

Review of "A net decrease in the Earth's cloud plus aerosol reflectivity during the past 33 yr (1979-2011) and increased solar heating at the surface," by J. R. Herman, M. T. DeLand, L.-K. Huang, G. Labow, D. Larko, S. A. Lloyd, J. Mao, W. Qin, and C. Weaver

General comments:

This is a well written paper on the development of a 30+ year normalized satellite data set from several SBUV instruments that have flown on several satellites since 1978. I am not familiar with manipulation of satellite data and the special problems that must be overcome to produce a common calibration and usable data set. However, the methods used to normalize the SBUV in sections 2 and 3 are well explained and seem plausible, and a reasonable case is made for using the 340 nm channel for this study. Therefore, I only direct my comments to the data analysis and results presented.

The introduction poses the problem well, however the last part on the satellite data sets that are available is hard to follow. You mention that Norris and Slingo (2009) summarize the problems with the ISCCP data set but you do state what those problems are. In between discussions of ISCCP data, you talk about CERES, AVHRR, and HIRS as alternatives, but the ISCCP website states that they use AVHRR data. This paragraph needs to be rewritten with a more logical, less confusing manner.

I believe that you can do more than attribute the changes in LER to a "combined cloud aerosol effect." Recent papers have documented and quantified a decrease in aerosol optical depth over the oceans and over many land areas of the globe. For example, Zhao, T. X.-P., I. Laszlo, W. Guo, A. Heidinger, C. Cao, A. Jelenak, D. Tarpley, and J. Sullivan (2008), *J. Geophys. Res.*, 113, D07201, doi:10.1029/2007JD009061 document AOD trends over the oceans spatially for a period similar to your analysis period. Chylek et al. (2007), *JGR*, 112, D24S04, doi: 10.1029/2007JD008740 use ocean AOD data as well as in situ AOD trends measured over various land areas to estimate that global AOD has been recently decreasing at a rate of -0.014/decade. You should be able to use this information to estimate the relative contributions of aerosols and clouds to the documented LER changes at TOA. At least you can estimate the average partitioning for the globe as a whole using Chylek et al's AOD trend. With the AVHRR AOD record, you can do this spatially over the oceans where the satellite AOD measurements are trustworthy. A recent publication by Augustine and Dutton (2013) *JGR*, 118, doi:10.1029/2012JD018551 partitions the relative contributions of AOD and cloud cover changes over that U.S. to changes in the surface radiation budget from 1996 to 2011. With the availability of global AOD measurements, a similar partitioning for reflected radiation at the TOA (LER) should be possible.

Specific comments:

p. 32005-6 When discussing Figs. 3 and 4 it may be clearer to the reader if "higher" and "lower" were used to describe latitude and longitude and "greater" and "smaller" be used to describe variations in LER.

- p. 31994, l. 21 Awkward sentence. Begin this sentence with “Evan et al. (2007)”, and remove “An analysis”
- p. 31997, l. 26 The sentence beginning with “As a result, many factors...” should be moved to be the 2nd sentence of the paragraph that it resides, before the discussion of the diffuser-related problems.
- p. 32006, l. 12-15 The sentence beginning with In the NH is awkward and should be divided into two sentences.
- Fig. 5 The two frames of Figure 5 should be labeled (a) and (b) and in the caption they should not be referred to as “upper” and “lower”. In the text they are referred to as 5a and 5b.
- p. 32006, l. 29 Why not just include the 2010–2011 in the list of major ENSO events and leave off the superfluous phrase beginning with “, and for most other...”
- p. 32008, l. 12-17 The two sentences beginning with “The largest change, ...” are badly worded and should be rewritten.
- p. 32010, l. 7 The entire term ($\lambda < 4000$ nm, 99% of the solar spectrum) should be in parentheses. The way you have it is very awkward.
- p. 32011 You refer to Fig. 10 in these two paragraphs, but I think you meant to refer to Fig. 11.
- p. 32012, l. 2 Figure 2 only represents one day. What is your point here?
- p. 32012, l. 5 The sentence beginning with “The percent distribution...” should be the first sentence of the paragraph it resides, not the second sentence.
- p. 32012, l. 20 Perhaps Figure 17 should be introduced here so that the reader can see the locations of the boxes you average over for the subsections of sections 7 and 8.
- p. 32013, l. 4-6 Figures 11 and 13 say nothing about ocean currents, but they do show that the intensity of ENSO events has decreased. You should first comment on the trend in ENSO events, then suggest that that change may imply long-term changes in underlying ocean currents.