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Climate of the Past Discussions

Interactive comment on "An Ocean – ice coupled response during the last glacial: zooming on the marine isotopic stage 3 south of the Faeroe Shetland Gateway" *by* J. Zumaque et al.

Anonymous Referee #1

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This paper reports new data from a sediment core taken from south of the Faroe Islands. The authors present magnetic, XRF, foraminiferal and dinocyst measurements in order to investigate oceanographic changes during a part of MIS 3. The paper is well referenced and includes a good introduction to the study and reasonable arguments throughout. However, I think that a combination of unsatisfactory temporal resolution, age model ambiguities and difficulties with specific proxies makes the interpretations uncertain.

The study makes use of a high sedimentation rate core, which has the potential to give a highly focussed view of the changes of interest here. And yet the authors have

chosen to sample with a frequency of 10 cm. Looking at their records, it strikes me that they would have done better to have either focussed on fewer analyses at higher resolution (e.g. at 2 cm resolution), or narrowed the window of their multi-proxy study to attain higher temporal resolution (in this respect it strikes me that use of the word 'zooming' in the title is not really appropriate). With so many high quality records out there, it is surprising that better advantage of this core has not been taken. The result is several (hard won I am sure) records that show rather inconsistent patterns of variability and as such pose a problem for straightforward interpretation. Without delving too far into the detailed interpretations I will comment on some of the more immediate concerns I have with the study.

Obviously the need for a reliable age model is of central importance to a study of this nature. The authors follow previous work in tying their record of magnetic susceptibility to the Greenland ice core temperature record. I do not have a problem with this approach per se and the resulting age model does 'make sense' for some (although not all) of the proxy records obtained from the core. However, the age model developed here does not strike me as particularly convincing, especially in the older section of the record. The authors show the record of mag sus in Fig 3, which shows repeated oscillations that are claimed to parallel D-O oscillations over Greenland (basis for the age model). But many of the variations outside of their study window appear not to have equivalents in the Greenland record. Can the authors explain why the "1:1" correlation between mag sus and Greenland temperature breaks down outside their study window? Or at least argue that it doesn't break down. Secondly the authors chose to throw out a 14C age at 1820 cm depth because it does not fit with their tuning strategy. How do the authors explain the presence of NPS with a (calibrated) calendar age of >2000 older than that predicted by their tuning approach? One cannot simply throw out a constraint because it doesn't fit within the paradigm. The authors claim that they observe the effect of the Laschamp (and Mono Lake) excursions within their records and use this to support their age model. Then they must show evidence of these excursions (e.g. a record of normalised paleo-intensity) if we are to be convinced. The

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apparent weakness of the age model (in my eyes) presents a serious problem with the interpretations of the other records presented here.

To makes things more complicated, the proxy records obtained from foraminifera and dinocysts show rather inconsistent trends and do not lend valuable support to the age model (even if we believe the age modelling strategy). The record of %NPS looks reasonable and IF the corresponding ïĄď18O record is dominated by temperature variations rather than local salinity, then that too makes sense (within the age model approach). The dinosyst records appear less sensible. I will admit that I am no expert on these latter proxies but observation of such warm summer conditions associated with the coldest 'mean annual' conditions (according to the foraminifer assemblages) seems to make little sense. If summer is so warm then why are there so few foraminifer species other than NPS? Furthermore, the 'anti-phase' nature of the Feb versus August SST records seems to hint at a problem. Why are the coldest summer temperatures associated with interstadial events? Part of the problem I have with these records again relates to the resolution – more specifically, the apparent noise to signal ratio. Some of the interpretations made by the authors appear to hang on single data points – if they were robust variations, then increasing the resolution would provide critical support for the interpretations. As it stands I have difficulty believing that all of the variations plotted here are real. It doesn't help that the authors have not plotted any data points in Fig. 6.

Other points:

Dinocyst assemblages: Surely modern dynocysts could also be reworked? If so then how can we know that the assemblage represents contemporaneous conditions at all? Especially in such a sedimentologically dynamic setting. . .

Smaller points:

p3045 line 8: Specify when this sector was under the proximal influence. . . p3045 line 10: How can a sector record a response? Perhaps use 'responded to'? p3045 line

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21: Don't use 'typify', perhaps 'suggest'? p3046 line 5: 'millennial', not 'millennium' p3046 line 23: replace 'resulting in' with 'corresponding to' – we don't know what drives what p3053 line 11: data generated every 2 cm with resolution close to 4 cm – need to explain this better p3054 line 11/12: This needs better explanation p3055 line 16: subscript 2 for CO2 p3060 line 5: 'If the D-O structure is clearly recognizable' – I would say that it is not, but perhaps the authors would disagree p3061 line 19: do not overstate it – for 2 records to perfectly mirror one another they would need to do just that – they do not. p3063 line 21: 'classically' would relate to a large number of other studies – perhaps replace with 'otherwise'

Interactive comment on Clim. Past Discuss., 8, 3043, 2012.