

The CM2.6 runs are, of course, not fully equilibrated. I don't think that this is an issue, as the NOC-strengthening during AMOC decline is mostly a transient phenomenon, unless the AMOC equilibrates at medium-strength, purely driven by deep convection in the Nordic Seas, while convection in the Labrador/Irminger Seas remains collapsed. What I miss are timeseries of AMOC at say 26 and 45N and a relevant NOC-metric, together with maximum (March) mixed-layer depths from the Nordic Seas convection site. At present there is hardly any information on how CM2.6 reacts on the forcing, apart from one figure (5) showing density changes averaged over the last 20-years of the run. Also, I miss info how long (if at all) the model was spun-up before the two 0-year runs were initialised. To what extent are the NOC-strengthening and AMOC decline still further developing or is there already a plateau in AMOC decline and onset of NOC weakening at the end of the runs?

We thank the reviewer for this thoughtful comment and for carefully reading our manuscript. Accordingly, we have computed AMOC at 26°N and 45°N as well as NOC in the Nordic Seas over the available 20 year output from both CM2.6 simulations:

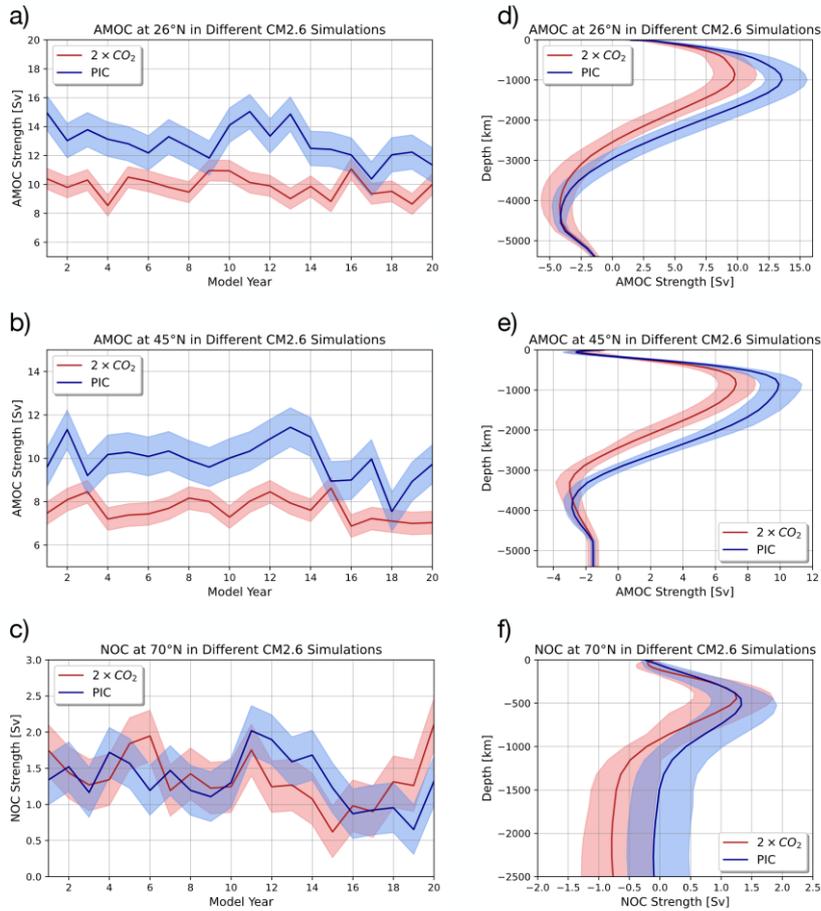
“The AMOC response to elevated CO₂ forcing in CM2.6 is characterized by a significant weakening at both 26°N and 45°N relative to PIC (Fig. C1). Concurrently, the NOC shows no comparable decline. The vertical structure reveals that the weakening at mid-latitudes is primarily associated with a reduction in upper-to mid-depth overturning.”

Furthermore, the manuscript now features, as suggested by the reviewer, an analysis of March mixed layer depth over the study region to illustrate the model's response to elevated atmospheric CO₂ forcing:

“The preindustrial control (PIC) simulation exhibits March mixed layer depths exceeding 2000–3000 m in the Labrador Sea and parts of the Nordic Seas (Fig.C2 a). Under CO₂ doubling 2xCO₂), the Labrador Sea remains a site of deep mixing, with the extent and intensity reducing relative to the control simulation. In contrast, parts of the Nordic Seas show localized deepening (Fig.C2 b). The anomaly field 2xCO₂– PIC) highlights this dipole-like response: pronounced shoaling in the Labrador Sea and subpolar western North Atlantic, accompanied by regional deepening in the eastern Nordic Seas (Fig.C2 c).”

The revised manuscript now features a more detailed description of the model spin-up and initialization:

“The model is initialized with preindustrial boundary conditions, including atmospheric CO₂ concentration of 280 ppm as well as observed present-day ocean-conditions (Steele et al., 2001), followed by a spin-up simulation of 100 years into quasi-equilibrium.”



The authors claim that for the opposing trends between AMOC and NOC so far, no causal links have been proposed. This is not strictly true. A strengthening of the NOC concurrent with decreasing convection in the Labrador/Irminger Seas, resulting in a very weak AMOC response to freshwater hosing was discussed in “Circulation adjustment in the Arctic and Atlantic in response to Greenland and Antarctic mass loss by van den Berk et al (2021);

We thank the reviewer for making us aware of this study! We included it in the introduction by adding

“The causal link between the opposing trends in AMOC and NOC has been little explored. Investigating the response to meltwater release from the Greenland and Antarctic ice sheets in a coupled climate model, van der Berk et al. (2021) found an increase in Nordic Seas convection concurrent with a decrease in convection in the subpolar North Atlantic as a result of changes in surface buoyancy fluxes and winds. Here, we suggest an additional mechanism.”

And the sentence in the abstract has been changed to *“So far, the causal link between these two opposing trends has been little explored.”*