QOS2016-140-3, 2016
Quadrennial Ozone Symposium of the International Ozone Commission

High frequency retrieval of total ozone from a ground-based NILU-UV radiometer using a neural network model: validation of the model and evaluation of satellite observations.

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The present study presents a new approach to retrieve total ozone at high temporal frequency from surface irradiance measurements performed with a NILU-UV multi-filter radiometer. Time series of 1-minute NILU-UV irradiances at central wavelengths of 302, 312, 320, 340 and 380 nm are used as inputs to a neural network model together with collocated solar zenith angles calculated at Thessaloniki, Greece (40.63E, 22.96N), and the day of the year and as well its sinusoidal components as temporal variables. A decade of coincident Brewer total ozone measurements (TOCs) are used as the target (output) values. A key feature of this Neural Network Model is the use of Singular Spectrum Analysis to denoise all time-series variables. The model is then fed with unseen real (noisy) inputs to estimate TOCs for the decade 2005-2014. Satellite total ozone from the GOME/ERS-2, SCIAMACHY/Envisat, OMI/Aura, and GOME2/MetopA GODFIT_v3 Ozone-CCI ESA algorithm at each overpass time are used to provide a comparison for instantaneous TOC estimates produced by the neural network model from NILU-UV irradiances. Furthermore, a collocated CCD spectrometer system provides TOCs values since late 2013 by applying the DOAS technique to the direct sun measurements performed in the UV spectral region of 315-337 nm. Time series analysis and correlation statistics identify the agreement limitations as well as atmospheric, algorithm-related and technical factors responsible for sources of discrepancy among the TOC retrievals.