

## ***Interactive comment on “A mechanism for dust-induced destabilization of glacial climates” by B. F. Farrell and D. S. Abbot***

### **Anonymous Referee #2**

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The paper proposes that desert dust can force the destabilization of glacial climates. The paper does not make its case very strong for several reasons:

Methods: half of the model is not described in the methods section, but in an appendix, so it's unclear how the study is done until after one reads the whole paper. I don't understand how this is coupled to the simple dynamical model: please rewrite the methods so that they follow logically.

The authors say that they use 10x current values for dust for their calculations for the glacial climate: where and when are these values typical for? Dust varies by several orders of magnitude both in space and time: what value did they use? You must be using a really high dust value to get such a strong response: please justify. Of course if the whole planet had dust values 10x the values seen over the Sahara all the time

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Comment

it would probably have huge dust impacts: but the deposition would have to be much higher than observed (or show us it wouldn't!).

Why would you use one value of dust and a 1d model to understand how the global system responds? Miller and Tegen, 1998 use a nice simple model to show how dust impacts climate, but based on one dusty region and another less dusty region. Most descriptions of dust impacts on climate show a similar dependence on location where the dust tends to shift precipitation away from a region, so the response seems to inherently be spatial. Please justify how the mechanism you describe here could work in a 3d world, or better yet, show that it works with 2 box world or 3+ box world.

“Explicit simulation of the dust state transition is not possible in the present generation of climate models since they do not solve for dust as a prognostic variable and since dust lofting depends crucially on small space and time scale meso and micro scale processes (Schepanski et al., 2009) that are not resolved.” I don't understand: you have already cited several studies that do include prognostic dust and interactions with climate, and you use a single column version of a general circulation model to look at dust radiative effects, so why do you claim they don't include these effects? That doesn't make sense. If you don't like GCMs, why would you use the most uncertain part of a GCM (the clouds, radiation, and subgrid mixing), and leave out the only part we know they do well (resolved flow). The methodology needs to be substantially better justified.

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Interactive comment on Clim. Past Discuss., 8, 1721, 2012.

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