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# Towards closure between measured and modelled UV under clear skies at four diverse sites

J. Badosa[1], R. L. McKenzie[2], M. Kotkamp[2], J. Calbó[1], J. A. González[1], P. V. Johnston[2], M. O'Neill[3], and D. J. Anderson[4]

[1]Departament de Física, Grup de Fisica Ambiental, Universitat de Girona, Girona, Spain

[2]National Institute of Water and Atmospheric Research (NIWA), Lauder, New Zealand

[3]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, USA

[4]Bureau of Meteorology (BoM), Melbourne, Australia

Abstract. The purpose of this work is determine the extent of closure between measurements and models of UV irradiances at diverse sites using state of the art instruments, models, and the best available data as inputs to the models. These include information about aerosol optical depth (unfortunately not extending down as far into the UVB region as desirable because such information is not generally available), ozone column amounts, as well as vertical profiles of temperature. We concentrate on clear-sky irradiances, and report the results in terms of UV Index (UVI).

Clear-sky data from one year of measurements at each of four diverse sites (Lauder – New Zealand, Mauna Loa Observatory – Hawaii, Boulder – Colorado, and Melbourne – Australia) have been analysed in detail, also taking account of different measurements of ozone, including satellite-derived values, as well as ground measured values, both from Dobson instruments and as retrieved from the UV spectra under study. Previous studies have generally focussed on data from a single site, and for shorter periods. As such, it is the most comprehensive study of its kind to date.

At Lauder, which is the cleanest low altitude site, we obtained agreement between measurement and model at 5% level, which is consistent with the best agreement found previously. At Mauna Loa Observatory, similar agreement was achieved, but model calculations need to allow for reflections from cloud that are present below the observatory. At this site, there are occasional problems with using satellite-derived ozone. At Boulder, mean agreements were similar but the dispersion around the mean was slightly larger, corresponding to larger uncertainties in the aerosol inputs to the model. However, at Melbourne, which is the only non-NDACC (Network for the Detection of Atmospheric Composition Change) site, there remain unexplained discrepancies. The measured values are significantly lower than the calculated values. We investigate the extent to which this discrepancy can be explained by incomplete knowledge of aerosol extinctions in the UV at this site. We conclude that further information about aerosol optical depth and single scattering albedo in the

UVB region is needed to resolve the issues. For more polluted sites (the four considered locations show in general small aerosol load), the uncertainties in the aerosol input parameters would lead to less confidence on the modelling approach. At the three NDACC sites, the closure provided by the study gives confidence in both the measurements and our ability to model them. This study revealed a limitation in the use of PTFE diffusers when temperatures are lower than approximately 20°C. It also documents the range of clear sky UVI values expected at these diverse sites.

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