
# Past and Future Influence of Melt Ponds on Arctic Climate

*2018 Polar Modeling Workshop Group Project*

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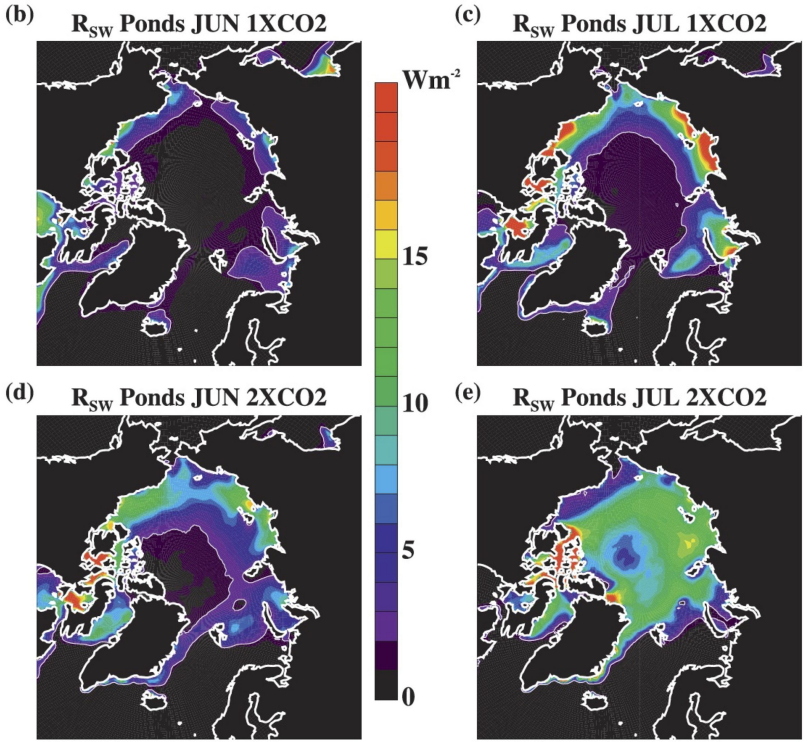
# Motivation

- "**Melt ponds will play an increasingly important role in the melting of the Arctic ice cover** and their incorporation in the sea ice component of Global Circulation Models is **essential for accurate future sea ice forecasts**." (Flocco et al, 2012)
- Radiative impact of melt ponds ~10 W/m$^2$ in July in the shelf regions (Holland et al, 2012)
- New melt pond scheme in CESM2.0: [level ice pond scheme]




Holland et al, 2012

# Science objectives

1. Determine the role of melt ponds in Arctic climate.
    a. Sea ice area and volume
    b. Surface albedo feedback
    c. Large-scale atmosphere and ocean impacts
2. Assess climate response to melt ponds and their impacts.
    a. Polar amplification
    b. Timing of melt pond formation and fall ice advance

UCAR | NCAR | CESM™ : : COMMUNITY EARTH SYSTEM MODEL

# Project overview

**Melt ponds in CESM2.0**

1x1 degree branched from 1000-yr control run (1850)

300 yr simulations

**5 simulations, fully coupled**

- Control: (1) PI control (2) no melt ponds (3) no melt ponds plus sea ice nudging
- 2x$CO_2$ forcing: (4) with melt ponds (5) without melt ponds

# Variables

**Ocean**: Standard output variables, but annually averaged for long-term storage

**Ice**: Pond concentrations, pond albedo, ice area, ice volume

**Atmosphere**: Temperature, latent and sensible heat fluxes, shortwave and longwave radiation

Writing monthly output except branched single years of daily output (every 20 years)

# Resources: 4.34 M core hours, 82T storage

All experiments are 300 years long and branched from the end of a long-term (1000 yr) spin-up of CESM2.0 using the B1850 compset

| Experiment | Core hours | Storage | Geyser/Caldera Hours |
|---|---|---|---|
| PI Control | 825,000 | 16T | 15,000 |
| No melt ponds | 825,000 | 16T | -- |
| No mps, sea ice nudged toward pi control mean state | 825,000 | 16T | -- |
| Abrupt 2xCO2 with mps | 825,000 | 16T | -- |
| Abrupt 2xCO2 without mps | 825,000 | 16T | -- |
| Daily ice branches | 200,000 | 1.2T | -- |

# Thank you!