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Interactive comment

Interactive comment on "Multiresolution analysis of the spatiotemporal variability in global radiation observed by a dense network of 99 pyranometers during the HOPE campaign" *by* Bomidi Lakshmi Madhavan et al.

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We thank the reviewer (Dr Manuel Nunez) for providing his valuable comments and suggestions on our article "Multiresolution analysis of the spatiotemporal variability of global radiation observed by a dense network of 99 pyranometers during the HOPE campaign" (acp-2016-694). In the process of revision, we have made the following corrections in the original manuscript:

- Title of the manuscript has been revised as "*Multiresolution analysis of the spatiotemporal variability in global radiation observed by a dense network of 99 pyra-*

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nometers" (based on the suggestion of referee# 2).

Major comments

- **What is the analysis telling us regarding the contribution of different cloud spatial dimensions to the variability?**

- We have examined the least square fitting for the single point measurements (Figure 5 is included as an additional figure in the revised manuscript) and the details of our findings are incorporated in the subsection 4.1 along with the inclusion of relevant literature as suggested. However, it should be noted that the global irradiance is a hemispherically integrated property and thus there cannot be an exact one-to-one relation to the cloud variability or to (directional) radiance variability. Finding an appropriate smoothing kernel requires intensive investigations of the interaction of clouds and radiation including 3D radiative effects, and is beyond the scope of this study.

- A new summary table (Table 3) outlining the spectral exponents and scale regimes from different studies has been included.

- **Treatment of direct radiation**

- We agree with that the transmittance in overcast scenes should not be explained by direct radiation.

- Fig. 4 (old manuscript) is Fig. 11 in the revised manuscript.

- The results of Fig. 4 (old manuscript) are quite relevant and important for understanding the variability of global radiation, and how the direct/diffuse contributions affect overall variability. Instead of dropping Fig. 4 (old manuscript), we would like to keep it by moving it to the very end of the results section, and make clear that these results are more of an outlook to future research than final results. Hence,

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the text from page 8, lines 3-10 are moved to a short subsection 4.4, which also makes it clear that this is only an initial assessment and clarifies that the large direct contribution in overcast situations is likely due to our not very strict classification of situations. In particular, even on the days classified as overcast, some periods with significant direct irradiance due to cloud gaps were observed and evidently dominate the power spectrum of the global transmittance.

- **Treatment of clear skies**

- The following statement is included in the subsection 4.1 - "Due to the changes in solar elevation and thus airmass over the day, a pronounced diurnal cycle in global transmittance is observed in clear sky situations, which introduces significant variance at longer time periods."

- The following statements are included in the subsection 4.3 - "The e-folding time of 6 min indicates that variations with frequencies higher than 1/6 min^{-1} are more or less uncorrelated between the point measurement and a spatial area of 1$\times$1 km^2. It should also be noted that the spatial average has a significantly lower power spectral density at these frequencies. We thus think these variations are thus associated with small-scale fluctuations in clear sky turbidity only evident in the point measurements, possibly induced by small scale structure in water vapor and/or aerosols. However, we cannot rule out that such variability corresponds to undetected small clouds or even measurement artefacts such as shading of the instruments by birds."

- **How widely applicable are the results?**

- Fully agreed! We have added a sentence to the conclusions that our study is representative for mid-latitude summer conditions.

Minor corrections

- **Page 2, line 7: replace "up" by "updrafts".**

- Corrected. Replaced "up" by "updraughts".

- **Page 2, line 24: replace "... could show that especially ..." by "... reported that spatially ...".**

- Corrected.

- **Page 6, line 20: replace "... zenith angle below 75^o" by "... zenith angle above 75^o". Is this correct?**

- This is not correct. We have obtained the MRA results for solar zenith angle below 75^o to exclude edge effects.

- **Page 8, line 21: replace "... wavelet-based spectra ..." by "... wavelet-based spectral power density ...".**

- Corrected.

- **Page 8, line 22: delete "The quality of fit ... been found to increase linearly with decreasing frequency" to "The root mean square error ($rmse$) which measures the quality of fit has been found to decrease linearly with decreasing frequency".**

- The statement is corrected.

- **Page 11, line 25: Side reflection from clouds is strongly enhanced in broken cloud conditions and could be important in lowering the correlation (Nunez et al., 2016).**

- The statement is included in the revised manuscript.

- **Page 26, Table 3: It might be appropriate in the table to include averaging period used in the various studies (10 minutes, hourly, daily, etc.).**

- Table 3 in the old manuscript is Table 4 in the revised manuscript. Table 4 is revised as suggested.