

SUPPLEMENTARY FIGURES FOR:

**Palaeogeographic controls on climate
and proxy interpretation**

Lunt et al, *Climate of the Past*, 2016

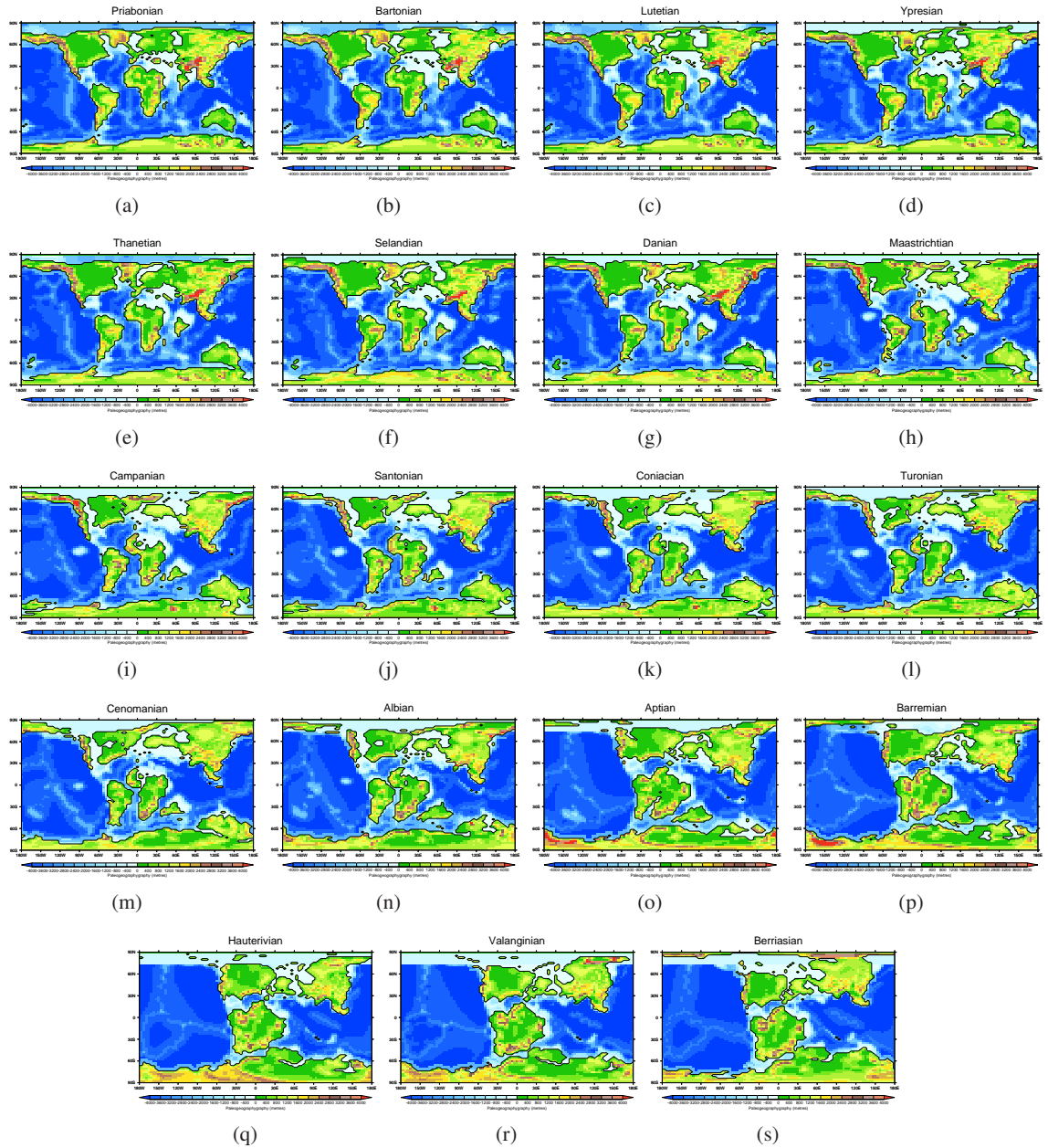


Figure S1: (a-s) Palaeogeography (topography, bathymetry) for each Stage, as used in the simulations. The palaeogeographies are reconstructed by Getech Plc, and then interpolated to the model resolution, and smoothing applied in certain regions to ensure stability (see Section 2.1). (a) Priabonian, (b) Bartonian, (c) Lutetian, (d) Ypresian, (e) Thanetian (f) Selandian, (g) Danian, (h) Maastrichtian, (i) Campanian, (j) Santonian, (k) Coniacian, (l) Turonian, (m) Cenomanian, (n) Albian, (o) Aptian, (p) Barremian, (q) Hauterivian, (r) Valanginian, (s) Berriasian.

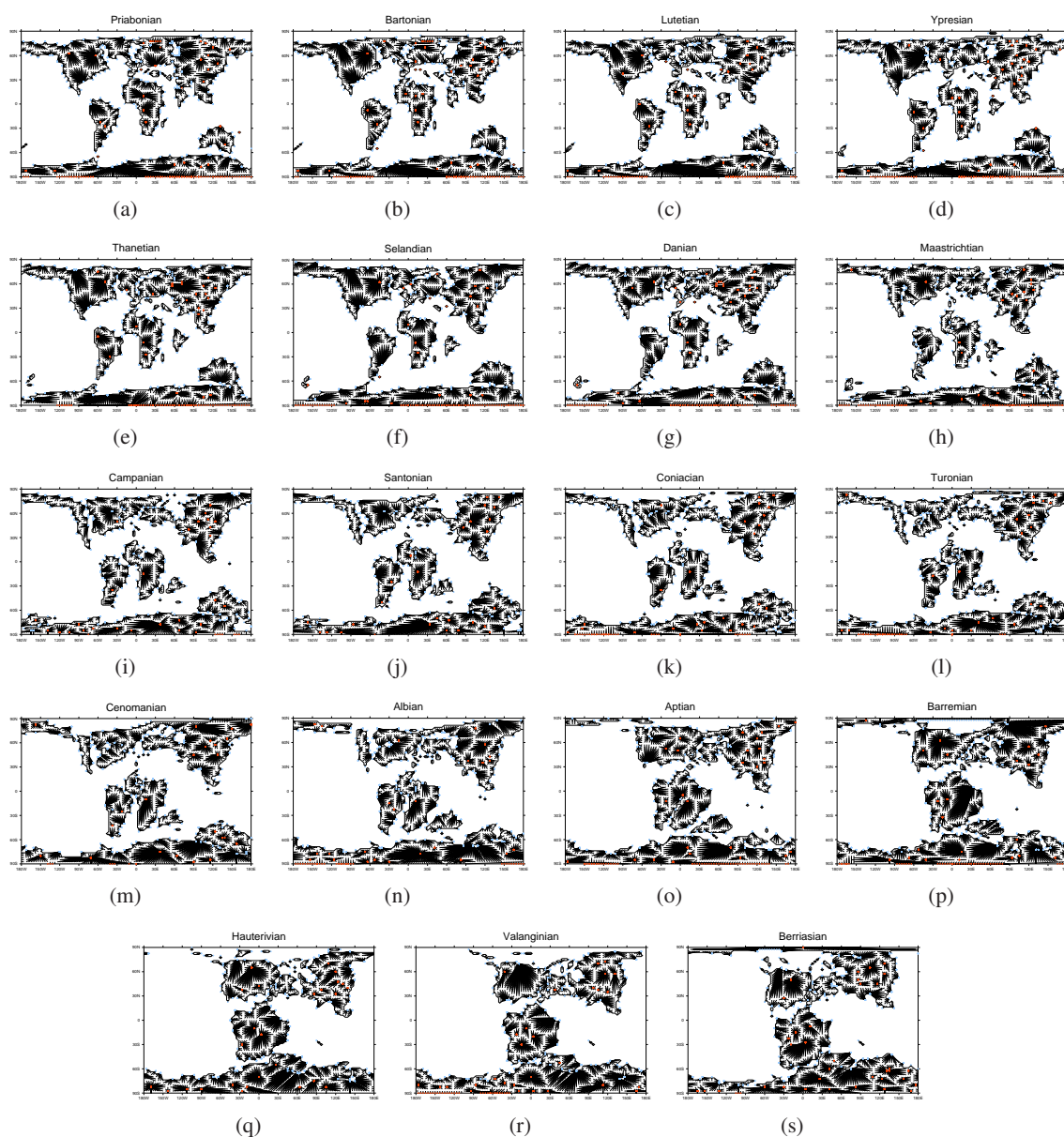


Figure S2: (a-s) Runoff routing in each simulation. Blue circles represent river mouth nodes, red circles are inland endorheic nodes. (a) Priabonian, (b) Bartonian, (c) Lutetian, (d) Ypresian, (e) Thanetian (f) Selandian, (g) Danian, (h) Maastrichtian, (i) Campanian, (j) Santonian, (k) Coniacian, (l) Turonian, (m) Cenomanian, (n) Albian, (o) Aptian, (p) Barremian, (q) Hauterivian, (r) Valanginian, (s) Berriasian.

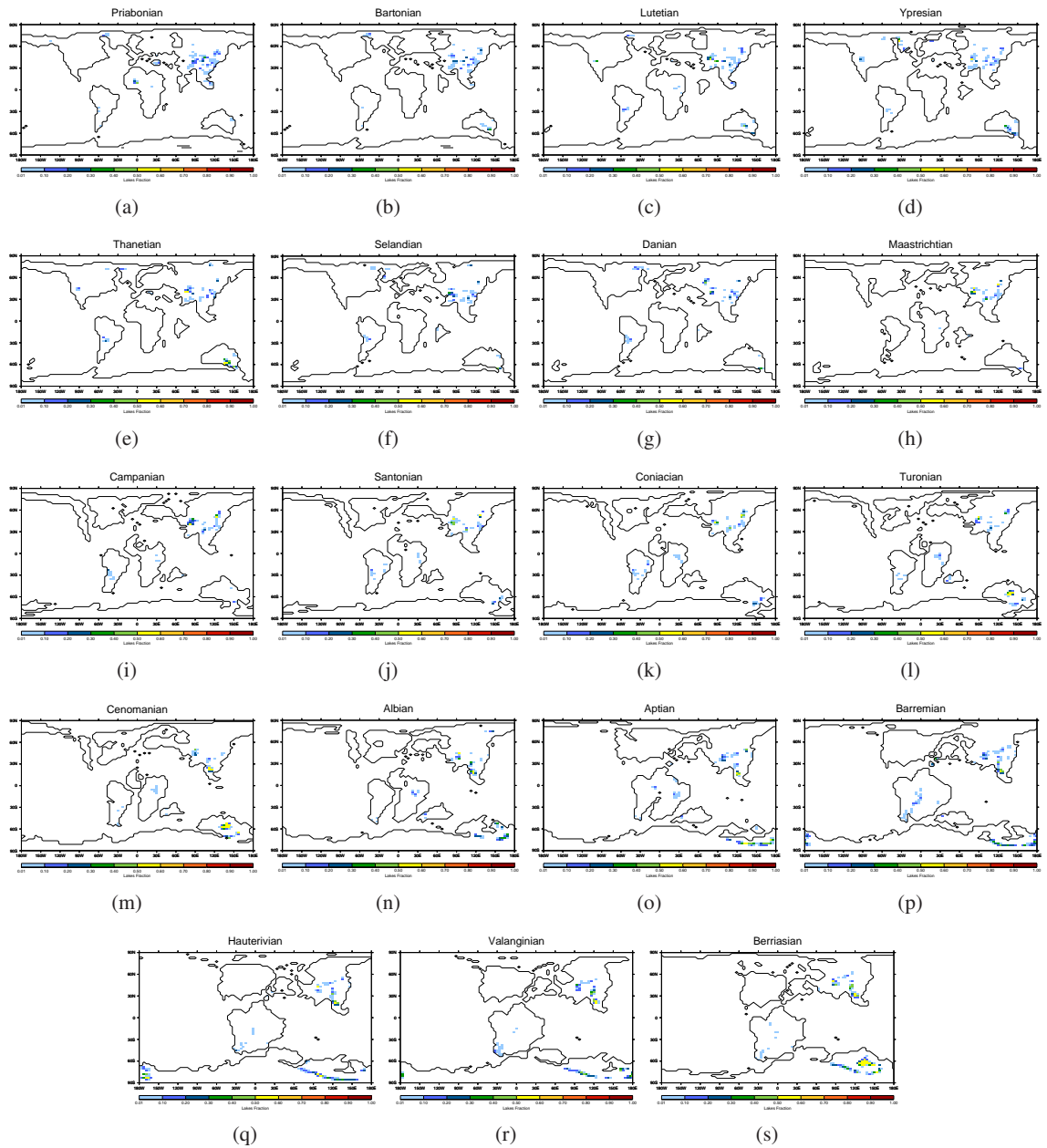


Figure S3: (a-s) Fraction of lake area prescribed in each simulation, and ice sheets in the Priabonian and Bartonian stages (grey shading). (a) Priabonian, (b) Bartonian, (c) Lutetian, (d) Ypresian, (e) Thanetian (f) Selandian, (g) Danian, (h) Maastrichtian, (i) Campanian, (j) Santonian, (k) Coniacian, (l) Turonian, (m) Cenomanian, (n) Albian, (o) Aptian, (p) Barremian, (q) Hauterivian, (r) Valanginian, (s) Berriasian.

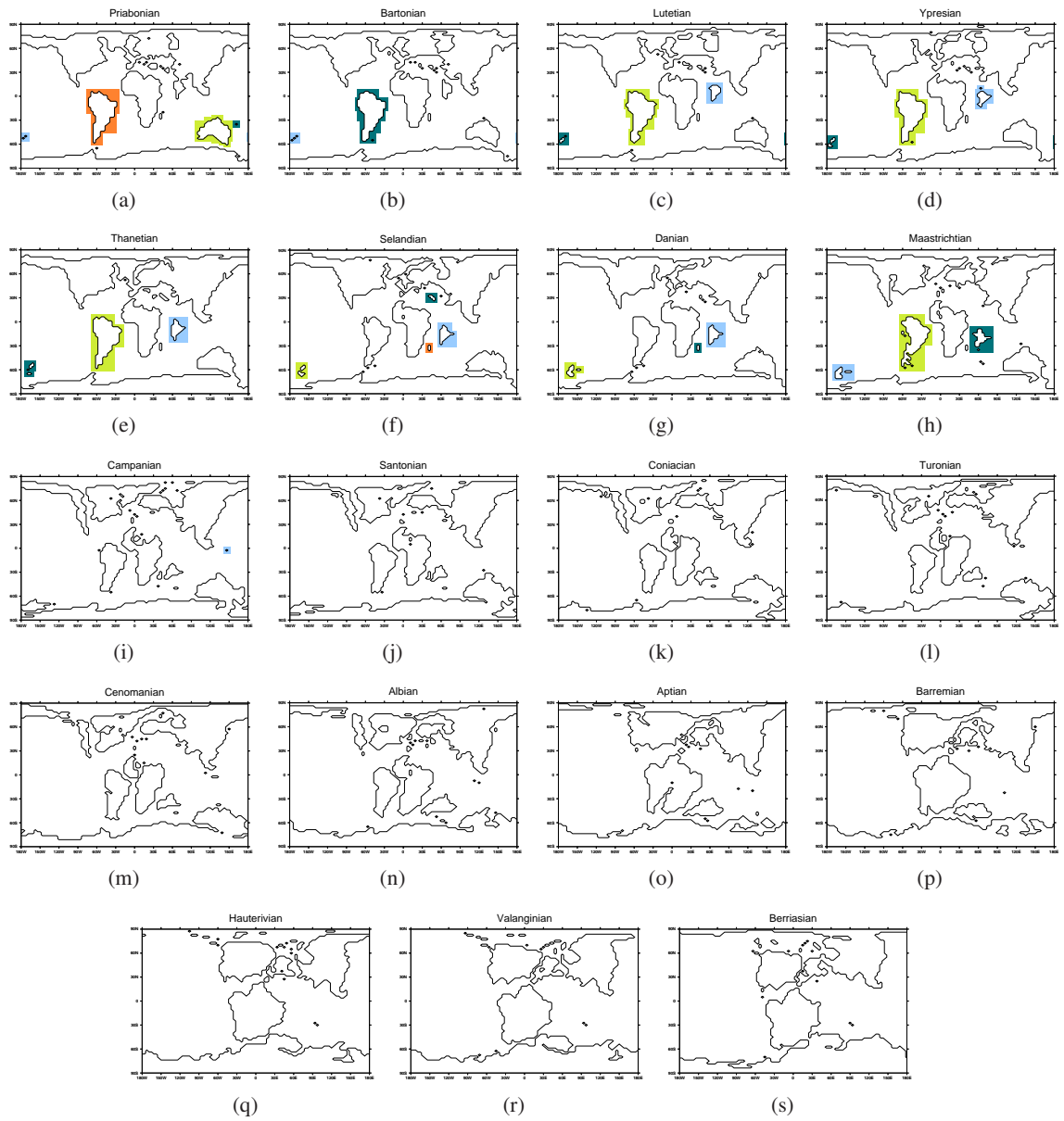


Figure S4: (a-s) Islands, as defined for the solution of the barotropic stream-function calculation. Each colour encompasses a different island. (a) Priabonian, (b) Bartonian, (c) Lutetian, (d) Ypresian, (e) Thanetian (f) Selandian, (g) Danian, (h) Maastrichtian, (i) Campanian, (j) Santonian, (k) Coniacian, (l) Turonian, (m) Cenomanian, (n) Albian, (o) Aptian, (p) Barremian, (q) Hauterivian, (r) Valanginian, (s) Berriasian.

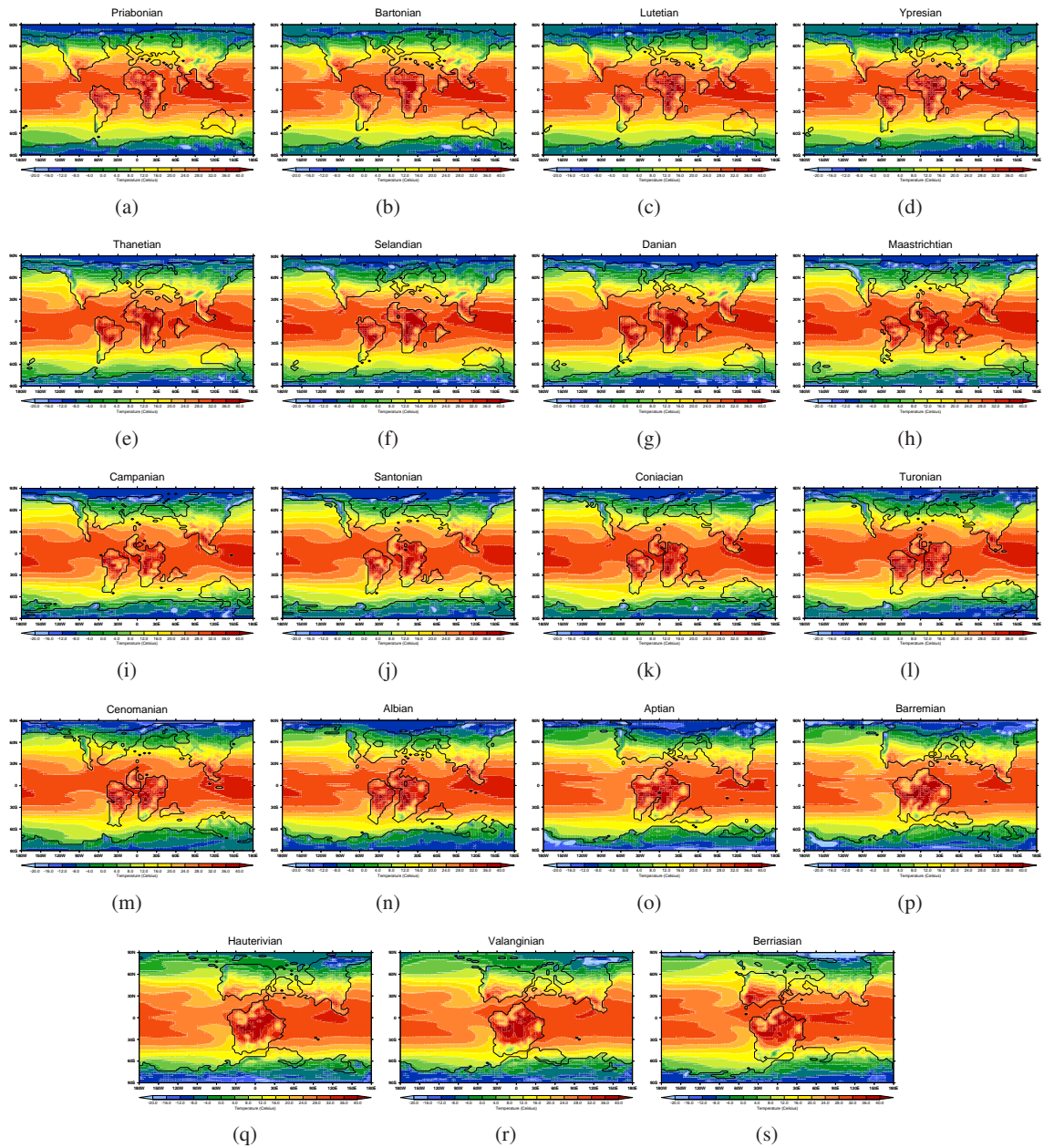


Figure S5: (a-s) Annual mean surface air temperature (at 1.5 m) for each Stage. (a) Priabonian, (b) Bartonian, (c) Lutetian, (d) Ypresian, (e) Thanetian (f) Selandian, (g) Danian, (h) Maastrichtian, (i) Campanian, (j) Santonian, (k) Coniacian, (l) Turonian, (m) Cenomanian, (n) Albian, (o) Aptian, (p) Barremian, (q) Hauterivian, (r) Valanginian, (s) Berriasian.

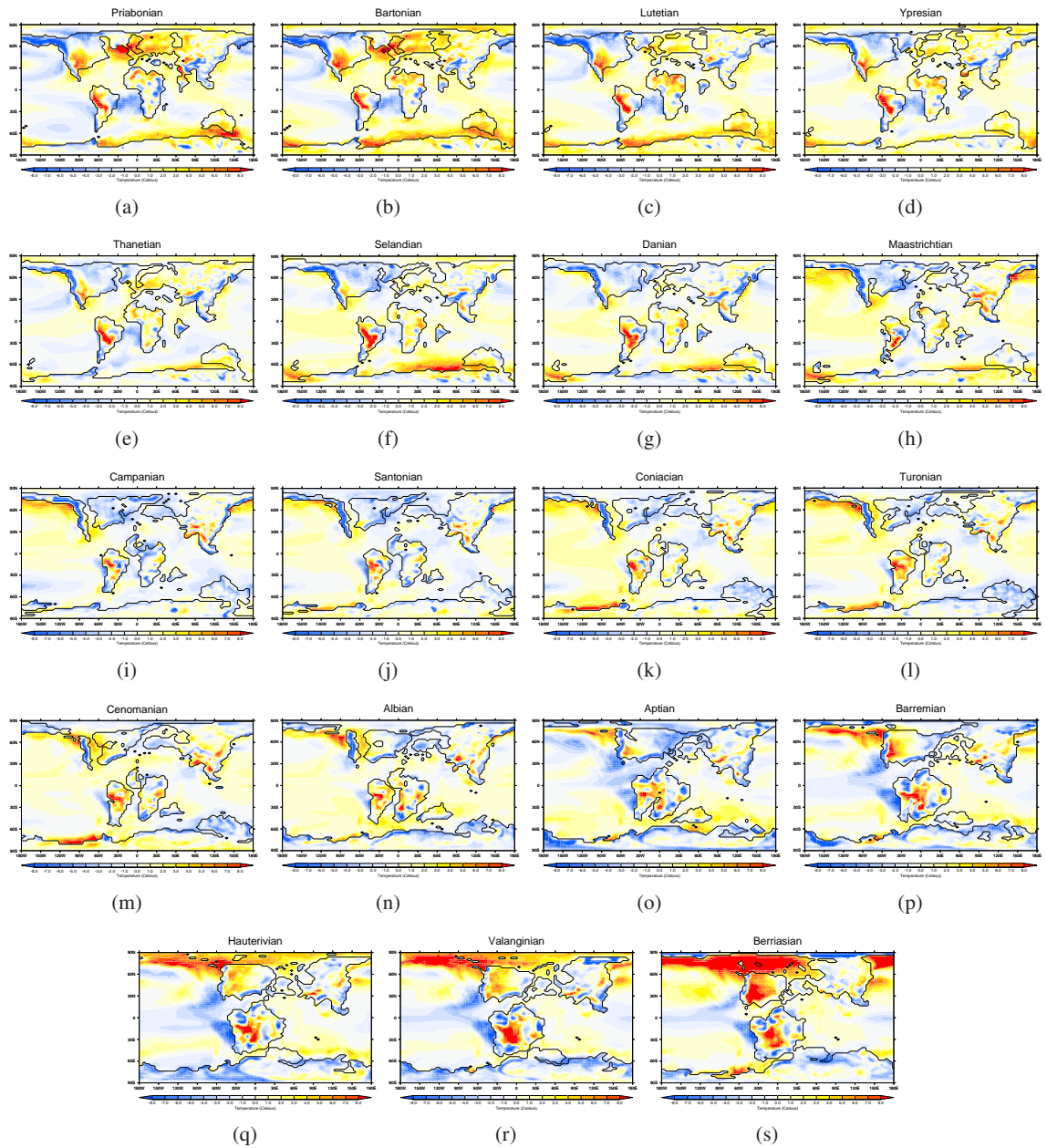


Figure S6: (a-s) Annual mean surface air temperature (at 1.5 m) for each Stage, expressed as an anomaly relative to the mean of all Stages. (a) Priabonian, (b) Bartonian, (c) Lutetian, (d) Ypresian, (e) Thanetian (f) Selandian, (g) Danian, (h) Maastrichtian, (i) Campanian, (j) Santonian, (k) Coniacian, (l) Turonian, (m) Cenomanian, (n) Albian, (o) Aptian, (p) Barremian, (q) Hauterivian, (r) Valanginian, (s) Berriasian.

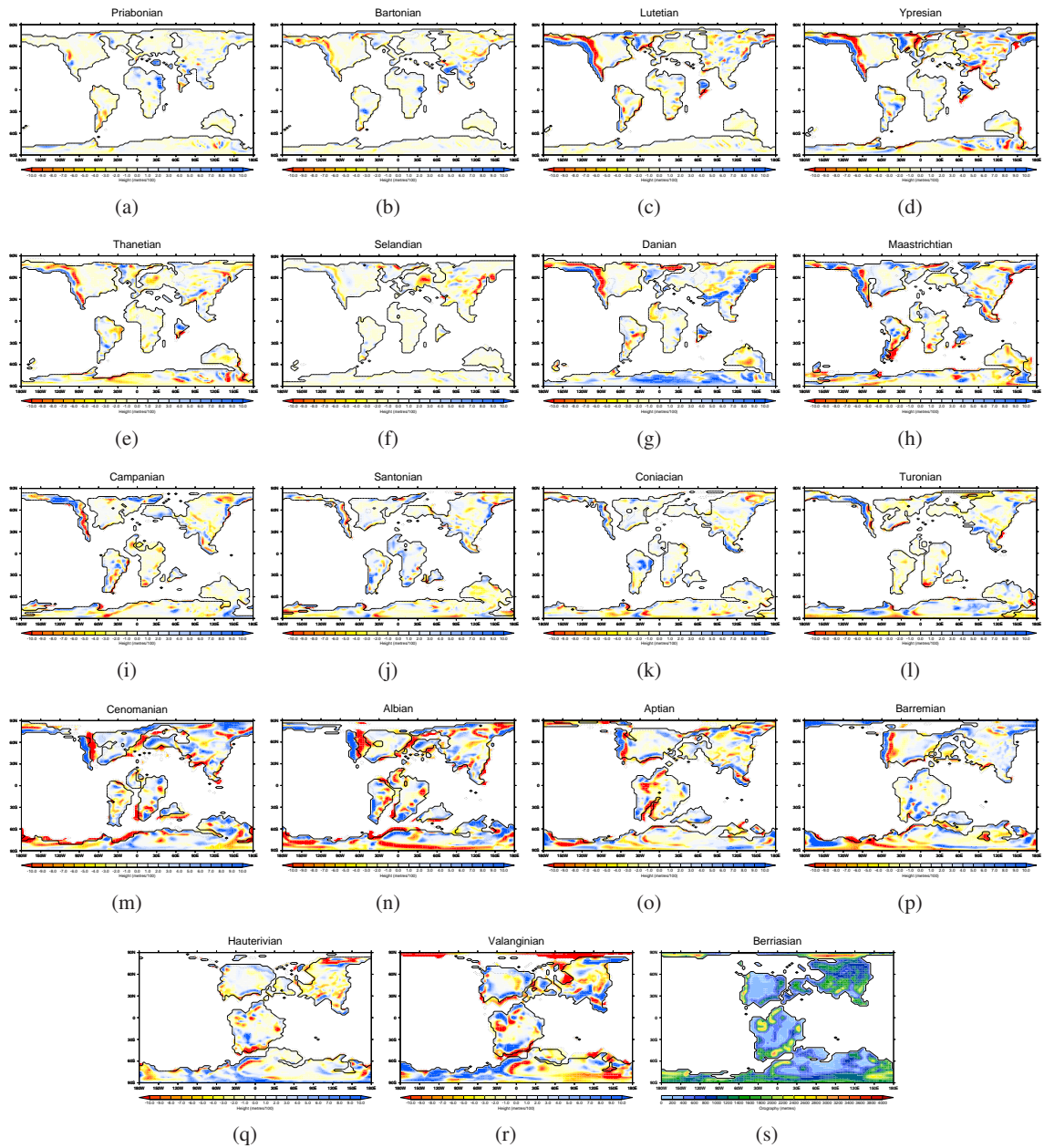


Figure S7: (a-r) Orography for each Stage, expressed as an anomaly relative to the previous Stage. (a) Priabonian–Bartonian, (b) Bartonian–Lutetian, (c) Lutetian–Ypresian, (d) Ypresian–Thanetian (e) Thanetian–Selandian, (f) Selandian–Danian, (g) Danian–Maastrichtian, (h) Maastrichtian–Campanian, (i) Campanian–Santonian, (j) Santonian–Coniacian, (k) Coniacian–Turonian, (l) Turonian–Cenomanian, (m) Cenomanian–Albian, (n) Albian–Aptian, (o) Aptian–Barremian, (p) Barremian–Hauterivian, (q) Hauterivian–Valanginian, (r) Valanginian–Berriasian. (s) Orography for the Berriasian stage.

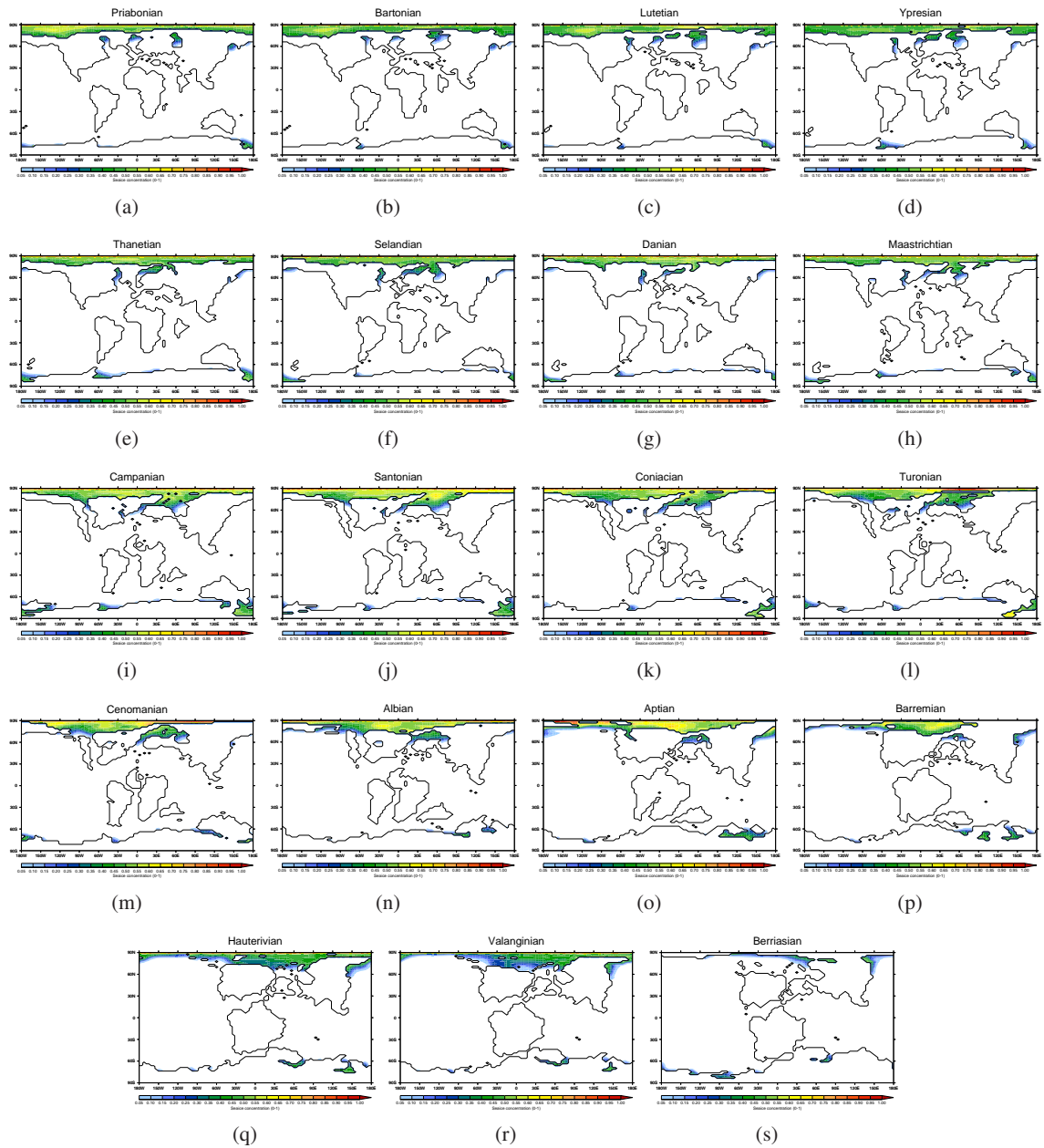


Figure S8: (a-s) Annual mean sea ice concentration for each Stage [0-1]. (a) Priabonian, (b) Bartonian, (c) Lutetian, (d) Ypresian, (e) Thanetian (f) Selandian, (g) Danian, (h) Maastrichtian, (i) Campanian, (j) Santonian, (k) Coniacian, (l) Turonian, (m) Cenomanian, (n) Albian, (o) Aptian, (p) Barremian, (q) Hauterivian, (r) Valanginian, (s) Berriasian.

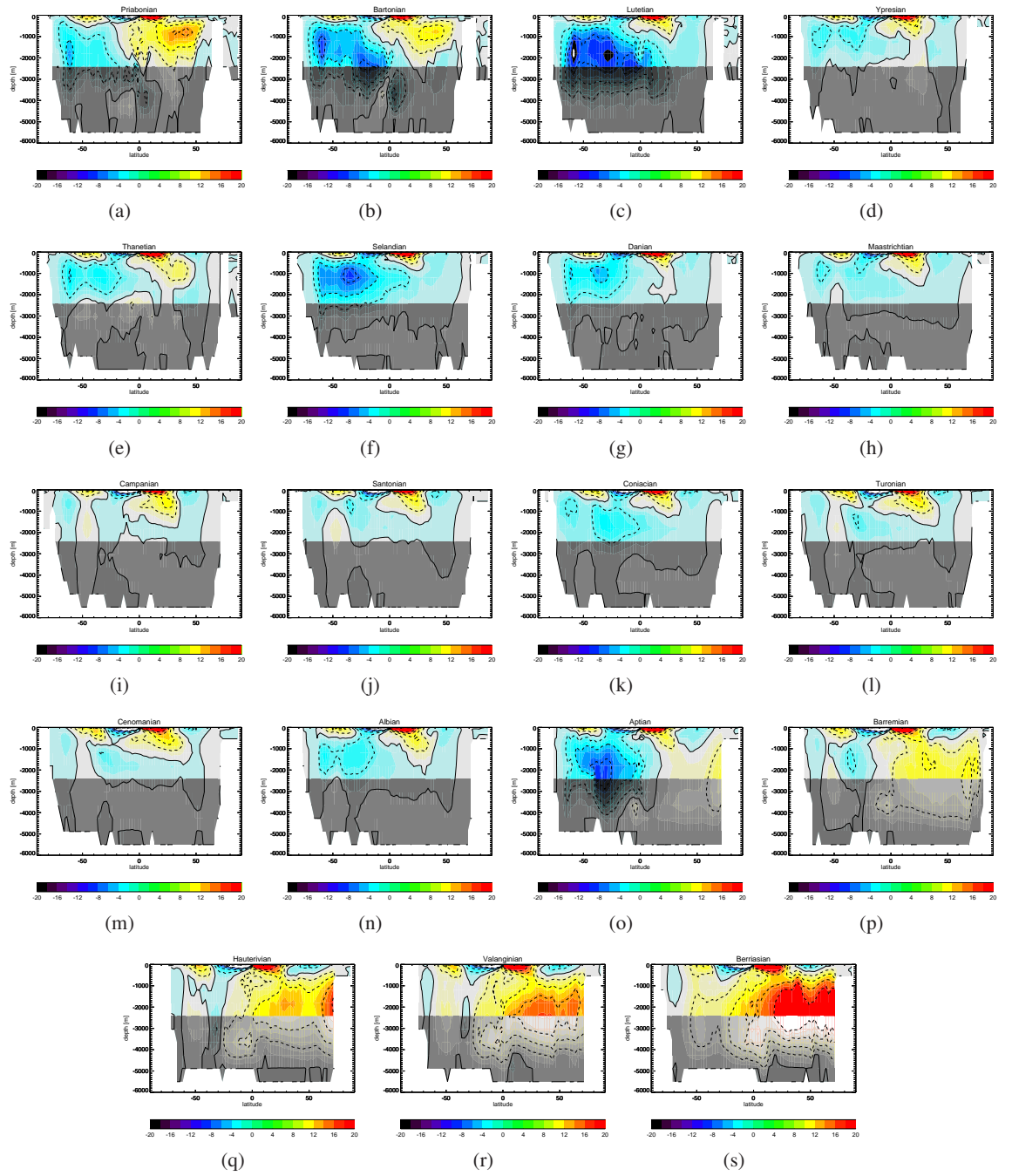


Figure S9: (a-s) Meridional global streamfunction for each Stage, expressed as an anomaly relative to the mean of all Stages. The net global ocean circulation is anticlockwise (viewed from east to west) along the negative contours, and clockwise along the positive contours. (a) Priabonian, (b) Bartonian, (c) Lutetian, (d) Ypresian, (e) Thanetian (f) Selandian, (g) Danian, (h) Maastrichtian, (i) Campanian, (j) Santonian, (k) Coniacian, (l) Turonian, (m) Cenomanian, (n) Albian, (o) Aptian, (p) Barremian, (q) Hauterivian, (r) Valanginian, (s) Berriasian. The greyscale used for depths below 2000 m is used to indicate that the model is not spun up at these depths.

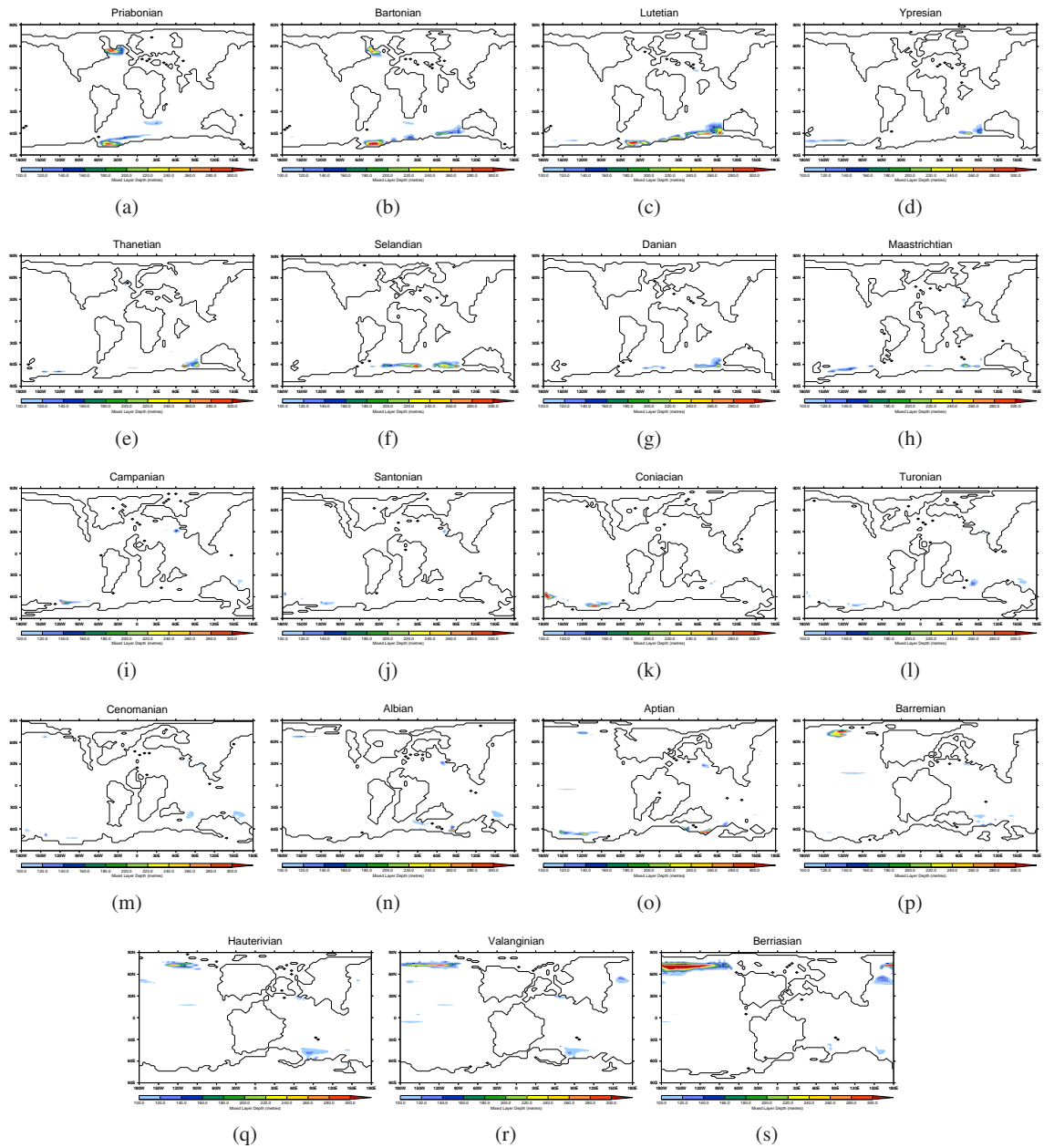


Figure S10: (a-s) Annual mean Mixed layer depth for each Stage [m]. (a) Priabonian, (b) Bartonian, (c) Lutetian, (d) Ypresian, (e) Thanetian (f) Selandian, (g) Danian, (h) Maastrichtian, (i) Campanian, (j) Santonian, (k) Coniacian, (l) Turonian, (m) Cenomanian, (n) Albian, (o) Aptian, (p) Barremian, (q) Hauterivian, (r) Valanginian, (s) Berriasian.

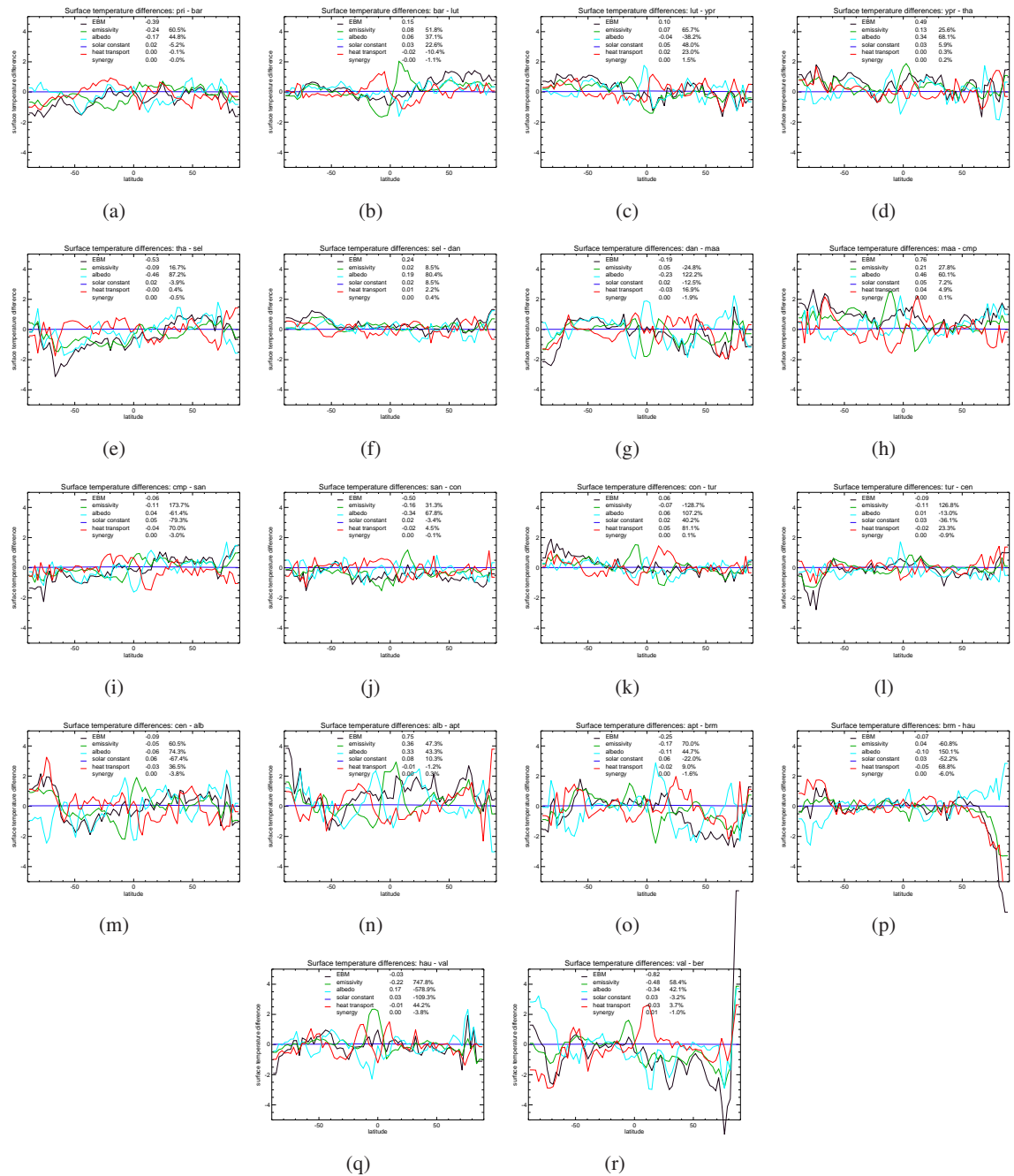


Figure S11: Energy balance analysis for the transitions between consecutive Stages. Black line shows the surface temperature change, green line the component of this that is due to emissivity change, cyan due to albedo change, blue due to solar constant change, and red due to heat transport change. The global mean values for each component are given in the key in degrees C and as a percentage of the total change. (a) Priabonian–Bartonian, (b) Bartonian–Lutetian, (c) Lutetian–Ypresian, (d) Ypresian–Thanetian (e) Thanetian–Selandian, (f) Selandian–Danian, (g) Danian–Maastrichtian, (h) Maastrichtian–Campanian, (i) Campanian–Santonian, (j) Santonian–Coniacian, (k) Coniacian–Turonian, (l) Turonian–Cenomanian, (m) Cenomanian–Albian, (n) Albian–Aptian, (o) Aptian–Barremian, (p) Barremian–Hauterivian, (q) Hauterivian–Valanginian, (r) Valanginian–Berriasian.

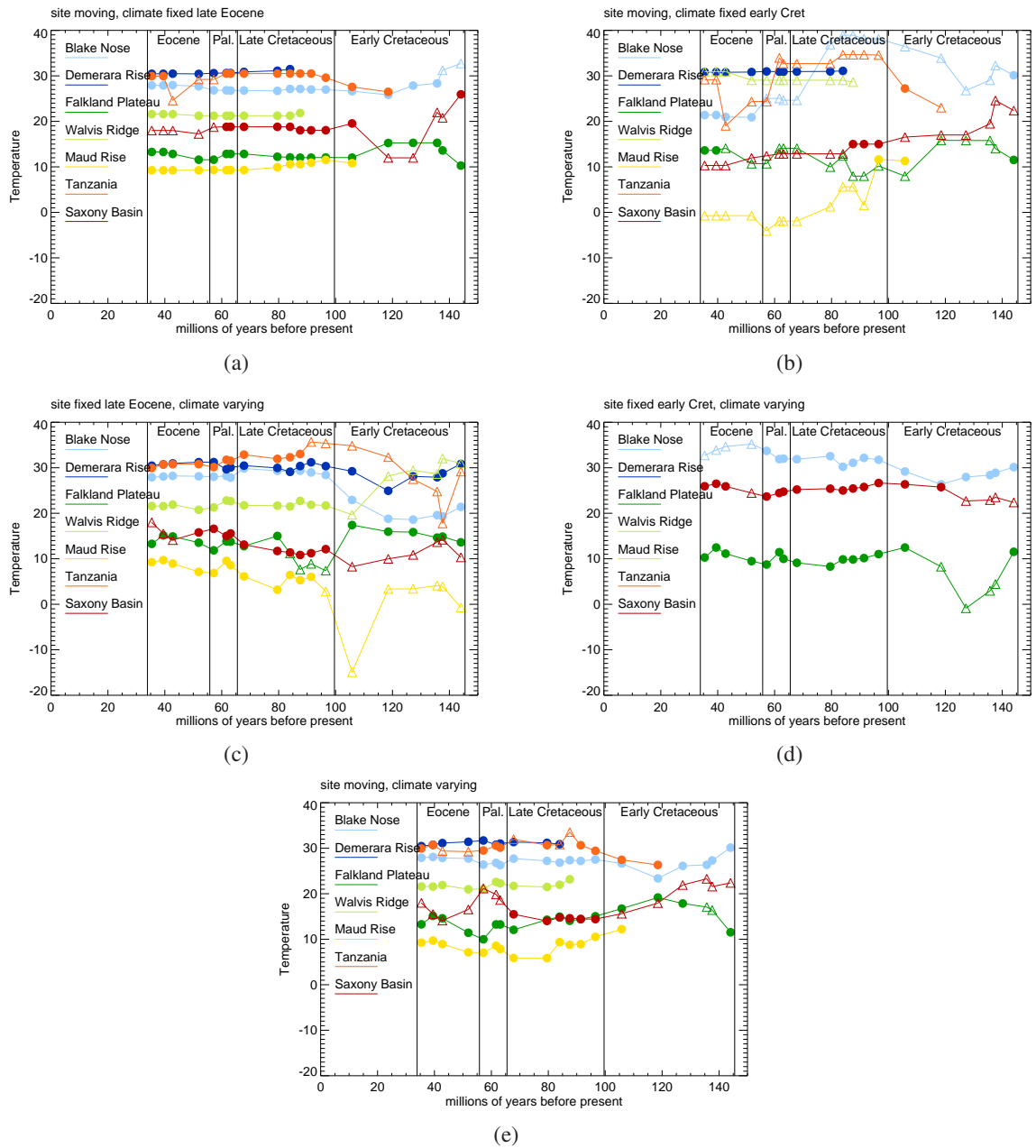


Figure S12: Climate evolution across the CPE, simulated by the model, as experienced at the 7 sites in Figure 9(a) in the main paper. (a) assumes that the climate stays constant at that of the late Eocene and that the sites move. (b) assumes that the climate stays constant at that of the early Cretaceous and that the sites move. (c) assumes that the climate varies and that the sites stay fixed at their location in the late Eocene. (d) assumes that the climate varies and that the sites stay fixed at their location in the early Cretaceous. (e) assumes that the climate varies and that the sites move, and is identical to Figure 9(b) in the main paper, apart from the change in scale of the y -axis.