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Climate of the Past Discussions

Interactive comment on "Thirty thousand years of vegetation development and climate change in Angola (Ocean Drilling Program Site 1078)" *by* L. M. Dupont et al.

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GENERAL COMMENTS

The manuscript 'Thirty thousands years of vegetation development and climate change in Angola (Ocean Drilling Program Site 1078)' by Dupont et al. presents a highly valuable contribution to improve the knowledge of past vegetation and related climate in West Africa, south of the Equator over more than 30 ka. The authors present a detailed palynological analysis of a marine core (ODP 1078C site) off Angola, at about 12°S. Vegetation cover and variations of the relative importance of different vegetation types over the neighbouring continent are reconstucted throught time, and corresponding cli-

matic changes are inferred. Alkenone-inferred sea surface temperatures reconstructed from the same sequence are compared and integrated in the climatic reconstruction. Scenarios of changes in the latitudinal position of atmospheric and marine fronts behind these reconstructed vegetation and SSTs variations are proposed. The focus is certainly fully within the scope of Climate of the Past. The manuscript is clearly organised and nice to read (but english language strictly speaking should rather be corrected by english-speaking persons !). I therefore recommend publication of this article, following a number of additions, mainly for clarification, and the response to relatively minor corrections and comments, as mentionned above.

SPECIFIC COMMENTS

P.116 lines 15-16: burrowing as an explanation for young radiocarbon age bias seems to be a weak argument. Couldn't also geochemical processes be responsible for this young age bias? What about possible recrystallization? Are there evidence to clearly support the hypothesis of shell burrowing? Also see P.117, lines 17-18 : Same comment-questions.

P.118 lines 4-5: sedimentation rates for the 27-22 ka BP period should be taken with greater caution, since it is calculated on three dates, but several dates are rejected within this depth interval.

P.121 lines 2-14: I highly recommend addition of a more detailed location map, that delineates the regional geographic descriptions used in this section. The map from figure 1c is not detailed enough to show some of the geographic and phytogeographic features, refered to in the text. Balombo River is not located on Fig. 1c. Huambe mountains cannot be drawm at the scale of Fig.1c. To the extent that manuscript discusses the input from different vegetation types, present-day location of the vegetation areas nearby the core site, and detailed geographic clarity should be of interest. For exemple : use of the only map from Fig.1c suggests that afromontane vegetation is at far distance from marine site ODP 1078C (East Africa, South-East Africa, ...). Text

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from section 6, indicates that afromontane vegetation (covering part of the Huambe mountains) is present in the vicinity of marine site ODP 1078C, and that pollen from this afromontane vegetation zone might be transported to the site through the Balombo River, also not shown. What is the maximum altitude of Huambe mountains?

P.121 lines 2-14: Fluvial and wind-transport are mentionned as the only two processes for pollen inputs to the marine core. What about influence of surface coastal currents on pollen inputs? Any evidence for their present-day impact (or 'minor-impact') in the area? Even if not significant at present-day (?), couldn't we consider that Coastal Current might had more important impact, during past periods, especially such as period of low sea-level? I also refer to comment 1 of Anonymous referee #3 and I share his advice that it should be helpful to develop and clarify 'mechanisms involved in deposition and archival of pollen (rain) in the ocean'.

P.121 line 14: 'Source areas of fluvial and aeolian pollen largely overlap'. SE trade wind intensity is largely variable through time, as underlined by the authors (P.124 line 14; P.126 line 8, ...). Precipitation (and seasonality?) changes can be evidenced over the last 30 ka, certainly inducing changes in the fluvial inputs. Both these two factors certainly modifies the relative importance of fluvial pollen inputs versus wind-transported pollen inputs. Does this possibly significantly change the present-day overlaping of fluvial and aeolian source areas?

Also, concerning the fluvial versus wind-transport inputs: explicit if there are criteria to distinguish between fluvial and wind pollen inputs? Several references are made to fluvial input increase : between 21.9 and 18.8 ka BP (P.122-line 29+ P.123-line 1) and during the Holocene, 10.0 to 7.8 ka BP (P.126-line 22, ...). Which arguments are behind the hypothesis that terrestrial input increase is due to fluvial input increase? Is this a data-inferred hypothesis (pollen assemblage composition? sedimentology?...) or is this proposed as an expected consequence of the reconstrucetd climate or atmospheric features (e.g. SE trade wind intensity is expected to increase wind-transported pollen inputs, while precipitation increase over the continent might increase fluvial inputs)?

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Explicit this.

P.123 lines 24-27. Due to its ability to be wind-transported, couldn't Podocarpus over-representation (and in particular its relative percentages calculated versus the other total mountain elements) be used as a qualitative indicator of wind transport efficiency and wind intensity?

P.124 lines 1-10. Great difference in the Podocarpus pollen representation between GeoB1016 and core ODP 1078C is mentionned. GeoB1016 site is about 3000 m. deeper than core ODP 1078C site. Core GeoB1016 is located just few kilometers south of core ODP 1078C site, but about 200 km further west. The authors mention than '... marine record of Podocarpus for this period is not consistent'. Are the distance betwen the two core sites and the difference in the water depth not simply suffisant to explain the apparent discrepancy between the two sites, in the Podocarpus pollen representation? Considering both terrestrial and marine Podocarpus records in the area on one hand, and topography of the continent on the other hand, can we imagine where are located the Podocarpus forests at that time?

P.124 lines 23-25. It is noted on P.117-line 26 and following P.118-line 1 that, even considering a 600 year reservoir age, would not change significantly the age model. What could be the reservoir age induced by an intensified upwelling, so that its generates several centuries bias on the ages from this deglaciation period? Any indication from age of modern materials in the present-day upwelling area?

MINOR SPECIFIC COMMENTS

P.116 lines 25-26: Add a comment on the number of pollen counted in the poorest samples. Comment on their statistical validity, for calculation of percentages? Also comment on the number of counted pollen grains versus apparent diversity of the samples? Even when poor, samples seem to have a relatively high "apparent" diversity and none of them is dominated by an over-represented pollen taxa. This makes them valuable for use in the pollen interpretation, even when they include much less than

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300 counted pollen grains. Fig. 4 shows this information, but is not so easy to read, especially for non-specialists, and in particular because pollen + spores number are expressed as deviation from the 300 standard number for pollen+spores counted. Explicit this in the text, to better demonstrate the robustness of the raw data, over the whole sequence.

P.117 line 12: 'the younger part' (0-22 ka)' should be replaced by 'the upmost part (0-9.8 mbsf)', since young age biases and dating discrepancies does not allow a simple transfer between depth interval and time interval. The sentence should therefore be re-written, and divided into two parts, since calibration procedure should indeed be described in calibrated ages.

P.122 lines 14-22: Altitudes and latitudes of the cited sites (and facultatively, site names) would help clarify the discussion, in this section; This is a general comment that could be applied in several other sections, where terrestrial sites are discussed (e.g. P.125 - lines 16-18; P. 128 - lines 19-23).

P.126 line 28 + P.127 line 1: Hypothesis that Rhamnaceae is mainly represented by Ziziphus pollen taxa. Could this hypothesis be developped? Is this based on its representation in modern flora? Other arguments?

P.127 line 25: Elaeis guineensis representation increases after 2 ka BP. Even if Elaeis guineensis is present in the natural vegetation in Angola, could its representation increase be favoured also by human impact and activities, as interpreted in West and West Central Africa (e.g. Sowunmi, 2006)? Sowunmi (2006). The significance of oil pam (Elaeis guineensis Jacq.) in the late Holocene environments of west and west central Africa: a further consideration. Vegetation History and Archaeobotany, 8 (3) : 199-210.

P.128 line 1: Argument to attribute pollen taxa of Hymenocardia (undifferentiated pollen) to the 'fire hardy' species Hymenocardia acida?

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P.128 lines 4-6: The authors refer to ' a change, but not necessarily an increase in the fire regime...' Again... (see above comment for P.127 line 25) ... could this change, evidenced in the charcoal and pollen records, be related or compared to a possible human impact in the region?

TECHNICAL COMMENTS

P.112, line 25: Vincens et al. (1999) refers to a study from ATLANTIC Equatorial Africa (several lake sequences from Congo) and NOT from East Africa, as written in the text. Add E.G. before quoting 'Vincens et al. (2005, 2007), Bonnefille and Chalié (2000) and Johnson et al. (2004)', since numerous other references coud be added for East African climate reconstructions, some of them being quoted in the text.

P.125 lines 23-24: '... Lake Malawi shows an increase of productivity during the Younger Dryas period (Johnson et al., 2004)'. Complete the sentence by 'interpreted as a dry oscillation at around 12-15°S' after 'Younger Dryas period'.

P.140 Tab.2 - Is there a logic in the order of selected taxa presented in Tab. 2? If so, please explicit it. In case of no special logic order, it would be much easier to read, ordering taxa and grouping them by vegetation types (e.g. ' moutain el' undifferentiated is just above Ericaceae, but the two other mountain elements Myrica and Podocarpus are far below in the table. It would be preferable to find them 4 on the first 4 lines of the table. Also, criteria to represent a percentage in bold characters is unclear. It should seem logic to use bold characters, for percentages when significant to define a given pollen zone. This is not really observed in table 2. Moreover, the taxa which percentages are pointed out with bold characters do not always correspond to taxa mentionned as markers of the pollen zone in the text (e.g. Myrica is mentionned as a marker of PZ1 (P.119 - line 14), while not in bold character). Homogeneise text and table would also increase readability.

P.147 Fig.7 - ITCZ and CAB latitudinal positions are drawn on a present-day vegetation map. I agree with Anonymous Referee #3 : this is rather confusing to draw the

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atmospheric front in this framework, and does not bring much information, since vegetation cover was quite different from present-day for the two selected periods. It could be usefull to represent on this map, the location of all sites discussed in the text, and which might have been used or usefull to draw ITCZ and CAB positions. Or to report again, as in Fig. 1a and 1b, the atmospheric front in the present-day situation for an easier comparison. ...

MINOR TECHNICAL CORRECTIONS

Page 112 line 12 (Abstract) and Page 112, line 20 : 'CongoLIAN Air Boundary' is usually refered to as 'CONGO Air Boundary' (as it is the case in the text and in the figures elsewhere).

P.113 line 8: Add a question mark instead of a dot after 'surface temperatures'.

P.113 line 25: Replace 'environmental change' by 'environmental changeS'?

p.116 line 7: Add a coma after 11°55'S

p.116 line 7: Core site depth is 427 m., and 426 m. on figures 2 and 3. Even if error on water depth is certainly greater than 1 m., consistent values should be given all along the article.

P.116 line 15: 'Dates at 1071 and 1021 CM' (instead of M); 'below sea floor (CMBSF)' (instead of mbsf).

P.119 line : Remove 'occurred' after 20.9°C

P.120 line 4: Add reference to Fig. 2, after 'global eustatic sea-level curve'

P.120 line 4: Add a dot after 'Fleming et al. (1998)'.

P.120 line 8: Replace 'high percentages ALSO of Artemisia afra also occurred' by 'high percentages of Artemisia afra also occurred'.

P.121 line 3: '...the site is situated in front OF (and not OFF) the mouth of Balombo

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River' OR '...the site is situated OFF (and not IN FRONT OFF) the mouth of the Balombo River'.

P.123 line 15: Replace 'Lake Barombi in Cameroon...' by 'Lake Barombi MBO in Cameroon...'

P.123 lines 16-17: Replace 'increase of grassland from ca. 24 ka on...' by 'increase of grassland from ca. 24 ka ONWARD'?

P.123 line 24: Replace 'the period between 18.8 to 15.4 ka...' by 'the period between 18.8 AND 15.4 ka...'

P.125 line 3: Remove 'and' in '... during this time AND is explained by erosion...'.

P.126 line 11: Replace '7.80 ka' by '7.8 ka'

P.126 line 18: Replace 'suggest' by 'suggests'

P.126 line 21: Replace 'Flemming' by 'Fleming'.

P.128 lines 26 and 29 : Replace 'ITZC' by 'ITCZ'

P.130 line 4: Add 'ka' after '15.4'

P.131 line 5: Replace 'Thymelaeaceae' by ' Thymeleaceae' (?)

P.132 line 8: Remove ' , ' after '(Chrysophytum)'

P.133 to 137: References : Journal titles of all references are expressed according to the JCR abbreviation. Standard abbreviation usually refer to ISO abbreviated titles, in particular in most articles published in Climate of the Past. To be changed?

P.134 line 21: Replace 'palaeoenironments' by ' palaeoenVironments'.

P.134 line 29: Replace 'om paired' by 'ON paired'

P.136 line 20: Replace 'Farbanks' by 'Fairbanks'

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P.137 line 30: Replace 'Meunier, D.' by 'Meunier, J.D.'

P.138 lines 6-10: two references are mentionned for Wefer et al. (1998): a book and a section within this book. Either (1) distinguish two references (1998a and 1998b) and adjust the two references in the text, or (2) merge both references to the full book reference only.

P.138 line 11 : Replace 'Rescourses' by 'Ressources'

P.138 Fig.1 legend: Replace '980 mbsf' by '980 Cmbsf'.

P.138 Tab.1 - Replace column title 'Depth (mbsf)' by 'Depth (Cmbsf)'.

P.138 Tab.1 - Replace column title 'Cal. Age range (ka)' by 'Cal. age range (a)'

P140 Tab.2 legend: Replace 'sea level a the site' by 'sea level AT the site'

P.140 Tab.2 legend: Add an explanation such as 'el = elements'

P.140 Tab.2: in line 'upper boundary (ka)' x column 'pollen zone 7': replace 'top' (which refers to depth) to 'Modern' or '0'

P.140 Tab.2: Replace line title 'Poacecae' by 'Poaceae'.

P.140 Tab.2: Replace line title 'Phaecoceros' by 'Phaeoceros'.

P.141 Fig.1: Legend of Fig. 1a and 1b is not explained. It should be explicited, since colors used in Figs 1 a and b are NOT the same as in Fig. 1c.

P.142 Fig.2 legend: add a space type between 'right shaded curve' and 'and upper axis'.

P.142 Fig.2: Replace 'sea/level change' by 'sea-level change' (top right)

P.142 Fig.2: Replace 'calbrated' by 'calibrated' (legend of right age axis)

P.142 Fig.2: Red and blue boxes should be empty, to avoid color overlaps between dates calibrated using two different calibration datasets (for dates younger than 25 ka

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BP).

P.143 to 146 Figs.3 to 6: Add 'LGM is shown as a shaded area (27.5 to 22.3 cal. ka BP)' in the legend.

P.144 Fig.4 legend: Replace 'op top' by 'on top'.

P.145 Fig.5 Legend: Replace 'are give' by 'are given'

P.145 Fig.5: Replace taxon name 'Polygonium senegalensis' by 'Polygonum senegalensis'.

P.146 Fig.6: What is the taxon named 'Type C3P6/9 echinulate'? This sould be either explicited and refered to in the text (if useful) or removed from the pollen diagram.

P.146 Fig.7 Legend: Add ' * = core site ODP 1078C location '.

Interactive comment on Clim. Past Discuss., 4, 111, 2008.