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Satellite- and model-based decadal surface UV reconstructions: Extremes in northern mid-latitude UV index as prevented by 25 years of the Montreal Protocol

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Global, regional and local long-term reconstructions of surface UV radiation have been created based on satellite observations of ozone and model simulations. The reconstructions show both the historical evolution of the surface UV radiation levels over the past decades in response to the observed changes in the ozone layer and a hypothetical path up to 2012 in response to a model ozone scenario without the Montreal protocol (Chipperfield et al., Nat. Comm., 2015), i.e. the world-avoided. The application of the ozone depletion as prevented by the Montreal Protocol on the ozone record used in the UV algorithms allowed us to compute the world-avoided in terms of detailed impact on surface UV radiation, including extremes in UV Index at northern mid-latitudes.

Clear-sky UV index (since 1979).
The clear-sky UV noontime index is the internationally agreed UV quantity used in weather forecasting and UV warnings to the public related to sunburn. Historical and world-avoided reconstructions of the clear-sky noontime UV index are provided globally at a spatial resolution of 0.25 x 0.25 degrees. The satellite data records are based on a newly assimilated multi-sensor reanalysis (MSR version 2) using satellite and ground-based total ozone column observations (van der A et al., AMT, 2015).

UV daily dose (since 2004).
The UV daily dose is the quantity directly related to the long-term impact of UV radiation on human health issues. Historical and world-avoided reconstructions of the UV daily dose, both for action spectra of skin reddening (erythema) and Vitamin-D production in the skin, are provided for the region of the earth covered by the Meteosat Second Generation (MSG) satellites. This includes most of Africa and Europe up to 70 degrees North. The UV daily dose is the spectrally-weighted integrated amount of UV radiation (in kJ m-2) incident at the surface between sunrise and sunset, taking into account short-term variations in UV cloud transmission using 15-minute quantitative cloud property observations by MSG (Stengel et al., ACP, 2014).

An analysis in terms of mean UV changes and UV extremes will be presented, specifically comparing the historical and world-avoided reconstructions. A discussion of the world-avoided scenario will be given and the avoided potential societal impacts will be addressed. The presented historical data sets are extended on a daily basis and made available - together with the (assimilated) input global ozone data sets - through the TEMIS webservices hosted at KNMI (http://www.temis.nl/uvradiation).