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The modeled impact of climate change on Arctic sea ice in CNRM-CM3 IPCC simulations

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The climate simulations specified by the IPCC for assessment report 4 were carried out at CNRM with CNRM-CM3 global coupled model. This model includes ARPEGE-Climat v3 AGCM (CNRM), OPA8 OGCM (CNRS/IPSL), Gelato2 sea ice model (CNRM) and TRIP river routing (University of Tokyo). The whole system is coupled by OASIS2 software (Cerfacs). On the period 1971-2000 the modelled surface of sea ice is in the range of observations, as it ranges from about 6 to 15 10ˆ6 kmˆ2. However an excess of sea ice is obvious in Barents Sea at all seasons. Also overestimated is the accumulation of sea ice near the Siberian shore due to the too zonal atmospheric flow near the surface. The yearly average surface of sea ice drops by about 10ˆ6 kmˆ2 between 1950 and 2000 (according to satellite observations the sea ice cover has declined by 0.95 10ˆ6 kmˆ2 between 1978 and 2003). The modelled Arctic sea ice becomes seasonal by the end of the XXIst century climate change experiments, except for the B1 scenario. The decline of perennial sea ice begins in the late XXth century, as reported by some observations. In all experiments ridges are still formed during the winter, especially near the coasts, reaching a few meters thick. However, after most of the (thinner) ice has disappeared due to atmospheric forcings, the temperature of superficial ocean layers increases rapidly (up to 5°C by the end of the XXIst century), which causes total melting even of thick ice during the summer.