

Analysis of open water and loose ice areas in the Siberian Arctic from model simulations

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Analysis of sea ice conditions affecting the duration of summer navigation through the Siberian Arctic seas (the North Sea Route) was performed using simulations with global climate model ECHAM5/MPI-OM (Marsland et al., 2003; Roeckner et al., 2003) with the SRES A2 scenario (IPCC, 2001). Characteristics of open water and loose ice (area, duration, dates of formation and freezing) for the warm season are analyzed. Daily sea ice concentration was used for detecting areas of open water and loose ice. We defined areas of open water and loose ice as areas with sea ice concentrations less than 10 % and 50 %, respectively (see Kern et al., 2005). Results of model simulations are compared to the ERA-40 reanalysis data (Simmons et al., 2000) for the period 1981-2000.

Figure 1 shows duration of loose ice for the warm season according to reanalysis (a) and model simulations (b) for the period 1981-2000. Model results show good agreement for loose ice duration in the Kara Sea. There are areas of less duration of loose ice in the Eastern Siberian Arctic (especially for East-Siberian and Chukchi Seas) in comparison with reanalysis.

Figure 1. Mean duration (in days) of summer loose ice (< 50 % sea ice concentration) in warm season according to the ERA-40 reanalysis (a) and model simulations with ECHAM5/MPI-OM (b) for the period 1981-2000.

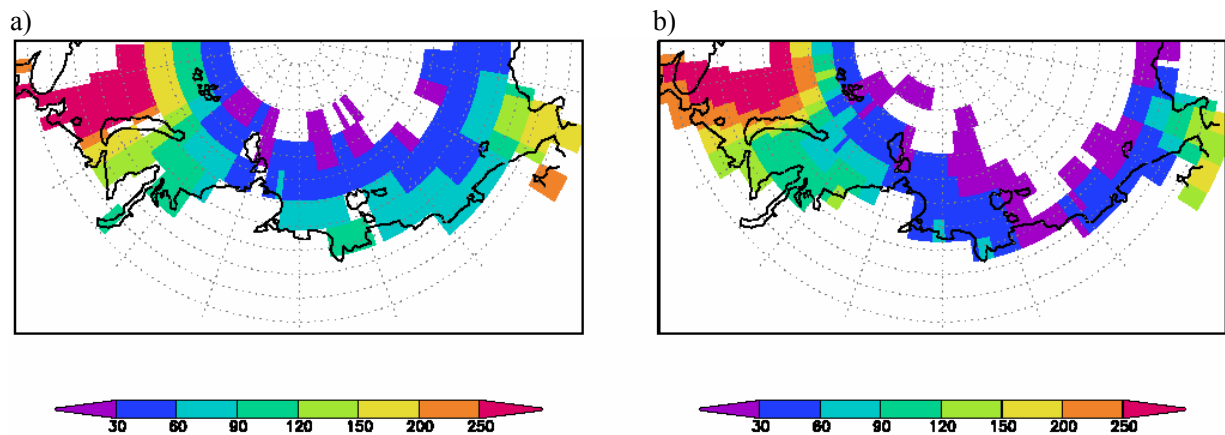


Figure 2 demonstrates trends of open water (a) and loose ice (a) duration in warm season according to model simulations for the period 2001-2050. Figure 3 shows mean area (in %) of open water and loose ice in the Kara (a) and Laptev (b) Seas for the different 10-years periods (1991-2000, 2021-2030, 2051-2060, 2081-2090) of model simulations. According to model results an increasing of the open water and loose ice area in the Kara Sea is connected with earlier ice melting and later ice freezing in the XXI century.

Figure 2. Trends (in days per 50 years) of open water (a) and loose ice (b) duration in warm season according to model simulations (SRES A2) for the period 2001-2050.

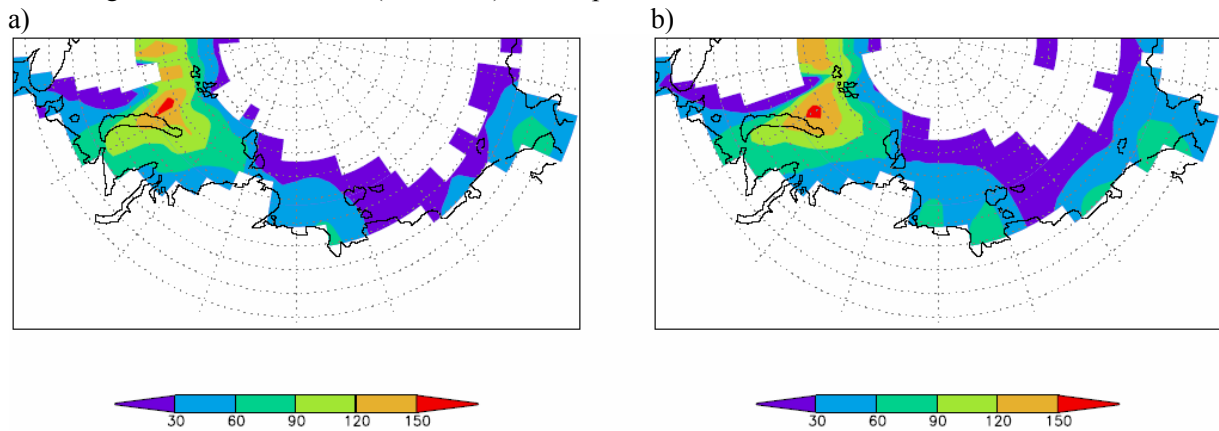
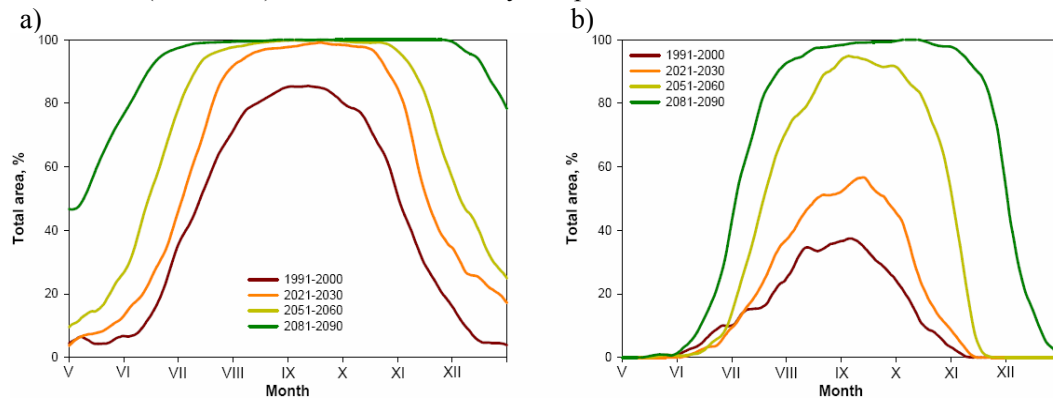


Figure 3. Mean area (%) of open water and loose ice in the Kara (a) and Laptev (b) Seas according to model simulations (SRES A2) for the different 10-years periods.



For the Laptev Sea model results show the increase for intensity of loose ice formation with a tendency to later ice freezing in the XXI century.

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