



The Total Ozone Series of Arosa: History, Homogenization and new results using statistical extreme value theory

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Atmospheric ozone protects the biota living at the Earth's surface from harmful solar UV-B and UV-C radiation. The global ozone shield is expected to gradually recover from the anthropogenic disturbance of ozone depleting substances (ODS) in the coming decades. The stratospheric ozone layer at extratropics might significantly increase above the thickness of the chemically undisturbed atmosphere which might enhance ozone concentrations at the tropopause altitude where ozone is an important greenhouse gas.

At Arosa, a resort village in the Swiss Alps, total ozone measurements started in 1926 leading to the longest total ozone series of the world. One Fery spectrograph and seven Dobson spectrophotometers were operated at Arosa and the method used to homogenize the series will be presented. Due to its unique length the series allows studying total ozone in the chemically undisturbed as well as in the ODS loaded stratosphere. The series is particularly valuable to study natural variability in the period prior to 1970, when ODS started to affect stratospheric ozone. Concepts developed by extreme value statistics allow objective definitions of "ozone extreme high" and "ozone extreme low" values by fitting the (daily mean) time series using the Generalized Pareto Distribution (GPD). Extreme high ozone events can be attributed to effects of El Niño and/or NAO, whereas in the chemically disturbed stratosphere high frequencies of extreme low total ozone values simultaneously occur with periods of strong polar ozone depletion (identified by statistical modeling with Equivalent Stratospheric Chlorine times Volume of Stratospheric Polar Clouds) and volcanic eruptions (such as El Chichón and Pinatubo).