Supplementary Material

Impacts of Cenozoic global cooling, surface uplift and an inland seaway on South American Paleoclimate and Precipitation $\delta^{18}O$

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These supplementary figures provide additional information in support of the key findings of the main paper. Figure DR1 presents the results of additional, similar simulations with different boundary conditions. Figures DR2 to DR5 present the austral summer, austral winter, and mean annual climatology and $\delta^{18}O_{prec}$ results from the main experiments discussed in the paper. These additional results are intended to supplement the key results in the main text and are relevant for regions in which DJF is not the dominant rainfall season. The results in shown in figures DR2 to DR5 are from the same simulations as those presented in figures 4 and 5 in the main text and are averaged over 20 years.

Figure DR1: Austral summer $\delta^{18}O_{prec}$ for additional experiments. **a-e)** 20 year average simulated amount-weighted summer $\delta^{18}O_{prec}$ (‰) predicted by GENESIS with a) Half Andes, b) $2xCO_2$, c) Half Andes, $2xCO_2$ d) Half Andes, SW_{marine}, e) No Ice, no Antarctic Ice Sheet and modern $\delta^{18}O_{ocean}$. **f-j)** Summer $\delta^{18}O_{prec}$ difference (simulation minus control) between the sensitivity simulation and the control run (Fig. 1d) for the simulations in (a-e). Note that the contour interval changes at 4‰.

Figure DR2: Mean annual and seasonal difference in precipitation (mm/day)

Simulated differences in precipitation for mean annual (a-d), austral summer (e-h) and austral winter (i-l) between simulation and control (simulation minus control) for **a, e and i)** 4xCO2, **b, f and j)** No Andes, **c, g and k)** Seaway, and **d, h and l)** No Ice. Note that the contour intervals change at 6 mm/day.

Figure DR3: Mean annual and seasonal difference in temperature (°C)

Simulated differences in temperature for mean annual (a-d), austral summer (e-h) and austral winter (i-l) between simulation and control (simulation minus control) for **a, e and i)** 4xCO2, **b, f and j)** No Andes, **c, g and k)** Seaway, and **d, h and l)** No Ice. Note that the contour intervals change at 10°C.

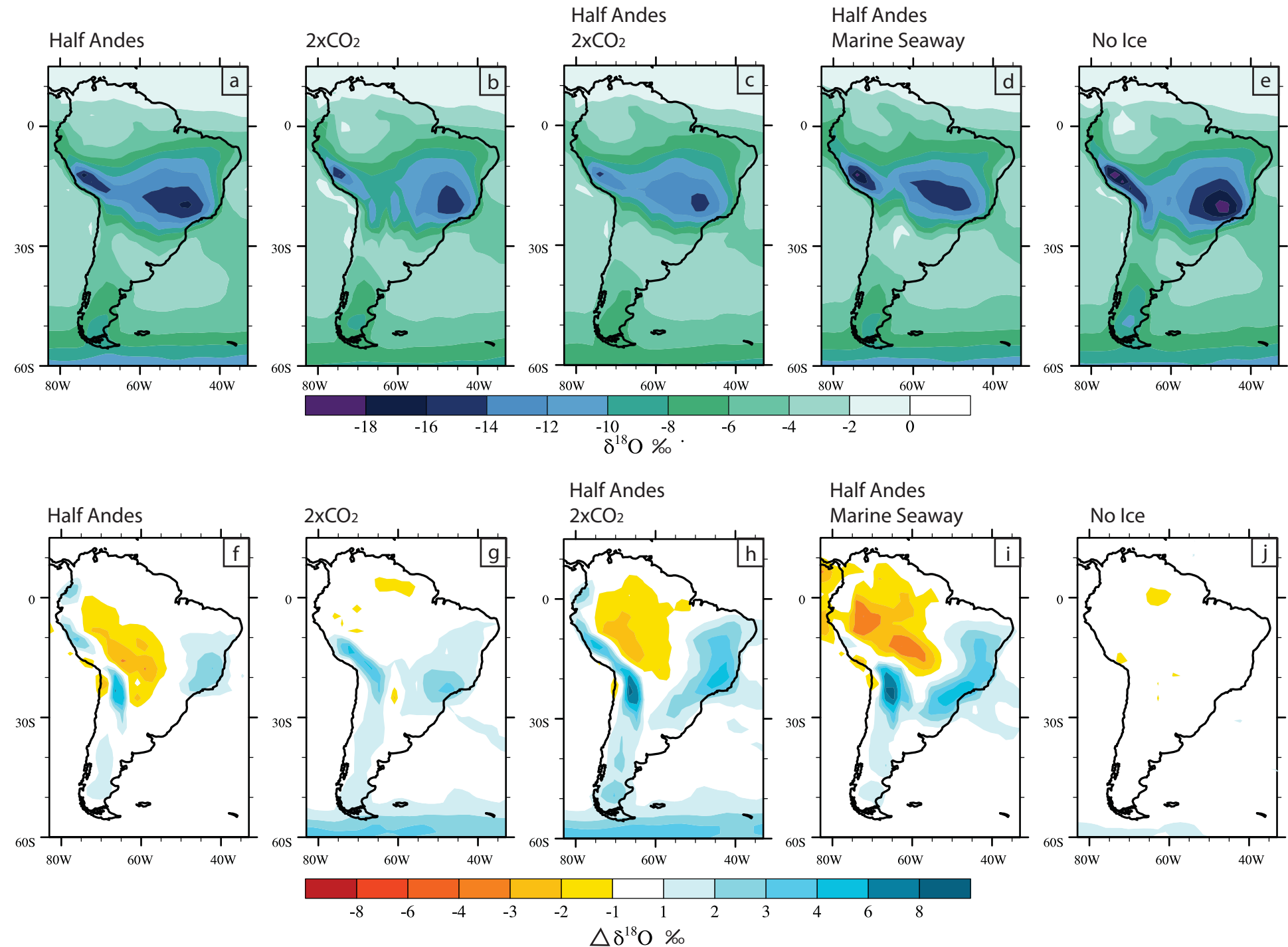
Figure DR4: Mean annual and seasonal $\delta^{18}O_{prec}$

Simulated $\delta^{18}O_{prec}$ for mean annual (a-f), austral summer (g-l) and austral winter (m-r). **a, g and m)** control simulation**, b, h and n)** 4xCO2, **c, i and o)** No Andes, **d, j and p)** Seaway with a marine isotopic composition, **e, k and q)** Seaway with a freshwater isotopic composition and **f, l and r)** No Ice.

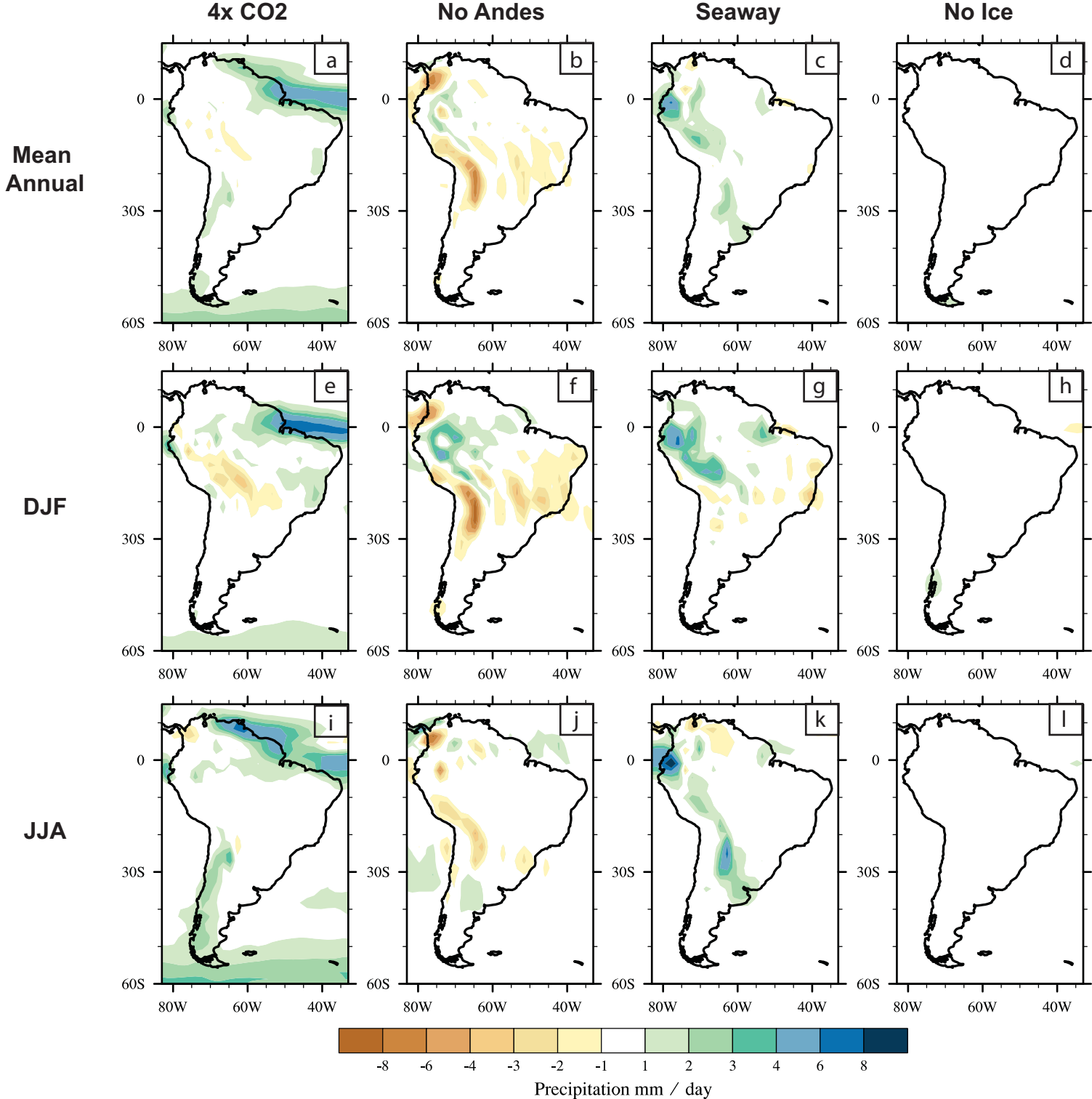
Figure DR5: Mean annual and seasonal difference in $\delta^{18}O_{prec}$

Simulated difference in $\delta^{18}O_{prec}$ for mean annual (a-f), austral summer (g-l) and austral winter (m-r). Differences in $\delta^{18}O_{prec}$ between simulation and control (simulation minus control) for **a, f and k)** 4xCO2, **b, g and l)** No Andes, **c, h and m)** Seaway with a marine isotopic composition, **d, i and n)** Seaway with a freshwater isotopic composition, and **e, j and o)** No Ice.

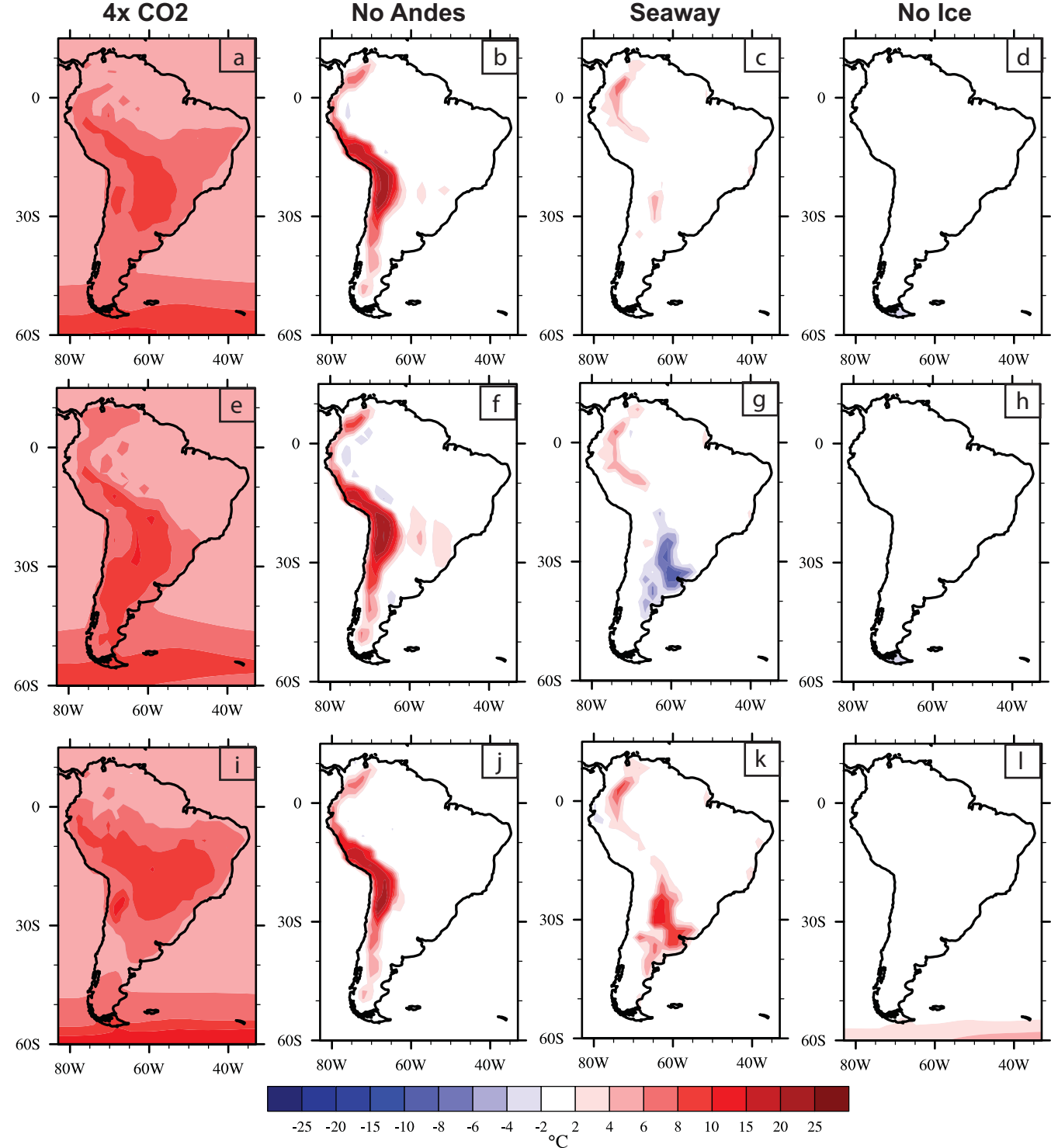
Supplementary
Figure DR1



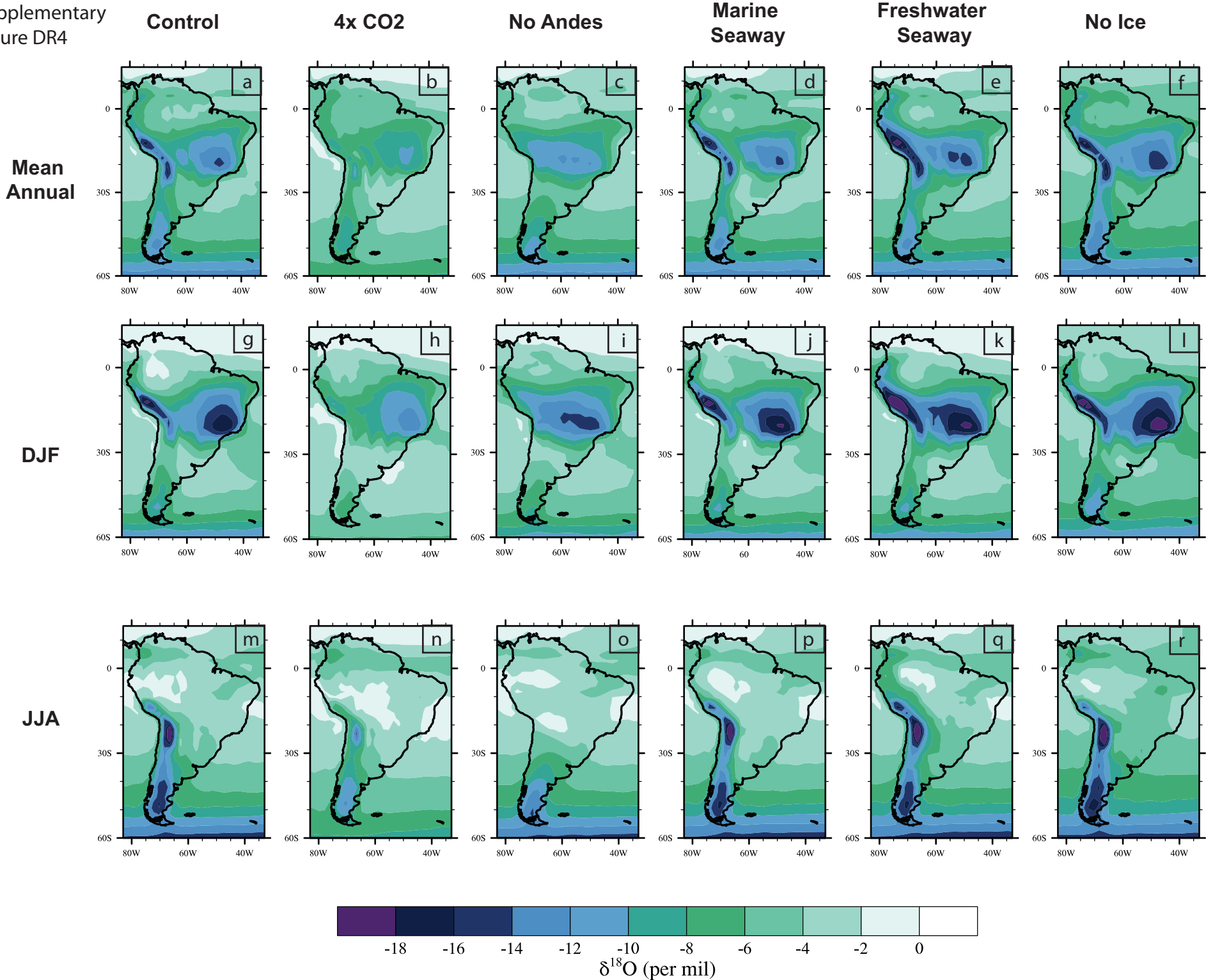
Supplementary
Figure DR2



Supplementary
Figure DR3



Supplementary Figure DR4



Supplementary
Figure DR5