Response to reviewer RC4

Review in italics, our response in standard text

We thank the reviewer for carefully reading our paper and for their comments.

In anticipation to the new ice core data beyond the Myr that the community will generate, Wolff et al. propose an overview of the possibilities that the community could have to correlate and date such old records. As per request from the handling editor, because the other reviewers have already commented on other points of the MS, and because this is indeed my expertise, I have concentrated my review only on the dust part of the paper.

I have two major issues :

- The authors compare the dust flux in ice on one hand, and an iron concentration on the other, justifying it by the fact that claim dust flux is what they will get in older ice cores, and claiming it is fair to compare it to concentration. I am sorry, but to me it is a bit like comparing apples and pears. And it has been a redundant problem within the dust community working on different archives. As the authors mention, to calculate a flux, one needs ages and accumulation rates, but those accumulation rates would also influence a concentration profile when using it. It is commonly accepted that fluxes or at worse ratios should be priviledged when comparing dust proxies between archives, so it is accept that fact and how to solve this issue if this is problematic for some archives or time intervals. Otherwise, again, it makes any comparison quite speculative despite a match which is indeed surprisingly good.

Some of the authors of this paper also have considerable expertise in dust (in ice), and have indeed written extensively about wet and dry deposition, and about the importance of considering either fluxes or concentrations under various circumstances in ice core studies. In this case we fully agree that flux would be the better comparator to the marine record. But this wish doesn't alter the fact that we do not measure flux, we measure concentration. To derive flux in an ice core requires a set of assumptions that may or may not be correct as we go further back in time. Indeed we discuss doing exactly that in the case of 10Be. In the case of dust we simply note that we are lucky and the concentration already shows a great correlation with the marine dust flux. It turns out that the r^2 value for a correlation of log (ice core dust) vs log (marine flux) is 0.69 both for the ice core flux and the ice core concentration. This is (we suggest) because the dynamic range of the ice core dust concentration (factor 100) is so great that the changes in accumulation rate (factor 3) are not very important. This is not the case in the marine record where the dynamic range is smaller. Ratios are used to normalise for flux in the marine record; this is not an option in the ice core record where there is no marker expected to have a constant flux. We have spelt this out in the revised text. We will also show the flux in Figure 5 as an additional comparison.

- What is "appropriate scaling". This is somehow linked to my previous comment as it feels like two curves which are in theory not comparable, can be perfectly "matched". There is no details whatsoever how this scaling is achieved. This is also valid for other matching in the MS, and also more generaly in the literature matching ice and marine records. There is absolutely no details on how it is achieved, and it would be good to provide a detailled explanation on this, including the calculations, how it is done ("stretching-compressing" method?, but how, on which time interval, varying depending on the time interval, etc?), all

that in supplementary data, so everybody could understand and more importandly, reproduce it.

There may be some misunderstanding here. We have simply scaled the y-axis of the two records so that peaks and troughs in the two records match. They are both on log scales in Fig. 5, so no additional vertical stretching is involved. For the time axis we used the matching already carried out by Martinez-Garcia et al (2011). Such matching is typically done using a program such as Match (Lisiecki and Lisiecki 2002) which uses dynamic programming to find the optimal alignment of two paleoclimate signals. We will clarify this in the revision

Minor comments/questions:

- I am ot a specialist in this, but really no means to date both marine and ice cores beyond 1Myr? That would help generating fluxes... And perhaps this is something the community should concentrate on?

We agree that improved and independent means of dating are important and note this comment. This is certainly something the community is focussed on and indeed is central to prompting us to write this paper.

- I think the reference citing dust from Patagonia to Antarctic could be reviewed by adding more recent references than only Delmonte, 2008.

While there are more recent papers looking at dust provenance in other cores and over particular time periods, this 2008 paper remains the most comprehensive effort at dust provenance over the 800 kyr period.