European ground based remote sensing capability for aviation hazards

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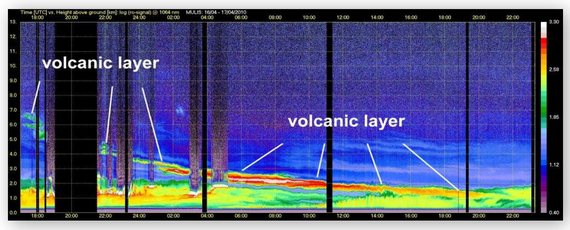
The European Natural Airborne Disaster Information and Coordination System for Aviation (EUNADICS-AV) is a H2020 project with the objective to close the significant gap in European-wide data and information availability during airborne hazards like volcanic eruptions, nuclear incidents, sand storms and large fires. Work package 3 has done an inventory of ground based remote sensing networks which provide essential measurements related to the natural hazards under consideration. These measurements will undergo a thorough cross-validation before being delivered to other work packages for integration and tailoring to meet user requirements.

Networks of active remote sensing instruments

EARLINET

Highly sensitive multi-wavelength lidars allow to accurately determine microphysical and optical aerosol properties and aerosol type.

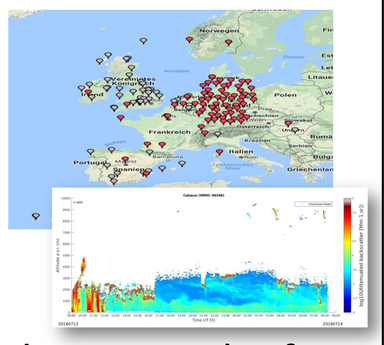
- 29 research stations
- near-real-time data when in operation



EUMETNET E-Profile

The attenuated backscatter measured by ceilometers contains information on aerosol distribution.

- real-time data
- operated 24/7
- 150 stations
- automatic calibration in the network
- wind profiler radar network of E-Profile provides wind vectors



ACTRIS/Cloudnet

The radar reflectivity is a measure of the number and size distribution of particles in the beam.

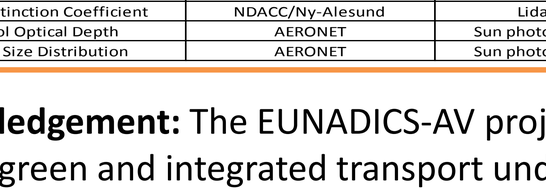
- independent of lighting conditions
- unaffected by adverse weather
- blind to fine ash → close to source
- 9 stations

Networks of passive remote sensing instruments

AEORONET/SKYNET

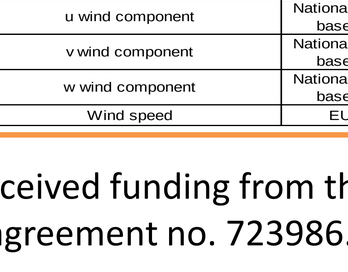
Photometers provide information on aerosol optical depth and aerosol microphysical properties.

- column-integrated
- 200 stations
- sun-photometers only daylight



EUBREWNET

The presence of SO_2 in the atmosphere is a strong indicator for volcanic eruptions.

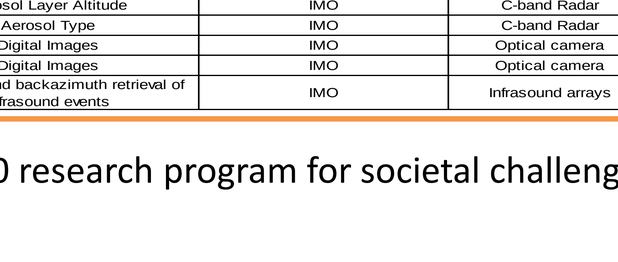


- SO_2 from UV absorption
- column-integrated
- 22 stations

Photo: World Meteorological Organisation

Volc. observatory / infrasound

Volcanic observatories with a multitude of on-site instruments and remote infrasound arrays provide information on volcanic ash injected into the atmosphere what is crucial for forecasts.



Parameter	Network	Instrument
Attenuated Backscatter coefficient	ACTRIS/EARLINET	Lidar
Aerosol Optical Depth	ACTRIS/EARLINET	Lidar
Aerosol Extinction Coefficient	ACTRIS/EARLINET	Lidar
Aerosol Backscatter Coefficient	ACTRIS/EARLINET	Lidar
Volume Depolarization Ratio	ACTRIS/EARLINET	Lidar
Linear Particle Depolarization Ratio	ACTRIS/EARLINET	Lidar
Integrated Backscatter	ACTRIS/EARLINET	Lidar
Lidar Ratio	ACTRIS/EARLINET	Lidar
Extinction related Angstrom Exponent	ACTRIS/EARLINET	Lidar
Backscatter related Angstrom Exponent	ACTRIS/EARLINET	Lidar
Aerosol layer altitude (base-top)	ACTRIS/EARLINET	Lidar
Aerosol Layer center of mass	ACTRIS/EARLINET	Lidar
Aerosol type	ACTRIS/EARLINET	Lidar
Aerosol concentration	ACTRIS/EARLINET + AERONET	LIDAR + Sun Photometer
Aerosol mass concentration	ACTRIS/EARLINET + AERONET	LIDAR + Sun Photometer
Normalized Relative Backscattering L1	MPLNet	Lidar
Aerosol Extinction L1.5a	MPLNet	Lidar
Aerosol Backscatter L1.5a	MPLNet	Lidar
Attenuated Backscatter coefficient	EUMETNET E-Profile	Auto. Lidars / Ceilometers
Uncalibrated Attenuated Backscatter coefficient	National Meteorological and Hydrological Services	Ceilometer
Aerosol layer altitude	EUMETNET E-Profile	Auto. Lidars / Ceilometers
Aerosol Backscatter Coefficient	NDACC/Ny-Alesund	Lidar
Aerosol Extinction Coefficient	NDACC/Ny-Alesund	Lidar
Aerosol Optical Depth	AERONET	Sun photometer
Aerosol Size Distribution	AERONET	Sun photometer

Parameter	Network	Instrument
Single Scattering Albedo	AERONET	Sun photometer
Refractive Index (real part)	AERONET	Sun photometer
Effective Radius	AERONET	Sun photometer
Asymmetry Factor	AERONET	Sun photometer
Aerosol Optical Depth	AERONET	Sun-Sky-Lunar photom.
Aerosol Optical Depth	SKYNET	PREDE Sun-photometer
Angstrom Exponent	SKYNET	PREDE Sun-photometer
Refractive Index	SKYNET	PREDE Sun-photometer
Phase function	SKYNET	PREDE Sun-photometer
Asymmetry factor	SKYNET	PREDE Sun-photometer
Volume size distribution	SKYNET	PREDE Sun-photometer
Sulfur Dioxide Vertical Column	EUBREWNET	Brewer radiometer
VEL Doppler Velocity	ACTRIS/Cloudnet	Doppler Radar
LDR Linear Depolarization Ratio	ACTRIS/Cloudnet	Doppler Radar
Z Radar Reflectivity factor	ACTRIS/Cloudnet	Doppler Radar
Wind direction	National institutes (Central data base under development)	Doppler Lidar
Wind speed	National institutes (Central data base under development)	Doppler Lidar
u wind component	National institutes (Central data base under development)	Doppler Lidar
v wind component	National institutes (Central data base under development)	Doppler Lidar
w wind component	National institutes (Central data base under development)	Doppler Lidar
Wind speed	EUMETNET E-Profile	Radar

Near-Source Characterization		
Parameter	**Network**	**Instrument**
Backscatterig power	INGV/OPGP	Radar
Radial velocity	INGV/OPGP	Radar
Backscatter coefficient	INGV/INAF/CNISM	Lidar
Linear Particle Depolarization	INGV/INAF/CNISM	Lidar
Lidar Ratio	INGV/INAF/CNISM	Lidar
Visible images	INGV	VIS camera network
Thermal images	INGV	TIR camera network
SO2 profiles	INGV	UV spectrometer network
SO2 images	INGV/UNIPA	UV camera network
Infrasound signal	INGV	Microphone sparse network
Linear Particle Depolarization Ratio	IMO	Lidar
Aerosol Layer Altitude	IMO	Lidar
Aerosol type	IMO	Lidar
Attenuated Backscatter coefficient	IMO	Ceilometer
SO2 column amount	IMO	DOAS
Aerosol Layer Altitude	IMO	X-band Radar
Aerosol Particle Shape Factor	IMO	X-band Radar
Aerosol Type	IMO	X-band Radar
Aerosol Layer Altitude	IMO	C-band Radar
Aerosol Type	IMO	C-band Radar
Digital Images	IMO	Optical camera
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Detection and backazimuth retrieval of infrasound events	IMO	Infrasound arrays

Acknowledgement: The EUNADICS-AV project has received funding from the European Union's Horizon 2020 research program for societal challenges - smart, green and integrated transport under grant agreement no. 723986.