

Sea-ice Outlook for Summer 2009

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1 Extent Projection

Our first guess of the September monthly mean Arctic sea-ice extent is 4.9 ± 0.5 millions km^2 .

2 Methods / Techniques

The 2009 sea-ice extent is estimated using a Pan-Arctic configuration of the Massachusetts Institute of Technology general circulation model (MITgcm) and atmospheric surface boundary conditions from the Japanese 25-year Reanalysis Project (JRA-25) [Onogi et al., 2007]. The model has 18km horizontal grid spacing and 50 vertical levels. The K-Profile Parameterization (KPP) scheme is used for vertical mixing [Large et al., 1994]. Lateral boundary conditions are monthly and are taken from the Estimating the Circulation and Climate of the Ocean, Phase 2 (ECCO2) global optimized solution (<http://ecco2.jpl.nasa.gov>, [Menemenlis et al., 2008]). Initial hydrographic conditions are from the World Ocean Atlas 2005 [Antonov et al., 2006; Locarnini et al., 2006] starting in January 1992. Initial sea-ice condition is from Zhang and Rothrock [2003]. No climate restoring is used. The forward integration period is Jan 1992 to Feb 2009. On March 1, 2009, we re-initialize sea-ice thickness with preliminary thickness from ICESat [Kwok et al., in press] and then integrate the model forward until the end of the available JRA25 reanalysis (May 2009). For summer 2009, predictions are performed using JRA25 surface atmospheric conditions from 2006 to 2008.

3 Rationale

The 2006-2008 forcing period covers the extreme 2007 summer condition with anomalously clear sky and wind patterns, which resulted in a large retreat of the Arctic sea-ice cover [Drobot et al., 2008]. Thus, we use atmospheric conditions from the last three years (2006-2008) to estimate upper/lower bounds of the Arctic sea-ice extent.

Using preliminary mid-February-to-mid-March ICESat-derived thickness as initial sea-ice thickness conditions, our solutions for September monthly mean sea ice extent are either 4.4 millions km^2 for 2007 atmospheric conditions or 5.5 millions km^2 for 2006 and 2008 atmospheric conditions. Our first guess of the monthly mean sea-ice extent for September of 2009 is $4.9 \pm 0.5 \times 10^6 km^2$, that is, the median of these experiments and their spread.

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