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Requirements for a coupled regional atmosphere-ocean-ice model to reproduce the Arctic sea-ice anomaly during summer 1998 realistically

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A series of sensitivity experiments have been conducted with the coupled regional atmosphere-ocean-ice model HIRHAM/NAOSIM in order to identify those model conditions that are essential for a realistic simulation of the Arctic sea-ice anomaly during summer 1998. The results highlight some important requirements for coupled model simulations: (i) A proper initial ice thickness distribution is of prime importance for a realistic reproduction of summer sea-ice retreat in short-term simulations without adequate spin-up period. (ii) The lead closing parameter in the ice model has to be chosen carefully, because it has fundamental impact on the steady-state of ice volume, which in turn affects the summer sea-ice retreat considerably. In particular, a too low value of this parameter results in a strong loss of sea-ice towards an unrealistic thermodynamic equilibrium. (iii) A correct reproduction of the atmospheric circulation is essential for a realistic simulation of the sea-ice distribution during summer, but the simulation of the atmospheric circulation also depends on the sea-ice distribution. This feedback is vitally important in a coupled model and raises difficulties in quantifying some model sensitivities finally.