

## Response to reviewers' comments – manuscript cp-2014-152

### Response to Dr Charlotte S. Miller's comments

Page 346 Line 3 – add ka after 24

We eliminated this acronym from the abstract following the suggestion from Prof. Hooghiemstra.

Line 14 – suggest, not suggested?

We prefer “suggested” to keep the same tense throughout the Abstract

Line 25 – you mention how the strength in the BUS is linked to arid conditions and the extent of the coastal Namib Desert. Do you mean that increased strength in the BUS results in increased aridity and an increase in the extent of the desert? Does the coastal desert expand inland? Maybe just make it a little clearer.

We have rephrased the sentence and eliminated the reference to the desert as the paragraph is about climate. It now reads: “The Benguela Upwelling System (BUS) also affects climate in southwestern Africa and is linked to arid conditions on the continent (Lutjerharms and Meeuwis, 1987)”.

We make the point about the link between low precipitation in the desert and BUS in the Modern environmental setting section.

Page 347 Line 3 – significant yes, as well as incredibly complex.

We have rephrased the sentence to acknowledge the complexity of the system. Now it reads “The complex link between globally-important atmospheric and oceanic systems and the climate of southern Africa make understanding past climate change in the region particularly significant”.

Line 5 – markers? Biomarkers? Do you mean proxies?

We have replaced “markers” with “planktic foraminifera assemblages” to add precision.

Line 25 – Walker – capital letter

Corrected

Page 348 Line 4 – not just today, and important in the face of future climate change scenarios surely? Maybe you could give an indication of what these scenarios suggest for southern Africa in the future? Is it likely here that the climate will become drier?

We have rephrased the sentence, it now reads: “Whether the last interglacial was characterised by orbitally-driven increased aridity or increased precipitation may have significant implications for resource availability and climate in the region today and in the near future. Projected patterns of precipitation change for the end of the 21<sup>st</sup> century indicate at least a 20% reduction of precipitation in southern Africa compared to pre-2005 values (IPCC, 2014). Understanding glacial-interglacial

climate and vegetation dynamics in this region may help unravel how much of the projected precipitation change corresponds natural variability”.

Page 351 Line 18 – is all the calcium carbonate from foraminifera?

To avoid overstating the information, we have modified the phrase and eliminated the reference to foraminifera: “The sediments of this 32-m long core were composed of calcium carbonates, biogenic silica, clays and organic matter (Bertrand et al, 1996)”.

Page 352 Line 1 – check tense – eliminated, and concentrated

We have replaced the word “eliminated” with “separated”

Page 353 Line 3 – did you do the DCA analysis on all fossil pollen taxa, or those with their % above a certain threshold? Did you try doing the DCA of the individual samples (sample scores)?

We run DCA analysis on the complete dataset and also filtering rare taxa. We have added this information and a reason for preferring the DCA where we filtered rare taxa: “These ordinations were performed on the complete dataset and filtering out pollen morphotypes that only occurred only in one sample. Results from the ordination performed on the reduced dataset were preferred when differences in axis scores were not discernible to reduce the effect of rare taxa”.

Any clustering in sample scores may indicate different vegetation compositions of the individual MISes?

We observed no clustering of samples, and have now included a sentence in the Results about this: “DCA1 axis scores from MIS 5 and 3 are overall positive in value, while scores from MIS 6 and 4 are negative, although clustering of samples was not observed.”

Line 28 – can you give an average sedimentation rate for the core?

We have calculated and added the average sedimentation rate

Line 28 – Can you show an age-depth model in the sup material?

We have added an age-depth curve as panel b in Supplementary Figure 1.

Page 354 Line 7 – how many taxa were identified in all the samples? How many unknowns?

We have added the requested information: “We identified 83 different pollen taxa in the whole sequence, and the mean number of pollen taxa per sample was 21. The proportion of unknown pollen taxa was between 1% and 2% per sample”.

Line 13 – why would low primary productivity result in low pollen concentrations?  
Unclear.

We have added a sentence to clarify: “The low net primary productivity that characterizes the vegetation of southwestern Africa (Imhoff et al 2004) is probably

linked to low pollen production and could explain relatively low pollen concentrations in the continental margin (Supplementary Fig.2).”.

Page 357 Line 21 – where is the DCA plot? Tell us that it is in the supplementary material. Can you give an indication of what DCA axis 1 actually represents?

The DCA axis 1 scores are plotted in Figure 4 as indicated at the beginning of the paragraph. To add clarity, we have added a few sentences: “The axis scores on DCA1 reveal changes in the composition of pollen assemblages that also resemble variations in the  $d^{18}O_{\text{benthic}}$  record (Fig.4). This similarity suggests that glacial-interglacial vegetation changes in southern Africa track global ice volume changes. DCA1 axis scores from MIS 5 and 3 are overall positive in value, while scores from MIS 6 and 4 are negative, although clustering of samples was not observed. The DCA1 axis represents relative changes in the pollen assemblage from one sample to the next”.

Page 358 Line 5 – Does Fig. S2 have anything to do with core top samples? I think that is the complete pollen record? Is the link to the figure is in the wrong place?

This was a mistake. Fig. 4 is now cited instead of Fig. S2.

Page 359 Line 15 – nss? Define.

nssCa<sup>2+</sup> refers to sea-salt calcium flux. This is now defined.

Page 362 Line 11 – why is there an increase in both the amplitude and frequency of shifts between positive and negative DCA from 100 ka onwards? What does the DCA axis 1 actually represent? You mention possibly enhanced trade wind variability, but I guess if so then this is not related to orbital cyclicity (from 100 ka onwards the amplitude of the precessional variability decreases). Any idea why trade wind variability increased?

The DCA1 Axis scores reflect the changes in the pollen assemblage (this is explained in the manuscript more clearly following the reviewer’s suggestion). In this section we explain that the record of pollen taxa like Restionaceae in MD96-2098 seem to support previous work where other authors have suggested increased trade wind strength, but we would prefer not to speculate on why the millennial-scale trade wind variability may have increased during the last 100 ka. We have added more detail to the paragraph to clarify some of the questions and referred the reader to the supplementary material where this point is discussed: “Increased Restionaceae pollen could indicate expansions of Fynbos vegetation, or enhanced pollen transport from the Fynbos region linked to increased trade-wind strength (see additional discussion on Present-day pollen-vegetation-climate relationships in the Supplementary material). Other Fynbos indicators did not display the same trend (Fig. 4), suggesting that Restionaceae variability between 100 ka and 24 ka were more likely the result of enhanced variability of southeast trade winds.

Figure comments: Fig 4 – not sure if a dashed line every 10 ka is necessary. It makes it difficult to see the stage boundaries. You don’t need the references on the actual figure if you mention them in the figure caption. Add some arrows of interpretation

on your data (like you have done with the 3 proxy records at the bottom of the figure).

We have eliminated the lines and moved references to the Figure caption. We also added arrows for the interpretation of our data in panel (b).

Sup. fig 1. caption – remove brackets around references Sup. fig. 2 – italicize sp. and genus where necessary.

Corrected.