R&D on satellite data at Météo-France

- Numerical Weather Prediction
- Marine forecasts / Sea state
- Nowcasting
- Air quality forecasts
- Continental surfaces
Total number of satellite observations used in ARPEGE
Impact of IASI on NWP scores

- A significant improvement of forecasts
- Reduction of RMSE for geopotential, Europe (left), and zonal mean (right).

**Forecasts to day 3 over Europe**

**Global forecasts to day 4**

**Différences in forecast errors**

**In blue, IASI improves the forecasts**
Impact of IASI in the high resolution non-hydrostatic system AROME

- Better localisation of rainfall
  example of cumulated rainfall forecast between 00 and 12 UTC, 21st May 2009

Forecast to 12h

Référence: without IASI
With IASI at 125km res
Vérif: raingauges

Guidard et al, 2010
CONCORDIASI experiment to help assimilate IASI data over ice surfaces

Use of CNES Drifting Stratospheric ballons To launch dropsondes in the Antrctic region
Land surface description: a new version of the ECOCLIMAP database (Europe+Africa)

Based on several annual cycles of SPOT/VEGETATION, 1km resolution
273 different surfaces categories, used in several applications (meteorological and hydrological models)
Future missions

- Participation in Mission Advisory Groups/Preparatory work for:
  - MTG, PostEPS
  - Megha-Tropiques (Tropical rainfall, CNES/India)
  - SWOT (Altimetry, CNES)
  - CFOSAT (State of the sea, CNES/China)
  - ADM-Aeolus (ESA)
  - SMOS (ESA)
  - PREMIER (ESA)
  - CoreH2O (ESA)

- Submission of EE8 proposal:
  - MAGEAQ (Geostationnary satellite for Air Quality)
Météo-France participates to 6 SAF projects:

- **Support to Nowcasting and Very Short Range Forecasting (NWC SAF)**
- **Satellite Application Facility on Ocean and Sea Ice (OSI SAF)**
- **Satellite Application Facility on Land Surface Analysis (LSA SAF)**
- **Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (O3M SAF)**
- **Satellite Application Facility on Numerical Weather Prediction (NWP SAF)**
- **Satellite Application Facility on Support to Operational Hydrology and Water Management (H-SAF)**
Nowcasting SAF

MF elaborates **Cloud Products** (largely used by other SAFs through distributed software)

Cloud MASK, Cloud TYPE, Cloud top temperature and height

*SEVIRI dust cloud over North Africa on 14th July 2003 at 13h00 UTC. (infrared image)*

MF also developed the product **Rapid Thunderstorm Development (RDT)**
Three important components of the heat budget can be inferred from satellite visible and infrared radiometers:

- Sea Surface Temperature (SST)
- Radiative short wave (SSI) flux
- Long wave (DLI) flux

The estimates of these fluxes by the NWP outputs suffer from systematic errors due to cloud parameterisations particularly.

Mirrored products from GOES+METEOSAT over Atlantic.
Hydro SAF (1/2)

- soil moisture products (ASCAT)
  - Quality monitoring (SMOSMANIA network in southern France)

soil moisture products (ASCAT)
- Assimilation in high resolution models (SIM, SAFRAN-JSBA-MODCOU)

ASCAT vs. SIM: correlation map for surface soil moisture (01/2007-05/2010)
Participation started in 1999.

- Development of algorithms for radiation fluxes (downward shortwave, albedo) and coll. on biophysical parameters (Leaf Area Index, Fraction of Vegetation, Photosynthetically Active Radiation Absorbed)

- Partners of the Consortium: IM (Portugal), RMI (Belgium), FMI (Finland), KIT (Germany), Univ. Valencia (Spain), Univ. Lisbon (Portugal)

- Participation to the Steering Group.
Resp. for the R&D activities for **SW radiative fluxes**

**SW radiative flux products**: instantaneous and daily

![Image of SW radiative fluxes](image-url)
 Responsible for the R&D activities for **Shortwave radiative fluxes**

- **surface albedo products:** daily and 10-day

Discrepancies in regions frequently cloudy:
GEO sat. (MSG) more reliable than Polar sat (TERRA/MODIS)
Météo-France in LSA SAF (4/4)

- Responsible for the R&D activities for Shortwave radiative fluxes

  - **BRDF (Bidirectional Reflectance Distribution Function):** every 10 days
    (an internal product, non distributed)

  => Calculation of LAI, veg and fAPAR

(method developed at MF; Roujean & Bréon, RSE, 1995)

Coll. with Spain (Univ. Valencia and EOLAB)
Inter-SAF coll. at Météo-France

NowCasting SAF software is considered for cloud removal. Threshold detection for clouds are determined from ground reflectance provided by LSA SAF.

OSI SAF: inter-comparison on downward radiative fluxes to ensure best coherence between ocean and land.

Down-welling Surface Shortwave Radiation (DSSF)

CM-SAF: Climate Monitoring SAF
Use of surface albedo in weather forecast

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

Surface albedo 15022007 00UTC+12
LandSAF-reference

no assimilation of snow/ice pixels

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 bias.

(J. Cedilnik, D. Carrer, J.-L. Roujean and J.-F. Mahfouf, “Analysis of satellite derived surface albedo for numerical weather prediction”, to submit)
Météo France objectives for the future phase CDOP-2 (2012-2017) are twofold:

- **To better answer to users needs** (stringent increasing demand!) in proposing new set of parameters derived from EUMETSAT and potentially ESA (Sentinel platforms) satellites:
  - Albedos for **Soil** and **Vegetation**.
  - **Direct** and **Diffuse** Radiative Fluxes.
  - 3-Hourly aerosol product (*further used to derive Diffuse Radiation*)
  - Reprocessed time series of surface albedo from previous Meteosat

- **To develop an assimilation of the LSA SAF products in NWP models through operators of observations.** (albedo in priority)
Prospects (2)

- **Motivations**
  - Contribute to improvement of the representation of carbon and water flux to the atmosphere

- **Synergies**
  - Hydrological modelling system SIM and LDAS over France
  - Development of operational carbon fluxes (GEOLAND-2 and follow-on)
  - Validation of snow albedo through airborne campaigns in Northern Europe
  - Comparison of surface albedo with GLOBALBEDO (ESA) and MODIS/NPOESS (NASA, NOAA)
  - Testbed area in the Mediterranean basin within the HYMEX programme
Thank you