Geophysical Research Abstracts, Vol. 9, 08259, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08259

Comparison of algorithms and input data for modelling solar ultraviolet radiation in the past

P. Koepke (1), A.W. Schmalwieser (2), H. De Backer (3), A. Bais (4), A. Curylo (5), K. Eerme (6), U. Feister (7), B. Johnsen (8), J. Junk (9), A. Kazantzidis (4), J. Krzyscin (10), A. Lindfors (11), J. A. Olseth (12), P. den Outer (13), A. Pribullova (14), H. Slaper (13), H. Staiger (15), J. Verdebout (16), L. Vuilleumier (17), P. Weihs (18)

(1) Meteorol. Instit., L-M-Univ., Munich, Germany, (2) Inst. Med. Phys. Biostatistics, Univ. Vet. Med., Vienna, Austria, (3) Royal Meteorol. Inst. Belgium, Brussels, Belgium, (4) Aristoteles Univ., Thessaloniki, Greece, (5) Inst. Meteorol. Water Manag., Legionowo, Poland, (6) Tartu Obs., Toravere, Estonia, (7) German Meteorol. Service, Richard Aßmann Obs., Lindenberg, Germany, (8) Norwegian Rad. Prot. Auth., Oesteraas, Norway, (9) Dep. Climat., Univ. Trier, Trier, Germany, (10) Inst. Geophys., Polish Acad. Sciences, Warsaw, Poland, (11) Finnish Meteorol. Inst., Helsinki, Finland, (12) Geophys. Inst., Univ. Bergen, Bergen, Norway, (13) Nat. Inst. Public Health Environ., Bilthoven, The Netherlands, (14) Geophys. Inst., Slovak. Acad. Sciences, Bratislava, Slovakia, (15) German Meteorol. Service, Dep. Climat. Environ., Freiburg, Germany, (16) Europ. Com. - Joint Res. Centre, Ispra, Italy, (17) Fed. Off. Meteorol. Climatol. MeteoSwiss, Payerne, Switzerland, (18) Inst. Meteorol., BOKU, Vienna, Austria

(peter.koepke@lrz.uni-muenchen.de)

The variation of ultraviolet (UV) radiation during the last decades is of interest for skin cancer development and other long-term studies of UV effects. Thus, to determine the geographical distribution of the UV-daily dose for whole Europe during the last 50 years, the COST action 726 “Long term changes and climatology of UV radiation over Europe” has been established. UV radiation of the past can only be obtained by using adequate models running with the correct input data, i.e. values of the parameters that affect the solar UV radiation at the surface. Consequently, available numerical models and algorithms have been recorded, and the availability has been tested, both of the meteorological data, which are needed to run these models for different places in Europe, and of measured UV data that can be used to check the model results.

To test the model quality, erythemally weighted daily doses have been calculated by each model and compared with measured values. To check the widest range of meteorological conditions, two complete years have been chosen as time interval, 1999 and 2002, and four stations distributed over Europe: Bergen (Norway, 60,4˚ N, 5.3˚ E, 45 m a.s.l.), Davos (Switzerland, 46.8˚ N, 9.8˚ E, 1590 m a.s.l.), Potsdam (Germany, 52.4˚ N, 13.1˚ E, 107 m a.s.l.), and Thessaloniki (Greece, 40.6˚N, 23.0˚E, 60 m a.s.l.). The modelled daily doses have been compared with the measured data with bsolute differences for each day. To get a final estimation of the model quality, a combination of model-measurement correlation together with equality of root mean square values of the modelled and the measured data has been used, as proposed by Taylor.

The models with best performance to model erythemally effective UV daily dose in the past are those that take a cloud modification factor (CMF) for the UV range which is derived from a measured CMF for global solar radiation to describe the cloud effects. The reason is that the global solar radiation is affected by the clouds similarly as the UV radiation. Besides solar elevation clouds are the most important input parameter to model UV radiation in the past. Strong effects of course result from variable ozone, which however is less variable in space and therefore can be taken more easily from old measurements. To determine the quality of the aerosol modelling cloud-free data have to be checked independently. As a first result it seems to be better to use climatological aerosol properties with low variability than with strong variations inferred from visibility data. In addition, the snow effects should be analysed again, and perhaps can be improved, since the correlation between snow height and age on the one hand, and regional albedo on the other hand, clearly depends on stations altitude, longitude and skyline.

The modelling exercise was very successful. Models that are suitable to perform the COST action have been identified. Moreover, a large body of data is available which can be used for many scientific questions, like practical aspects of cloud, aerosol or albedo effects on UV and model improvement.