



Growing
ideas
through
networks

inDust

Dust observations

Lucia Mona, Serena Trippetta, Vassilis Amiridis

Rome| Italy | 11-March- 2019



Funded by the Horizon 2020 Framework Programme
of the European Union

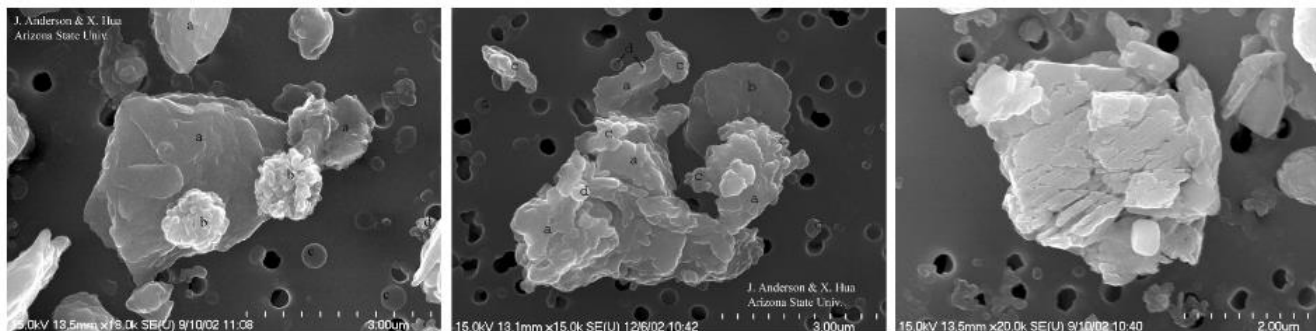
Observing Dust Particles

□ Small particles travelling in the air



Observing Dust Particles

- ❑ Small particles travelling in the air
- ❑ What desert dust particles are



Microscopic silicate dust particles collected in Asia are aggregated with soot and black carbon, left, and aluminosilicates and carbon, center. Right: a calcite particle that was etched by acid as it was transported across China.

J. Anderson and X. Hua/Arizona State University

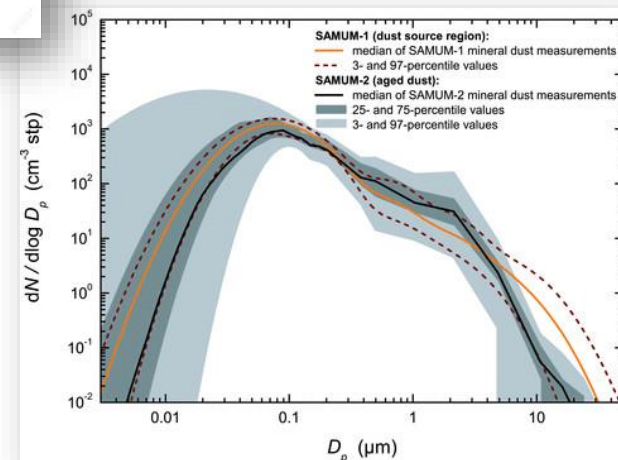
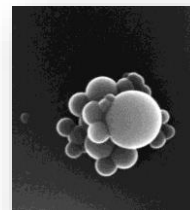


Observing Dust Particles

- ❑ Small particles travelling in the air
- ❑ What desert dust particles are
- ❑ Mixed with other particles

Observing Dust Particles

- Small particles travelling in the air
 - What desert dust particles are
 - Mixed with other particles
 - How to identify dust within the mixture
- chemical composition, size distribution
shape & morphological information

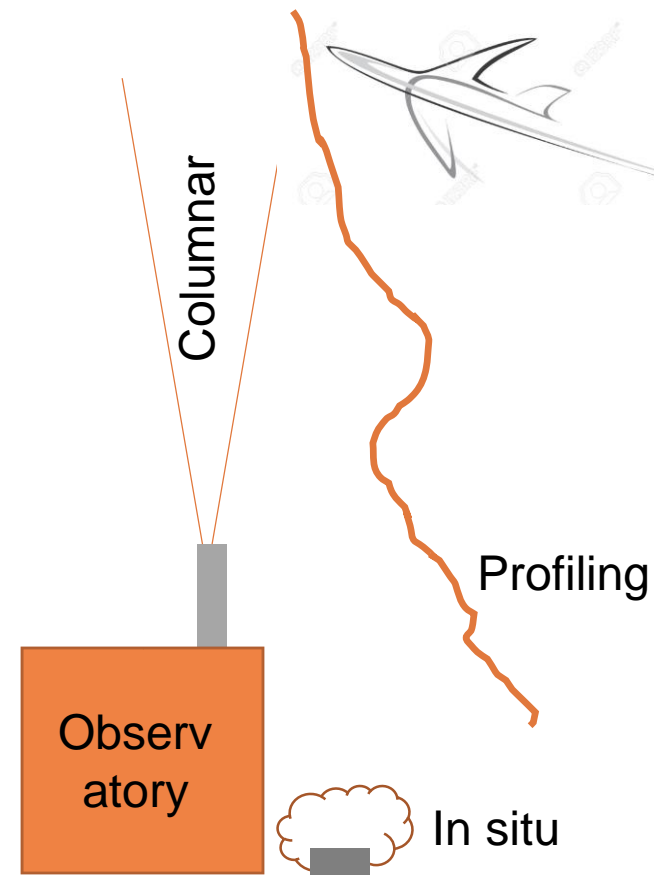




State of art for particle characterization

- ☐ Satellite measurements
- ☐ Ground based remote sensing
- ☐ Near surface characterization
- ☐ Measurement campaigns

(developing and testing methods)



Looking dust from the space

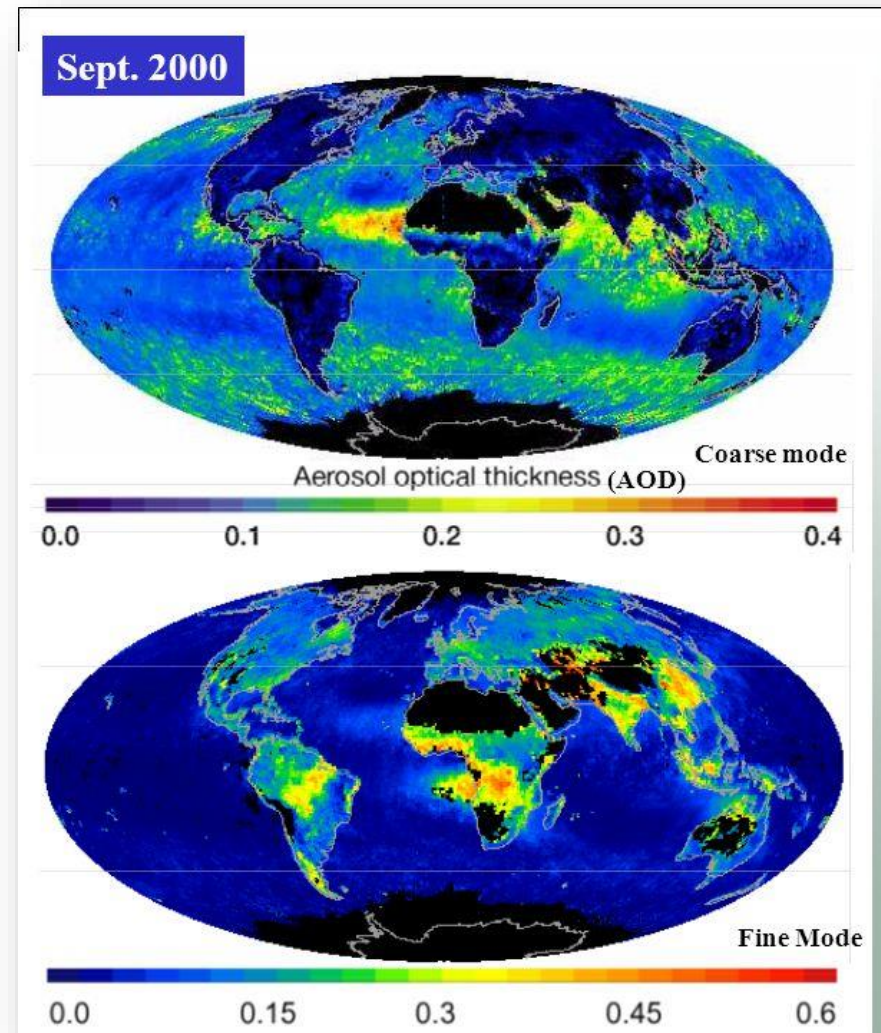
□ Satellite can detect dust pattern



Looking dust from the space

□ Satellite can detect dust pattern

□ Satellite can provide dust component (big particles)





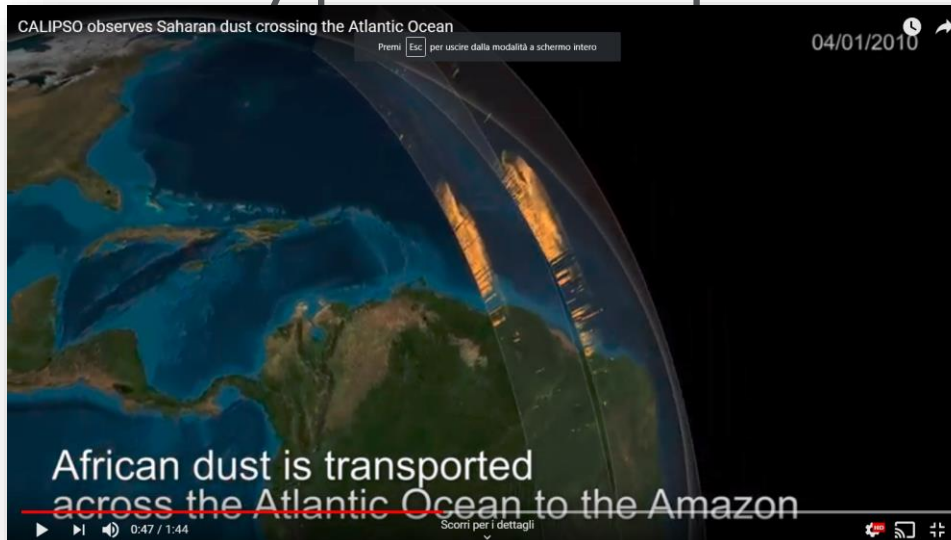
Looking dust from the space

- ❑ Satellite can detect dust pattern
- ❑ Satellite can provide dust component (big particles)
- ❑ Satellite can identify particles and provide 4D path

<https://www.youtube.com/watch?v=uIirzhILWZk>

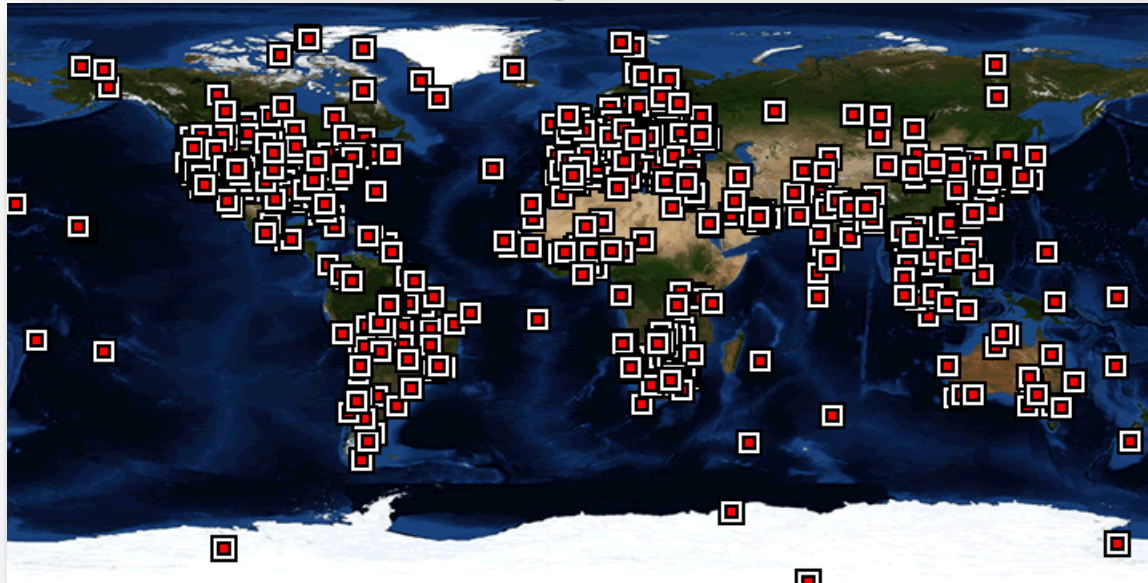
Looking dust from the space

- ❑ Satellite can detect dust pattern
- ❑ Satellite can provide dust component (big particles)
- ❑ Satellite can identify particles and provide 4D path



Looking dust from the ground

Columnar info

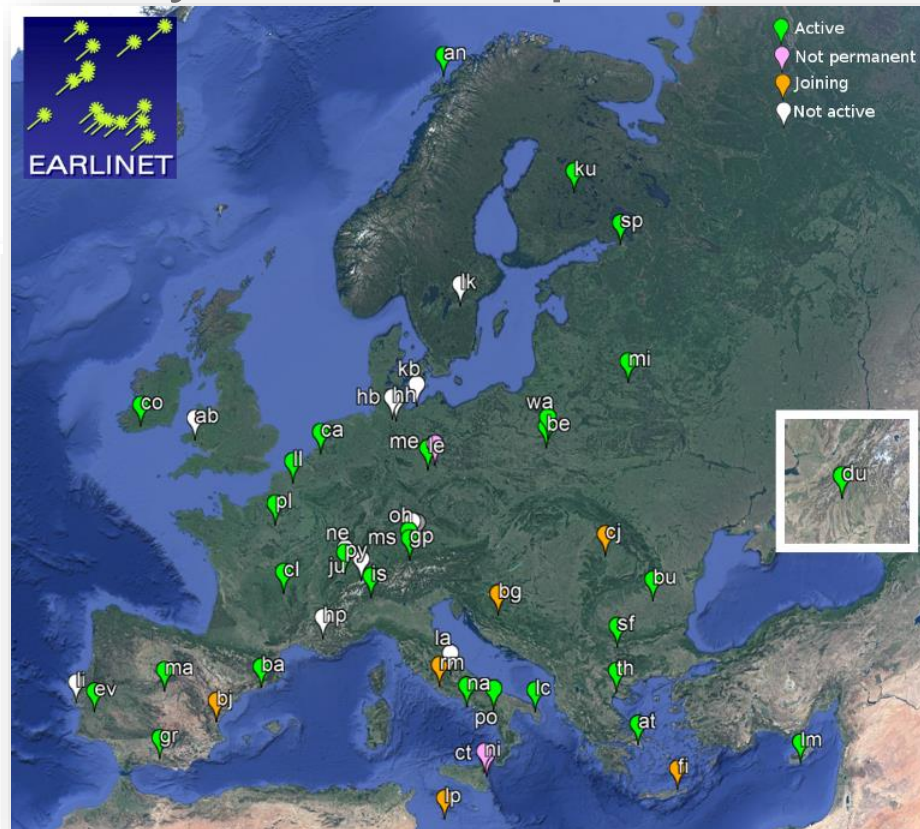


Around 300 sites over Europe:

- AOD at several wavelengths
- Size distribution
- Angstrom exponent
- Fine mode fraction
- SSA
- Asymmetry function
- Phase function

Looking dust from the ground

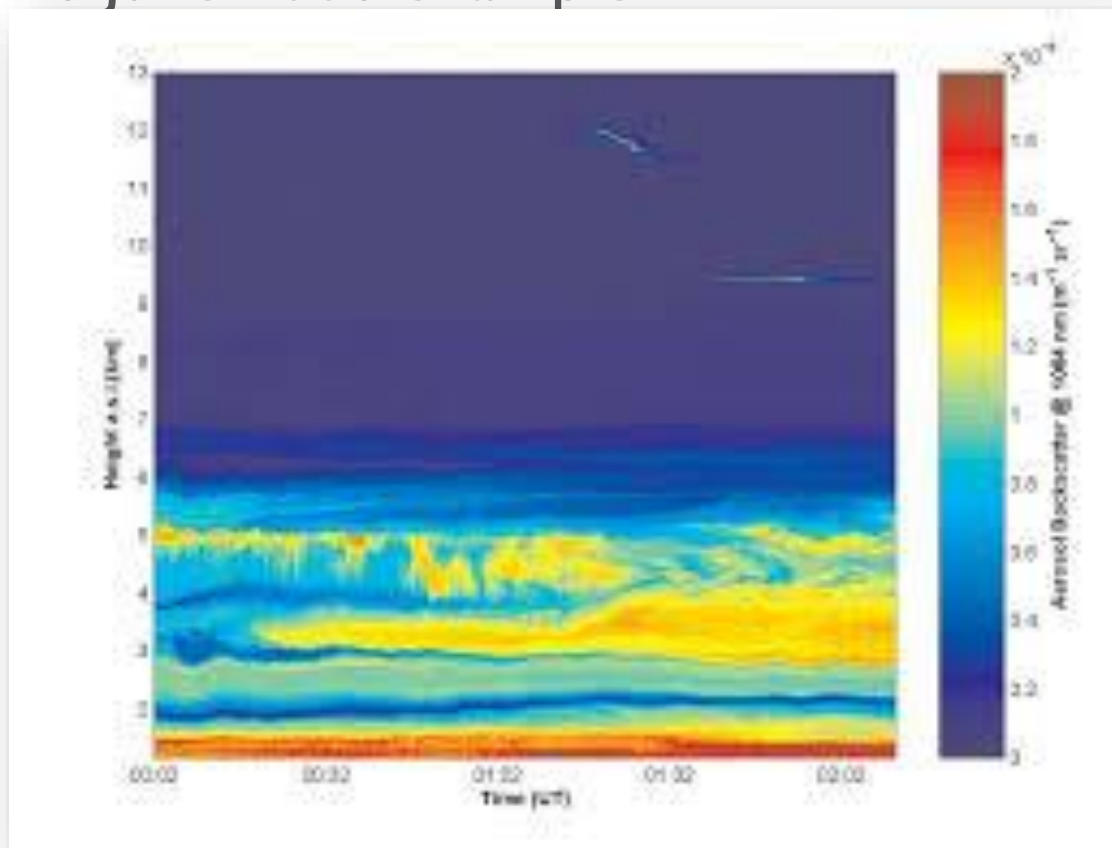
- Profiling capability over Europe with EARLINET



Looking dust from the ground

- Potenza- 26 June 2006 example

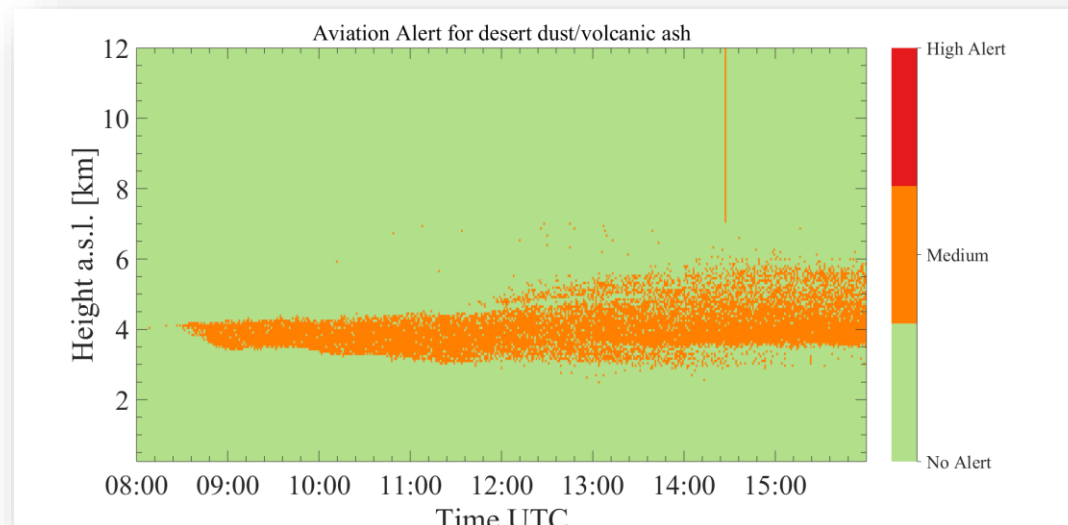
Profiling



Looking dust from the ground

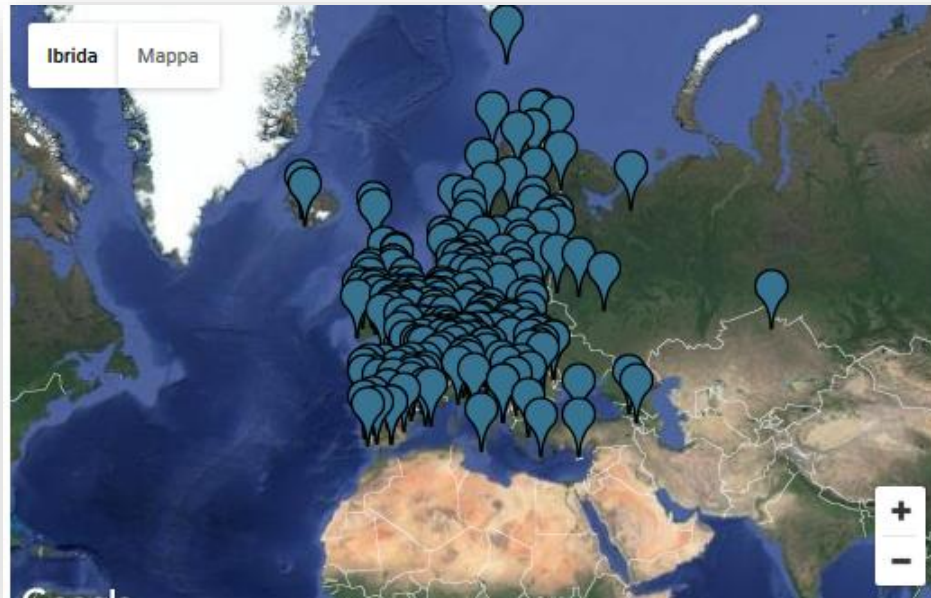
■ Early Warning System under development

Ash/dust alerting system as an experimental tailored product.
Example for 21 /03/2018 – Closure of Herakleion airport.
(concentration up to $4700 \mu\text{g}/\text{m}^3$)



Looking dust near the surface

- **European Monitoring and Evaluation Programme (EMEP)**



244 stations providing different parameters (in different combinations) like PM₁₀, PM_{2.5} and PM₁ + wet deposition

Looking dust near the surface

- **ACTRIS-Near Surface – linked to GAW**



173 stations: Chemical composition, size distribution, backscatter coefficient, PM_x

Looking dust near the surface

■ European environment Information and Observation NETwork (EIONET)



Eionet is a partnership network of the European Environment Agency (EEA) and its 39 member and cooperating countries.

The EEA is responsible for developing Eionet and coordinating its activities, together with national focal points (NFPs) in the countries, based in national environment agencies or environment ministries.

WMO White paper report for dust obs

- Near surface characterization
- Photometer measurements
- Lidar measurements
- Lidar +Photometer
- Satellite observations
- Networks
- Gaps and Needs

WMO report

WHITE PAPER ON DESERT DUST OBSERVATIONS

Lucia Mona (CNR, Italy), Vassilis Amiridis (NOA), Sara Basart (BSC, Spain), Angela Benedetti (ECMWF), Emilio Cuevas (AEMET, Spain), Valentin Foltescu (UNEP), Alexander Haseler (MeteoSwiss, Switzerland), Thomas Popp (DLR, Germany), Peter Knippertz (KIT, Germany), Fabio Madonna (CNR, Italy), Slobodan Nickovic, Gelsomina Pappalardo (CNR, Italy), Carlos Pérez García-Pando (BSC, Spain), Sergio Rodriguez (CSIC, Spain), Sangbeom Ryoo (KMA, Korea), Andrea Sealy (CIMH, Barbados), Nobuo Sugimoto (NIES, Japan), Enric Terradellas (AEMET, Spain), Bernadette Weinzierl (University of Wien, Austria), Edda Dagnason-Waldhauserova (Agricultural University of Iceland, Iceland - Czech University of Life Sciences Prague, Czech Republic)

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BAMS online paper

- ❑ Concise version of WMO report for obs status of the art
+ needs and gaps
- ❑ It will offer broad and free access to the information





Online database of dust observations

- ☐ Under development in InDust
- ☐ Linked to the WMO report+ BAMS paper
- ☐ On line inventory collecting in 1 place all dust info

Web interface

inDust Dust Observations Inventory

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Filters

Parameter: Aerosol Optical Depth, Aerosol Index, ...

Satellite: Terra, Aqua, Aura, ...

Instrument: MODIS, OMI, CALIOP

Wavelengths (nm): 550, 354, 388, 500, 354 - 388, ...

Unit: Unitless, km-1sr-1, km-1

Active/Passive: ☐ Active ☒ Passive

Temporal Resolution: Daily, 5-min, Sub-daily

Spatial Resolution: 1 deg x 1 deg, 10 km x 10 km, 3 km x 3 ...

Parameter	Satellite	Instrument	Wavelengths (nm)	Unit	Active/Passive	Temporal Resolution	Spatial Resolution	Vertical Resolution
Aerosol Optical Depth	Terra	MODIS	550	Unitless	Passive	Daily		
Aerosol Optical Depth	Aqua	MODIS	550	Unitless	Passive	Daily		
Aerosol Optical Depth	Terra	MODIS	550	Unitless	Passive	5-min		
Aerosol Optical Depth	Terra	MODIS	550	Unitless	Passive	5-min		
Aerosol Optical Depth	Aura	OMI	354, 388, 500	Unitless	Passive	Sub-daily		
Aerosol Index	Aura	OMI	354 - 388	Unitless	Passive	Sub-daily		
Absorption Aerosol Optical Depth	Aura	OMI	354, 388, 500	Unitless	Passive	Sub-daily		
Backscatter Coefficient	CALIPSO	CALIOP	532, 1064	km-1sr-1	Active	Daily		
Particulate Depolarization Ratio	CALIPSO	CALIOP	532	Unitless	Active	Daily	5 km x 70 m	30, 60, 180 m
Extinction Coefficient	CALIPSO	CALIOP	532, 1064	km-1	Active	Daily	5 km x 70 m	30, 60, 180 m

Observations categories

Contents

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New entry


International Network to Encourage the Use of Monitoring and Forecasting Dust Products (inDust) - COST Action CA16202
Developed by ReACT, IAASARS, National Observatory of Athens

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

ReACT Remote sensing of Aerosols, Clouds and Trace gases

<http://react.space.noa.gr/indust>

Web interface

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Data Availability

Coverage

Open Data?

Product View

Data Repository

References

From	To	Coverage	Open Data?	Product View	Data Repository	References
2000-02-24	Present	Globe	Yes	Link	Link	Levy et al. (2013) - (doi:10.5194/amt-6-2989-2013); Hsu et al. (2013) - (doi:10.1002/jgrd
2002-07-01	Present	Globe	Yes	Link	Link	Levy et al. (2013) - (doi:10.5194/amt-6-2989-2013); Hsu et al. (2013) - (doi:10.1002/jgrd
2000-02-24	Present	Globe	Yes	Link	Link	Levy et al. (2013) - (doi:10.5194/amt-6-2989-2013); Hsu et al. (2013) - (doi:10.1002/jgrd
2000-02-24	Present	Globe (above dark surfaces)	Yes	Link	Link	Remer et al. (2013) - (doi:10.5194/amt-6-1829-2013)
2004-10-01	Present	Globe	Yes	Link	Link	Torres et al. (2013) - (doi: 10.5194/amt-6-3257-2013)
2004-10-01	Present	Globe	Yes	Link	Link	Torres et al. (2007) - (doi:10.1029/2007JD008809)
2004-10-01	Present	Globe	Yes	Link	Link	Torres et al. (2013) - (doi: 10.5194/amt-6-3257-2013)
2006-06-13	Present	Globe	Yes	Link	Link	https://www.atmos-meas-tech.net/special_issue903.html
2006-06-13	Present	Globe	Yes	Link	Link	https://www.atmos-meas-tech.net/special_issue903.html
2006-06-13	Present	Globe	Yes	Link	Link	https://www.atmos-meas-tech.net/special_issue903.html

Official website

International Network to Encourage the Use of Monitoring and Forecasting Dust Products (inDust) - COST Action CA16202
Developed by ReACT, IAASARS, National Observatory of Athens

Data source



Literature



<http://react.space.noa.gr/indust>



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