**Supplementary Material for**

# Pacific Oceanic Front Amplifies the Impact of Atlantic Oceanic Front on North Atlantic Blocking

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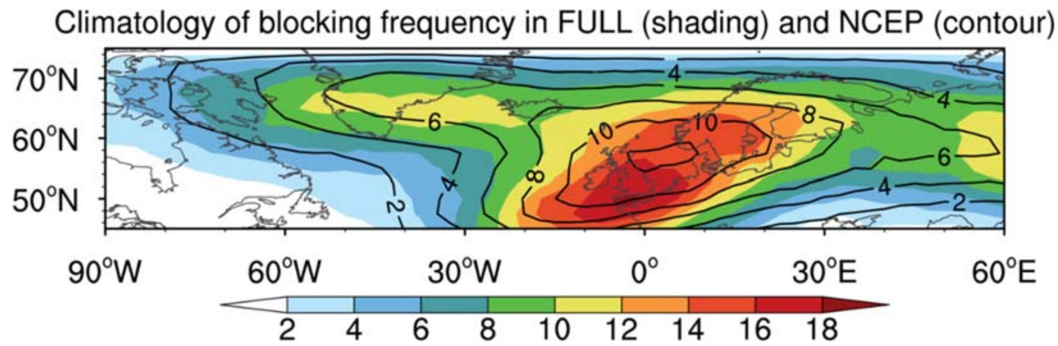
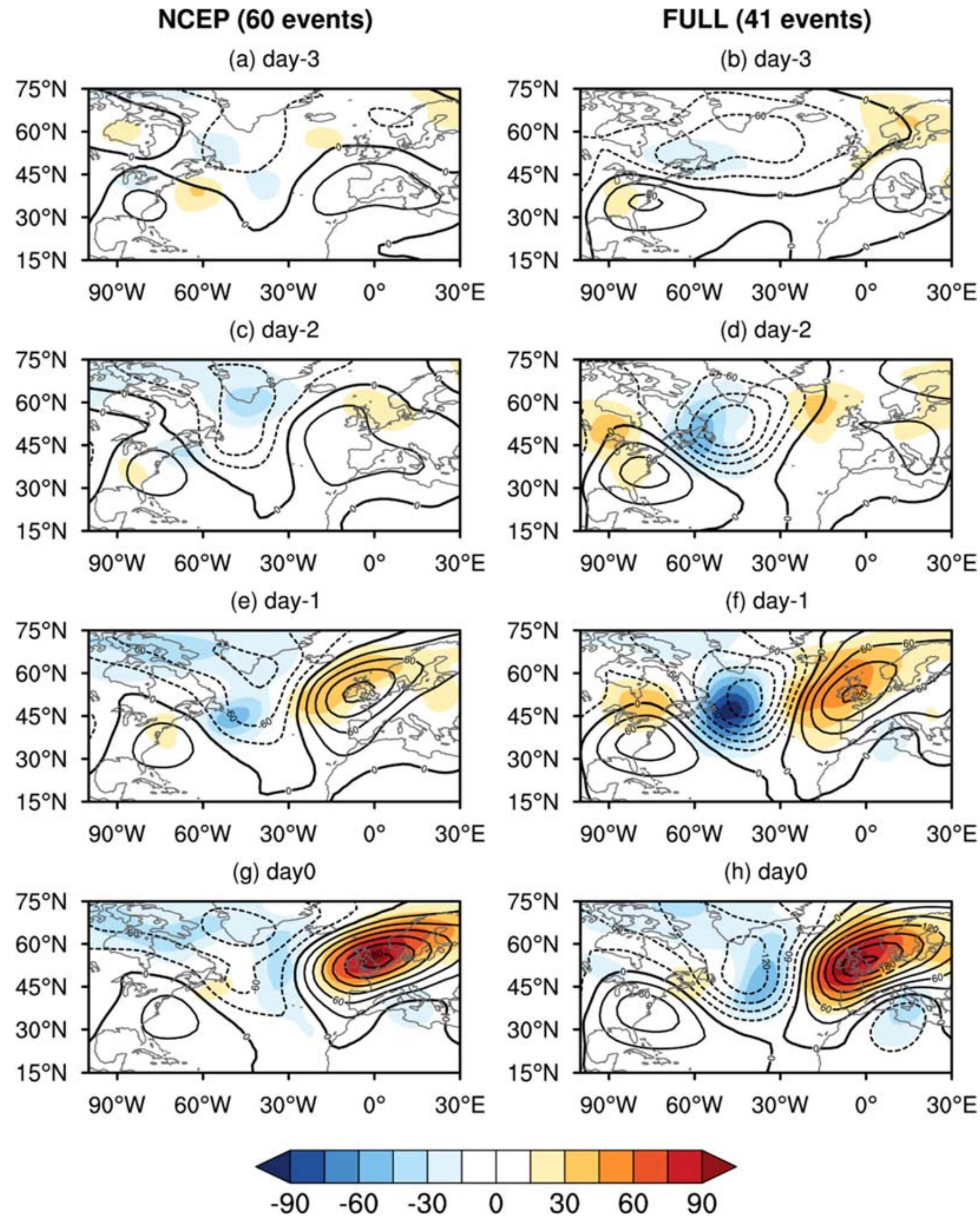
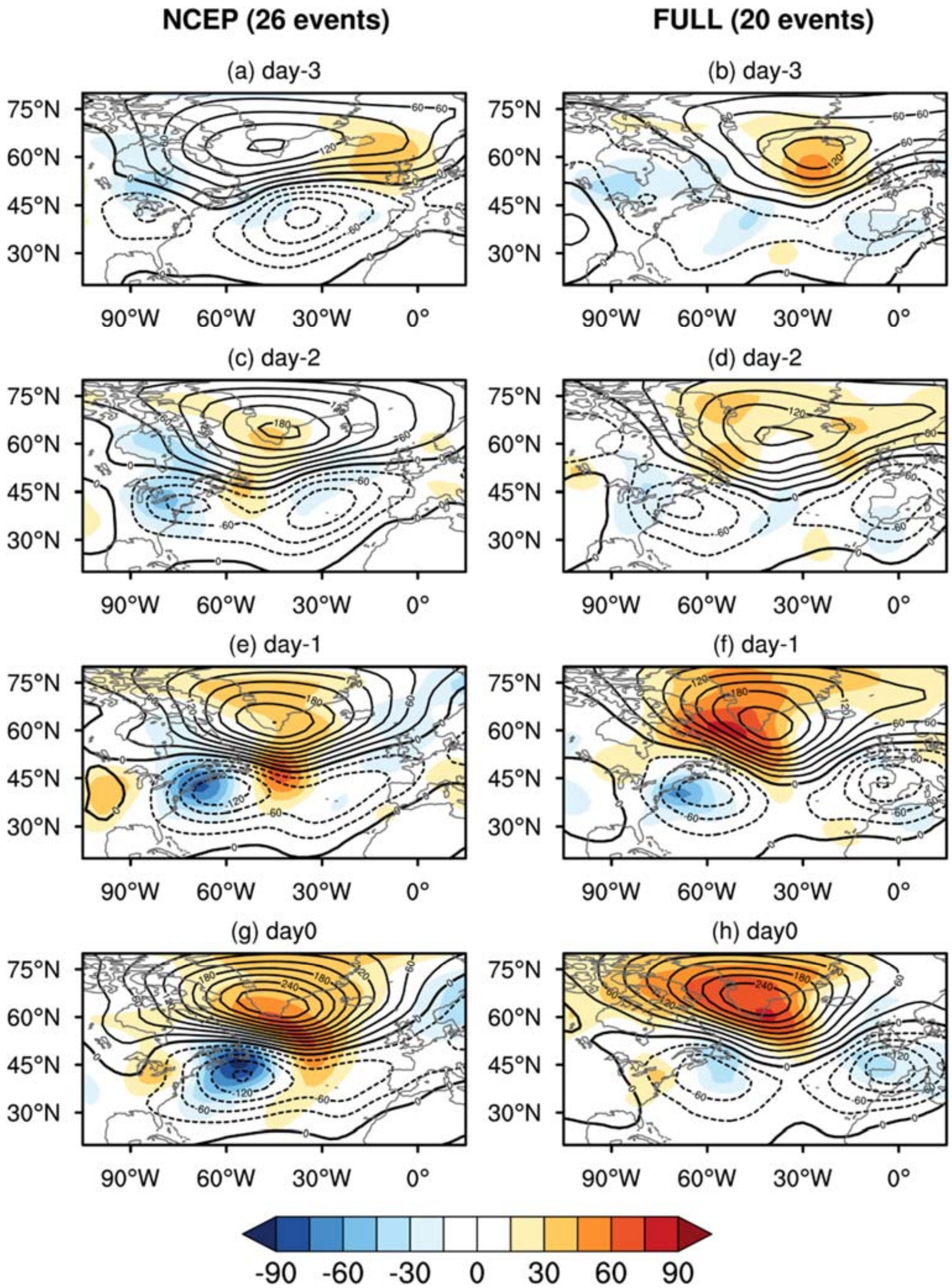
## Contents



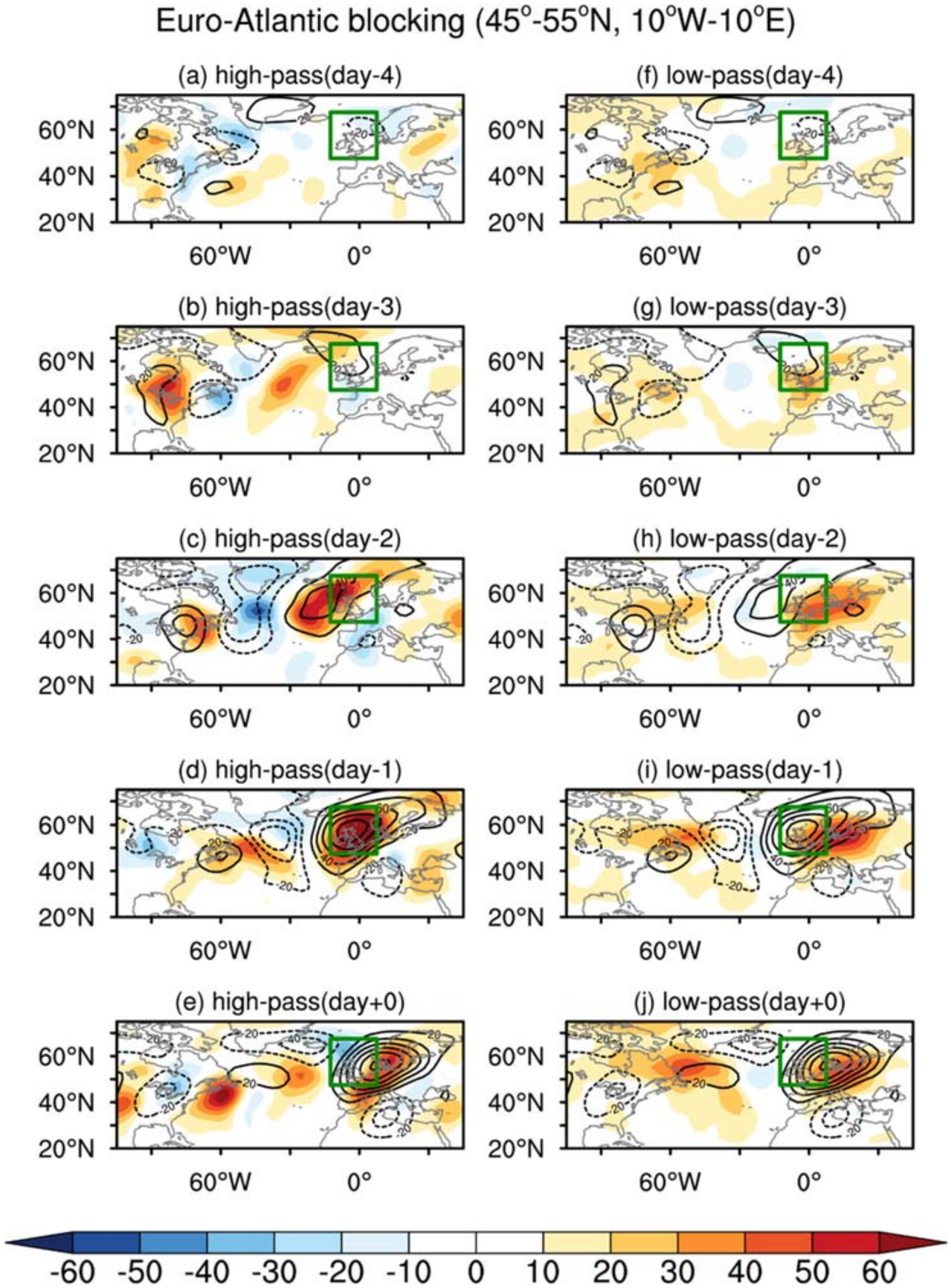

**Supplementary Figure. 1. Ability of the MAECHAM5 atmospheric model to simulate the winter climatology of blocking frequency.** Comparison of the climatology of winter (December-January-February; DJF) blocking frequency in the FULL run (prescribing realistic SST in the Northern Hemisphere and tropics; shading) and in the NCEP/NCAR reanalysis datasets (contours). Unit: %.



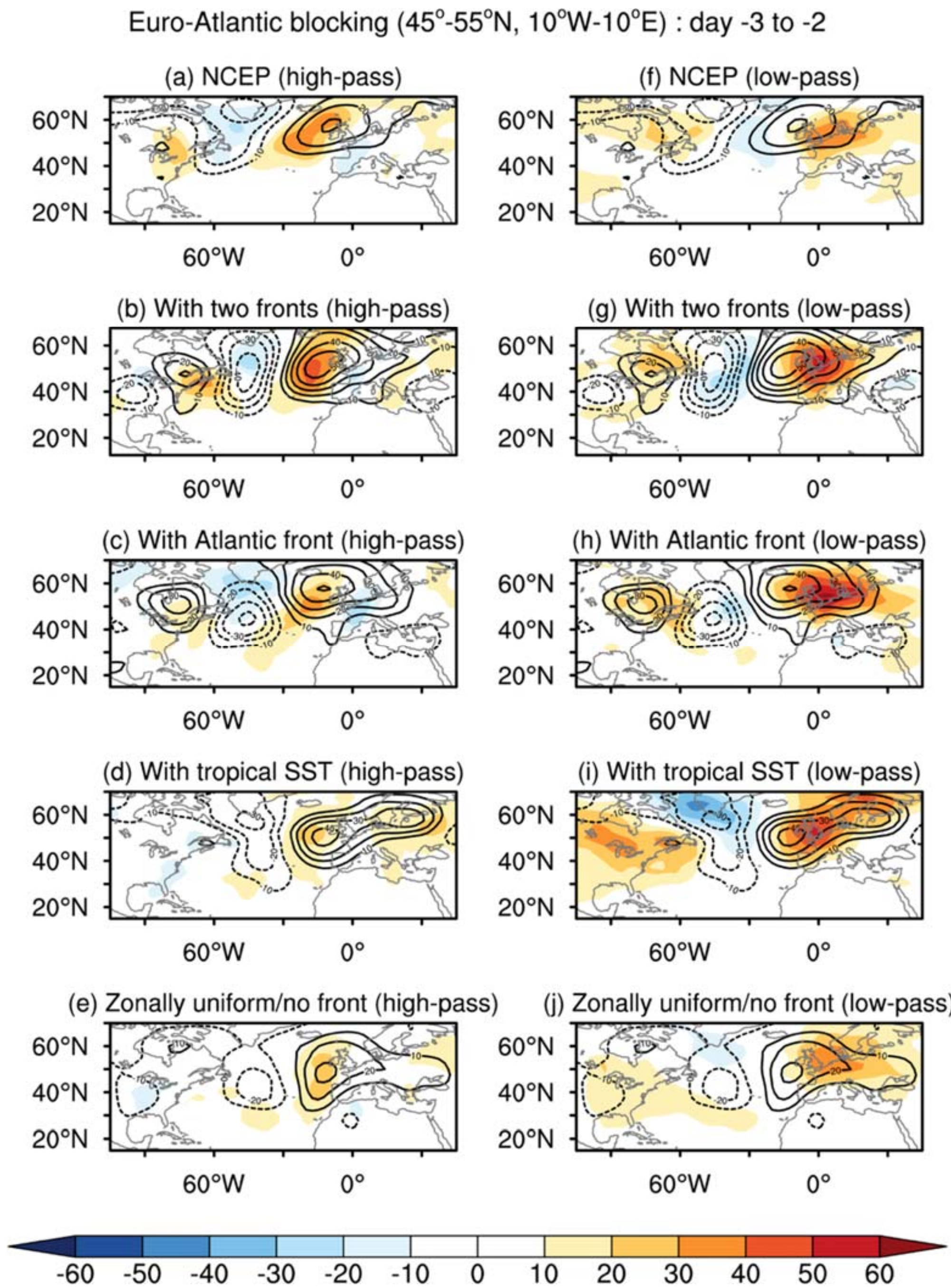

**Supplementary Figure. 2. Ability of the MAECHAM5 atmospheric model to simulate the development of Euro-Atlantic blocking.** Comparison of the 500-hPa geopotential height anomaly (contour interval: 30 *m*) and tendency (shading: *m*) during day−4 to day+0 of Euro-Atlantic blocking (45°–55°N and 10°W–10°E) between (left panel) the NCEP/NCAR reanalysis datasets and (right panel) the FULL run: (a)–(b) day−3, (c)–(d) day−2, (e)–(f) day−1, (g)–(h) day+0, where day+0 is the onset of blocking.



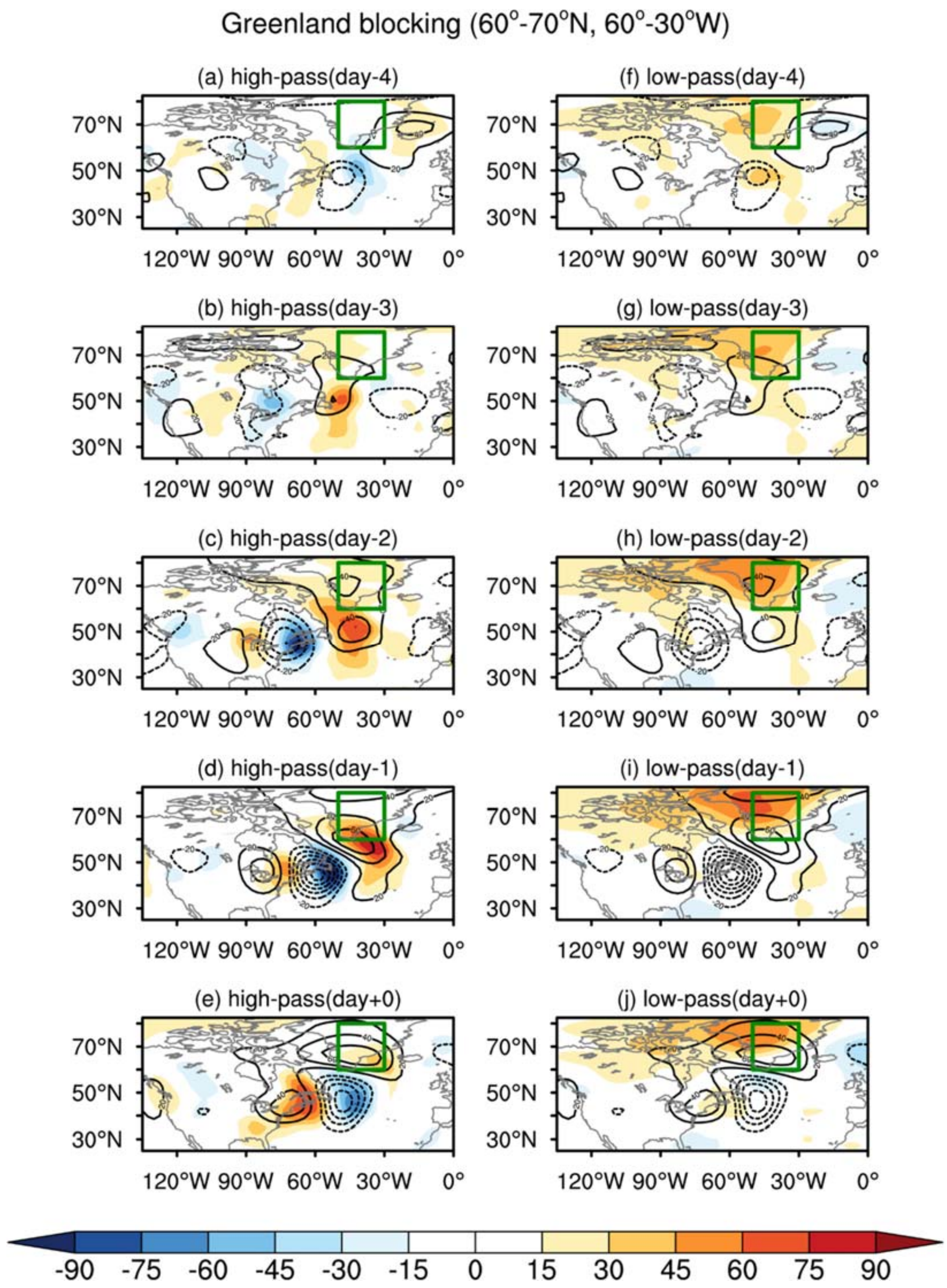

**Supplementary Figure. 3. Ability of the MAECHAM5 atmospheric model to simulate the development of Greenland blocking.** Comparison of the 500-hPa geopotential height anomaly (contour interval: 30 *m*) and tendency (shading: *m*) during day−4 to day+0 of Greenland blocking (60°–70°N and 60°–30°W) between (left panel) the NCEP/NCAR reanalysis and (right panel) the FULL run: (a)–(b) day−3, (c)–(d) day−2, (e)–(f) day−1, (g)–(h) day+0, where day+0 is the onset of blocking.



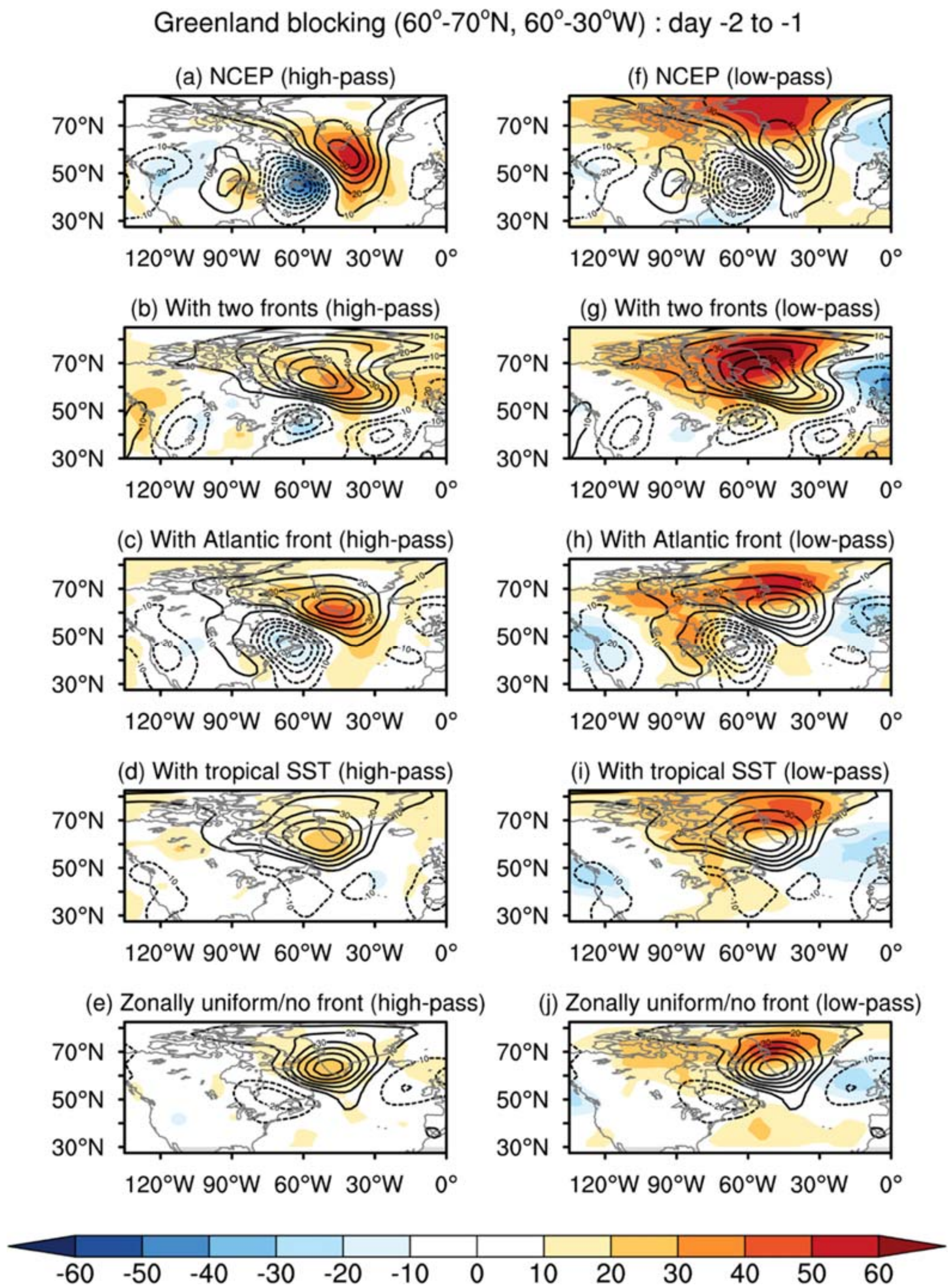

**Supplementary Figure. 4. Development of Euro-Atlantic blocking in the reanalysis.** The daily composites of the 500-hPa geopotential height tendency (contours) and its contribution from the (a)–(e) high-frequency and (f)–(j) low-frequency component (shading) of the vorticity flux convergence from day−4 to day+0 of the Euro-Atlantic blocking events in the NCEP/NCAR reanalysis. Unit: *m* day$^{-1}$.



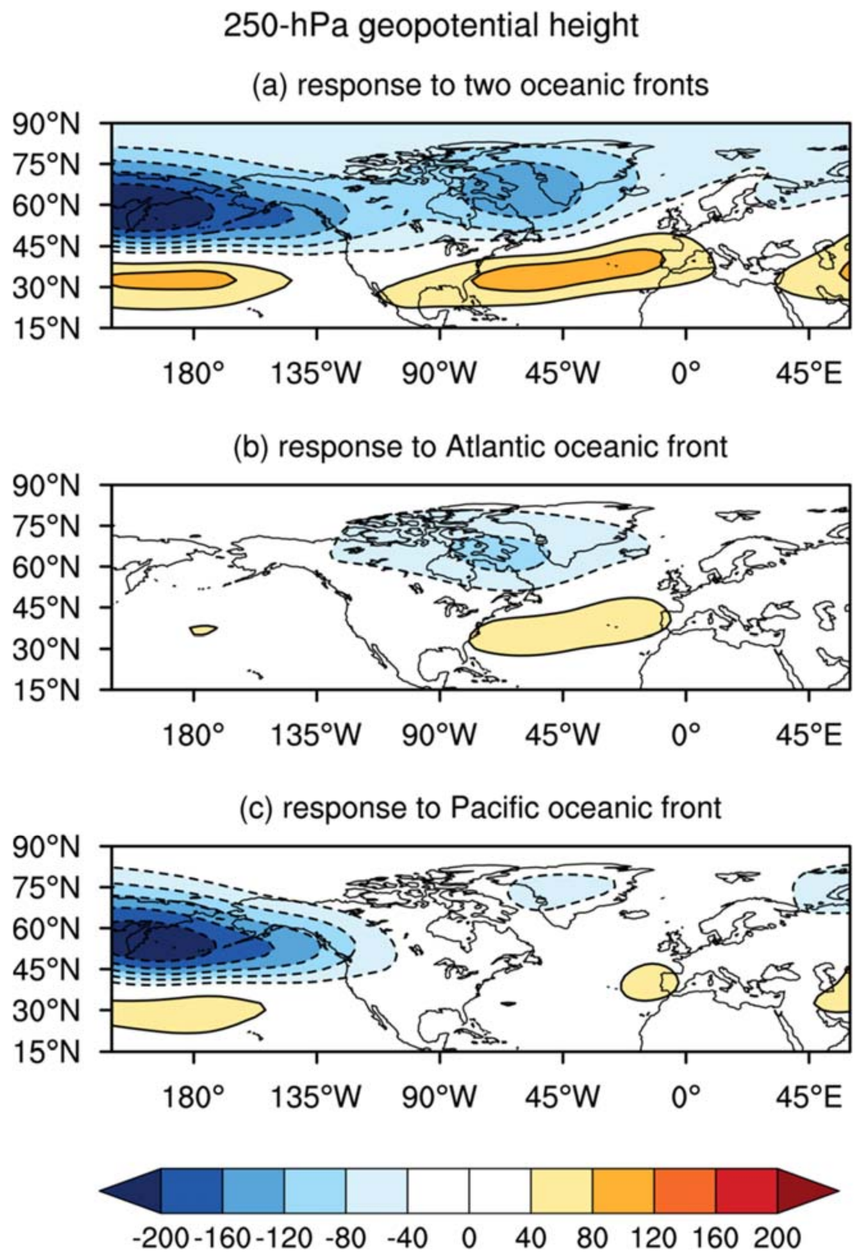

**Supplementary Figure. 5. Major dynamic processes involved in the development of Euro-Atlantic blocking in the reanalysis and different semi-idealised experiments.** 500-hPa geopotential height tendency (contour interval: 30 *m*) and its contribution from (a)–(e) high-frequency dynamics and (f)–(j) low-frequency dynamics (shading: *m*) during day−3 to day−2 of Euro-Atlantic blocking (45°–55°N and 10°W–10°E) in (a),(f) the NCEP/NCAR reanalysis, (b),(g) Atlantic and Pacific oceanic fronts (EXT_ALL run), (c),(h) Atlantic oceanic front (EXT_ATL run), (d),(i) tropical SST (TROP_ALL run), and (e),(j) zonally uniform tropical SST/no fronts (ZUNF run).



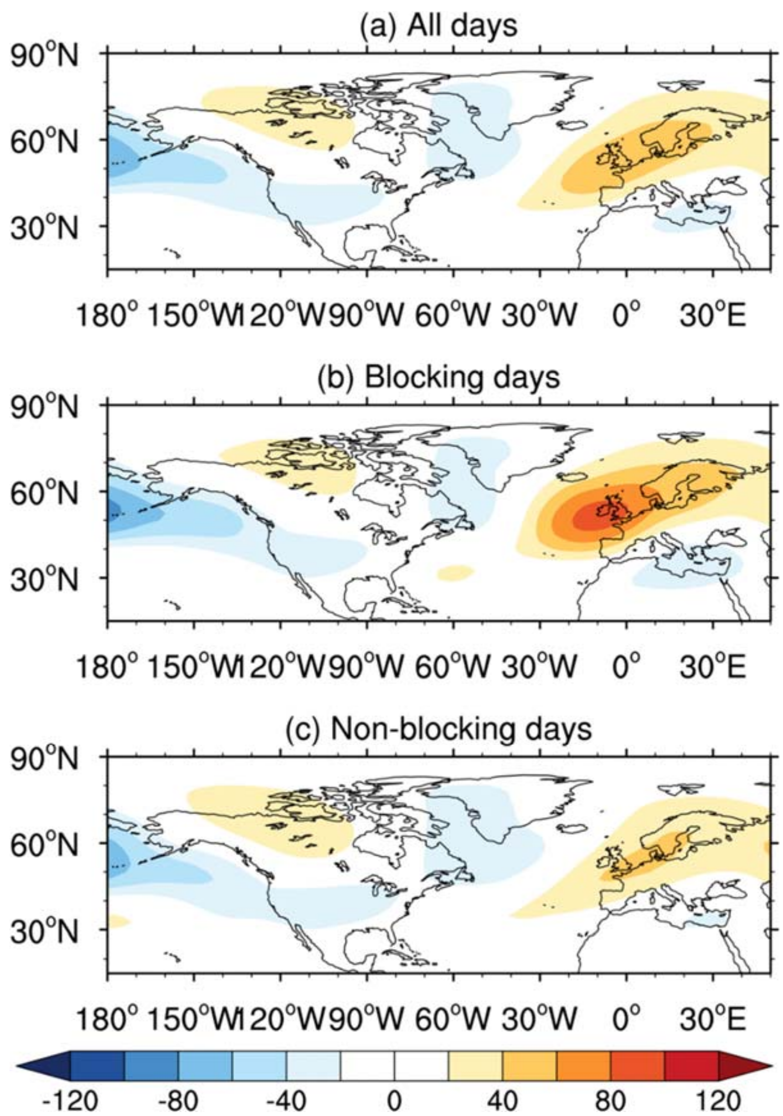

**Supplementary Figure. 6. Development of Euro-Atlantic blocking in the reanalysis.** The daily composites of the 500-hPa geopotential height tendency (contours) and its contribution from the (a)–(e) high-frequency and (f)–(j) low-frequency component (shading) of the vorticity flux convergence from day−4 to day+0 of the Greenland blocking events in NCEP/NCAR reanalysis. Unit: *m* day$^{-1}$.



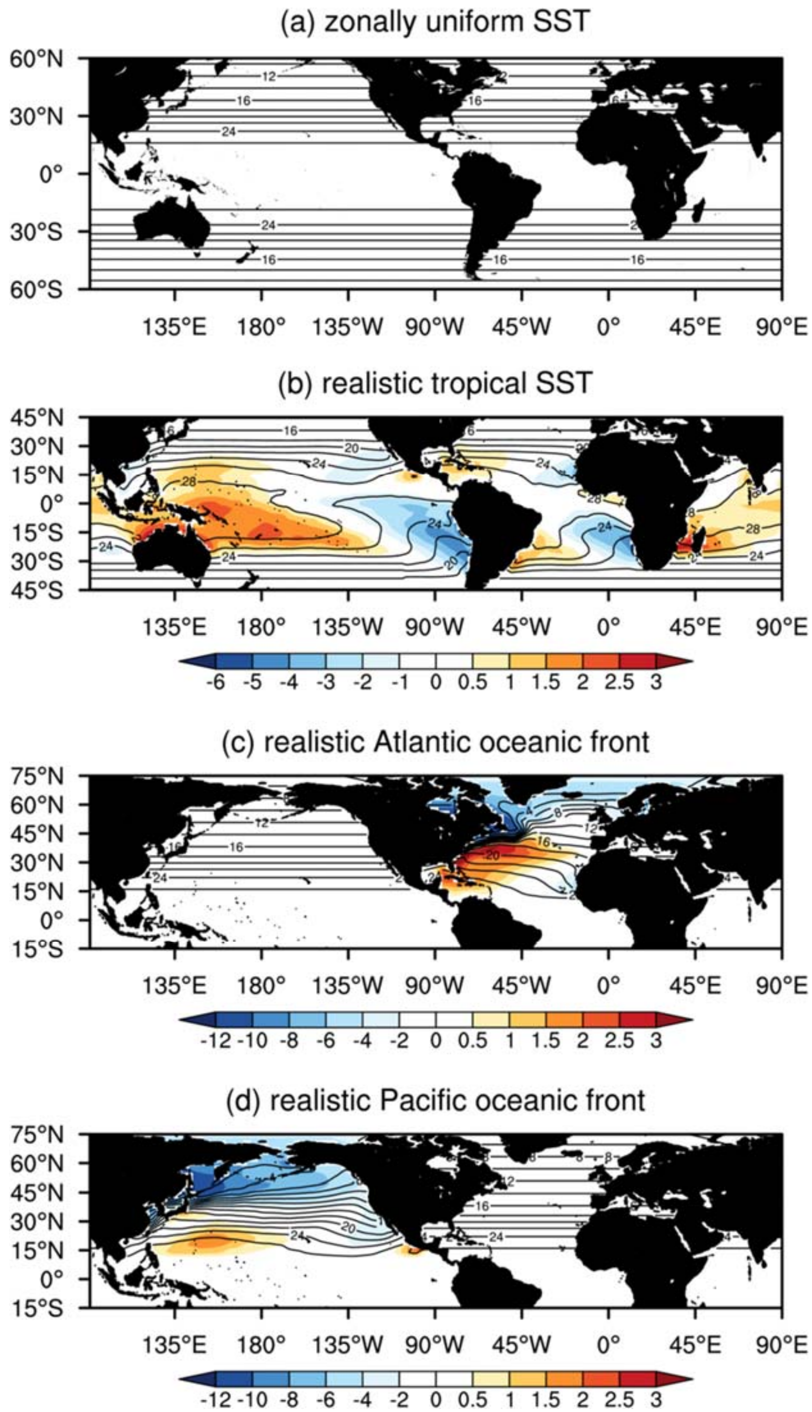

**Supplementary Figure. 7. Major dynamic processes involved in the development of Greenland blocking in the reanlaysis and different semi-idealised experiments.** 500-hPa geopotential height tendency (contour interval: 30 *m*) and its contribution from (a)–(e) high-frequency dynamics and (f)–(j) low-frequency dynamics (shading: *m*) during day−3 to day−2 of Greenland blocking (60°–70°N and 60°–30°W) in (a),(f) the NCEP/NCAR reanalysis, (b),(g) Atlantic and Pacific oceanic fronts (EXT_ALL run), (c),(h) Atlantic oceanic front (EXT_ATL run), (d),(i) tropical SST (TROP_ALL run), and (e),(j) zonally uniform tropical SST/no fronts (ZUNF run).




**Supplementary Figure. 8. Impacts of the oceanic fronts on the mean state**. The response of 250-hPa geopotential height to (a) Atlantic and Pacific oceanic fronts (EXT_ALL run), (b) Atlantic oceanic front (EXT_ATL run), (c) Pacific oceanic front (EXT_PAC run). Unit: m.




**Supplementary Figure. 9. Impacts of the oceanic fronts on the stationary planetary-scale wave during blocking and non-blocking days.** Response of the eddy-geopotential height to the co-existence of Atlantic and Pacific mid-latitude oceanic fronts (EXT_ALL run): (a) all DJF days, (b) blocking days, and (c) non-blocking days. Here blocking days refer to day−7 to day+7 of blocking events occurring within 45°–65°N and 30W°–30°E.




**Supplementary Figure. 10. SST boundary conditions.** DJF-averaged SST boundary condition (contour interval: 2°C) in (a) the ZUNF run (zonally uniform tropical SST, no fronts), (b) the TROP_ALL run (with realistic tropical SST), (c) the EXT_ATL run (with realistic extratropical Atlantic SST, i.e., with an Atlantic oceanic front), and (d) the EXT_PAC run (with realistic extratropical Pacific SST, i.e., with a Pacific oceanic front). In (b)-(d), shading indicates the difference between the sensitivity experiment and the ZUNF run. Unit: °C. Note the uneven color bar intervals.