Dear Christian Zeeden,

Thank you very much for your very constructive review.

Here we will reply directly to your review.

The compilation of an equatorial Atlantic benthic isotope stack, its comparison to the established LR04 stack, and the at least in some intervals higher quality of the new stack is a substantial advance in paleoceanography and paleoclimate research. The limitation to the last 5 Ma may go into the manuscript title.

We will revise the title to "**Revisiting the Ceara Rise, equatorial Atlantic Ocean: isotope stratigraphy of ODP Leg 154 from 0 to 5 Ma**". In fact, the splices of all sites were corrected as far down core as possible. Including rechecking the age model this covers the interval back to 15 Ma. In this paper we focus on the last 5 million years because most of the isotope data are published from this interval and it allows comparison of our results to the LR04 stack.

You provide a final dataset which is smoothed. Also because not all software that you use is open source, I would suggest to consider also providing the full isotope dataset on the spliced record. This will facilitate other researchers to determine uncertainty, and provides the option to use other smoothing methods. In addition, I suggest to supply the magnetic susceptibility record of the splice to allow for a detailed investigation of the tuning. Could you also comment on the possibility of using this record for alternative age models?

We will add a table with the full isotope data compilation together with the smoothed isotope record to the dataset and mention this in the revised manuscript. In addition we will add the spliced magnetic susceptibility, color reflectance, and GRA density spliced for each site.

We think the pattern of the magnetic susceptibility records can be tuned as done in your Zeeden et al. 2013 paper. Here we wanted to be independent from this approach and only use images and color reflectance data. Subsequently, plotting the magnetic susceptibility data versus insolation provides a crosscheck for a consistent phase relationship throughout the record. We will clarify this point in the revised version.

Generally, you make reference to the original tuning of the record (Bickert et al., 1997; Tiedemann and Franz, 1997) and the well-known phase relationship. In my opinion repeating their approach in several more sentences here would be beneficial for many readers.

The phase relation for tuning is discussed in detail in your Zeeden et al. 2013 paper as well, chapter 5.2. We will add a mention of the phase relationship between insolation and MS as well as add the 2013 citation to the text.

Chapter 2.2.: If I understand this correct, you do not correct the ODP files for horizontal differences in colour? This is not necessarily a problem here, but should be clarified. In addition, this would imply that ca. 9/10 m cycles in colour may be related to this effect – please mention this.

Similar experiments of extracting data and correcting for the light source have been made by (Nederbragt and Thurow, 2001, 2005) and I suggest to give reference their work here.

You are correct concerning the ~10m cycles that may appear in the lighting-corrected image data. We will point this out in the text. We have been working with spectral analysis of image lightness profiles versus depth and there is in fact a peak at 0.1 cycle/m that is relatively constant despite changing sedimentation rates down hole. True cycles, such as precession, shift position down hole with varying sedimentation rate.

Lighting correction is a complicated issue. You can see in Figure 2 that there is a purplish color cast to the digitized photo as well as uneven lighting. We are now working on a macro for lighting & color correction of the entire core box image that we would like to apply prior to cutting the core sections from the image. Ideally this will remove most of the 10m effect.

We were not aware of the work by Nederbragt and others and appreciate the references which will be added to the text.

In lines 269/269 you mention that a more robust age model will be helpful, if I understand this correct. This stands in contrast to previous suggestions of a known phase relationship. In my opinion a clarification, and an estimation of age model accuracy would be helpful for a wide readership, also to assess similarity of pattern, age and age uncertainty reported by (Lisiecki and Raymo, 2005).

The passage you mention is: “The CODD software package thus could play a key role in the construction of a new generation of the benthic isotope stack and surely will be very helpful in extending the stack into the Miocene. The next important step will be to form a more robust and accurately tuned initial signal used to form the benthic isotope stack.”

This sentence refers to the other records used for the LR04 stack as initial references. From the Lisiecki and Raymo 2005 paper: ”Our initial alignment targets are high-resolution segments of seven d18O records: GeoB1041 from 0– 0.15 Ma, ODP Site 1012 from 0 – 0.6 Ma, ODP Site 927 from 0–1.4 Ma, ODP Site 677 from 0–2.0 Ma, ODP Site 849 from 1.7 – 3.6 Ma, ODP Site 846 from 2.7 – 5.3 Ma, and ODP Site 999 from 3.3 – 5.3 Ma”. Basically for refining the LR04 stack in the interval older than about 4 Ma the Leg 138 records (Site 846, 849) need to be splice-checked. The data from Site 999 are from a single hole only (999A), and NOT a splice. Given our experience splicing other sites it is possible that as much as 10% of the sediment column of Site 999 is missing. Data from these 3 sites need to be correlated to the revised records now presented here from Ceara Rise and their age models modified accordingly. This effort is already in progress.

Accessing the real uncertainty in the age model is difficult and cannot be discussed in this manuscript as it would require a lot of testing. However, in your Zeeden et al. 2013 and 2014 papers this is already done with regards to the uncertainty in the target curve. The outstanding match of sedimentary pattern and insolation calculations, which is amazing

keeping in mind that the Laskar et al. 2004 model is based on a relatively short time of observational data, gives confidence that the error for the Miocene is less than a single precession cycle. Due to the overwhelmingly good match in patterns we think the main error will be lying in the accuracy of the target (precession and obliquity). The error in precession maxima and minima positions will be only relevant to times older than 5 Ma (see Lourens et al. 2004 in the GTS book), and this is already discussed in the Zeeden et al. 2013, 2014 papers.

With respect to the exact ages for terminations and interglacials of the Quaternary we refrain from doing so here, because this is not the scope of the manuscript. The overall match to the LR04 stack from 0-3 Ma shows that the straight forward tuning as done in the manuscript is reliable.

You use quite some figures, some of which may not be very relevant for a wide readership. I suggest considering to move few figures to supplements.

One of the main goals of the manuscript is to introduce the new CODD macro software package. We move step by step to allow the reader to understand how the CODD software functions and is used to construct the Ceara Rise compilation. The CODD software is a visually driven tool and thus we would like to keep all the figures to illustrate its functionality. We will move figure 9 to the supplement (the comparison between the oxygen isotope data from the smoothed Ceara Rise composite and the LR04 global compilation).

Additional comments:

We will correct all typos and add comments to the text as suggested by the reviewer.

References:

Lisiecki, L. E., and Raymo, M. E.: A Pliocene-Pleistocene stack of 57 globally distributed benthic d18O records, Paleoceanography, 20, 10.1029/2004PA001071, 2005.

Lourens, L. J., Hilgen, F. J., Laskar, J., Shackleton, N. J., and Wilson, D.: The Neogene Period, in: A Geological Timescale 2004, edited by: Gradstein, F., Ogg, J., and Smith, A., Cambridge University Press, Cambridge University Press, UK, 409-440, 10.1017/CBO9780511536045.022, 2004.

Zeeden, C., Hilgen, F., Westerhold, T., Lourens, L., Röhl, U., and Bickert, T.: Revised Miocene splice, astronomical tuning and calcareous plankton biochronology of ODP Site 926 between 5 and 14.4 Ma, Palaeogeography, Palaeoclimatology, Palaeoecology, 369, 430-451, http://dx.doi.org/10.1016/j.palaeo.2012.11.009, 2013.

Zeeden, C., Hilgen, F. J., Hüsing, S. K., and Lourens, L. L.: The Miocene astronomical time scale 9–12 Ma: New constraints on tidal dissipation and their implications for paleoclimatic investigations, Paleoceanography, 29, 2014PA002615, 10.1002/2014PA002615, 20142014.