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Boundary current heat loss and mixing processes at the Arctic Ocean continental margin

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Inflowing Atlantic Water forms a significant heat reservoir in the Arctic Ocean. In the Barents Sea, where the Atlantic Water layer resides close to the surface, strong upward heat fluxes reduce the sea ice cover. Along with a warming climate, an eastward progression of these conditions typical for the Barents Sea is anticipated. These new conditions have the potential to cause dramatic regime shifts in the Laptev Sea region, where the sea ice and the oceanic surface layer are currently sheltered from the warm Atlantic Water by a permanent halocline. Understanding and quantifying the dominant mixing processes in the Siberian Seas is hence crucial to predict how mixing and sea ice conditions, as well as particle and nutrient transport pathways will evolve in the future.

Based on recent temperature and current velocity profiles from this region, we quantify the Atlantic Water heat loss along its pathway around the Arctic basin margins. Contemporaneous turbulent microstructure measurement reveal that only 20% of this heat loss takes place in the deep basin, emphasizing the important role of stronger mixing in the continental slope region. Observed boundary mixing processes include:

- Mixing in the frictional near bottom layer, strongly enhanced at the lee side of a topographic features and where large temperature gradients associated with the upper bound of the Atlantic Water layer are present in the turbulent near bottom layer.
- Spatially confined but energetic mixing events over the whole water column. These events are ephemeral but re-occurring and can homogenize the intermediate water column down to a depth of over 300m, with substantial implications for heat transport, the vertical distribution of nutrients and cross-slope particle transport.

The presented results provide new insights into the complex mixing and transport patterns at the

Arctic basin margins, and further emphasize the importance of boundary mixing across disciplines.