Geosci. Model Dev. Discuss.,
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Interactive comment on "Grid-independent High Resolution Dust Emissions (v1.0) for Chemical Transport Models: Application to GEOS-Chem (version 12.5.0)" *by* Jun Meng et al.

Anonymous Referee #3

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The authors generate high spatial and temporal resolution mineral dust emissions fields that can be prescribed for use in lower-resolution simulations with the GEOS-Chem model. Online dust emissions are well known to depend on model resolution because of nonlinearity in the governing parameterization. The use of consistent dust emissions across model resolutions overcomes this problem. I disagree with Referee 1 on his/her main point, and agree with Referee 3 on his/hers. The modeler wants to represent the most accurate dust emissions distribution possible irrespective of model resolution, and in particular whether or not they are consistent with the coarse model wind field. Representing high-resolution emissions, even crudely at lower resolution, is much preferred than not representing them at all. Specifically, smoothing of the wind fields at coarser

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resolution leads to wind speeds falling below the threshold and zero dust emissions in locations that do emit dust. Scaling of global emissions to match those generated at higher resolution leads to unrealistic amplification (hotspots) elsewhere. This is a real problem that the proposed methodology alleviates.

The authors make good use of AERONET, MODIS-DB and MAIAC datasets to justify an annual global emission total for the year concerned.

The manuscript is well written and mostly clear. I recommend the manuscript be accepted with some clarifications.

1. Question: Please clarify how the high resolution (0.25 deg. x 0.25 deg.) satellite-identified dust source function (line 79, 110) is obtained. Section S1 refers to Ginoux et al (2001) and Zender et al. (2003). However, how are the surface factors S and in particular the Am factors obtained at this higher resolution? How is the updated source function then applied (presumably interpolated?) for online 2x2.5 deg. simulations? Please clarify.

2. Line 127: sounds like the default emissions would be at the 2 x 2.5 deg. resolution original source function. Please clarify.

3. Line 154: it is unclear if these 2 simulations are both conducted at 2x2.5 deg. resolution.

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