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Simultaneous retrieval of total ozone column amounts and cloud/aerosol optical depths from multi-channel, moderate bandwidth filter instruments

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A new method is presented based on using neural networks (NN) to analyze ultraviolet (UV) irradiance data recorded by multi-channel, moderate bandwidth filter instruments. Application of the NN method to three years of data obtained by a NILU-UV multi-channel, moderate bandwidth filter instrument, revealed that compared to a traditional look-up table (LUT) method, the NN method yielded better agreement against the Ozone Monitoring Instrument (OMI) with a 1% decrease in relative difference and a significant increase in the correlation of total ozone column (TOC) values. Furthermore, this new method resulted in larger number of valid retrievals (daily average values within a meaningful range of 200-500 DU) than the LUT method. Compared with NN retrievals based on NILU-UV irradiance measurements, TOC values obtained from OMI were underestimated under cloudy conditions. Cloud optical depth (COD) values derived by the NN method were more reliable than corresponding results derived by the LUT method, the latter results were less accurate for heavy cloud cover, broken cloud situations or snow-covered ground. The potential for retrieving aerosol optical depth (AOD) values under cloud-free conditions will be discussed. The cloud-aerosol information obtained by irradiance instruments such as the NILU-UV can be used in conjunction with a radiative transfer model to estimate cloud/aerosol radiative forcing and hence the impact of clouds and aerosols on the radiative energy balance. Deployment of multi-channel, moderate bandwidth filter instruments at AERONET sites and analysis of such data in conjunction with AERONET and satellite remote sensing data can provide crucial information needed for the assessment of the influence of ozone, clouds, and aerosols on climate.