

Response to the Dr. Hay's comments

Editorial suggestions: One special comment: $p\text{CO}_2$ versus $p\text{CO}_2$ versus $\text{PCO}_{2\text{atm}}$ The italic p indicates partial pressure in the atmosphere (Geologists often cite this in terms of ppmv although that is not an expression of pressure. This opens a real can of worms). As best I can tell, the regular p is used specifically for the partial pressure of blood CO_2 . The last variant is Paul Pearson's (2009) which he defined as being the concentration of CO_2 in the atmosphere in ppmv. Unfortunately, it looks so much like the other expressions it is sure to add to the confusion. Geologists have taken the habit of referring to the concentration of CO_2 in the atmosphere in ppmv as $p\text{CO}_2$ or $p\text{CO}_2$. This expression appears a few times in the paper. This is incorrect, and will not be understood by the rest of the scientific community. As noted above, the expressions $p\text{CO}_2$ and $p\text{CO}_2$ refer to the partial pressure of CO_2 and would be in pressure terms of hectapascals (SI) or millibars (US), not ppmv. They change with altitude. In medicine or in discussions of hyperbaric conditions, as in deep sea diving, they are used in discussions of the pressure of CO_2 in the lungs. The proper expression in this and other papers concerning the concentration of CO_2 in the atmosphere in terms of ppmv or ppm is simply 'atmospheric CO_2 ' or 'atmospheric CO_2 concentration' or if 'atmospheric' is understood, simply ' CO_2 concentration' or ' CO_2 level.'

According to the referee's suggestion, we revised the term " $p\text{CO}_2$ " as "atmospheric CO_2 level" (Page 2, Line 28; Page 9, Line 4; Page 9, Line 10; Page 10, Line 9; Page 10, Line 13; Page 11, Line 5-6; Page 15, Line 24; Page 15, Line 25, 26, 27, and 30; Page 16, Line 2, 4; Page 17, Line 14; and Page 32, Line 21 in the revised manuscript).

Other minor changes are as follows:

P.121, line 5: for 'peak' read 'maximum'

"peak" has been changed to "maximum" as suggested (Page 2, Line 20 in the revised manuscript).

P.124, line 16: for 'are stemmed' read 'stem'

"are stemmed" has been changed to "stem" as suggested (Page 4, Line 27 in the revised manuscript).

P.124, line 18: 'ence of each basins' read 'ences of each basin'

"difference of each basins" has been changed to "differences of each basin" as suggested (Page 4, Line 10 in the revised manuscript).

P.128 I suggest not using $p\text{CO}_2$ (lines 13, 20) but atmospheric CO_2

" $p\text{CO}_2$ " has been changed to "atmospheric CO_2 " as suggested (e.g., Page 16, Line 2 and 4 in the revised manuscript).

P.128, line 28: for ‘westries’ read ‘westerlies’

“westeries” has been changed to “westerlies” as suggested (Page 9, Line 24 in the revised manuscript).

P.129, lines 1-2: for ‘several evidences support’ read ‘there is evidence to indicate that’

“several evidences support” has been changed to “there is evidence to indicate that” as suggested (Page 9, Line 25-26 in the revised manuscript).

P.129, lines 10, 14: pCO₂ again.

“pCO₂” has been changed to “atmospheric CO₂” as suggested (Page 10, Line 9 and 13 in the revised manuscript).

P.129, line 20: for ‘can’ read ‘could’

“can” has been changed to “could” as suggested (Page 10, Line 18 in the revised manuscript).

P.129, line 24: for ‘by’ read ‘with’

“by” has been changed to “with” as suggested (Page 10, Line 21 in the revised manuscript).

P.129, line 29: for ‘Northern South Atlantic’ read ‘northern South Atlantic’

“Northern South Atlantic” has been changed to “northern South Atlantic” as suggested (Page 10, Line 26 in the revised manuscript).

P.130, line 11: pCO₂ again

“pCO₂” has been changed to “atmospheric CO₂” as suggested (Page 11, Line 5-6 in the revised manuscript).

P.130, line 25: for mid-latitude’ read ‘mid-latitudes’

“mid-latitude” has been changed to “mid-latitudes” as suggested (Page 11, Line 21 in the revised manuscript).

P.131, lines 5, 7: delete ‘wave’

“wave” has been deleted as suggested (Page 11, Line 29, 31 in the revised manuscript).

P.132, line 22: delete ‘that’

“that” has been deleted as suggested (Page 14, Line 23 in the revised manuscript).

P. 133, lines 22, 23, 25, 27: pCO₂ again

“pCO₂” has been changed to “atmospheric CO₂” as suggested (Page 15, Line 25, 26, 27 and 30 in the revised manuscript).

P.133, line 25: for 'shrink' read 'shrank'

"shrink" has been changed to "shrank" as suggested (Page 15, Line 28 in the revised manuscript).

P.134, lines 2, 5: pCO₂ again

"pCO₂" has been changed to "atmospheric CO₂" as suggested (Page 16, Line 2 and 4 in the revised manuscript).

P. 134, line 4: for 'predicting' read 'predicted'

"predicting" has been changed to "predicted" as suggested (Page 16, Line 3 in the revised manuscript).

P.134, line 5: for 'predicting' read 'predicted'

"predicting" has been changed to "predicted" as suggested (Page 16, Line 5 in the revised manuscript).

P.134, line 6: for 'will possibly reach' read 'may be reached'

"will possibly reach" has been changed to "may be reached" as suggested (Page 16, Line 5 in the revised manuscript).

P.134, line 7: for 'possibility of presence' read 'possible presence'

"possibility of presence" has been changed to "possible presence" as suggested (Page 16, Line 6 in the revised manuscript).

P.134, line 8: for 'as Pale-' read 'as the Pale-'

"as Paleocene" has been changed to "as the Paleocene" as suggested (Page 16, Line 8 in the revised manuscript).

P.148, line 4: for 'Skeleton' read 'Skelton'; for 'evidences' read 'evidence'

"Skeleton" has been changed to "Skelton" as suggested (Page 32, Line 4 in the revised manuscript).

P.150, line 2: for 'Gray' read 'Orange'

"Gray" has been changed to "Orange" as suggested (Page 32, Line 10 in the revised manuscript).

P.150, line 3: for 'black-dotted' read 'red dotted'

"black-dotted" has been changed to "red dotted" as suggested (Page 32, Line 11 in the revised manuscript).

manuscript).

P.150, line 9: for ‘evidences’ read ‘evidence’; delete ‘;’ after ‘2008)’

“evidences” has been changed to “evidences”, and “;” after “2008” has been deleted as suggested (Page 32, Line 17 in the revised manuscript).

P.150, line 13: pCO₂ again

“pCO₂” has been changed to “atmospheric CO₂” as suggested (Page 32, Line 21 in the revised manuscript).

P.150, line 20: delete comma after ‘modified after’

“,” after “modified after” has been deleted as suggested (Page 32, Line 28 in the revised manuscript).