

# Background & Rationale for AeroSat

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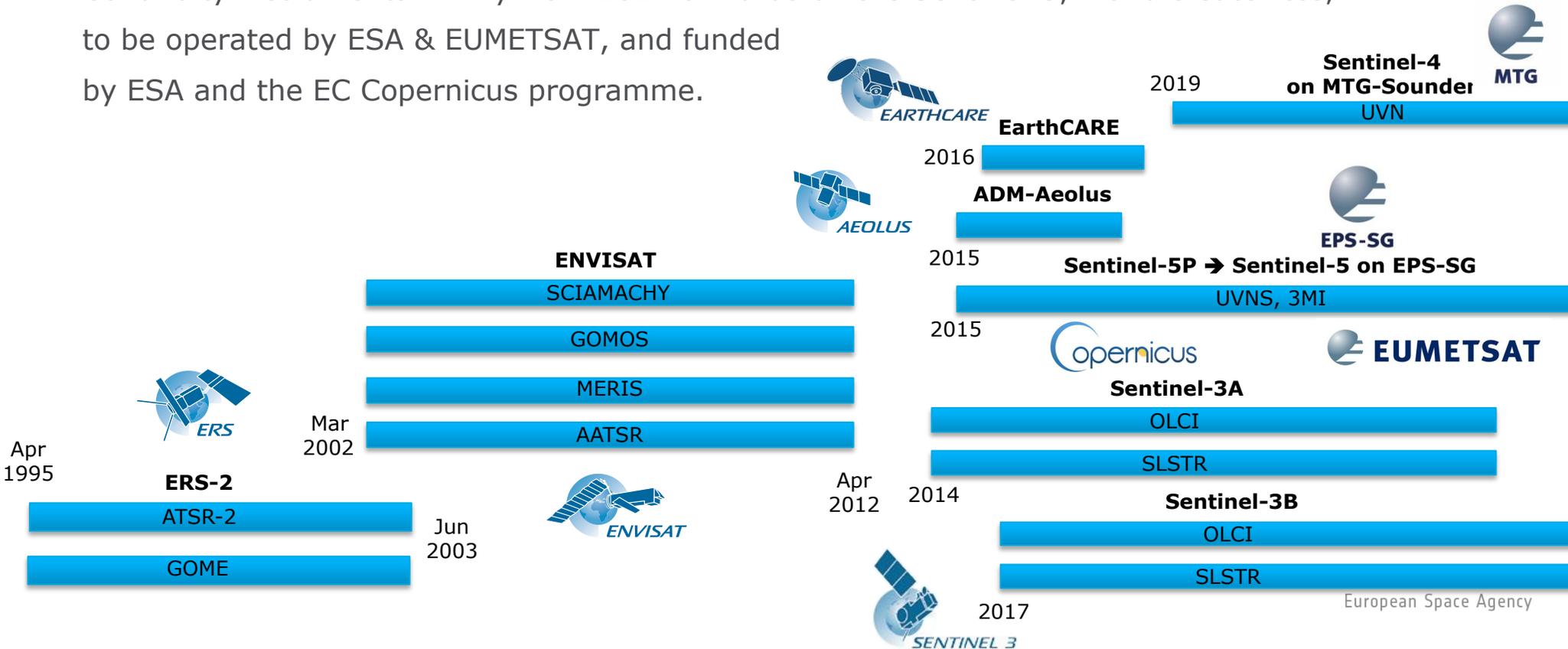
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# Aerosol Observations from ESA Satellites



- ESA doesn't have an instrument dedicated to aerosol retrieval flying yet (EarthCARE is coming...)
- But information about aerosols is retrieved from several past instruments, often as a by-product of the atmospheric correction, e.g.: MERIS, (A)ATSR, GOME, GOMOS, SCIAMACHY
- Continuity instruments will fly from 2014 onwards on the Sentinel-3, 4 and 5 satellites, to be operated by ESA & EUMETSAT, and funded by ESA and the EC Copernicus programme.





## CCI Programme Objective:

*"To realize the full potential of the long-term global Earth Observation archives that ESA together with its Member States have established over the last thirty years, as a significant and timely contribution to the ECV databases required by United Nations Framework Convention on Climate Change (UNFCCC)."*

## Cardinal Requirements on each project:

1. Develop and validate algorithms to meet GCOS ECV requirements for (consistent, stable, error-characterized) global satellite data products from multi-sensor data archives
2. Produce, within an R&D context, the most complete and consistent possible time series of multi-sensor global

## 4. Generate complete specifications for an operational production system

3. Strengthen inter-disciplinary cooperation between international earth observation, climate research and modelling communities, in pursuit of scientific excellence

## Budget, Duration:

- Proposed to ESA Ministerial Council in Nov 2008.
- Result: 85 M€ programme (2010-2016)



# Task: Design an Operational Production System for Climate Data Records



## Why is production of an operational CDR a bit different from, say, production of space agency standard operational products?

- CDR production does not suffer the constraints of NRT production. Needs to be reprocessed every 1-2 years => Can use best instrument calibrations and ancillary data, can process & validate whole time series in one go, etc...
- CDR must be multi-mission intercalibrated (e.g. ATSR, ATSR-2, AATSR, SLSTR) over a long time series.
- CDR must use the latest and best algorithm, selected through international peer review, and accepted as the best algorithm by the authoritative community.
- Continual algo improvement is essential part of an operational CDR production system, because in many cases we are far from the GCOS reqs.
- CDR must be exhaustively validated/intercompared, uncertainties validated, long term stability assessed – most of this will be done after release, because the data producer will not have resources to do it thoroughly enough. In fact it shouldn't be considered a CDR at all until the international expert community has evaluated it and endorsed it.



CDR must be at the Cutting Edge of technical capability and must have Scientific Credibility from the Users' perspective

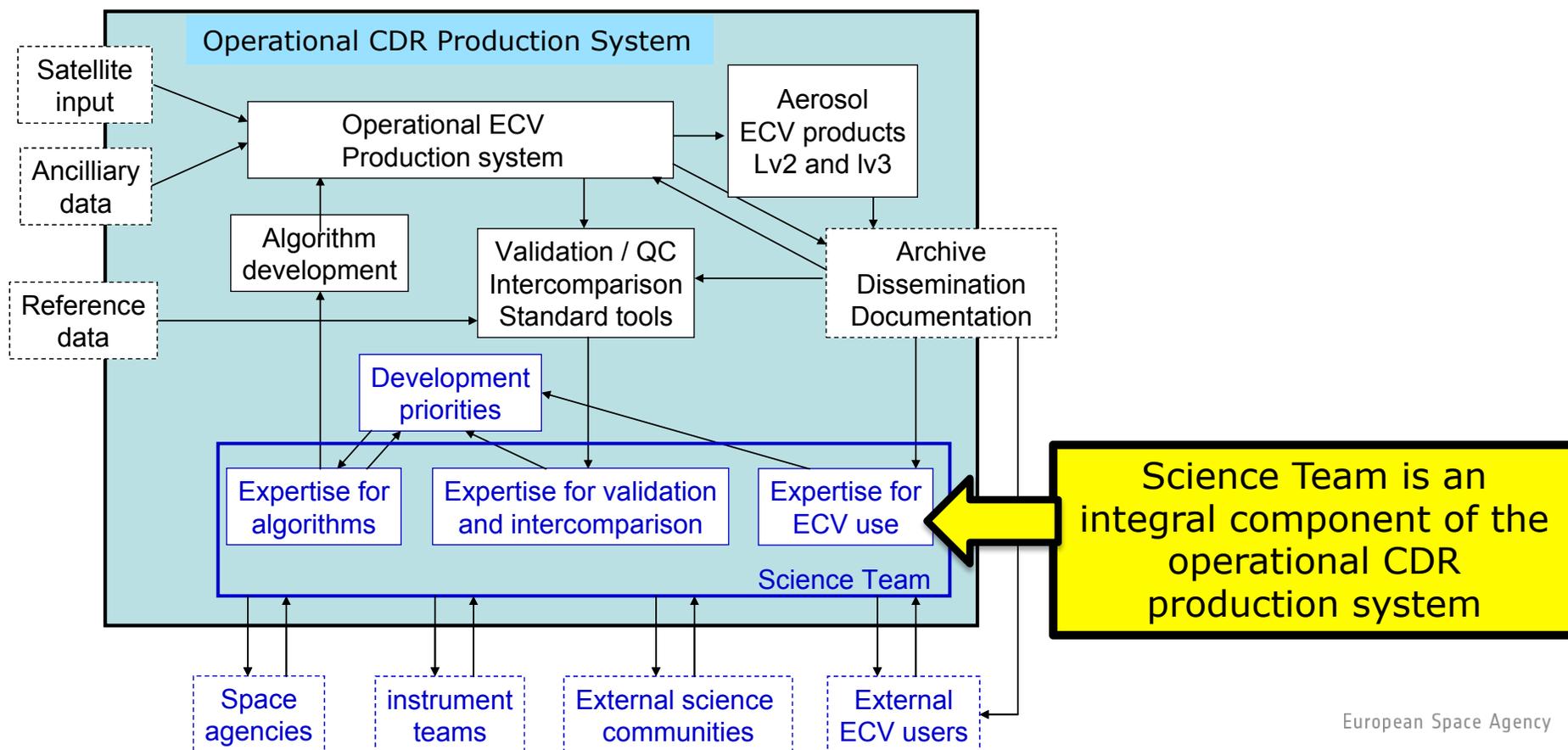
- CDR development must be **driven** by the recognised community of **leading international** scientists
- Development, production, validation must be done **openly** and must be **inclusive**, ideally through open **international collaboration**.

All this has to be **inside** the "operational CDR production system"



## Operational System Specification

Or: How to implement "operational" production of climate data records.



# Other motivations for an International Science Team...(a.k.a. AeroSat)



## The Why?

CDR operational production is one good reason for AeroSat, but not the ONLY good reason:

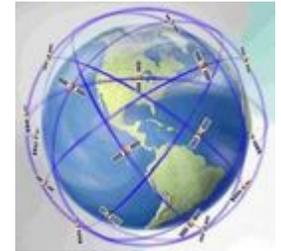
- Federate the algorithm developers to encourage collaboration and stimulate progress
- Coordinate scientific activities of mutual benefit (intercomparisons, validation data collection, common definitions, common tools, common formats, ...)
- Identify and promote best practice
- Better connect the data producers with the data users to improve user-uptake
- Provide collective, more powerful voice towards the ecosystem of umbrella and associated projects
- Provide collective, more powerful voice to funding agencies
- Provide collective, more powerful voice to space agencies

## The Who?

International....

- aerosol retrieval experts
- validation experts (including AERONET, GALION, GAW, etc)
- aerosol data users (research, climate, NWP, air quality, ... AeroCom, ICAP, ...)
- agency representatives

# The Ecosystem



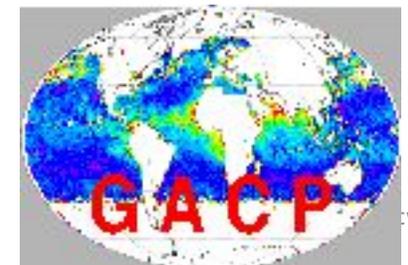
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The international satellite aerosol science community would benefit from a louder and consolidated voice in the ecosystem of international projects and coordinating bodies



ICAP



# Example #1: Group for High Resolution Sea Surface Temperature (GHRSSST)



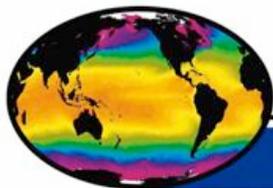
## Objective:

"To develop and nurture cooperation and progress at the world scale in the subject area of satellite Sea Surface Temperature"

## Benefits:

- Widespread increased adoption of satellite SST in operational models
- Common definitions of SST as a function of depth
- Development of common sensor-specific error statistics
- Multi-mission SST data sets in common format provided by an international network of 20+ data centres (e.g. Long Term Reanalysis and Stewardship Facility hosted by NODC)
- Multi-model ensemble products
- NRT product validation tools ("HR-DDS")
- Working groups on specific technical issues: retrieval algorithms, validation, inland waters, high-latitudes, diurnal variability, intercomparisons, climate data records, ...





# GHRSSST

Group for High Resolution  
Sea Surface Temperature



## Climate Data Evaluation Framework

### Basic screen

E.g.: dataset covers minimum ten years, consistently processed; GDS2 compliant data are in LTSRF

Generate evaluation information and submit  
I.e., provide complete information for climate data evaluation by CDR-TAG and users

CDR-TAG review  
Critical review of information, including clarifications and requests for revision if necessary

Approval and publication  
CDEF information is maintained in accessible location on GHRSSST web site and with the dataset

**We need one of these for aerosol CDRs**

# Example #2: International Ocean Colour Coordinating Group (IOCCG)



## Objectives:

- To foster expertise in using ocean-colour data (training)
- To provide a common voice for the user community
- To advocate the importance of ocean-colour data to the global community
- Optimize quality of data for calibration and validation
- Advocate the collection of essential ocean and atmosphere data.
- Facilitate merging and access to ocean-colour data



[www.ioccg.org](http://www.ioccg.org)

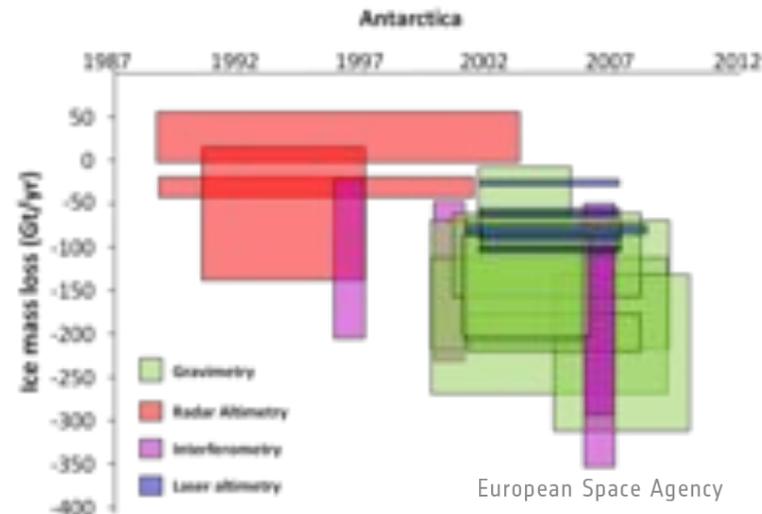
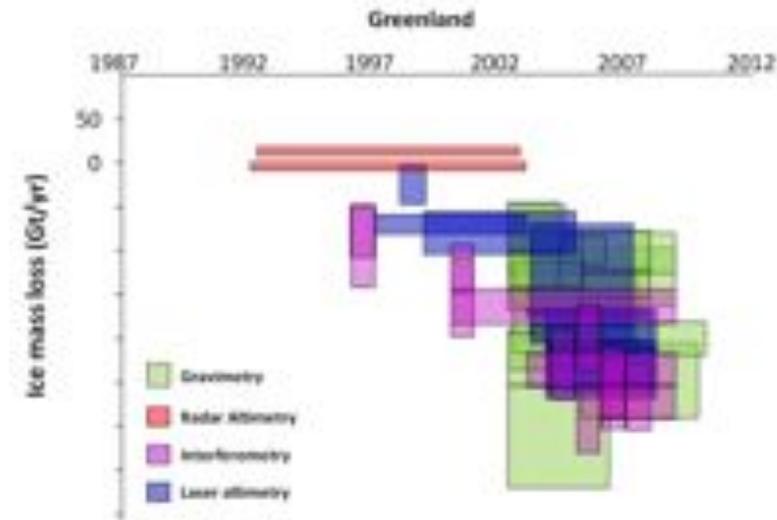
**One of the many achievements is a Scientific Report series: mission requirements, best practice, advocacy, ...**



# Example #3: Ice Sheet Mass Balance Intercomparison Exercise (IMBIE)



- IPCC AR4 highlighted disagreement in ice sheet mass balance estimates. Serious concern that no improvement by AR5.
- Greenland and Antarctic ice sheet mass imbalance of between **-676** and **+69** Gt yr<sup>-1</sup>
- IMBIE was established to reconcile the estimates and restore **scientific credibility**
- In 2012, IMBIE achieved this aim and reconciled measurements of ice sheet mass balance using satellite altimetry, gravimetry and the input-output method
- Through a series of experiments that used common spatial definitions and time periods, and that investigated the impacts of various ancillary datasets used, it was shown that there is good agreement between estimates of Antarctic and Greenland mass balance determined from the three techniques



# My Selfish Motive for wanting AeroSat



... as an employee of a space agency

Space agencies have programmes and funding for:	→	AeroSat would help us to implement our programmes more efficiently if it would act as a focal point for the international satellite aerosol science community to:
Developing, building, launching and operating satellite missions capable of aerosol retrieval	→	Help prioritise and justify the next generation of aerosol missions
Developing aerosol retrieval algorithms	→	Advance retrieval algorithm development and identify best practice
Operating processing chains to deliver aerosol information to users	→	Streamline feedback to us from the expert and user communities
Developing the use of satellite aerosol information in users' applications (NWP, climate, air quality, research, ...)	→	Promote, facilitate and define requirements for strengthening the use of satellite data in users' applications

**In return: AeroSat members would have more influence over space agency programmes**

# My Selfish Priorities for AeroSat



... as technical officer of the Aerosol\_CCI project

- Ensure Aerosol\_CCI developments are embedded in the international effort to provide CDRs and benefit from the international best practice.

**=> CDR working group, please!**

- Ensure Aerosol\_CCI products are properly intercompared with other CDRs.

**=> Intercomparison activity, please!**

- Ensure maximum user-uptake of Aerosol\_CCI products

**=> Interoperability working group, please! (Obs4MIPS et al.)**

**In return: we can use CCI resources to support AeroSat activities of mutual benefit**

# Thanks for your time

## **Acknowledgements:**

Thomas Holzer-Popp, Gerrit De Leeuw, & the Aerosol\_CCI team – for making CCI a success

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