1. ESA Satellites
2. Aerosol_CCI project
3. AERO-SAT

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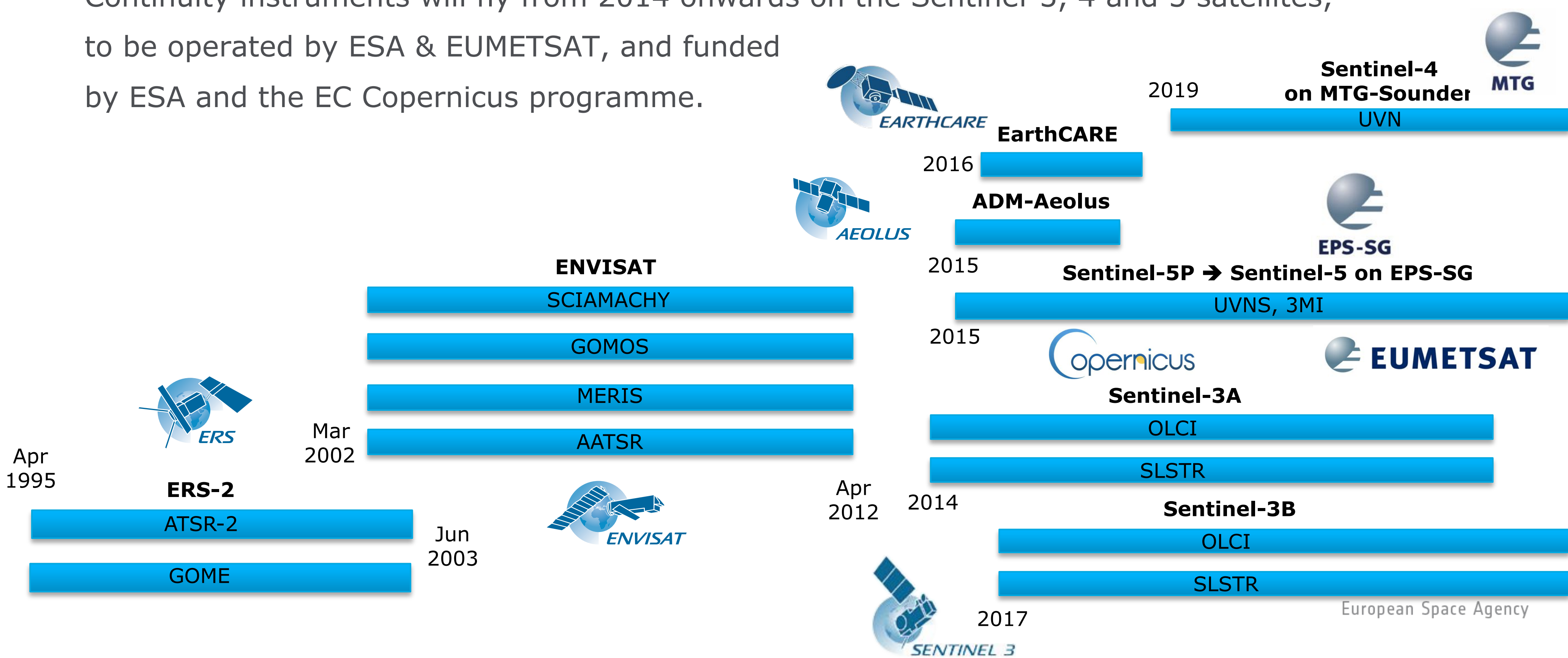
5th ICAP Working Group Meeting – Tsukuba, Japan - 5 Nov 2013

Aerosol Observations from ESA Satellites

esa

- 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.

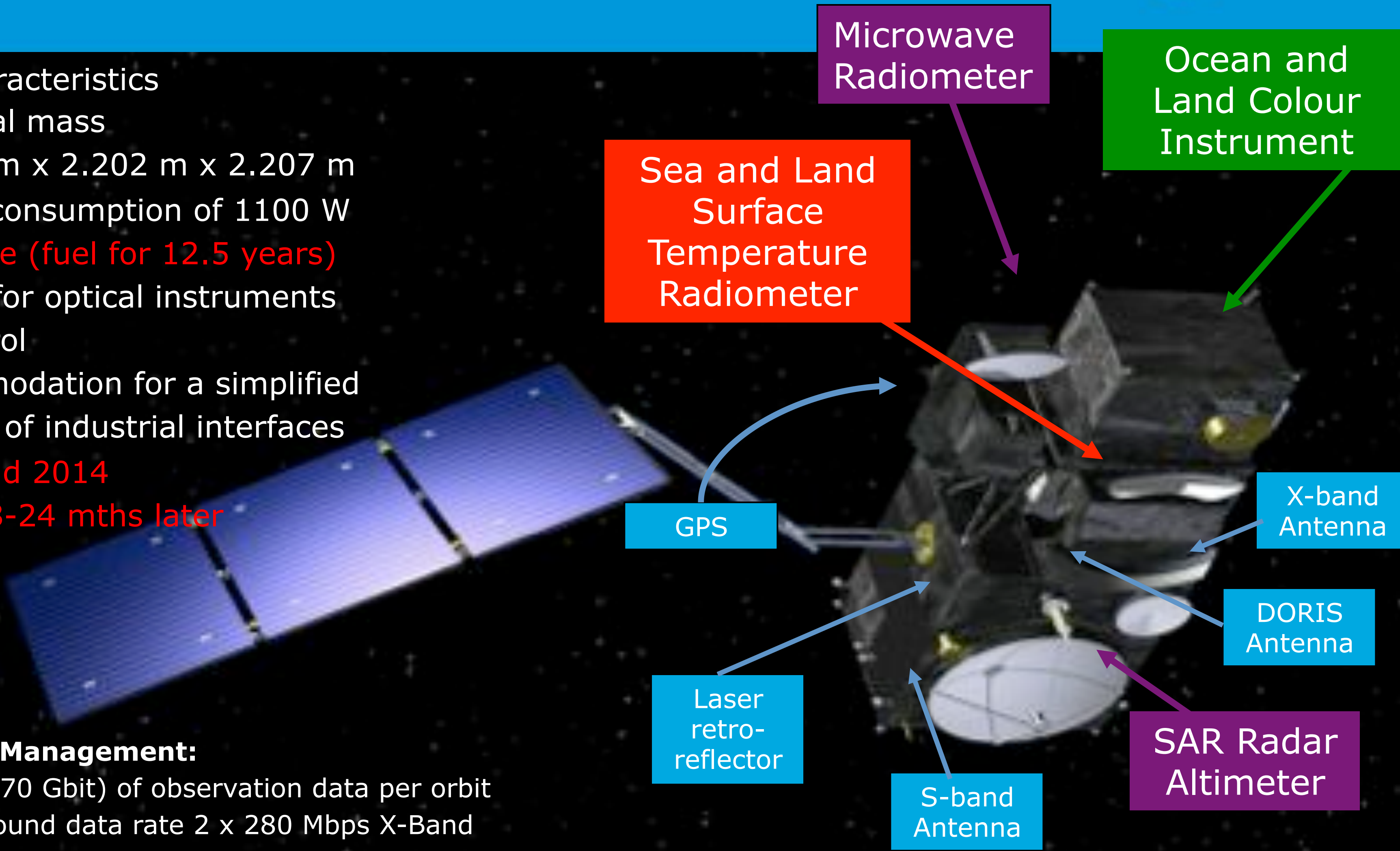


Sentinel-3: Continuity of Envisat Ocean Observations

esa

Main satellite characteristics

- 1250 kg maximal mass
- Volume in 3.89 m x 2.202 m x 2.207 m
- Average power consumption of 1100 W
- 7.5 years lifetime (fuel for 12.5 years)
- Large cold face for optical instruments thermal control
- Modular accommodation for a simplified management of industrial interfaces
- Launch S3A: end 2014
- Launch S3B: 18-24 mths later



Observation Data Management:

- 21.25 Gb (170 Gbit) of observation data per orbit
- Space to ground data rate 2 x 280 Mbps X-Band
- 1 ground contact per orbit
- 3h delivery timeliness (from satellite sensing)
- Land products provided by ESA
- Marine products provided by EUMETSAT

Copernicus EUMETSAT

Sentinel-3 Orbit and Instrument Swaths

Sun-synchronous frozen orbit close to 800 km

Required for optical observations continuity

Topography mission requirements

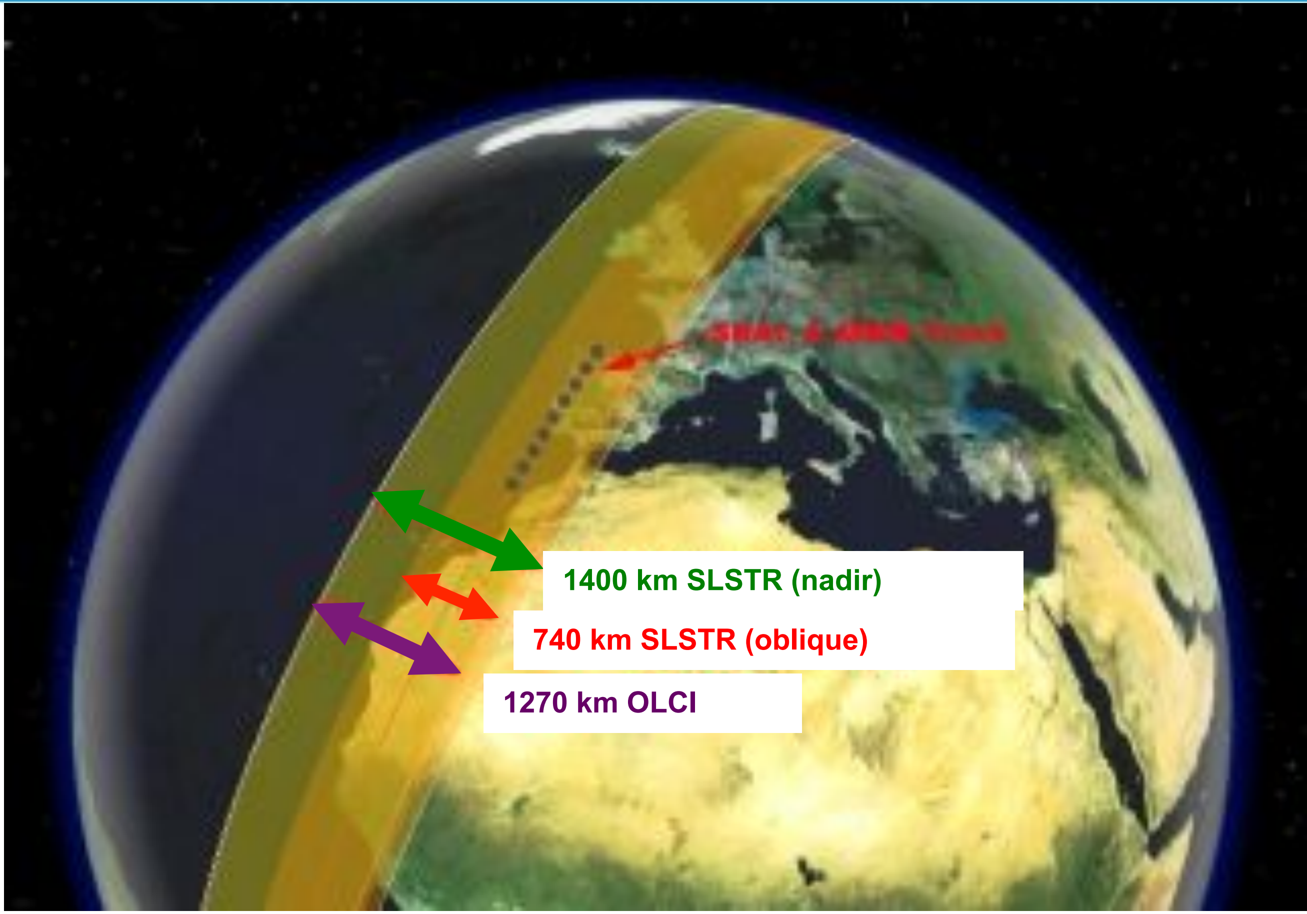
- Repeat cycle > 20 days,
- Optimum Topography mission spatial sampling
- Minimization of aliasing

Ocean Colour mission requirements

- 2-day global coverage with 2 satellites, 4 days with one
- Implies a sub-cycle of 4 days
- Local time of observation shall be > 10 h to avoid morning haze

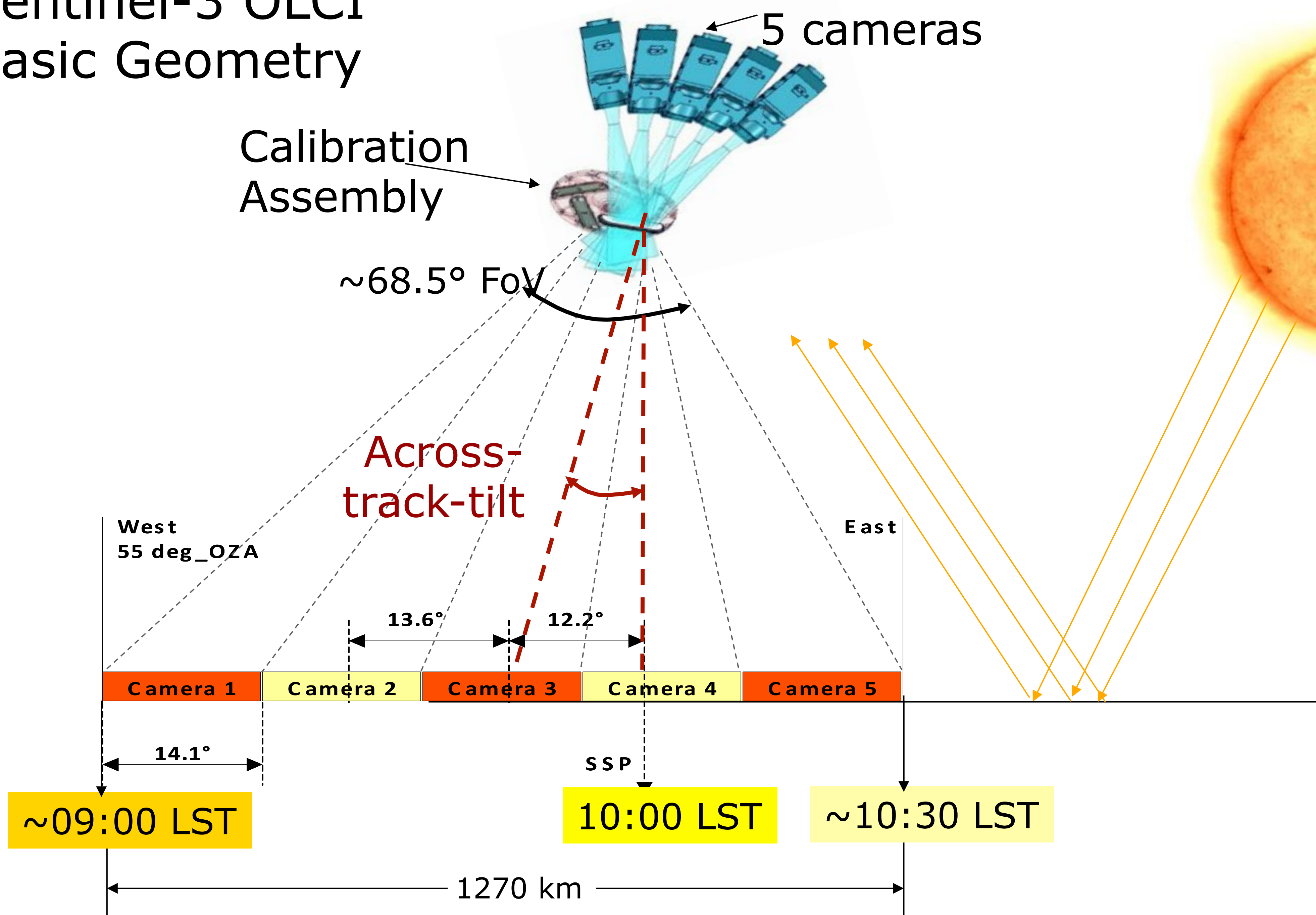
Sea Surface Temperature mission requirements

- Local time at node shall be < 11 h to avoid skin effects



Orbit type	Repeating frozen SSO
Repeat cycle	27 days (14 + 7/27 orbits/day)
LTDN	10:00
Average altitude	815 km
Inclination	98.65 deg

Sentinel-3 OLCI Basic Geometry



Sentinel-3 OLCI – Compared to Envisat MERIS

Compared to MERIS:

- **More spectral bands** (from 15 to 21): 400-1020 nm
- **Broader swath**: 1270 km
- **Reduced sun glint** by camera tilt in west (12.20°)
- **Full res. 300m acquired systematically** for land & ocean
- Reduced res. 1200m binned on ground (L1b)
- Improved characterization, e.g. straylight, camera boundary characterization
- **Ocean coverage** < 4 days, (< 2 days, 2 satellites)
- Timeliness: 3 hours NRT Level 2 product
- **100% overlap with SLSTR**

MERIS Bands	λ center	Width
Yellow substanace/detrital pigments	412.5	10
Chl.. Abs. Max	442.5	10
Chl & other pigments	490	10
Susp. Sediments, red tide	510	10
Chl. Abs. Min	560	10
Suspended sediment	620	10
Chl. Abs, Chl. fluorescence	665	10
Chl. fluorescence peak	681.25	7.5
Chl. fluorescence ref., Atm. Corr.	708.75	10
Vegetation, clouds	753.75	7.5
O_2 R-branch abs.	761.25	2.5
O_2 P-branch abs.	778.75	15
Atm corr	865	20
Vegetation, H_2O vap. Ref.	885	10
H_2O vap., Land	900	10
New OLCI bands	**λ center**	**Width**
Aerosol, in-water property	400	15
Fluorescence retrieval	673.75	7.5
Atmospheric parameter	764.375	3.75
Cloud top pressure	767.5	2.5
Atmos./aerosol correction	940	20
Atmos./aerosol correction	1020	40

Sentinel-3 SLSTR – Compared to Envisat AATSR

- **9 spectral bands increased** from 7 to 9 (new 1.3 and 2.2µm) for better cirrus cloud detection
- **Increased spatial resolution for VIS and SWIR channels** (0.5 km @ nadir, TIR 1 km @nadir)
- Maintain along track scanning with **increased swath of oblique view to 740 km**
- **Increased nadir swath: 1400 km**
- **Covers full OLCI swath**
- Dedicated **Active Fire channels**
- Timeliness: 3 hours NRT Level 2 product

Sentinel-3 Aerosol Product – Status

(Philippe Goryl - *Sentinel-3 Optical Product Manager, ESA*)

Current Operational Processing Chain:

- **SLSTR**
  no aerosol product
- **OLCI**
  AOD 865 nm product from the ocean-colour atmospheric correction at 300m and 1km in NRT over ocean only - considered as by-product (i.e used to perform atmospheric correction)
- **OLCI + SLSTR**
  SYNERGY AOD 550 nm in NTC (non-time critical) at 300m resolution over land only.

Request from European Commission:

- Global Aerosol in core product list
- Aerosol at pixel level (goal)
- Accuracy: goal AOD 0.1 over land, AOD 0.05 over ocean
- NRT (< 3 h)
- AOD 550 nm over ocean and land (goal)
- Include uncertainties at pixel level (goal)

Sentinel-3 Aerosol Product – Plans

(Philippe Goryl - *Sentinel-3 Optical Product Manager, ESA*)

ESA will develop NRT aerosol as core product for Sentinel-3:

- Implementation details currently under discussion between ESA and Eumetsat

Extension of SYNERGY aerosol algorithm to ocean (P. North et al., Swansea Univ.)

- Use standard surface model developed under CCI (accounting for glint, foam, chlorophyll)
- Include maritime aerosol model set

Improvement of aerosol retrieval to state-of-the-art

- Use continuous aerosol size retrieval developed under CCI
- Include climatology of aerosol composition developed under CCI as prior to improve retrieval accuracy
- Improve surface spectral characterisation over land to improve accuracy for off-nadir pixels outside the SLSTR dual-view region
- Improved cloud mask optimised for SLSTR

Processing Time improvement

- NRT mandatory → challenge for SYN
- Backup solution : SLSTR only in NRT, SYN in NTC

Sentinel Data Policy

SENTINEL DATA POLICY

1. ESA: Joint Principals for a GMES Sentinel Data policy

- Access to Sentinel data will be free, full and open.
- Anybody can access acquired Sentinel data; in particular no difference is made between public, commercial and scientific use and in between European or Non-European users
- The licenses for the Sentinel data itself are free of charge.

2. EC: Commission Delegated Regulation (EU) No../.. of 12.7.2013 establishing registration and licensing conditions for GMES users and defining criteria for restricting access to GMES dedicated data and GMES service information (two different regimes of data dissemination):

DATA ACCESS IN PRACTICAL TERMS

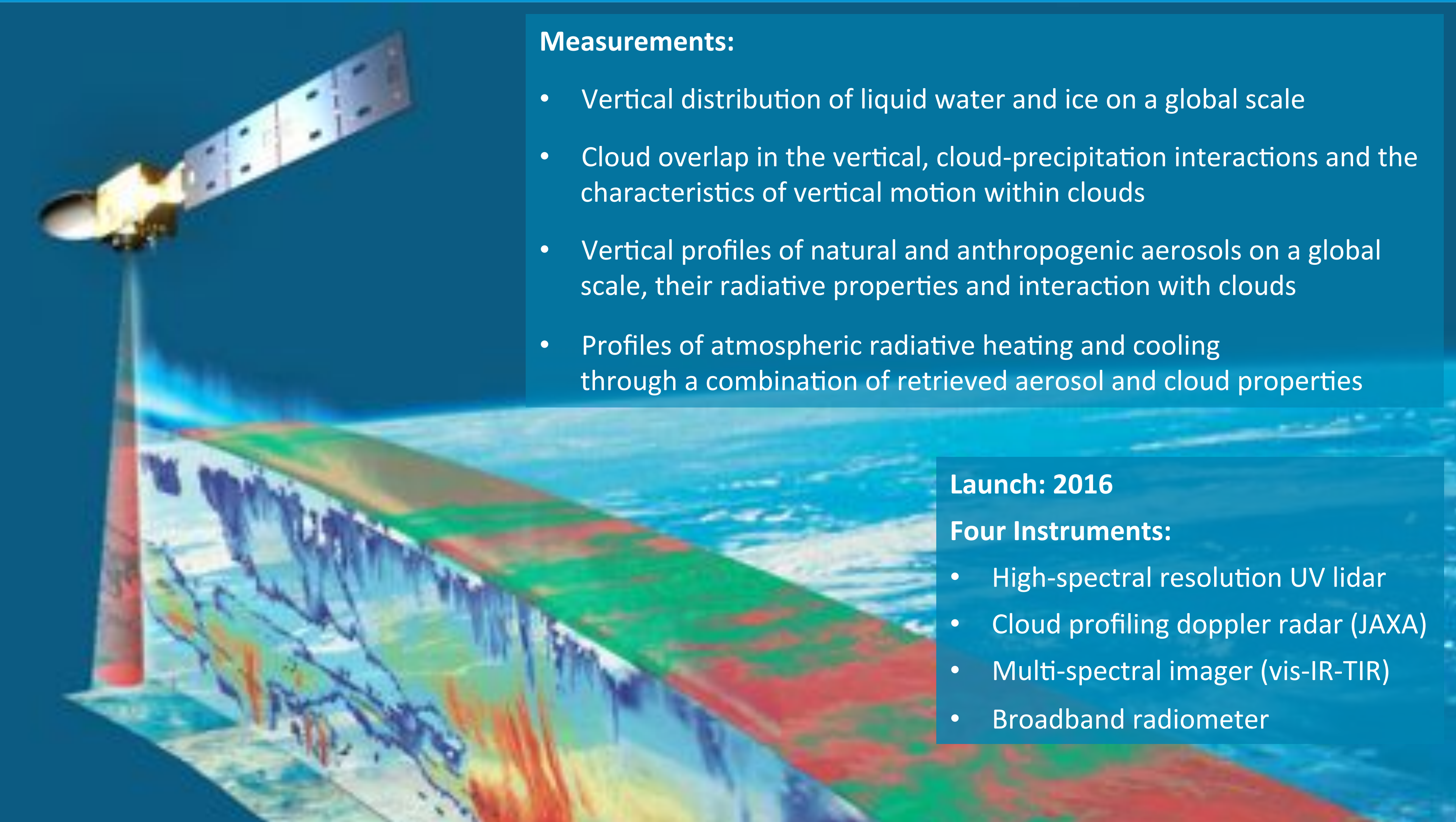
Free, full and open data policy versus CSC data access funding – dedicated access per user type

- Copernicus services → Coordinated Data Access System (CDS**)**
- ESA MSs Collaborative Users → national mirror sites
- ESA funded R&D projects → rolling archive on ESA funded dedicated distribution platform and/or ESA member states ' national mirror sites
- International users → International mirror sites
- Scientific/other users (i.e. not covered under any of the above groups) → rolling archive on ESA funded dedicated distribution platform.

Data access will follow ramp-up scenario (satellite commissioning → establish links to Copernicus core services and collaborative ground segment for national use → … → routine operations)

EarthCARE

ESA-JAXA Clouds, Aerosol and Radiation Explorer



Measurements:

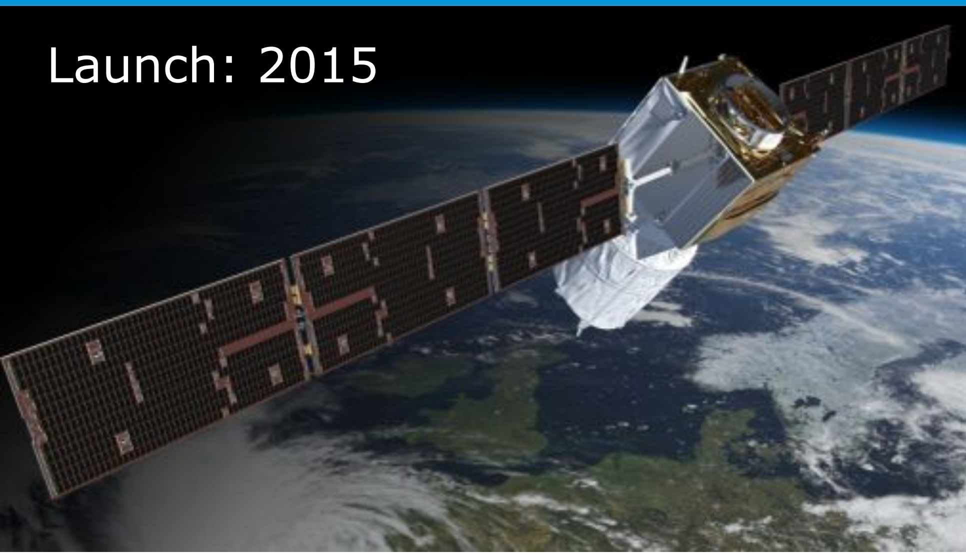
- Vertical distribution of liquid water and ice on a global scale
- Cloud overlap in the vertical, cloud-precipitation interactions and the characteristics of vertical motion within clouds
- Vertical profiles of natural and anthropogenic aerosols on a global scale, their radiative properties and interaction with clouds
- Profiles of atmospheric radiative heating and cooling through a combination of retrieved aerosol and cloud properties

Launch: 2016

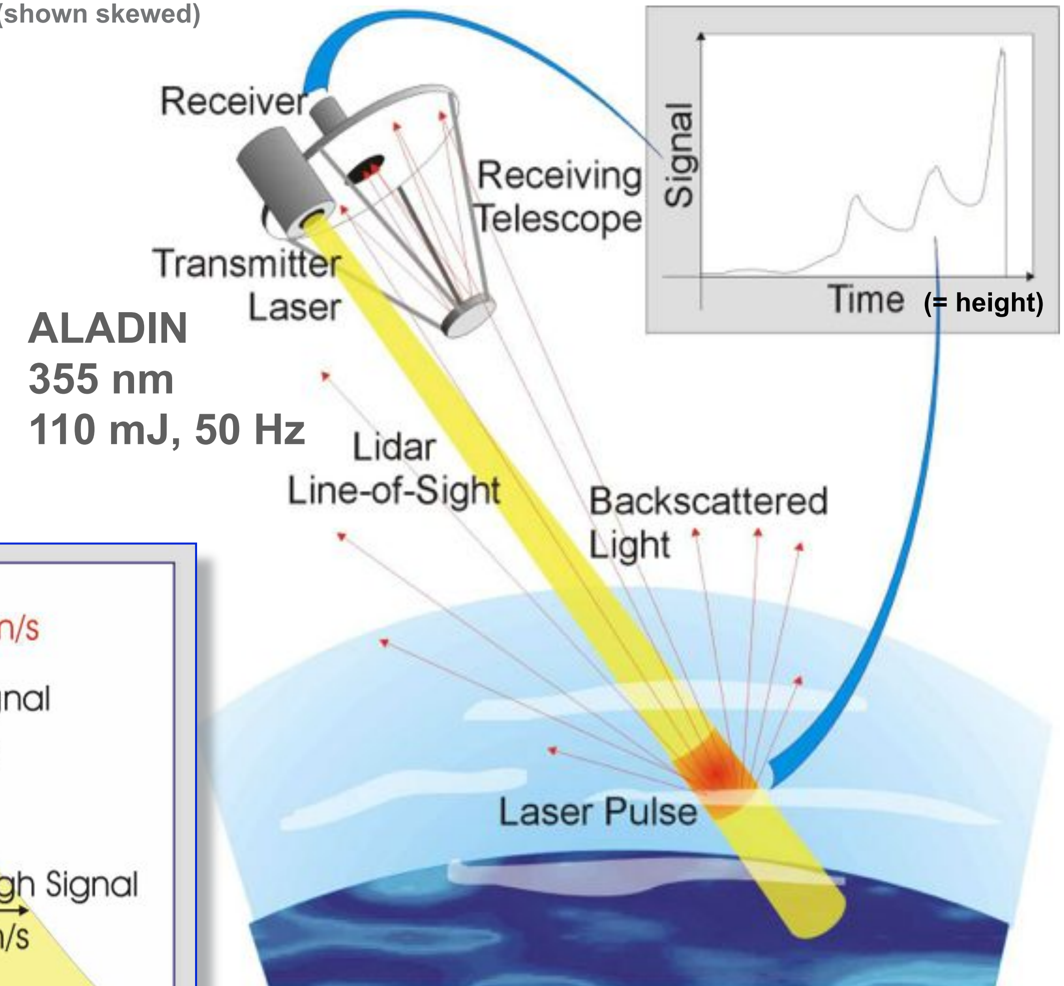
Four Instruments:

- High-spectral resolution UV lidar
- Cloud profiling doppler radar (JAXA)
- Multi-spectral imager (vis-IR-TIR)
- Broadband radiometer

ADM-Aeolus – Doppler Wind Lidar Mission

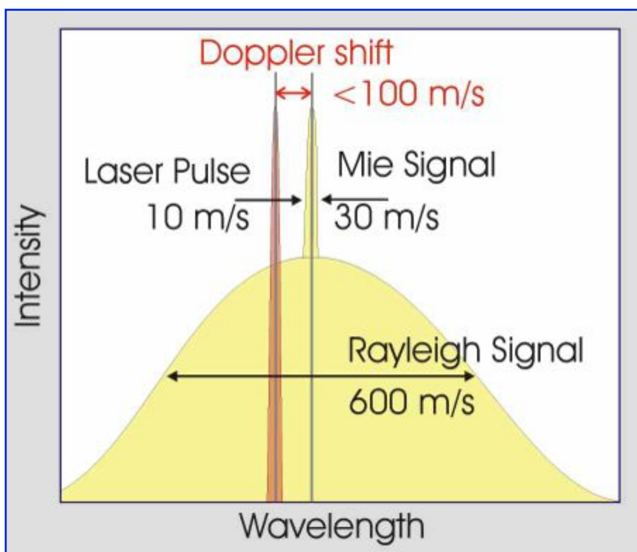


Monostatic emit-receive path
(shown skewed)



European Space Agency

Wind and atmospheric optical properties profile measurements are derived from the Doppler shifted signals that are back-scattered along the lidar line-of-sight (LOS)



ADM-Aeolus atmospheric products

Powerful space-borne lidar with separate molecular and particle backscatter detection

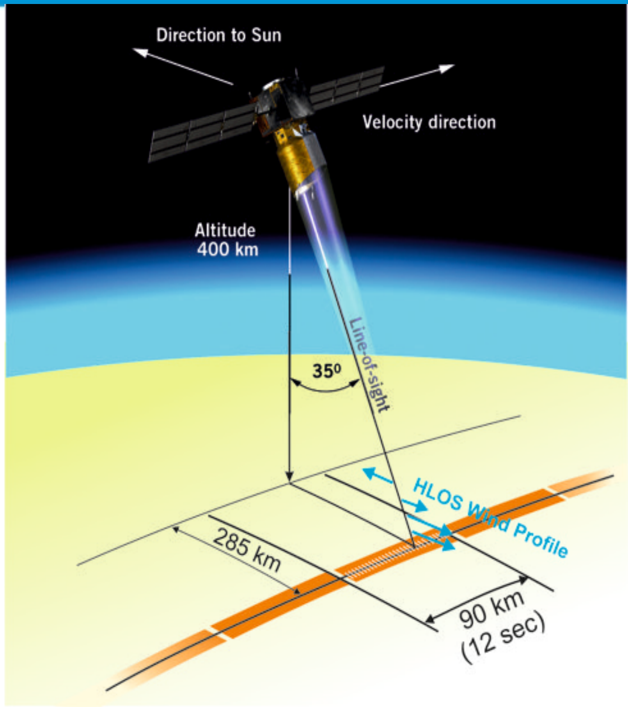
1. Primary (L2b) product:

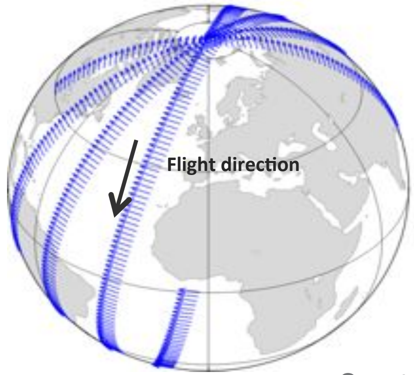
a. Horizontally projected LOS (HLOS) wind profiles
   - Approximately zonal at dawn/dusk (6 am/pm)
   - 3 km-averaged measurements and ~85 km observation averages – scene classified
   - From surface to ~30 km in 24 vertical layers
   - Random errors: 1-2(PBL), 2(Trop), 3-5(Strat) m/s
   - Bias requirements: 0.5 m/s

2. Spin-off (L2a) products:

a. Optical properties profiles
   - β, σ, OD, scattering ratio
   - Cloud/aerosol cover/stratification, top/base heights
   - Aerosol typing (backscatter-to-extinction ratio only!)
   - 3 km averaged measurements and <85 km observation averages – scene classified

Near Real Time delivery of L1b data + L2b processor for:
* numerical weather prediction (NWP)
* potential aerosol assimilation in forecast and climate models





Dusk/dawn orbit

Courtesy N. Žagar

ESA's Climate Change Initiative

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)."

Proposed to ESA Ministerial Council in Nov 2008.

Result: 6 Year Programme / 75 Meuro.

Table 1: ECVs for which satellite observations make a significant contribution (GCOS-138)

Domain	Essential Climate Variables
Atmospheric (over land, sea and ice)	Surface wind speed and direction; precipitation; upper-air temperature; upper-air wind speed and direction; water vapour; cloud properties; Earth radiation budget (including solar irradiance); carbon dioxide; methane and other long-lived greenhouse gases; and ozone and aerosol properties, supported by their precursors.
Oceanic	Sea-surface temperature; sea-surface salinity; sea level; sea state; sea ice; ocean colour.
Terrestrial	Lakes; snow cover; glaciers and ice caps;, ice sheets; albedo; land cover (including vegetation type); fraction of Absorbed Photosynthetically Active Radiation (FAPAR); Leaf Area Index (LAI); above-ground biomass; fire disturbance; soil moisture.

CCI Projects

DUE Projects

14 CCI Projects

www.esa-cci.org

esa

cloud_cci	***DWD (D)***
ozone_cci	***BIRA (B)***
aerosol_cci	***DLR/FMI (D/FI)***
ghg_cci	***U Bremen (D)***
sst_cci	***U Edinburgh (UK)***
land_cover_cci	***UCL (B)***
sea_level_cc	***CLS (F)***
ocean_colour_cci	***PML (UK)***
glaciers_cci	***U. Zurich (CH)***
fire _cci	***U.Alcala (E)***
sea_ice_cci	***NERSC (N)***
soil_moisture_cci	***TU Wien (A)***
ice_sheet_cci	***DTU Space (DK)***
CMUG	***UKMO - Hadley Centre (UK)***

CCI Project Cardinal Requirements

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 satellite data products for climate research and modelling

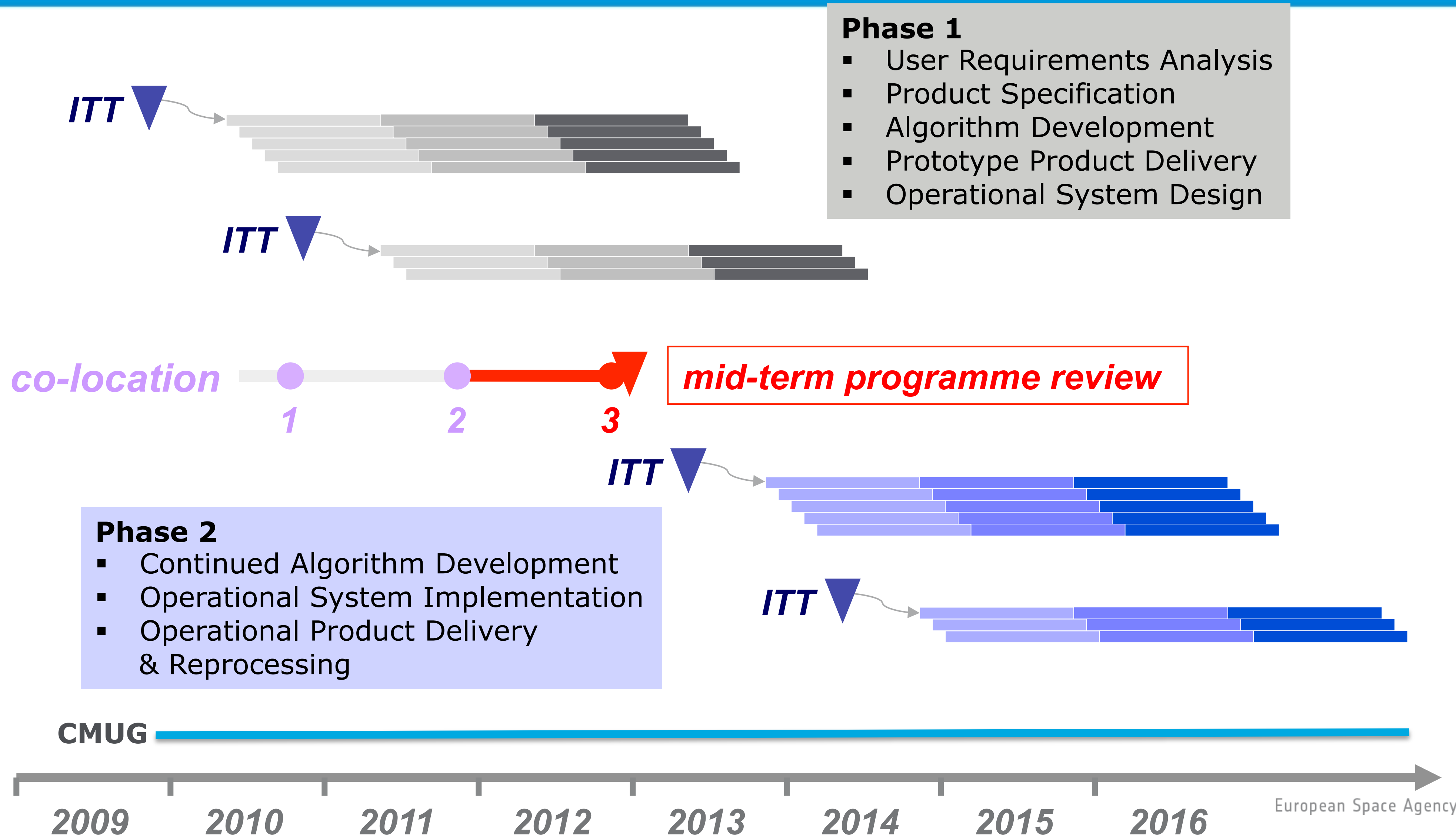
3. Optimize impact of ESA EO missions data on climate data records

4. Generate complete specifications for an operational production system

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

Not forgetting some CCI Principles:
Transparency, open access to documentation and results, international collaboration, rigorous uncertainty characterisation

CCI Programme Overview



Aerosol_CCI: Team

Science Leaders:
Thomas Holzer-Popp (DLR) & Gerrit de Leeuw (FMI)

EO team

DLR, Finnish Meteorological Institute (Ilmatieteen laitos / Meteorologiska institutet), Freie Universität Berlin, Rutherford Appleton Laboratory (Science & Technology Facilities Council), CNRS INSU, aeronomie.be, KNMI, Swansea University / Prifysgol Abertawe, University of Oxford, University of Bremen Institute of Remote Sensing, HYGEOS

system engineer team

DLR, Rutherford Appleton Laboratory (Science & Technology Facilities Council), University of Oxford, CNRS INSU

user / validation team

CNRS INSU, Meteorologisk institutt (met.no), Max-Planck-Institut für Meteorologie, Paul Scherrer Institut (PSI), NILU

CMUG
UK Met Office
ECMWF
Meteo France
MPI-Met

Phase 1: 2010 – 2013
Phase 2: 2014 – 2017
www.esa-aerosol-cci.org

Aerosol_CCI: Phase 1 Approach (2010-2013)

- Improve algorithms: Workshops + experiments (1 month)
  - Optical models, cloud masks, (surface)
  - Post-processing (cloud contamination, bright surface)

Holzer-Popp, et al., AMT 2013

- Select algorithms: Round robin exercise (4 months)
  - Best versions for all algorithms

de Leeuw et al., RSE 2013, in press

- Produce selected ECV products (entire 2008)

Kinne, et al., in preparation

- At all steps application of the same validation tools and statistics
  - Level 2 and level 3
  - Global + regional statistics
  - Scoring (spatial / temporal correlation)
  - Against AERONET / MAN + MODIS / MISR / CALIPSO

Aerosol_CCI: data products

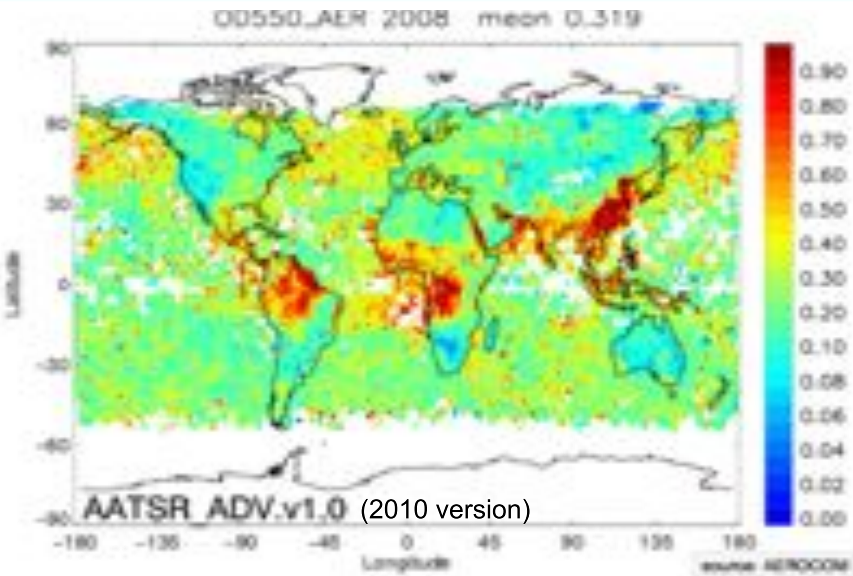
Parameter	Sensor (Algorithms)	Coverage
AOD, Ångström	ATSR-2 + AATSR (ADV, SU, ORAC)	1995 – 2012, global
AOD, Ångström	MERIS (ALAMO) MERIS (ESA STD)	2008, ocean only 2008, ocean and land
Absorbing Aerosol Index	OMI (GOME, TOMS)	1978 – 2012, global
Stratospheric extinction vertical profiles & AOD	GOMOS	2008, global
AOD, Ångström	MERIS (BAER)	2008, global
AOD, aerosol type	SCIAMACHY + AATSR (SYNAER)	3/6/9/12 2008, global
AOD, Ångström	AATSR + MERIS (SYNERGY)	3/6/9/12 2008, global
Stratospheric extinction	GOMOS + OSIRIS	2003, global
AOD, aerosol properties	POLDER (GRASP)	Example scenes, land
Absorbing AOD (SSA)	AATSR + MERIS	Examples, glint areas

All products contain pixel level uncertainties & quality flags

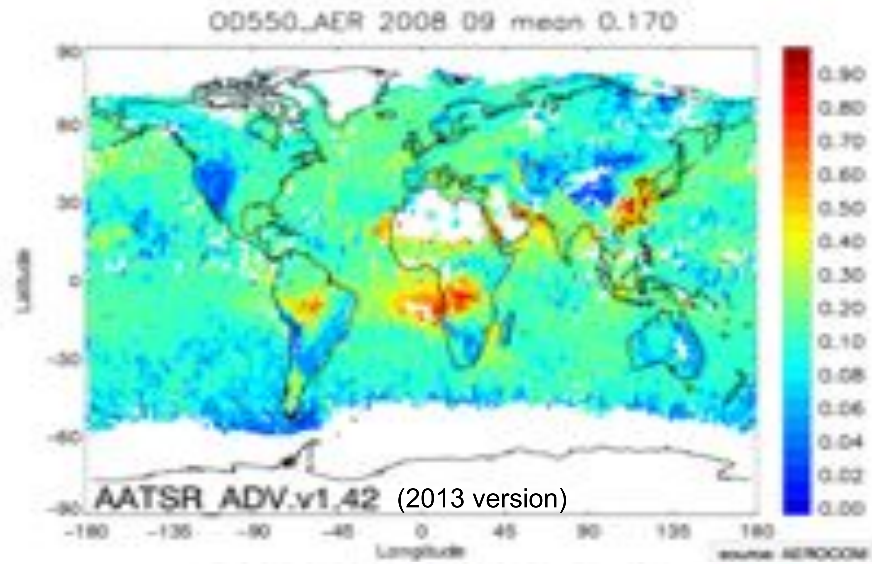
AATSR Retrieval Improvements – FMI example

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

September 2008



(2010 version)



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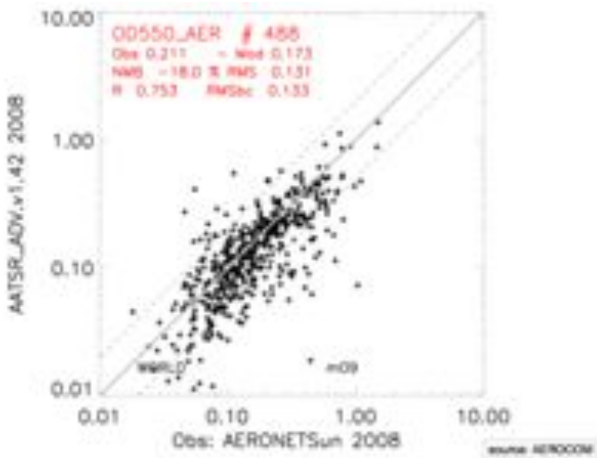

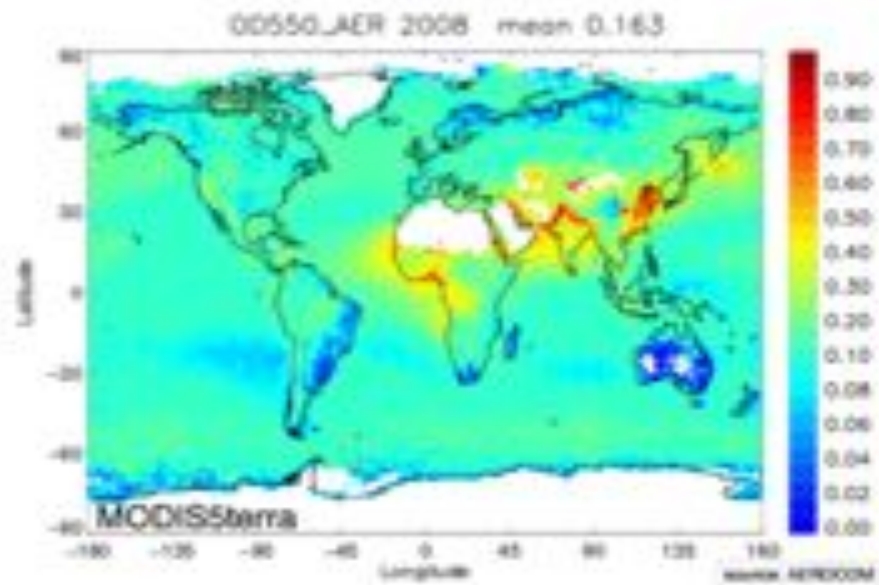

Credit: G. de Leeuw, L. Sogacheva, P. Kolmonen, FMI

Summary of improvements

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FINNISH METEOROLOGICAL INSTITUTE

Changes accepted in ADV

- X Common aerosol models
- \- Fine mode fraction is optimised in ADV (Set2)
- X Cloud edge treatment (as post-processing
- X Ocean module (ASV) corrected
- \- uncertainty estimation
- X solar zenith angle increased up to 75 degree
- X BT12 limit in cloud detection module decreased to 273K
- \- Forward pixel (i+2, j+1) collocated to nadir (i,j)
- X drift correction for ATSR2 implemented
- X monthly wind speed climatology over ocean

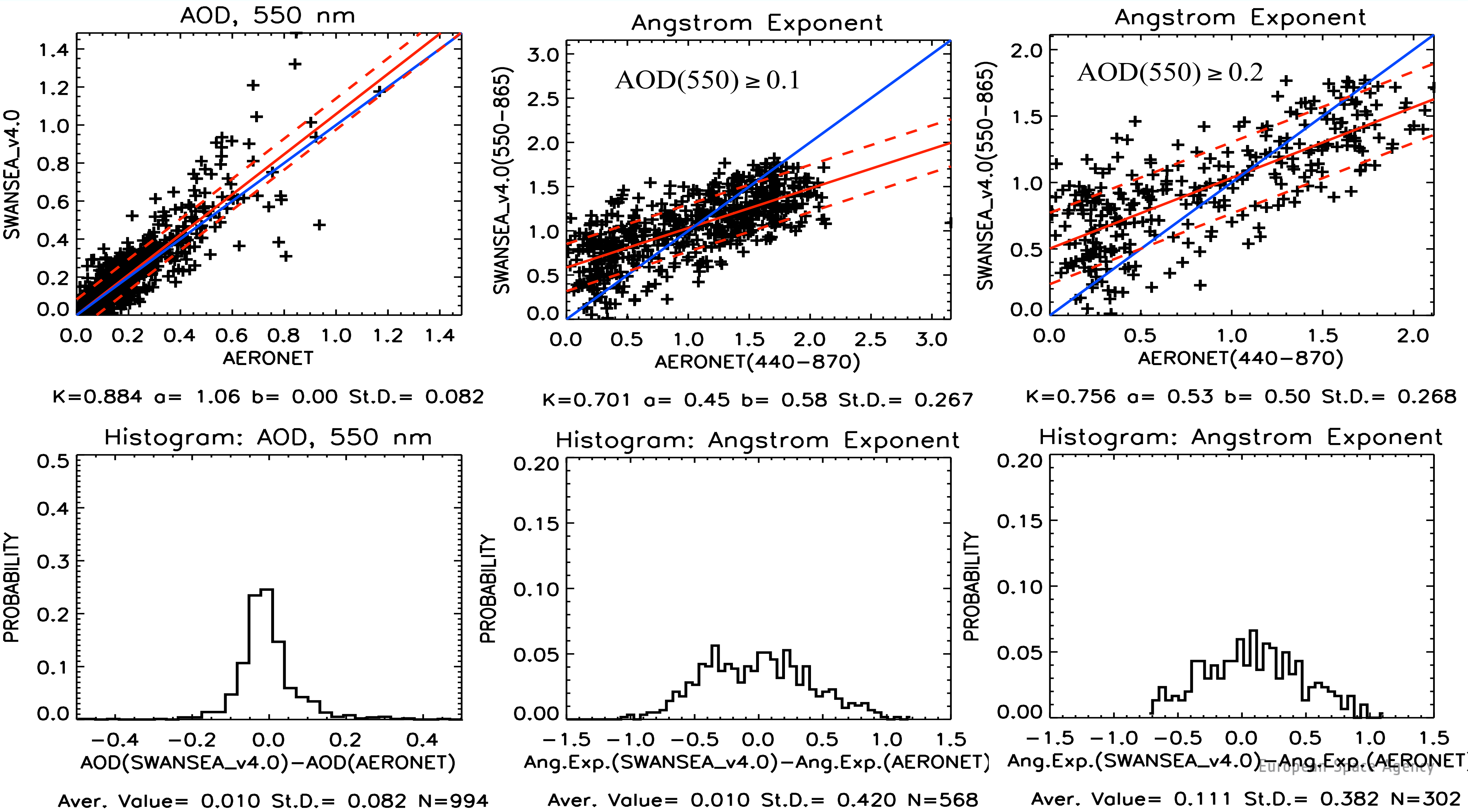
Some of the problems in ADV/ASV at the beginning of the project:

- V Overestimation over ocean
- V Cloud contamination
- V Aerosol models (spherical dust in ADV)
- <?> Retrieval over bright surface
- V Coverage
- V ASTR2 ?
- V Two separate algorithms for high ($1km^2$) and low ($10km^2$) resolution

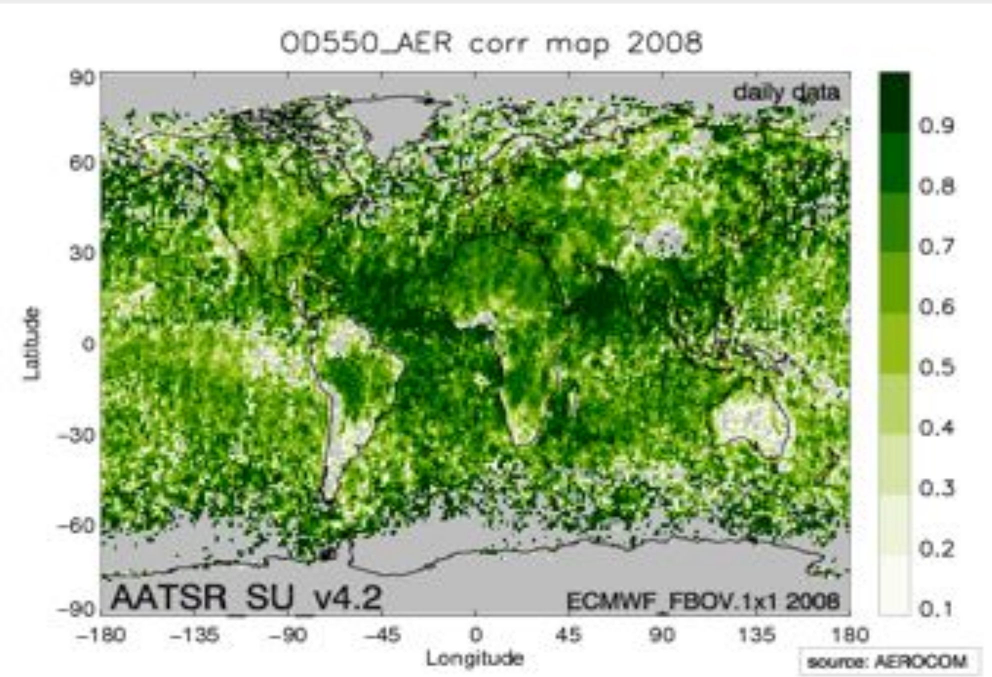
ADV_2.10

AATSR Swansea v4.0 Land (17yr time series)

Credit: P. North & A. Heckel, U. Swansea

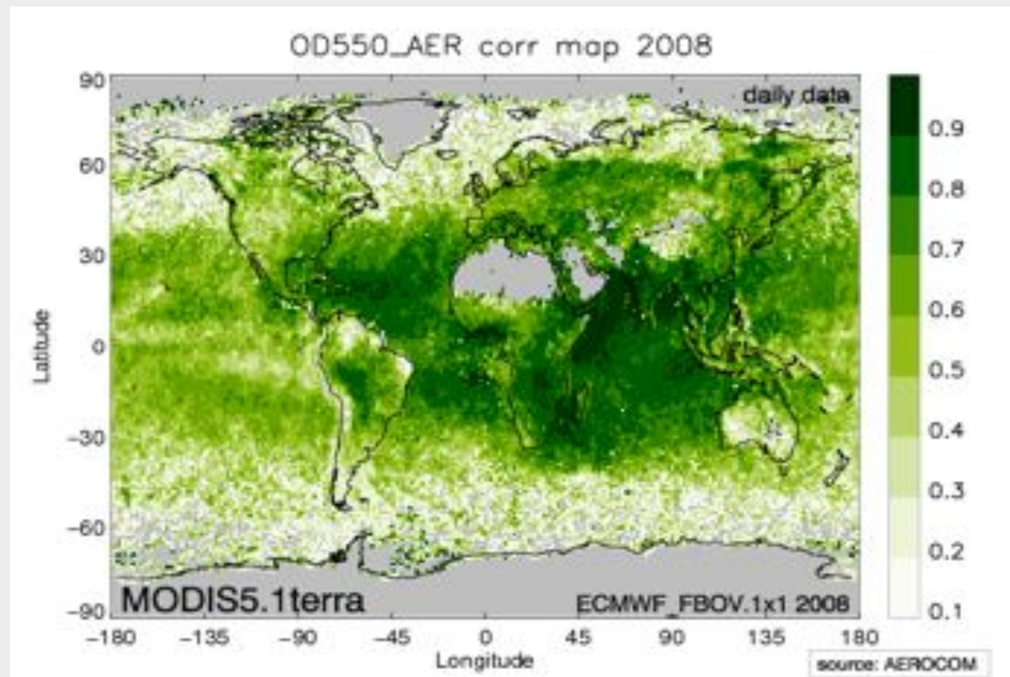


How does SU 4.2 compare to a model Reanalysis: ECMWF_FBOV



SU 4.2 correlation vs. ECMWF_FBOV

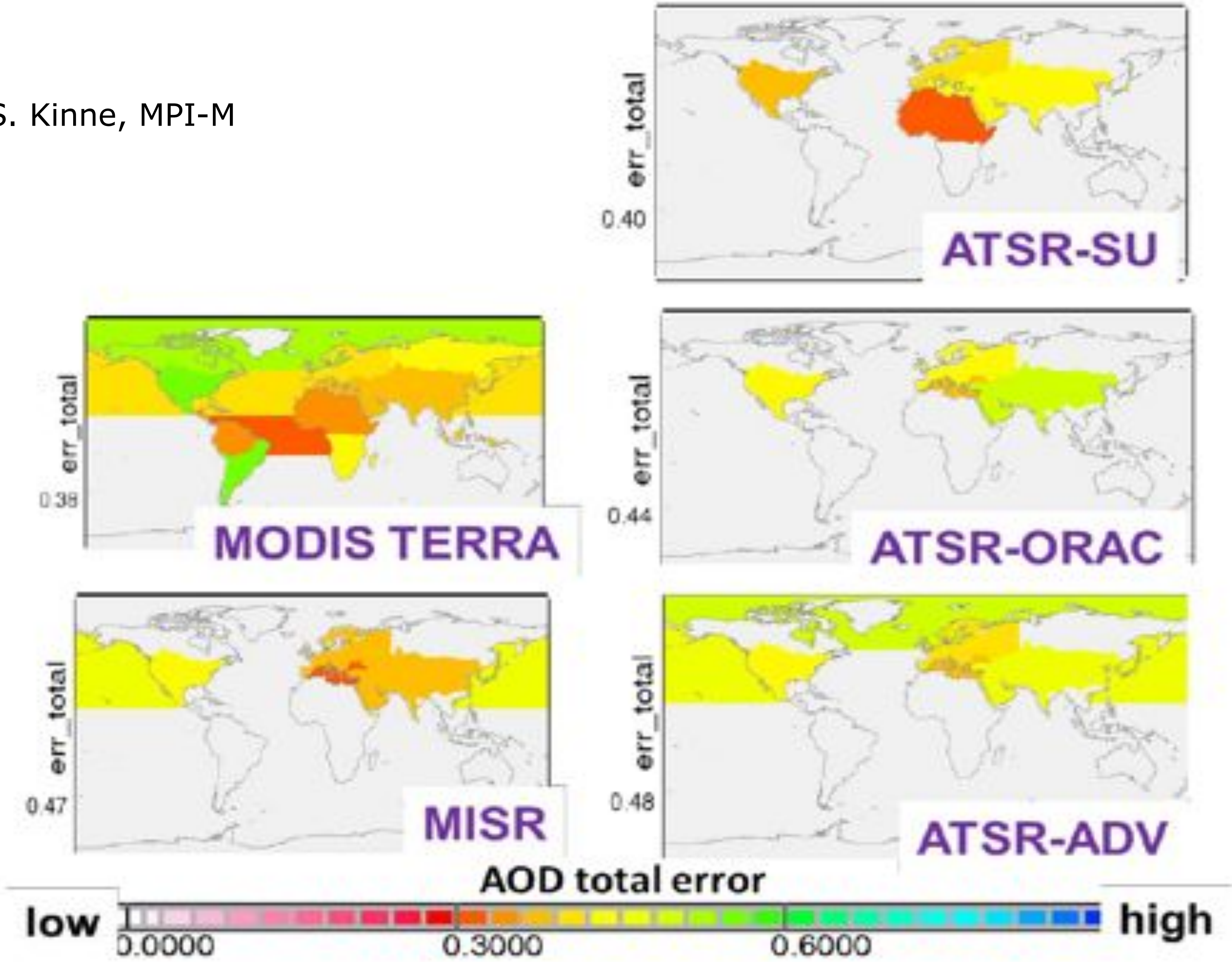
MODIS5.1terra vs. ECMWF_FBOV



Credit: J. Griesfeller & M. Schulz, NMI (met.no)

Validated products:
Lv3 scoring (correlations x,t)

Credit: S. Kinne, MPI-M



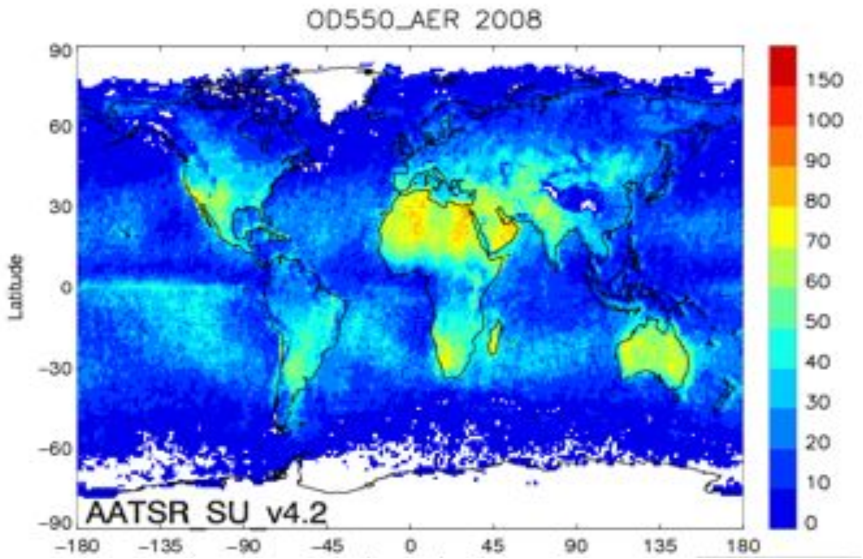
Statistics vs. AERONET Year 2008 World

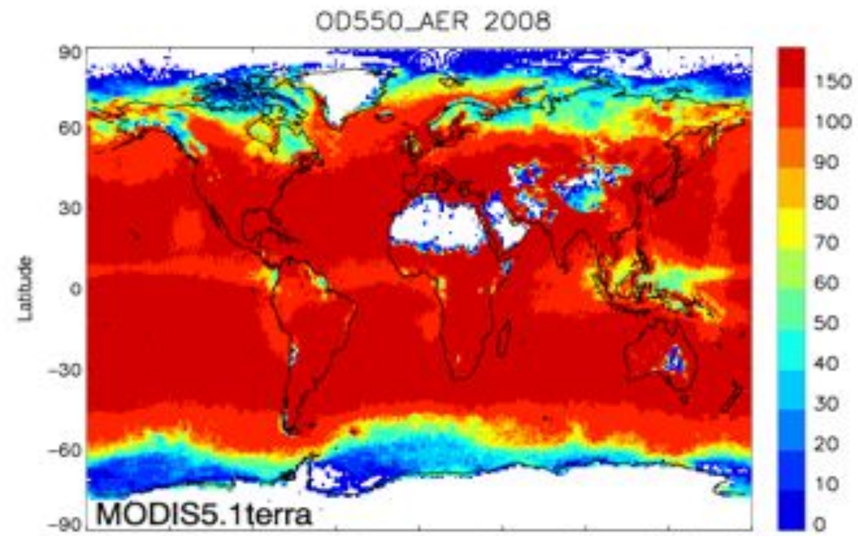
Retrieval name	NumObs	R-CORR	RMS	NMB	RMSbc
AATSR_SU_v4.2	4809	0.759	0.16	-5.85	0.16
AATSR_ADV.v1.42	5192	0.816	0.13	-13.40	0.14
AATSR_ORAC.v2.02	4828	0.744	0.13	2.24	0.13
ECMWF_FBOV.1x1	33307	0.765	0.15	13.90	0.15
MODIS5.1aqua	21777	0.799	0.15	17.40	0.13
MODIS5.1terra	22665	0.821	0.15	15.10	0.13

Meteorologisk institutt met.no

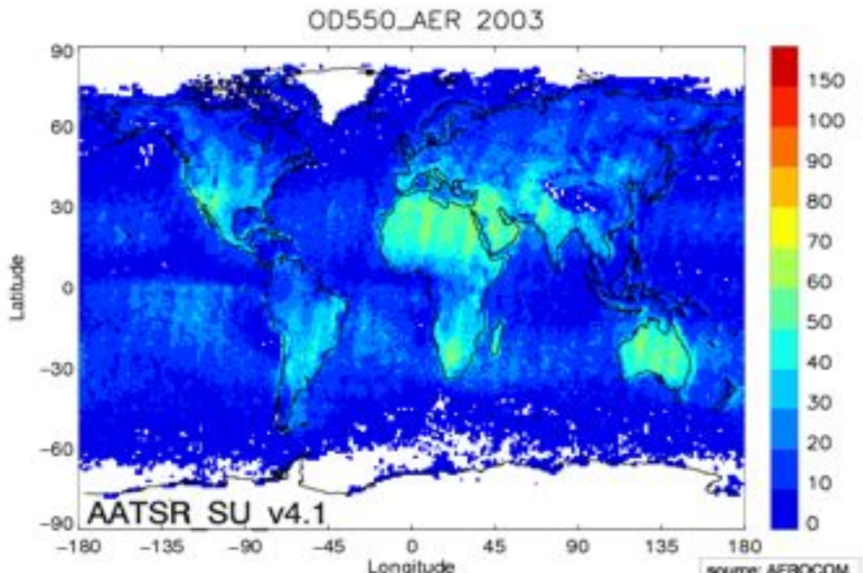
Credit: J. Griesfeller & M. Schulz, NMI (met.no)

NB: AATSR Coverage is Low w.r.t. MODIS - swath is only 500km wide

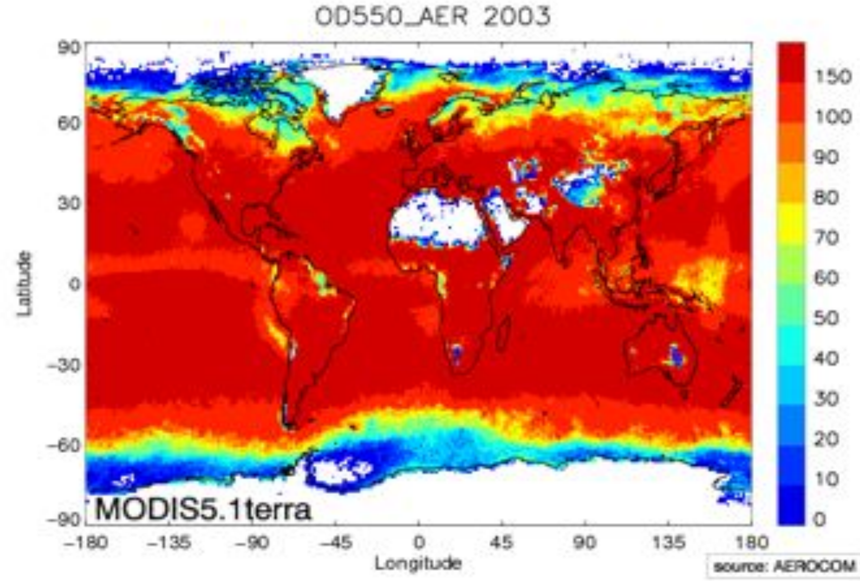




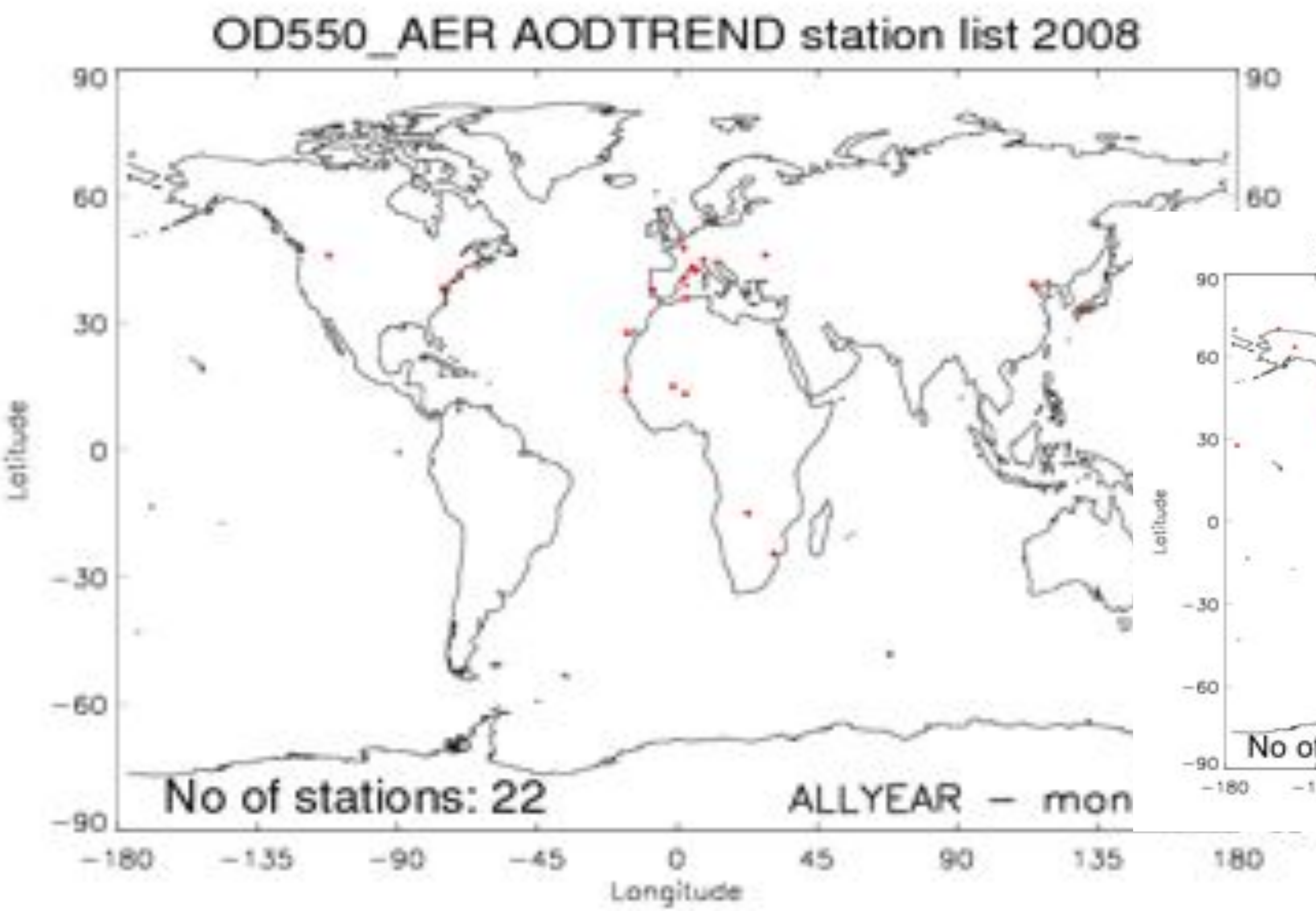
2008

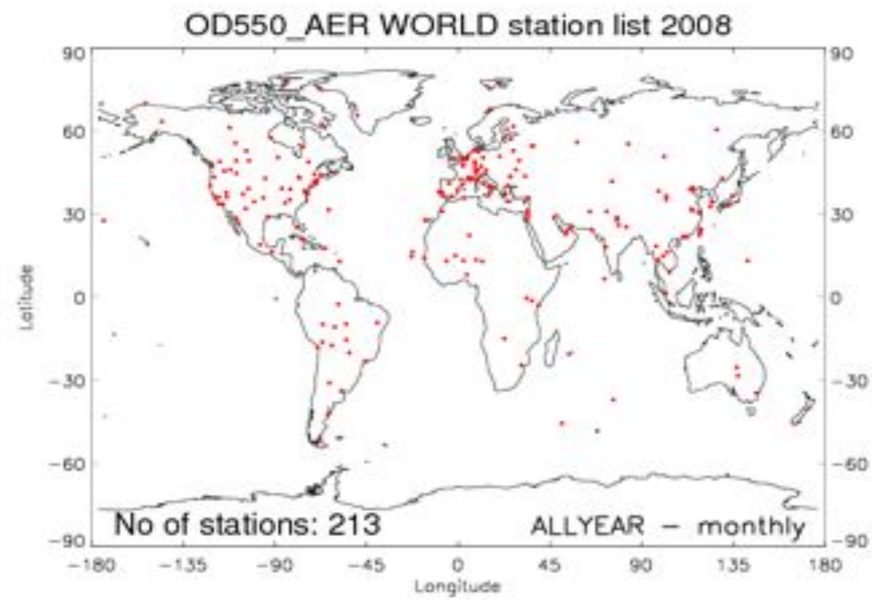


2003



Long term AERONET sites for trend analysis

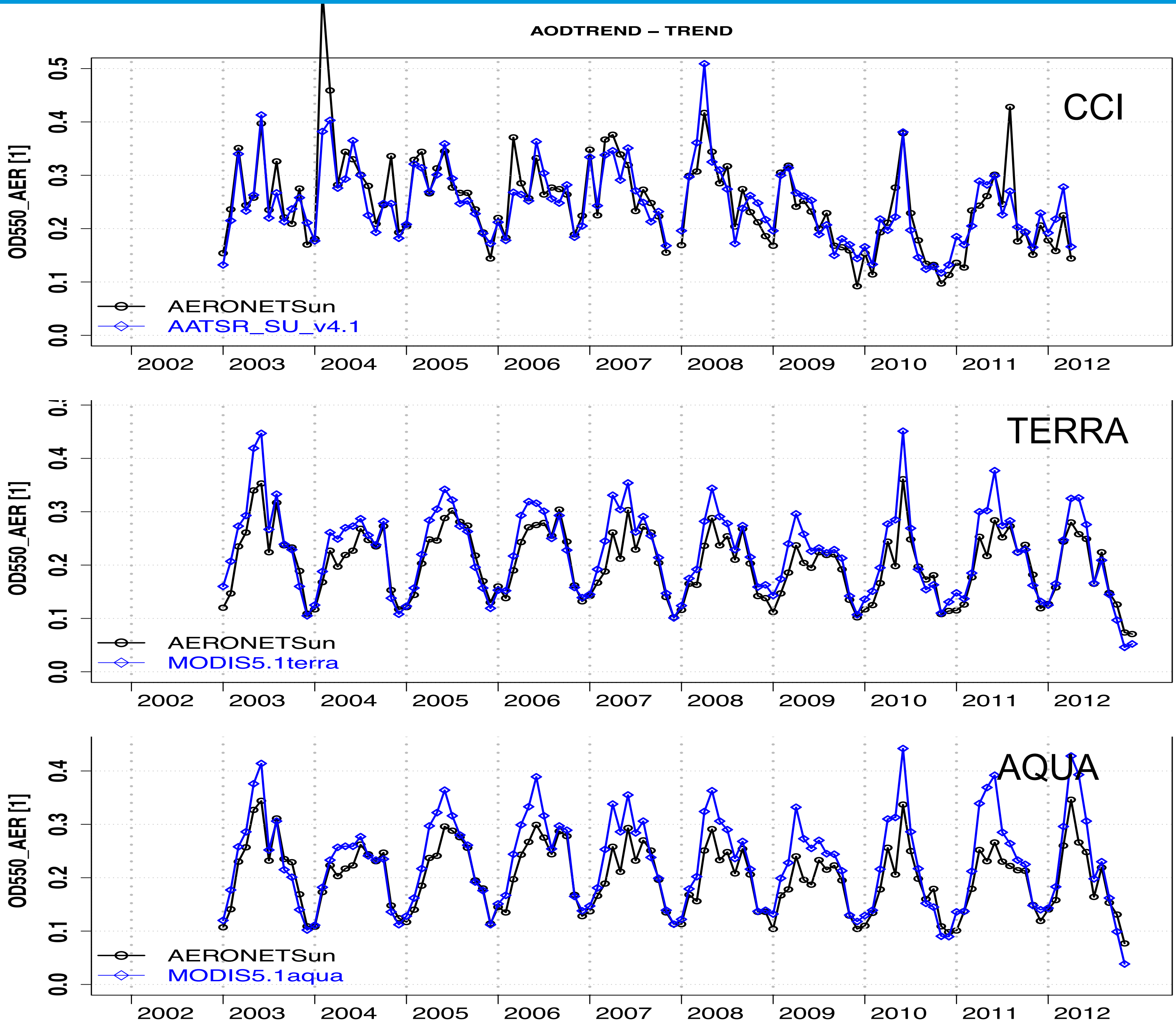




Meteorologisk institutt met.no

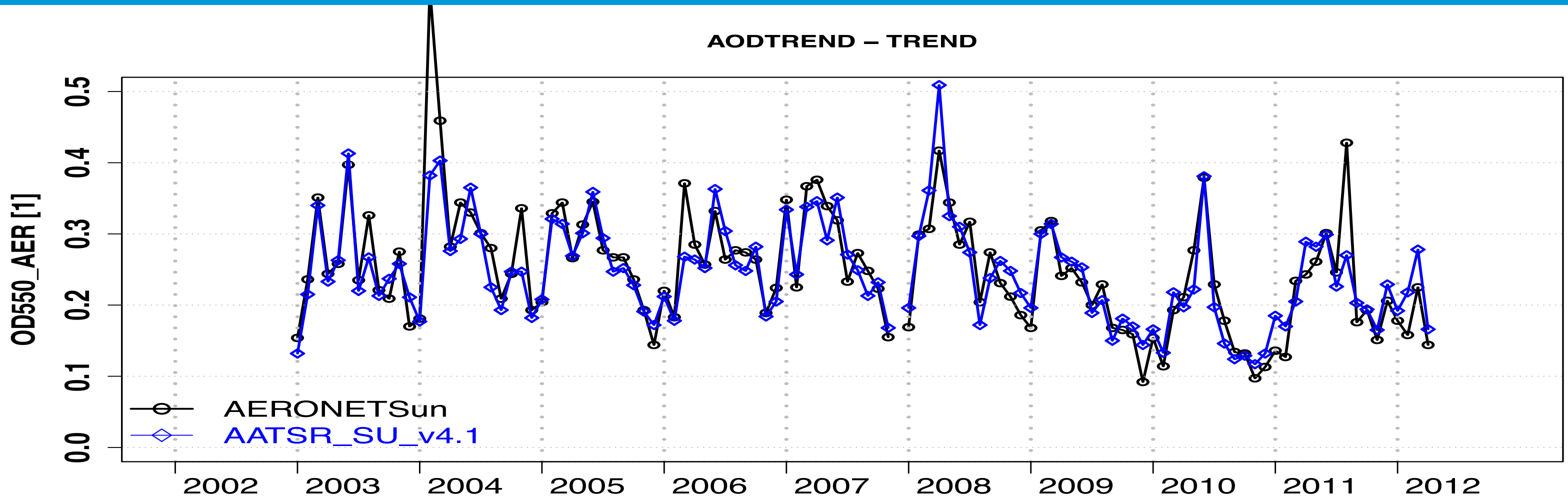
European Space Agency

Credit: J. Griesfeller & M. Schulz, NMI (met.no)

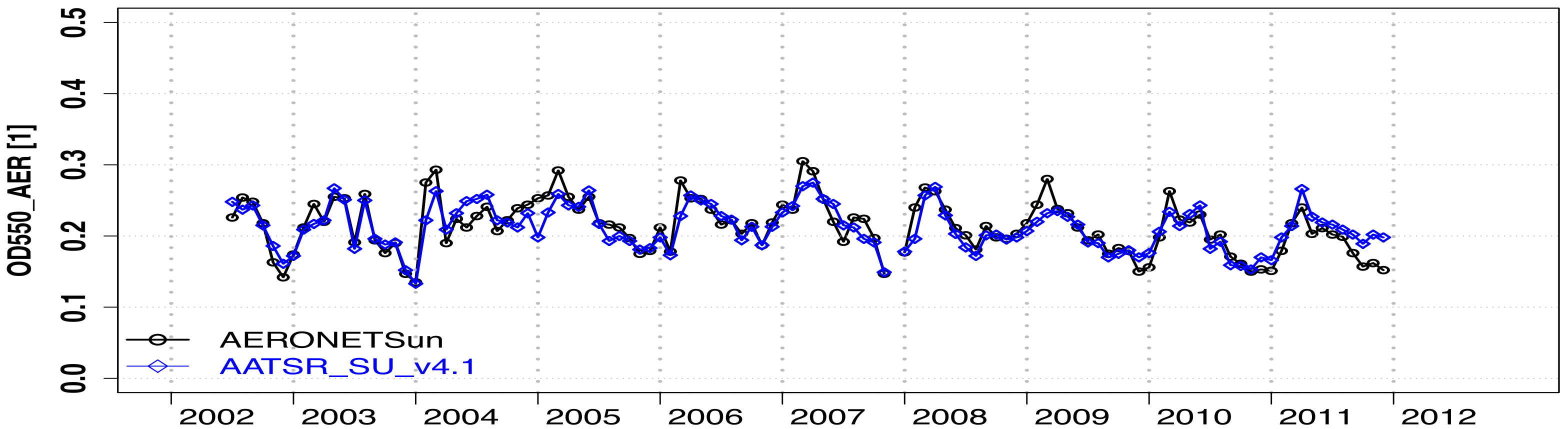


Credit: J. Griesfeller & M. Schulz, NMI (met.no)

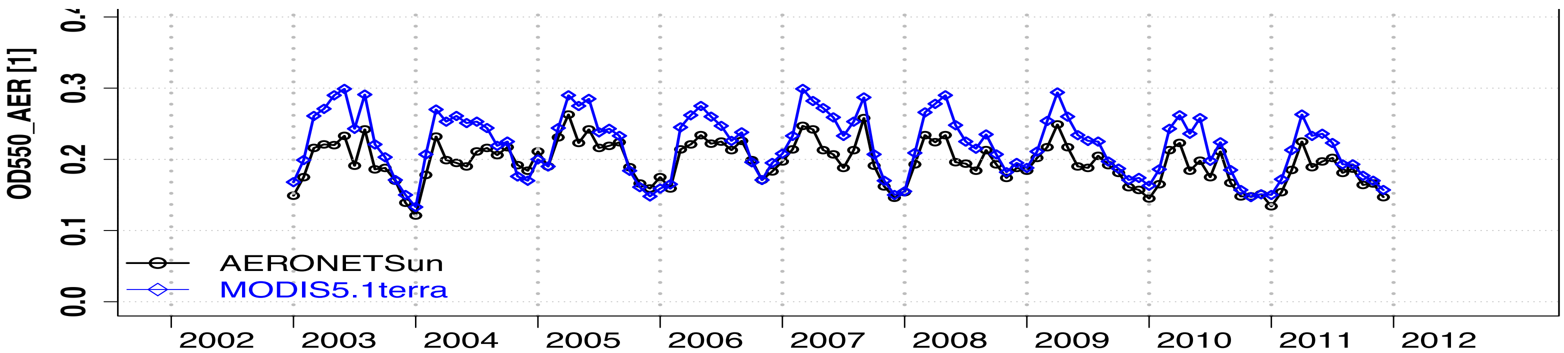
SELECTED SITES CCI



ALL AERONET WORLD CCI



MODIS TERRA

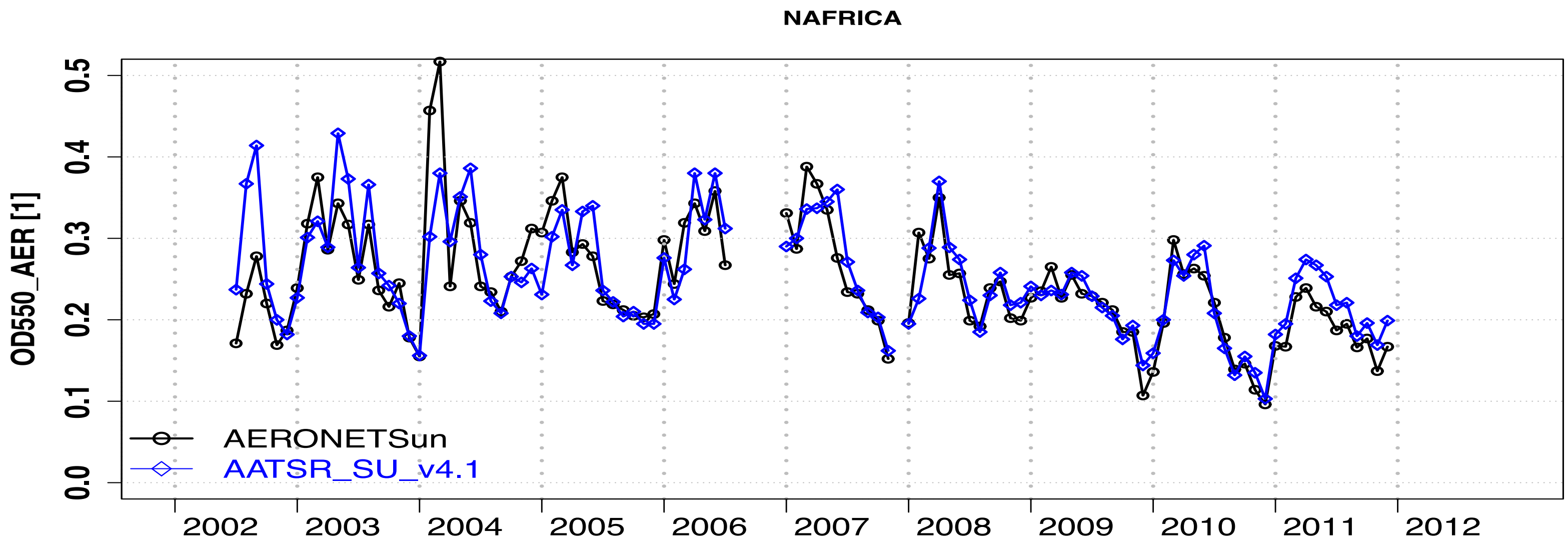


Meteorologisk institutt met.no

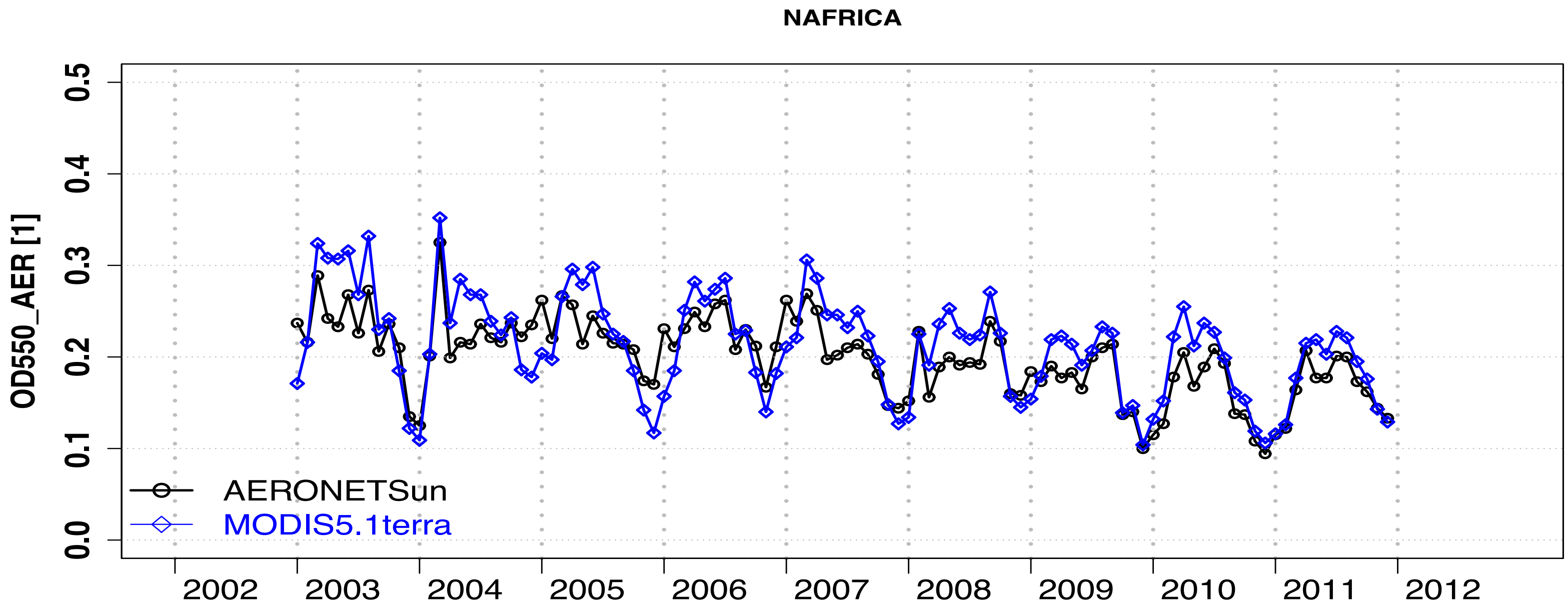
Credit: J. Griesfeller & M. Schulz, NMI (met.no)

N Africa
Trends

CCI



MODIS



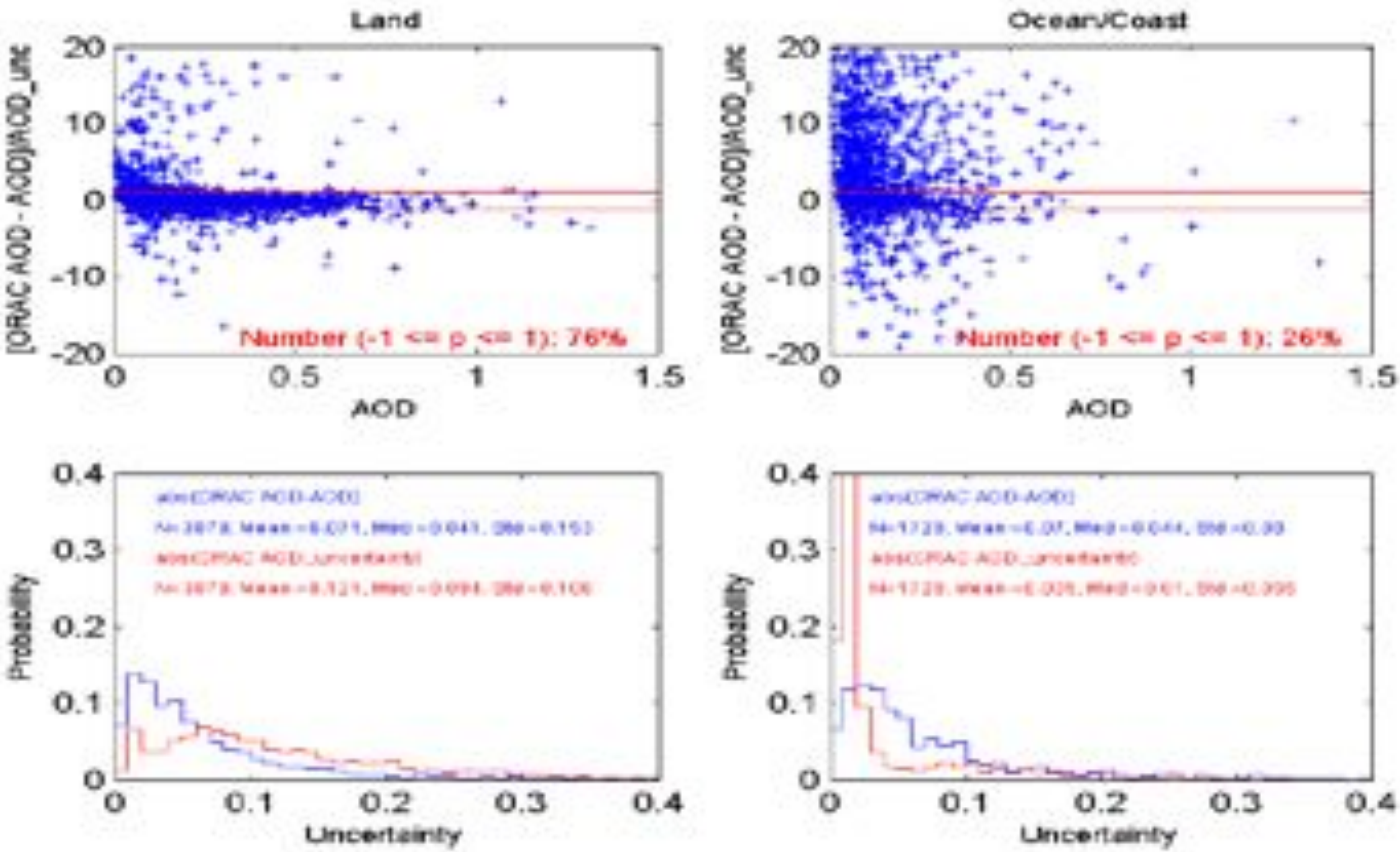
Meteorologisk institutt met.no

European Space Agency

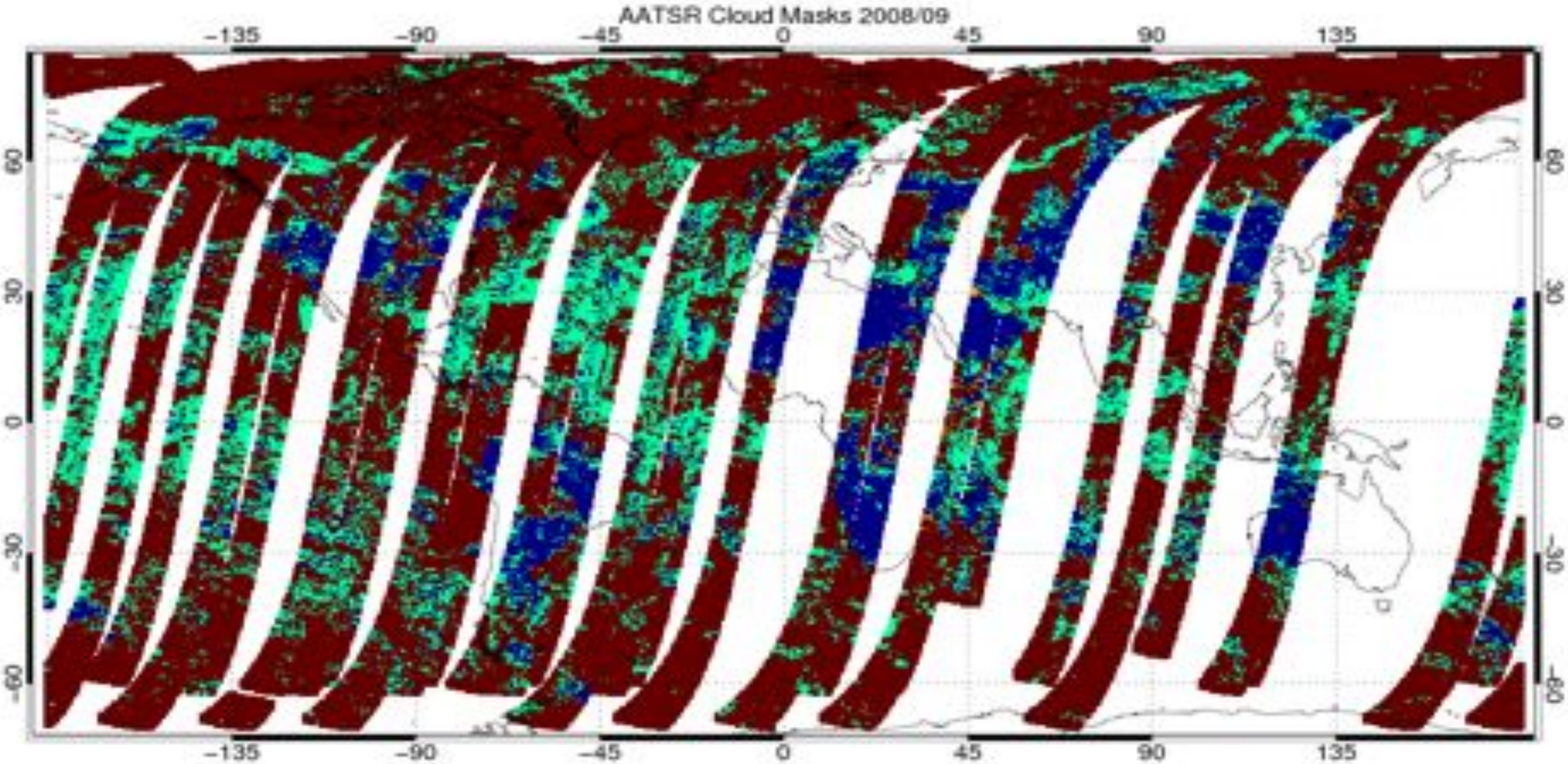
Credit: J. Griesfeller & M. Schulz, NMI (met.no)

Uncertainty Estimates: AATSR ORAC

Credit: G. Thomas, D. Grainger, U. Oxford



Cloud mask consistency: Aerosol_CCI / Cloud_CCI

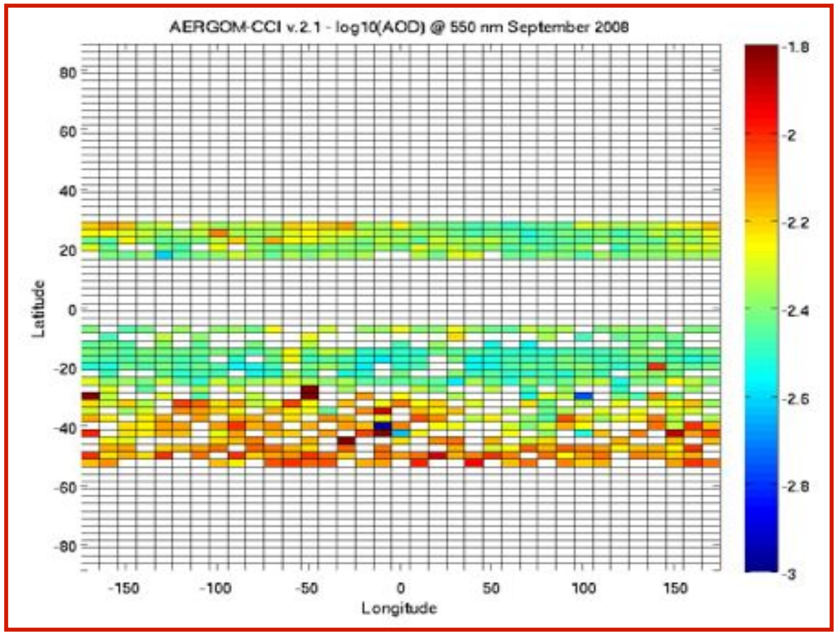


Credit: L. Klueser, DLR & Stefan Stapelberg, DWD

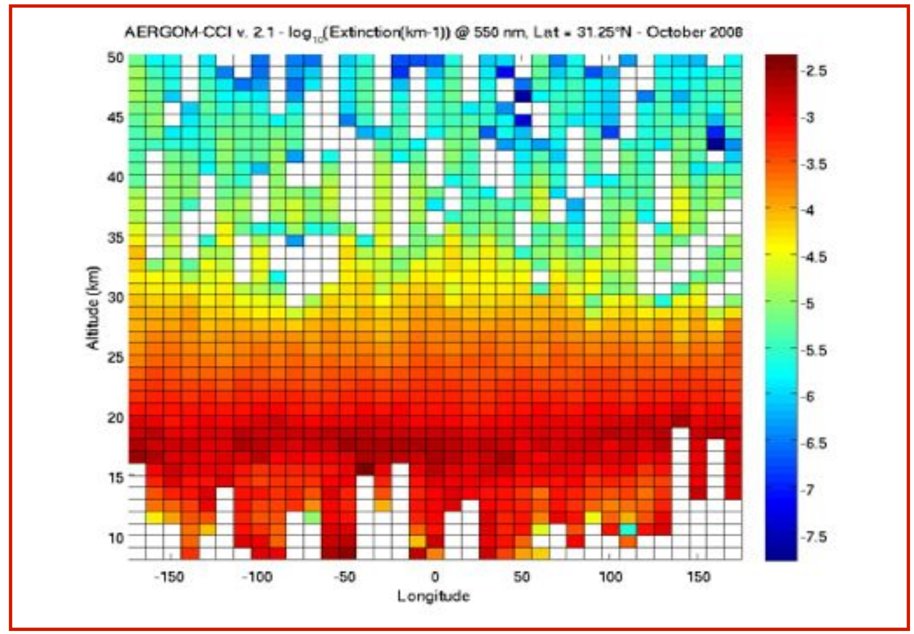
GOMOS: Stratospheric Aerosol

- 3D resolution in the stratosphere as needed for atmospheric and climate modelling, geoengineering, atmospheric retrieval
- Insight into spatially resolved particle size information
- Occultation experiment retrieval based on robust techniques to provide reference datasets for limb sounders

aeronomie.be

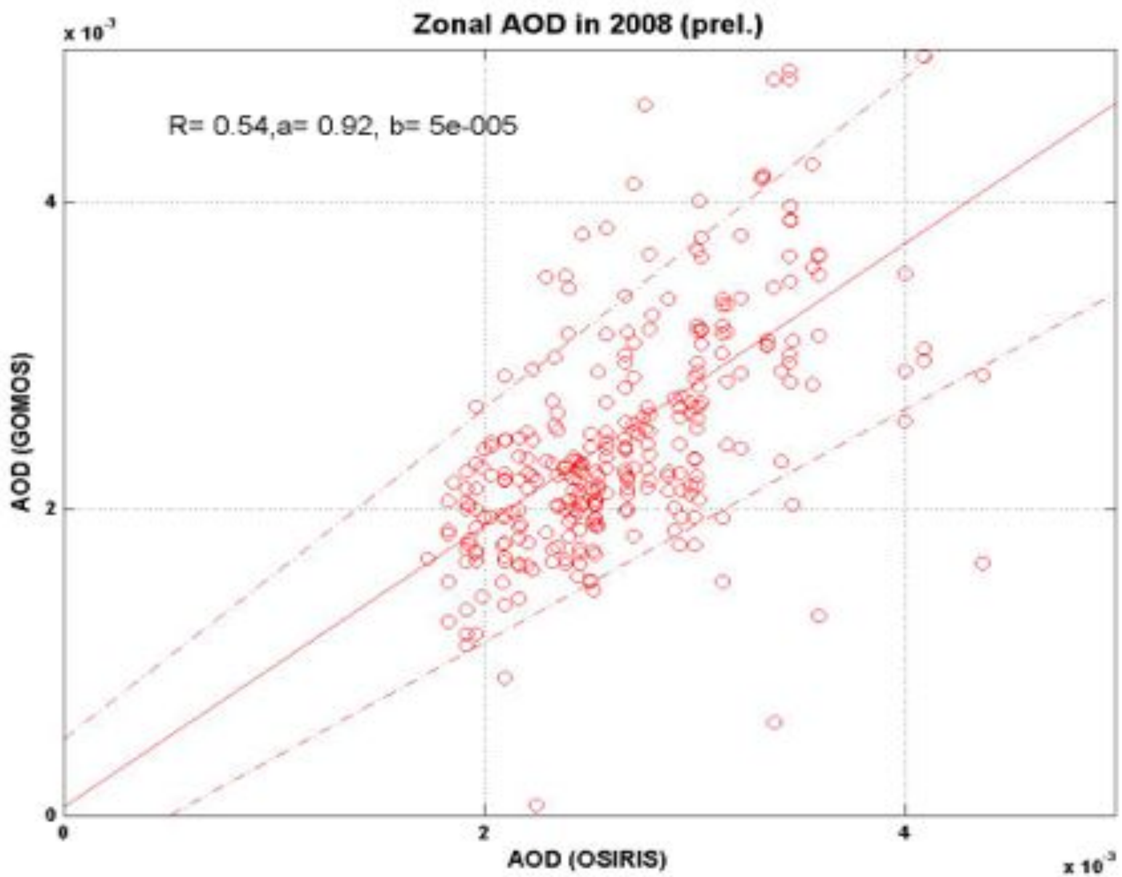


Stratospheric AOD550



Zonal extinction profiles

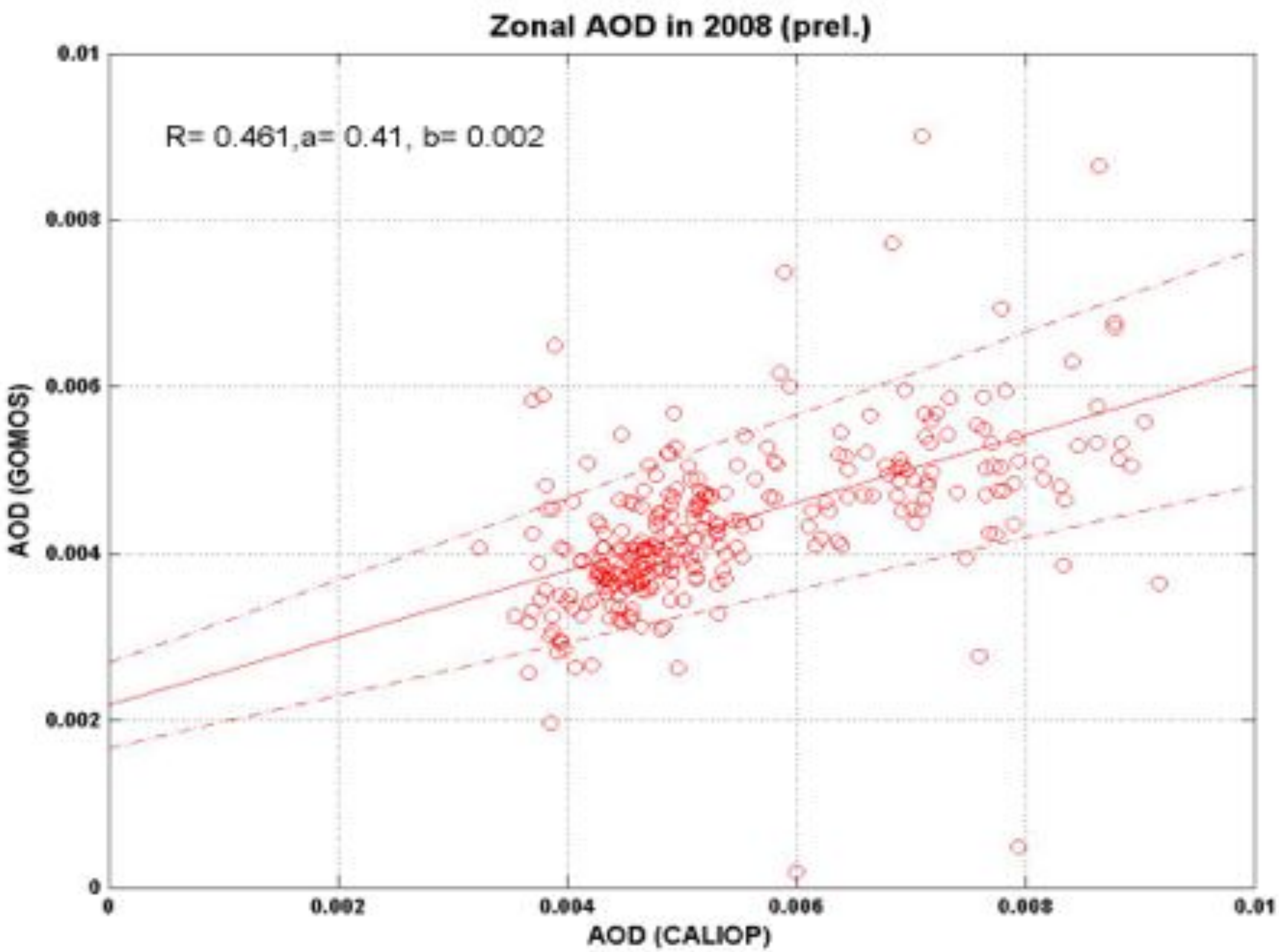
GOMOS - OSIRIS: Intercomparison



Zonal Averages

Credit: C. Bingen & C. Roberts, BIRA
K. Stelzer, NILU

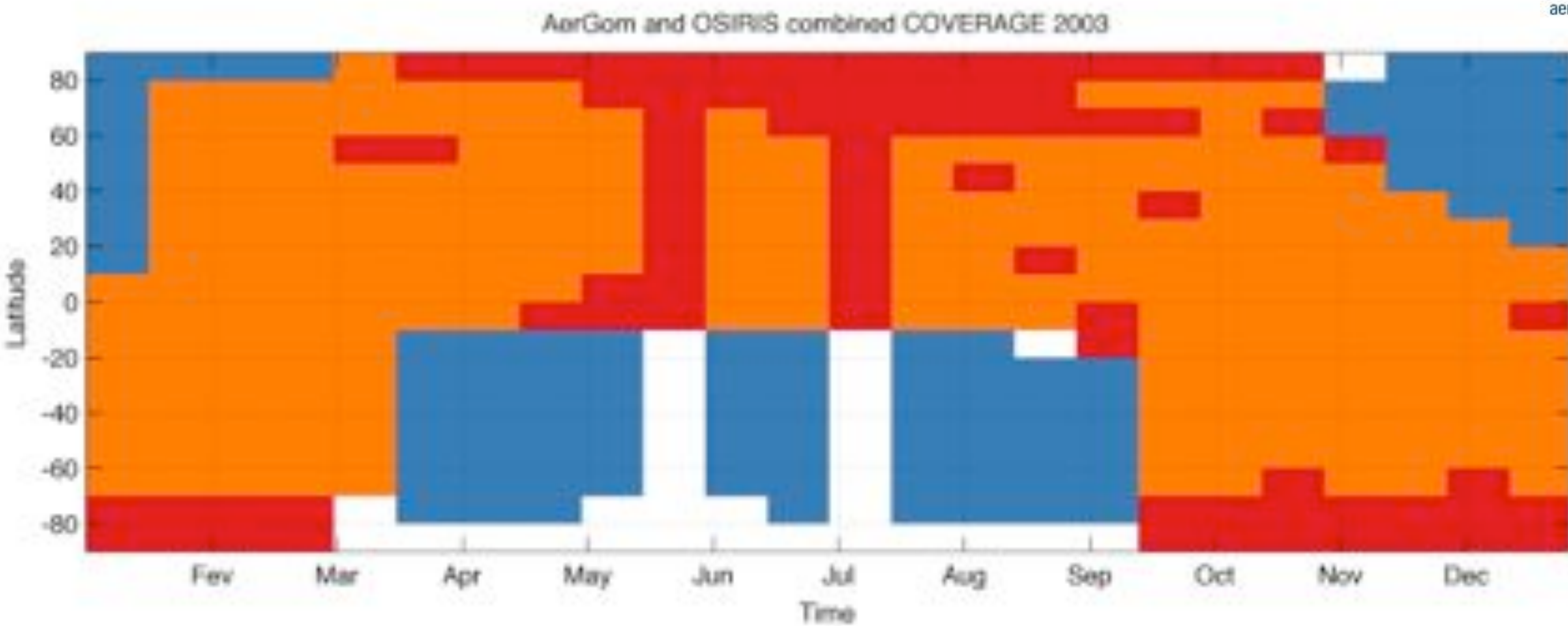
GOMOS - CALIOP: Intercomparison



Credit: C. Bingen & C. Roberts, BIRA
K. Stelzer, NILU

GOMOS + OSIRIS: Coverage

Binning parameters: Δt=15 days ; Δlat=10 ; Δz=1km

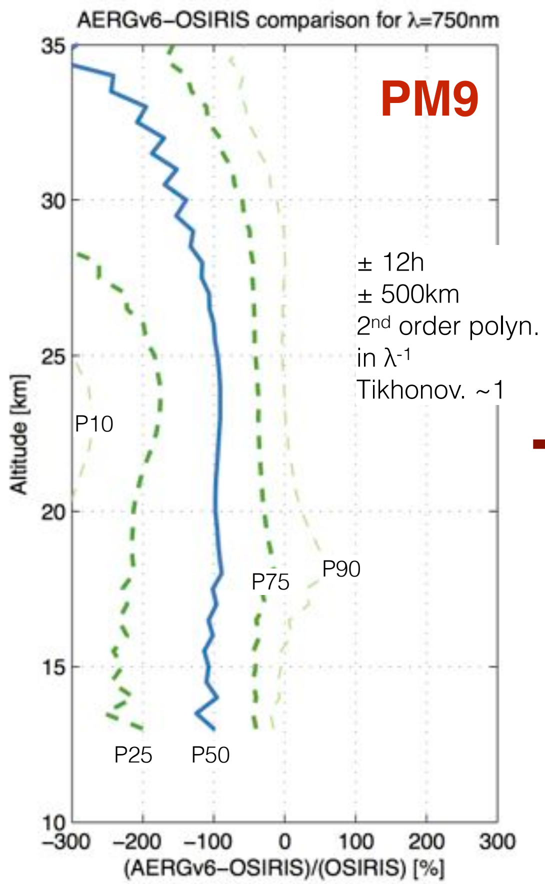


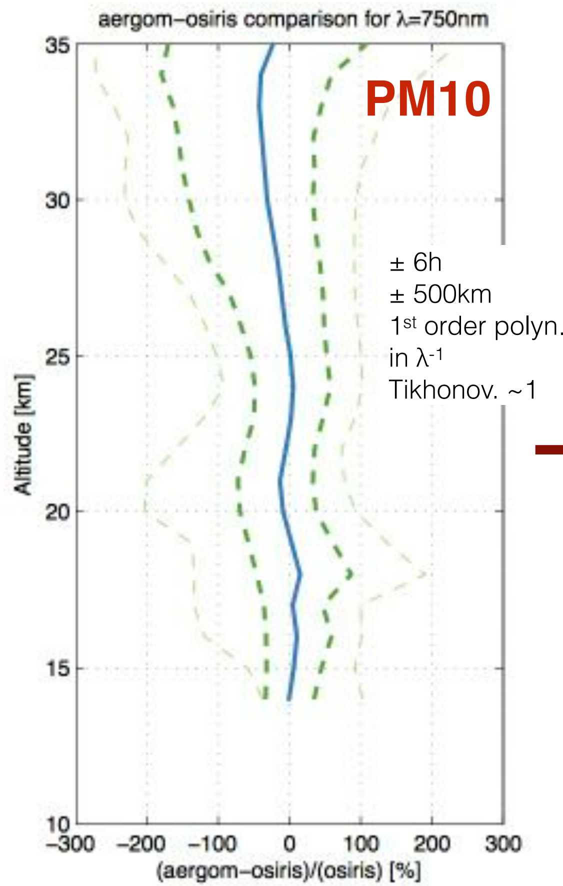
combined AerGom OSIRIS No data

Credit: C. Bingen, BIRA

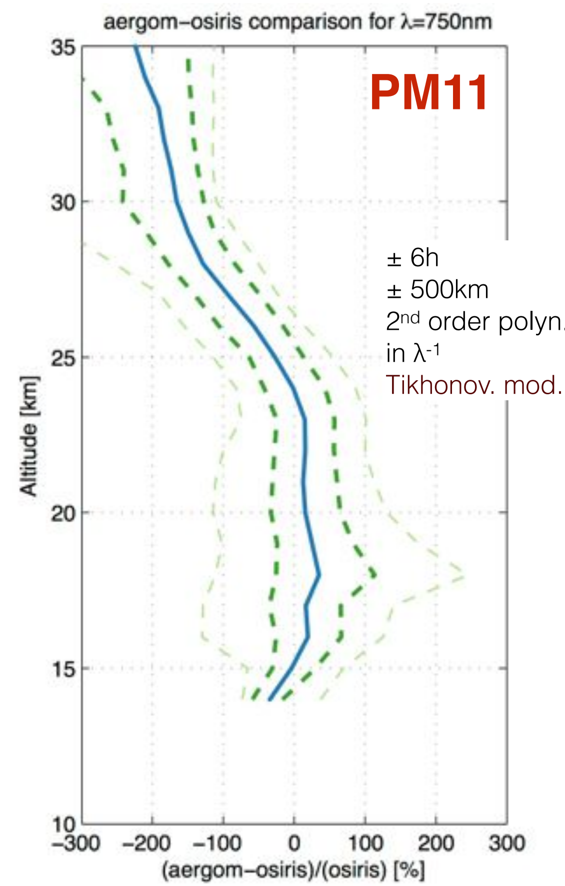
GOMOS + OSIRIS: Bias

- Challenge: GOMOS results are best for λ∼500 nm while OSIRIS output is only available at 750 nm.





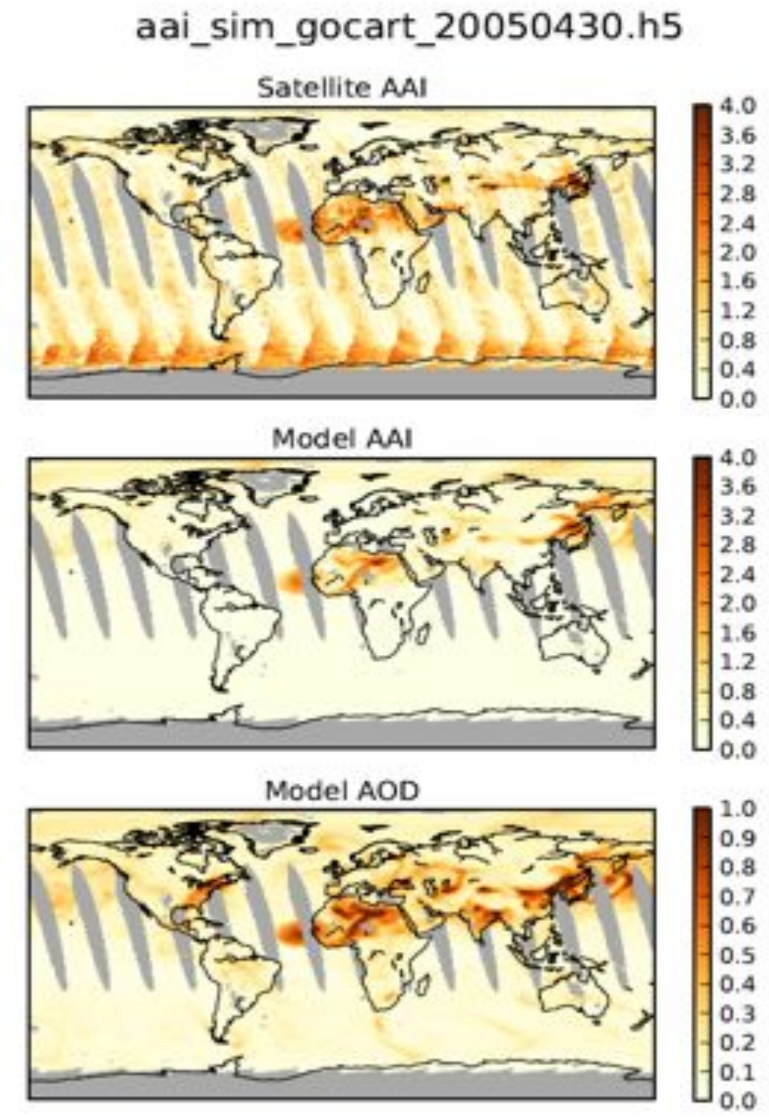
Official AerGom !



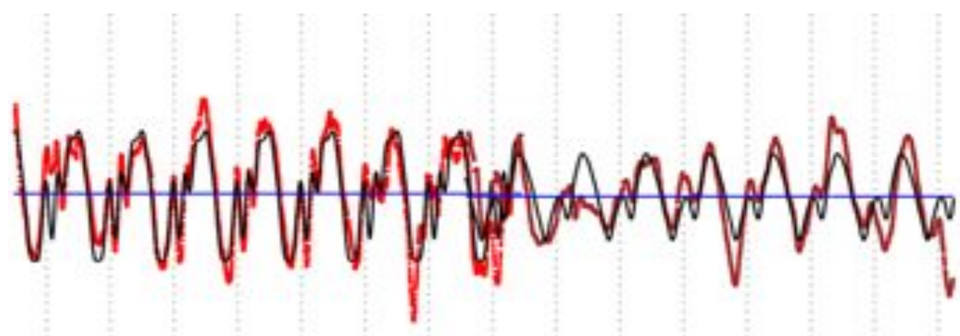
e Agency

Credit: C. Bingen & C. Roberts, BIRA

OMI: Absorbing Aerosol Index



- Indication of absorbing aerosols not hindered by cloud coverage
- Long-term record: 30+ years of daily, global data
- Can be used together with AOD for simple aerosol typing
- Connection between measurement & models via AAI simulation
- Tools for AAI error characterization and quantification



Credit: P. Veefkind & D. Stein-Zweers, KNMI

OMI + GOME-2: Merged AAI

Merging AAI from different instruments is hampered by large bias.

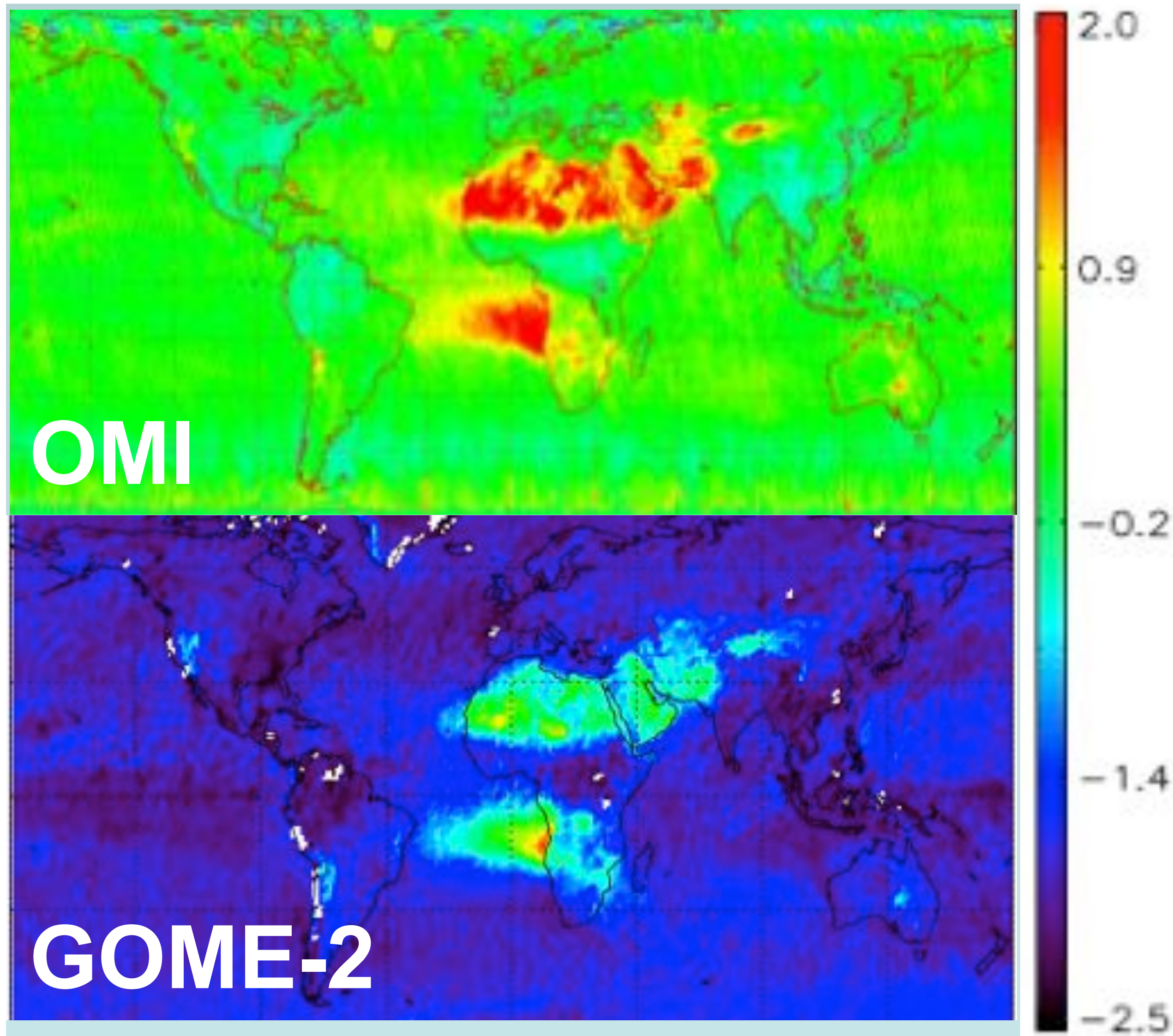
Attempt to understand source of bias in CCI has so far failed.

Suspect L1 calibration problems?

Further work will be indertaken in CCI Phase 2.

Credit:

P. Veefkind & D. Stein-Zweers, KNMI



KNMI

Harmonized product sheets

Characteristics	Information
name	**SU algorithm v4.0** ENVISAT / AATSR + ERS-2 / ATSR-2
provider	Swansea University
contact	P.R.J.North@swansea.ac.uk
parameters	4 AOD, 3 mixing fractions, Ångström coefficient
algorithm features	**Main principle: Dual view**
	Cloud mask: ESA standard
	Aerosol model: Aerosol_cci 4 common components
	Surface: BRDF model
	Other: -
main advantage	**17 year time series, includes retrieval over deserts**
limitations	**coverage (512 km swath), moderate accuracy over ocean**
rmse/bias/correlation (land)	0.08 / -0.01 / 0.86 (daily 1°AOD550 vs. AERONET – 1394 pts.)
rmse/bias/correlation (sea)	0.08 / -0.02 / 0.78 (daily 1°AOD550 vs. AERONET – 87 pts.)
coverage	2008, global (except polar latitudes)
resolution	Daily, 10x10 km2
continuation	Sentinel-3 / SLSTR

Aerosol_CCI Phase 2 (2014-2017) New Developments

Major improvements planned:

- Extend the limited time series (typically one year) to full mission / dataset length (10 – 20 years)
- Improve the accuracy of mature datasets further to bring them closer to the GCOS requirements
- Improve experimental retrievals up to user acceptable level and establish the quality of new datasets
- Conduct dedicated efforts to consolidate algorithms over ocean, to improve cloud clearing and to improve surface treatment for nadir only algorithms
- Consolidate pixel level uncertainty estimation
- Use additional information content in the thermal spectral range (IASI sensor, thermal radiometer bands)
- Extend the comprehensiveness of validation globally by analyzing multi-annual datasets
- Assess the long-term stability and overlap consistency of the full time series
- Further assess the retrieved aerosol type information
- Improve the validation capability where only few ground-based measurements are available by using long-term datasets from the POLDER instrument (with highest information content) as reference over ocean (standard product) and remote land regions (innovative product)
- Four user case-studies making use of the mature CCI products, also providing a mechanism to stimulate user-feedback

Aerosol_CCI Phase 2: Products

Aerosol-cci phase 2 aims at producing a set of validated aerosol ECV products for the full time series from a set of European satellite instruments with substantially different characteristics:

Total column products:

- 17 years from dual view ATSR-2 and AATSR (AOD, global, 1995 – 2012)
- 10 years from a dual view / multi-spectral combination of AATSR and MERIS (AOD, global, 2003 – 2012)
- 10 years from a combination of nadir / multi-spectral AATSR and SCIAMACHY (AOD / aerosol type, global, 2003 – 2012)
- 10 years from thermal IASI (global, 2006 – 2015, mineral dust AOD)
- 10+ years from polarization / multi-angle / multi-spectral POLDER (selected land regions, 1996/7 + 2002/3 + 2005 – 2015, AOD and aerosol properties)

Stratospheric products

- 10 years from occultation GOMOS (global, 2003 -2012, extinction profile, stratosphere AOD and size)
- 20 years merged from limb / occultation SAGE-II, OSIRIS, GOMOS (global, 1984 -2005, extinction profile, stratosphere AOD and size)

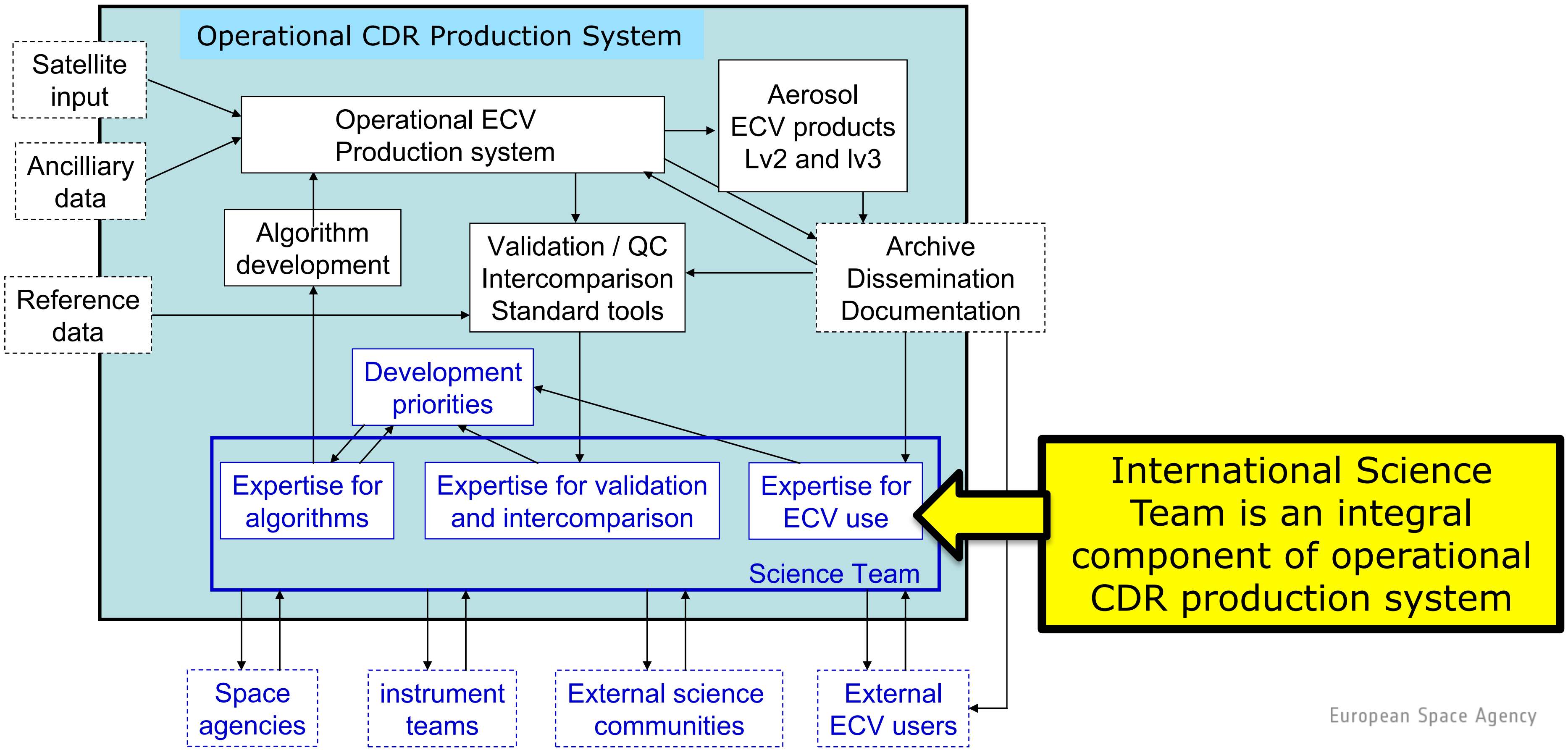
AAI

Each product will include a pixel-wise error characterization. Updated based on a refinement of user requirements and intensive dialogue with the user community.

CCI "Operational 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. AERO-SAT)

The Why?

CDR operational production is one good reason for AERO-SAT, 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 What/Who…?

Open un-funded international science working group focussing on realising the benefits obtainable through strengthened international collaboration.

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

AERO-SAT (www.aero-sat.org)

AERO-SAT Objectives

- Advance satellite aerosol retrieval research and product development by providing a mechanism to promote and facilitate international scientific collaboration.
- Federate the satellite aerosol community to provide a more powerful collective voice towards the ecosystem of international projects, funding agencies and space agencies
- Coordinate scientific activities of mutual benefit (e.g. intercomparisons, common definitions, common tools, common formats, etc.)
- Stimulate communication and coordination between producers of satellite information on aerosol properties and the global user community.
- Identify best practice in retrieval development
- Promote the long term continuity of satellite aerosol data set production
- Encourage the open exchange of satellite, model and in-situ aerosol data streams, and harmonized access for users
- Help users to understand the strengths and weaknesses of different satellite aerosol products by promoting activities to intercompare data sets

AERO-SAT (www.aero-sat.org)

Report of 1st Meeting – 27 Sep 2013, 10th AeroCom, Hamburg

Terms of Reference were endorsed

Chairs elected:
- Ralph Kahn, NASA
- Thomas Holzer-Popp, DLR

Priority Working Groups Identified:
- Aerosol Climate Data Records
- Intercomparisons
- Uncertainties
- Coordination with Models

Next Meeting Planned
- 27-28 Sep 2014 during 11th AeroCom meeting (t.b.c.)

Web site
- aero-sat.org – see web site for more info on all the above.

ICAP feedback ?

Some Questions for ICAP from AERO-SAT:

- Relationship between ICAP and AERO-SAT?

- Are there ICAP Priorities for AERO-SAT Working Groups?

Also…

Are there ICAP needs that can be supported by ESA Application Development programmes? (e.g. VAE, DUE, SEOM, STSE?)

Acknowledgement to:

Aerosol CCI Team:

DLR	Thomas Holzer-Popp, Dmytro Martynenko, Max Schwinger
FMI	Gerrit de Leeuw, Larisa Sogacheva, Pekka Kolmonen
MPI-Met	Stefan Kinne
NMI	Michael Schulz, Jan Griesfeller
U. Swansea	Peter North, Andreas Heckel
U. Oxford	Gareth Thomas, Don Grainger
RAL	Richard Siddans, Caroline Poulsen
U. Bremen	Wolfgang Hoyningen-Huene, Marco Vountas, Alex Kokhanovsky
HYGEOS	Didier Ramon
LOA/ICARE	Didier Tanre, Jacques Decscloitres, Pavel Litvinov, Francois-Marie Breon, Oleg Dubovic
BIRA	Christine Bingen, Charles Robert
KNMI	Deborah Stein-Zweers, Pepijn Veefkind
FUB	Rene Preusker, Juergen Fischer
NILU	Kerstin Stebel, Marcus Fiebig
PSI	Paul Zieger, Urs Baltensperger

Acknowledgement to:

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ESRIN	Philippe Goryl	(AATSR, MERIS, Sentinel-3)
ESRIN	Torsten Fehr	(GOME, GOMOS, Sentinel-4 and 5P)
ESRIN	Claus Zehner	(GOME, GOMOS, Sentinel-4 and 5P)
ESTEC	Michael Eisinger	(EarthCARE)
ESTEC	Anne Straume	(ADM-Aeolus)
ESTEC	Ben Veihelmann	(Sentinel-4 and 5P)
ESTEC	Craig Donlon	(Sentinel-3)
ESTEC	Tobias Wehr	(EarthCARE)