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Arctic sea-ice variability and its implication to the path of pollutants under a changing climate

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The increasing concentration of pollutants from anthropogenic origin in the Arctic atmosphere, water, sediments and biota has been evident during the last decade. The sea-ice is an important vehicle for pollutants in the Arctic Ocean. Pollutants are taken up by precipitation and dry atmospheric deposition over the snow and ice cover during winter and released to the ocean during melting. Recent changes in the sea-ice cover of the Arctic Ocean affect the fresh water balance and the oceanic circulation, and with it, the fate of pollutants in the system.
The Arctic Ocean is characterized by complex dynamics and strong stratification. Thus, to evaluate the current and future changes in the Arctic circulation high-resolution models are needed. As part of the EU FP7 project ArcRisk (under the scope of the IPY), we use a high resolution regional sea-ice-ocean coupled model covering the Arctic Ocean and the subpolar North Atlantic based on the Massachusetts Institute of Technology - circulation model (MITgcm). Under realistic atmospheric forcing we obtain hindcast results of circulation patterns for the period 1990 – 2010 for validation of the model. We evaluate possible consequences on the pathways and transport of contaminants by downscaling future climate scenario runs available in the coupled model intercomparison project (CMIP3) for the following fifty years.
Particular interest is set in the Barents Sea. In this shallow region strong river runoff, sea-ice delivered from the interior of the Arctic Ocean and warm waters from the North Atlantic current are main sources of contaminants. Under a changing climate, a higher input of contaminants delivered to surface waters is expected, remaining in the interior of the Arctic Ocean in a strongly stratified water column remaining.