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Representative climate projections for the North Sea and Baltic Sea

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Robust estimations of uncertainty for climate projections on the regional scale are highly needed but are still challenging. Regional climate projections rely on downscaling global climate scenarios. Typically, a number of different global climate models are downscaled to assess the inherent model uncertainty. The more models, the more robust the estimate of model uncertainty. However, this strategy is time consuming and so ensembles of regional projections are usually smaller than ensembles of global projections which can lead to an underestimation of regional uncertainty. With an increasing number of available global projections regional downscaling becomes increasingly expensive. We use a regional ensemble of coupled atmosphere-ice-ocean scenarios and a ensemble of ocean-ecosystem scenarios for the Baltic Sea to explore the effect of model selection on the representation of model uncertainty. Using a number of climate indices to characterize the regional system we apply a model selection that is representative of the original ensemble in terms of ensemble spread. We use existing algorithms to generate orthogonal patterns of climate change for the Baltic Sea. A small number of patterns is used to represent the climate change and its uncertainty in physical and biogeochemical parameters of the Baltic Sea. We show that climate change signals in atmosphere, ocean and ecosystem are coherent and that atmospheric or oceanic indices can be used to select global climate models for an ensemble of representative regional ecosystem scenarios for the Baltic Sea. Since the atmospheric climate in the regional climate model is close to its representation in the global climate model that latter can be used to perform an initial model selection.