

Interactive comment on “Measurements of UV irradiance within the area of one satellite pixel” by P. Weihs et al.

Anonymous Referee #1

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The paper focuses on results of a three-months campaign of comparisons between ground-based measurements of solar erythemal UV irradiance taken at six closely located sites in the city area of Vienna with corresponding satellite-derived pixel values of solar UV radiation. Among the scientific issues and results of this study, two main aspects are worth to be emphasized:

- i) the still very large uncertainties in downwelling solar erythemal UV radiation derived from satellite-based measurements as well as their dependence on aerosol optical depths and cloudiness, and
- ii) natural small-scale variations of UV radiation within the area of a satellite pixel.

Referring to the first aspect, the results of the study confirm results of other studies and

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provide thus more evidence of the need to improve algorithms for retrieval of UV radiation from satellite-based data. The second more innovative aspect of small-scale variations of UV radiation due to varying atmospheric conditions, in particular cloudiness, underlines the great value of ground-based measurements that are capable of resolving those small-scale variations of solar UV radiation in space and time and thus in providing representative daily and monthly doses in a desired spatial resolution. Those small-scale variations that are not resolved by present-day satellite sensors reveal also the problem inherent in comparisons between measurements of different spatial and temporal resolution and the different viewing geometries of ground-based and satellite-based sensors. Especially this second aspect may be considered worth to be further studied and be extended for other, more inhomogeneous conditions of surface albedo and atmospheric conditions such as mountaineous terrain, patchy ice and snow covered surfaces, urban and industrialized areas with high levels of air pollution etc.

The results of this study will certainly be appreciated by groups dealing with the development of algorithms to derive UV radiation from satellite-based measurements, and also by users of satellite-based UV data in their decisions, whether satellite-derived data of UV radiation with their respective high uncertainties and course spatial resolution can be used for their specific purpose.

The description of results is generally sufficient for the conclusions derived. The paper is recommend for publication in ACPD. A few comments for clarification will be given below. The paper should also be checked for writing errors and language use.

Page 3694, L7 to L9: It is stated in the abstract that the sub-pixel variation of the UV index under clear sky conditions is within the measurement uncertainty of $\pm 8\%$, whereas in section 3.1.1, P 3698, L1 to L2 it is stated to be $\pm 5\%$. Referring to the whole abstract, wording might be changed such that it becomes more clear, what the range of sub-pixel variations of the UV index is, and what the uncertainties of satellite-based UV data are, at least a new paragraph may be started after 3h averages.

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Page 3697, Line 21: Include at noon time after UV radiation

Page 3697, Line 19 to Line 24, Reference to Figures 2a to 2c: Fig. 2b shows a stronger scatter than Fig. 2c that refers to overcast conditions. This appears to be in contrast to Table 2, where larger differences between ground-based and satellite-based values occur with partly cloudy sky as compared to overcast conditions.

Page 3698, Line 10: constant

Page 3699, Line 13: Overcast sky is usually defined by a cloud cover of 8 Okta, i.e. sky covered by clouds without gaps, so it can not be further enhanced. I recommend to replace the wording totally overcast by overcast throughout the paper, because readers who are not familiar with cloud cover definitions may think there is a difference between the two expressions.

Page 3699: Has the homogenization of the UV index referring to ozone as defined by equations 1 and 2 also been applied with cloudy conditions? If so, can you argue on its applicability?

Page 3700, Line 22: quite

Page 3701, Line 14: outliers; Is 0 to 40 per cent difference between satellite-based and ground-based UV radiation meant to be an average? According to Fig. 6, many higher values do occur.

Page 3701, Line 27: values

Page 3702, Lines 9 and 21, Page 3703, Line 12: on average

Page 3702, Line 20: It is said that the OMI UVI algorithm does not agree very well with ground-based observations. This wording appears to be quite positive, if the differences discussed before are taken into account.

Page 3704: It is said that current ground-based networks can not be replaced by the use of satellite data because of the still high overestimation of actual UV values under

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cloudy and overcast conditions. The statement appears to reflect only part of the main results presented in this study. If satellite-based measurements have been seriously designed to replace ground-based networks instead of being a valuable addition to them, their uncertainties under all weather conditions, and their resolution in space and time would need to be comparable to ground-based measurements. This is obviously not the case now, and will probably remain a problem in the near future. Satellite-based UV measurements have a great value due to their global coverage and providing data over regions, where ground-based measurements do not exist or cannot be made such as over the oceans and in remote areas. In regions where ground-based data are available, satellite-based data may be merged with ground-based data, as soon as their uncertainties will have been significantly reduced to improve spatial data coverage. Ground-based measurements will also remain to be a valuable data source for further validation of satellite-based data and improvement of their retrieval algorithms.

Page 3704, Line 8, under

Page 3709, Table 2: Include percentage after average

Page 3717, Figure 5: replace momentaneous by instantaneous, add to Figure caption, what upper and lower panel of the Figure mean.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 3693, 2008.

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