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Attenuation of global ultraviolet and visible irradiance over Greece during the total solar eclipse of 29 March 2006

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Abstract. The variability of ultraviolet and photosynthetically active radiation (PAR) during the total solar eclipse of 29 March 2006 was examined in this study. The measurements from NILU-UV multichannel radiometers at 7 stations of the Greek UV Network were used, where the maximum eclipse percentage ranged from 73.1% to 94.8%. In addition, an extra instrument was established at a remote Greek island, Kastelorizo, which was within the Moon's umbral shadow. The reduction of irradiance at 305 and 312 nm relative to non-eclipse conditions at all sites was almost 1.5 times more than the corresponding decrease in the UVA and visible part of the spectrum and reached 98% for eclipse percentage equal to 94%. The availability of several instruments in close proximity to the path of the umbral shadow provided a challenging test for the models. The measured changes in UV and visible irradiance were compared with 1-D model calculations accounting for the limb darkening effect. The agreement between measurements and modeled values at all sites is within 3% for eclipse percentages of less than 30% and becomes worse as the eclipse progresses. The 1-D model reproduced the spectral effect of the eclipse in UVA and PAR wavelength regions within 3% for eclipse percentages up to 50%, but only the half of the observed change was captured as the eclipse progressed. At three sites, where the eclipse maximum was more than 94%, the measured irradiance at 305 nm for eclipse percentages of more than 85% decreased with slower rates than for longer wavelengths. As a result, the total ozone values, derived from the 305/320 nm ratios, apparently decreased significantly for high eclipse percentages. The effect is similar at all three sites, but the interpretation of this observation remains a challenge. Comparison results with 3-D model calculations shortly before, during and shortly after totality were performed for the first time and revealed an agreement with measurements within 20% in the UV-A region. However, the modeled estimates of irradiance at 312 nm are three times lower than measured values.

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