CLIMATE@EUMETSAT: EUMETSAT Climate Data Records

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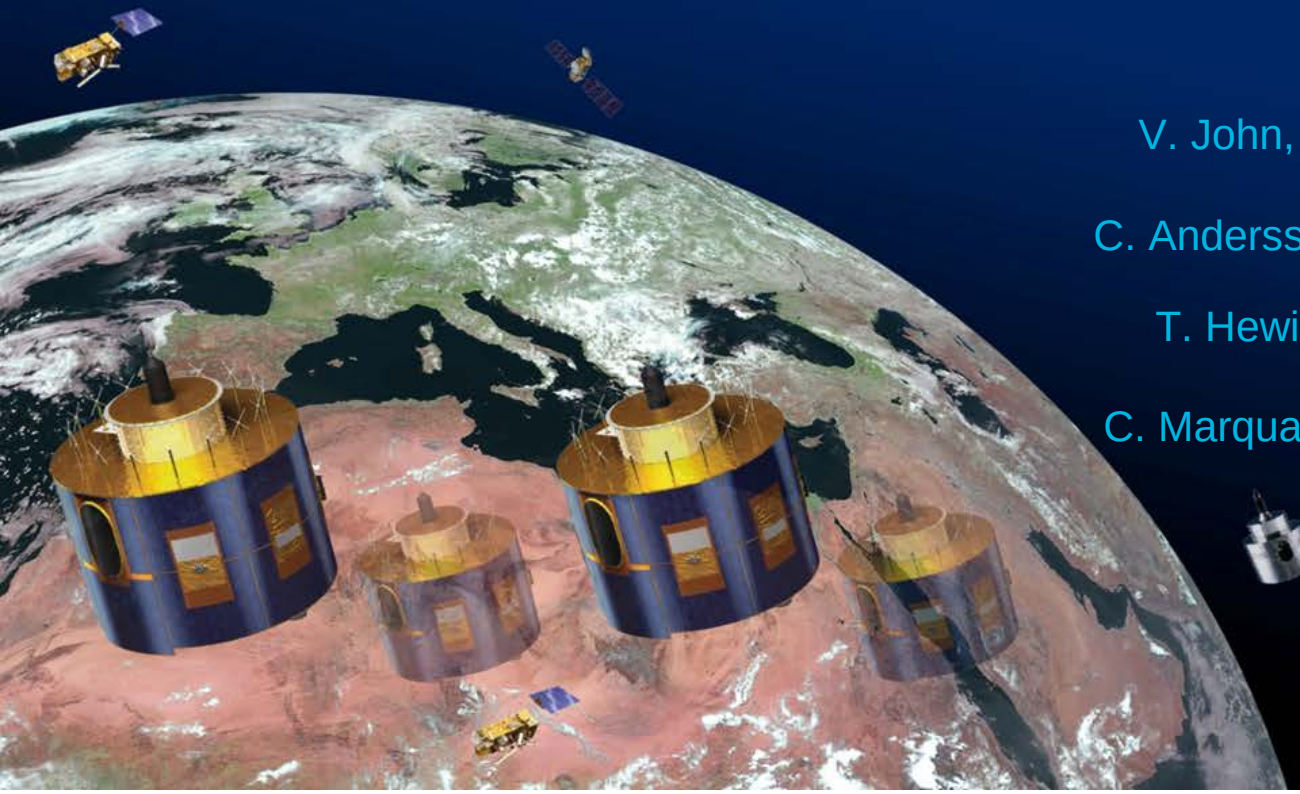


Content

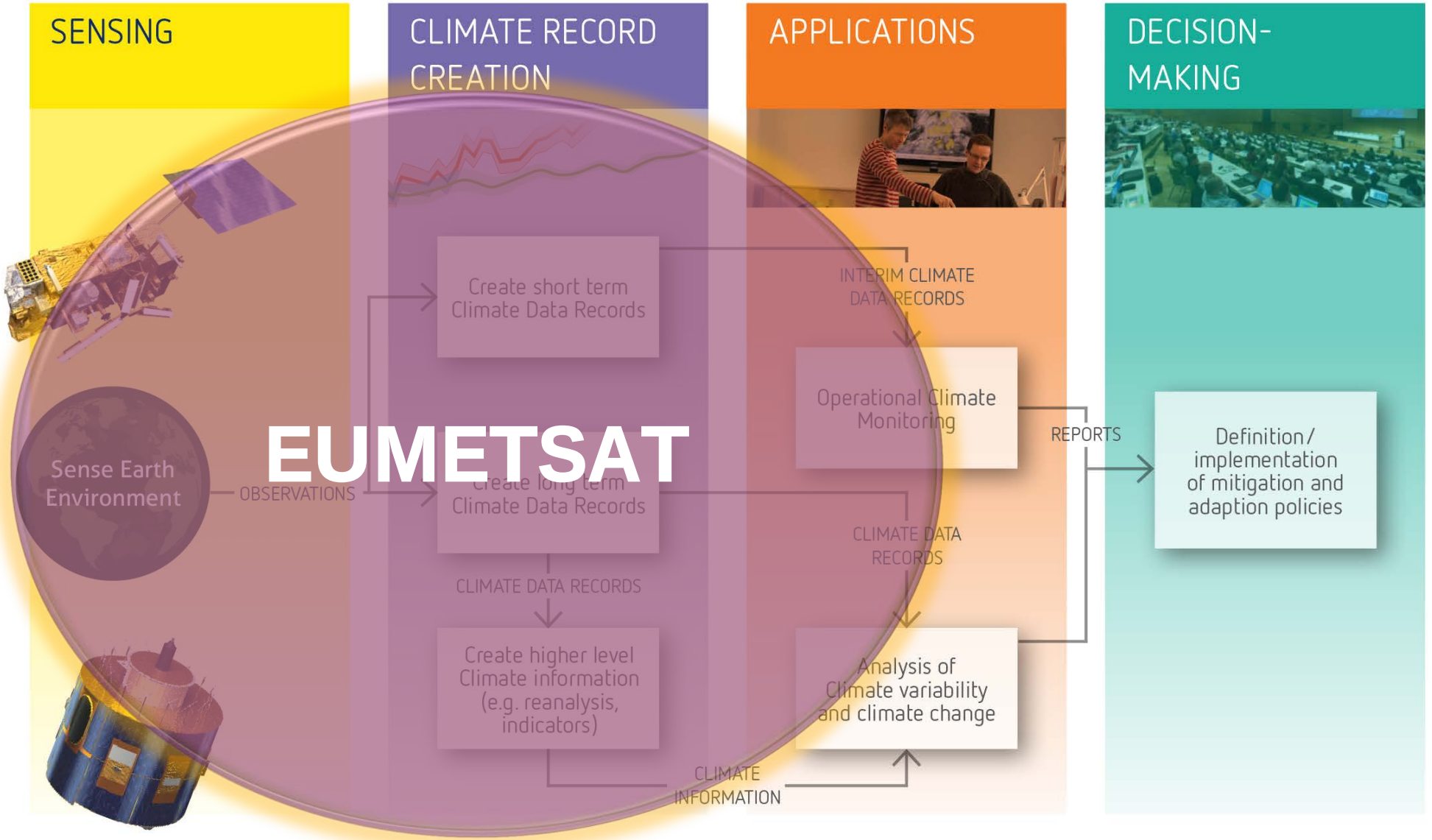
- Introduction
- EUMETSAT Current and Future Space and Ground Segment
- Climate Data Records: Examples
- EUMETSAT SAF Network Contribution
- Summary

Mandate and Role of EUMETSAT

- Our mandate: Contribute to the operational monitoring of the climate and the detection of global climatic changes

- Our role:
  - Delivering advanced multi-satellite programmes with long-term commitment;
  - Maintaining a unique archive of decades of space-based observations;
  - Producing consistent climate data records (level 1 data, ECVs for ocean, atmosphere, land) and providing easy access;
  - Supporting climate-related capacity building initiatives

Architecture for Climate Monitoring from Space (WMO Cg XVI, Res. 19)



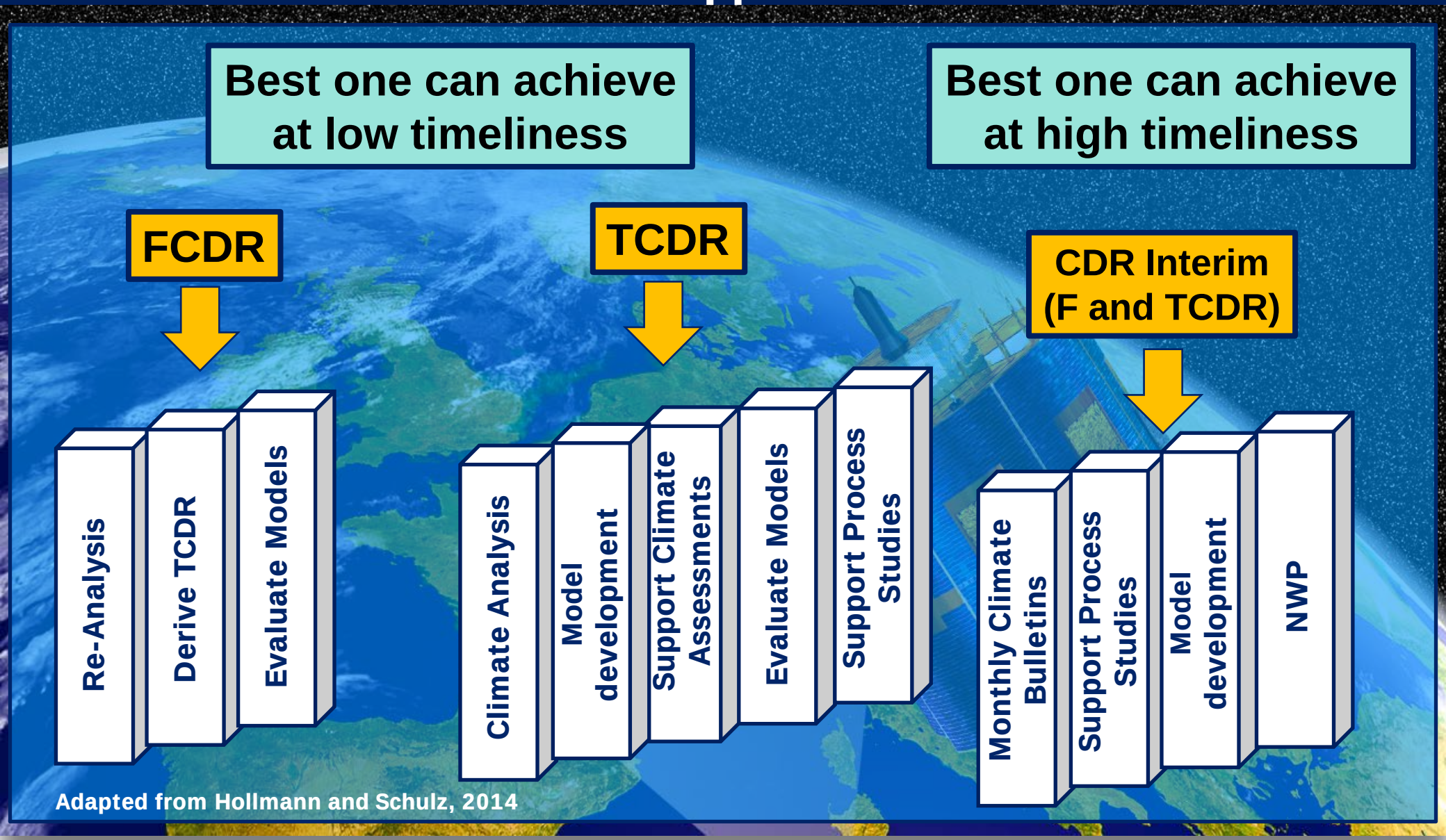
EUMETSAT Contributions to GCOS ECV Data Records

- EUMETSAT Secretariat provides Fundamental Climate Data Records (FCDR, i.e. Radiances or RO Bending Angles) for its sensors serving as input to data records on geophysical variable (Essential Climate Variables) (yellow);
- The SAF network provides single and multi-sensor ECV data records using the FCDRs (indicated in pink);
- Data record generation is performed using operational processing systems.

Atmosphere	Ocean	Terrestrial
Composition	Surface	
Aerosol Properties	Sea Surface Temperature	Land Cover
Carbon Dioxide & Methan	Sea Level	Fire Disturbance
Ozone	Sea Ice	Soil Moisture
Long-Lived Green House Gases	Ocean Colour	Glaciers and Ice Caps
	Sea State	Ice Sheets
Upper Air	Current	Snow Cover
Cloud Properties	Sea Surface Salinity	Albedo
Temperature	Carbon Dioxide Partial Pressure	Leaf Area Index
Water Vapour	Phytoplankton	FAPAR
Wind Speed and Direction	Ocean Adicity	Lakes
Earth Radiation Budget	Sub surface	Above Ground Biomass
Near Surface	Carbon	Permafrost
Air Pressure	Current	Ground Water
Air Temperature	Nutrients	River Discharge
Precipitation	Ocean Adicity	Soil Carbon
Radiation Budget	Oxygen	Land Surface Temperature
Water Vapour (Humidity)	Salinity	
Wind Speed	Temperature	
	Tracers	
	Global Ocean Heat Content	

EUMETSAT FCDR | EUMETSAT ECV

Pathway of Satellite Climate Data Records
From Satellite observation to application



Entering the Value Chain Upstream: Reanalyses

Global reanalyses at ECMWF:

- Uses huge parts of reprocessed satellite data from EUMETSAT;
- Has more than 20,000 registered external users (ERA INTERIM);
- EUMETSAT will make a dedicated contribution to the Copernicus Climate Change Service covering more instruments and extending to the past.

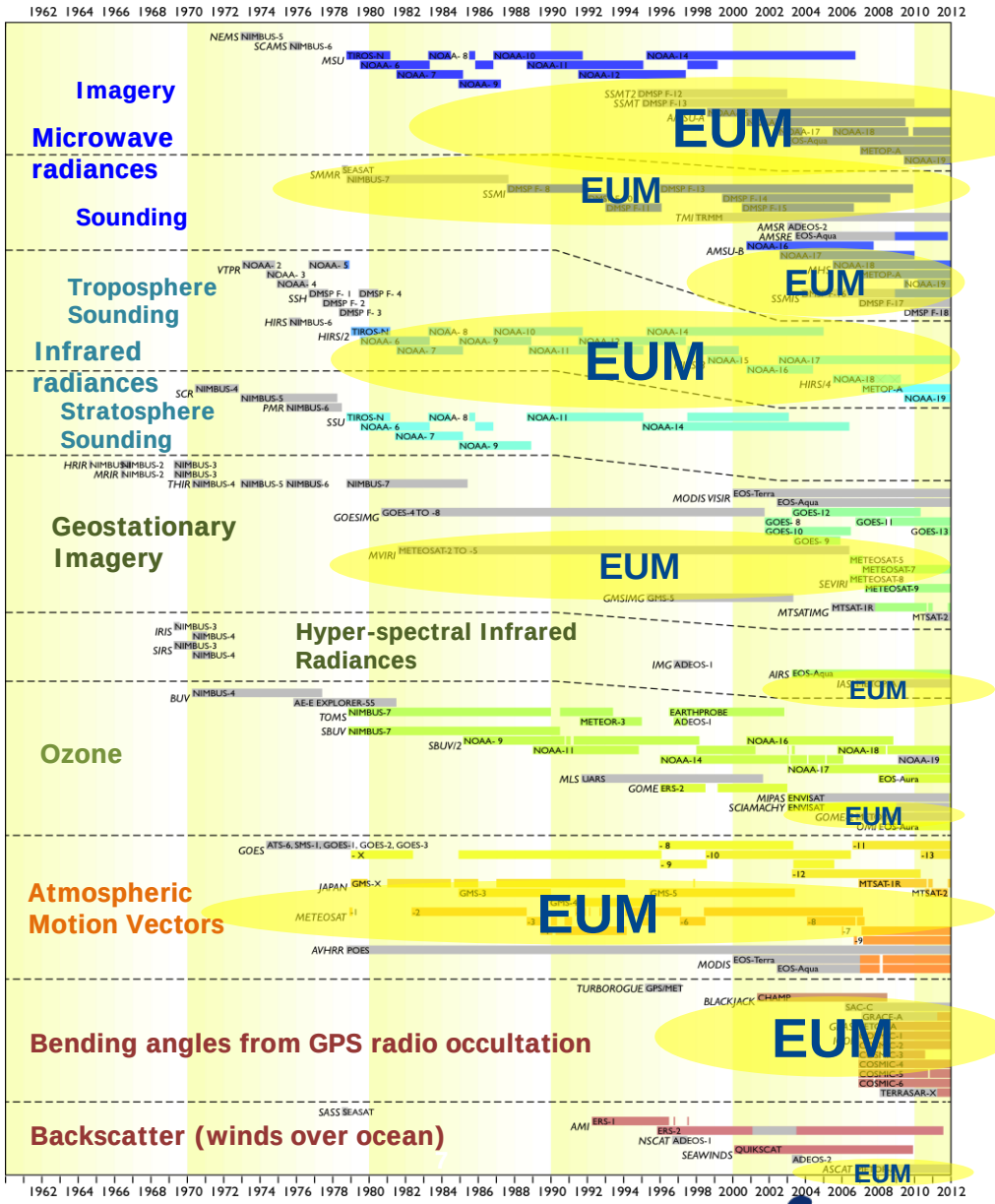


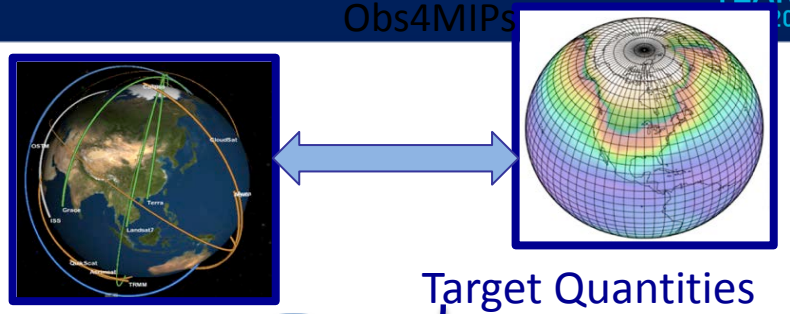
Figure courtesy of Paul Poli

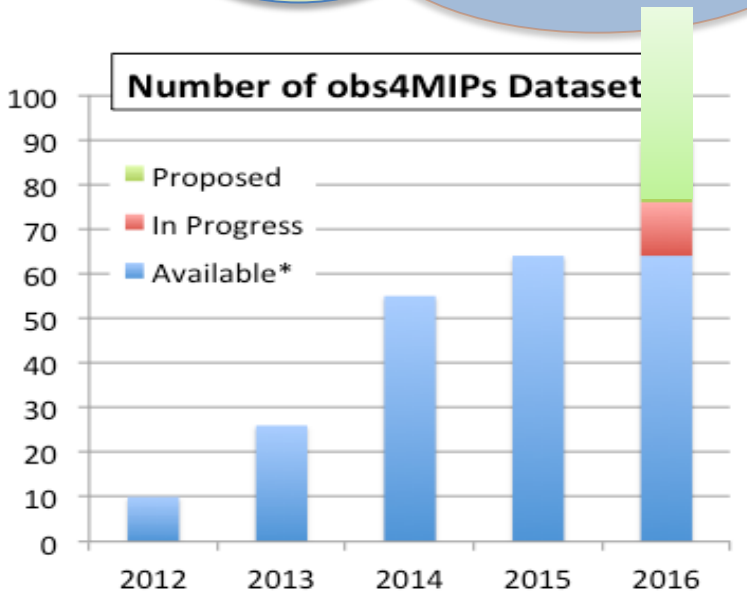
obs4MIPs

https://www.earthsystemcog.org/projects/obs4mips/

Single Slide Project Flyer

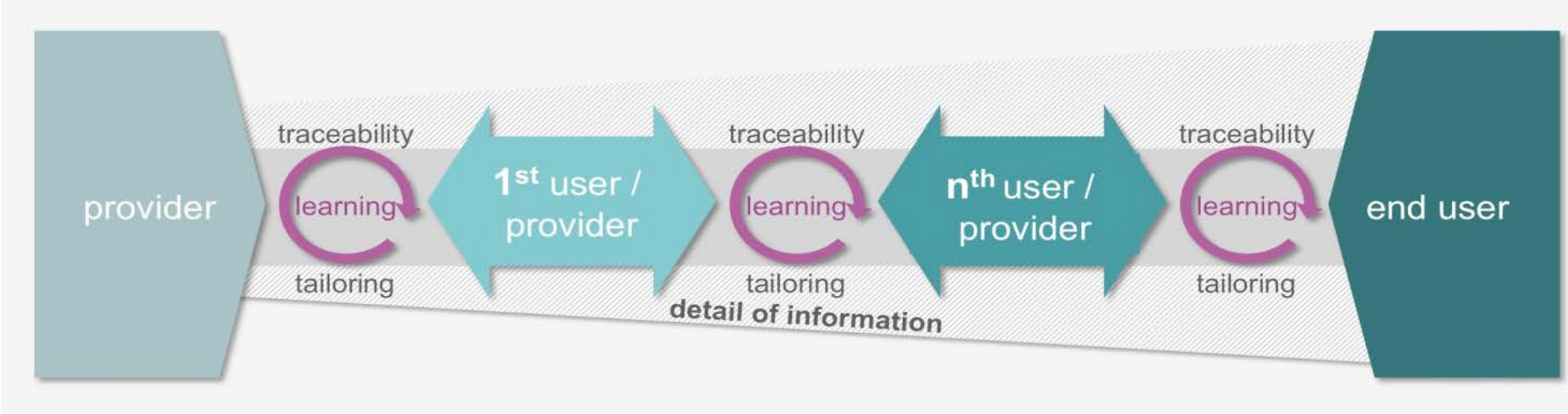
- A Project for identifying, documenting and disseminating observations for climate model evaluation;
- Greatly facilitating research on the quality of today's climate models;
- Facilitates access to on the Earth System Grid Federation (ESGF) alongside the Coupled Model Intercomparison Projection (CMIP) model output;
- EUMETSAT SAF Network has submitted >25 data records to it;
- Guided by the World Climate Research Program (WCRP) Data Advisory Council obs4MIPS Task Team.





.... and growing!

Information Transfer



Otto, J., C. Brown, C. Buontempo, F. Doblas-Reyes, D. Jacob, M. Juckes, E. Keup-Thiel, B. Kurnik, **J. Schulz**, A. Taylor, T. Verhoelst, P. Walton, 2016: Uncertainty: Lessons learned for climate services. Bulletin of American Meteorological Society, http://dx.doi.org/10.1175/BAMS-D-16-0173.1.

EUMETSAT Current Space and Ground Segment

Current EUMETSAT Satellite Fleet

30 YEARS 1986-2016

Sentinel -3a
(LOW-EARTH, SUN-SYNCHRONOUS ORBIT)

Copernicus Global Marine and Land Environment Mission
Operated by EUMETSAT

METOP -A and -B
(LOW-EARTH, SUN – SYNCHRONOUS ORBIT)

EUMETSAT POLAR SYSTEM/INITIAL JOINT POLAR SYSTEM

JASON-2, -3
(LOW-EARTH, 63° INCL. NON SYNCHRONOUS ORBIT)

OCEAN SURFACE TOPOGRAPHY MISSION

METEOSAT-7 (1st GENERATION)
(GEOSTATIONARY ORBIT)
at 57°5 E (until April 2017)

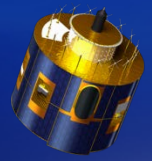
METEOSAT SECOND GENERATION -9, -10, -11
(GEOSTATIONARY ORBIT)

TWO-SATELLITE SYSTEM:
- METEOSAT-11: IN-ORBIT BACKUP
- METEOSAT-10: FULL DISK IMAGERY MISSION AT 0° (15 MN)
- METEOSAT-9: RAPID SCAN SERVICE OVER EUROPE AT 9.5°E (5 MN)

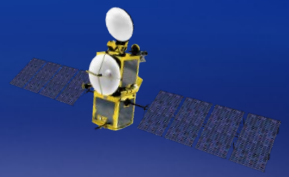
METEOSAT -8 (2nd GENERATION)
(GEOSTATIONARY ORBIT)

INDIAN OCEAN DATA COVERAGE MISSION
AT 41.5° E

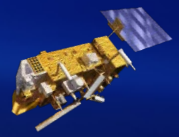
EUMETSAT ground segment overview



METEOSAT



JASON-2



INITIAL JOINT POLAR SYSTEM
METOP NOAA SATELLITES

CONTROL AND DATA ACQUISITION

FLIGHT OPERATIONS

PRE-PROCESSING EUMETSAT HEADQUARTERS

THIRD-PARTY DATA SOURCES

DATA CENTR... EUMETSAT HEA...ERS

REAL TIME DATA PROCESSING EUMETSAT HEADQUARTERS

SATELLITE A... WITH... ...TIES ...MBER STATES

Central processing and generation of products

...ed processing and generation of products

CLIM... ...A PROCESSING ...T HEADQUARTERS

REAL TIME DISSEMINATION OF DATA AND PRODUCTS VIA EUMETCAST

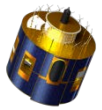
navigator.eumetsat.int

SAF archive access points

APPLICATIONS GROUND SEGMENT

USERS

EUMETSAT Programme Overview



YEAR... 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

METEOSAT FIRST GENERATION

METEOSAT-7

METEOSAT SECOND GENERATION

METEOSAT-8 …Extended lifetime .....

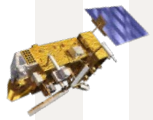
METEOSAT-9 …Extended lifetime .....

METEOSAT-10 …Extended lifetime ...

METEOSAT-11 .....

Not on this slide Meteosat First Generation with data coverage starting in 1978.

Mandatory Programmes



EUMETSAT POLAR SYSTEM (EPS)

METOP-A …Extended lifetime .....

METOP-B …Extended lifetime .....

METOP-C …Extended lifetime .....

Currently scheduled for launch 10/2018

Launched 17.01.2016

Operational Development

JASON

JASON-2

JASON-3

Launched 16.02.2016

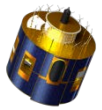
Optional and Third Party Programmes

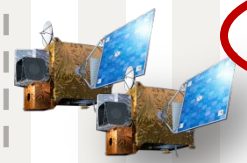
COPERNICUS

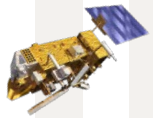
SENTINEL-3

YEAR... 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

EUMETSAT Programme Overview







YEAR... 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

METEOSAT FIRST GENERATION

METEOSAT-7

METEOSAT SECOND GENERATION

METEOSAT-8 …Extended lifetime .....

METEOSAT-9 …Extended lifetime .....

METEOSAT-10 …Extended lifetime ...

MSG-4/METEOSAT-11 .....

First launch 2021

METEOSAT THIRD GENERATION

MTG-I-1 : IMAGERY

MTG-S-1: SOUNDING

MTG-I-2: IMAGERY

MTG-I-3: IMAGERY

MTG-S-2: SOUNDING

MTG-I-4: IMAGERY

First Launch 2021

Mandatory Programmes

EUMETSAT POLAR SYSTEM (EPS)

METOP-A …Extended lifetime .....

METOP-B …Extended lifetime .....

METOP-C …Extended lifetime .....

METOP SECOND GENERATION

METOP-SG-A1

METOP-SG-B1

METOP-SG-A2

METOP-SG-B2

METOP-SG-A3

METOP-SG-B3

Operational Development

Current Launch year 2020

JASON

JASON-2

JASON-3

JASON CONTINUITY OF SERVICE (JASON-CS)

COPERNICUS

SENTINEL-3

SENTINEL-4 ON MTG-S

SENTINEL-5 ON EPS-SG

Optional and Third Party Programmes

YEAR... 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

Meteosat: Spectral, Spatial and Temporal Sampling

	Meteosat 1st Generation			Meteosat 2nd Generation			Meteosat 3rd Generation		
'Core' channels	Central wavelength (µm)	Width (FWHM) (µm)	Spatial Sampling (km)	Central wavelength (µm)	Width (FWHM) (µm)	Spatial Sampling (km)	Central wavelength (µm)	Width (FWHM) (µm)	Spatial Sampling (km)
FC-VIS 0.4							0.444	0.06	1.0
FC-VIS 0.5							0.510	0.05	1.0
FC-VIS 0.6	0.7	0.35	2.5	0.635	0.08	3.0	0.645	0.08	0.5
FC-VIS 0.8				0.81	0.07	3.0	0.86	0.07	1.0
FC-NIR 0.9							0.96	0.06	1.0
FC-NIR 1.3							1.375	0.03	1.0
FC-NIR 1.6				1.64	0.14	3.0	1.61	0.06	1.0
FC-NIR 2.2							2.26	0.05	0.5
FC-IR 3.8*				3.9	0.44	3.0	3.8	0.40	1.0
FC-IR 6.2	6.1	1.3	5.0	6.2	1.0	3.0	6.2	1.00	2.0
FC-IR 7.3				7.35	0.5	3.0	7.35	0.50	2.0
FC-IR 8.7*				8.7	0.4	3.0	8.7	0.40	2.0
FC-IR 9.7				9.66	0.3	3.0	9.66	0.30	2.0
FC-IR 10.8	11.5	1.9	5.0	10.8	1.0	3.0	10.5	0.7	1.0
FC-IR 12.0				12.0	1.0	3.0	12.3	0.5	2.0
FC-IR 13.3				13.4	1.0	3.0	13.3	0.60	2.0
Repeat Cycle :	30 min			15 min			10 min		

New capabilities of MTG for climate monitoring

- Climate relevance of MTG:
  - By 2040 MTG extends Meteosat imaging to ~60 years in a consistent manner. Data records of radiance, reflectance, and all derived geophysical parameters can be extended;
  - Improved imaging capability contributes to:
    - research on the global circulation (long term change in polar front position, storm tracks, etc.);
    - better fire detection products and an increase in the quality of climate-relevant products such as fire radiative energy and power, which can be used to calculate carbon dioxide emissions from fires.
  - Improved spatiotemporal sampling addresses analysis of extreme events at local scale, e.g., thunderstorms;
  - MTG IR sounder opens new opportunities:
    - for 3D AMV time series in conjunction with IASI/IASI-NG and AVHRR/MetImage;
    - for reanalyses with NWP models operating at regional scale and assimilating high resolution temperature, humidity and cloud information.
  - Lightning imager may contribute to quantification of naturally occurring NO_x and aircraft-induced NO_x.

New capabilities of EPS-SG for climate monitoring

- Climate relevance of EPS-SG by 2040:
  - EPS-SG extends many EPS missions (Radio Occultation, scatterometer, hyperspectral IR sounding, etc. to ~35 years in a consistent manner.
  - EPS-SG extends heritage data records on VIS/IR imaging, IR and MW sounding to more than 60 years;
  - Derived geophysical parameters data records can be extended;
- EPS-SG adds new measurement capabilities:
  - 3MI allows to address aerosol-cloud-radiation interaction at process level;
  - Microwave Imager (MWI) is currently the only committed operational continuation of the successful passive microwave radiometer series SMMR, SSM/I, SSMIS, AMSR-E, TMI, GMI, etc. and provides more accurate radiance data;
  - Ice Cloud Imager (ICI) will provide improved information on Cirrus clouds which is essential to understand Earth Radiation Budget.

New EPS mission 3MI imaging polarimeter on Metop SG A

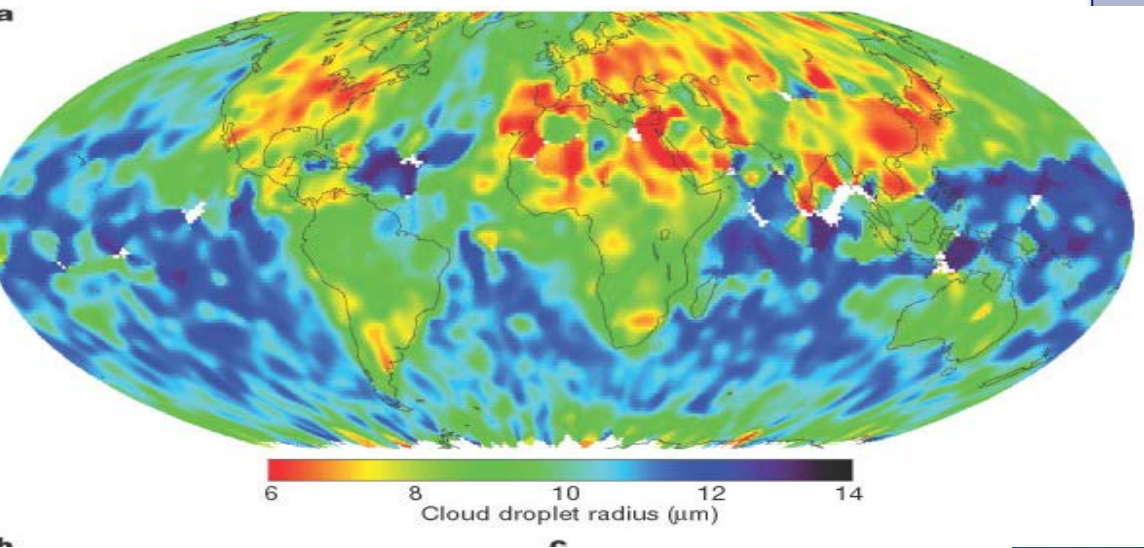
Mission objectives

- Aerosols
- Phase, altitude, properties of clouds
- Albedo, radiative budget (BRDF)

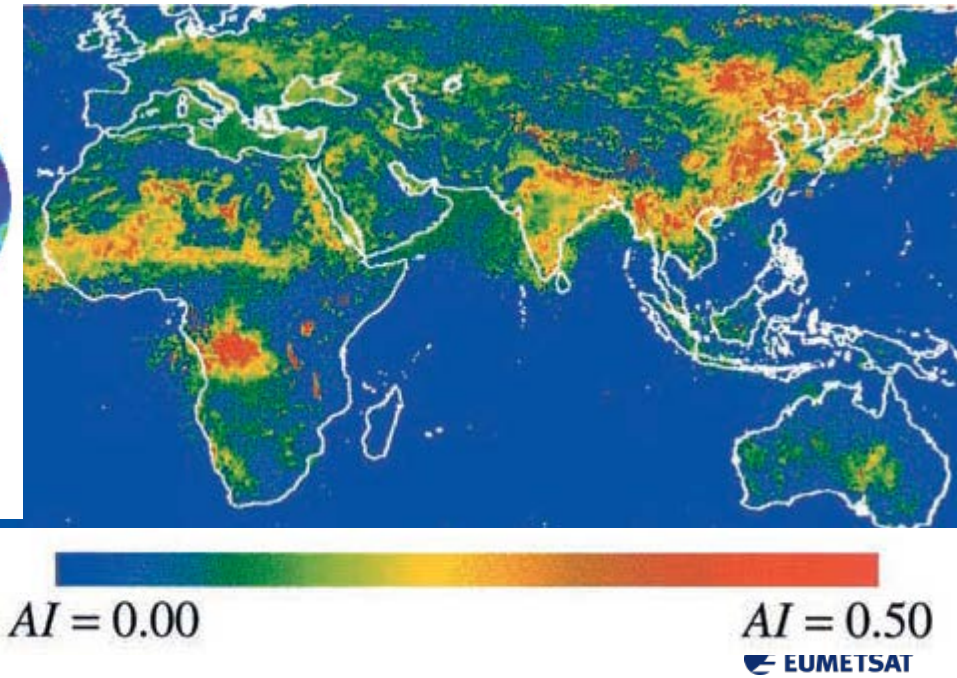
First operational polarimeter

Major improvements over POLDER

- Horizontal Resolution: 4 km
- 11 channels, extension to SWIR: Better aerosol characterisation
- Higher angular resolution (14 view angles)



Kaufman et al. (2002)



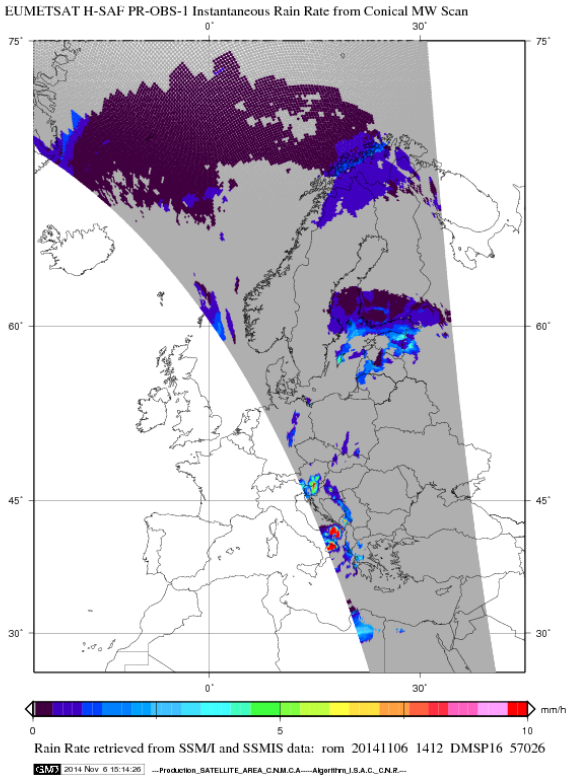
New EPS mission: Micro-Wave Imager (MWI) on Metop-SG B

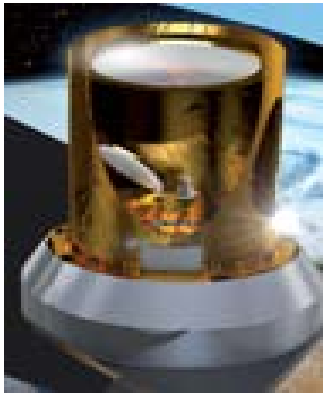
Mission objectives

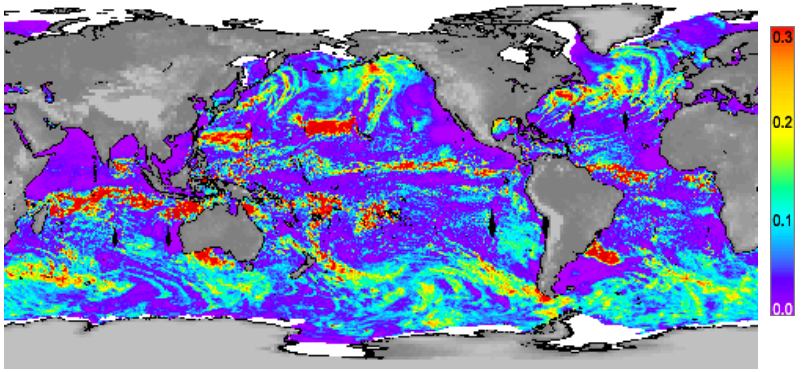
- Precipitation and clouds
- Imagery and H2O profiles
- Sea ice, surface snow

19 channels (18.7 - 183 GHz)

- Enhancement wrt SSMI/S
- Addition of sounding channels
  - Improve estimation of precipitation
  - Water vapour and clouds
- European part of future GPM constellation







mm

Cloud Liquid Column

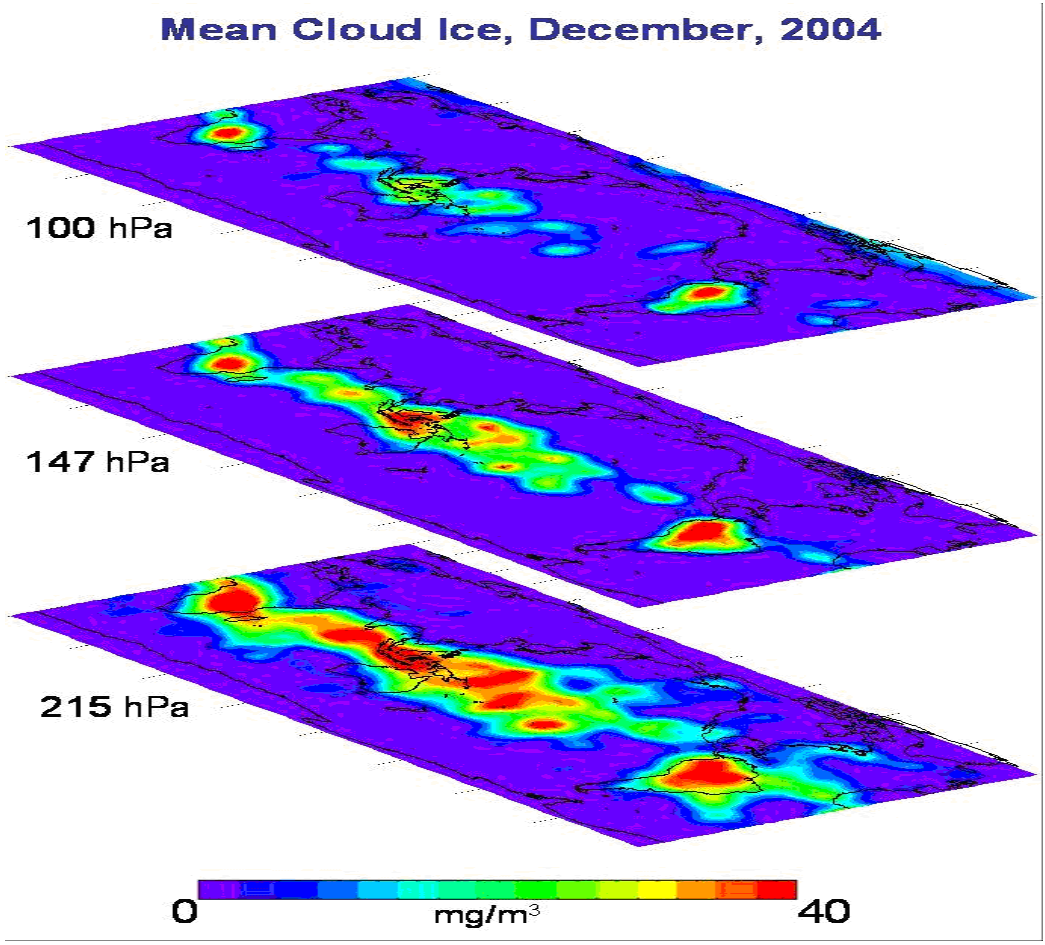
New EPS mission: Ice-Cloud Imager (ICI) on Metop-SG B

Mission Objectives

- Clouds (ice phase)
- Detection of snow

11 channels (183 – 664 GHz)

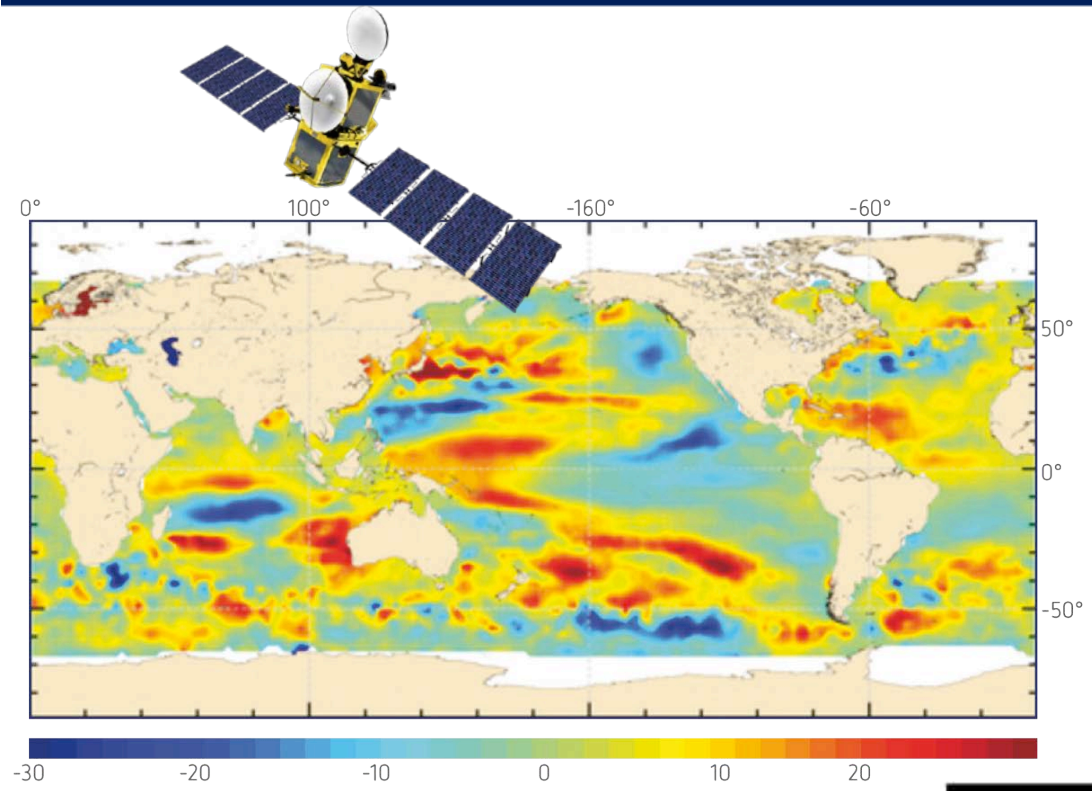
- **First operational ice cloud imagery mission**
- **Meteorology and climate (Cirrus)**

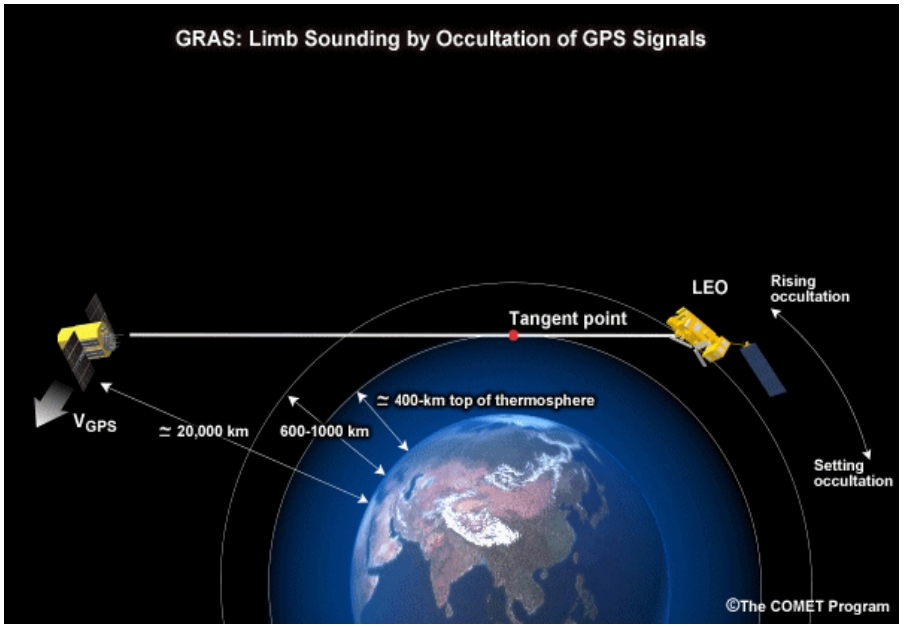


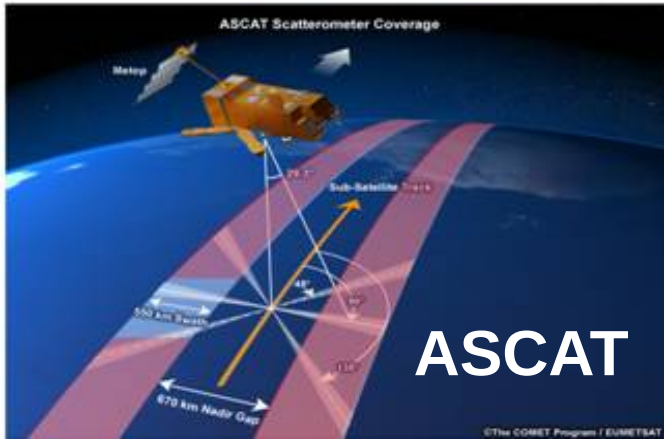
NASA: Aura/MLS

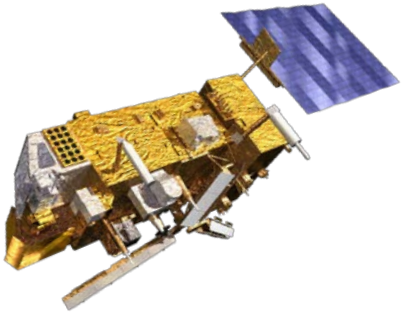
Climate Data Records Examples

Some missions are optimised for climate monitoring…

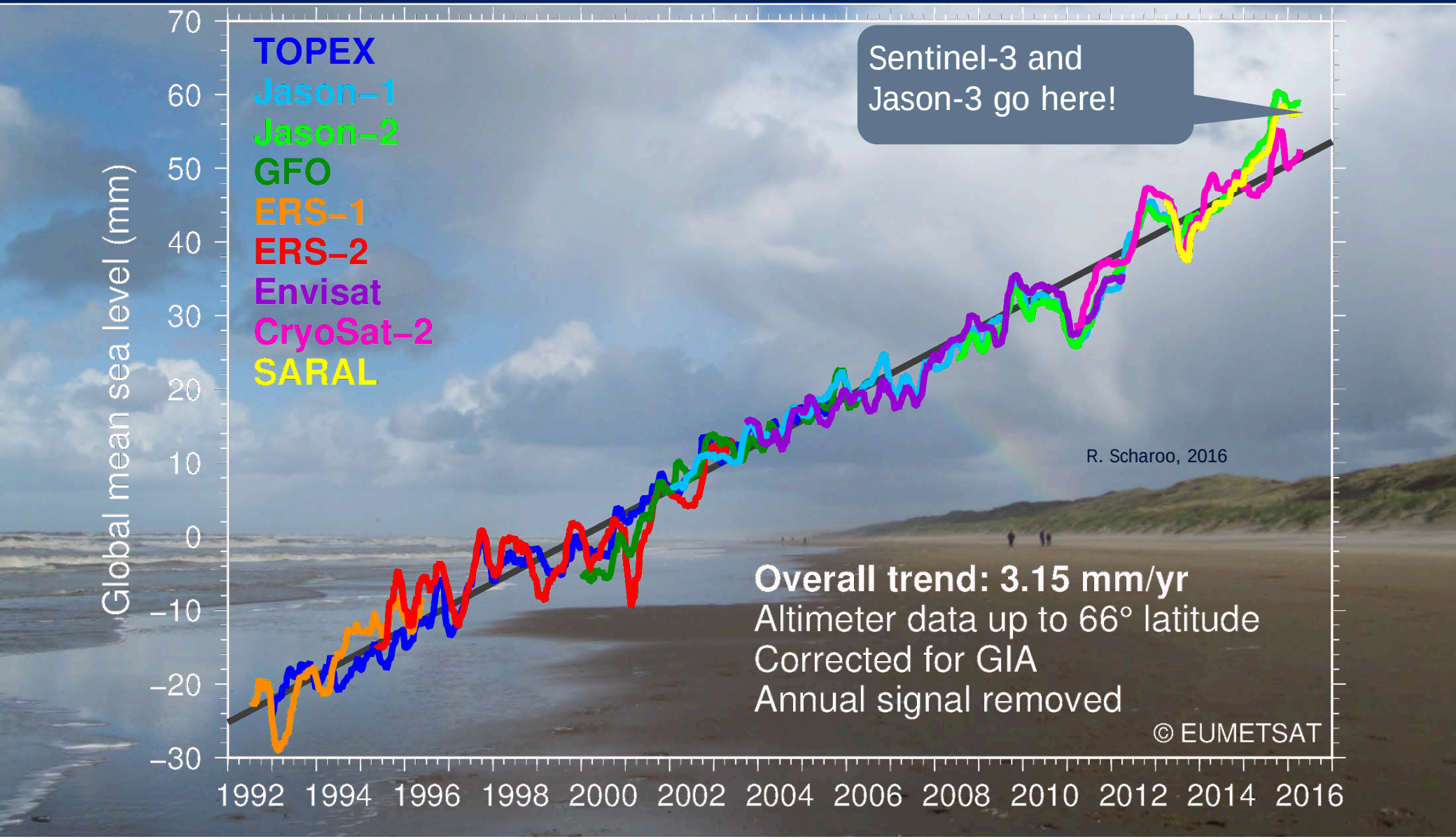




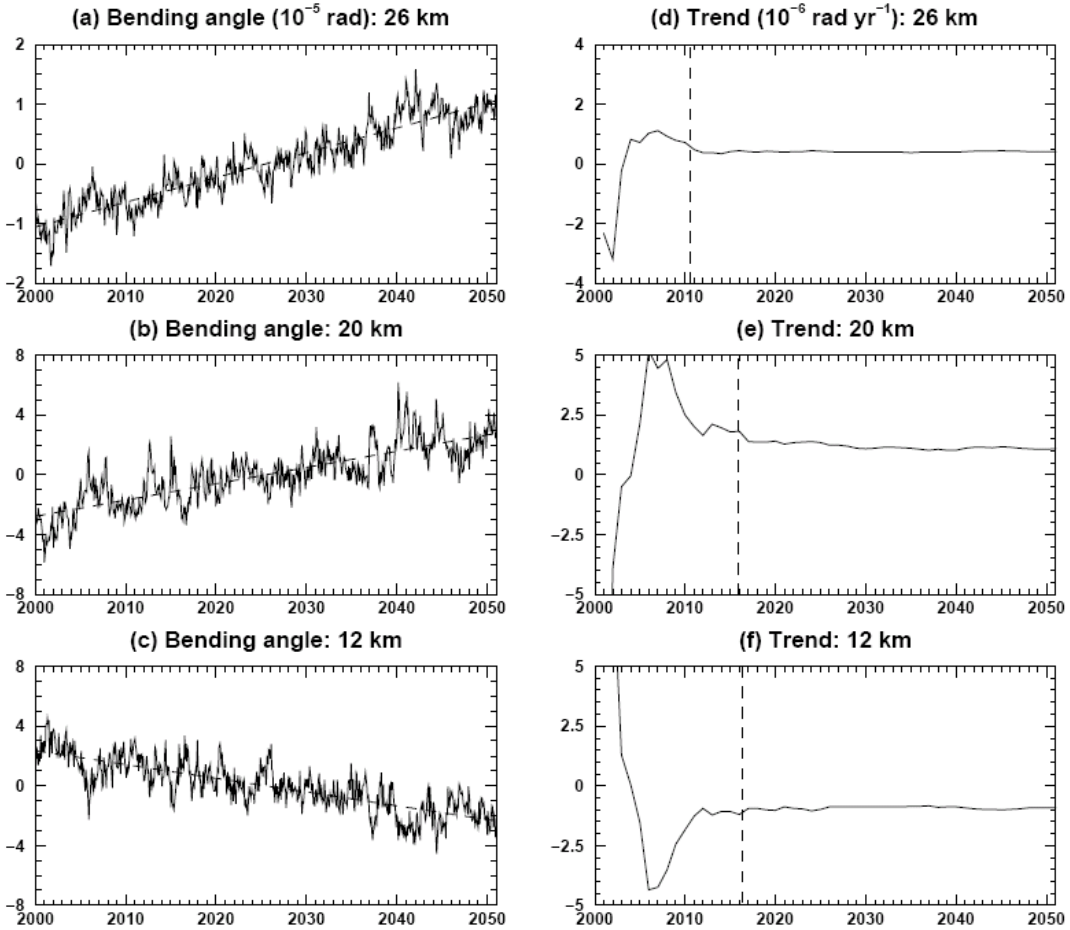




Climate Change Monitoring: Mean Sea Level



Monitoring 21st Century Climate Using GPS Radio Occultation
(Ringer and Healy, 2008)



- Time series of the monthly mean bending angle at equator at impact heights of 12, 20 and 26 km, respectively

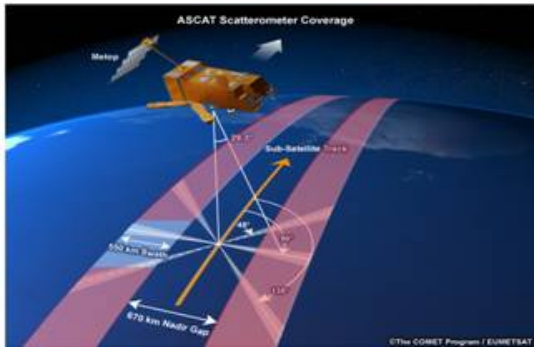
➢ Trend is discernable (temperature change)

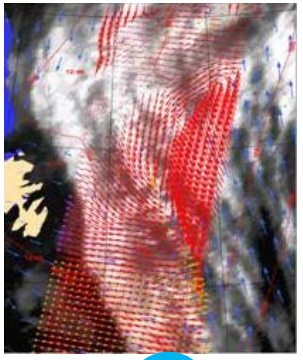
➢ Detection times with 95% confidence:
  - at 12 km: 14.6 - 18.2 years
  - at 20 km: 13.6 - 18.7 years
  - at 26 km: 9.7 - 11.7 years

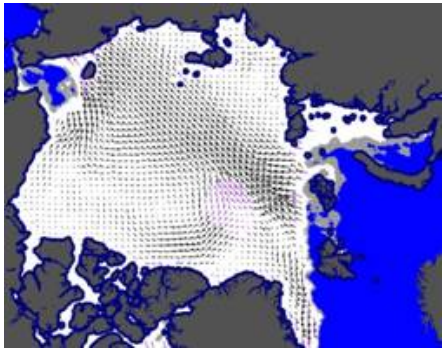
- EUMETSAT is generating bending angle profile data records for Metop, COSMIC, CHAMP and GRACE satellites.

Metop-A ASCAT Data Record

ASCAT | Ocean winds | Sea ice drift | Soil moisture



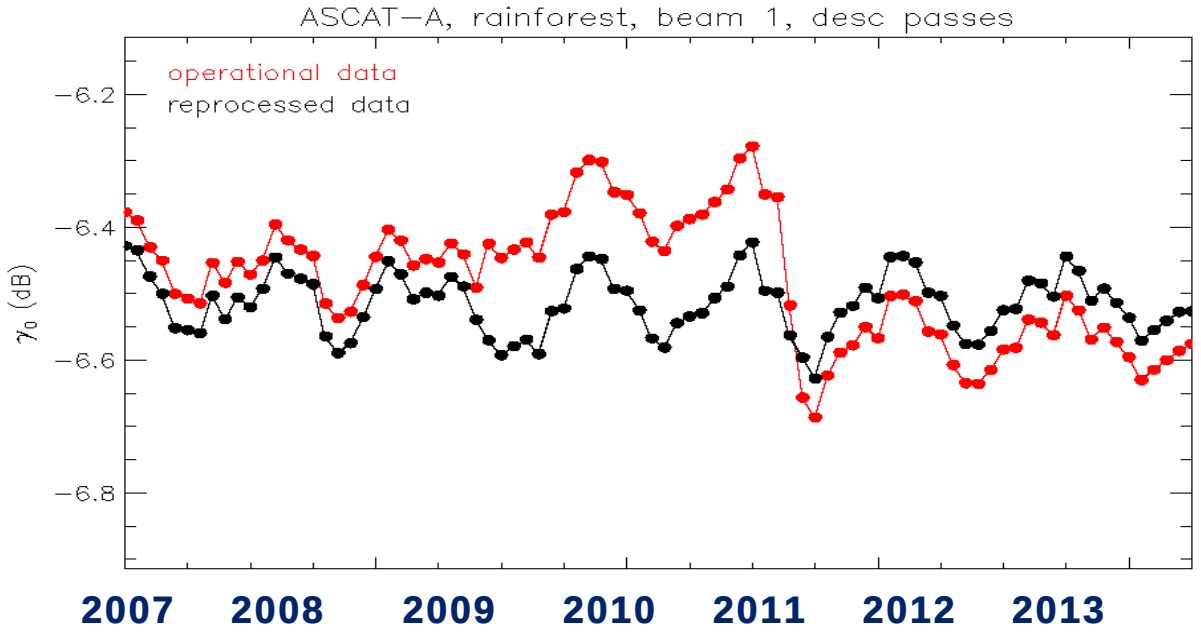




OSI SAF

H SAF

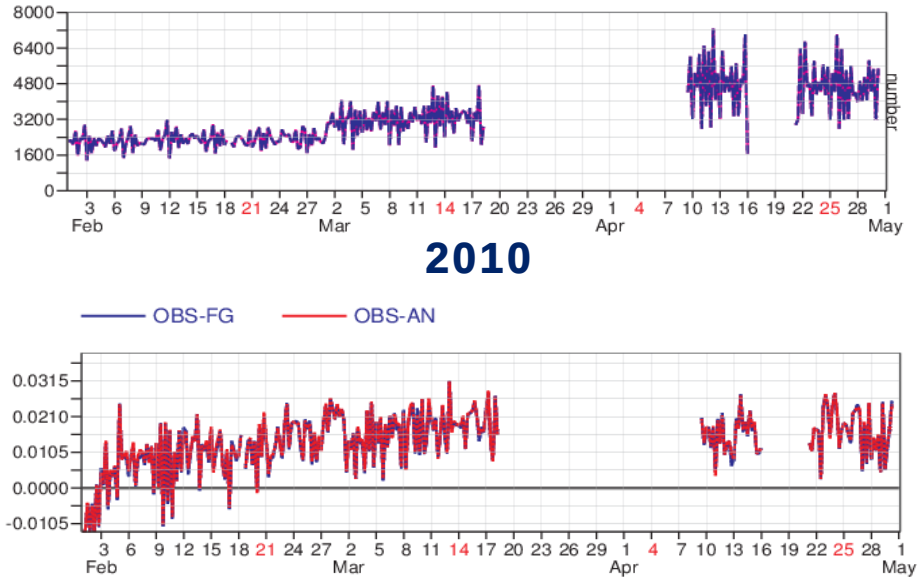
- Recalibration eliminates drifts and jumps in the time series;
- Reflects only natural variations of backscatter of the forest canopy;
- EUMETSAT provides the basis for improved ECV data records.



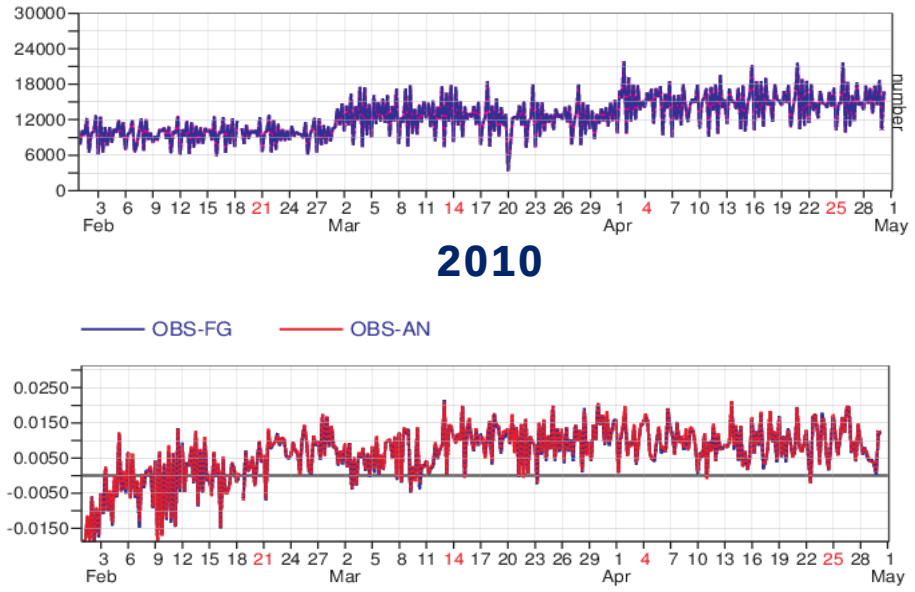
EUMETSAT

Use of ASCAT Retrieved Soil Moisture in Reanalysis

ASCAT data assimilated in operations (CTRL)



Reprocessed ASCAT(REPROC)



- **4 times more assimilated observations in REPROC;**
- **Background and analysis mean departure errors reduced by 30 %.**

Courtesy of Patricia de Rosnay

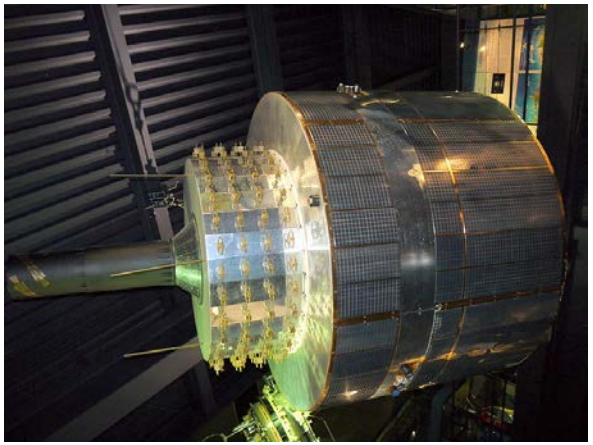
ECMWF EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

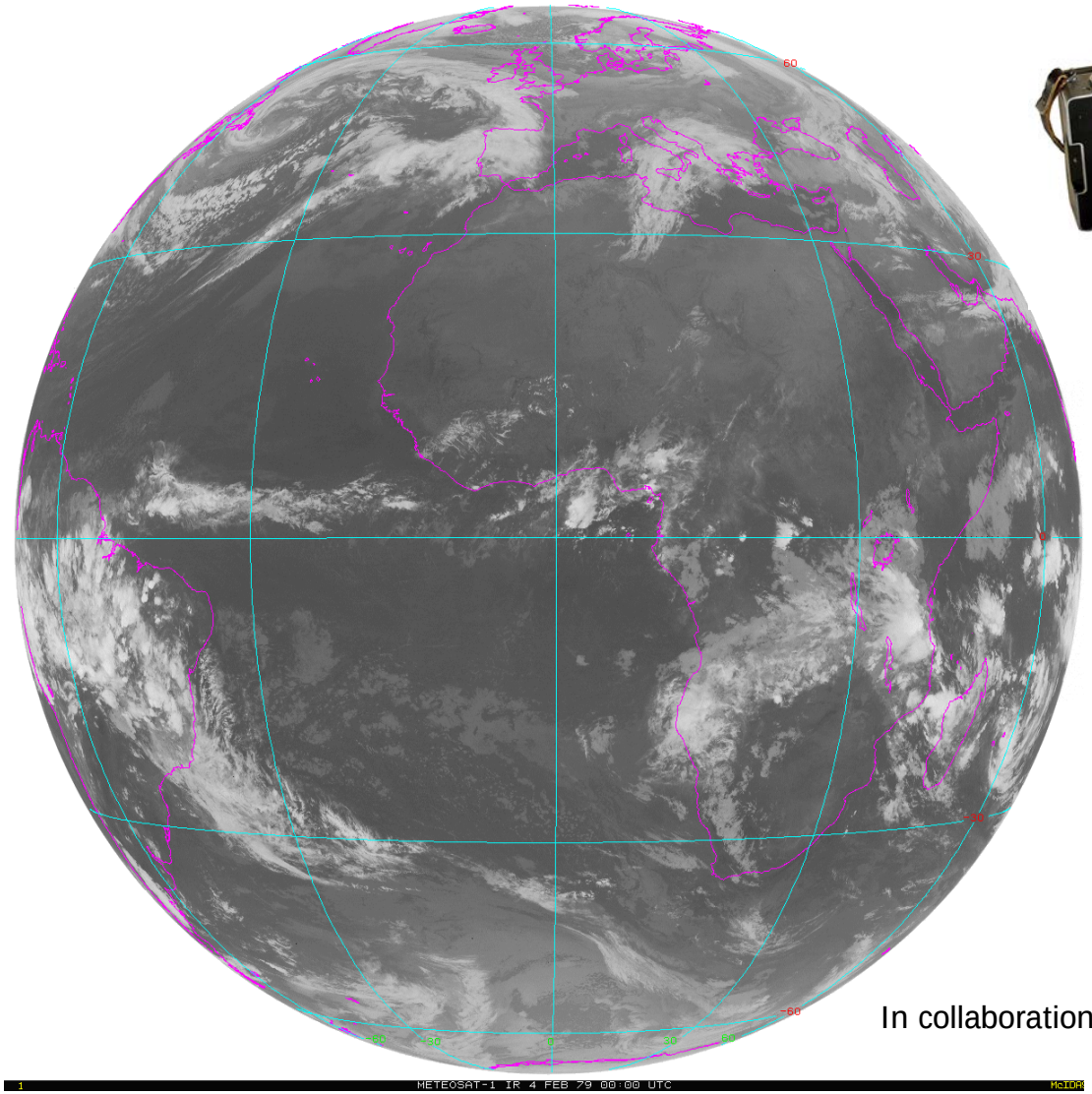
… and some are not: METEOSAT-1 Infrared Channel

4th February 1979

45 images

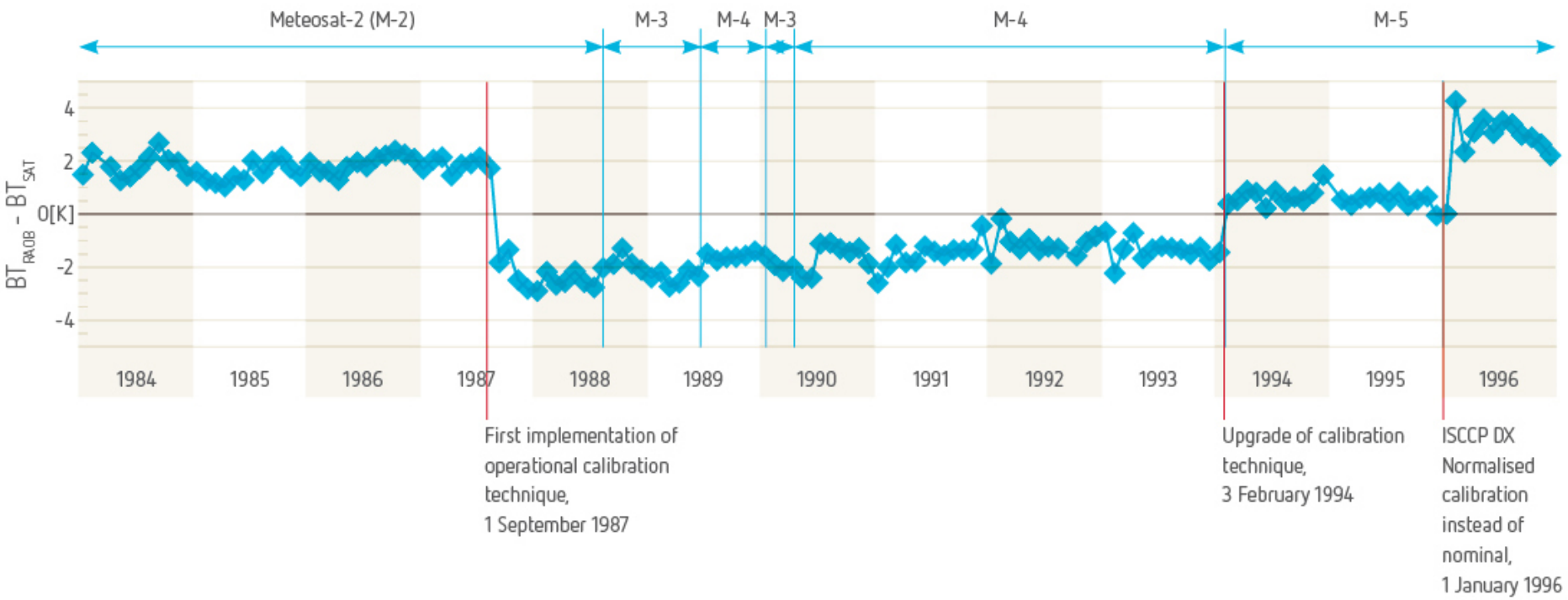
Every 30 minutes from 00:00 UTC until 23:30 UTC *(missing images at 8:00 and 8:30 UTC)*





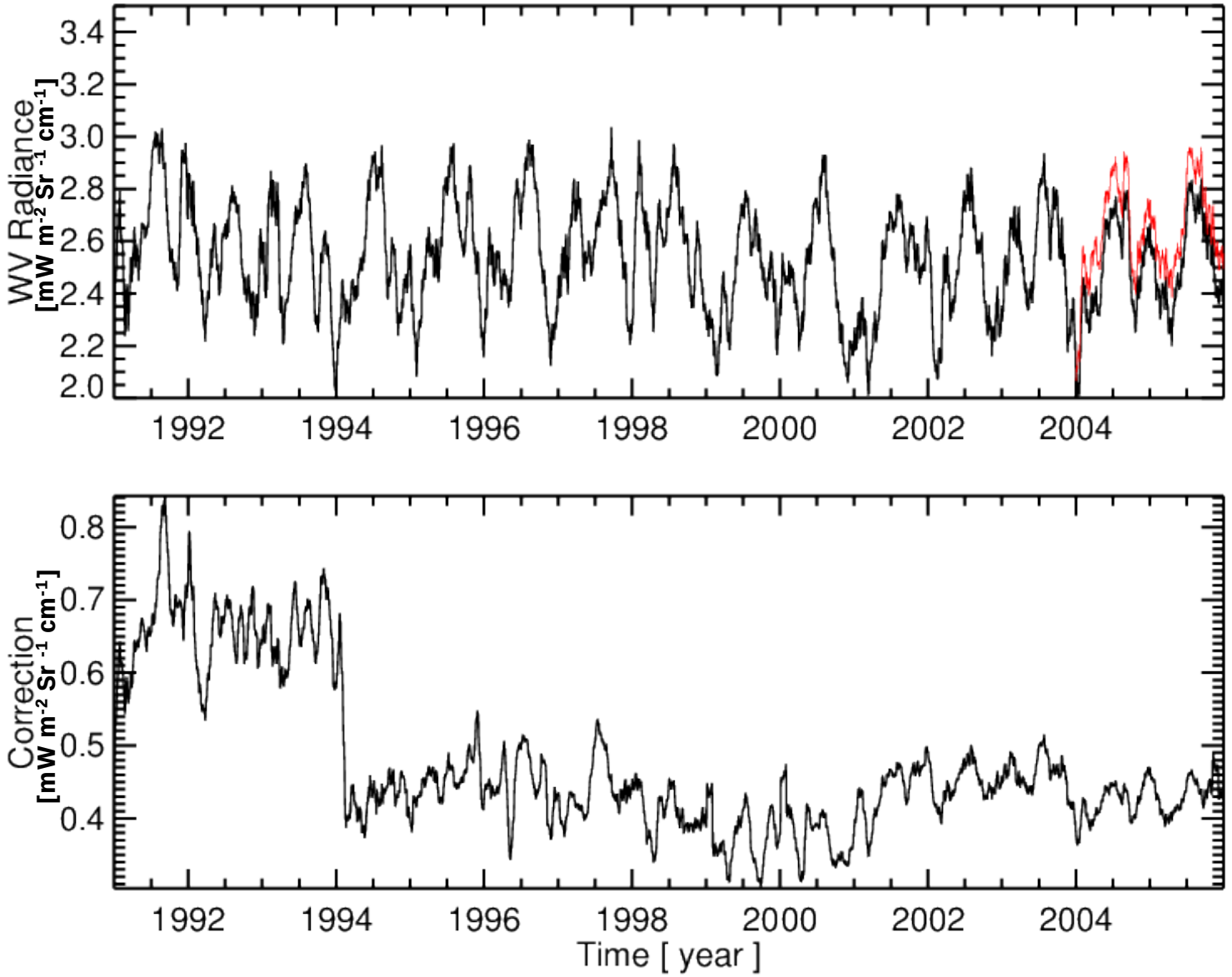
In collaboration with CIMSS/SSEC

Resulting Inhomogeneous Time Series



- Quality of data needs to be assessed and improved per instrument;
- Data can be re-calibrated to reference observations, e.g., using IASI in the infrared, that also has the effects of data record harmonisation and homogenisation.

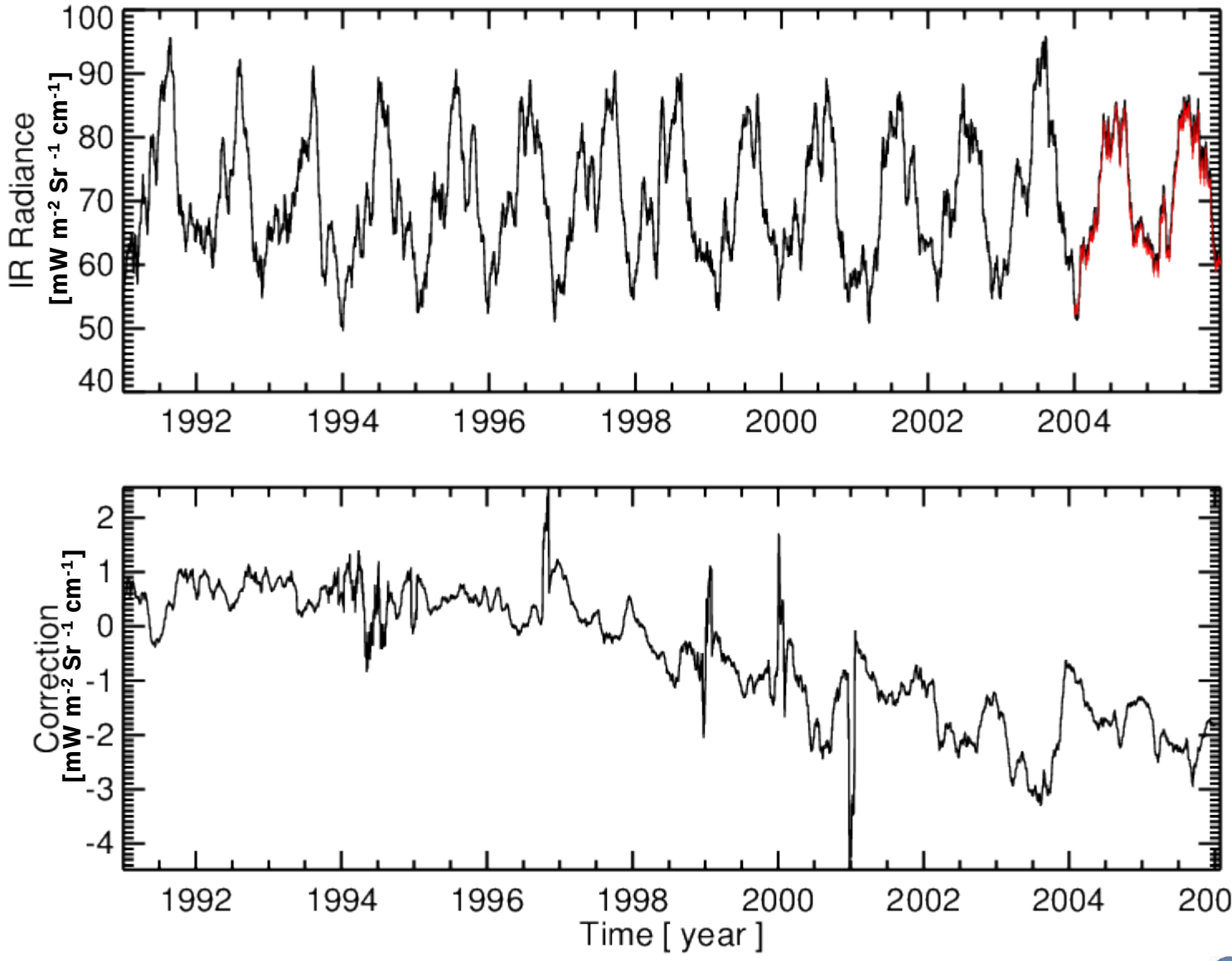
Re-calibrated WV Channel Radiances



MFG

MSG

Re-calibrated IR channel radiances



MFG

MSG

Use of Re-calibrated Meteosat FCDR in CM SAF

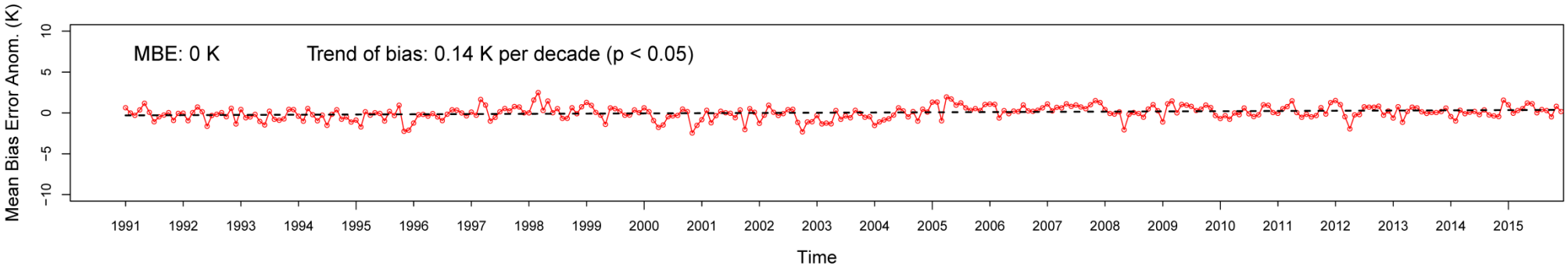


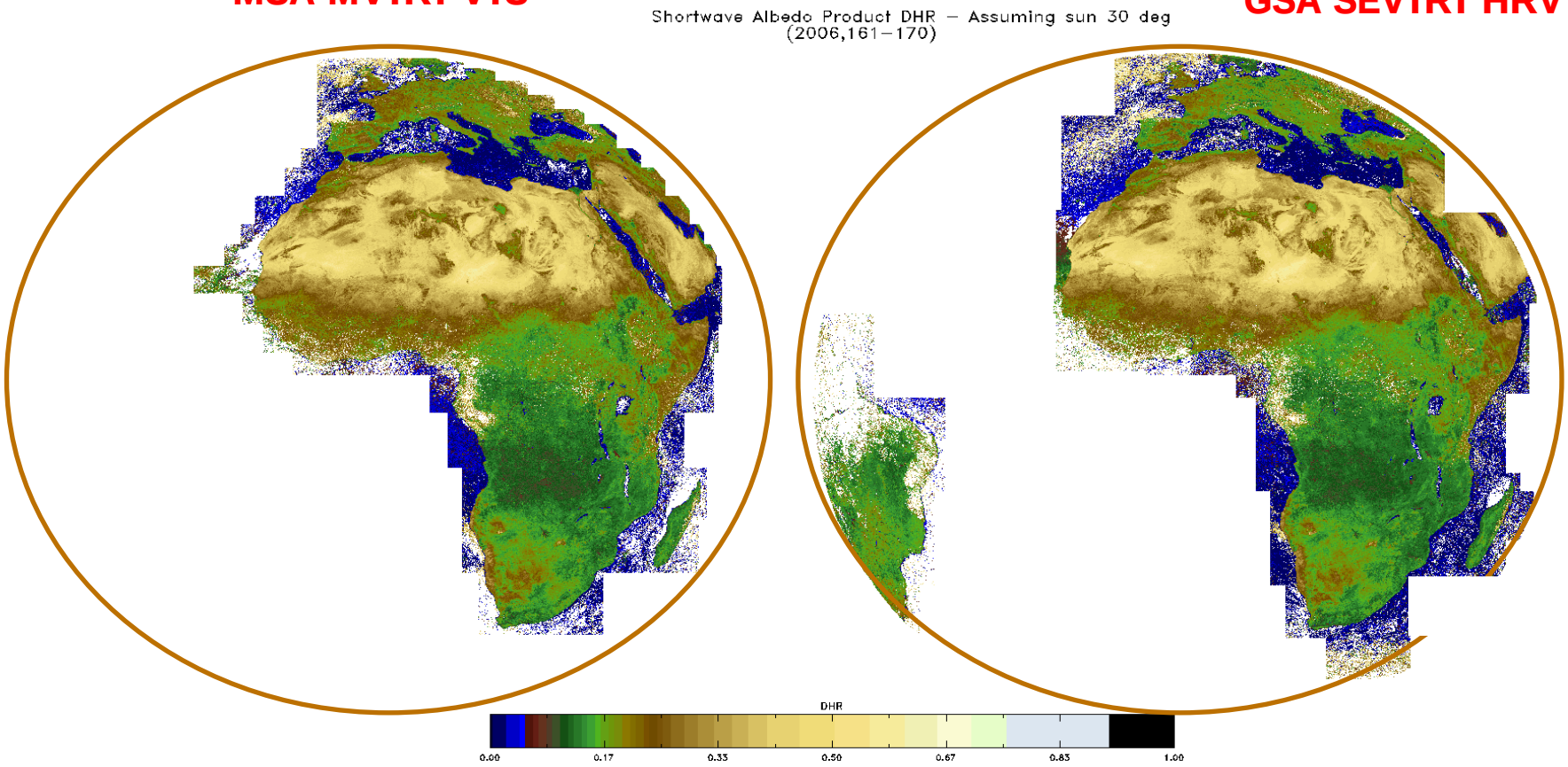
Figure: Courtesy from Anke Duguay-Tetzlaff, Meteo-Swiss

- CM SAF Land Surface Temperature error anomaly vs. ECMWF ERA-Interim skin temperature over a 1 x 1 degree grid in Europe;
- Trend of bias is 0.14K/decade at 95% significance (GCOS requirement is 1K/decade).

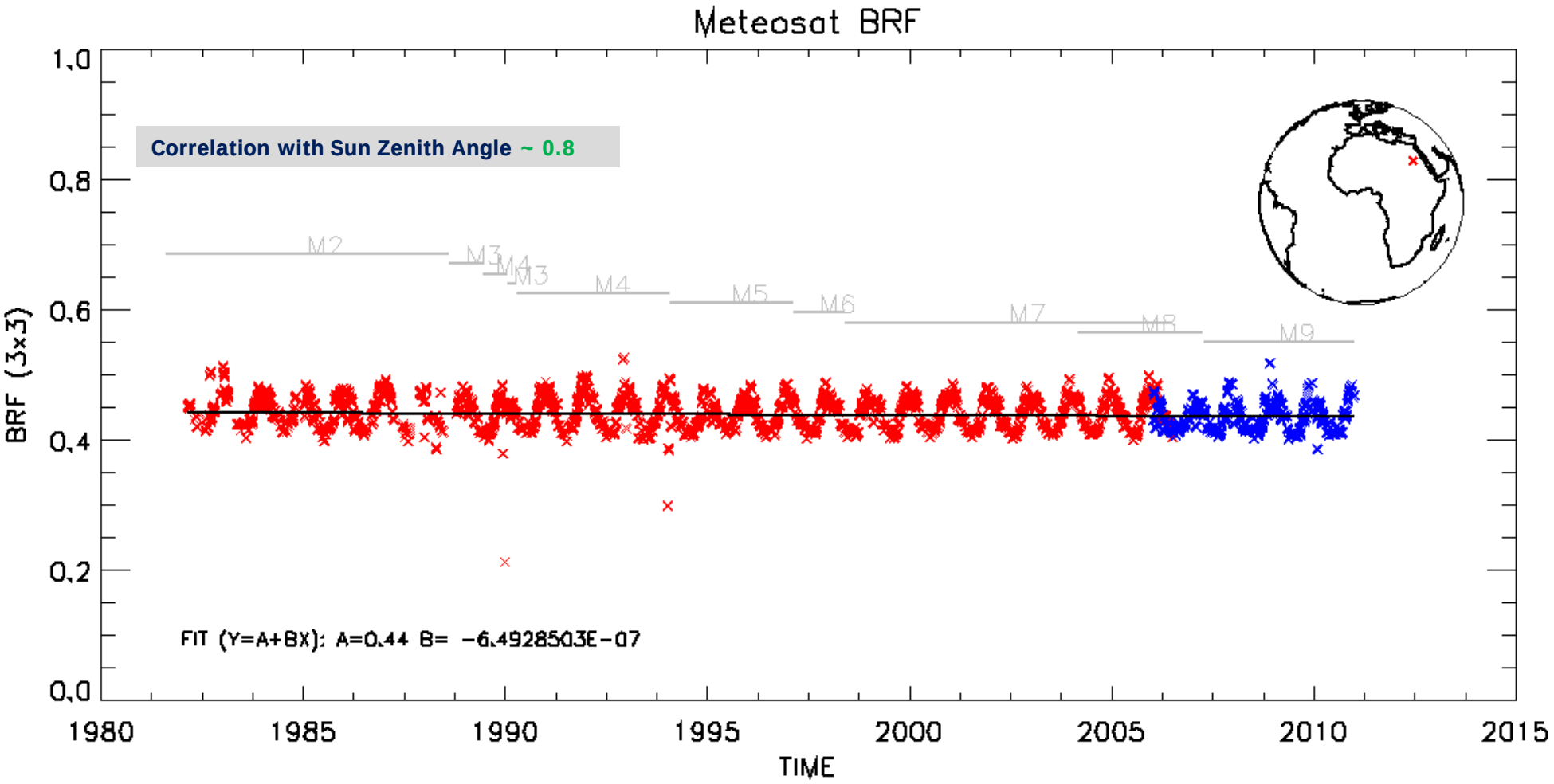
Shortwave albedo from MVIRI and SEVIRI HRVIS

MSA MVIRI VIS

GSA SEVIRI HRVIS



Shortwave BRF Time Series Retrieved from METEOSAT



Shortwave (0.3-3.0 µm) Bidirectional Reflectance Function (BRF) time series at a Libyan desert site from 1982 to 2010 derived from the MVIRI instruments onboard Meteosat First (M2-M7) and SEVIRI instruments on board Meteosat Second (M8-M9) Generation.

Database of global reference sites for albedo product validation

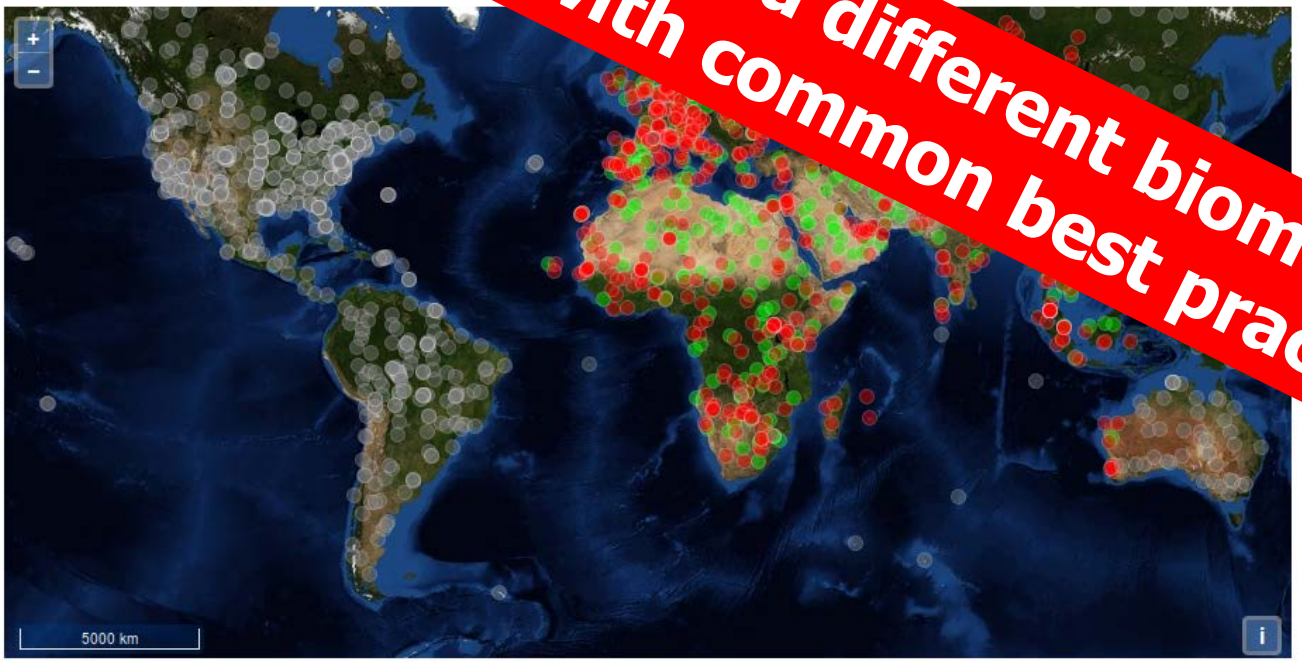
METHOD:

- ❑ **Identify** … validation sites (existing network infrastructures).
- ❑ **Charac** … homogeneity of these sites using ancillary … nd Cover, DEM, MSA).
- ❑ **Define** … sites.
- ❑ **Select** sites w… n capabilities.

Hosted by EUMETSAT:
http://savs.eumetsat.int
Doi: http://dx.doi.org//10.15770/EUM_SEC_CLM_1001
(Linked with CEOS LPV web site: http://lpvs.gsfc.nasa.gov/)

Range and different biomes needed, with common best practises!

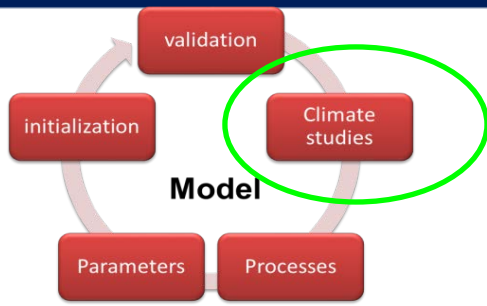
GSAValDB (v1.0) GCOS met (32…



Network	Reference / Remark
FLUXNET	Initial studies by Cescatti et al. (2012)
BSRN	http://www.bsrn.awi.de/
Aeronet	http://aeronet.gsfc.nasa.gov/
…NIP-2	http://calvalportal.ceos.org/web/olive/site-description
…	http://calvalportal.ceos.org/ceos-landnet-sites
…	…://landval.gsfc.nasa.gov/coresite_gen.html
…	…l.gov/NPP/npp_home.shtml
…	…l.gov/Pages/default.aspx
…	…fault.aspx
Sur…	…d/surfrad/index.html
LTER	
ILTER	
SAFARI-2000	http…

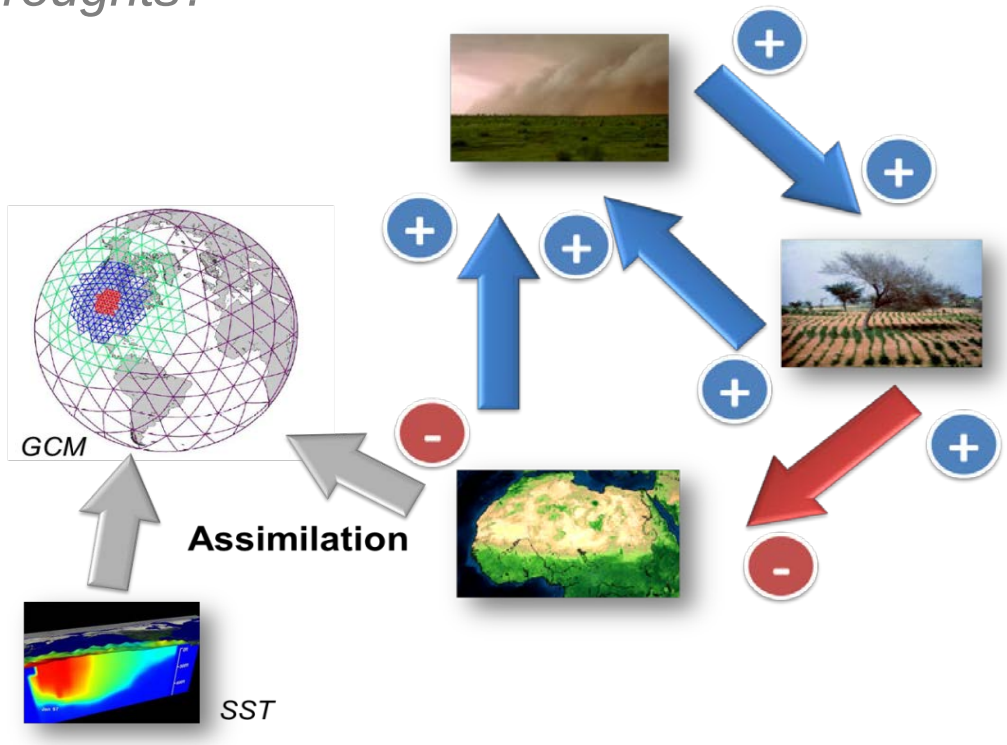
Citation: Loew, A., Bennartz, R., Fell, F., **Lattanzio, A.**, **Doutriaux-Boucher, M.**, and **Schulz, J.**: A database of global reference sites to support validation of satellite surface albedo datasets (SAVS 1.0), Earth Syst. Sci. Data, doi:10.5194/essd-2016-11, in press, 2016.

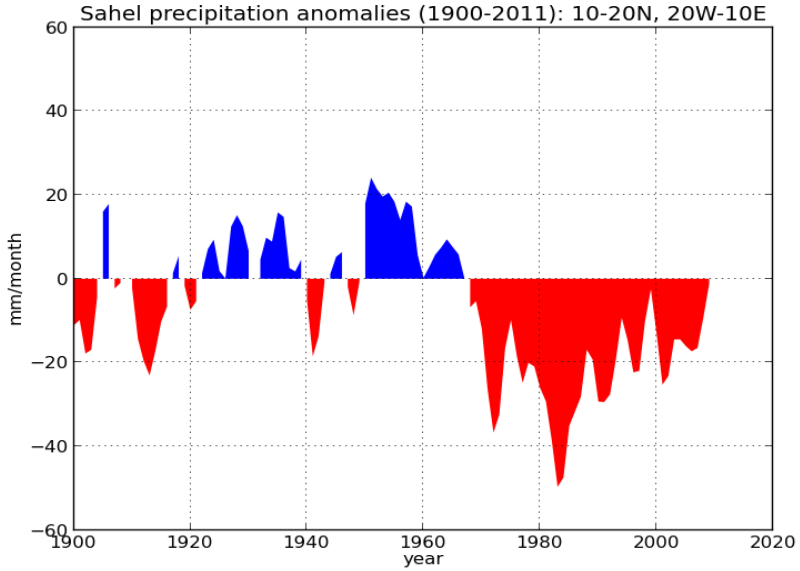
From Observations to Information



New opportunities in climate modelling using long-term satellite observations

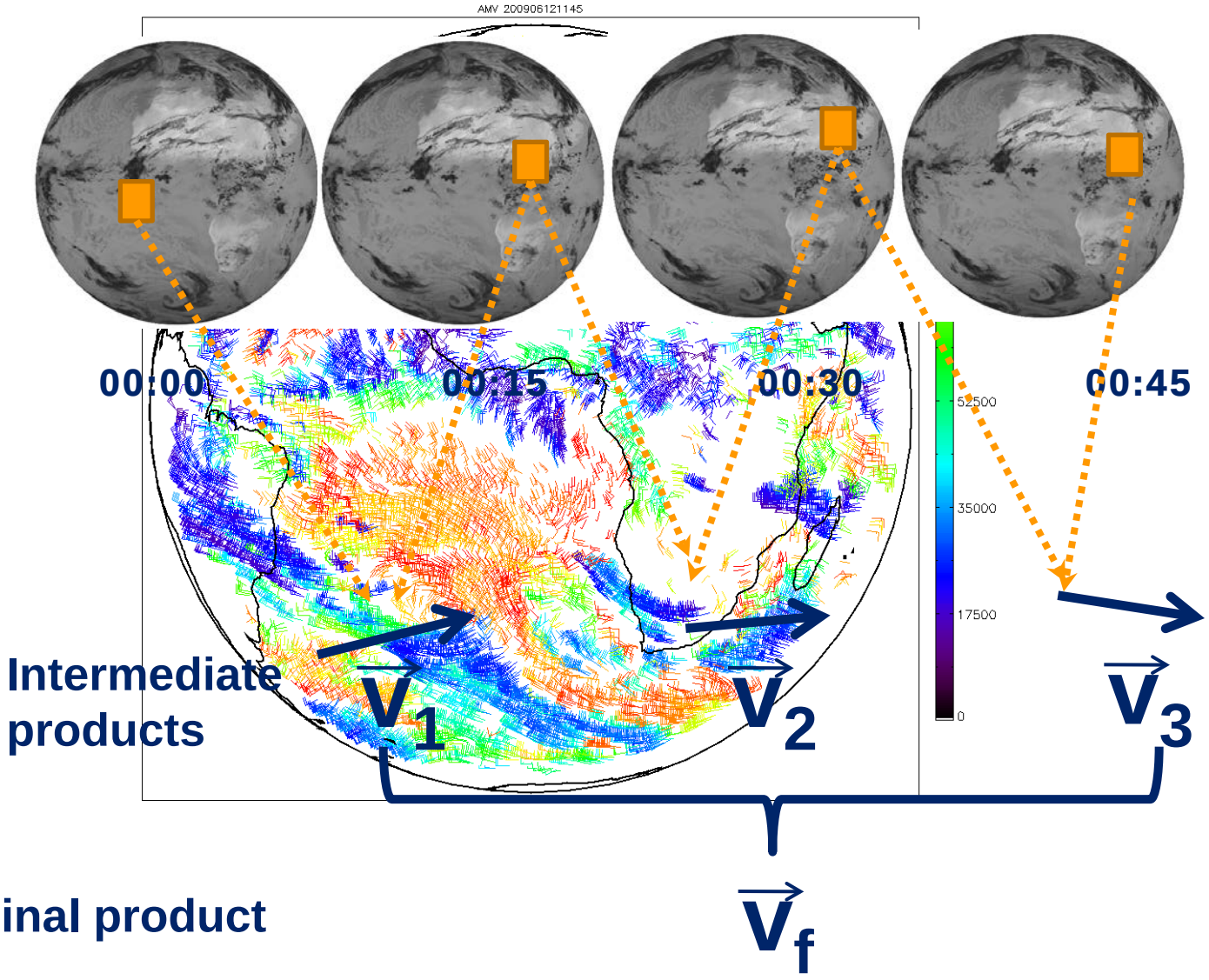
Example Sahel drought: how does the land surface affect droughts?



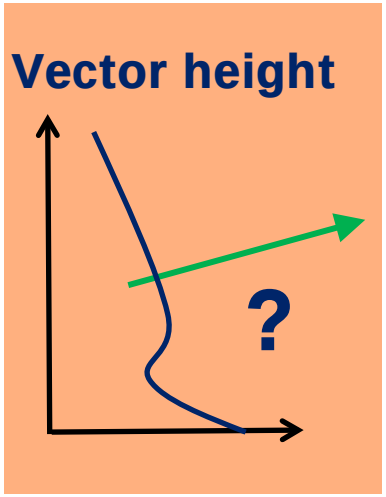


Courtesy of Alexander Loew, LMU, Munich, Germany

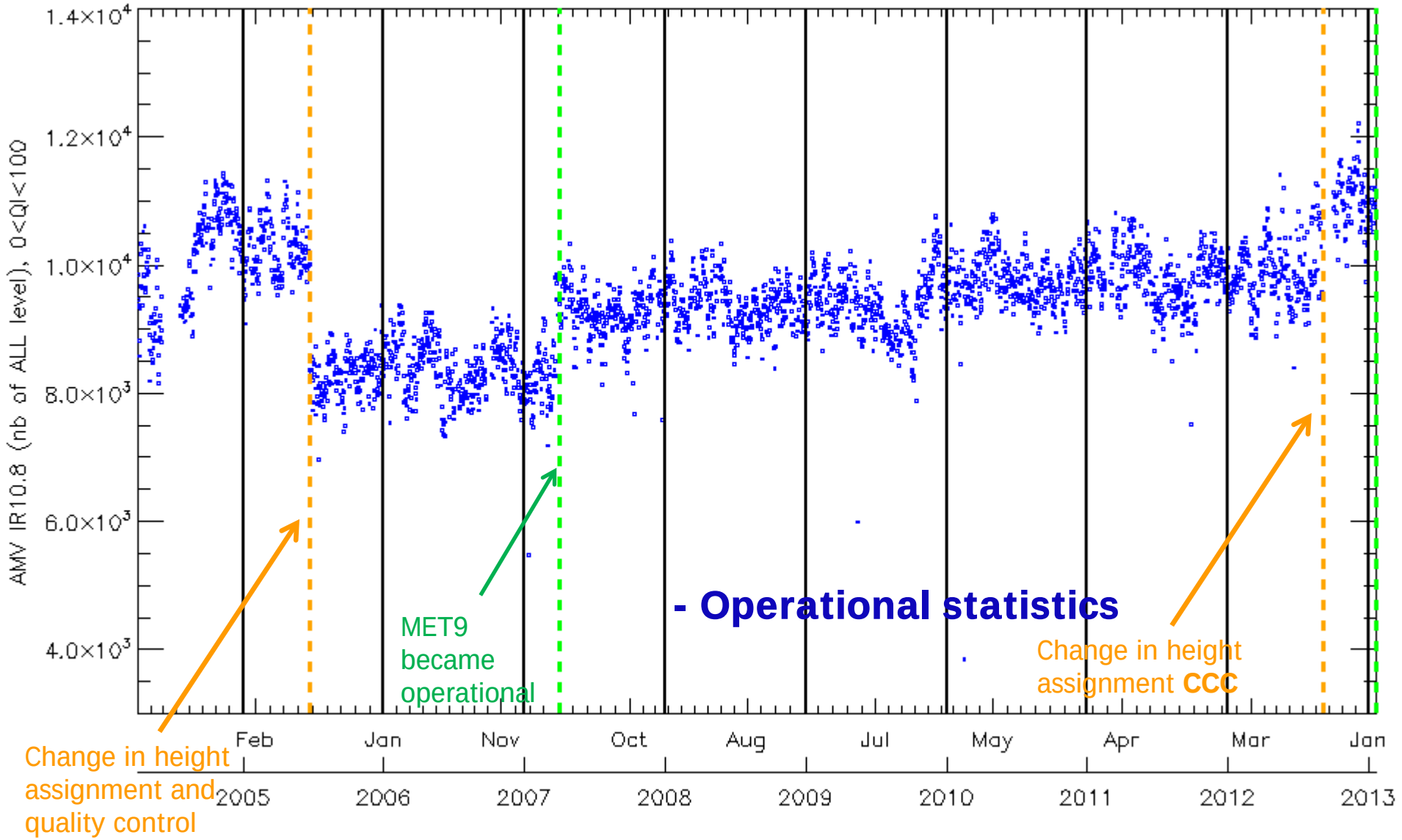
AMV from Imager Onboard Geostationary Satellite



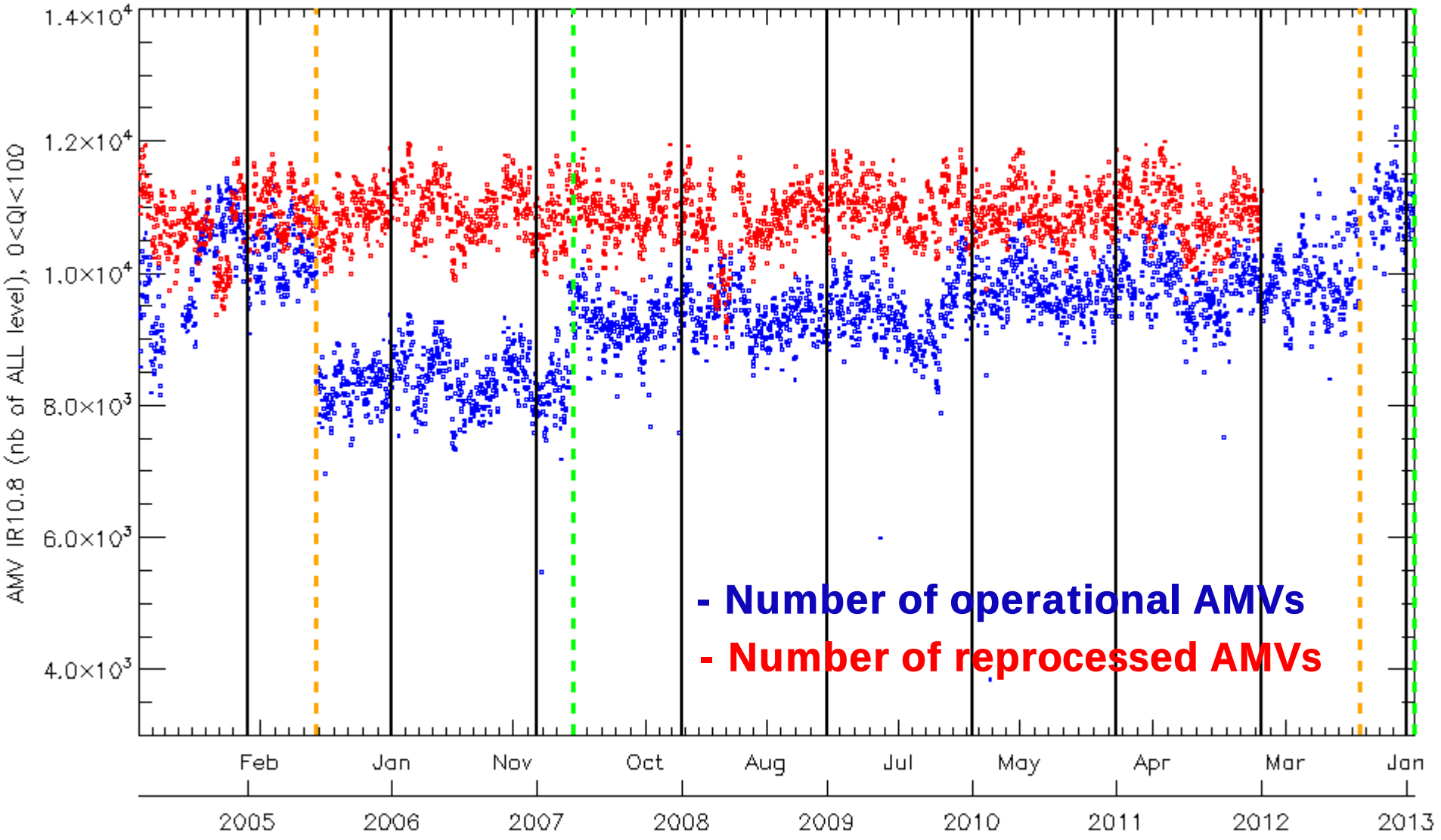
About 10000 winds are detected.



Time series of the number of derived AMVs

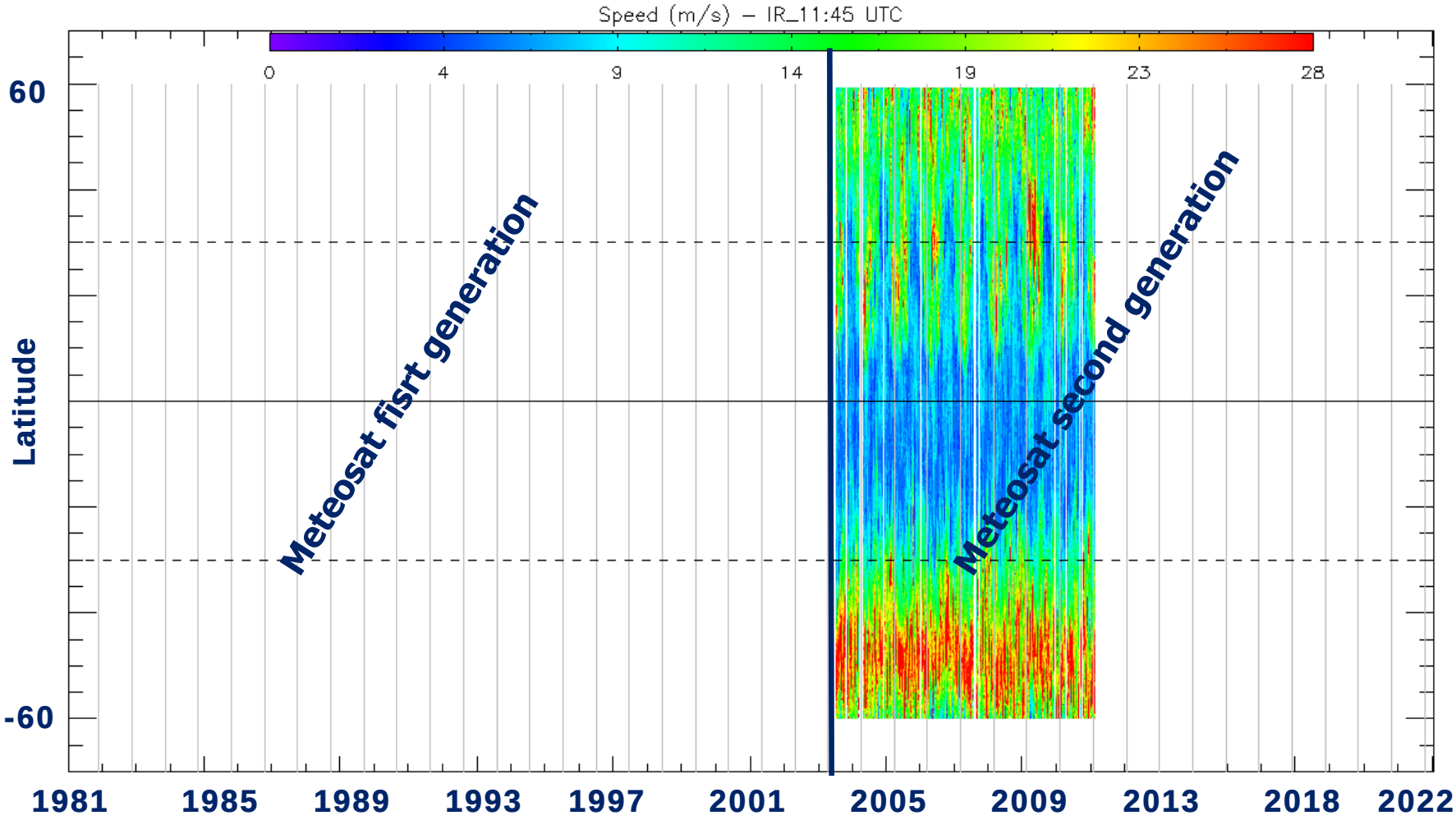


Time series of the number of derived AMVs

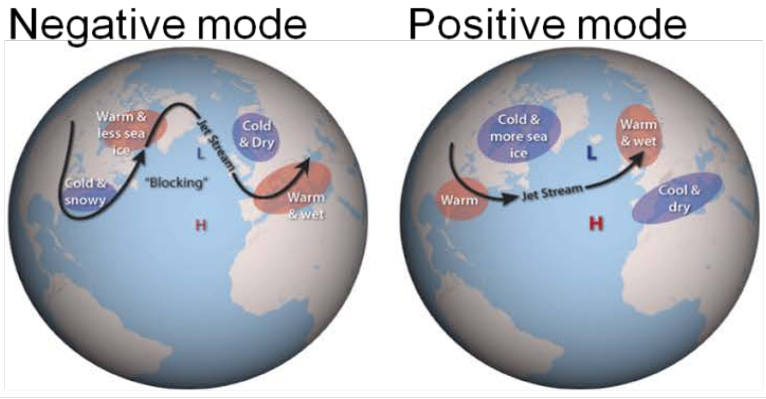


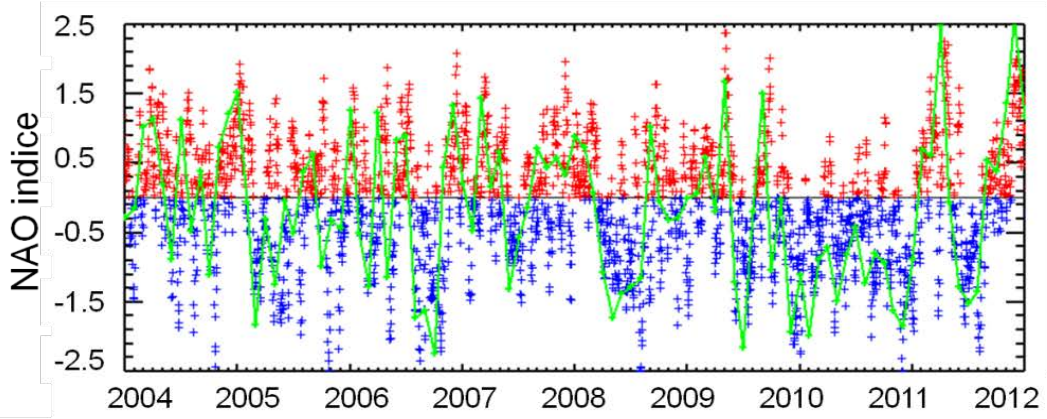
...and next year, the complete series...

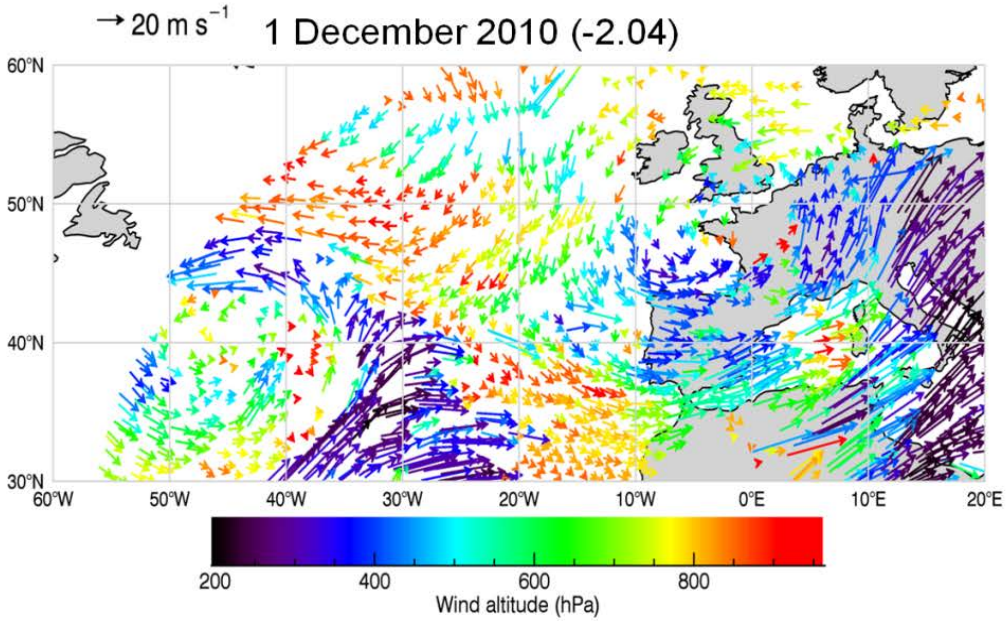
Using SEVIRI type AMV algorithm for MFG and MSG processing

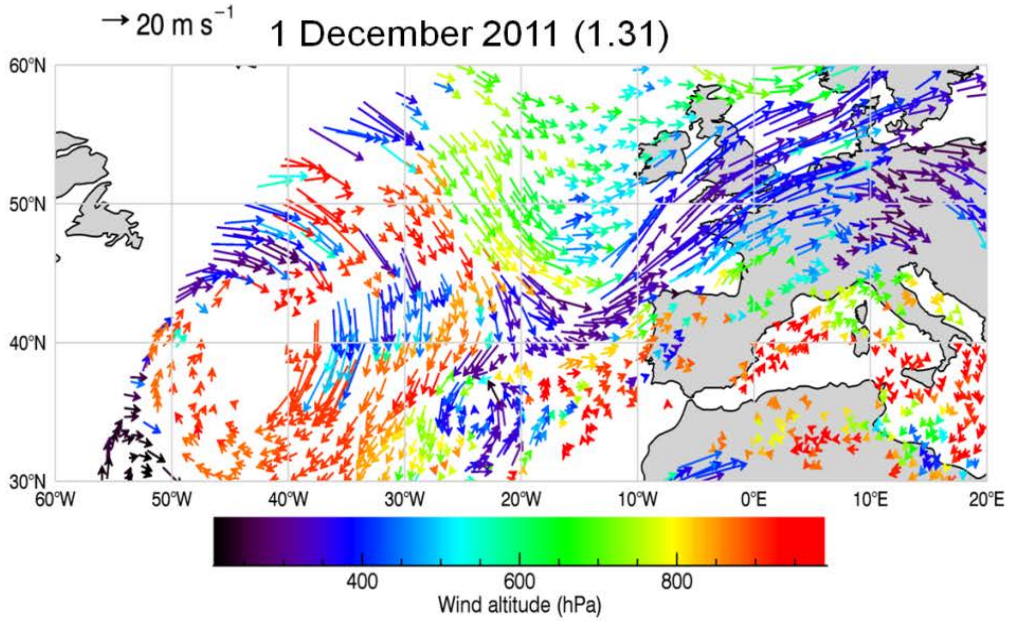


Verification of the validity: North Atlantic Oscillation

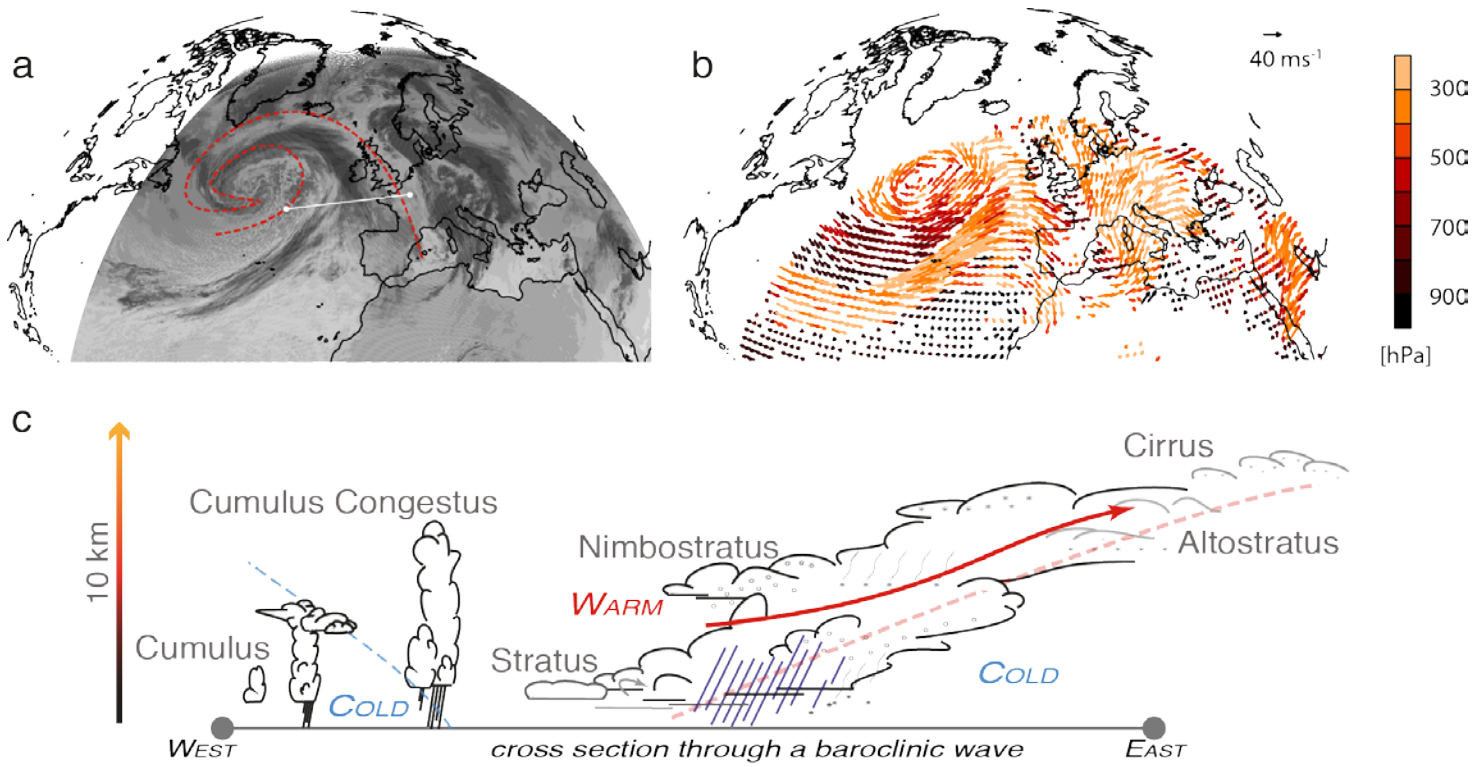








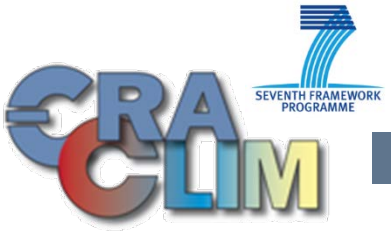
AMV CDR to study variability of atmospheric circulation



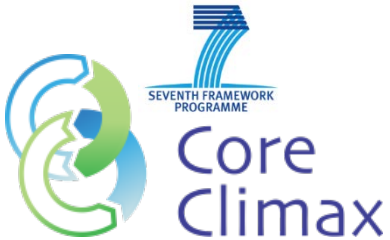
What controls the position, strength and variability of storm tracks? a, Infrared radiances visualize patterns of clouds in a developing storm whose wavelike structure is outlined by red contours delineating air-mass boundaries in upper troposhere. **b,** Cloud motion vectors, coloured by cloud-top pressure, derived from radiances. **c,** Conceptual cartoon illustrating major cloud types along a cross-section through te storm system. In a and b the data are from 5 January 2014 and limited by the field of view of the Meteosat satellite. Panel **a, b** © 2015, EUMETSAT.

Bony et al., Nature Geosc., doi:10.1038/ngeo2398, 2015. AMV presented in the Figure processed by EUMETSAT, 2014.

Utilising Results from EU Research Projects



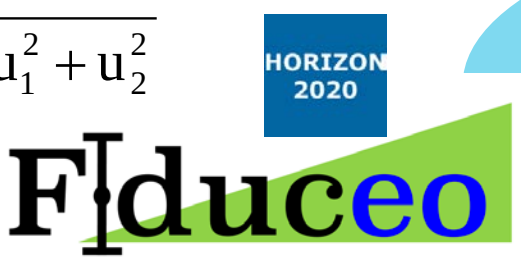
Data Records for Reanalysis



Support to Quality Assurance

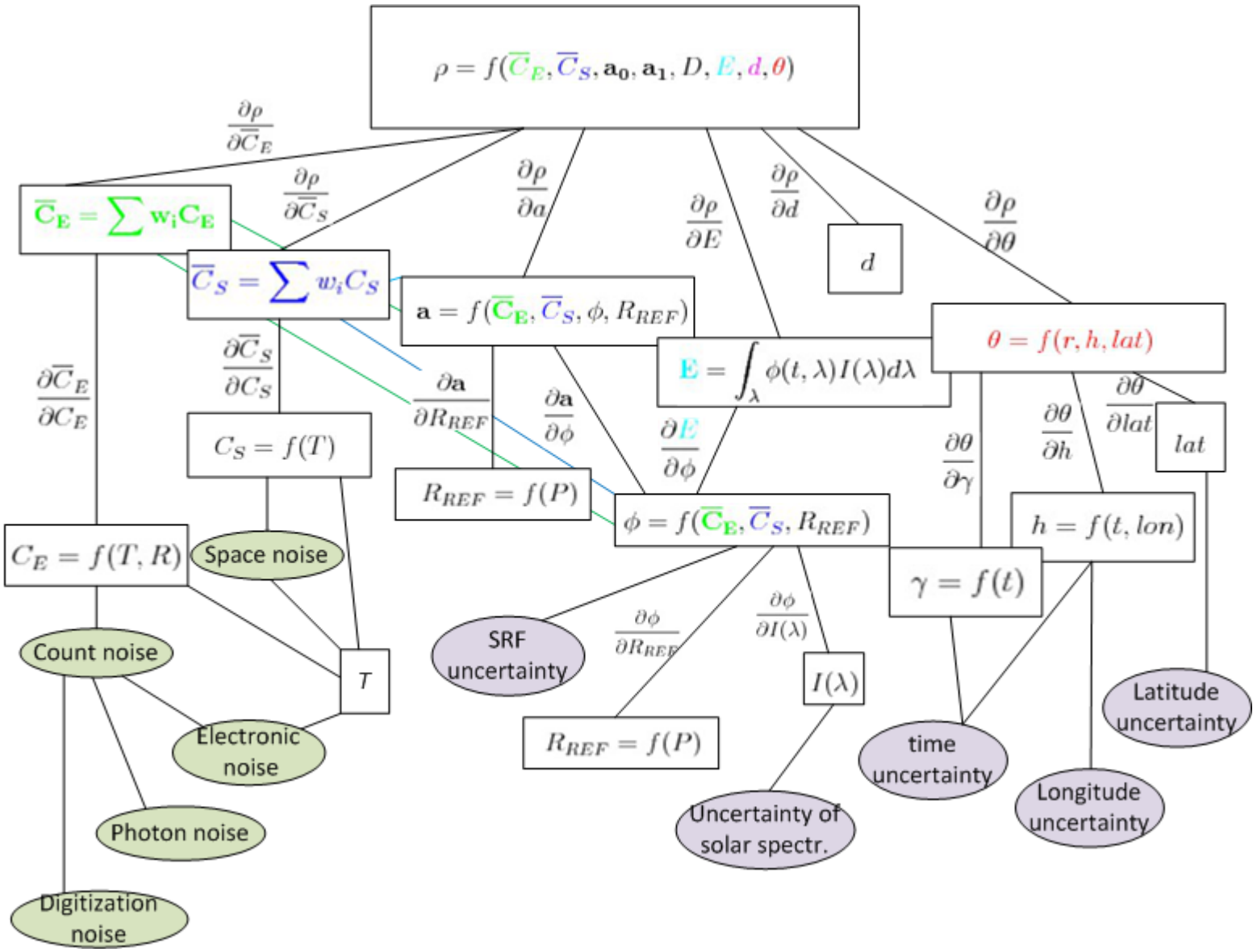
$$|m_1 - m_2| < k\sqrt{\sigma^2 + u_1^2 + u_2^2}$$

$$\sigma < \sqrt{u_1^2 + u_2^2}$$



Quantitative Uncertainty Characterisation

How to Assess Uncertainty?



EUMETSAT SAF Network Contribution

What is a SAF ?

- SAF = **Satellite Application Facility**
- part of the EUMETSAT application ground segment
- providing operational products and services to users
- specialised on topics and themes
- complement production of standard meteorological products at EUMETSAT Secretariat
- located at Weather Services in EUMETSAT Member and Co-operating States
- developed and operated by consortium of partners

SAF
The EUMETSAT
SAF Network

EUMETSAT SAF Network Across Europe

30 YEARS 1986-2016

NWC SAF
Support to Nowcasting and Very Short Range Forecasting
Led by Agencia Estatal de Meteorología, Spain

OSI SAF
Ocean and Sea Ice
Led by Météo France

CM SAF
Climate Monitoring
Led by Deutscher Wetterdienst, Germany

NWP SAF
Numerical Weather Prediction
Led by Met Office (UK)

LSA SAF
Land Surface Analysis
Led by Portuguese Meteorological Institute

O3M SAF
Ozone and Atmospheric Chemistry Monitoring Led by Finnish Meteorological Institute

ROM SAF
Radio Occultation Meteorology
Led by Danish Meteorological Institute

H SAF
Support to Operational Hydrology and Water Management Led by Italian Meteorological Institute

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Numerical Weather Prediction
Led by Met Office (UK)

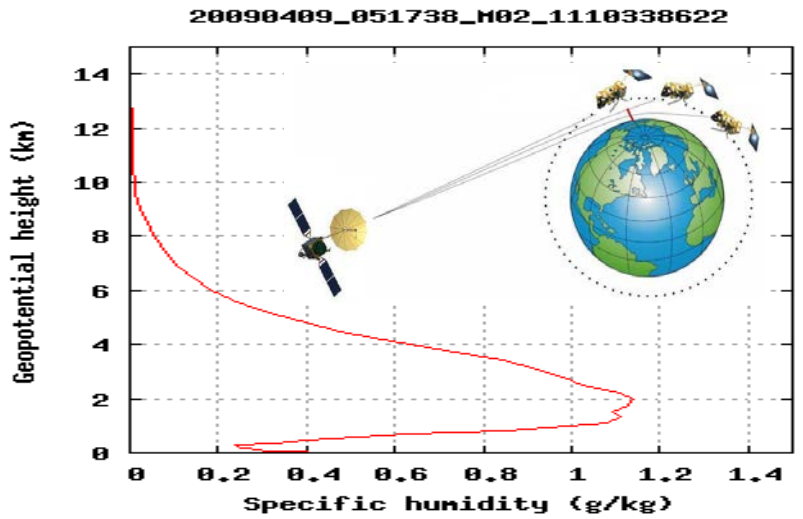
EUMETSAT

ROM SAF 30 YEARS 1986-2016

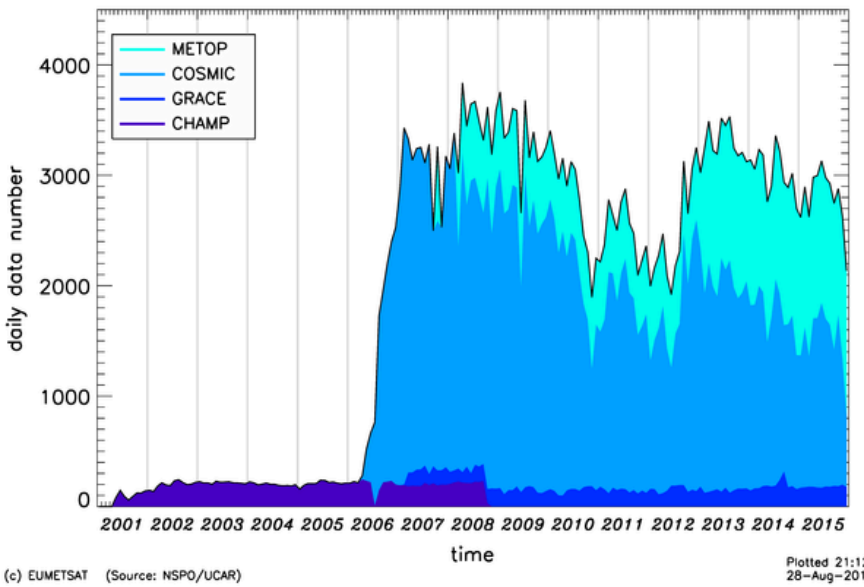
ECMWF

- SAF on Radio Occultation Meteorology
- The Leading Entity is the Danish Meteorological Institute DMI, Copenhagen
- GRAS: Global Positioning System (GPS) Receiver for Atmospheric Sounding flown on EPS/Metop satellites
- Near real-time, offline, and climate products:
  - sounding data (bending angle, refractivity, temperature, pressure, humidity)
  - corresponding validation products, and
  - assimilation software

  are generated based on data from EPS, COSMIC, CHAMP and GRACE satellites.



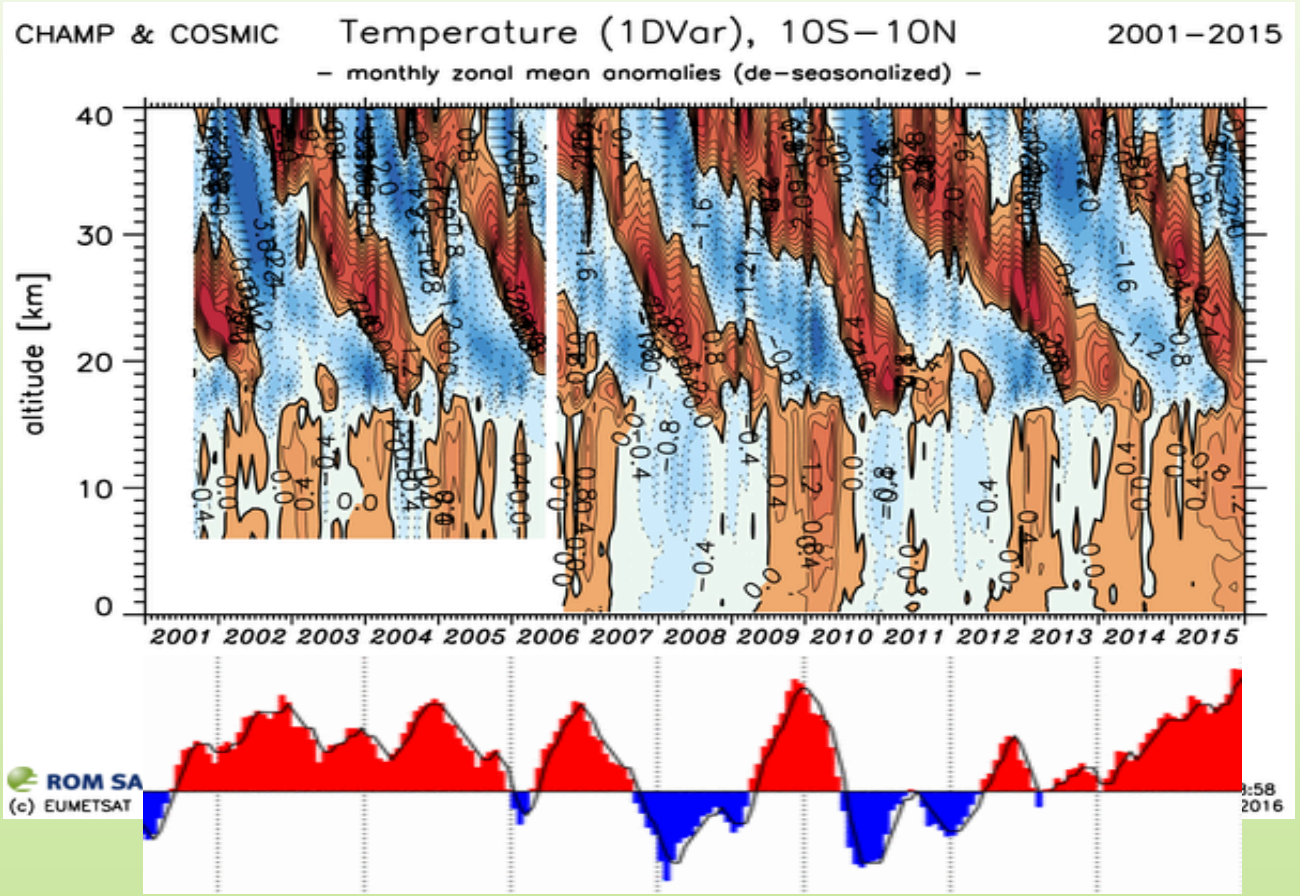
RO MISSIONS Mean daily data numbers 2001–2015



EUMETSAT

ROM SAF reprocessing

– time series of monthly mean anomaly data –



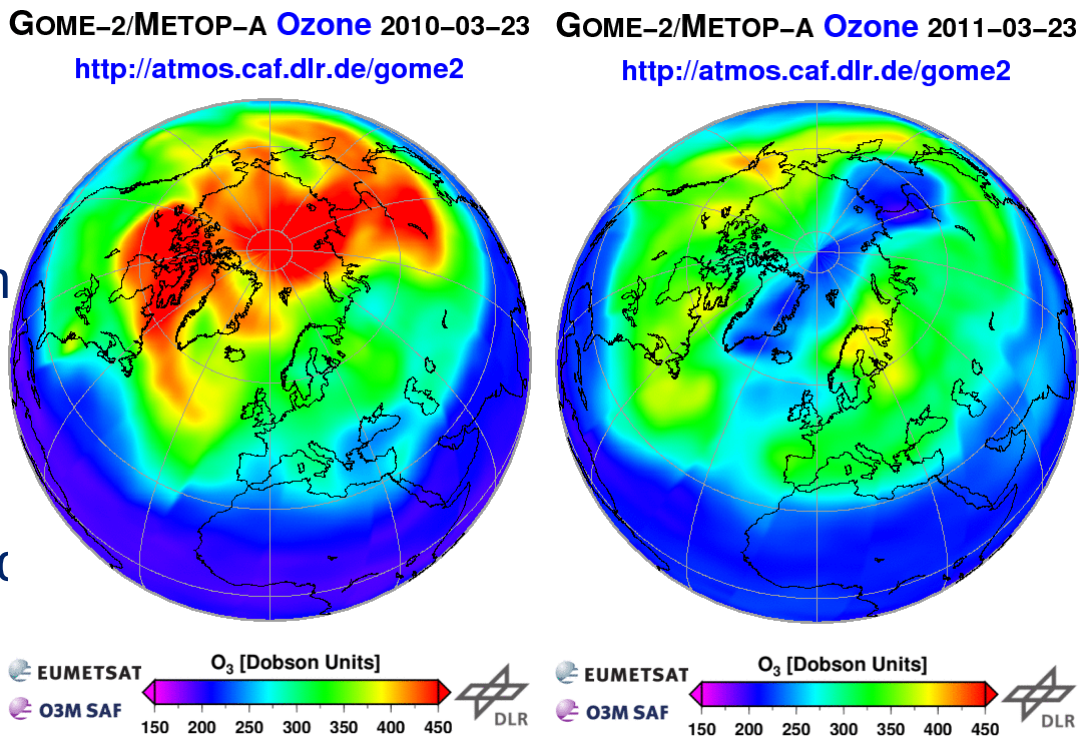
Data from NESDIS/NOAA.

Equatorial temperatures retrieved from RO data, showing QBO and ENSO signatures. Comparison with a commonly used ENSO index: the SST anomaly in the Nino 4 Region (5°N-5°S, 150°W-160°E).

Ozone SAF

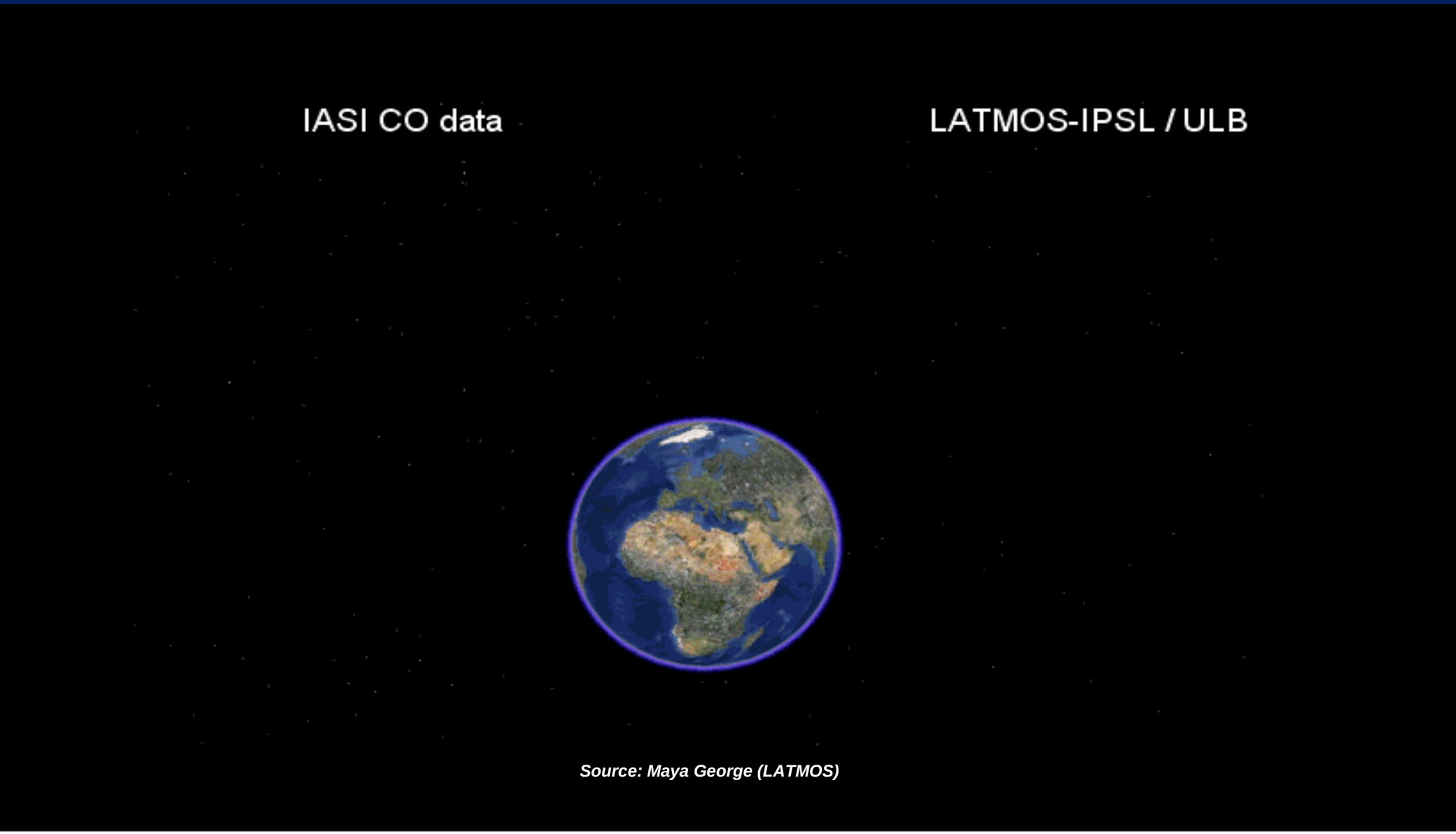
- SAF on Ozone and Atmospheric Chemistry Monitoring (O3M SAF)
- Leading Entity is the Finnish Meteorological Institute FMI, Helsinki
- Developed for the processing of ozon other trace gases, aerosols and ultraviolet radiation products;
- Emphasis on the Global Ozone Monitoring Experiment (GOME-2) and IASI on EPS (Metop)
- Real time, offline and climate data records are/will be generated;
- (Renamed to Atmospheric Composition Monitoring SAF (AC SAF)

O3M SAF



Total Ozone Column over the Arctic, observed with GOME-2 on Metop-A
Source: Ozone SAF, DLR, 2011

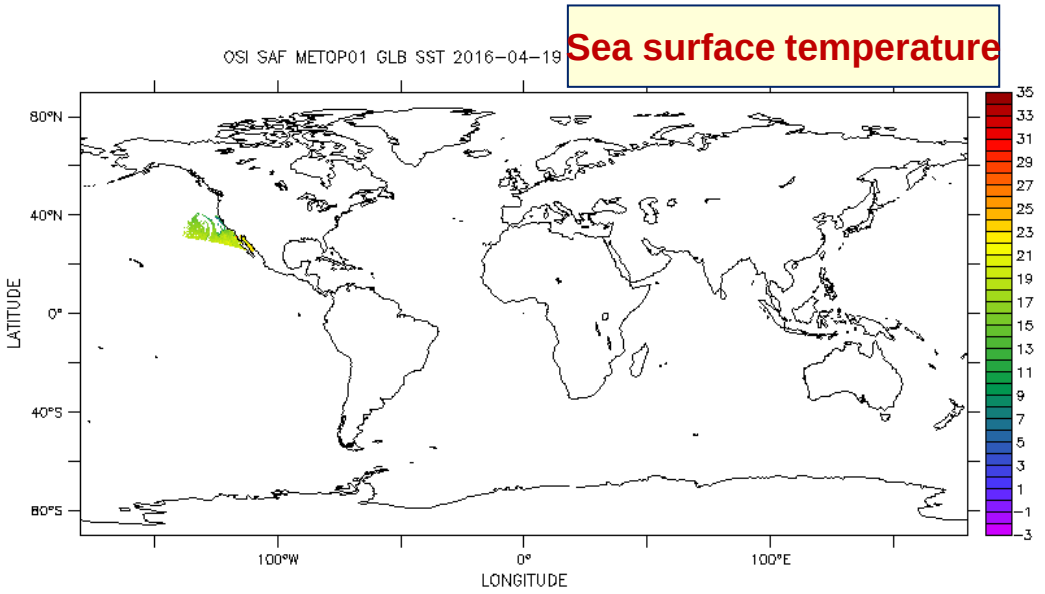
Monitoring large scale fires and associated pollution: Russia, summer 2010

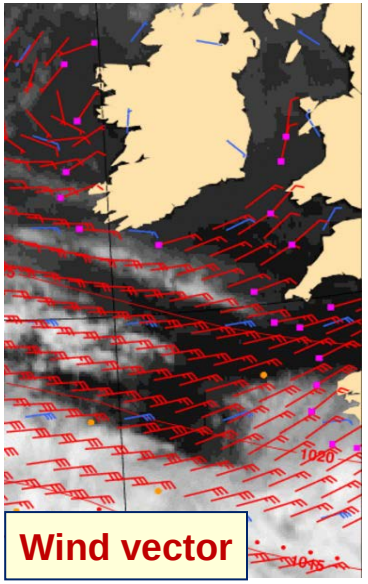


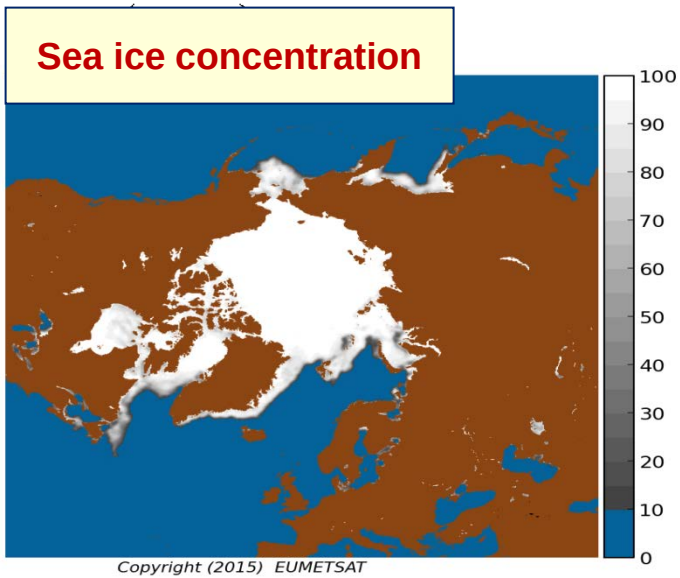
Source: Maya George (LATMOS)

Ocean and Sea Ice SAF

- Ocean and Sea Ice (OSI) SAF routinely produces and disseminates products characterising the ocean surface:
  - Sea Surface Temperature and the energy fluxes
  - Information on the sea ice characteristics (extend, concentration, …)
  - Surface wind vector from Scatterometer
- Leading Entity is Météo-France in Lannion
- OSI SAF distributes near real-time products based on data EUMETSAT, NOAA, ESA, DMSP satellites and also generates climate data records for some of those products.

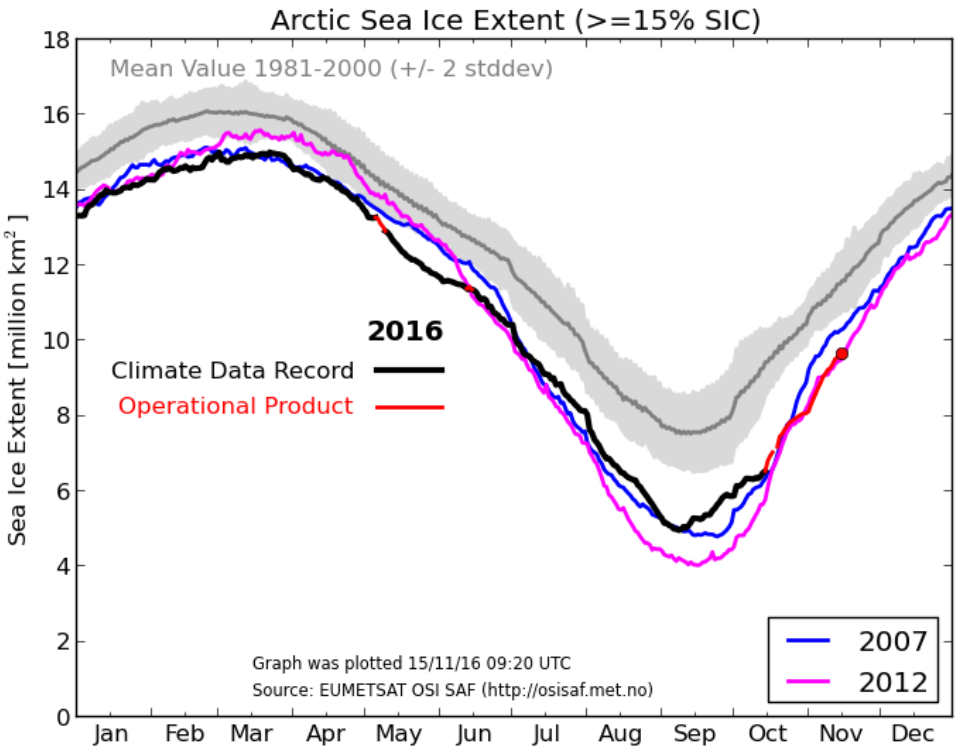


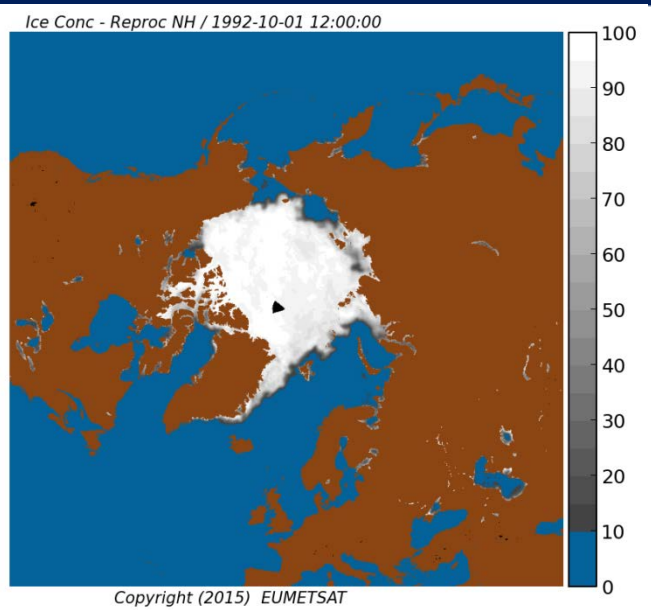




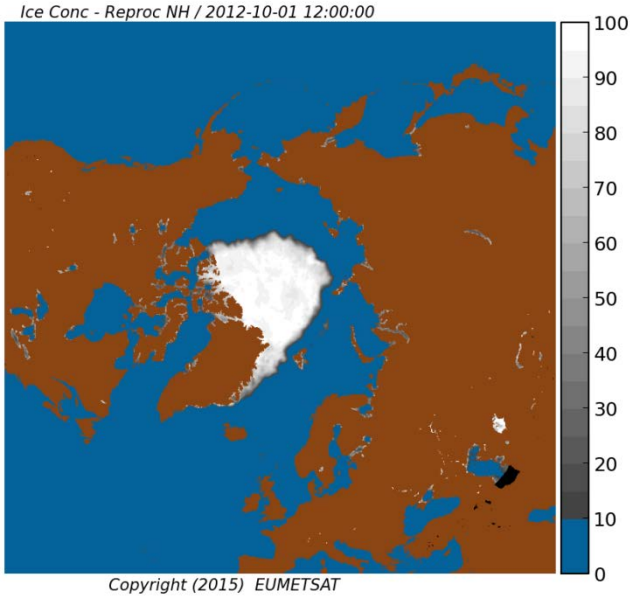
Reaching Downstream: Monitoring Arctic Sea Ice Extent

OSI SAF





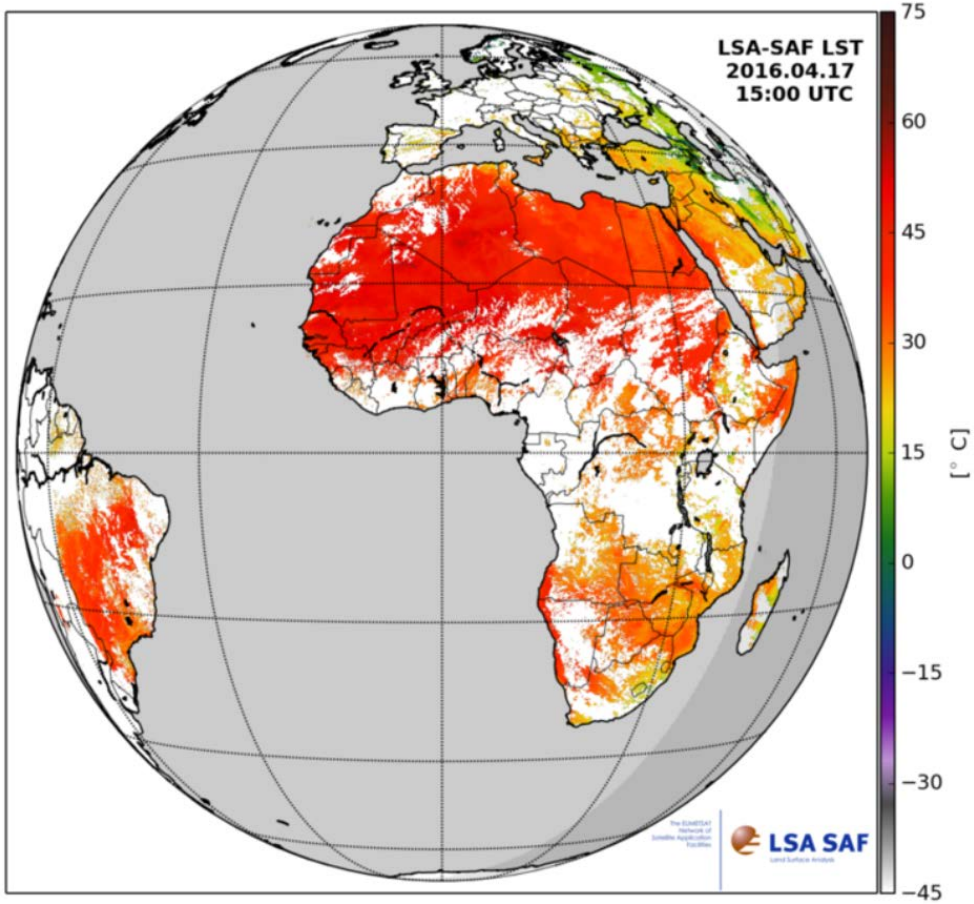
1 October 1992



1 October 2012

Land Surface Analysis SAF

- SAF on Land Surface Analysis (LSA SAF)
- Leading entity is the Portuguese Sea and Atmosphere Institute, IPMA, Lisbon
- established to increase the benefit from MSG and EPS data related to land, land-atmosphere interaction and biospheric applications
- Generates operationally data services related to Surface Radiation, Vegetation and wild fire and is reprocessing such data in collaboration with the CM SAF.



Summary

- EUMETSAT operates dedicated infrastructures in space and on ground and generates climate data records as an input to various applications driven by partners and users;
- We coordinate this effort at global level through the Architecture for Climate Monitoring from Space (CEOS/CGMS);
- We exploit the new capabilities coming with data from the new satellite programmes and Copernicus missions;
- We try to tailor data records to needs of applications;
- We have started to engage in developing credible uncertainty estimates applying the science of metrology;
- The workshop shall provide us with the information on products for applications related to modelling including needed level of uncertainty characterisation in the mid to long-term future.

Thank you for your attention!