Response to Reviewer 1

This paper provides an update to the status of the GEBA (Global Energy Balance Archive) database that contains surface measurements of energy components in uniform units of watts per meter-squared. It addresses what is in the archive and how to access those data.

We would like to thank the reviewer for his time and efforts to go through our manuscript and his constructive comments.

The only substantive point that I have problems with is their focus on the notion that aerosols can explain the decadal brightening and dimming in surface shortwave (solar) radiation. The aerosol record was poor until careful measurements began in the 1990s so I do not understand how quantitative statements can be made before this period. Further, a very careful study of brightening in North America by Augustine and Dutton (2013; JGR-Atmos doi:1 0.1029/20 12JD018 551) finds that accurately measured aerosol optical depth changes cannot explain the brightening bythe direct effect and invoking indirect effects would be highly uncertain and speculative. I would like to see them soften the notion that aerosols can explain this decadal behavior.

We agree with the reviewer that the relative contributions of changes in aerosol and cloud characteristics to the dimming and brightening phenomenon is still not overly well established and may also be regionally and temporally variable. It is, however, beyond the scope of this paper to discuss in detail the potential causes of dimming and brightening (this has been covered in other works). The aim here was rather to show how studies explicitly using GEBA data contributed to the topic of dimming and brightening. The only statement we made so far in section 5.2 on potential causes of dimming and brightening was related to the discussion of the papers of Norris and Wild and reads as follows: "Their results suggest that changes in cloud cover can hardly explain the observed decadal variations in surface shortwave radiation, pointing to other important influential factors, particularly changes in aerosols and/or changes in cloud optical properties." We made this statement more precise, changing it to "…can hardly explain the observed decadal variations in surface shortwave radiation *at European and Chinese sites*". We also added a general statement after this sentence: "However, the relative contribution of changes in aerosol and cloud characteristics (related or unrelated to aerosol changes) to the observed variations in surface solar radiation is at many sites still not well established, although conceptual frameworks exist (see e.g., Wild 2012, 2016)."

Further we add to Section 5.4 a caveat "These studies rely on the assumption that the decadal changes seen in the shortwave GEBA records predominately induced by aerosol direct and indirect effects."

Specific points:

Lines 23-26, page 4: The diffuse and infrared uncertainties are 'best possible', not typical. Field measurements will have generally have greater uncertainty.

We revised the respective sentences as follows:

"Diffuse shortwave radiation measurements are obtained by shading the pyranometers from the direct solar beam, with an instantaneous accuracy of 2 - 4 Wm^{-2} *under ideal conditions* (Michalsky et al., 2007). The accuracy of downward longwave radiation measurements carried out with pyrgeometers is near 3 - 4 Wm^{-2} *under ideal conditions* (Philipona et al., 2001;Marty et al., 2003;Wang and Dickinson, 2013).

Line 20, page 5: The sentence that begins here is needs to be rewritten.

We reformulated the sentence as follows:

“Particularly challenging is thereby the determination of the energy fluxes at the Earth’s surface, which cannot be directly measured from space, and which are accordingly afflicted with substantial uncertainties.”

Line 20, page 6: ’occurs’ could be replaced with ’partitions’

We replaced ’occurs’ with ’takes place’

Figure 2 caption: Is the red line a 4th order polynomial fit?

Yes, we changed the caption to include the term “4th order polynomial fit”

Figure 8 caption: I assume that this is global shortwave, but I do not find it stated in the caption.

We replaced “mean monthly time series” by “mean monthly time series of downward shortwave radiation” in the caption of Figure 8.