

The European COST Networking Action Harmonia: International network for harmonization of atmospheric aerosol retrievals from ground-based photometers

presentation by **Anca Nemuc**, INOE, Romania 

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*AERONET Science and Application Exchange 2024,
17-19 September 2024, College Park, MD, USA*

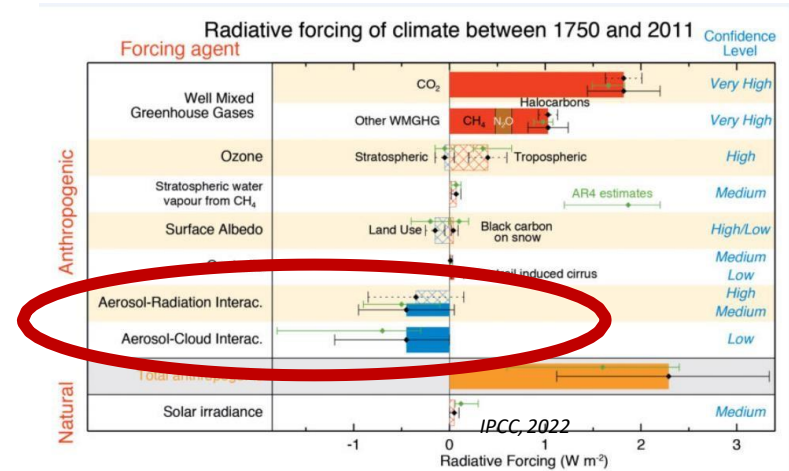
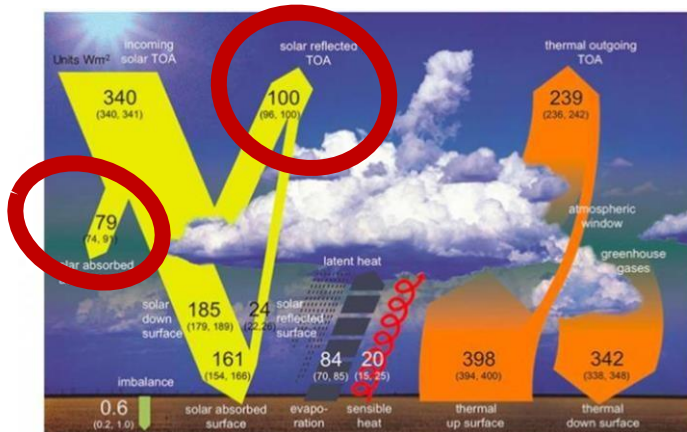
Harmonia - Idea and Main goal

Harmonia – “Αρμονία a Greek nymph immortal goddess of harmony and concord”

The main aim of the COST Action HARMONIA is to **Establish a network** involving institutions, instrument developers, scientific and commercial end users, in order to **improve, homogenize and valorize aerosol columnar retrievals**, using mainly solar and sky but also lunar and star **photometers** from different networks

The role of aerosols in the Climate system and their radiative effects

The level of our knowledge for aerosol – radiation and aerosol-cloud interactions

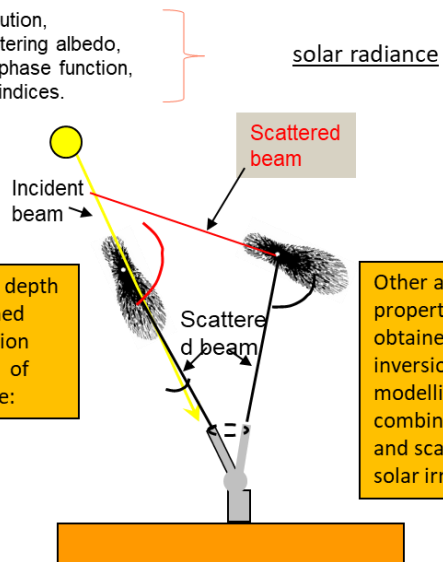




Sun-photometers: Retrieval of aerosol optical properties

Aerosol products:

- Aerosol optical depth retrieved from direct solar/lunar irradiance
- Size distribution,
- Single scattering albedo,
- Scattering phase function,
- Refractive indices.

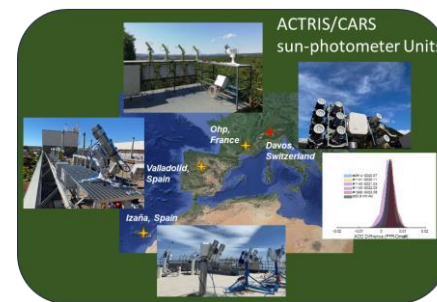
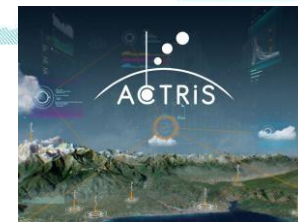


Aerosol optical depth (AOD) is obtained from transmission measurements of the atmosphere:

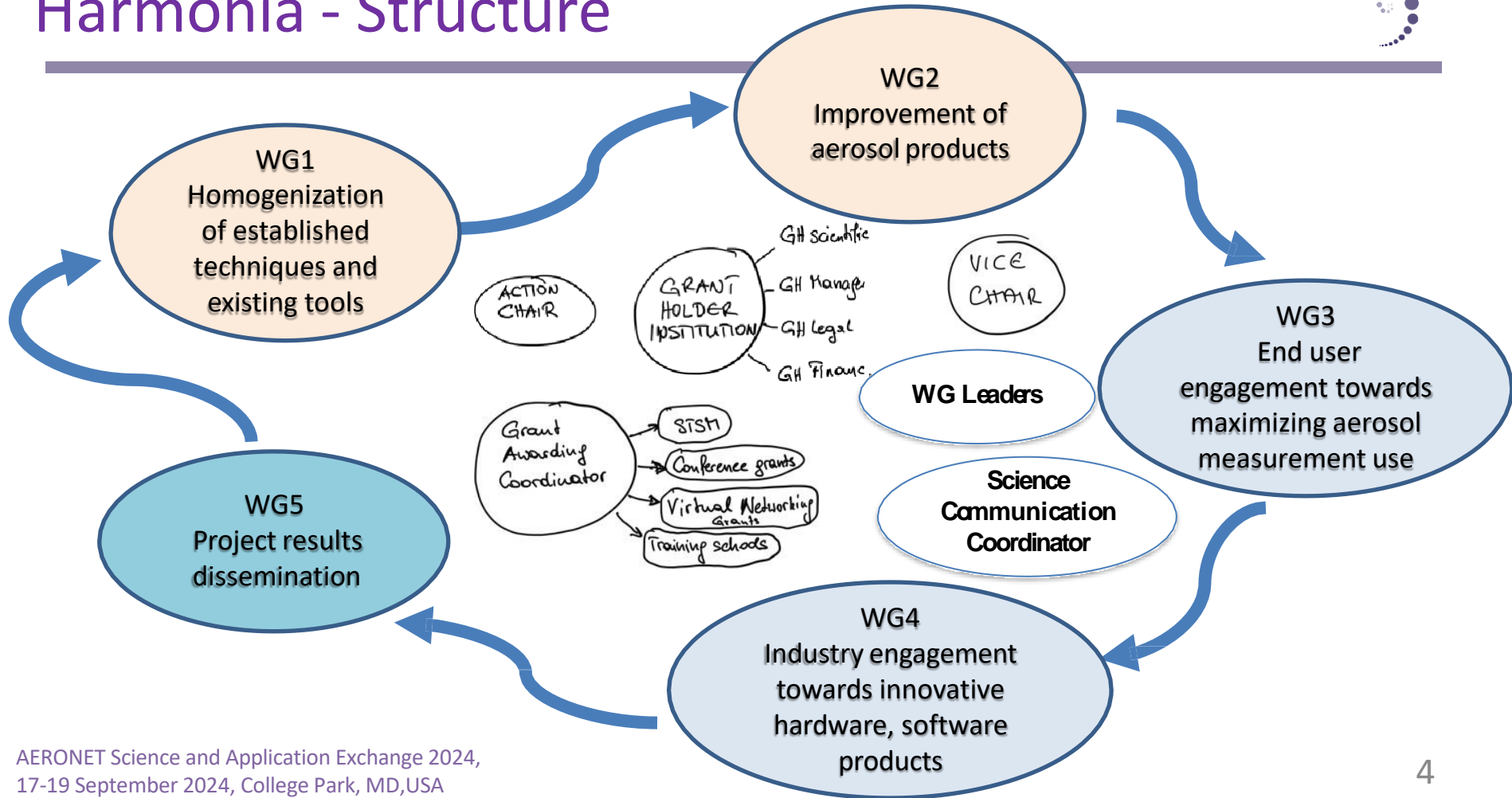
Other aerosol properties are obtained from inversion modelling combining direct and scattered solar irradiance.



ACTRIS European RI



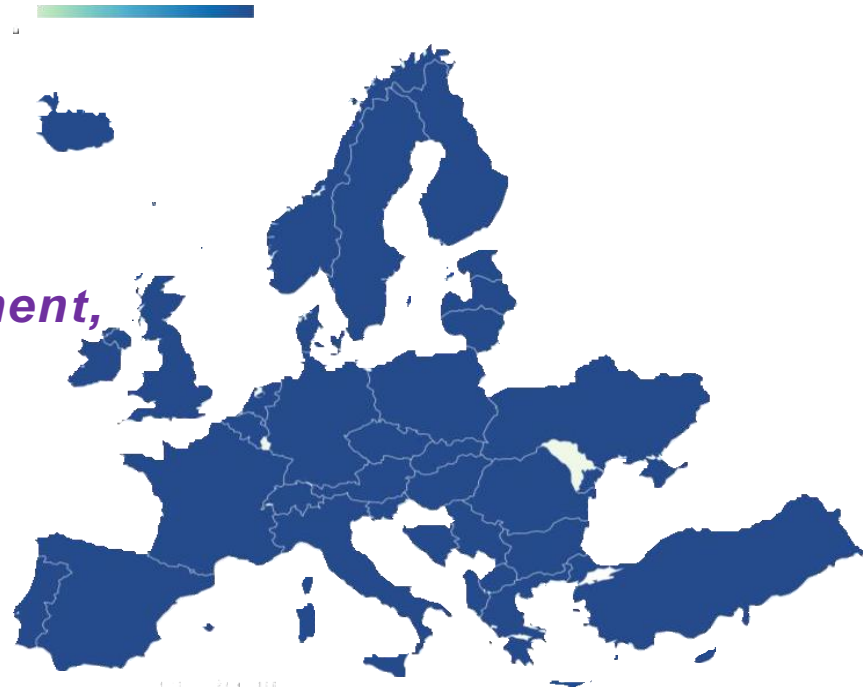
Harmonia - Structure



Management Committee members: 56
Management Committee Countries: 37
WG members: **144 approved, from 44 countries**

Cost Harmonia tools

- *Meetings (Working groups, management, Core group)*
- *Summer schools, training schools*
- *Workshops / webinars*
- *Short term scientific missions*
- *Virtual Mobility Grants*





How European and global sun-photometer users can use common standards?

O1: Homogenization and harmonization of global aerosol measurements and retrievals

- **calibration standardization**, recommendations towards **harmonization** of metadata formats, real-time retrievals and optimization of standard operation procedures
- **retrieval uncertainties** and assess the limitations on their use.

Link current calibration methods with results of projects dealing with **metrology-based traceability** to S.I. unit standards

WG1

Aerosol
measurement
homogenization

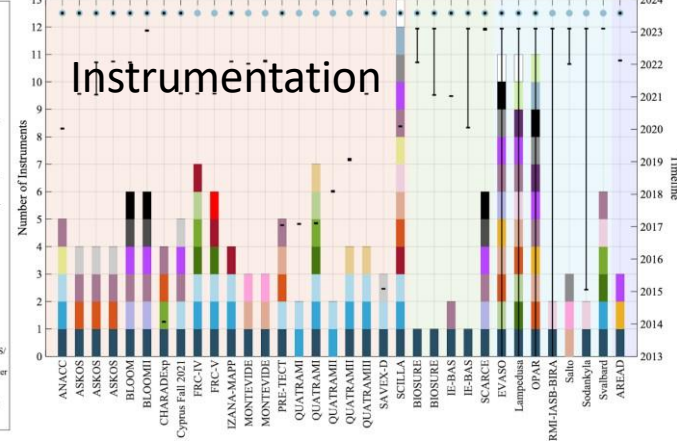
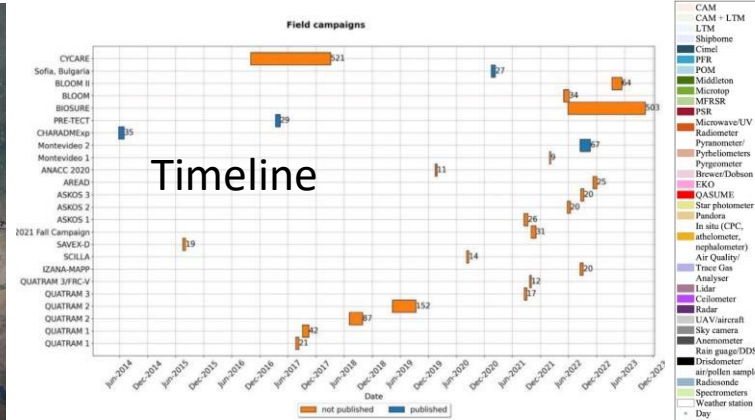




Task 1: Documentation of relevant Campaigns



Campaign map



Documentation of campaign data and analysis on the objectives of each campaign: **available material for people to work on Harmonia objectives & other ideas**





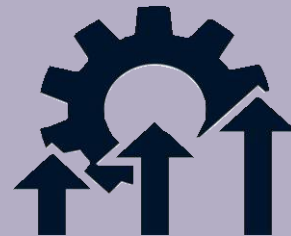
O2: Improve the solar, lunar and stellar measurements and data quality

Suggest **improvements** for solar, lunar and star photometry measurement quality based on **exploiting past datasets**

- **Link lunar and stellar calibration with solar retrievals** exploiting databases of experimental campaigns of the past
- **Assess the measurement uncertainties compared to the needs** of specific activities (e.g. trends, satellite validation)

WG2

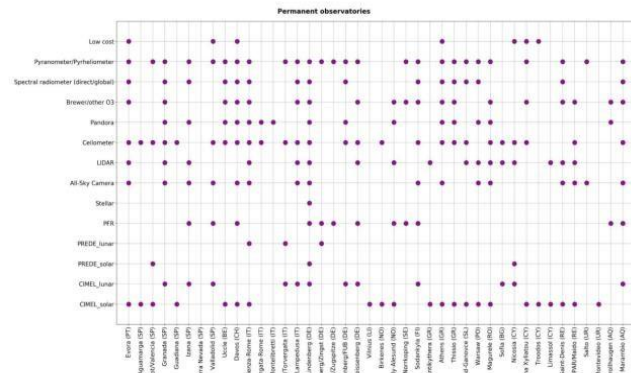
Aerosol measurement improvement



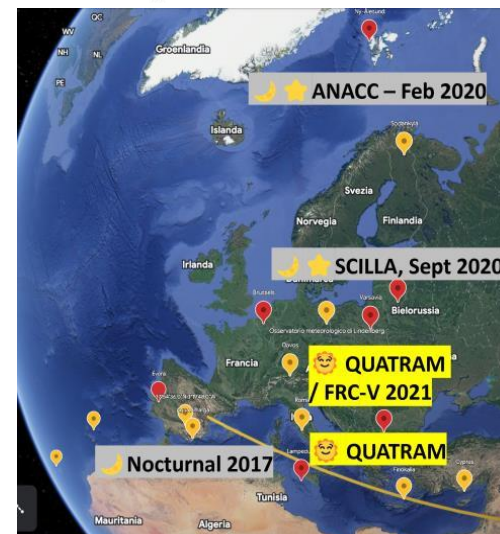
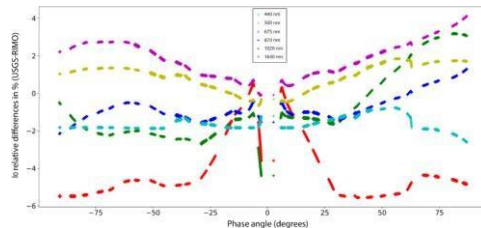
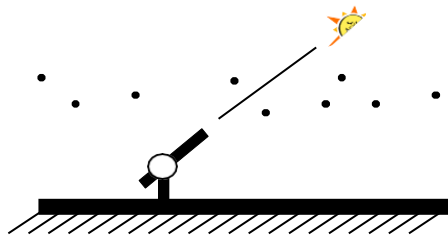
WG2 How can scientists improve the measurement quality of aerosol optical properties?

Groups - subjects

- Improvements towards a better performance of the techniques and lower uncertainty
- Assessment of new instruments including low cost sensors
- Improvements towards enhanced products with different instrumentation
- Artificial Intelligence (AI) and Machine Learning (ML) techniques
- Trace the instruments calibration to SI
- The need to link sun photometer uncertainties with actual user needs



Direct sun and sky radiance Lunar and stellar measurements





O3: Increase the applicability for aerosol optical properties for different scientific fields

Stimulating the communication between operational agencies and academia, increasing the applicability of aerosol products through:

- Create a road map towards **future needs for measurement improvements**

WG3

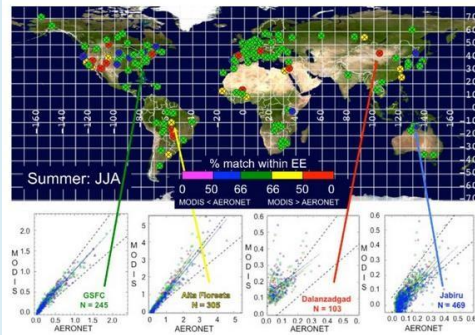
End user engagement
towards maximizing
aerosol measurement
use



How can the aerosol community increase the applicability of the aerosol products?



Satellite validation

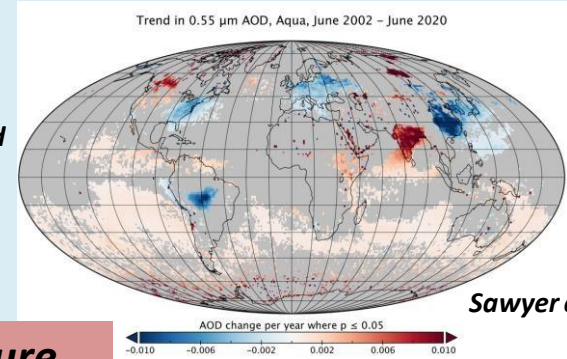


R. Kahn et al.,

Satellite based sensors are constantly validated with surface based sun photometers

Spatiotemporal changes

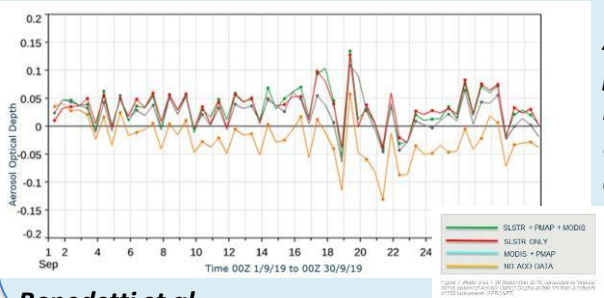
Aerosol climatology and trends



Sawyer et al.,

+ Climate, Solar energy, agriculture..

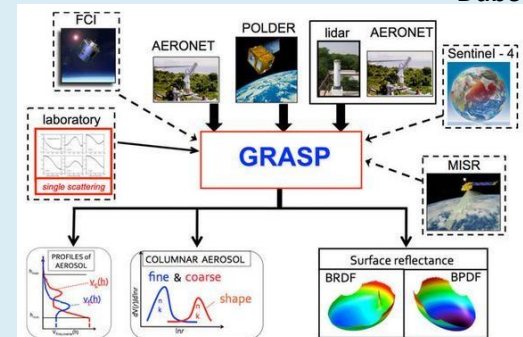
Model improvement



Benedetti et al.,

Aerosol and other parameter forecasting improvement with the use/assimilation of aerosol data

Synergies



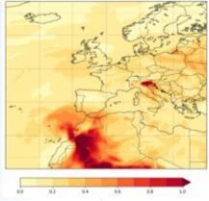
Dubovik et al.,

Model products including sun photometric aerosols
e.g. lidars, satellites

How can the aerosol community increase the applicability of the aerosol products?

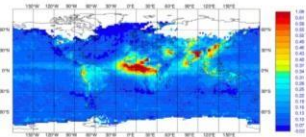


Model information



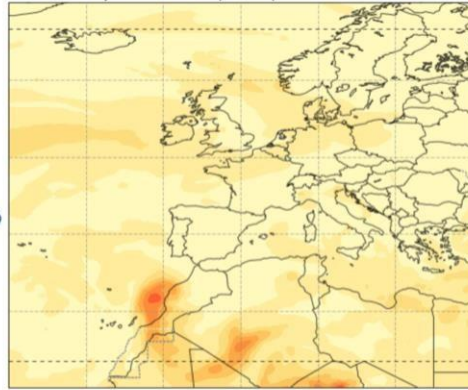
Observation information

STATISTICS FOR AEROSOL FROM MOZA-DOVRES
 MEAN OBSERVATION VALUE (ALL)
 DATA PERIOD = 2023-01-20 15:20:23 - 2023-02-24 15:20:23
 RSP = 0.00, LEVEL = 0.20, 1013.25 hPa
 Min: 0.000 Max: 0.050 Mean: 0.149
 QND: 0.000 0.000



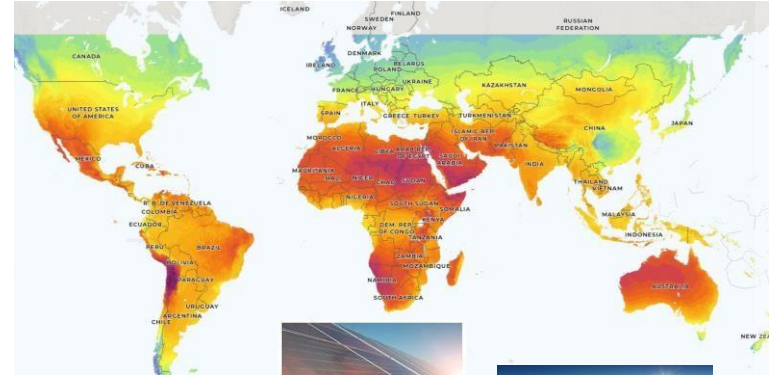
Forecast

CAMS Analysis Total Aerosol Optical Depth at 550nm, 20230201T00

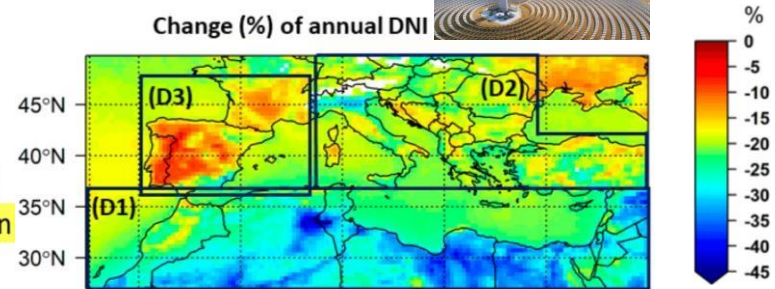


Model assimilation
M. Ades, ECMWF

Solar Energy

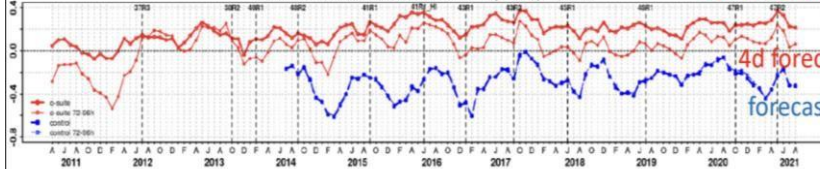


Change (%) of annual DNI



MONITORING CAMS AOD forecast bias against AERONET

MACC/CAMS 2011-2021 versus Aeronet - Aerosol Optical Depth @550nm



1d forecast with DA

4d forecast with DA

forecast without DA

Positive impact on AOD

K. Papachristopoulou 2023

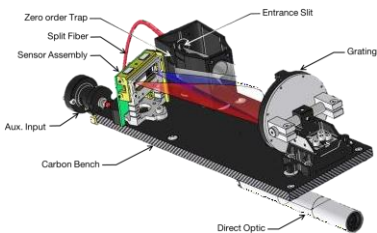
How can scientists improve aerosol measurement quality through hardware/software innovation, including low-cost sensors?



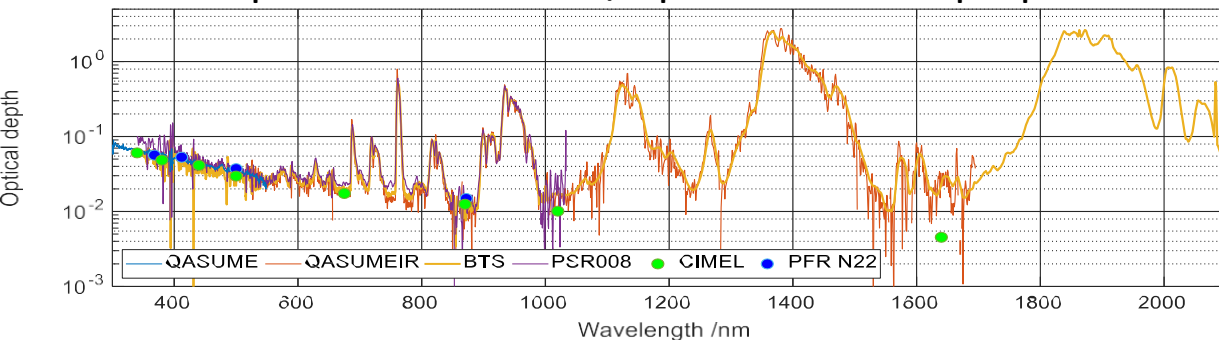
O4: Create a group of people, involving aerosol measurement users, scientists and the sun-photometric related industrial sector

Promote innovation in aerosol measurement technology:

- Hardware developments to improve retrievals
- Collaboration with Metrological institutes
- New spectroradiometers for aerosol retrievals
- Software improvements for post processing
- Low cost sensors



Spectroradiometers/ spectral aerosol properties



WG4

Industry engagement towards innovative hardware, software products





SKY OVER BERLIN HARMONIA

2024 TRAINING SCHOOL
ON AEROSOL MEASUREMENTS
8-10 April 2024 Berlin - Lindenberg



- IN FU BERLIN AND DWD LINDENBERG
- LECTURES BY EXPERTS
- SMALL GROUPS WORKSHOPS
- AVAILABLE TRAVEL FUNDING

DETAILS AND REGISTRATION
[HTTPS://HARMONIA-COST.EU/](https://harmonia-cost.eu/)



HARMONIA

3 days
34 trainees
15 trainers

**Material
available**



Videos

<https://www.youtube.com/@HARMONIAACOST>
<https://harmonia-cost.eu/videos/>

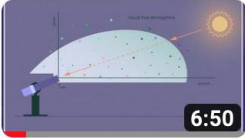


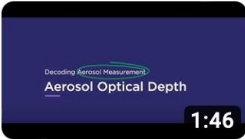



Video caricati da
HARMONIA COST

HARMONIA COST
20 video 1 visualizzazione Ultimo...

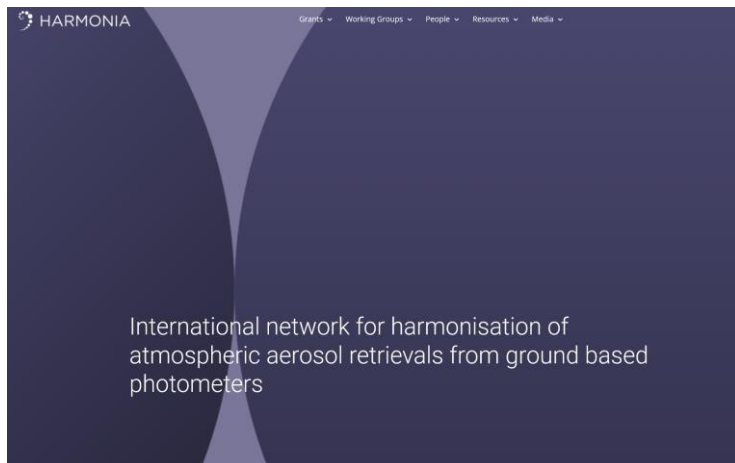
 

 Riproduci tutto  Casuale

-  **Introducing Atmospheric Aerosols and the Basics of their Measurement**
HARMONIA COST • 24 visualizzazioni • 2 giorni fa
6:50
 -  **Decoding Aerosol Measurement: Single Scattering Albedo**
HARMONIA COST • 7 visualizzazioni • 2 giorni fa
1:46
 -  **Decoding Aerosol Measurement: Angstrom Exponent**
HARMONIA COST • 27 visualizzazioni • 2 giorni fa
1:30
 -  **Decoding Aerosol Measurement: Aerosol Optical Depth AOD**
HARMONIA COST • 74 visualizzazioni • 2 giorni fa
1:46
 -  **HARMONIA Logo Dance (short edit)**
HARMONIA COST • 19 visualizzazioni • 4 mesi fa
0:33
- HARMONIA Workshop
1000 Workshop for aerosol and user engagement
Academy of Athens 19-20-2023
- Aerosol observations for aviation sector - O.Vasardani**

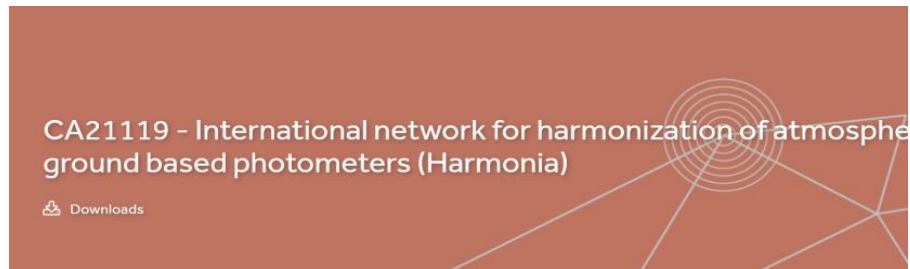
Joining Haímonia

<https://www.cost.eu/actions/CA21119/>



@HARMONIA_COST

AERONET Science and Application Exchange 2024,
17-19 September 2024, College Park, MD,USA



[Home](#) > [Browse Actions](#) > International network for harmonization of atmospheric aerosol retrievals from ground based photometers (Harmonia)

Description

Management Committee

Main Contacts and Leadership

Working Groups and Membership

Working Groups

Number	Title	Leader
1	Homogenization of established techniques and existing tools	Dr Lionel DOPPLER
2	Improvement of aerosol products	Dr Monica CAMPANELLI
3	End user engagement towards maximizing aerosol measurement use	Dr Stavros SOLOMOS
4	Industry engagement towards innovative hardware, software products	Dr Natalia KOUREMETI
5	Project results dissemination	Dr ANCA NEMUC

Express your interest to join any of the working groups by applying below.

It is required to have an e-COST profile to submit your application. If needed, [create it first](#) and then click 'Apply'.

Apply

MARS = Magurele centre for Atmosphere and Radiation Studies

- A 20,000 sqm atmospheric observatory
- Located 8 km **SW Bucharest- capital city of Romania**
- instruments related to international networks: ACTRIS RI (RADO-Bucharest), GAW station in WMO Region VI – Europe (Magurele_INOE), PANDONIA, AERONET, e-profile, CLOUDNET



Fog



Wind and precipitation



Aerosols



Clouds

MARS = Magurele centre for Atmosphere and Radiation Studies

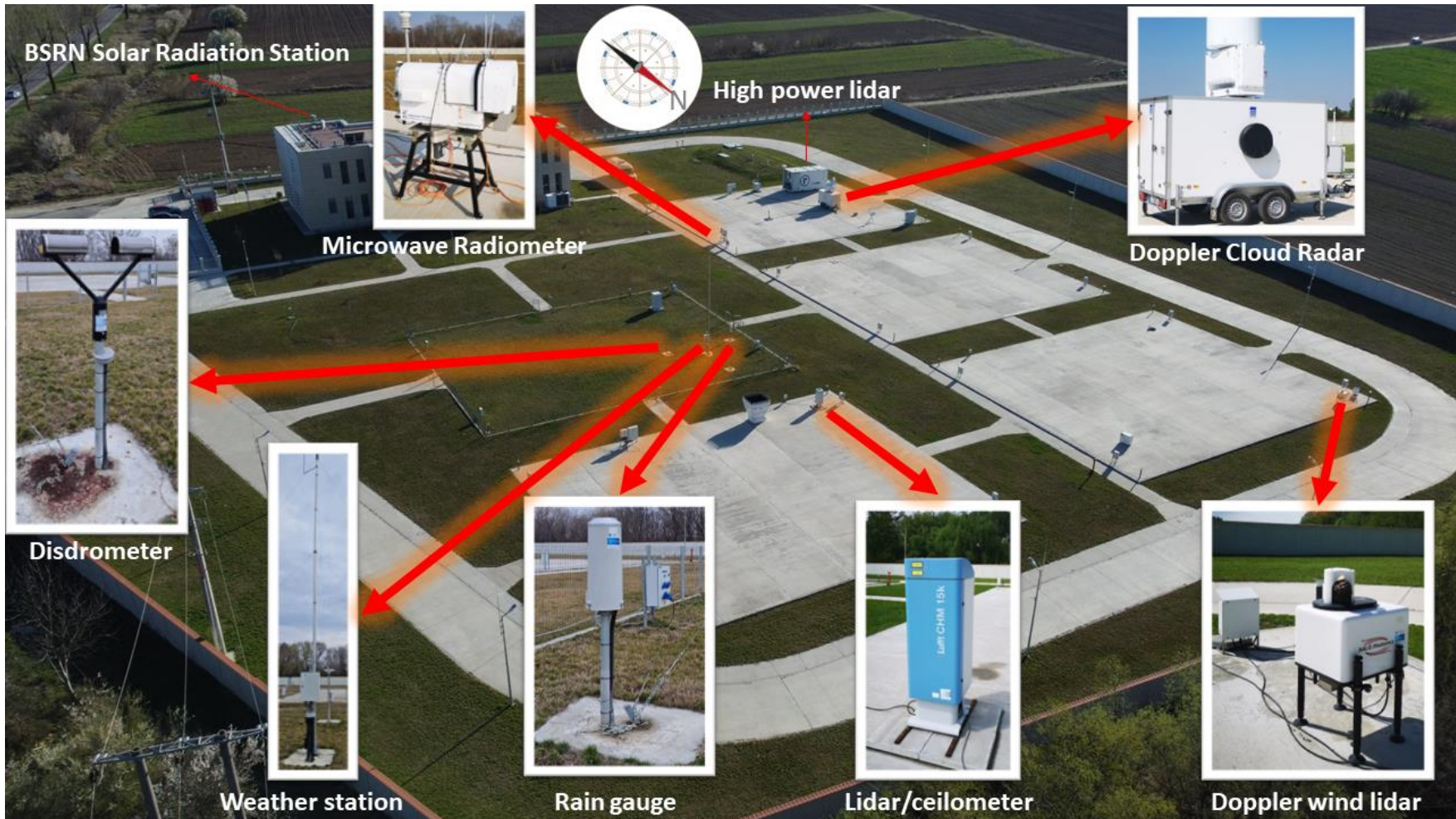


Precipitation



Clouds





Thank you for your attention!



Anca Nemuc & HARMONIA team
anca@inoe.ro

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- We thank all AERONET PI investigators and their staff for establishing and maintaining all sites used in investigations.
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COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks. Our Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.

