

Aerosol Optical Depth measurements from the GAW-PFR network

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1. Project description

Aerosol optical depth (AOD) is the most important parameter related to aerosol radiative forcing studies. Multiwavelength AOD has been defined as an essential climate variable from various global bodies and agencies such as the Global Climate Observing System, the Global Atmosphere Watch (GAW) Program of the World Meteorological Organization, the European Space Agency Climate Change Initiative and others.

Ground-based sun-photometers have been deployed during the last 20-25 years in order to provide long term series of AOD measurements at various locations. PMOD/WRC during the start of the 90's has developed the Precision Filter Radiometer (PFR) that has been used for long term AOD measurements under a GAW-PFR Network of sun-photometers started in 1995 at Davos Switzerland and from 1999 at other locations worldwide (Kazadzis et al., 2018a).

Currently, more than 40 PFR instruments are operating worldwide. 15 of them are located in locations defined by the WMO Scientific Advisory Group for aerosols and maintained/calibrated by PMOD/WRC (including the Jungfraujoch station). Another 14 instruments owned by scientific institutes are also associated with PMOD/WRC as they are regularly calibrated by the WRC section WORCC that is the WMO defined World Aerosol Optical depth Research and Calibration Center. WORCC mandate also includes actions towards world AOD homogenization (Kazadzis et al., 2018b) and measurements for high altitude stations including Jungfraujoch, Mauna Loa, USA (Toledano et al., 2018) and Izana, Tenerife, Spain (Cuevas et al., 2019). An overview of the results of the GAW-PFR station measurements till 2018 have been presented in Kazadzis et al., 2019.

Aerosol Observations at Jungfraujoch (JFJ) have started in 1999. PFR instruments are measuring direct sun irradiance and only under cloudless sky conditions (minutes) they derive the AOD in four wavelengths and the Ångström exponent. During the period 2018-2020 JFJ activities have been included (together with all other GAW-PFR instruments) in the project "GCOS - The Global Atmosphere Watch Precision Filter Radiometer (GAW-PFR) Net-

work for Aerosol Optical Depth long term measurements" funded by the Federal Office of Meteorology and Climatology MeteoSwiss / International Affairs Division, Swiss GCOS Office.

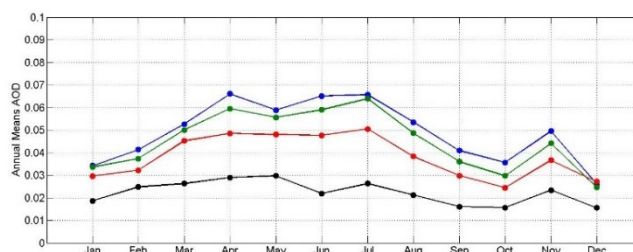


Figure 1. Interannual variability of aerosol optical depth at 368nm (blue), 412nm (green), 500nm (red) and 863nm (black)

Table 1 shows the current GAW-PFR instrumentation. The instrument specifications are according to WMO recommendations.

Instrument type	PFR-N
Measuring wavelengths (nm)	368, 412, 500, 863
Field-of-view (deg)	2.5
FWHM (nm)	3.8-5.4
Measurement principle	Sun pointing on tracker

Table 1. Current GAW-PFR aerosol optical depth instrumentation at Jungfraujoch.

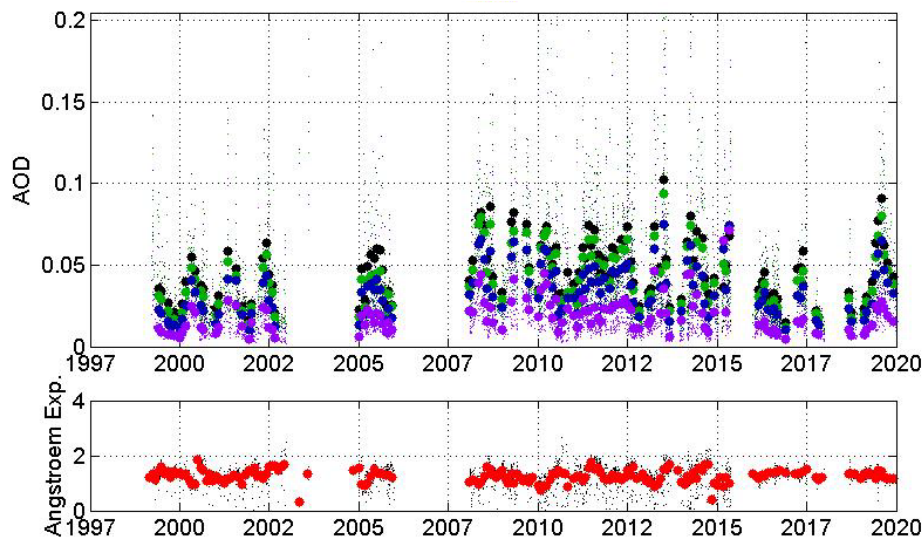


Figure 2. Time series 1999-2019 of aerosol optical depth (4 wavelengths) and Ångström Exponent at Jungfraujoch measured with the PFR instrument.

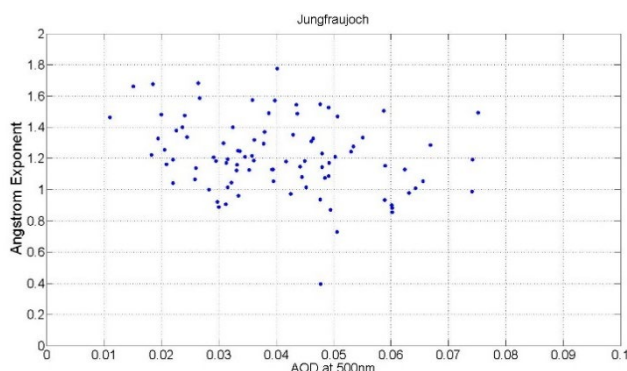


Figure 3. Ångström Exponent vs. Aerosol optical depth monthly averages at Jungfraujoch.

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Internet data bases

<http://ebas.nilu.no>

Collaborating partners / networks

Dr. L. Vuilleumier, MeteoSwiss, Payerne

Scientific publications and public outreach 2019

Refereed journal articles and their internet access

Cuevas, E., P. M. Romero-Campos, N. Kouremeti, S. Kazadzis, P. Räisänen, R.D. García, A. Barreto, C. Guirado-Fuentes, R. Ramos, C. Toledano, F. Almansa, and J. Gröbner, Aerosol optical depth comparison between GAW-PFR and AERONET-Cimel radiometers from long-term (2005-2015) 1 min synchronous measurements, *Atmos. Meas. Tech.*, **12**, 4309-4337, 2019. <https://doi.org/10.5194/amt-12-4309-2019>

Conference Papers

Kazadzis, S., N. Kouremeti, Aerosol Optical Depth Measurements at the WMO Global Atmospheric Watch - PFR Network Stations, American Geophysical Union Conference, San Francisco, USA, December 9-13, 2019.

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