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The impact of the Atlantic-Arctic exchange on rising ocean bottom temperatures and the fate of gas hydrates

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Vast amounts of methane hydrates are potentially stored in sediments along the continental margins, owing their stability to low temperature – high pressure conditions. Global warming could destabilize these hydrates and cause a release of methane (CH4) into the water column and possibly the atmosphere. Since the Arctic has and will be warmed considerably, Arctic bottom water temperatures play a key role in the fate of gas hydrates. A hierarchy of ocean/sea-ice models has been studied to understand the impact of warm inflowing Atlantic water and the exchange of the Atlantic with the Arctic Ocean on the modulation of bottom water temperatures on interannual to decadal timescales. The future evolution projected by a climate model was analyzed and confirmed strongest impact on shallow regions affected by Atlantic inflow. The resulting warming is spatially inhomogeneous. Within the next 100 years, the warming affects 25% of shallow and mid-depth regions containing methane hydrates. Release of methane from thawing hydrates in these areas could enhance ocean acidification and oxygen depletion in the water column.