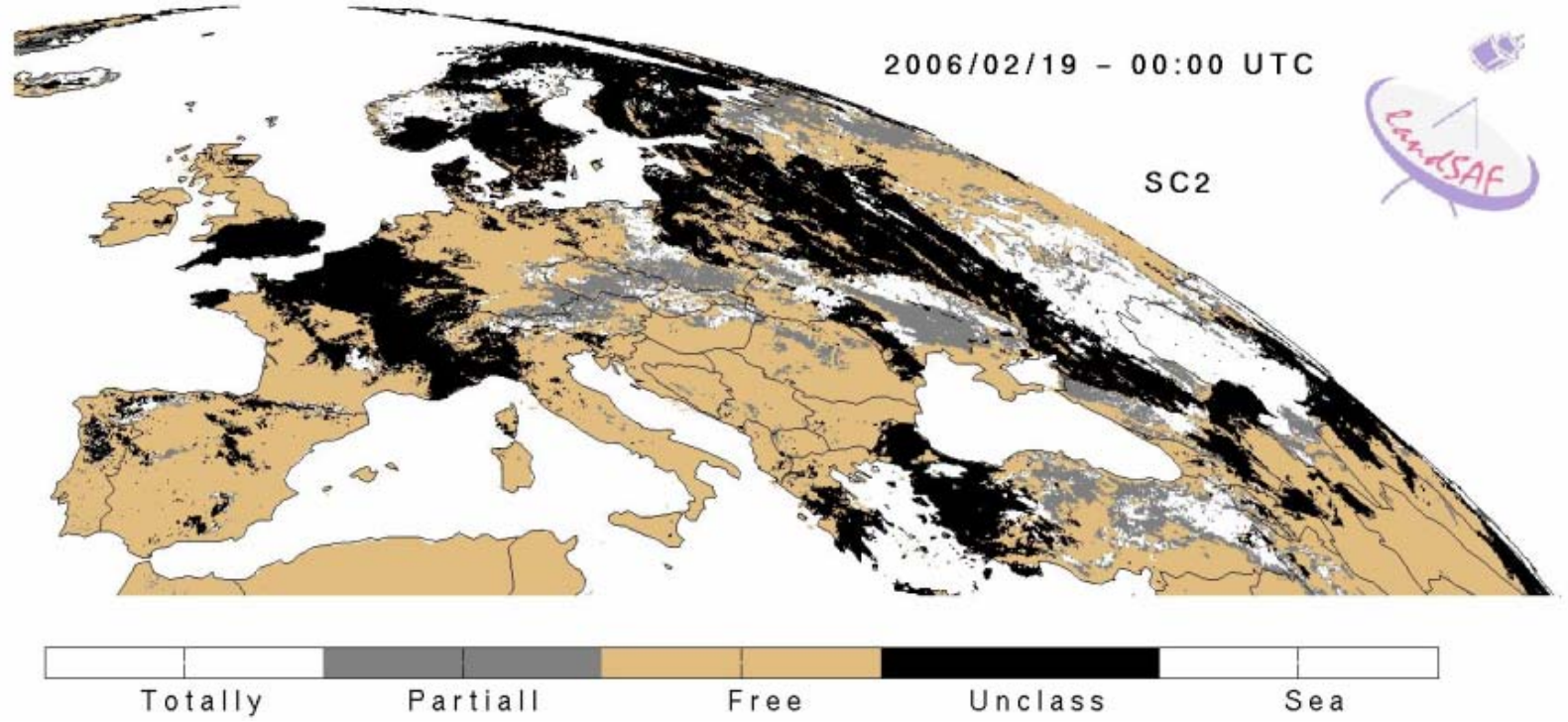
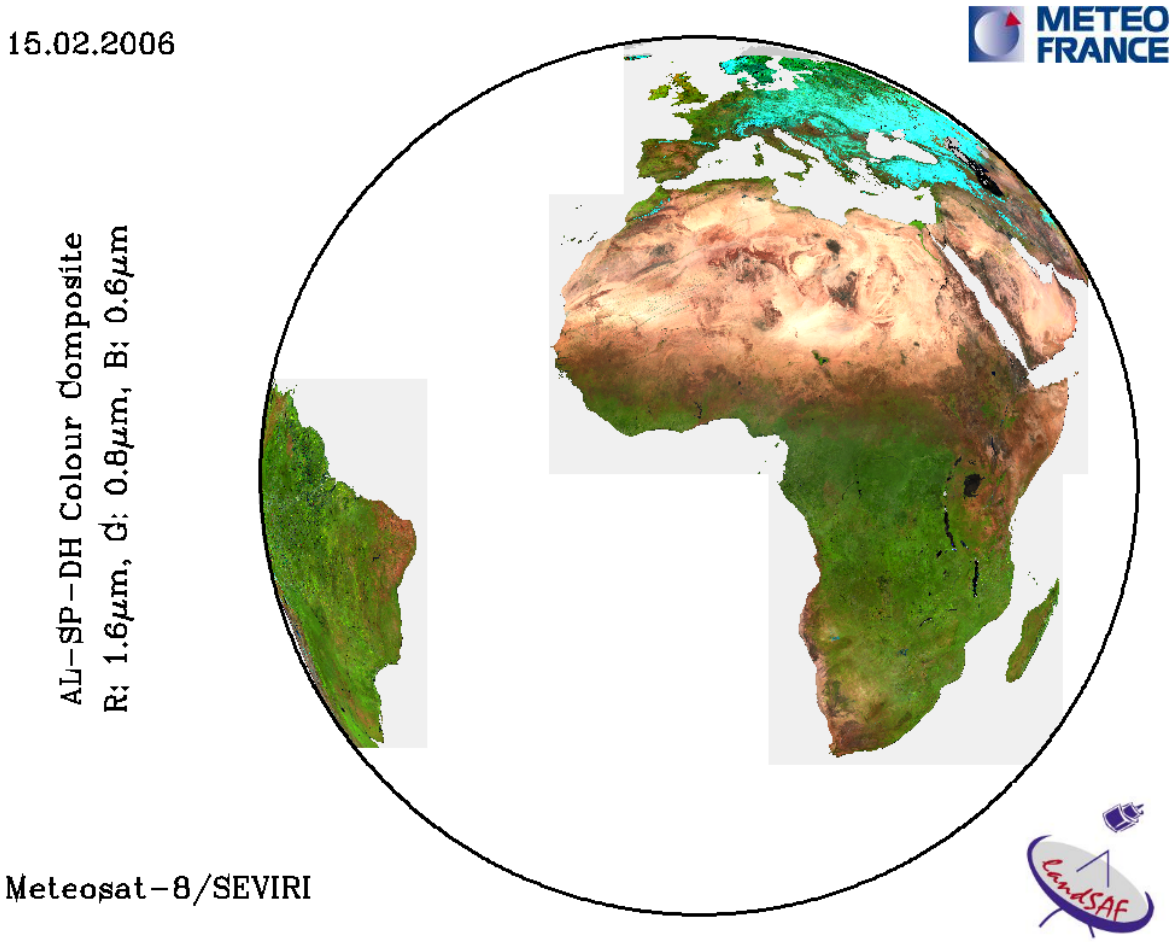
THE PRODUCTS

Product	Acronym	Type	Institution
Surface Albedo	AL	OP	MF
Bi-directional Reflectance Distribution Function	BRDF	OP-Int	MF
Land Surface Temperature	LST	OP	IM
Thermal Surface Parameter	TSP	POC-Int	IMK
Emissivity	EM	OP-Int	ICAT
Downwelling Surface Short-wave Fluxes	DSSF	OP	MF
Downwelling Surface Long-wave Fluxes	DSLF	OP	IM
Snow Cover	SC	OP	SMHI
Evapotranspiration	ET	OP	RMI
Fractional Vegetation Cover	FVC	OP	UV
Leaf Area Index	LAI	OP	UV
Risk Fire Manager	RFM	DEM	IDL
Fire Radiative Power & Energy	FRP&FRE	OP	
Fraction of Absorbed Photosynthetic Active Radiation	fAPAR	OP	UV

SNOW COVER


2006/02/19 – 00:00 UTC
SC2
LandSAF
Totally
Partiall
Free
Unclass
Sea

SURFACE ALBEDO



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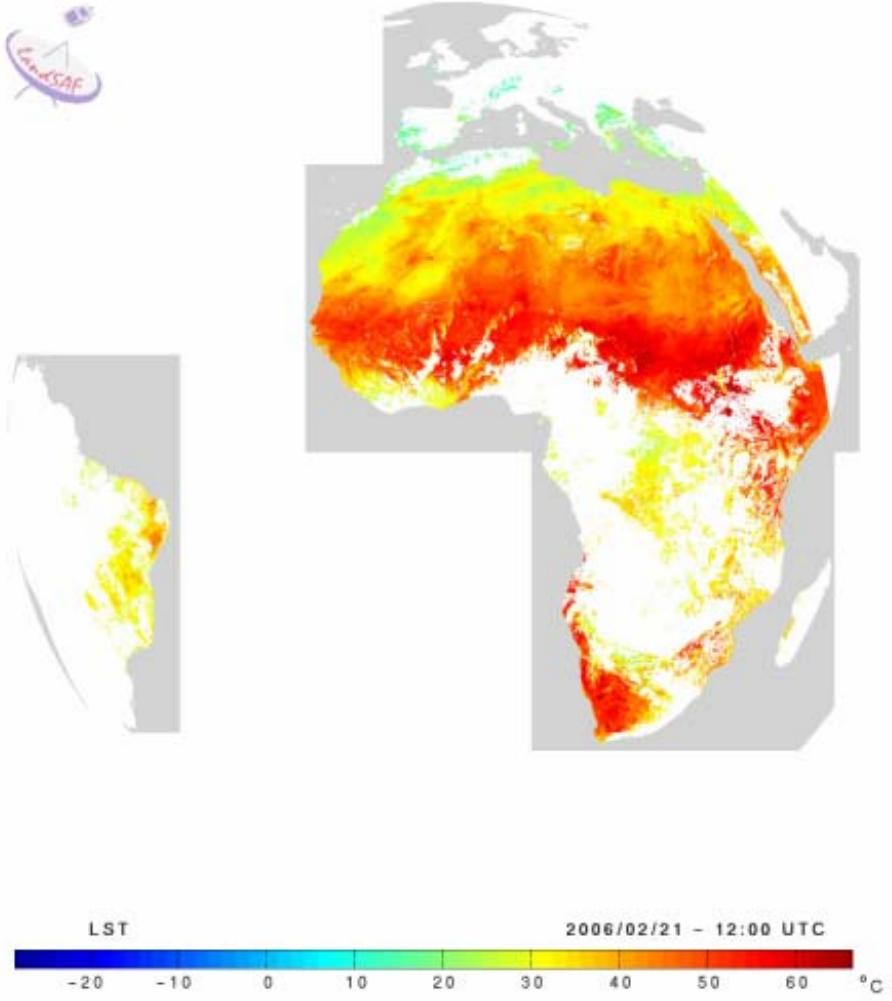
LAND SURFACE TEMPERATURE



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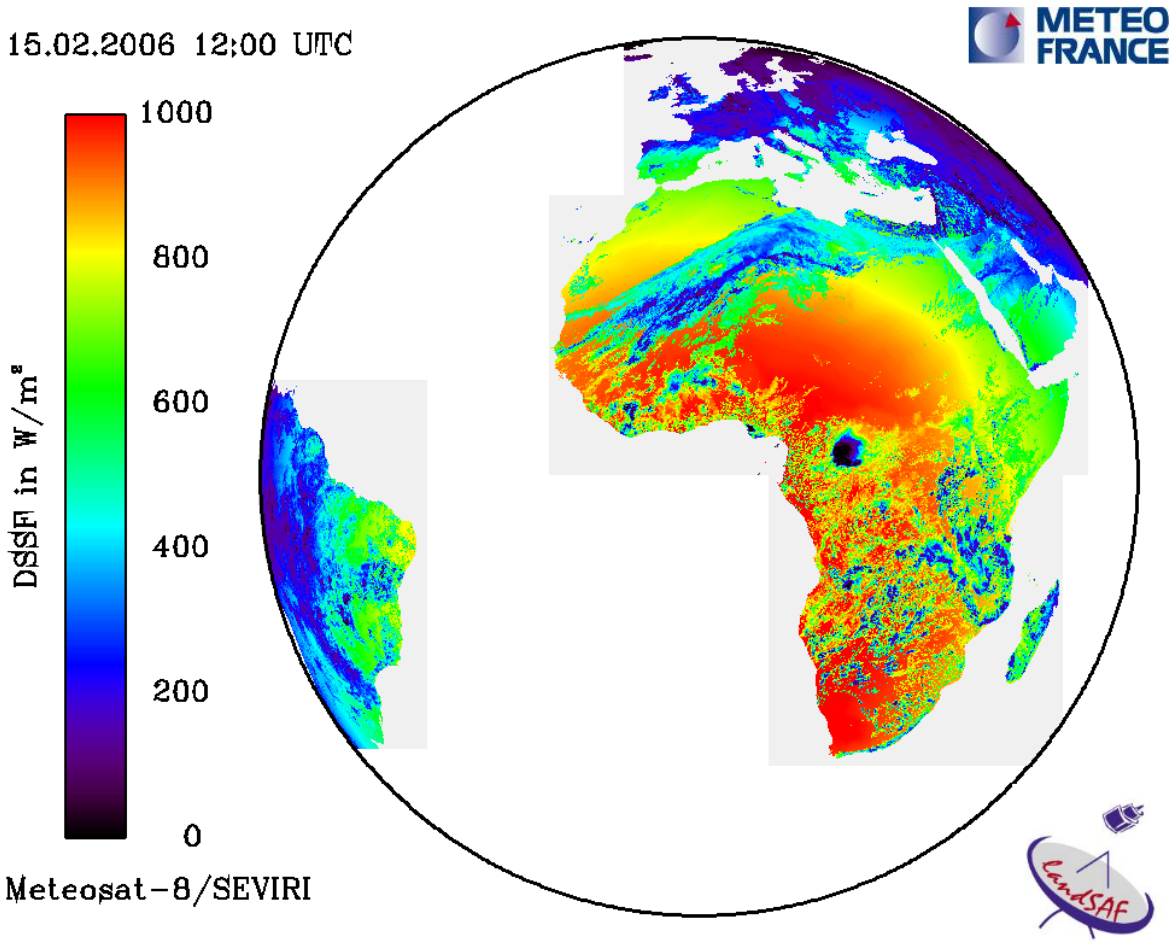
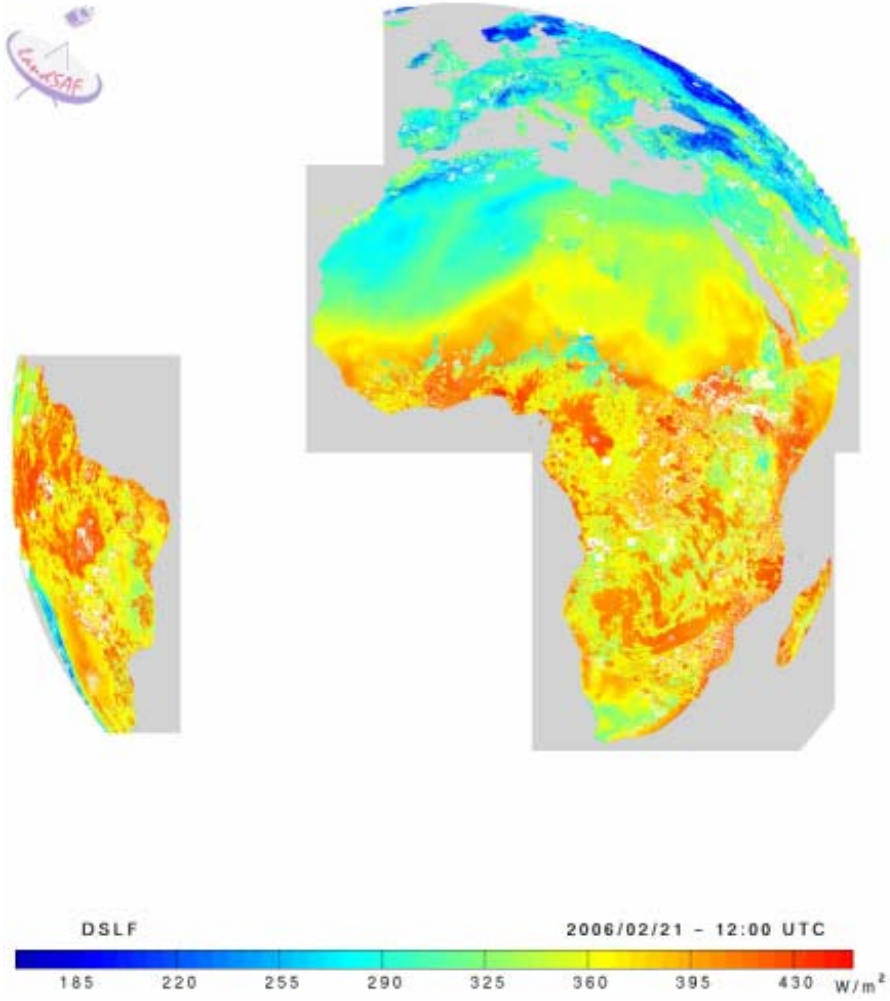
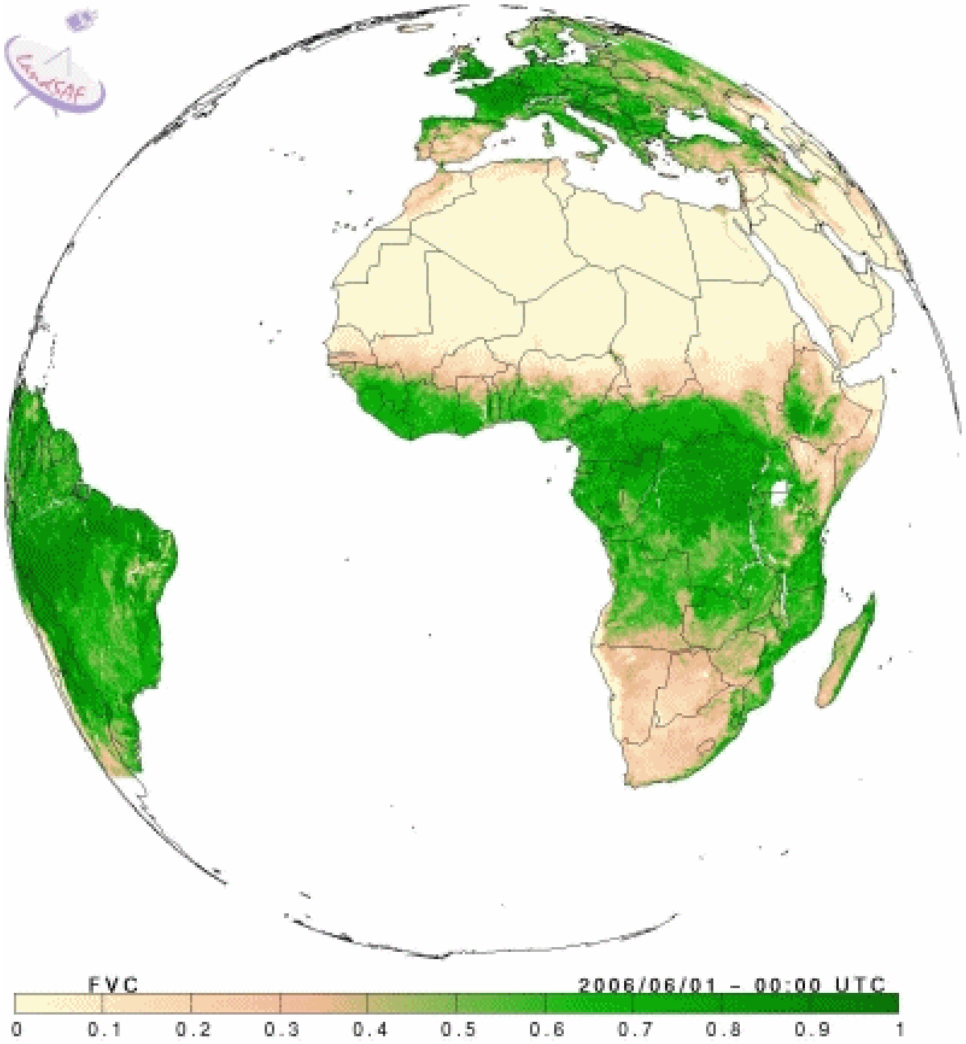
SHORT-WAVE RADIANCE



LONG-WAVE RADIANCE



FRACTIONAL VEGETATION COVER



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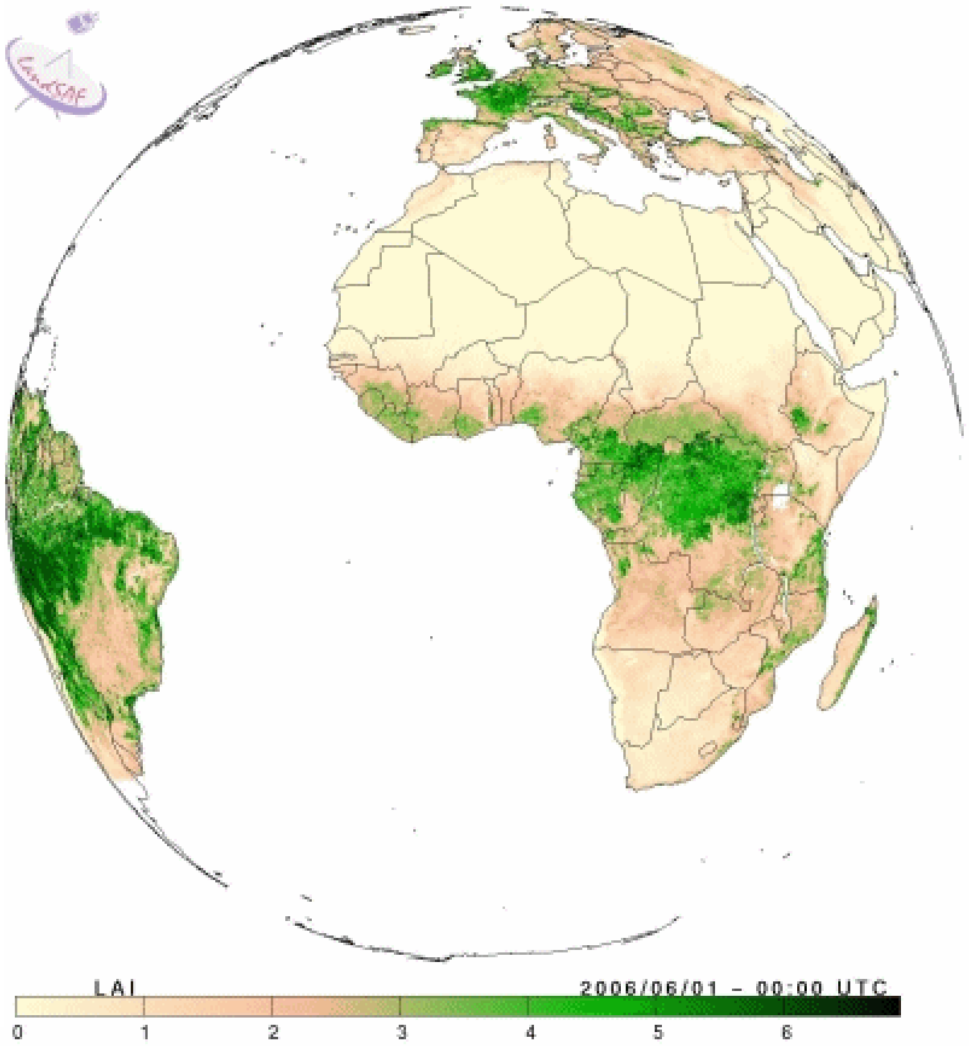
METEO FRANCE
Toujours un temps d'avance

LEAF AREA INDEX



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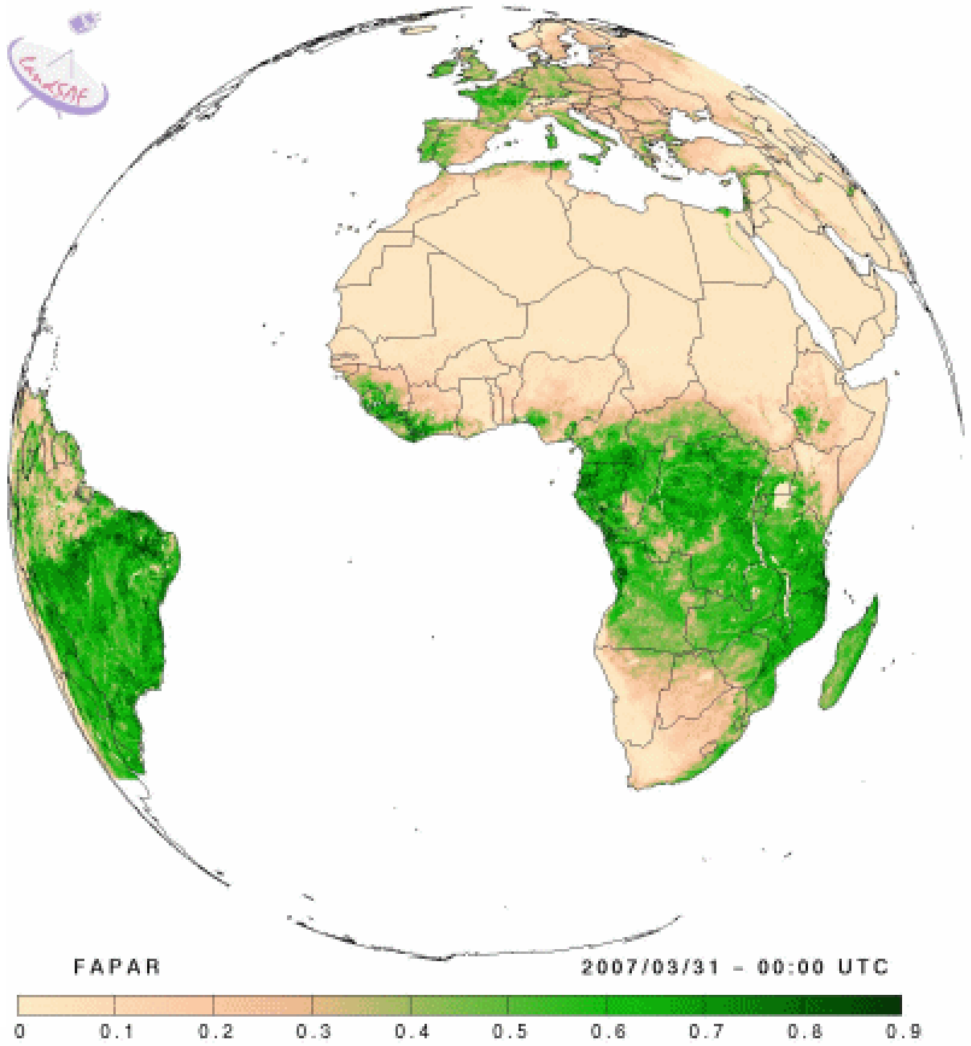
METEO FRANCE
Toujours un temps d'avance

fAPAR



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METEO FRANCE
Toujours un temps d'avance

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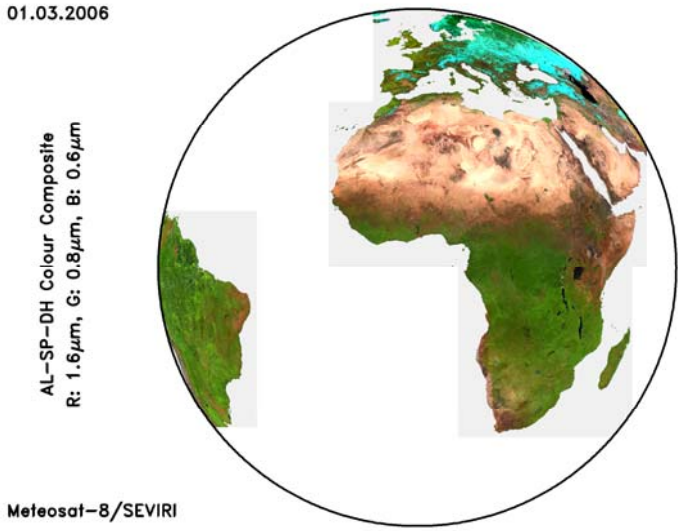
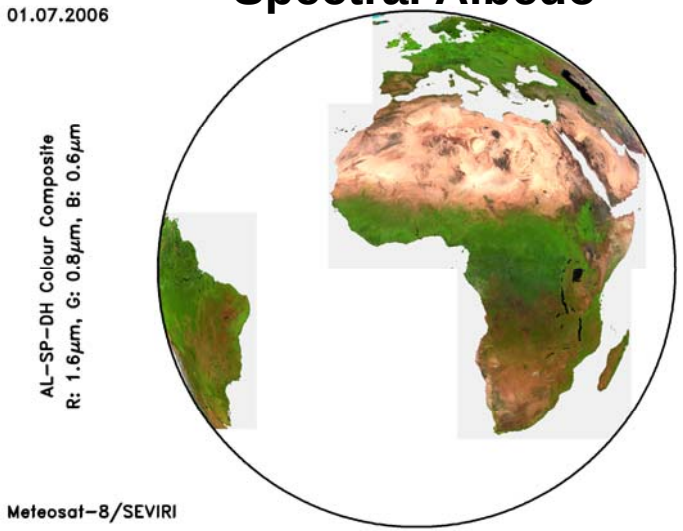
- Perspectives

PRODUCT CHARACTERISTICS (AL)



Colour Composite Of Spectral Albedo



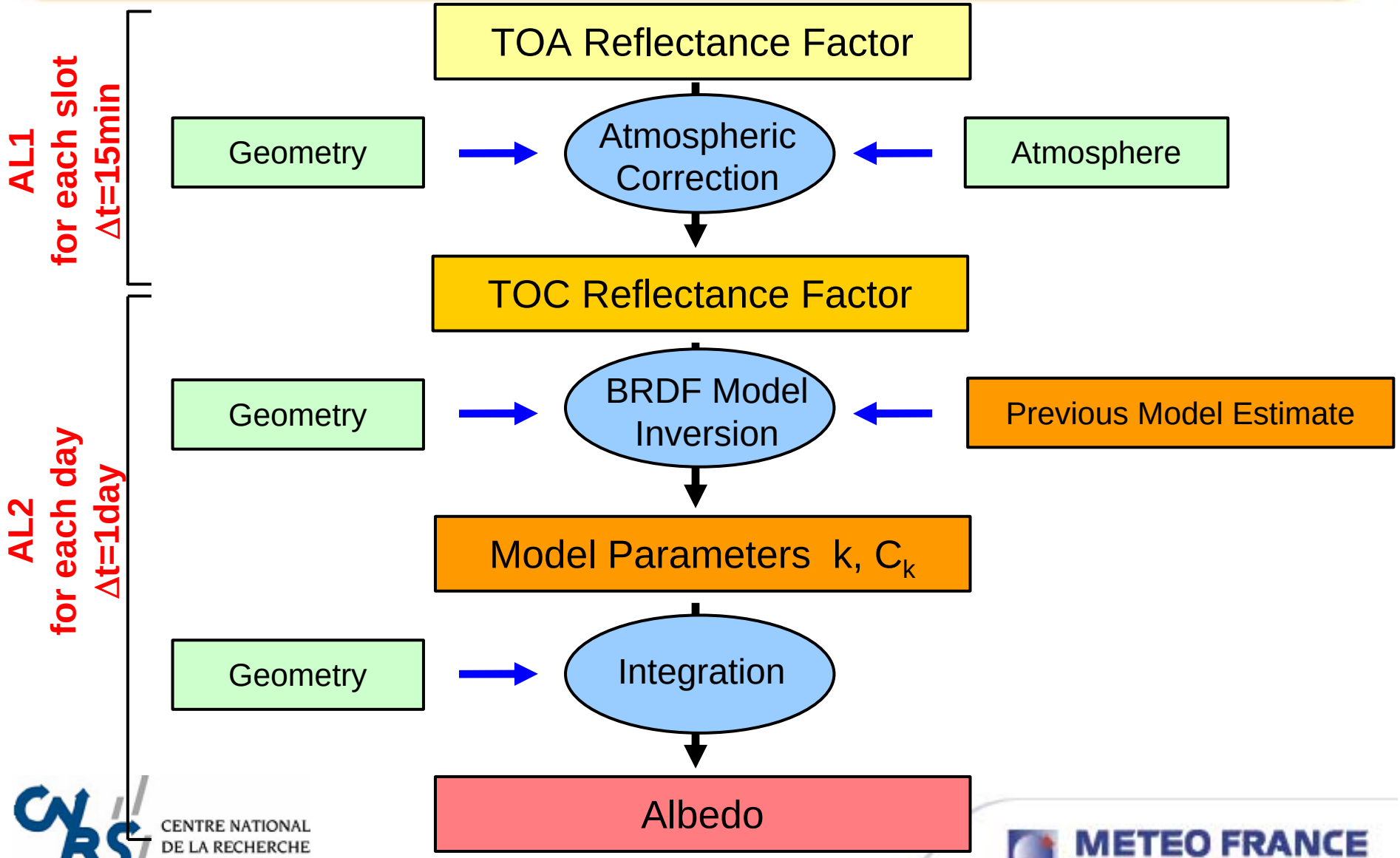
Spatial Resolution: 3km at the Sub-Satellite Point
Projection: native MSG/SEVIRI Projection
Production Frequency: Daily
Effective Temporal Resolution: 5 Days
Format: HDF5
Timeliness: 3 hours
Dissemination: EUMETSAT broadcast system (EUMETCast), and project website (http://landsaf.meteo.pt)

Spectral Albedo (6): 0.6µm, 0.8µm, and 1.6µm (DH&BH)

BroandBand Albedo (4): VIS-DH ([0.4µm, 0.7µm]), NIR-DH ([0.7µm, 4.0µm]), SW-DH ([0.3µm, 4.0µm]), SW-BH ([0.3µm, 4.0µm])

METEO FRANCE
Toujours un temps d'avance

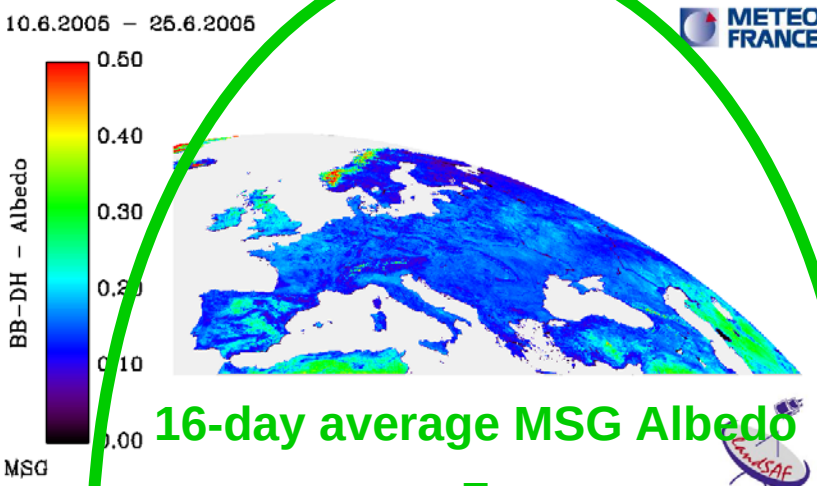
METHOD FOR RETRIEVAL



ALBEDO INPUT DATA

- **MSG Data: 0.6µm, 0.8µm, 1.6µm**
- **Solar and View Angles**
- **Land/Sea Mask**
- **Cloud Mask (SAF-NWC software)**
- **Total Column Water Vapour, and Pressure (ECMWF)**
- **Ozone Content (Climatology)**
- **Aerosol Optical Thickness (Climatology)**

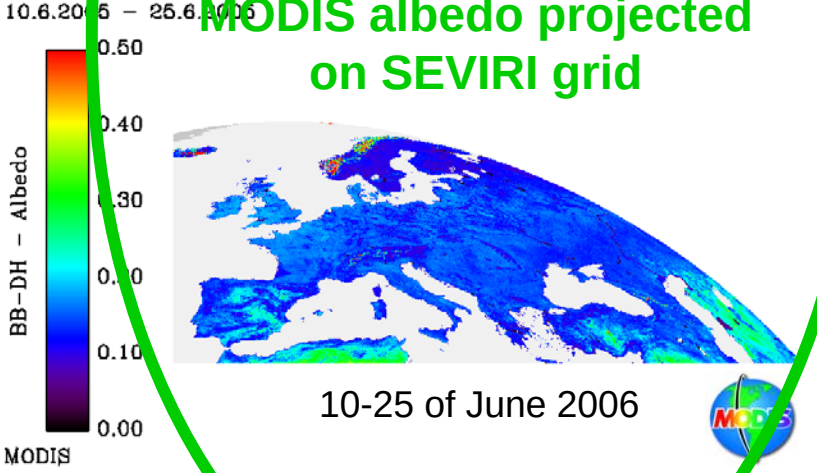
COMPARISON WITH MODIS ALBEDO (1/2)



16-day average MSG Albedo

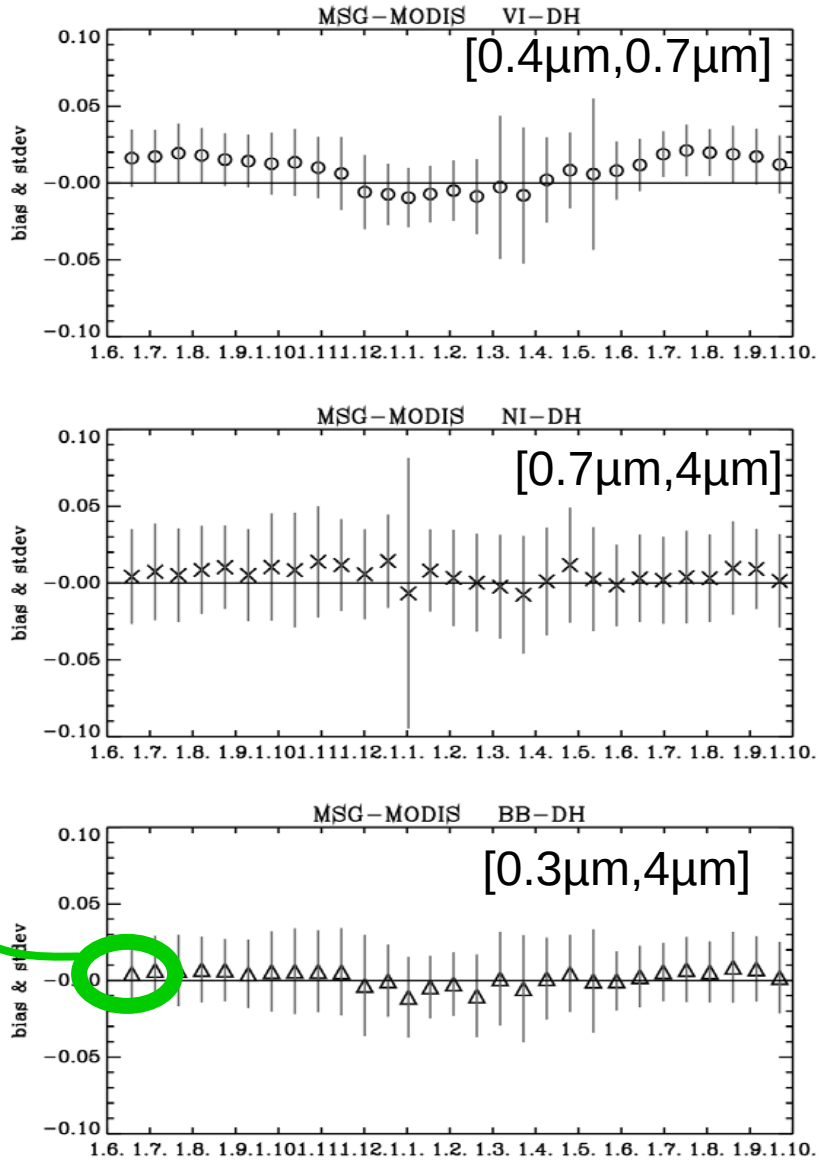
–

MODIS albedo projected on SEVIRI grid



10-25 of June 2006

over Europe (from 2005-06-01 to 2006-10-01)



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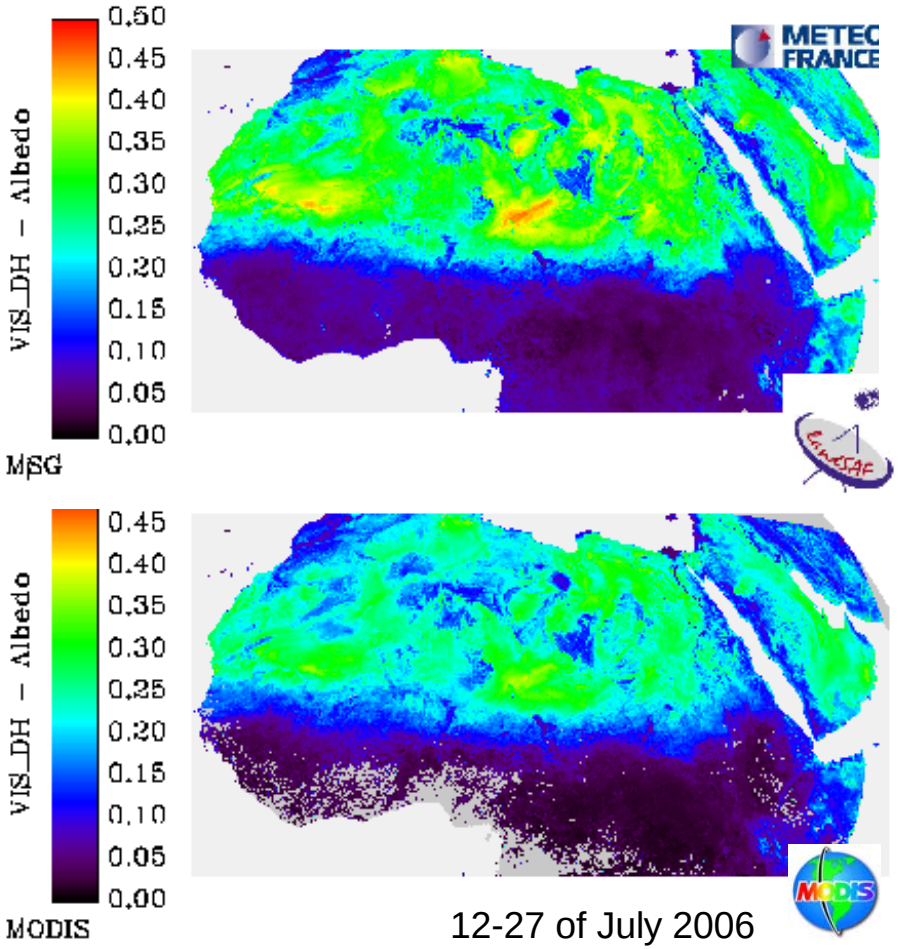
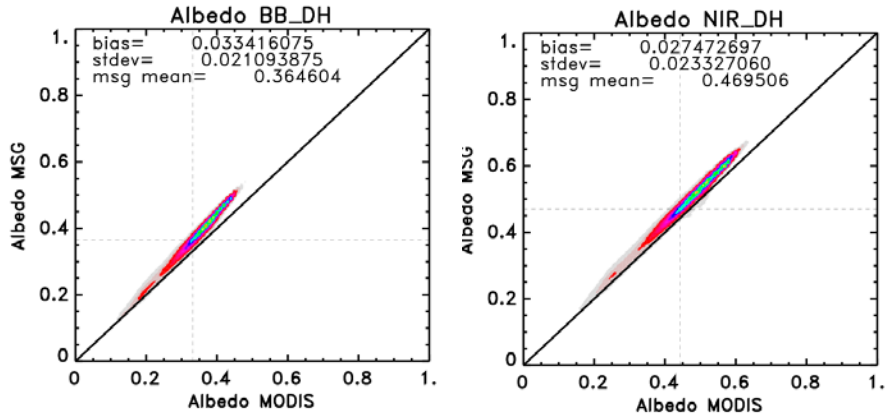
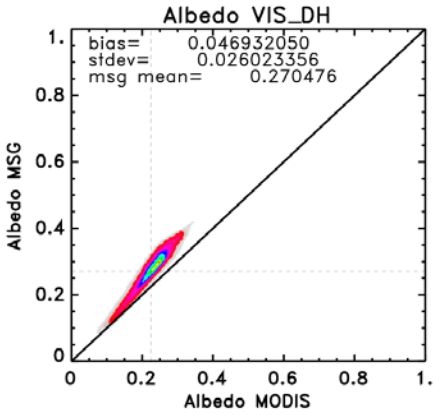
COMPARISON WITH MODIS ALBEDO (2/2)

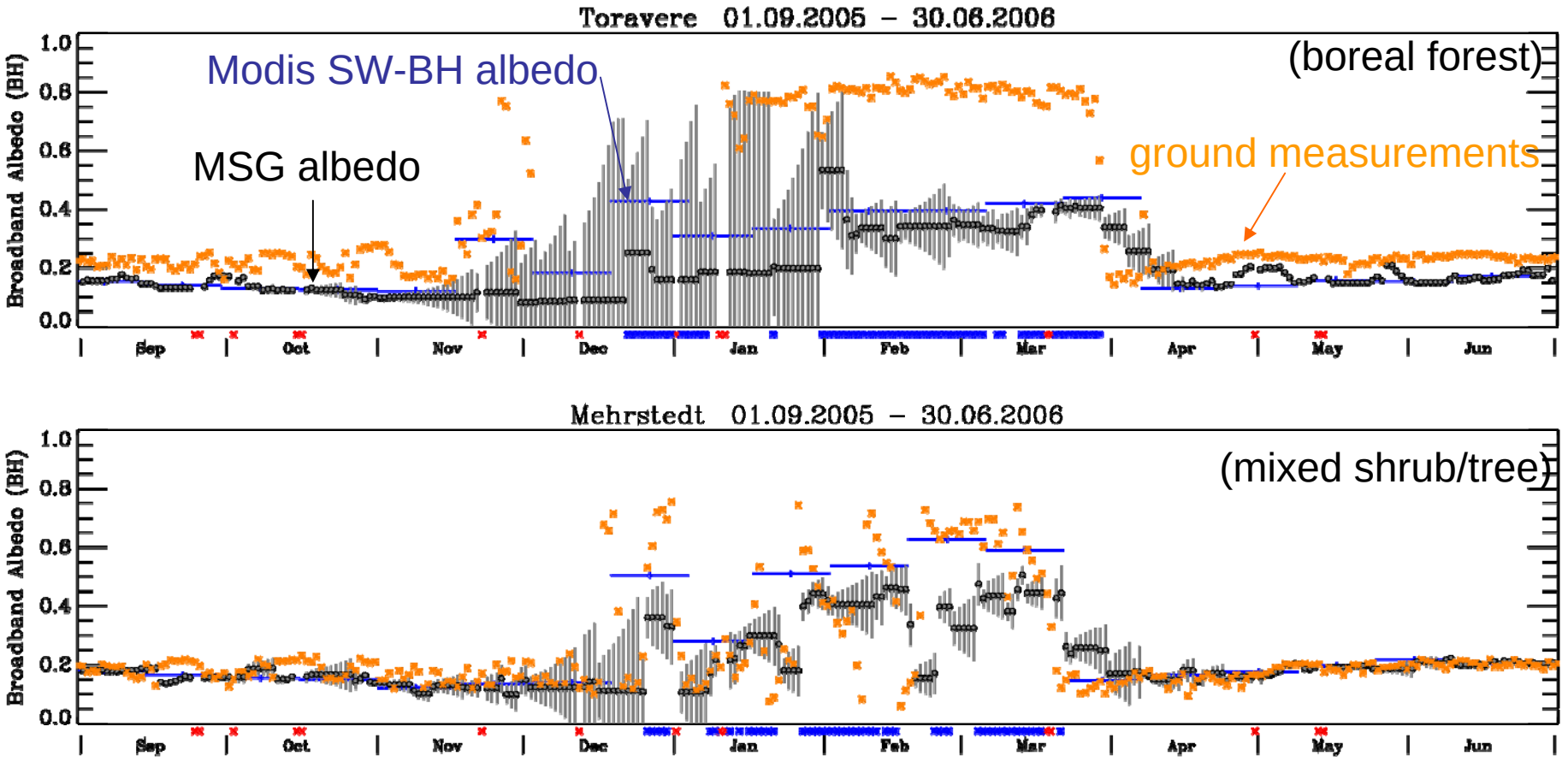


12-27 of July 2006

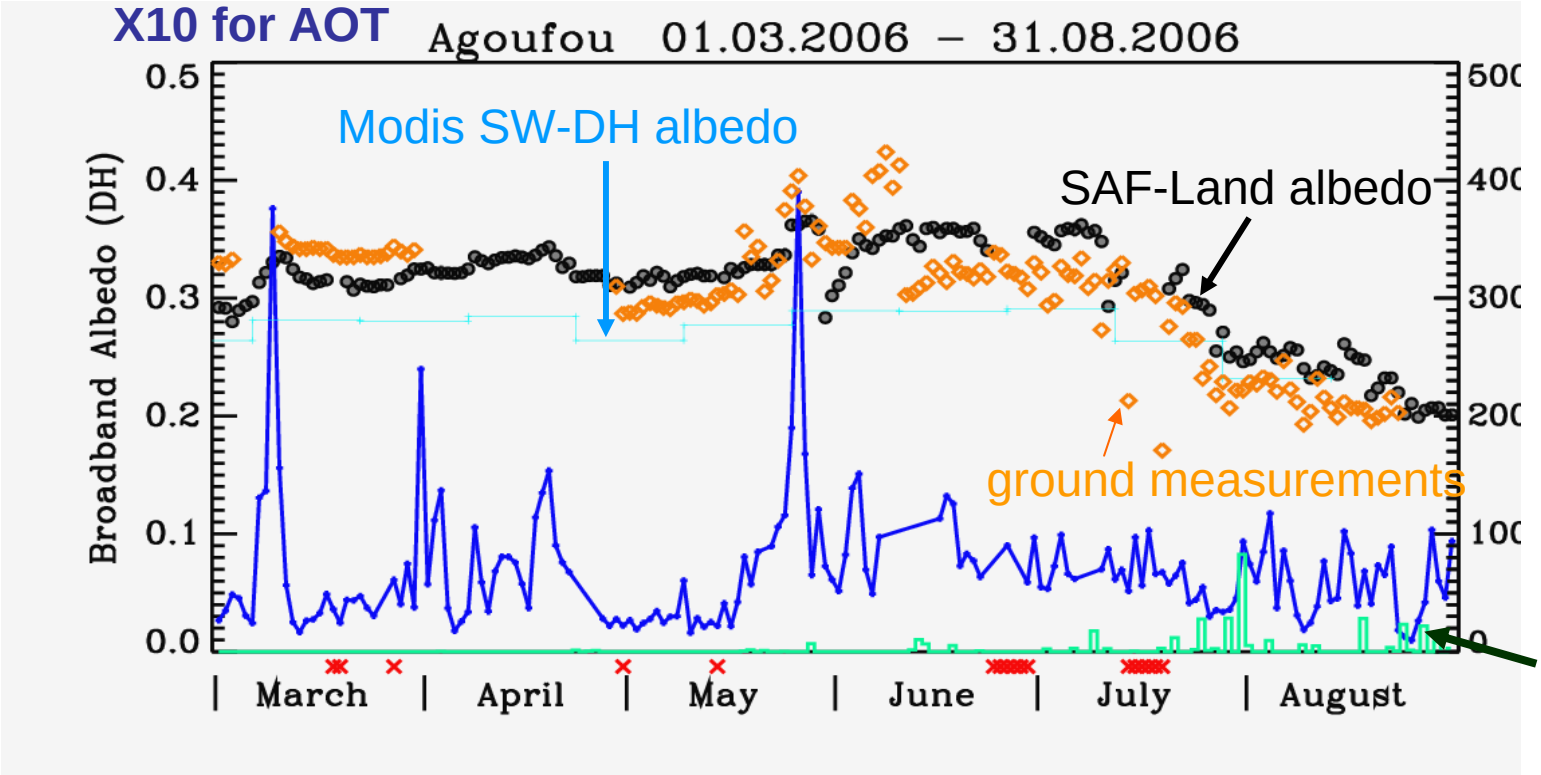




ALBEDO TIME SERIES (snowfall episodes)



ALBEDO TIME SERIES (aerosol events)



The temporal evolution of the albedo estimate is related to the evolution of surface properties (typically rainfall). The spurious fluctuations appear to be caused by aerosol effects.

SUMMARY OF PERFORMANCES (AL)

Accuracy

Over mid-latitude region:

bias: 5% in relative units for SW and NIR broadband albedo (except for snow/ice pixels) **– bellow 0.01 in absolute unit**

20% for VIS broadband albedo (potentially due to the use of different BRDF models and aerosol products)

stdev: 0.015 for VIS and 0.030 for NIR and SW (or BB)

Over brightening surfaces (North Africa): **no degradation in relative units**

Publications:

• Geiger, B., Carrer D., Franchistéguy L., Roujean J.-L., Meurey C., 2008, "*Land Surface Albedo derived on a daily basis from Meteosat Second Generation Observations*", IEEE Transactions on Geoscience and Remote Sensing, **published**.

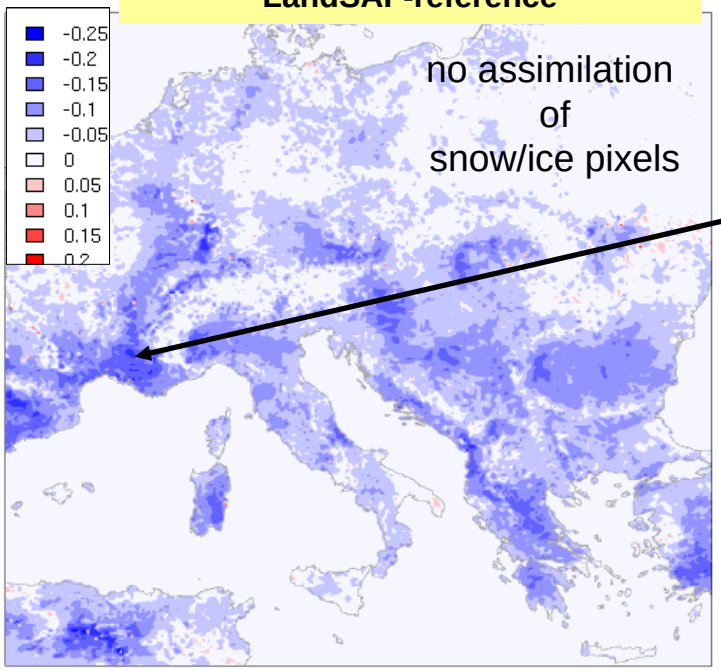
• Carrer, D., Roujean J.-L., Meurey C., "Evaluating operational MSG/SEVIRI land surface albedo products from Land SAF with ground measurements and MODIS", IEEE Transactions on Geoscience and Remote Sensing, **submitted**.

• Product User Manual, and Validation Report, 2008, internal documents.

APPLICATION FOR WEATHER FORECAST

Weather forcast model: ALADIN (~9.5km)
Two experiments: with ALADIN albedo and with Land SAF albedo analysis
Run every day at 00h: 20070201->20070731 (54h forcast)

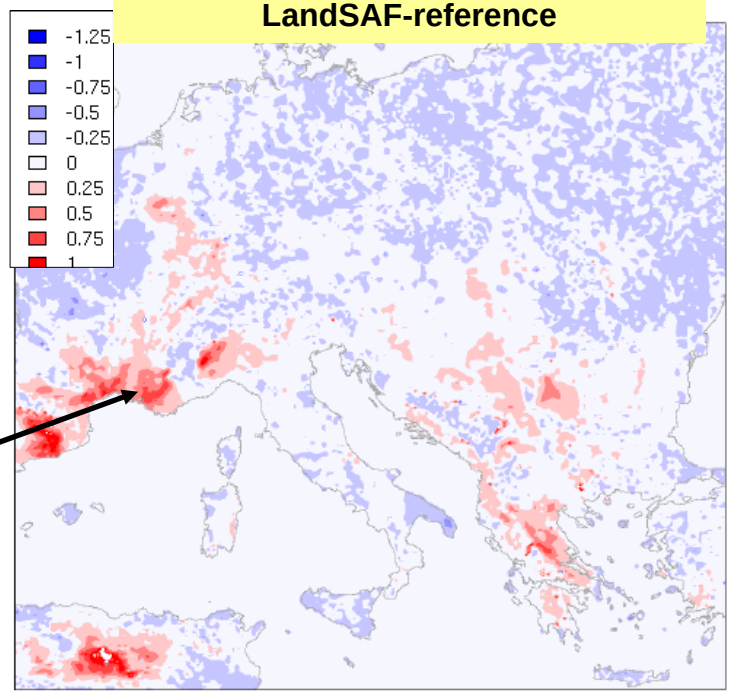
Surface albedo 15022007 00UTC+12
LandSAF-reference



LandSAF albedo is lower than Aladin albedo

a lower albedo induced warmer atmospheric T2m

2m temperature 15022007 00UTC+12
LandSAF-reference



Conclusion of Score Study: weather model has a significant cold bias in winter. Satellite data permit to reduce this bais.

(J. Cedilnik, D. Carrer, J.-L. Roujean and J.-F. Mahfouf, "Analysis of satellite derived surface albedo for numerical weather prediction", **to submit**)

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OPEN ISSUES AND FURTHER DEVELOPMENTS

•**2009-2012**:

1/ tuning of algorithms

2/ high latitude coverage: extension achieved due to the merging of MSG and MetOp data.

3/ to strengthen validation: over Africa & snow covered areas

4/ use in NWP models:

- radiative forcing (DSSF & DSLF).
- surface analysis (albedo).

5/ aerosols:

- operational algorithm under development.

(Carrer et al., submitted)

•**Until 2019**:

=> a perennial operational production with MTG and MetOp-2.

That's all folks!

LAND SURFACE ANALYSIS SATELLITE APPLICATIONS FACILITY

dominique carrer

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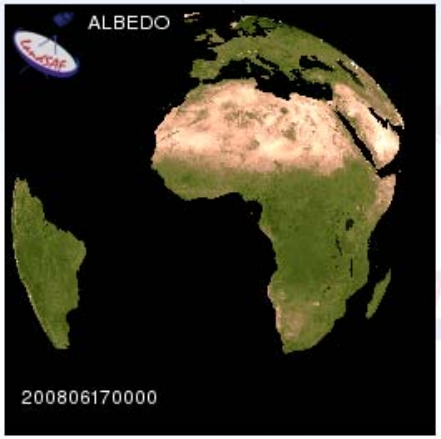
The scope of Land Surface Analysis Satellite Applications Facility (LSA SAF) is to increase benefit from EUMETSAT Satellite (MSG and EPS) data related to:

- Land
- Land-Atmosphere interaction
- Biospheric Applications

The LSA SAF performs:

- R&D Programs.
- Operational Activities
  - Generation
  - Archiving
  - Dissemination

of land surface related products.



See product colormaps...

Latest News:

- **Information** LSA SAF outage see more...
- **Information** Possible difficulties in accessing the Landsaf.meteo.pt see more...
- **Information** Possible difficulties in accessing the Landsaf.meteo.pt see more...
- **Information** LSA SAF outage see more...
- **Information** New algorithm versions see more...
- **Information** LSA SAF outage see more...

Product Development Status:

MSG System

LST	DSSF	DSLF	AL	SC	ET
FVC	LAI	fAPAR	FRPPIXEL		

EPS System

Caption

Internal	Develop.	Demo.	Pre-Operat.	Operat.

LSA SAF is an initiative of: EUMETSAT

LSA SAF consortium in CDOP (2007-2012): IM, MF, RMI, IMK, UV, FMI, IDL

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dominique.carrer@meteo.fr

METEO FRANCE Toujours un temps d'avance

MANY THANKS

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