



## **PMOC response to the Atlantic freshwater forcing**

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The response of Pacific Meridional Overturning Circulation (PMOC) to the freshwater forcing in the Atlantic Ocean was investigated using a fully-coupled model. A linearly-varying freshwater flux (FWF) forcing was given to the North Atlantic (NA) region under the Last Glacial Maximum (LGM) and pre-industrial (PI) boundary conditions. As the Bering Strait (BS) is closed in the LGM but not in the PI, we conducted an additional experiment (PI\_BC) as a sensitivity test, in which boundary conditions are the same as the PI but the BS is closed. Our simulation results demonstrate that boundary conditions, especially the opening or closing of the BS, can significantly affect the response of PMOC to the FWF forcing. In the LGM and PI\_BC where the BS is closed, PMOC develops as the FWF is given in the NA. This is achieved by enhanced net evaporation over the North Pacific, which encourages dense water formation. Also, strong northward Ekman transport is found in the Southern Ocean in the active PMOC cases. The consistent water supply to the north requires a sinking motion to maintain the equilibrium. Since the Atlantic surface is too fresh by the direct FWF forcing, the North Pacific has a more favorable condition for a sinking motion to happen. On the other hand, in the PI, the open BS enables the freshwater given to the NA to flow into the Pacific via the Arctic Ocean. Therefore, the north Pacific surface density decreases and PMOC does not develop.