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Comparison of thermodynamic sea-ice models for climate simulations

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The polar regions play an important role in the earth's climate system. Especially sea ice can react quickly to changes in environmental conditions and, because of its high albedo, can alter the net surface radiation significantly in these regions within relatively small time scales. This makes sea ice an important possible amplifier of climatic change.

Here we examine the performance of four existing thermodynamic sea-ice models to identify the best one for use in numerical climate simulations. The models are tested for their ability to represent the seasonal cycle of growth and decay of thick multi-year and of thin young sea ice that is expected to prevail in a future warmer climate. To do so, a number of numerical experiments were carried out and compared to reference simulations and to measured ice-thickness data.

The tested models are the **Semtner 0-layer**, **Semtner 3-layer**, **Bitz and Lipscomb** and the **Winton** model. Preliminary results suggest that among these models, the Semtner 3-layer model is the most suitable for use in climate simulations, since it is highly computational efficient and delivers results in good agreement with more complex models for a variety of environmental conditions. This is despite a certain lack of physical realism in representing sea-ice thermodynamics in this model.