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Discussions

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Interactive comment on "Optimizing UV index determination from broadband irradiances" *by* Keith A. Tereszchuk et al.

Anonymous Referee #1

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This paper is a thorough study of utilizing the radiation output from a global weather forecast model to directly provide the UV index values. As the authors describe this is not an easy task. In order to even think about doing such a task is dependent upon how many bands the radiation spectrum is divided up into such that there are enough bands in the UV part of the spectrum to provide adequate results when weighted by the erythemal action spectrum. The authors go into great lengths and detail to ensure that their Cloud-J radiation scheme will produce accurate results. They compare test cases with UV spectral observations from the Canadian Brewer network. They determine that the Canadian Global Environmental Multi-scale model (GEM) has deficiencies in the incoming solar spectrum as well as values generated by its radiation code in the smaller UV wavelengths. Modifications to the downwelling shortwave radiation by clouds is

always a difficult task and is key to getting the global energy balance perfected. This paper provides the necessary homework prior to the next step of generating UV index forecasts for various hours of the day for multiple days. At that time forecast errors of ozone, clouds, snow will need to be evaluated.

The following are general comments and questions: - I am not accustomed to seeing correlations expressed as percent, rather as a unitless values ranging from -1.0 to 1.0. - This is a rhetorical question: Which is preferred : 'UV index' or 'UV Index'? Even the WMO web page has a mixture of both. But its acronym is 'UVI' implying that 'index' is capitalized.

Comments, questions: P2, L20: Should be 'oxygen (O_2)'.

P2, L27: Expand on what is meant by 'more sensitive population'.

P3, L4: 'erythemal action spectrum (EAS)'

P3, L15 The UVI does not have to be an integer.

P3, L17 The tropics have high UVI values not just because the SZA is small, but also because the total column ozone there is also low compared to higher latitudes.

P3, L24 I would also cite the two WMO reports addressing the UVI and the 'Global Solar UV Index' publication by the WMO.

P4, L 6 Is there a reference for the GEM?

P4, L11 Provide a reference here at the initial mention of the Cloud-J model.

P4, L20 Is there a reference for the cccmarad RTM?

P4, L34 Is the ozone (total and mixing ratios) really generated separately? The next paragraph discusses how LINOZ scheme is used 'within' the GEM to generate ozone forecasts. P10, L7 Can you determine the elevation adjustment per kilometer to determine if the difference between the gridpoint elevation and the actual elevation is the

reason?

P10, L7 While doing the above can you determine if the elevation adjustment is equal at all UV wavelengths or wavelength specific?

P10, L12 Is there a plan to bias adjust the GOME observations to bring them more in line with the Brewer observations?

P12, L4 Typing error : "Simpson's rule"

P12, L15 Do you plan to 'correct' the GEM equivalent broadband absorption cross-section and the TOA solar fluxes to agree with the Cloud-J?

P13, L20 All of these adjustments or scalings will need to be revisited every time the GEM's radiation code is modified. Communication and collaboration between the authors and the GEM modelers needs to be strong such that these differences can be addressed and best corrected in the GEM so that the number of adjustments in the UVI computations is limited or eliminated.

P13, L31 The I294-310 is where the bulk of the erythemal weighted values come from. I would think that the coefficient (11.03) would be total column ozone and solar zenith angle dependent.

P14, L18 I presume that the actual total column ozone was used during this comparison and not the OMI climatology, then why wasn't the GEM's albedo used instead of the OMI albedo climatology? Does the GEM's albedo need to be corrected to the OMI's for 100% snow cover? Using the GEM's albedo would then eliminate the 'cold spot' discussed in the following paragraph. The purpose of these two difference plots should be to show the differences between the integrated and linear solutions, not the differences between each and the GEM.

P15, L8 What is meant by 'short term forecasts'? 6, 12, 24, 48 hour?

P15, L30 Instead of just using the 18 UTC observations and model output, other times

of the day could have been used to generate additional UVI and solar zenith angle determinations. Additionally, the range of total ozone values over Canada during July and August are rather small. Comparisons between model and observations could have also been done for April or May when the sun is relatively not too low in the sky but range of total column ozone values is much greater.

P16, L31 As % cloud amount increases so does the variability of transmission through the clouds. Such a plot in place of the density plot may better show the differences between the Cloud-J and the GEM all sky values.

It would be interesting to note if, via the Cloud-J model, there is a spectral dependence of UV adjustments upon cloud amount, type, altitude.

The point of the text discussion is that the GEM and the Cloud-J produce reasonably similar results under all-sky conditions. Is it known whether either is correct against real world observations from the Brewers or solar radiometers?

P18, L10 I gather this answers my previous question about spectral impacts upon cloud amount. Or else the impacts are accumulated in the band coefficients.

P18, L22 There are only so many aspects of solar radiation that can be accounted for. Hopefully, these additional aspects are second order and fall within the error bars of the UVI values.

Figure 11 The symbols and line need to be identified in the figure caption. The Y axis caption also needs to have '% difference' in it.

Figure 13 Add 'effective' to cloud cover (ECC) in first line of figure caption.