**Climate
of the Past**

*Corrigendum to*

# "The relative roles of $CO_2$ and palaeogeography in determining late Miocene climate: results from a terrestrial model–data comparison" published in Clim. Past, 8, 1257–1285, 2012

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In the manuscript "The relative roles of $CO_2$ and palaeogeography in determining late Miocene climate: results from a terrestrial model–data comparison" by C. D. Bradshaw et al. (Clim. Past, 8, 1257–1285, 2012), an error in a database query used for our model–data comparison has been found, altering the magnitude and direction of a small number of anomalies. Although some results change slightly, the overall study findings and conclusions are unaltered. The original publication included a corrigendum (doi:10.5194/cp-8-1301-2012) as figure fonts were incorrectly embedded; these are now obsolete.

– Section 5.1.1, sentence 3: the "129 overlaps" should be "135 overlaps".

– Section 5.1.2, paragraph 3, sentence 2: the reduction of "12 overlaps, or 3 %", should be "18 overlaps, or 4 %" and the "13 %" improvement should be "11 %".

– Section 5.1.2, sentence 2: the "852 overlaps" should be "858 overlaps".

– Section 5.1.2, paragraph 2, sentence 1: the "192 improvements" should be "185 improvements" and the "23 deteriorations" should be "25 deteriorations".

– Section 5.6, paragraph 2, sentence 9: the "172 more overlaps" should be "166 more overlaps".

Due to the change in direction of some of the anomalies, the following alterations to the text are required:

– Section 5.1.1, sentence 2 "no datapoint is suggesting cooler temperatures in the late Miocene" should read "only 12 datapoints suggest cooler temperatures in the late Miocene and these are concentrated in South East Asia."

– Section 5.1.2, paragraph 1, add after sentence 2: "For 29 datapoints, the warmer late Miocene MATs produced by the model are too warm as compared to the data. These are found particularly in regions of the most orographic change (the Andes, the Himalayas, the East African Plateau and the southern-most tip of the Rockies), and also in the southern Mediterranean."

– Section 5.1.2, paragraph 2, add after sentence 2: "Despite these improvements in the model-data comparison, there are still many mid-latitude Northern Hemisphere datapoints which indicate warmer MATs than the LM400c simulation is able to model. However, there are now 26 additional datapoints for which the model simulated temperatures are too warm, especially in North America."

– Section 5.2.1, sentence 2 "the MAPs are wetter; none of the datapoints suggest drier MAPs in the late Miocene" should read "the MAPs are generally wetter; 41 of the datapoints in Europe and Africa suggest drier MAPs in the late Miocene."

– Section 5.2.2, sentence 2 "The 88 datapoints which do not overlap with the modelled MAPs are wetter than the model predicts" should read "Of the 88 datapoints which do not overlap with the modelled MAPs, 86 are wetter than the model predicts."

– Section 5.3.1, sentence 2 "the CMTs are wamer; none of the datapoints suggest cooler CMTs in the late Miocene" should read "the CMTs are generally cooler in the late Miocene across Europe and south-east Asia; further sensitivity studies are required to identify the boundary conditions causing this difference. However, CMTs are warmer in central and northern Asia in the late Miocene and this is perhaps related to the presence of the Paratethys and the lower orography of the Himalayas (e.g. Ramstein et al., 1997)."

**Supplementary material related to this article is available online at http://www.clim-past.net/10/199/2014/ cp-10-199-2014-supplement.pdf.**
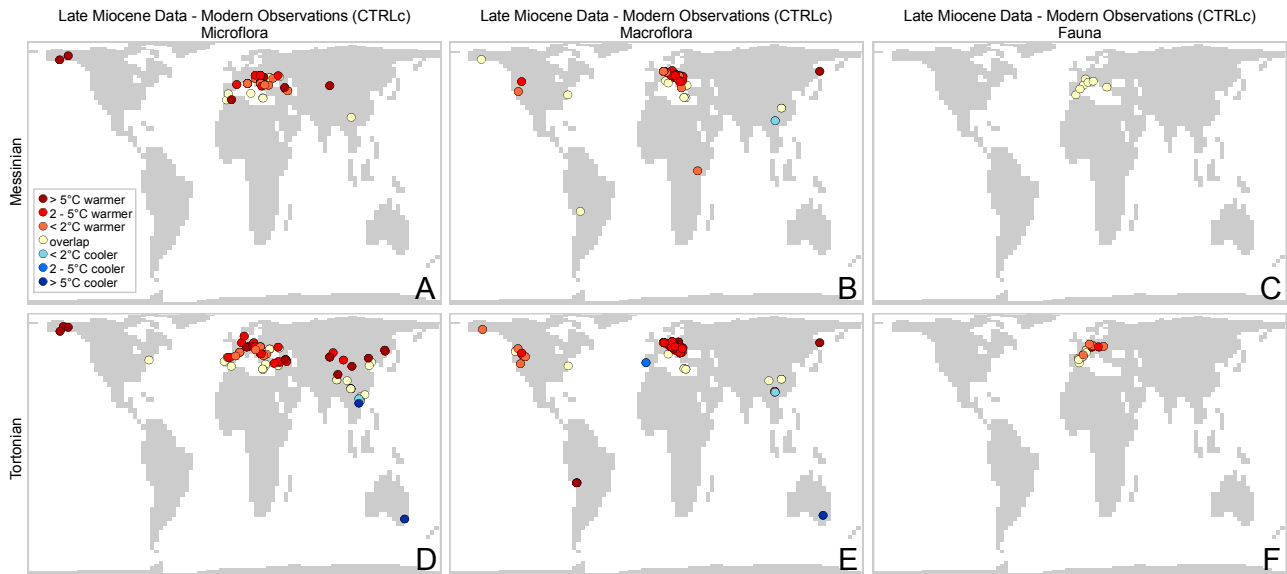
**Fig. 7.** Results from the model–data comparison for mean annual temperature, late Miocene data – modern potential natural climate estimates.
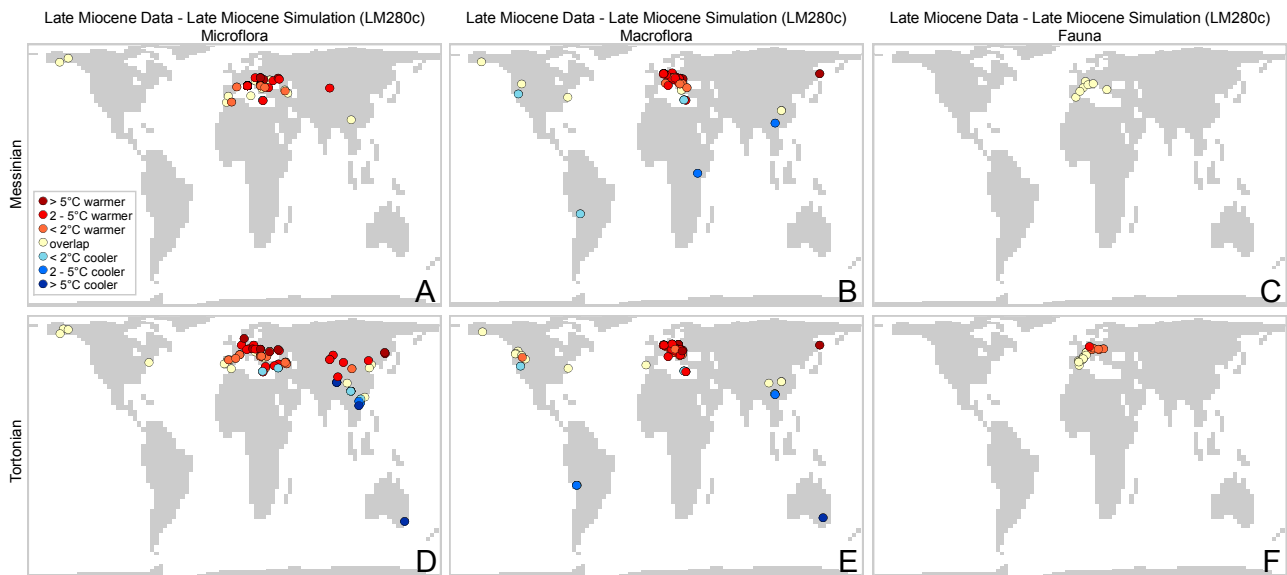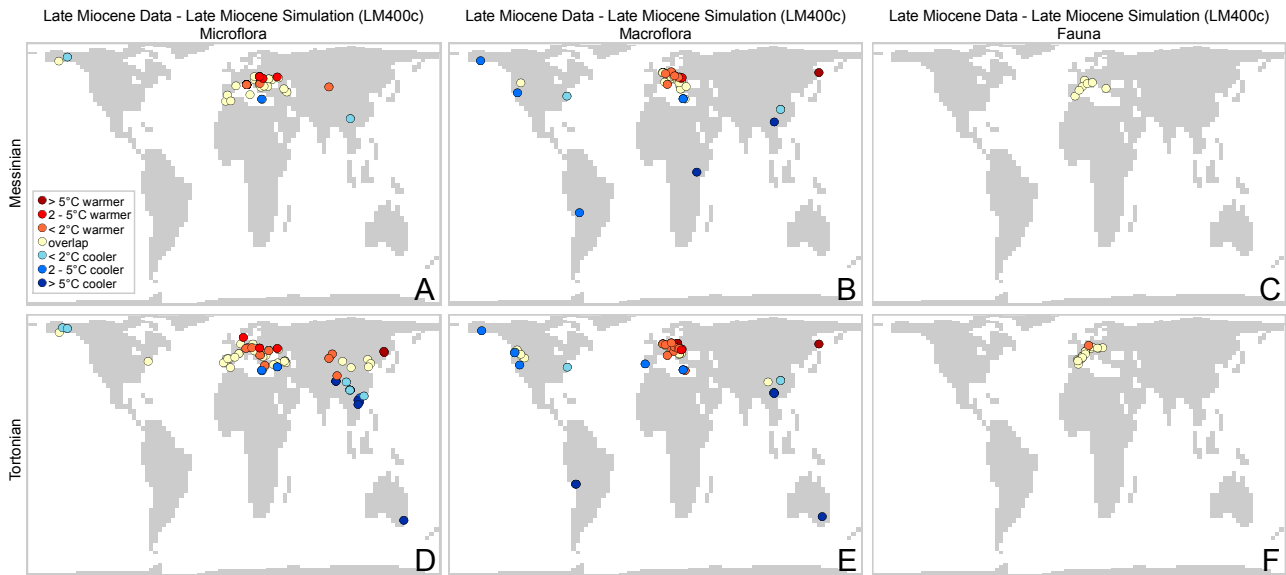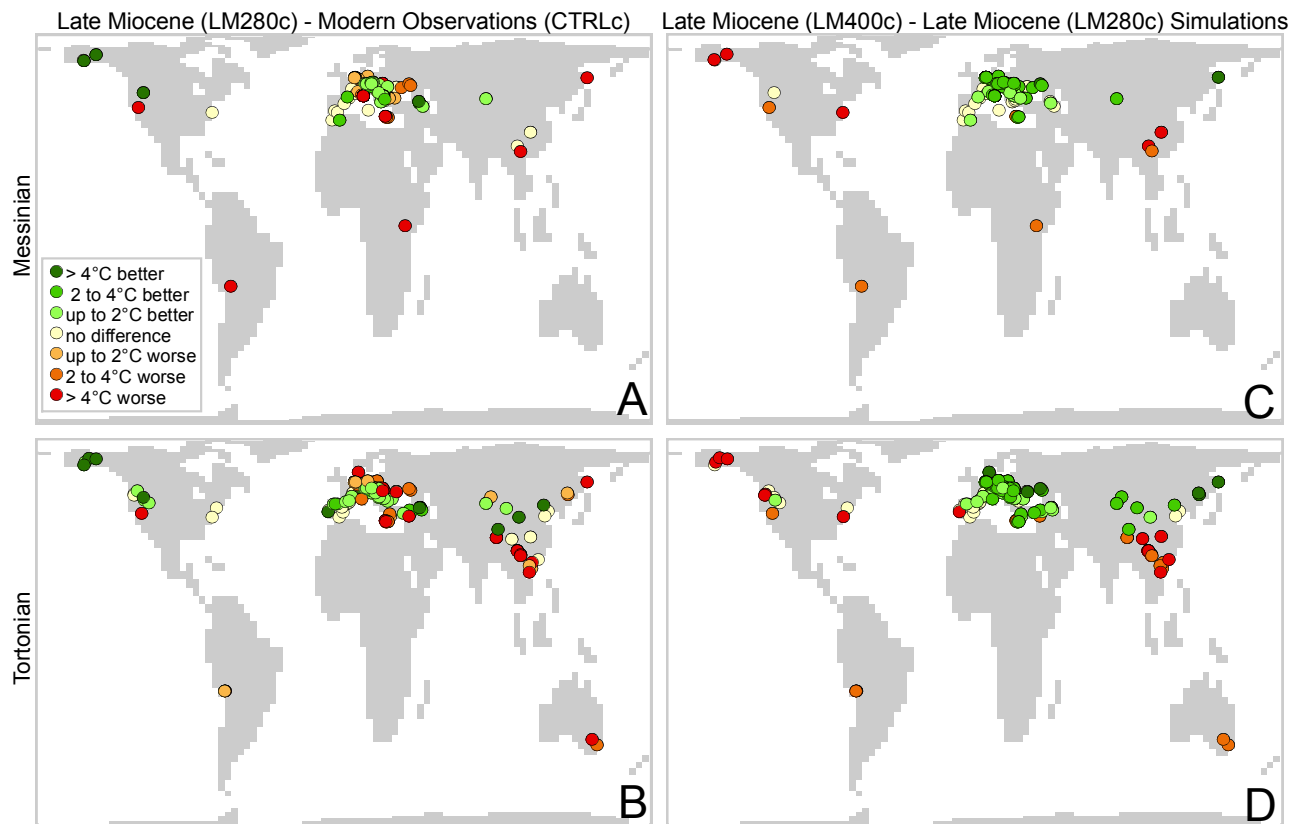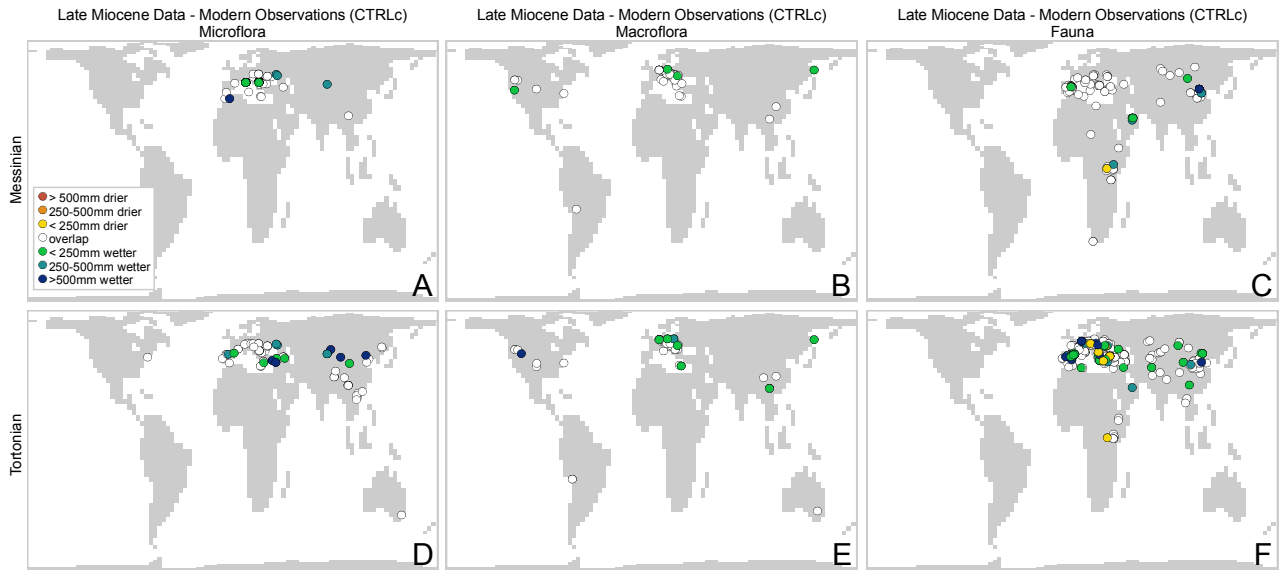


**Fig. 8.** Results from the model–data comparison for mean annual temperature, late Miocene data (LM280c).

**Fig. 9.** Results from the model–data comparison for mean annual temperature, late Miocene data (LM400c).



**Fig. 10.** Improvements in the model–data comparison for mean annual temperature. The lefthand column **(A, B)** shows the improvement that the late Miocene palaeogeography makes to the model–data comparison. The righthand column **(C, D)** shows the improvement that higher $CO_2$ makes to the model–data comparison. Green circles indicate an improvement; red circles indicate a deterioration. The datapoints showing "no difference" (white circles) are plotted underneath the other datapoints in order to highlight the differences.

**Fig. 11.** Results from the model–data comparison for mean annual precipitation, late Miocene data – modern potential natural climate estimates.



**Fig. 12.** Results from the model–data comparison for mean annual precipitation, late Miocene data (LM280c).
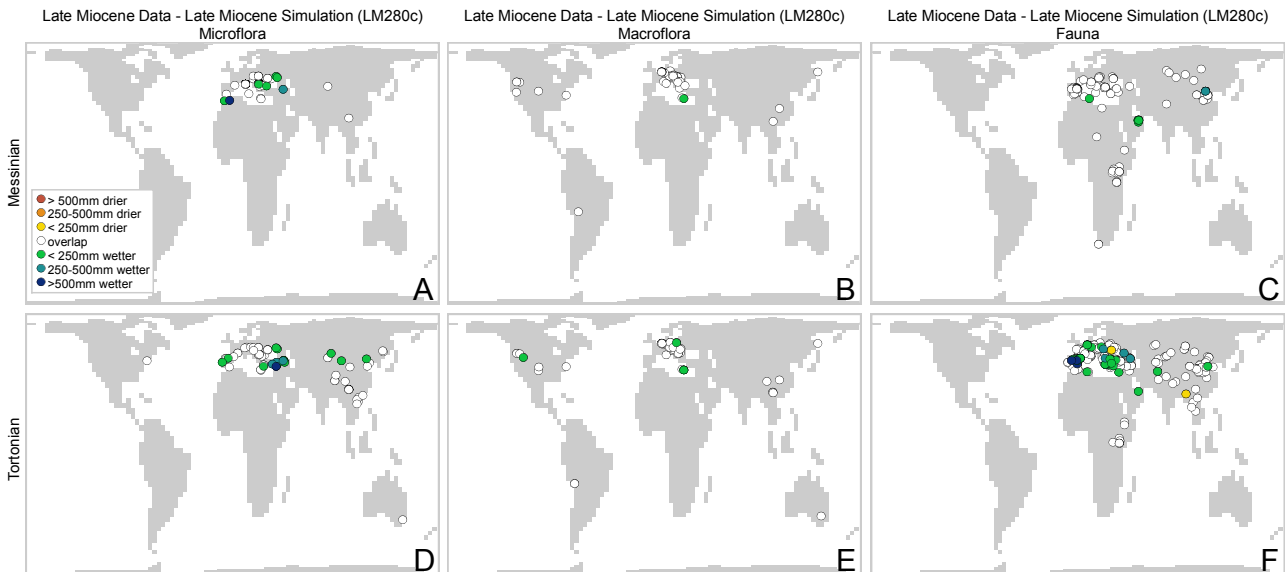
**Fig. 13.** Results from the model–data comparison for mean annual precipitation, late Miocene data (LM400c).
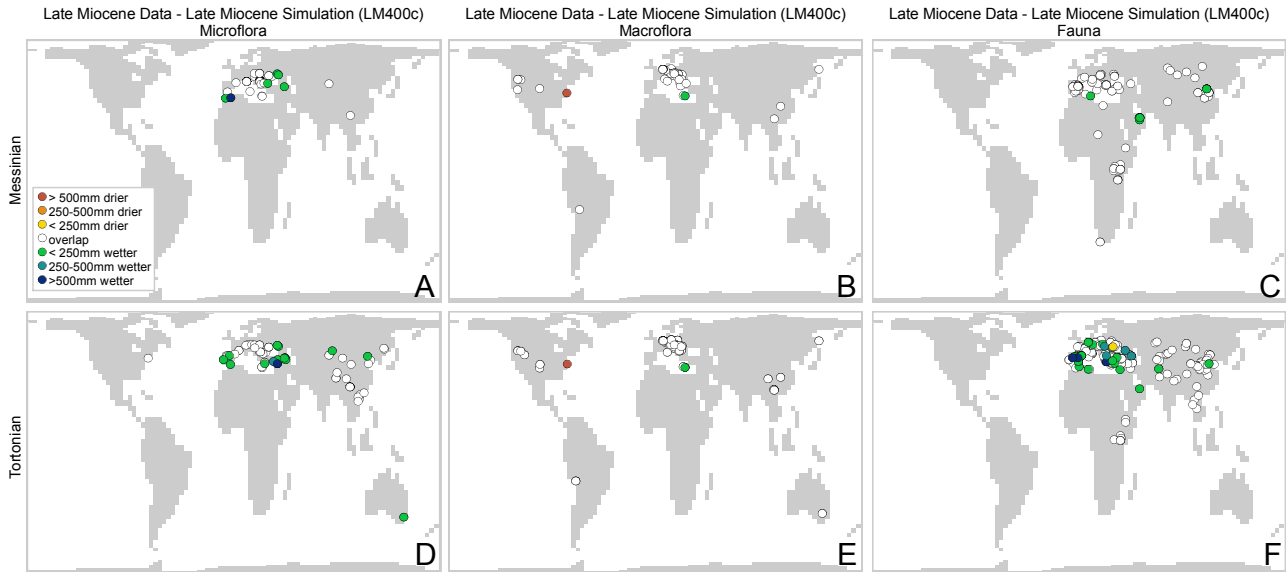


**Fig. 14.** Improvements in the model–data comparison for mean annual precipitation. The lefthand column **(A, B)** shows the improvement that the late Miocene palaeogeography makes to the model–data comparison. The righthand column **(C, D)** shows the improvement that higher $CO_2$ makes to the model–data comparison. Green circles indicate an improvement; red circles indicate a deterioration. The datapoints showing "no difference" (white circles) are plotted underneath the other datapoints in order to highlight the differences.
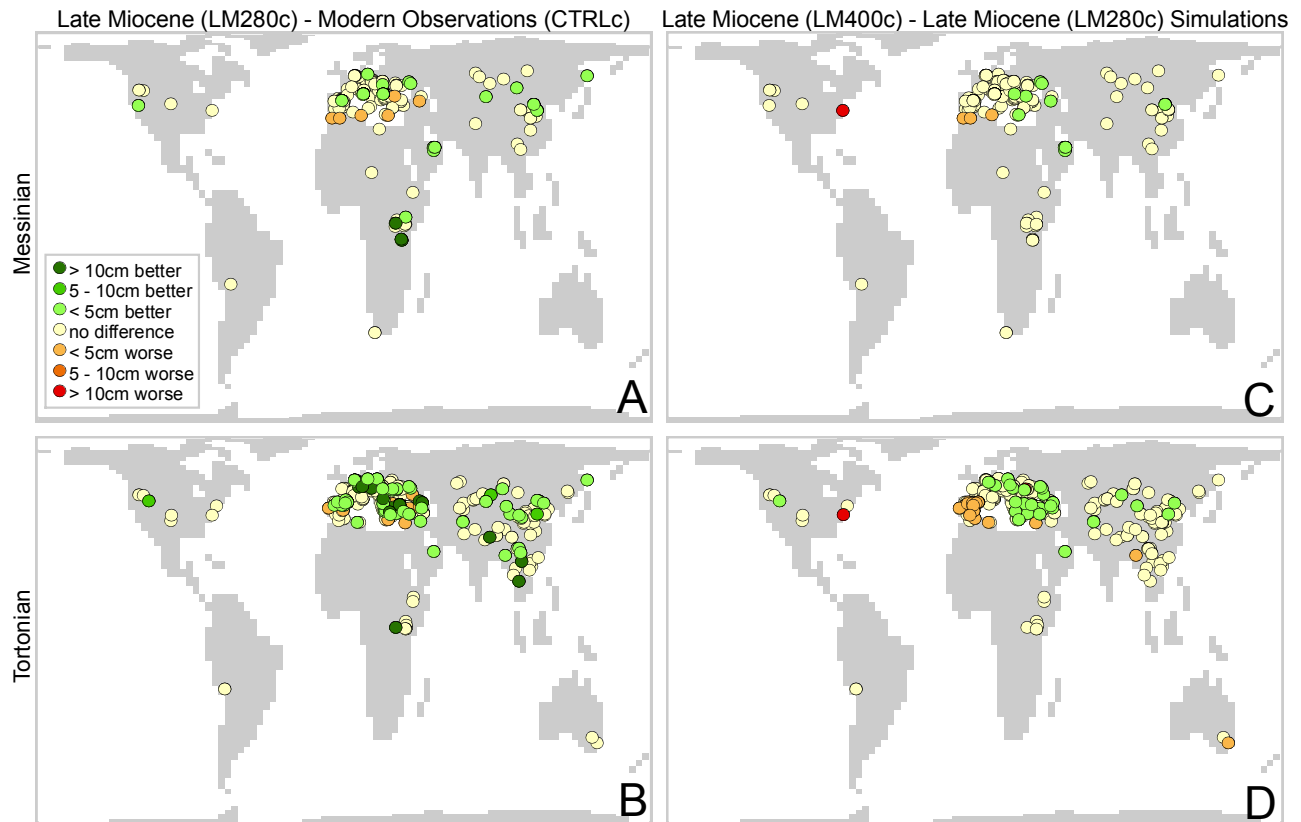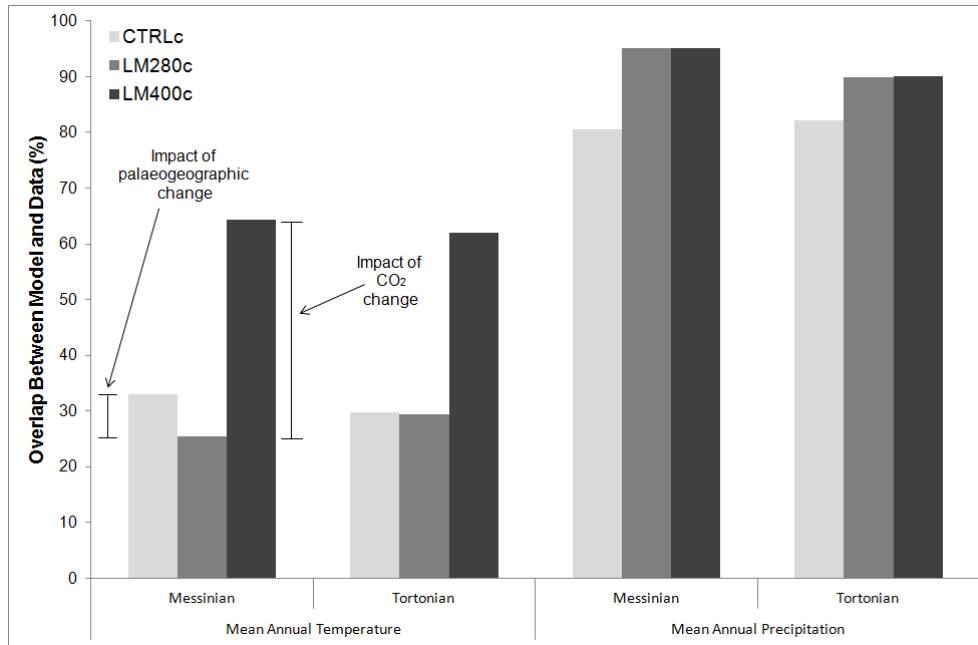
**Fig. 17.** Model–data comparison summary for MAT and MAP. Shown are the percentages of the total number of datapoints that overlap with the model results.
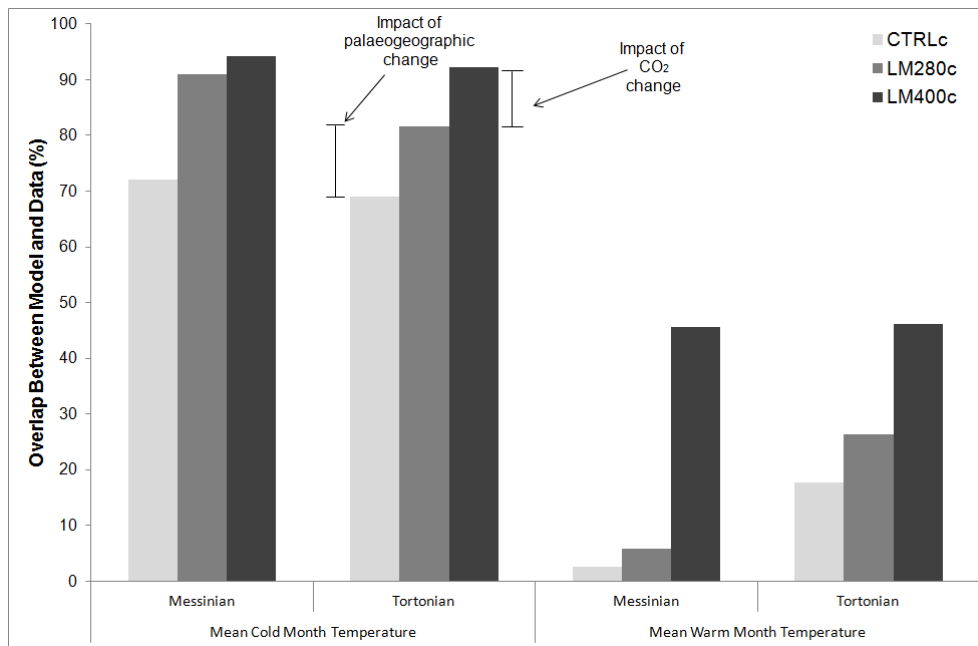


**Fig. 18.** Model–data comparison summary for CMT and WMT. Shown are the percentages of the total number of datapoints that overlap with the model results.

**Table 2.** Results from the model–data comparison for modern and late Miocene palaeogeography. Totals are expressed in bold.

| Variable | Epoch | CTRLc–LMdata datapoints in agreement | LM280c–LMdata datapoints in agreement | Total number of LMdata datapoints | Number of LM280c improvements over CTRLc All data (overlaps) | Number of LM280c deteriorations over CTRLc All data (overlaps) | Net LM280c improvement over CTRLc All data (overlaps) | Percentage improvement LM280c over CTRLc All data (overlaps) |
|---|---|---|---|---|---|---|---|---|
| MAT (Macroflora) | Messinian | 13 | 8 | 55 | 19(2) | 28(7) | −9(−5) | −16(−9) |
| MAT (Microflora) | Messinian | 53 | 41 | 159 | 88(33) | 62(45) | 26(−12) | 16(−8) |
| MAT (Fauna) | Messinian | 6 | 7 | 7 | 0(0) | 0(0) | 0(0) | 0(0) |
| MAT (Macroflora) | Tortonian | 17 | 18 | 90 | 41(8) | 38(7) | 3(1) | 3(1) |
| MAT (Microflora) | Tortonian | 32 | 29 | 98 | 53(12) | 29(15) | 24(−3) | 24(−3) |
| MAT (Fauna) | Tortonian | 13 | 14 | 20 | 6(1) | 1(0) | 5(1) | 25(5) |
| **MAT (All)** | **late Miocene** | **135** | **117** | **429** | **207(56)** | **158(74)** | **49(−18)** | **11(−4)** |
| MAP (Macroflora) | Messinian | 47 | 50 | 51 | 4(4) | 1(1) | 3(3) | 6(6) |
| MAP (Microflora) | Messinian | 104 | 146 | 154 | 48(45) | 4(3) | 44(42) | 29(27) |
| MAP (Fauna) | Messinian | 129 | 135 | 143 | 14(7) | 1(1) | 13(6) | 9(4) |
| MAP (Macroflora) | Tortonian | 69 | 75 | 79 | 9(7) | 2(1) | 7(6) | 9(8) |
| MAP (Microflora) | Tortonian | 77 | 76 | 94 | 15(4) | 6(5) | 9(−1) | 10(−1) |
| MAP (Fauna) | Tortonian | 432 | 482 | 531 | 95(57) | 11(7) | 84(50) | 16(9) |
| **MAP (All)** | **late Miocene** | **858** | **964** | **1052** | **185(124)** | **25(18)** | **160(106)** | **15(10)** |
| CMT (Macroflora) | Messinian | 31 | 38 | 48 | 16(11) | 5(4) | 11(7) | 23(15) |
| CMT (Microflora) | Messinian | 106 | 135 | 142 | 36(34) | 5(5) | 31(29) | 22(20) |
| CMT (Macroflora) | Tortonian | 53 | 57 | 74 | 19(13) | 11(9) | 8(4) | 11(5) |
| CMT (Microflora) | Tortonian | 45 | 59 | 68 | 22(18) | 5(4) | 17(14) | 25(21) |
| **CMT (All)** | **late Miocene** | **235** | **289** | **332** | **93(76)** | **26(22)** | **67(54)** | **20(16)** |
| WMT (Macroflora) | Messinian | 0 | 2 | 48 | 27(2) | 21(0) | 6(2) | 13(4) |
| WMT (Microflora) | Messinian | 5 | 9 | 143 | 15(5) | 124(1) | −109(4) | −76(3) |
| WMT (Macroflora) | Tortonian | 2 | 6 | 72 | 47(4) | 23(0) | 24(4) | 33(6) |
| WMT (Microflora) | Tortonian | 23 | 31 | 69 | 31(8) | 15(0) | 16(8) | 23(12) |
| **WMT (All)** | **late Miocene** | **30** | **48** | **332** | **120(19)** | **183(1)** | **−63(18)** | **−19(5)** |
| Megabiome | Tortonian | 124 | 123 | 314 | N/A(19) | N/A(20) | N/A(−1) | N/A(0) |
| **Megabiome** | **late Miocene** | **229** | **222** | **556** | **N/A(34)** | **N/A(41)** | **N/A(−7)** | **N/A(−1)** |

**Table 3.** Results from the model–data comparison for high and low $CO_2$ concentration assumptions. Totals are expressed in bold.

| Variable | Epoch | LM280c–LMdata datapoints in agreement | LM400c–LMdata datapoints in agreement | Total number of LMdata datapoints | Number of LM400c improvements over LM280c All data (overlaps) | Number of LM400c deteriorations over LM280c All data (overlaps) | Net LM400c improvement over LM280c All data (overlaps) | Percentage improvement LM400c over LM280c All data (overlaps) |
|---|---|---|---|---|---|---|---|---|
| MAT (Macroflora) | Messinian | 8 | 34 | 55 | 39(29) | 9(3) | 30(26) | 55(47) |
| MAT (Microflora) | Messinian | 41 | 101 | 159 | 116(62) | 3(2) | 113(60) | 71(38) |
| MAT (Fauna) | Messinian | 7 | 7 | 7 | 0(0) | 0(0) | 0(0) | 0(0) |
| MAT (Macroflora) | Tortonian | 18 | 51 | 90 | 63(43) | 18(10) | 45(33) | 50(37) |
| MAT (Microflora) | Tortonian | 29 | 59 | 98 | 56(41) | 25(11) | 31(30) | 32(31) |
| MAT (Fauna) | Tortonian | 14 | 19 | 20 | 6(5) | 0(0) | 6(5) | 30(25) |
| **MAT (All)** | **late Miocene** | **117** | **271** | **429** | **280(180)** | **55(26)** | **225(154)** | **52(36)** |
| MAP (Macroflora) | Messinian | 50 | 49 | 51 | 1(0) | 1(1) | 0(−1) | 0(−2) |
| MAP (Microflora) | Messinian | 146 | 147 | 154 | 5(1) | 2(0) | 3(1) | 2(1) |
| MAP (Fauna) | Messinian | 135 | 135 | 143 | 7(0) | 1(0) | 6(0) | 4(0) |
| MAP (Macroflora) | Tortonian | 75 | 76 | 79 | 4(2) | 1(1) | 3(1) | 4(1) |
| MAP (Microflora) | Tortonian | 76 | 75 | 94 | 15(1) | 4(2) | 11(−1) | 12(−1) |
| MAP (Fauna) | Tortonian | 482 | 483 | 531 | 24(5) | 29(4) | −5(1) | −1(0) |
| **MAP (All)** | **late Miocene** | **964** | **965** | **1052** | **56(9)** | **38(8)** | **18(1)** | **2(0)** |
| CMT (Macroflora) | Messinian | 38 | 42 | 48 | 10(7) | 3(3) | 7(4) | 15(8) |
| CMT (Microflora) | Messinian | 135 | 141 | 142 | 7(7) | 1(1) | 6(6) | 4(4) |
| CMT (Macroflora) | Tortonian | 57 | 65 | 74 | 17(11) | 3(3) | 14(8) | 19(11) |
| CMT (Microflora) | Tortonian | 59 | 64 | 68 | 7(7) | 4(2) | 3(5) | 4(7) |
| **CMT (All)** | **late Miocene** | **289** | **312** | **332** | **41(32)** | **11(9)** | **30(23)** | **9(7)** |
| WMT (Macroflora) | Messinian | 2 | 13 | 48 | 46(11) | 0(0) | 46(11) | 96(23) |
| WMT (Microflora) | Messinian | 9 | 14 | 143 | 134(5) | 0(0) | 134(5) | 94(3) |
| WMT (Macroflora) | Tortonian | 6 | 23 | 72 | 66(17) | 0(0) | 66(17) | 92(24) |
| WMT (Microflora) | Tortonian | 31 | 43 | 69 | 38(12) | 0(0) | 38(12) | 55(17) |
| **WMT (All)** | **late Miocene** | **48** | **93** | **332** | **284(45)** | **0(0)** | **284(45)** | **86(14)** |
| Megabiome | Messinian | 99 | 119 | 242 | N/A(39) | N/A(19) | N/A(20) | N/A(8) |
| Megabiome | Tortonian | 123 | 158 | 314 | N/A(58) | N/A(23) | N/A(35) | N/A(11) |
| **Megabiome** | **late Miocene** | **222** | **277** | **556** | **N/A(97)** | **N/A(42)** | **N/A(55)** | **N/A(10)** |