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NO₂ and HCHO photolysis frequencies from irradiance measurements in Thessaloniki, Greece

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Abstract. An empirical approach for the retrieval of nitrogen dioxide (NO₂) and formaldehyde (HCHO) photolysis frequencies from measurements of global irradiance is presented in this work. Four months of synchronous measurements of actinic flux and global irradiance performed in Thessaloniki, Greece by a Bentham spectroradiometer were used to extract polynomials for the conversion of global irradiance to photolysis frequencies [J(NO₂) and J(HCHO)]. The comparison of these photolysis frequency values to the corresponding values calculated by spectral actinic flux measurements, showed a ratio very close to unity for all J's with a standard deviation of 12% (2σ) for J(NO₂) and 6% (2σ) for J(HCHO). Additional sets of polynomials were also extracted to allow determination of J(NO₂) by spectroradiometers with lower upper wavelength limits such as single and double Brewer spectroradiometers within acceptable uncertainty (corresponding ratio was 1 and standard deviation was 12% (2σ) for the method that can be used with double Brewers and 20% for the method that can be used for single Brewers). The validity of the method under different atmospheric conditions was also examined by applying the polynomials to another set of actinic flux and global irradiance measurements performed in May 2004, in Buchhofen, Germany. In this case, comparing J values extracted from the polynomials to those calculated from actinic flux, showed equivalent results, demonstrating that the method can also be applied to other measurement sites.

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