

Broadband AOD from 1909 to 2010 at Davos, Switzerland

D. Lachat (1,2), Ch. Wehrli (1), and H. Wanner (2)

(1) Physikalisch-Meteorologisches Observatorium Davos, World Radiation Centre (PMOD/WRC), (2) Institute of Geography and Oeschger Centre for Climate Change Research, University of Bern

Solar radiation and atmospheric transmission have been of increasing interest in climate research in the past decades. In this context, recent studies have observed decadal trends in solar radiation received at the Earth's surface. They claim a decrease of solar radiation starting from the 1950s to the end of the 1980s followed by an increase from the 1990s to present. These periods are referred to as Global Dimming and Global Brightening (1), respectively. Trends in cloud coverage and atmospheric transmission are prime focal points in the quest for possible causes of this variability.

Pyrheliometric measurements have been carried out at the PMOD/WRC from 1909 until present which results in the longest stationary direct irradiance record. A variety of radiometers and changing measurement scales had to be adjusted to the World Radiometric Reference (WRR).

Following the Ratioing Technique used by Hoyt and Fröhlich (2), apparent atmospheric transmission was obtained by calculating the ratio of irradiances, interpolated at two fixed airmasses from a fit through observations. In the 1970s, apparent atmospheric transmission over Davos shows a slight transition from Dimming to Brightening which is more pronounced if favourable seasonal subsets are analyzed.

Recently, there are efforts to analyze the Dimming and Brightening trends by separating the contributions of water vapor absorption and aerosol extinction (3). This implies the factorization of transmission into Rayleigh scattering and water vapor absorption, and interpreting the residual as aerosol extinction. Therefore, Integrated atmospheric Water Vapour (IWV) has been estimated from specific humidity and 2m-temperature measurements. Estimated IWV and GPS measurements are in good agreement.

Atmospheric transmission accounting for water vapor absorption and Rayleigh scattering respectively have been simulated using a simple radiative transfer model. The resulting IWV-transmission-series and the residual BAOD-series are analyzed for decadal trends.

References:

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- 2 Hoyt D., Fröhlich C.: Atmospheric Transmission at Davos 1909-1979, *Climate Change* 5, 61-71, 1983.
- 3 Haywood J., Bellouin N. et al.: The roles of aerosol, water vapor and cloud in future global dimming/brightening, *Journ. Geophys. Res.* 116, D20203, 2011.