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Varying Atlantic meridional and Nordic Seas zonal temperature gradients through the Pliocene and how to understand this variability

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By synthesizing Pliocene SST records from the North Atlantic and the Nordic Seas, we have identified significant changes in the meridional SST gradient between the North Atlantic and the Nordic Seas through the Pliocene, as well as corresponding changes in the zonal SST gradient within the Nordic Seas. Occasionally though the Pliocene, the SST gradient between the North Atlantic and the Nordic Seas was comparable to the present gradient. At other times, it was stronger than at present. When the meriodional SST gradient between the North Atlantic and the Nordic Seas was strong, the zonal gradient was mostly weak, and vice versa. Inflow of Atlantic Water to the eastern Nordic Seas is constrained by the topography of the GSR, and further affected by: 1) Changes in wind forcing influencing the push towards the Nordic Seas, 2) changes in the barotropic pressure gradient over the GSR, pulling Atlantic Water into the Nordic Seas and/or 3) changes in the estuarine forcing linked to outflow of polar water from the Arctic and compensating entrainment of ambient water in the Atlantic region of the Nordic Seas. The dynamics of the subpolar gyre is also important for the heat transport from the North Atlantic towards the Nordic Seas. The potential cause(s) behind the observed changes in meridional and zonal temperature gradients through the Pliocene will be discussed.