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Projected Arctic Sea Ice Conditions, 1970 -2100

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SUMMARY

The purpose of this project is to illustrate the how climate warming will cause changes in Arctic sea ice from 1970-2100. The results are not predictions but detailed descriptions of what plausible futures we can expect. The authors have more confidence in the spatial patterns of sea ice retreat than the precise timing of the retreat. There are two parts to the study: coarse resolution (100 x 100 km) arctic wide and high resolution regional (18 x 18 km) projections.

Part A. The objective of Part A is to explore the future Arctic sea ice loss as simulated by different climate models driven by two radiative forcing scenarios. Radiative forcing is also called the "greenhouse effect" and describes the amount of heat (Watts/metre²) trapped in the atmosphere by clouds and greenhouse gases (e.g. carbon dioxide, methan and nitrous oxide). Two levels of radiative forcing were included in the analyses: RCP4.5, a mid-range scenario where the globally averaged human-caused warming stabilizes in 2070 at 4.5 W/m² and RCP8.5, the high range, business as usual scenario where the globally averaged radiative forcing reaches 8.5 W/m² in 2100 and continues to rise. Thirty-two (32) global climate models were analyzed and results from the ensemble of model projections presented. Climatological averages of sea ice concentration, sea ice thickness and snow depth over ice were computed for the historical period and two future scenarios for 2006-2100. Ice free days gradients were computed in each case to show the patterns of sea ice retreat.

Part B completes the picture by running a high-resolution (18km) regional ocean and ice model, providing finer spatial details of ice conditions projected by the GFDL Climate Model version 3 under the business-as-usual RCP8.5 forcing scenario for the period 2006-2080. The focus of Part B was the Canadian high arctic archipelago, also referred to as the Last Ice Area. The results indicate a complete disappearance of September sea ice around 2050 and the replacement of multi-year sea ice by annual, seasonal sea ice.