

# Climate Monitoring at EUMETSAT and the role of Satellite Application Facilities



**Alain Ratier**  
**Director-General**

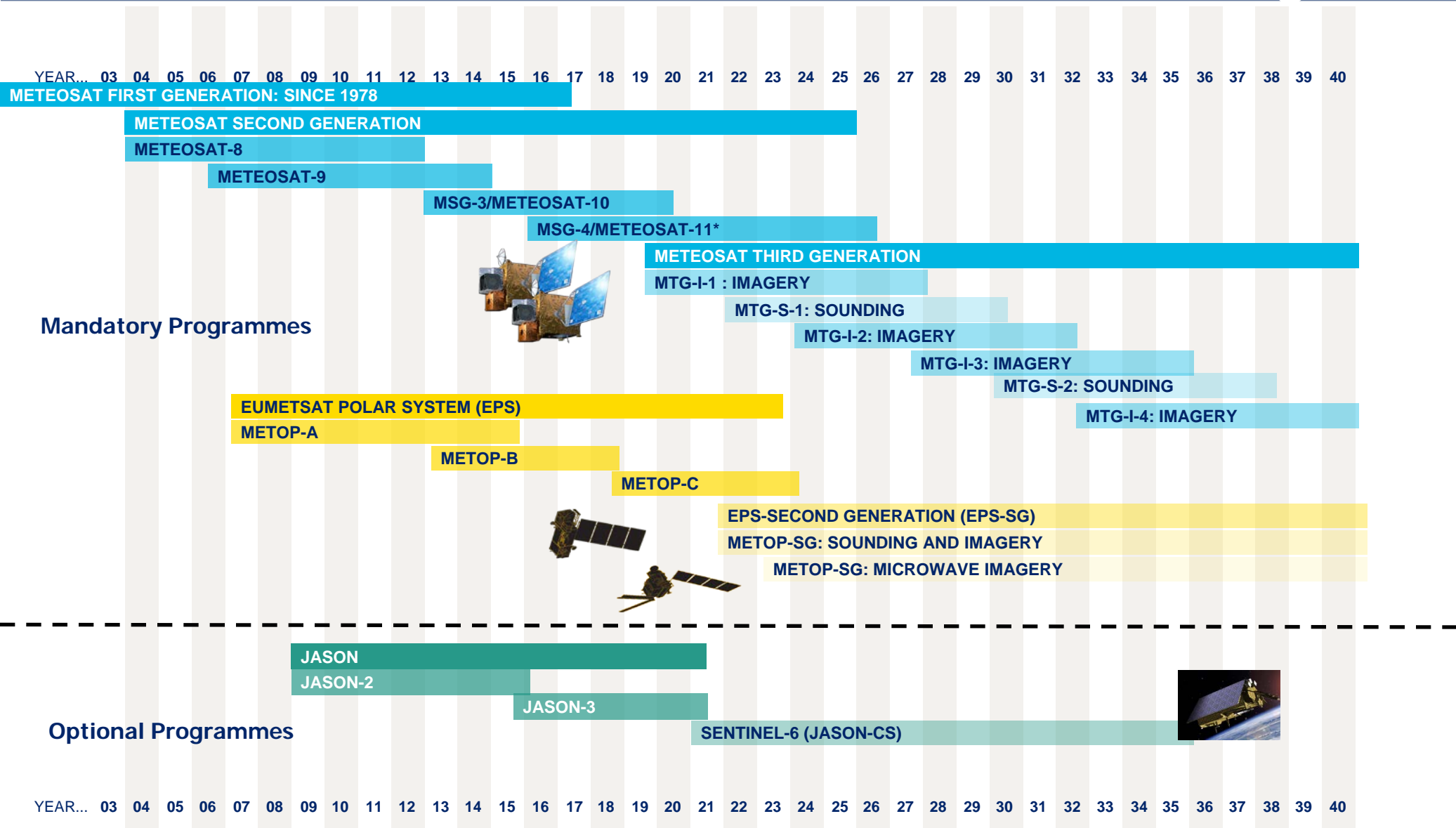
4<sup>th</sup> CM SAF User Workshop  
10 March 2014  
Grainau, Germany



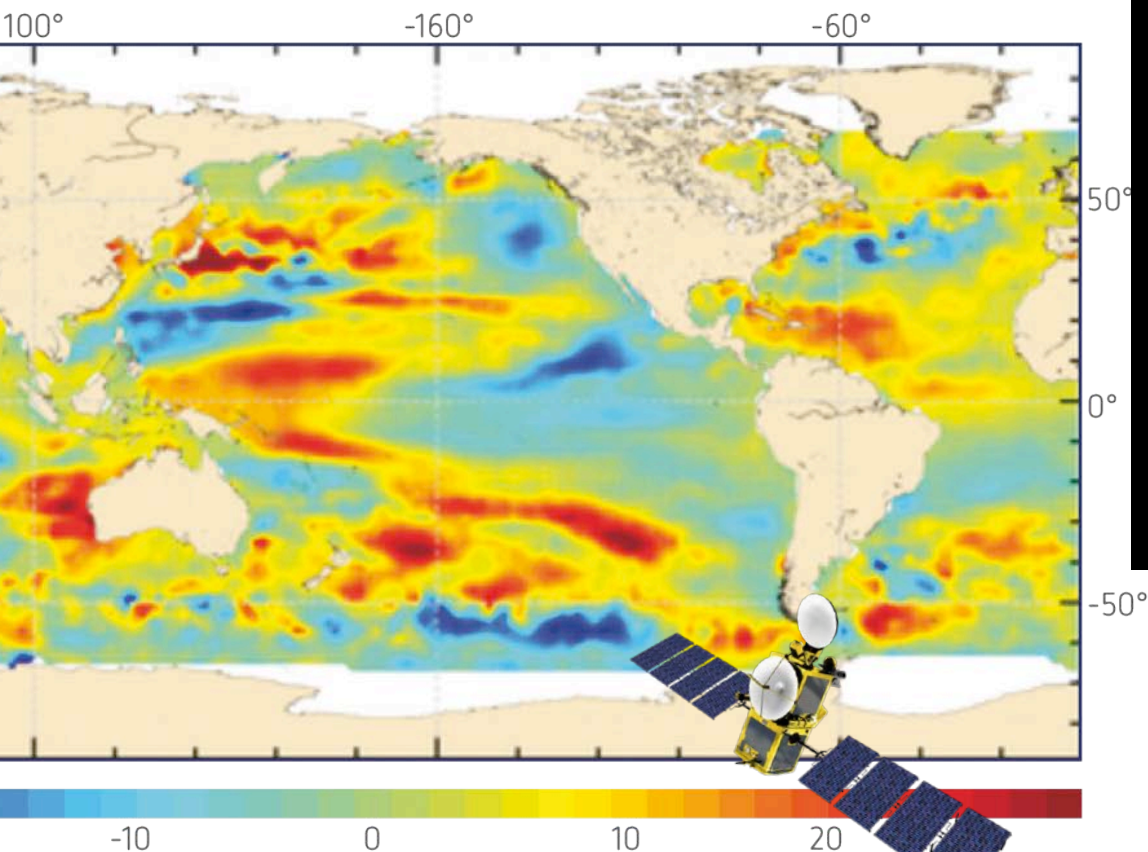
# EUMETSAT's mission/Convention: yes we can !

- The primary objective is to establish, maintain and exploit European systems of operational meteorological satellites, taking into account as far as possible the recommendations of WMO
- *A further objective is to contribute to the operational monitoring of the climate and the detection of global climatic changes*

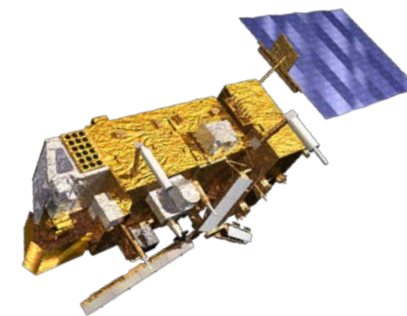
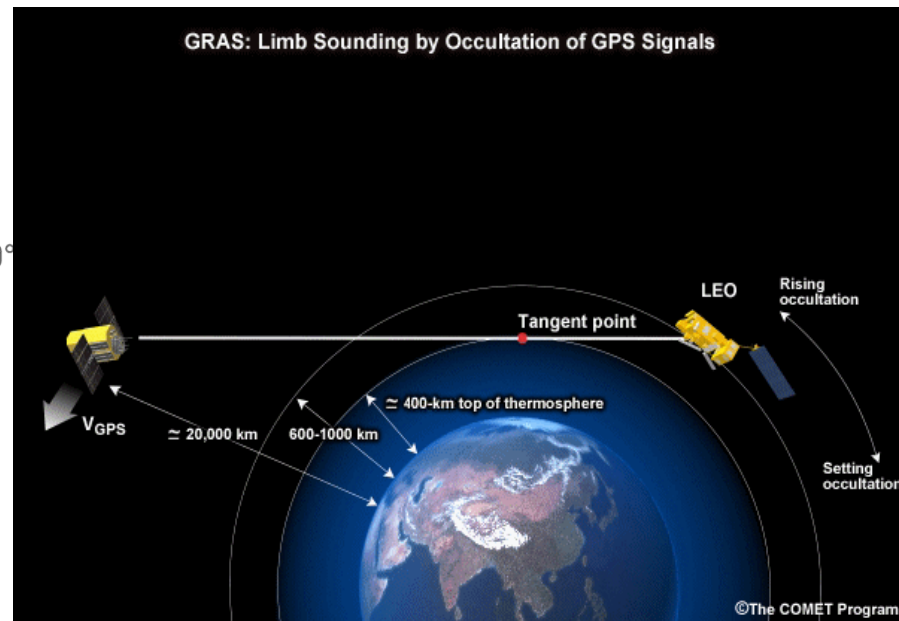
# The relevance of operational programmes: decades of observations for climate monitoring



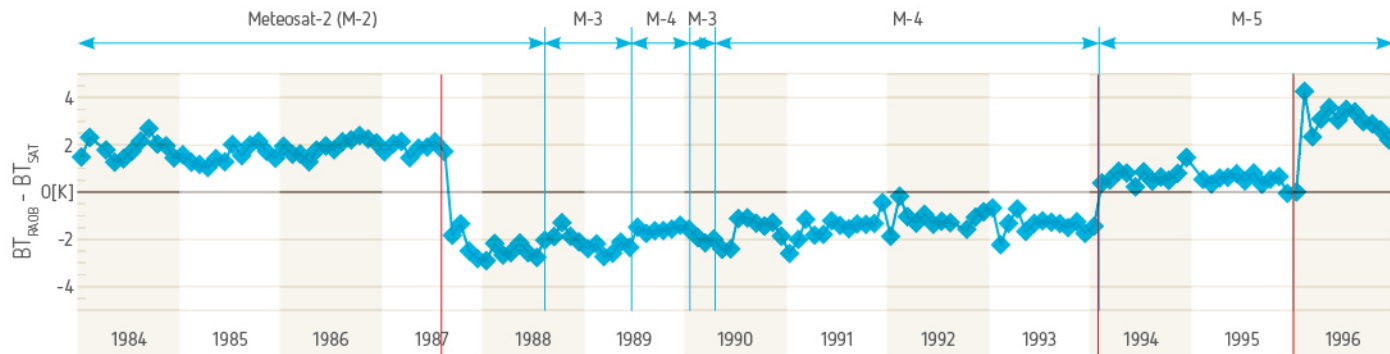
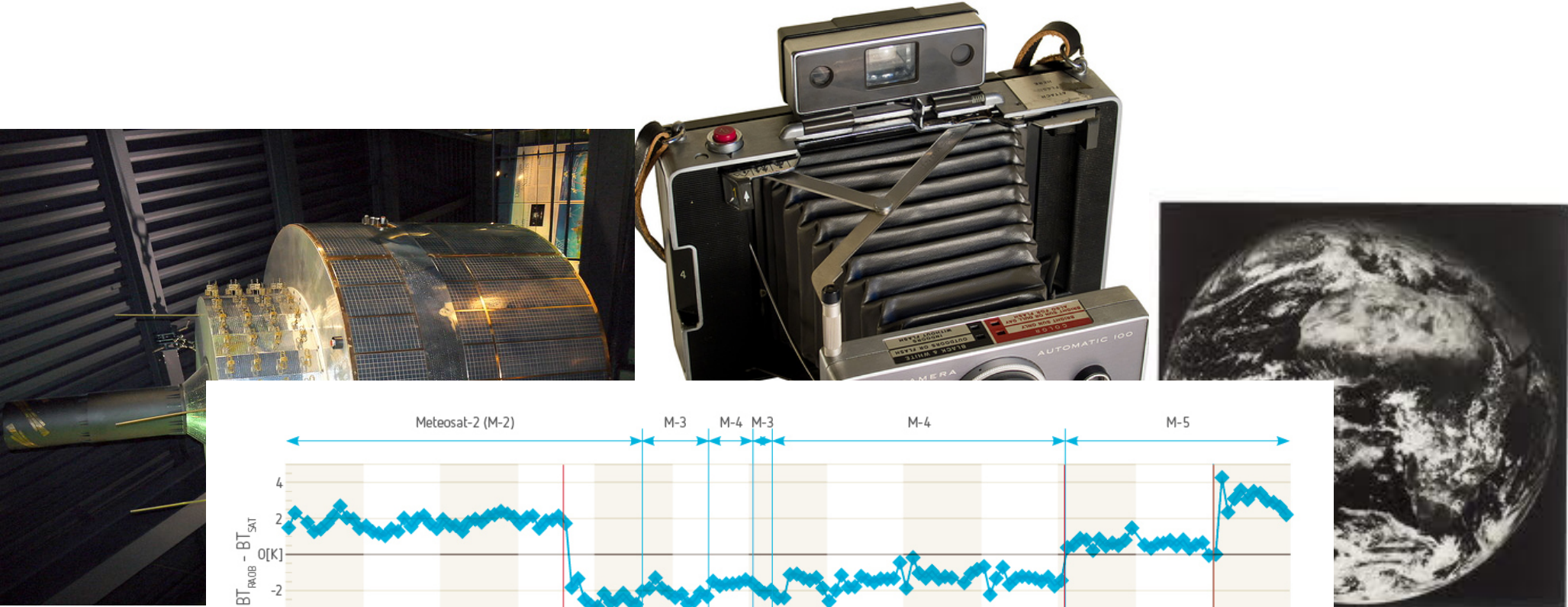
# Some missions are optimised for climate monitoring...



(I.B. : applied / wet tropo. :RADIOMETER-derived, seasonal signal removed)



# ....but others require recalibration



First implementation of operational calibration technique, 1 September 1987

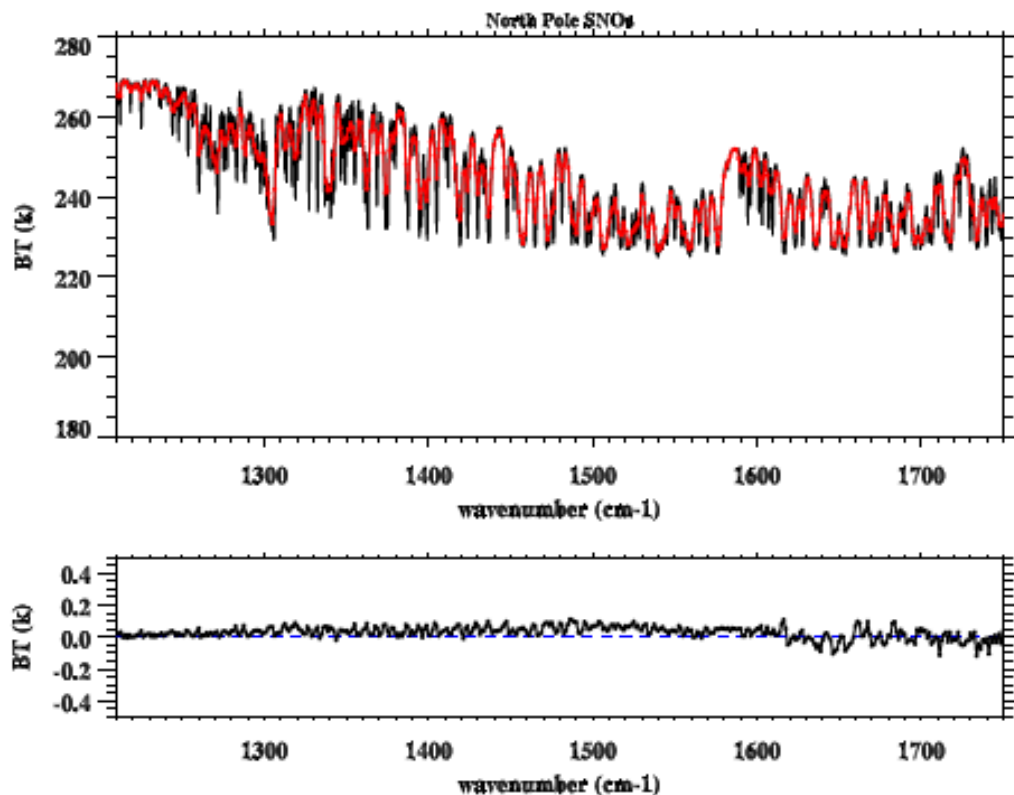
Upgrade of calibration technique, 3 February 1994

ISCCP DX Normalised calibration instead of nominal, 1 January 1996

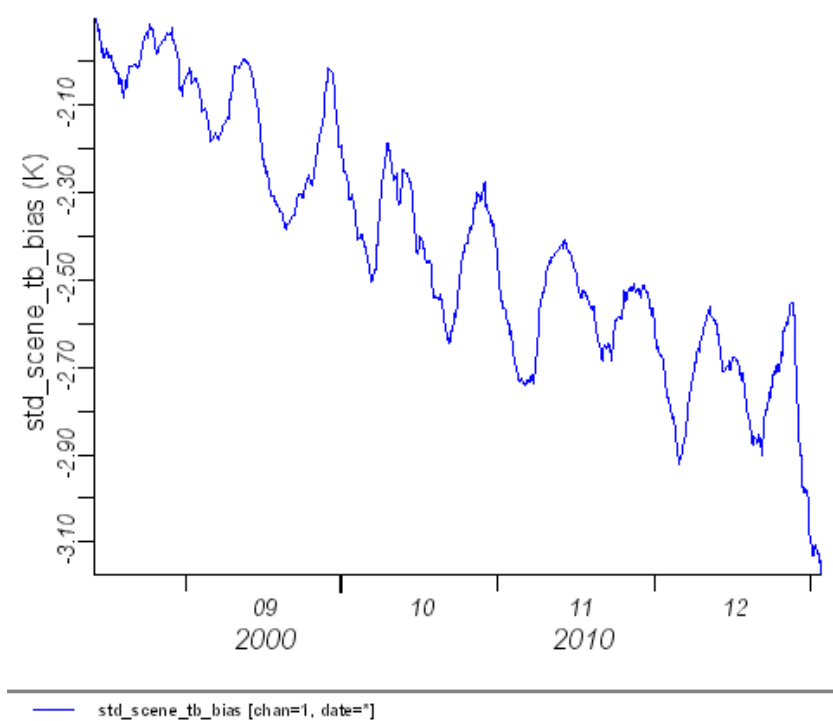
FIRST IMAGE: 9 DEC 1977  
COPYRIGHT ESN

# The challenge can be met through cross-calibration with data from reference instruments like IASI

Reference IR Instrument: IASI on Metop



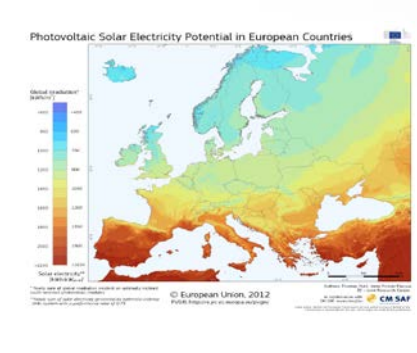
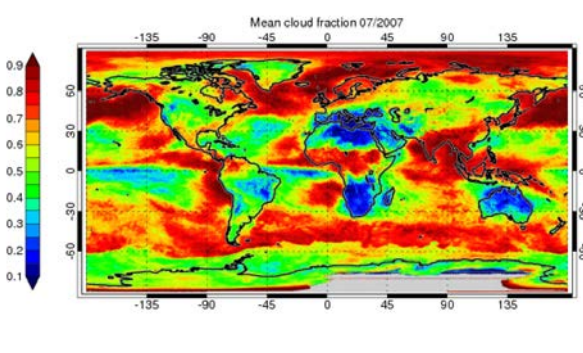
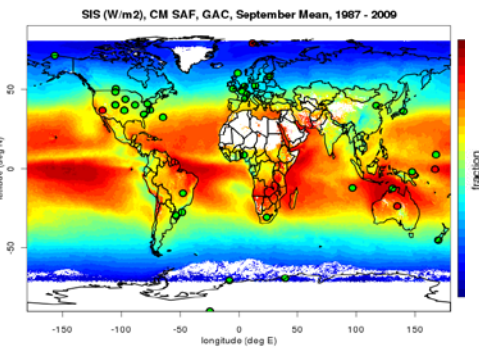
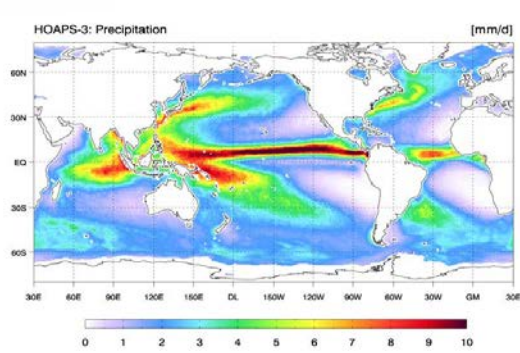
Meteosat-7 against IASI



# EUMETSAT climate monitoring activities: how & who

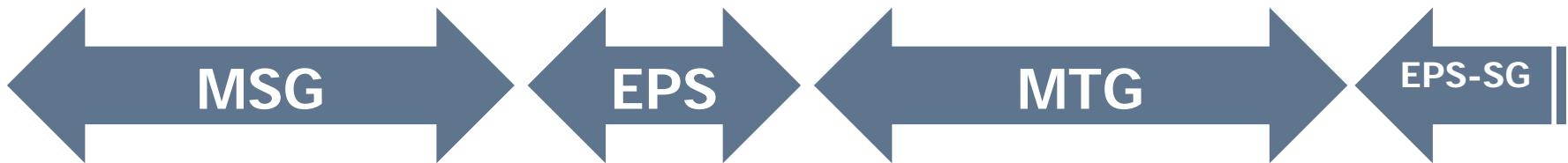
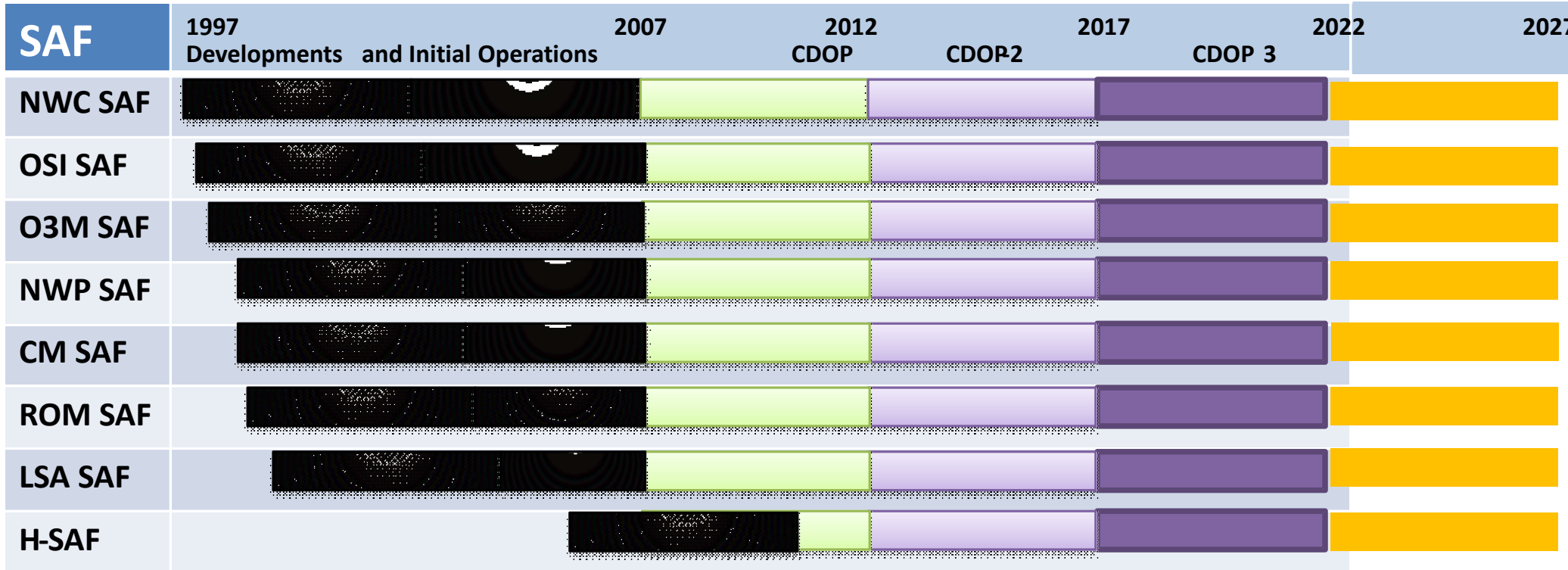
- Climate monitoring implementation plan
  - Prioritised Secretariat's activities
    - Dependence on external funding e.g. from FP7
  - SAF on Climate Monitoring & contributions from other SAFs
  - Working Group on coordination of reprocessing
- Activities embedded in/articulated with cooperative projects
  - WMO GSICS and SCOPE-CM projects
  - FP-7 Projects: CORE-CLIMAX, Q4ECV, ERACLIM 1/2
  - ESA CCI

# SAF on Climate Monitoring

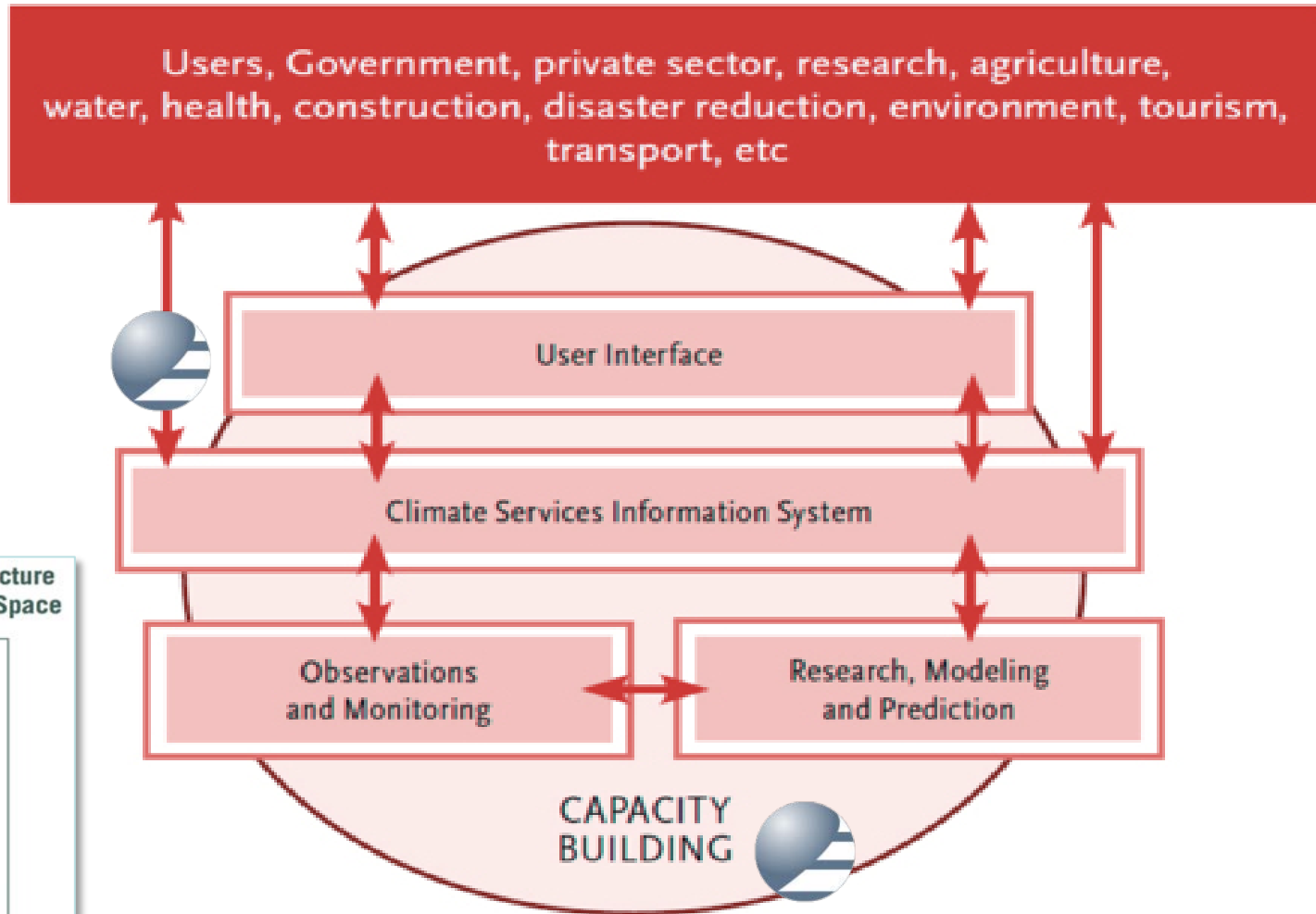
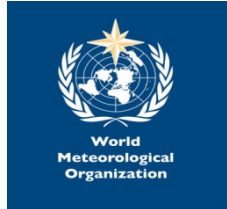




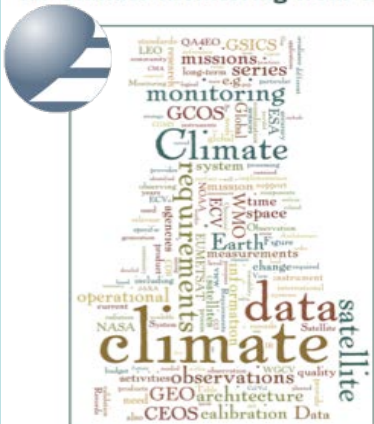
# SAF Network phasing and funding



# EUMETSAT and the Global Framework for Climate Services



Strategy Towards an Architecture for Climate Monitoring from Space

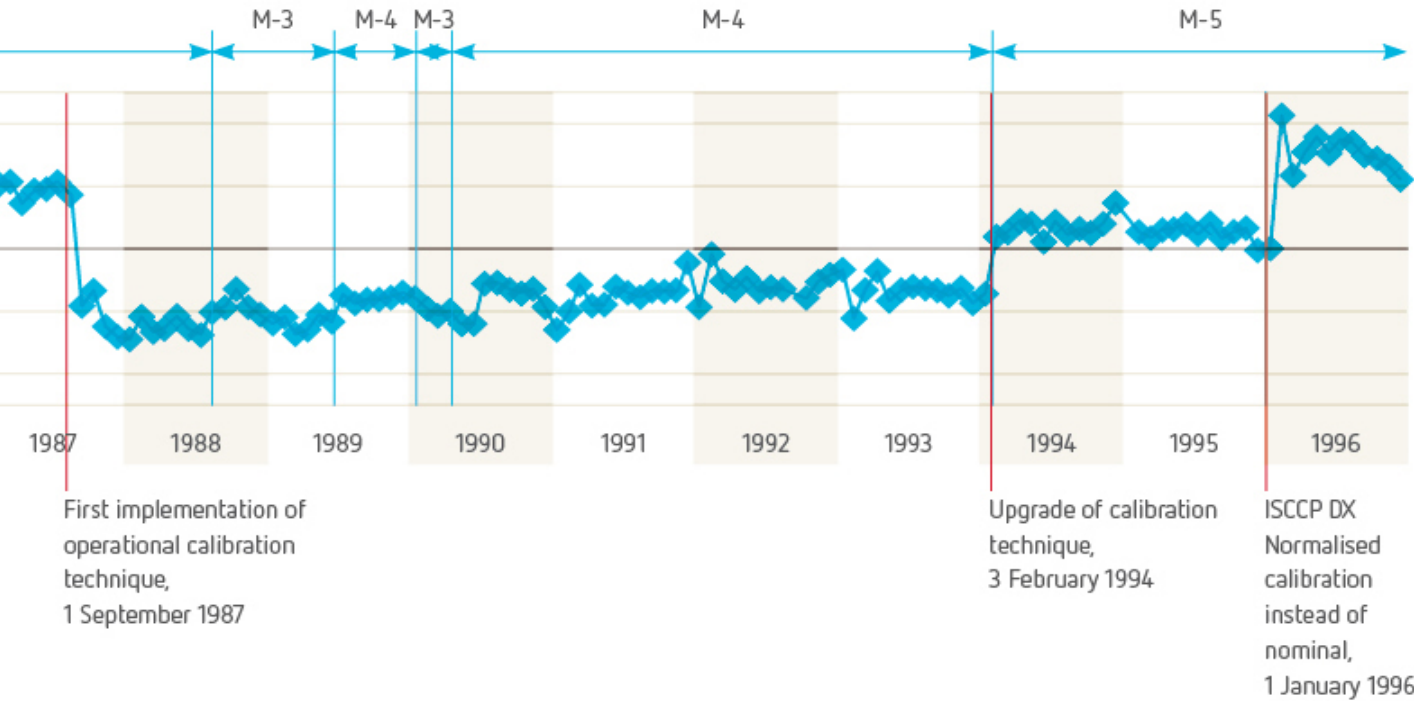


# Scope of EUMETSAT climate monitoring activities

- Re-calibration and cross calibration of historical data
- Production of Fundamental Climate Data Records
- Production of Thematic Climate Data Records
- Delivery to users/projects with documentation, support to scientific validation
- Support to international projects
- Development of methods for maturity/quality/capacity assessment (CORE-CLIMAX, Q4ECV, SCOPE-CM)
- International coordination: WMO, architecture, CEOS-CGMS

# GSICS/SCOPE-CM Re-calibration Procedure

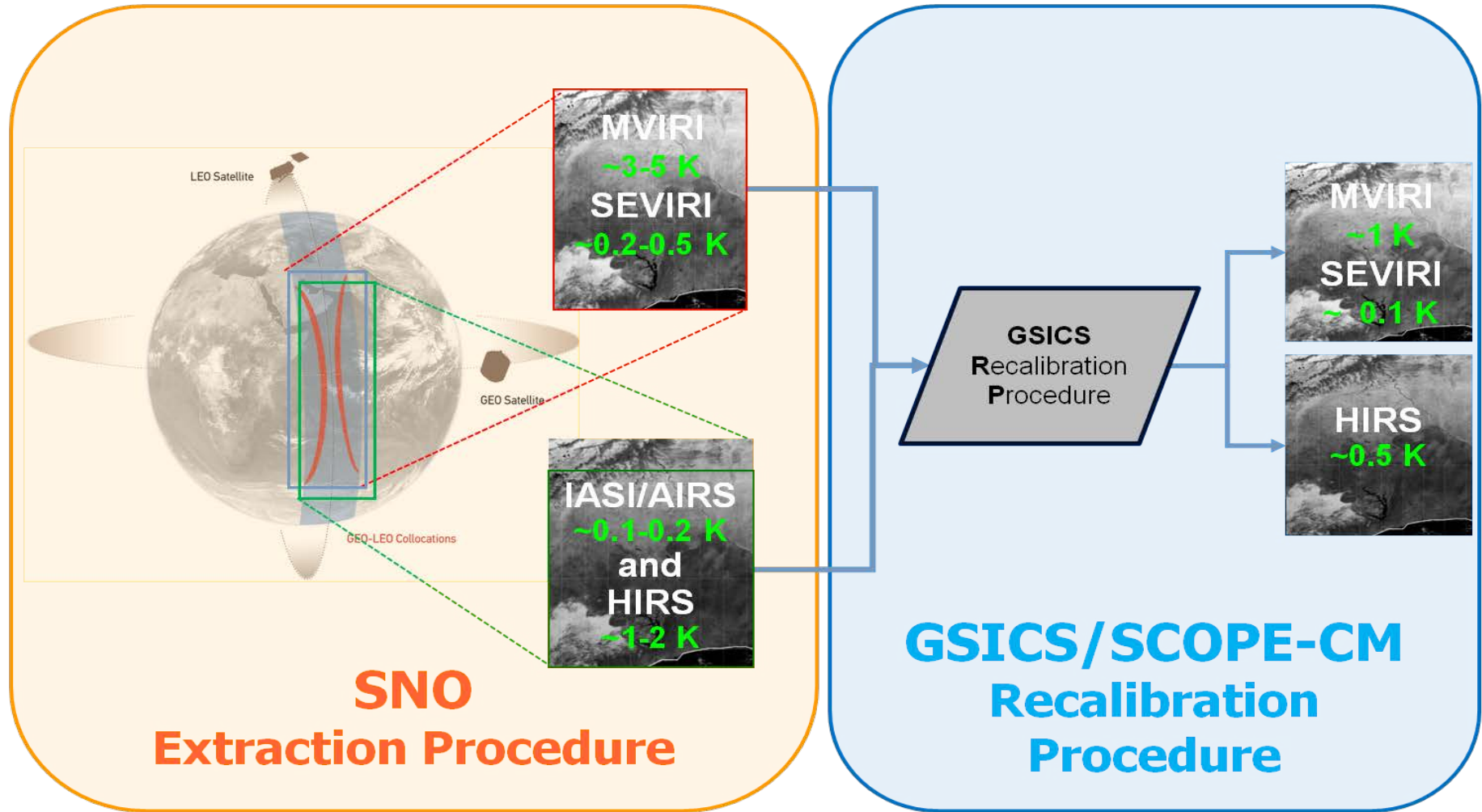
Need for recalibration of historical Meteosat image data



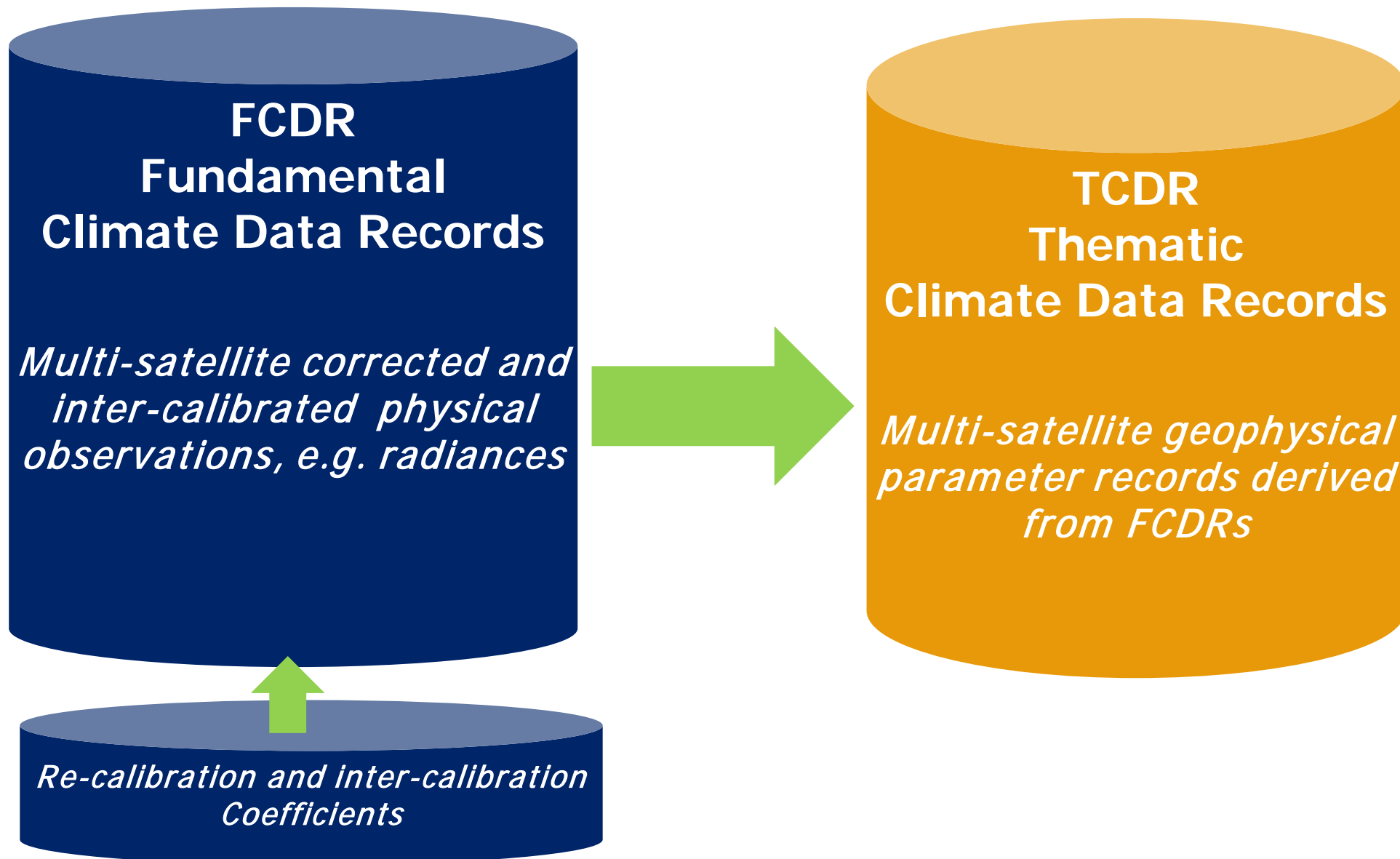
Availability of instruments in polar orbit for inter-satellite calibration



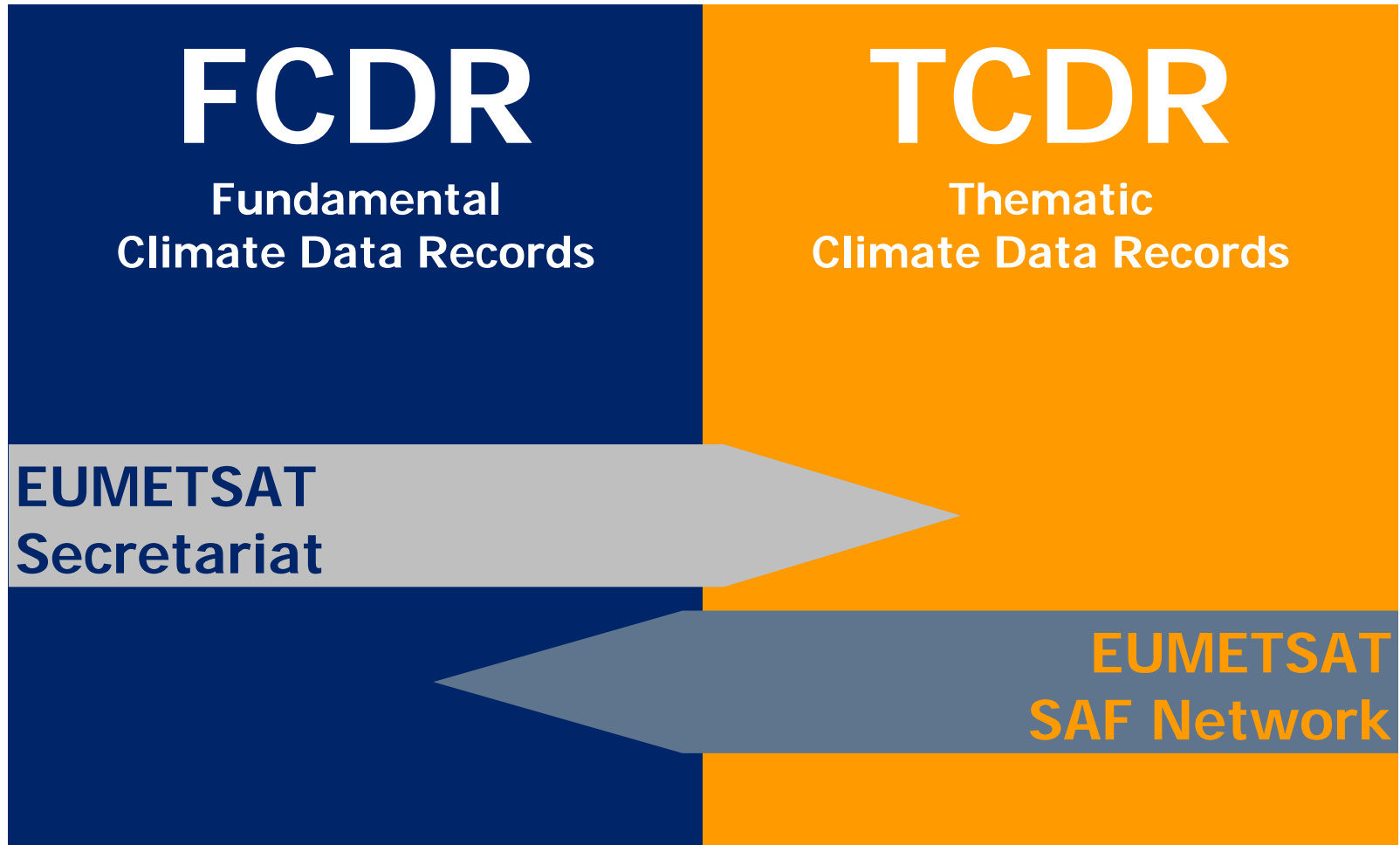
# GSICS/SCOPE-CM Re-calibration Procedure



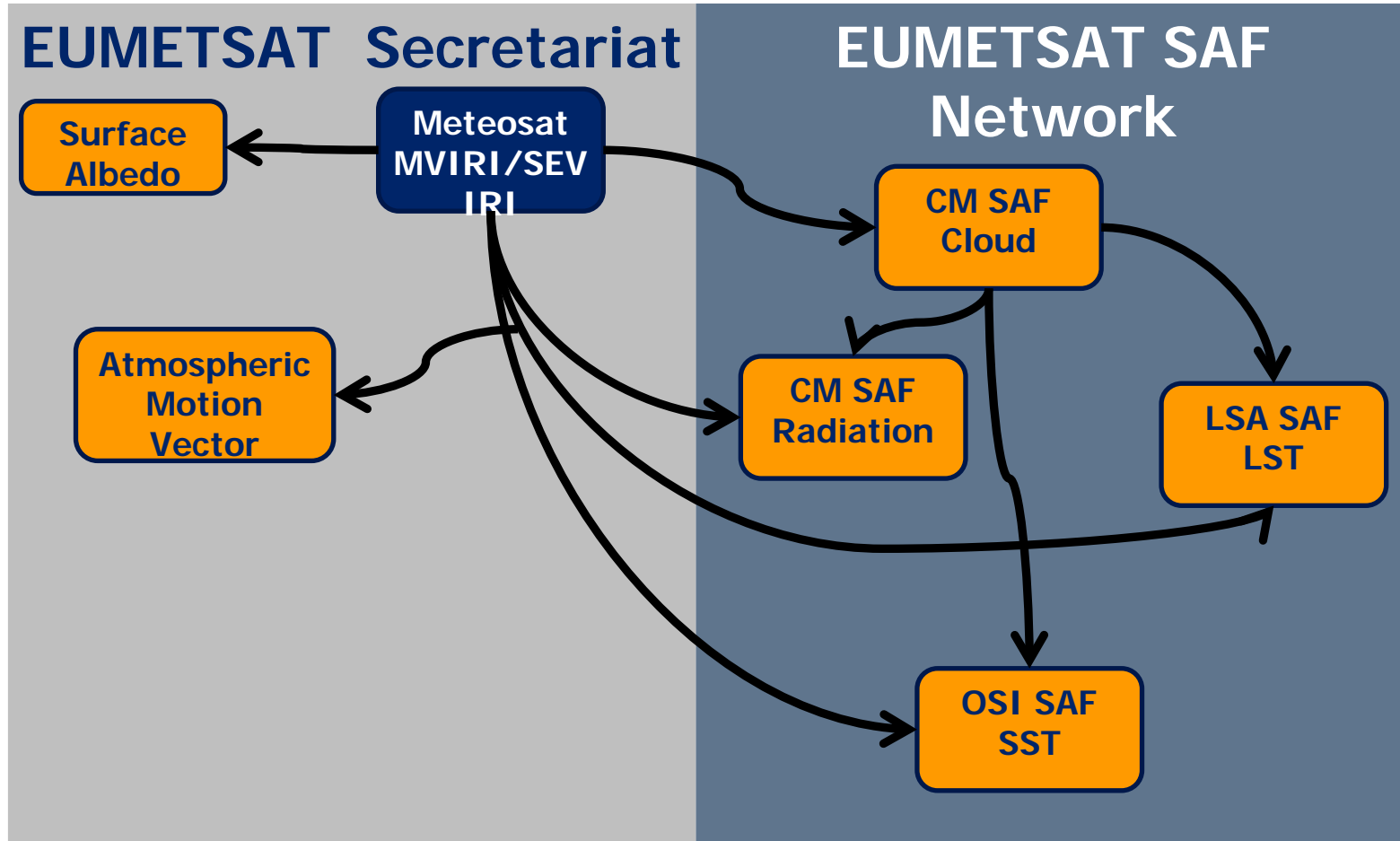
# Climate Data Records Dependency



# EUMETSAT Climate Data Records: responsibilities



# Climate Data Records Interdependencies: example



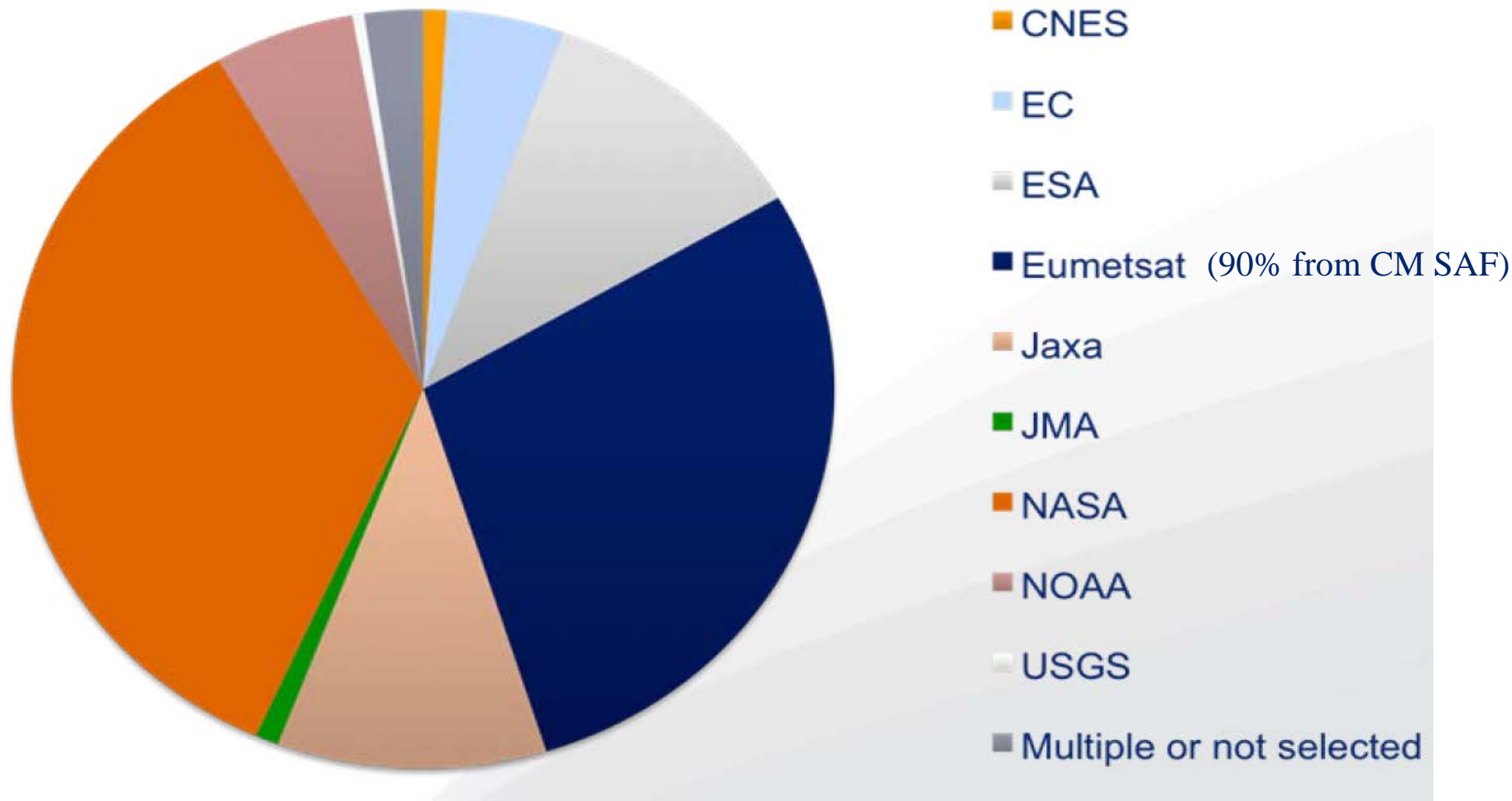


# ECV-based inventory of TCDRs

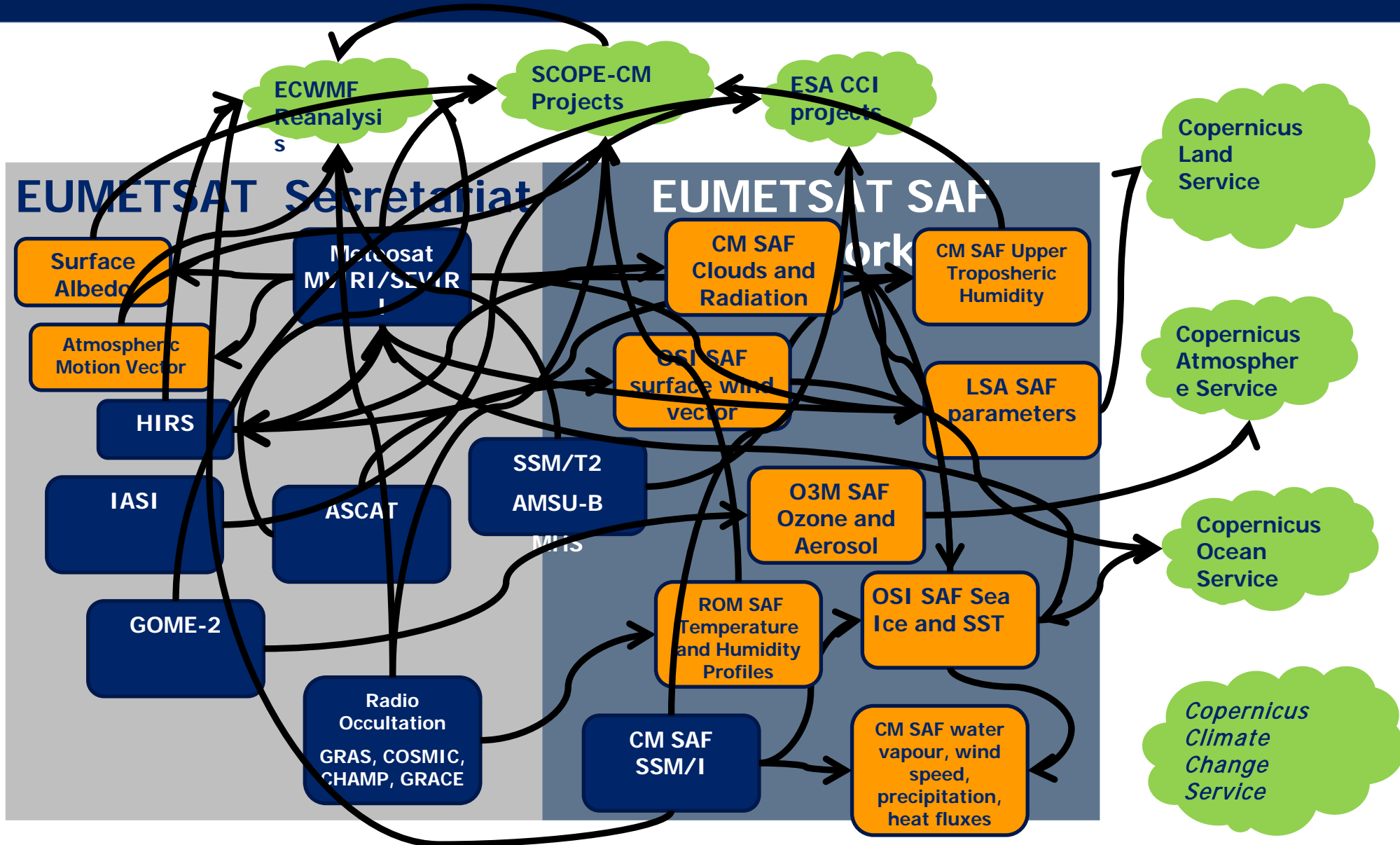
(<http://www.ecvinventory.com>)



Essential Climate Variable (ECV) Inventory



# From Climate Data Records to projects and services



# Maturity Matrix Concept



Is the software robust and maintainable?

Are the data and methods well documented?

Has the trueness of the data been systematically assessed?

Are data well used and user feedbacks taken care of?

Software readiness	Metadata	User documentation	Uncertainty Characterisation	Public Access, Feedback and Update	Usage
Are the codes compliant with standards, stable, portable and reproducible?	Do the metadata meet international standards, and allow provenance tracking?	Are the formal documents and peer-reviewed papers up-to-date and public?	Are the uncertainties assessed systematically in a standard manner?	Are the data, source code, and documents publicly available and regularly updated?	Are the data widely used in the scientific, and decision and policy making communities?

# Maturity of CM SAF Clouds TCDR

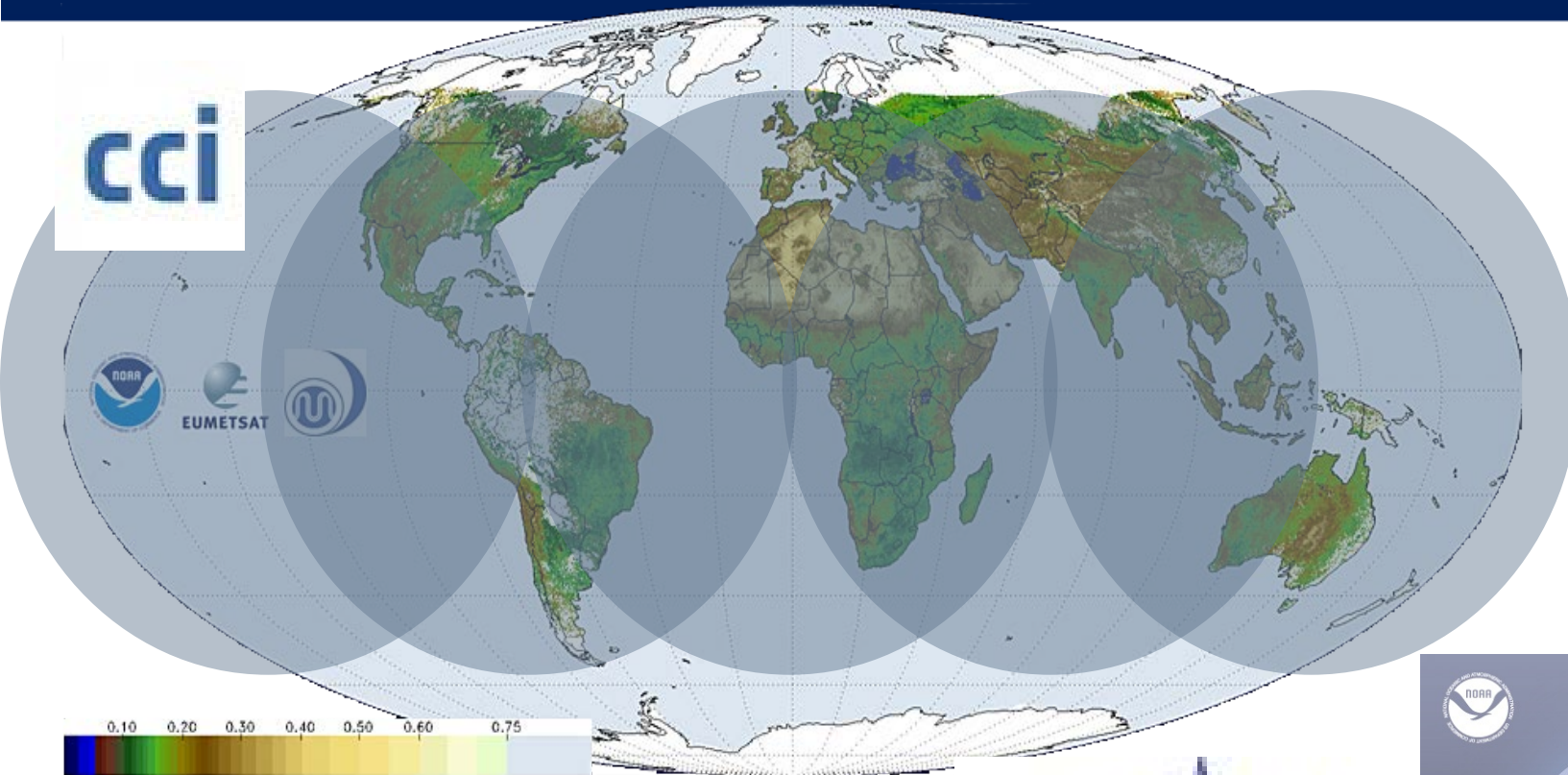
## CLARA-A1 Cloud Properties

maturity level as of 19/12/2013

### CORE-CLIMAX System Maturity Matrix

Maturity	SOFTWARE READINESS	METADATA	USER DOCUMENTATION	UNCERTAINTY CHARACTERISATION	PUBLIC ACCESS, FEEDBACK, UPDATE	USAGE
1	Conceptual development	None	Limited scientific description of the methodology available from PI	None	Restricted availability from PI	None
2	Research grade code	Research grade	Comprehensive scientific description of the methodology, report on limited validation, and limited product user guide available from PI; paper on methodology is submitted for peer-review	Standard uncertainty nomenclature is identified or defined; limited validation done; limited information on uncertainty available	Data available from PI, feedback through scientific exchange, irregular updates by PI	Research: Benefits for applications identified DSS: Potential benefits identified
3	Research code with partially applied standards; code contains header and comments, and a README file; PI affirms portability, numerical reproducibility and no security problems	Standards defined or identified; sufficient to use and understand the data and extract discovery metadata	Score 2 + paper on methodology published; comprehensive validation report available from PI and a paper on validation is submitted; comprehensive user guide is available from PI; Limited description of operations concept available from PI	Score 2 + standard nomenclature applied; validation extended to full product data coverage, comprehensive information on uncertainty available; methods for automated monitoring defined	Data and documentation publicly available from PI, feedback through scientific exchange, irregular updates by PI	Research: Benefits for applications demonstrated. DSS: Use occurring and benefits emerging
4	Score 3 + draft software installation/user manual available; 3rd party affirms portability and numerical reproducibility; passes data providers security review	Score 3 + standards systematically applied; meets international standards for the data set; enhanced discovery metadata; limited location level metadata	Score 3 + comprehensive scientific description available from data provider; report on inter comparison available from PI; paper on validation published; user guide available from data provider; comprehensive description of operations concept available from PI	Score 3 + procedures to establish SI traceability are defined; (inter)comparison against corresponding CDRs (other methods, models, etc); quantitative estimates of uncertainty provided within the product characterising more or less uncertain data points; automated monitoring partially implemented	Data record and documentation available from data provider and under data provider's version control; Data provider establishes feedback mechanism; regular updates by PI	Score 3 + Research: Citations on product usage in occurring DSS: societal and economical benefits discussed
5	Score 4 + operational code following standards, actions to achieve full compliance are defined; software installation/user manual complete; 3rd party installs the code operationally	Score 4+ fully compliant with standards; complete discovery metadata; complete location level metadata	Score 4 + comprehensive scientific description maintained by data provider; report on data assessment results exists; user guide is regularly updated with updates on product and validation; description on practical implementation is available from data provider	Score 4 + SI traceability partly established; data provider participated in one inter-national data assessment; comprehensive validation of the quantitative uncertainty estimates; automated quality monitoring fully implemented (all production levels)	Score 4 + source code archived by Data Provider; feedback mechanism and international data quality assessment are considered in periodic data record updates by Data Provider	Score 4+ Research: product becomes reference for certain applications DSS: Societal and economic benefits are demonstrated
6	Score 5 + fully compliant with standards; Turnkey System	Score 5 + regularly updated	Score 5 + journal papers on product updates are and more comprehensive validation and validation of quantitative uncertainty estimates are published; operations concept regularly updated	Score 5 + SI traceability established; data provider participated in multiple inter-national data assessment and incorporating feedbacks into the product development cycle; temporal and spatial error covariance quantified; Automated monitoring in place with results fed back to other accessible information, e.g. meta data or documentation	Score 5 + source code available to the public and capability for continuous data provisions established (ICDR)	Score 5 + Research: Product and its applications becomes references in multiple research field DSS: Influence on decision and policy making demonstrated

# International coordination and cooperation



- Task: coordinate the sustained development of the Architecture for climate monitoring from space
- 3 main objectives:
  - (i) provide visibility on Climate Data Records available and planned from missions of CEOS and CGMS agencies
  - (ii) create the conditions for delivering further Climate Data Records to fulfil GCOS requirements
  - (iii) optimise the planning of future missions to expand existing and planned Climate Data Records and close possible gaps with respect to GCOS requirements

# WCRP-EUMETSAT Climate Symposium 2014

- A world-leading event on climate, following the release of IPCC 5<sup>th</sup> Assessment Report
- Hosted in Darmstadt on 13-17 October 2014
- Supported by the EC, ESA, NASA, NOAA, JAXA
- Expected attendance : 600 participants

