Aerosol
Cloud
Trace Gas
Research
Infra
Structure

ACTRiS

AERONET in Europe 2011-2019

8 years supporting scientific research and innovation

EU Framework Program 7 and Horizon 2020 ACTRIS projects

P. Goloub, C. Toledano, E. Cuevas et al.,
+ site (PI + M)

CNRS/U. Lille, UVA, AEMET, METEOFRANCE, GSFC

AERONET
AEROSOL ROBOTIC NETWORK

NASA

cnes

esa

Our objectives ?

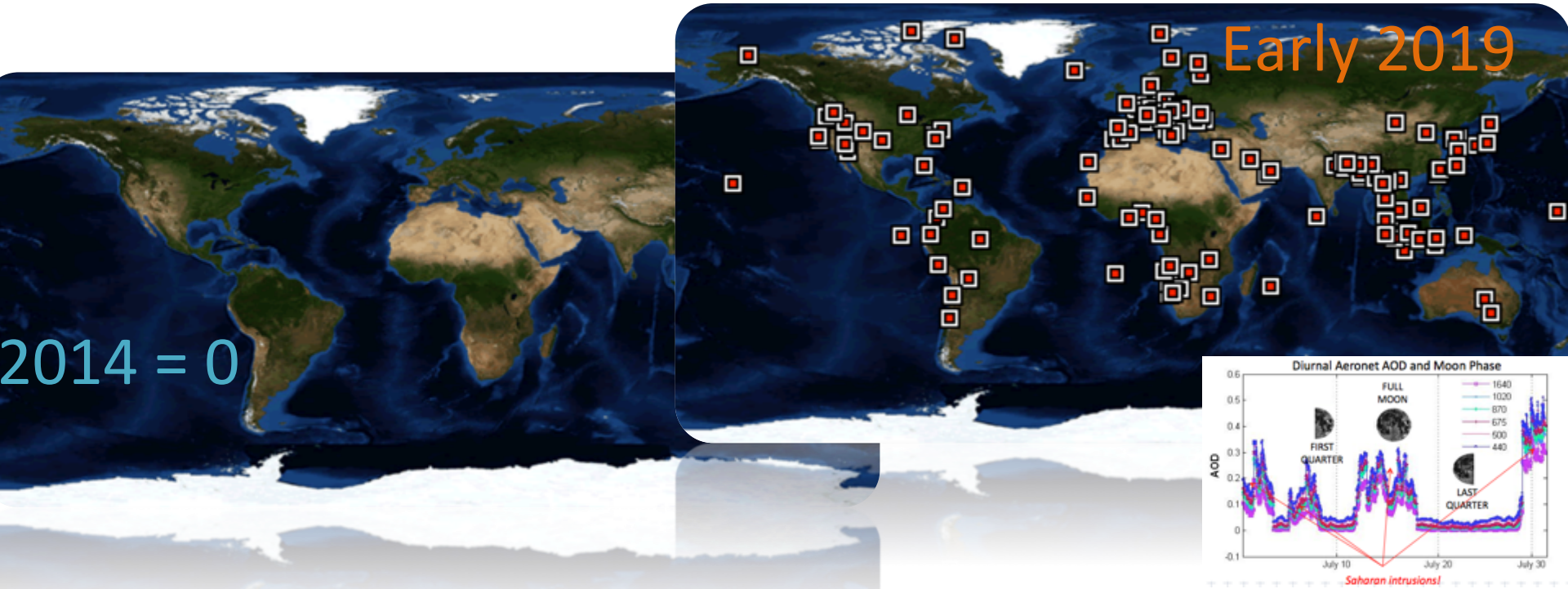
- **Long-term high quality ground-based aerosol observation and monitoring**
- **Calibration, Trainings, Good practice** (academic and private users).
- **New technologies** (new instrument + increase TRL, in collaboration with SMEs)

- **(i) Polarimeter CE318;**
  (ii) Lunar photometer CE318T;
  (iii) Mobile Automatic photometer CE318TM;
  (iv) Compact and automatic integrated systems;
  (v) Low cost handheld photometer;
  (vi) ……

- **Integration/synergetic activities** (photometer, LiDAR, in situ, satellites and modelling)
- **Added value products** (through innovative algorithms, e.g. GRASP) & **through ACTRIS-DC**
- **Maintain services in the long-term** (upgrade of calibration platform, technologies, data processing, resources and expertise).
- **Close cooperation with SMEs, Space Agencies**

Evolution ?

Distribution of « Model T » (CE318T) – sun/sky/polar/moon – new robot & control box

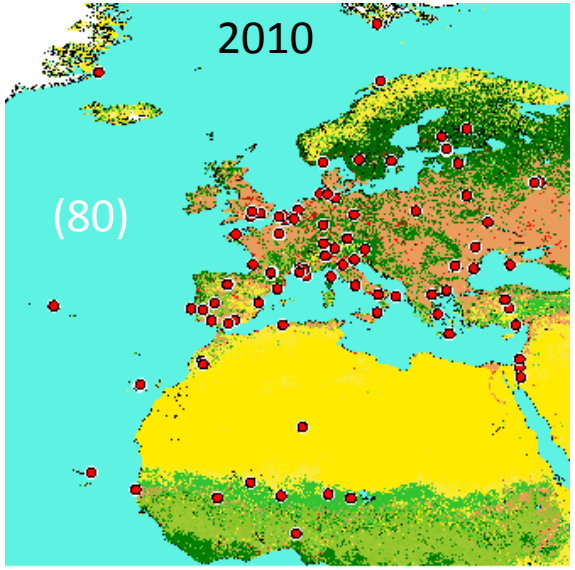


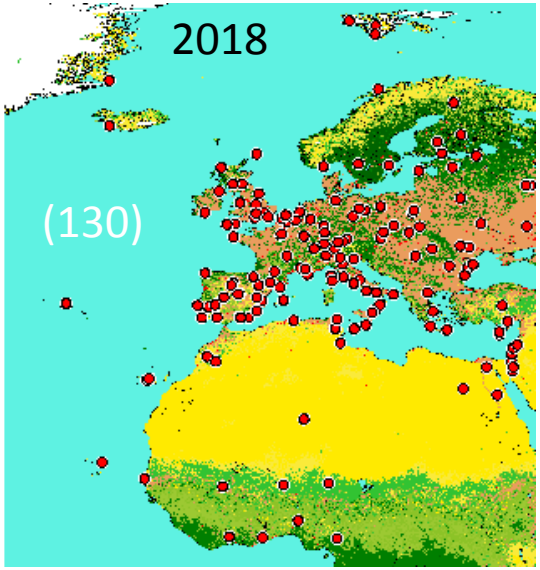
- More than 130 sites in the network (upgrades + new sites) in 2019
- About 30% in the ACTRIS perimeter

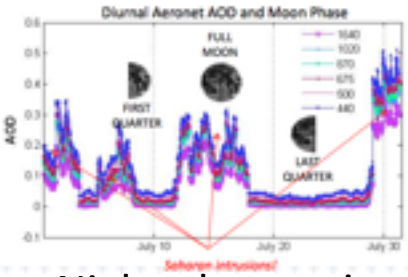
This short presentation: highlights on main technical and scientific outcomes supported by the European branch of AERONET during ACTRIS-1 and ACTRIS-2

Overview of European Capacity

-**Perimeter**







Night observation

- **Research** (aerosol properties, variability, trends and impacts,…)
- Earth Observation **Space Missions** (calibration, validation, synergy,…)
- **Innovation** (instrument, methodology, data processing and aerosols retrievals)
- Data Center and **Services to Users**
- **Calibration** platforms and activities

Mobility

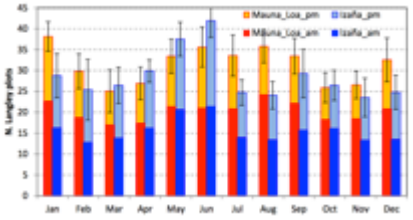
- Partnerships with WRC/NPL
- Partnerships with SMEs and Space Agencies

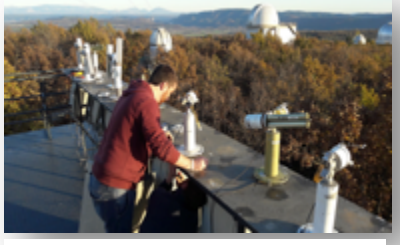
Training

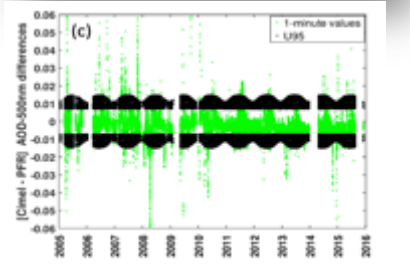
Papers (Extr.) : Baretto et al., Li et al., Kazadzis et al., Toledano et al., Lopatin et al., Cuevas et al., Karol et al., Torres et al., Popovici et al., Mortier et al.,…

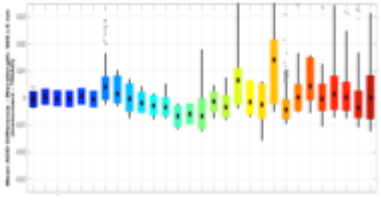
1. Support to « calibration »

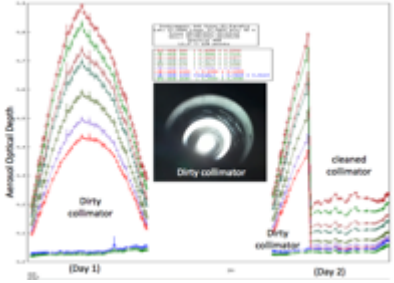
- **Solar** (absolute, transfer)
- **Radiometry** (absolute)
- **Polarimetry** (absolute)
- **Alternative methods** (direct AOD-to-Radiance transfer)
- **Lunar** (absolute, transfer, direct)
- Link and **Traceability** with other networks/WMO
- **Maintenance**
- **QC**



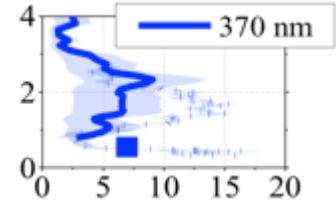








2. Support to Aerosol Characterization



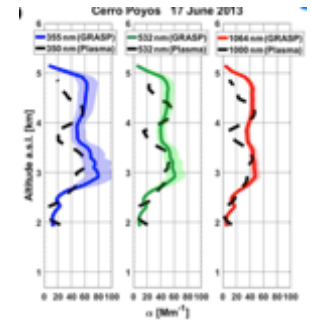
- **<u>Synergy column-profile</u> : Algorithm dev. and validation**

  - *Photometer and Multiwavelength LiDAR*

    . Algorithm GARRLIC, at AERIS DC (prototype chain, implementation)

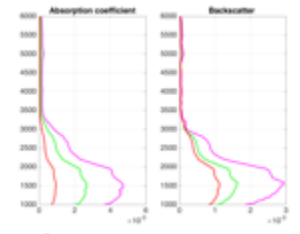
    => special activity on **absorption profiling**

    . Algorithm LIRIC

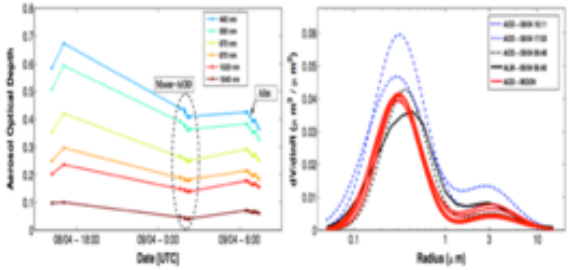


  - *Photometer, single wavelength LiDAR/Ceilometer and in situ*

    . Algorithm BASIC (AERIS Data and Service Center)

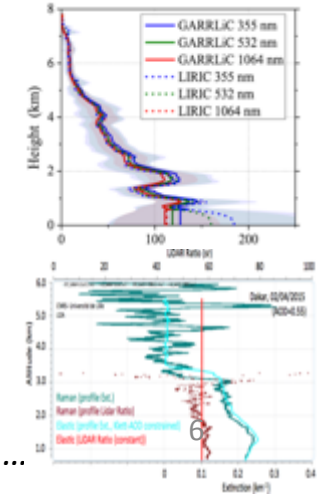


- **New <u>stand-alone</u> photometer retrievals**



- Spectral AOD inversion -> Size Distribution

  (GRASP-AOD, AERIS-DC)

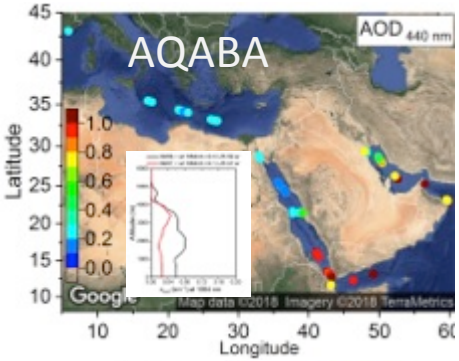


Tsekeri et al.; Chaïkovsky et al., Benavent-Oltra et al.; Mortier et al., Lopatin et al; Hu et al., Torres et al.., …

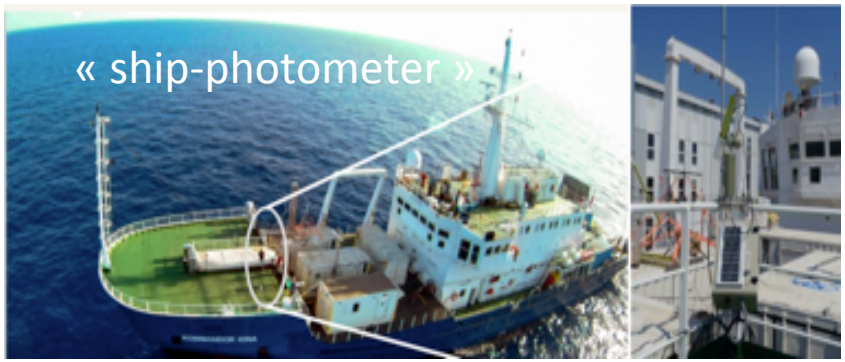
3. Support to Field Campaigns

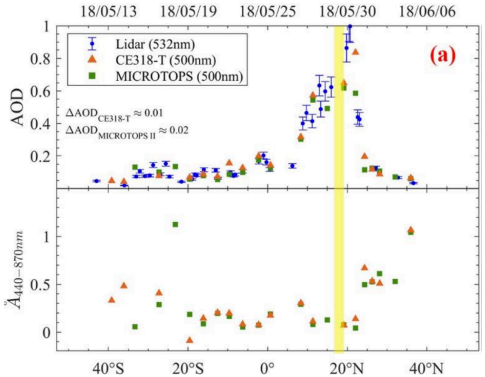
Lend, manage, integrate, calibrate, data processing of standard & specific instrument for campaigns

Germany (Melpitz), Greece (Athens), Cyprus (Nicosia), Spain (Granada, Slope), SHADOW-2 (Africa, Dakar), OCEANET I&II (Atlantic), AQABA (Cyprus), CHARMEX (Mediterranean), USA (DRAGON), China (MOABAI), AEROCLO-SA (Namibia), FIREX-AQ (USA), DAO (China)

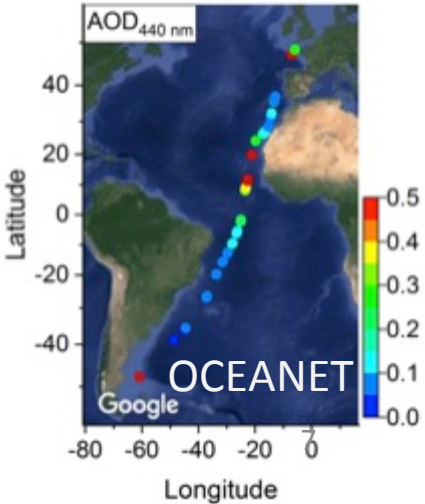


*New automatic CIMEL **mobile** sun/sky/lunar-photometer*





Scheduled & in progress : MOSAIC (Arctic 2019), SEA2CLOUD (2020), etc…,



Projects of permanent mobile observation: Marion Dufresne (Ind. Ocean)

= New automatic instrument for exploratory platform

Yin et al., AMT, 2019; Unga et al., EGU

4. Support to other networks

UK Met Office (field instruments, training)

Figure 1.The Met Office Lidar-sunphotometer operational network. Also shown the location of the operational ceilometers.

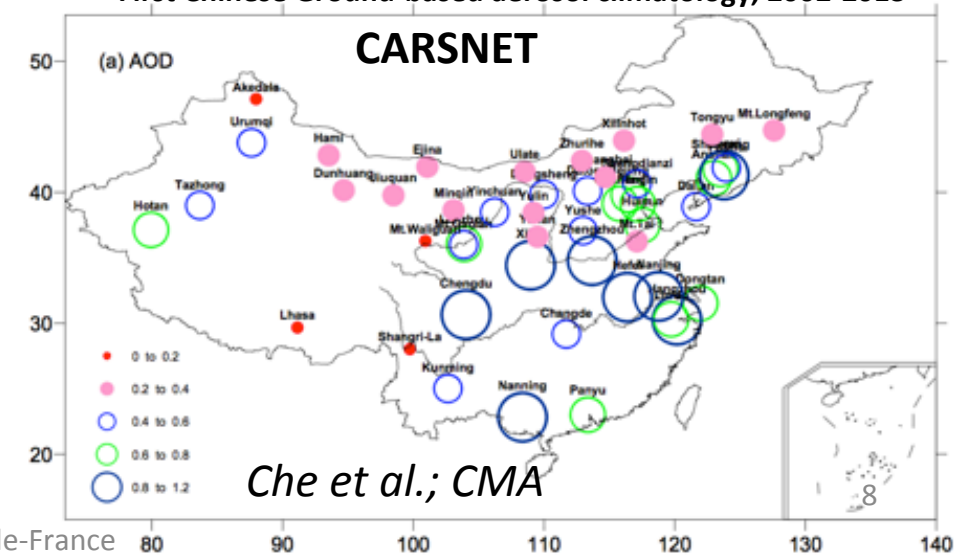
(*Adam, Buxmann et al.*)

Chinese Networks (SONET, CARSNET)

Reference instrument, calibration methods,
Joint research activities

SONET Network (*Li et al.; RADI/CAS*)

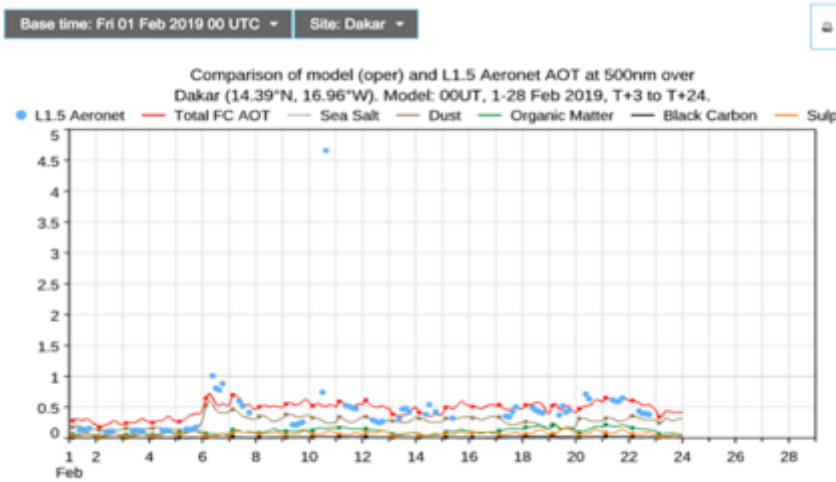
First Chinese Ground-based aerosol climatology, 2002-2013

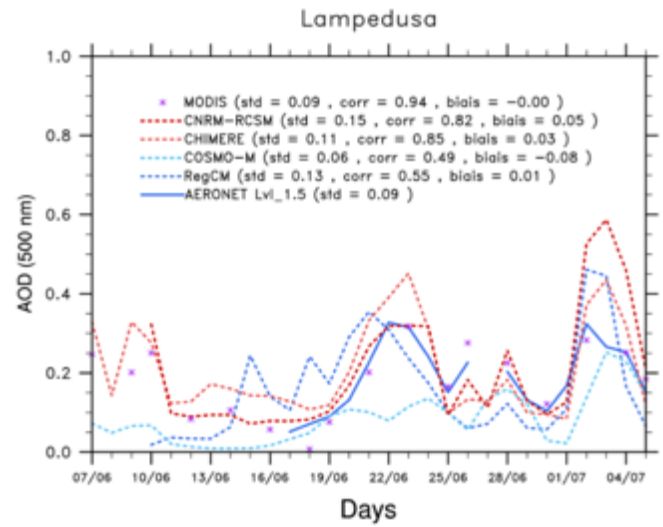


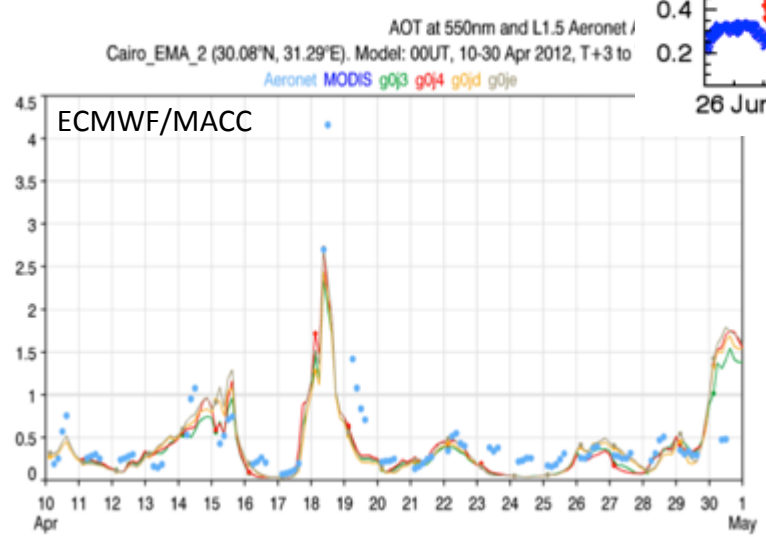
Che et al.; CMA

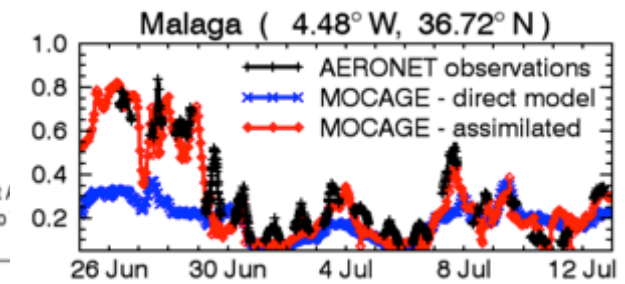
5. Support to Modelling

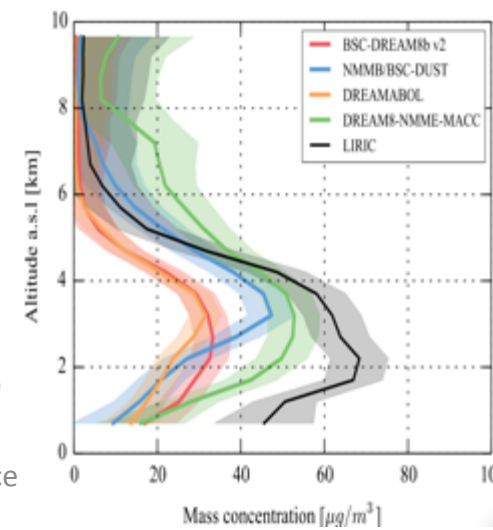
- **ECMWF**/MACC (AOD)
- **CAMS** (COPERNICUS) (Verification AOD)
- **WMO-SDS-WAS** (DREAM, Dust Model)
- **AEROCOM** (Verification)
- **MOCAGE**, **CHIMERE** (Verification)
- **Emission evaluation** (Inverse modelling)







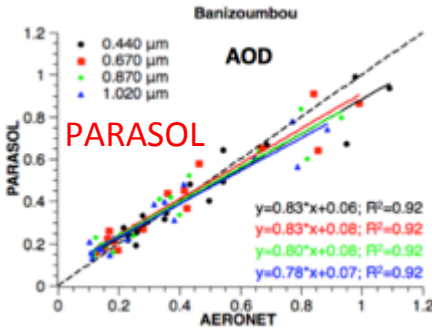


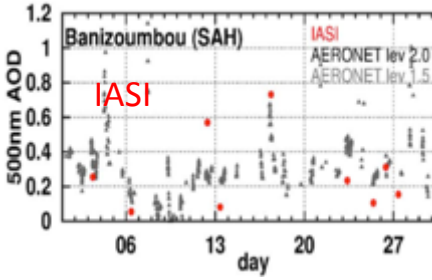


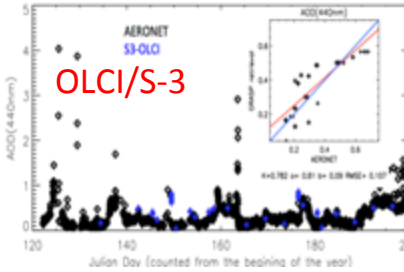
Basart et al.; Cuevas et al.; Binietoglou et al.; Sic et al.; Cheng et al.; Di Tomaso et al.; Gliss et al., Benedetti et al.; Remy et al.;…

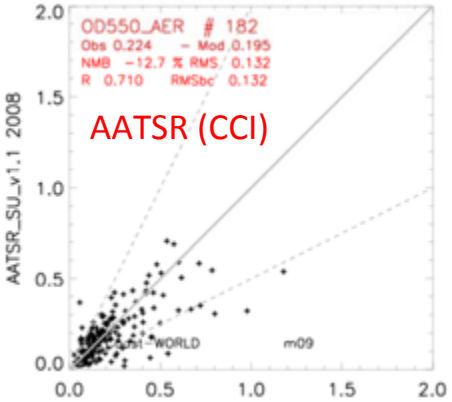
6. Support to past, present and future EO Missions

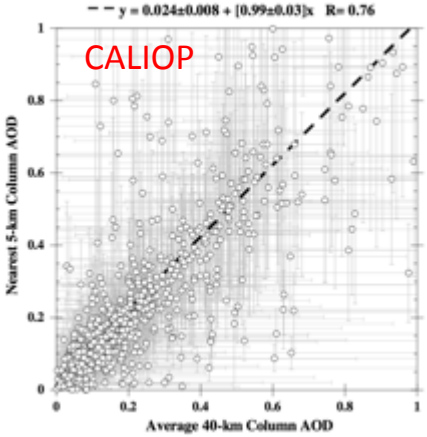
- **Reference Measurements** for validation/calibration of satellites sensors/products (MERIS, AATSR, PARASOL, IASI, OLCI, SEVIRI, MODIS,CALIOP,...
- **25 year-QA-database** (version 3) for satellite CAL/VAL exercises
  (now including 4 year-Night time AOD)
- **ESA**-Climate Change Initiative (**CCI**) inter-comparison
- **ESA**-Instrument Data quality Evaluation and Analysis Service (**IDEAS**)
  (uncertainty, traceability, calibration facility, cal/val campaigns)
- **ESA**-Quality Assurance For Earth Observation (**QA4EO**) program
- Future **COPERNICUS/EUMETSAT** missions; ESA/JAXA EARTHCARE
  - MTG (S-4 mission, UVN)
  - EPS-SG (S-5 mission)
    3MI, IASI-NG, …
- Other **Non EU** missions
  - DPC/GF-5
    …

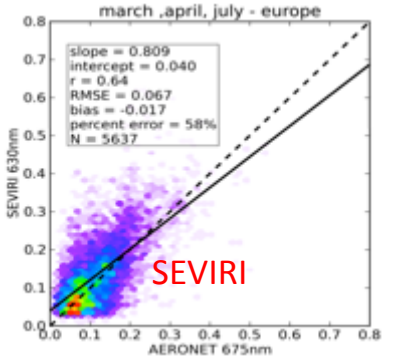








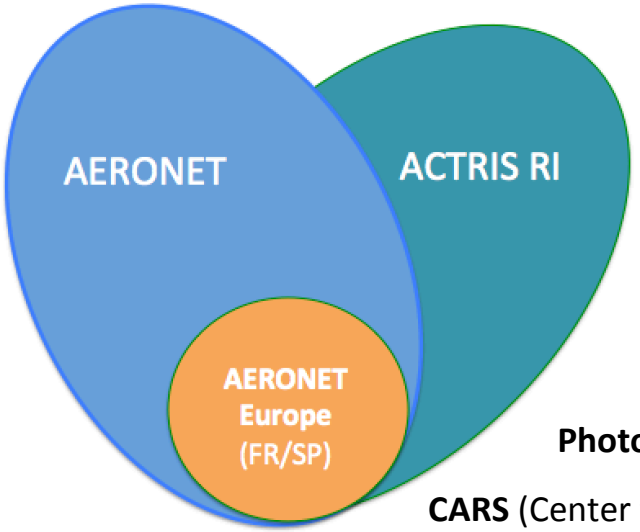




Papers (extr.): Capelle et al.; de Leeuw, Dubovik et al.; Cuesta et al.; Carrer et al.; Bernard et al., Omar et al.; Waquet et al.; Holzer-Popp et al.; Vandenbussche et al.; Amiridis et al., 2015, ACP (CALIOP).

7. Summary - Perspectives

AERONET-Europe is part of the **AERONET Federation**
of the **ACTRIS** **Research Infrastructure**



France and **Spain** with US

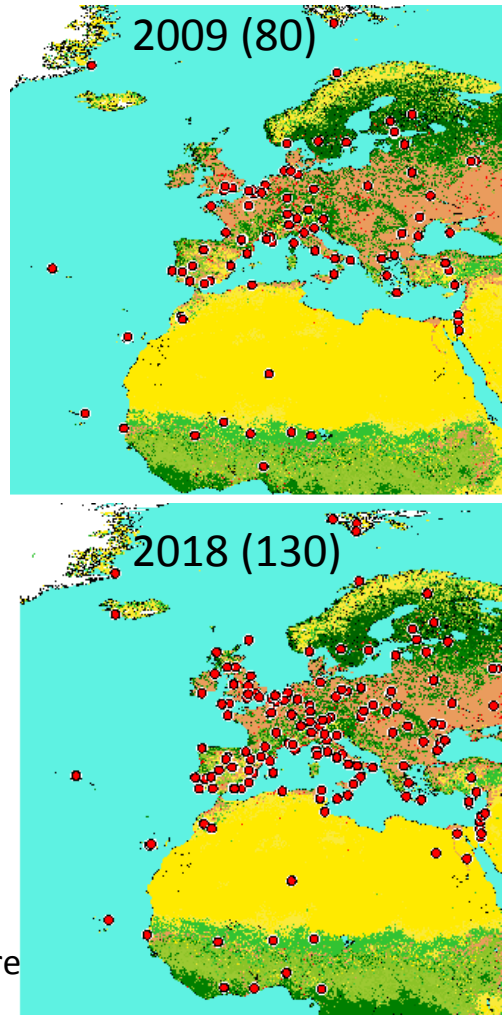
Scientific Achievements (papers)

Public and NRT data/products

Services to wide community

Photometer and Lidar in CARS, part of **ACTRIS**

CARS (Center for Aerosol Remote Sensing)



Innovation: instrument, algorithm, services (through various partnerships)
> Relevant instrumental concept, with expected evolutions
- integrated passive/active/in situ stationary & mobile system;
- high spectral resolution; imager

> Relevant aerosol retrieval concept

Added value aerosol products: through synergies and specific data process. and Data Centre

Partnerships:
> with SMEs & Space Agencies
> with non AERONET networks (e.g. China)
> with non-Cimel networks

ACTRIS-RI : operational end 2024
- Photometer already operational
- Photometer and Lidar expected in 2022

Merci !