We first would like to thank all the three reviewers and the editor for their critical and constructive comments, which will help to improve the manuscript.
In the following we address their concerns and specific points together with more general concerns.

Referee 1:

1. The referee asks us to clarify what parameter we aim to reconstruct precisely, 'Temperature maxima and minima or mean seasonality'.

This study deals with oxygen isotope individual specimen analysis (ISA). Our observations concern two planktic species *Globigerinoides ruber* and *Globigerina bulloides,* which show a wide spread in their oxygen isotope composition. Comparing the composite calcification temperature range with modern SST data, we find similar temperature ranges. Hence, we take this observation as evidence that the (multi-decadal) SST range is captured by the composite temperature range recorded by the two species as explained in the manuscript. By definition, seasonality is the difference between the maximum and the minimum, in this respect the difference between the maximum and the minimum calcification temperature of the two species.
These temperature extremes are given in Figure 3 of our original manuscript.
We realize however, that the reconstructed temperature extremes (maximum and minimum **calcification temperatures** as shown in this figure) likely do not perfectly reflect the maximum and minimum SST's. The main reason for this is that it is unlikely that the $\delta^{18}O$ of the foraminifera did indeed record the most extreme SST values, since the duration of such events would be relatively short compared to the length of time represented within each sample (likely in the order of a number of decades). Proxy based studies are flux-dependent which leads abrupt or 'freak' events to only be preserved in exceptional circumstances (i.e. tempesites and tsunami deposits in the sedimentary record), yet a general shift in the whole-range to cooler and/or warmer conditions will more likely be recorded (i.e. Heinrich events). Furthermore, as the composite calcification range depends on the number of oxygen isotope measurements, an increase of this range can be expected with increasing number of measurements, up to a point. In practice, only a limited number of measurements is feasible. In our case we have generally measured 30 to 40 specimens of each species for each sample. Whilst this appears to leave us with the problem that we need to robustly estimate the range based on a relatively limited number of oxygen isotope measurements. We have avoided that our composite calcification temperature ranges are solely dependent on the two most extreme values measured, by subjecting the oxygen isotope data to various outlier detection tests.
In the method section we say 'The total range of calcification temperatures is calculated...' Here we use both the terms 'temperature ranges' and 'seasonality' as the difference between maximum and minimum in temperature for the time period covered within the sample and not necessarily within one year.
We will change the text accordingly to make this point clear.

2. The referee states that we cannot exclude a contribution of the oxygen isotope composition of the sea-water to the $\delta^{18}O$ of the foraminifera.

The glacial - interglacial difference (glacial effect) is generally considered to be ~1‰ caused by the release of water from continental ice-sheets . The glacial effect dominates the general change to heavier values in $\delta^{18}O_{calcite}$ from the upper to the lower part of the core (left panel in Figure 3), the shift in the extremes is ~2‰. Minor fluctuations in ice volume cause less but also significant effects in $\delta^{18}Osw$ and are thus also incorporated in the $\delta^{18}O$ of the shells. To exclude these ice-volume signals in our temperature reconstruction we used the Mg/Ca temperatures as anchor points for the mean temperature of each time interval covered for both species in the respective samples. Changes in the evaporation/precipitation balance could potentially have caused additional changes in $\delta^{18}O_{sw}$.

However, these additional changes are considered to be negligible by Delaygue et al., (2001) who utilise new observations combined with modeling results to improve the understanding of the modern $\delta^{18}O$ – salinity relationship in the northern Indian Ocean. Using atmospheric fluxes corresponding to Last Glacial Maximum (LGM) conditions in a multibox model the authors conclude that there was no important change within the $\delta^{18}O$ – salinity relationship during this period compared to the present.

We thus regard additional effects of $\delta^{18}O_{sw}$ to be minimal and the $\delta^{18}O$ variability of foraminifera in the studied region to be caused by temperature and the glacial effect.

We will incorporate a short discussion on this in the revised manuscript.

Further, considering the modern analogue within this region with two radically different conditions during winter and summer months, the utilisation of two separate species (*Globigerinoides ruber* and *Globigerina bulloides*) with different ecological and life modes (high temperatures and oligotrophic conditions versus lower temperatures and eutrophic conditions) allows us to consider any potential interannual varability through changes in evaporation and precipitation which we will address in the discussion of the revised version.

3. All three reviewers felt an explanation was warranted in the use of outlier detection:

The reason to perform outlier tests for the oxygen isotope ranges of the two species is to robustly estimate the range, rather than taking the difference between the maximum and minimum values measured. Although based on different approaches, the three commonly used outlier detection methodologies yield very similar results, showing that the reconstructed ranges are insensitive to statistical method used. More importantly this result indicates that our reconstructed ranges are robust. In figure 3 we applied the IQR method as it does not require normal distribution of the data, and resulted in the least number of points rejected.

Referee 2:

1. The referee points out the fact that there is some confusion in the paper regarding the modern temperature range in the region, and that the seasonal temperature range from the modern dataset presented within Figure 1 (Inset) do not match the NOAA downloadable climatic data.

The figure provided by the referee are monthly mean data for the area near the core site, a time resolution we also refer to. However we state in the text concerning the high range temperatures:

'*This is approximately 3°C higher than the observed modern range (Fig. 1) and can be explained by the fact that modern observations represent monthly averaged temperatures over a period of 34 years, thus excluding extreme temperatures due to averaging*'.

For the ultimate calibration of our data we would need to have SST data in weekly if not daily resolution over at least a few decades before 1992. Such data are, to our knowledge, unavailable. The NGDC does however provide such data since 2002. These data, representing 24 hr mean values near the core site, clearly indicate the loss of extreme low values in the monthly average data for the same time slices. The plots presented in figure 1 (this reply) were generated using the nomads live access server (LAS) choosing the data set NOAA SST / optimum interpolation sea surface temperatures AVHRR http://nomads.ncdc.noaa.gov/las. We have chosen to generate nine plots positioned in a half a degree grid surrounding the core-site 905. The GUI tool allows for data to be

plotted from 20th June 2002 onward until 9th December 2009. Whilst, the time interval shown does not match the time interval represented by the core top (collected in 1993). The graphs are presented to show the reduction in SST variability resulting from plotting the monthly mean as provided by referee 2, in comparison with daily mean,. The daily records show temperatures as low as 20ºC. What is apparent is that the high temperature extremes do not vary as much (2ºC) as the low temperature extremes (4ºC) during the 7 years record. However, low temperatures (16ºC) as measured by Swallow and Bruce (1966) are not covered in the time series.
As weekly or even daily resolution of SST is not available for the period covered by our surface sample, we thus cannot calibrate our data set to observed SST's in the way we would have liked to. Still we regard our record based on *G. ruber* as robust and fully reflecting the warm temperature end as there is relatively low variability within the warm season.
However, we cannot claim that our data set fully reflects the cold temperature extremes, as the sporadic occurrence of extreme low temperatures may not be covered by one of the individual measurements of *G. bulloides*. This implies that the minimum temperature and thus the total range may be even more extreme than depicted in our record.
We will discuss this critical issue, which has implications for other proxy based studies in the revised version of the paper.

2. The referee would like us to clarify our salinity estimation:

Our estimate of salinity variation is based on CTD profiles taken during the expeditions. The difference between our own salinity measurements and the World Ocean Atlas 05 dataset may potentially be the result of the measurements being outside of the main upwelling cell, and approximately ~0.5° degree East of our most easterly core-top site (907B).
We will provide our (as yet unpublished) salinity-$\delta^{18}O_{sw}$ data in a separate table within the revised version.

3. The discrepancy in the range between the two species shown within Figure 2:

We analyzed in the first instance *Globigerinoides ruber* only and then realized that it might not reflect the full range of temperatures. The minimum temperature where G. *ruber* calcifies is at around 16ºC (Hemleben et al., 1989. In our record G. *ruber* does not show temperatures lower than 18ºC, see Fig. 3, right panel. Thus, in order to generate a complete record an additional species, *G. bulloides*, was measured, knowing it predominantly calcifies in the nutrient rich and cold waters (Hemleben et al., 1989).

The oligotrophic conditions present during non-upwelling favours symbiotic species such as *G. ruber* in the surface ocean, which thereby limits it's depth within the water column. The oxygen isotopic signature apparent within *G. bulloides,* a symbiont barren species, likely incorporates a component of ontogenetic depth migration. This particularly holds for the lower end of our temperature estimate, an issue we will deepen in the revised version of the ms.
Furthermore, we disagree with the reviewer's comment that as *G. ruber* is present for a greater portion of the year this necessarily dictates the size of the range. Not only does each species have it's only ecological tolerances (e.g. temperature; salinity; nutrients) that limits its presence or absence within a particular situation, but that these tolerances must be seen within the framework of the entire year. Figure 1 (below) clearly indicates that for a greater portion of the year the sea surface temperature range is relatively narrow, suggesting that actually the frequency and amplitude are a much bigger controller of the signal.

4. Error of the mean

We agree with the reviewer and will incorporate a discussion on this issue within the revised manuscript. Including the potential for error propagation throughout any potential methodology. There are some points regarding (1) and (2) in that utilising the same calibration at different points should reduce the significance of this error, as whilst the values may not be as accurate as one wishes the relationship between one sample and another should still hold true.
We agree that the Mg/Ca temperatures used as anchorpoints for all our samples including the Younger Dryas interval are regarded as reflecting the mean temperatures of growth of the two species might have some errors in accuracy: “The analysis of foraminifera suggests an interlaboratory variance of about ±8% (%RSD) for Mg/Ca measurements, which translates to reproducibility of about ±2–3°C.” from Rosenthal et al., 2004.
Whilst we agree with the reviewers comments that there is an apparent interlaboratory variance amounting to 2-3°C, measurements were performed within the same laboratory, by the same individual, thus negating this effect by having if anything a continuous offset relative between samples. Furthermore, the high reproducibility of the Mg/Ca results within three different size fractions (Table 2a) make it an excellent anchor point for the $\delta^{18}O$ ISA.

Referee 3:

In addition to the points already addressed above a few more specific points are:

1. Introduction

We agree with the reviewers that introduction in the revised manuscript should highlight the importance of our work with respect to palaeoceanography in the Somalian upwelling region, proxy based studies and the implications of the methodology.

2. Figure 3

We will add an additional figure as requested to visualize our results in a climatic perspective, including key events such as the Younger Dryas, Last Glacial Maximum *etc*.

3. Discussions

We agree also with the reviewer that the discussion is essentially lacking and we will put our results into a broader framework and more clearly highlight implications of seasonality for past climate changes in the monsoon region and beyond.

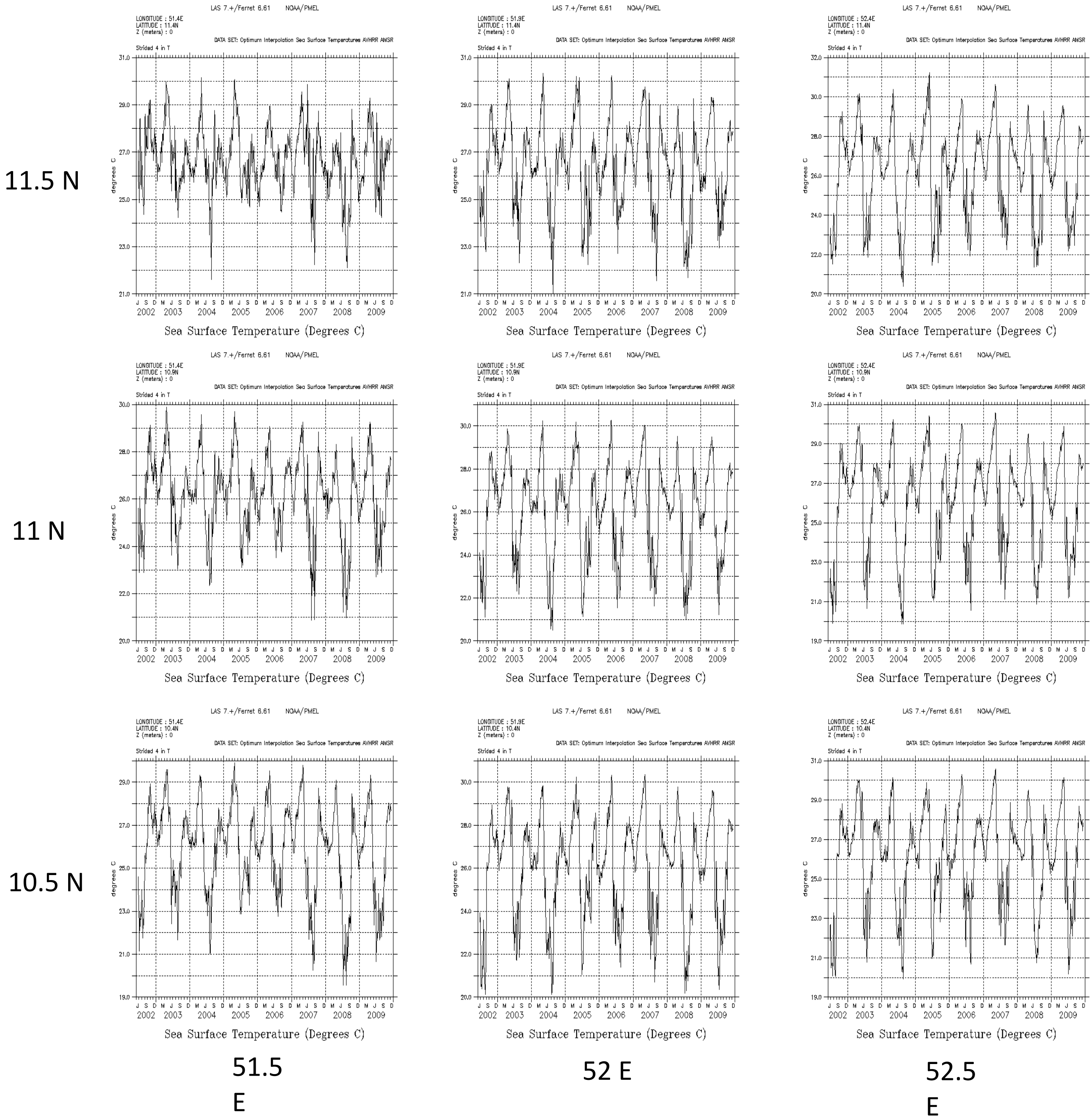
Additional references used in this reply:

Delaygue, G., E. Bard, D. Rollion, J. Jouzel, M. Stievenard, J.-C. Duplessy and G. Ganssen, 2001. Oxygen isotope/salinity relationship in the Indian Ocean. Journal of Geophysical Research, 106, C3, 4565-4574.

Hemleben, Ch., M. Spindler, and O. R. Anderson, 1989. Modern Planktonic Foraminifera, *Springer Verlag, Berlin, 363 pp.*

Rosenthal, Y., et al., 2004. Interlaboratory comparison study of Mg/Ca and Sr/Ca measurements in planktonic foraminifera for paleoceanographic research, Geochem. Geophys. Geosyst., 5, Q04D09, doi:10.1029/2003GC000650.

Figure 1:



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