CICE Consortium 2020 User's Workshop

Welcome to NCAR!

Community User Slides

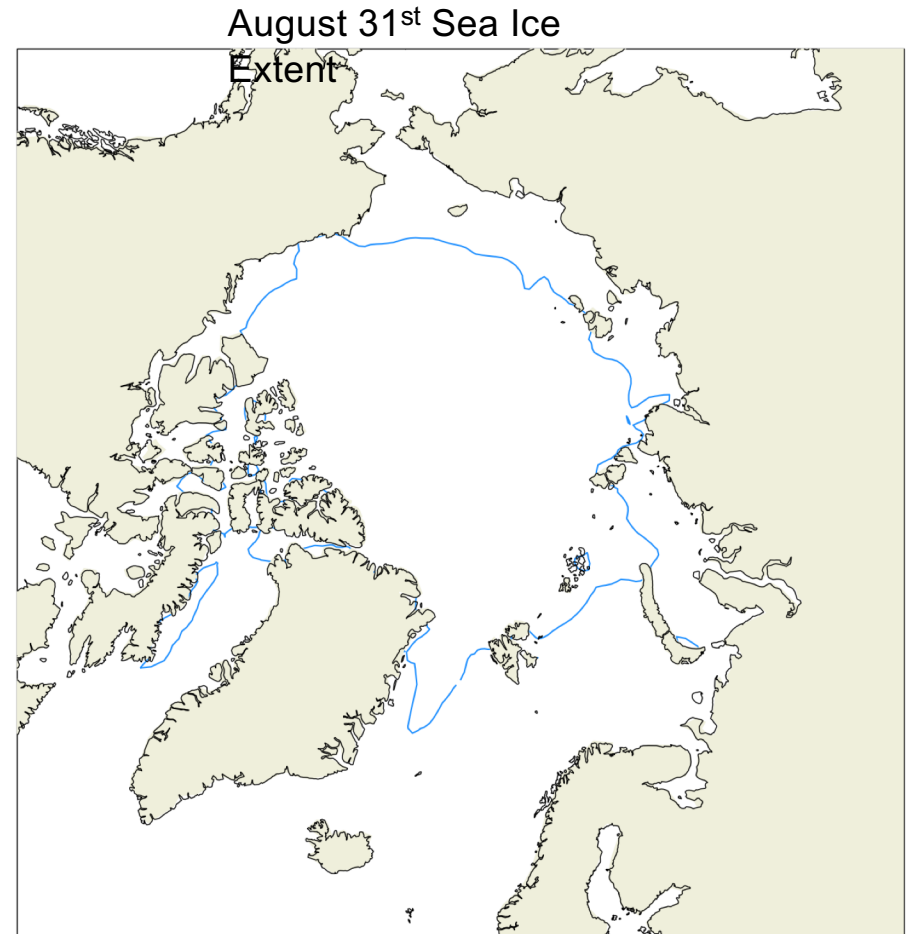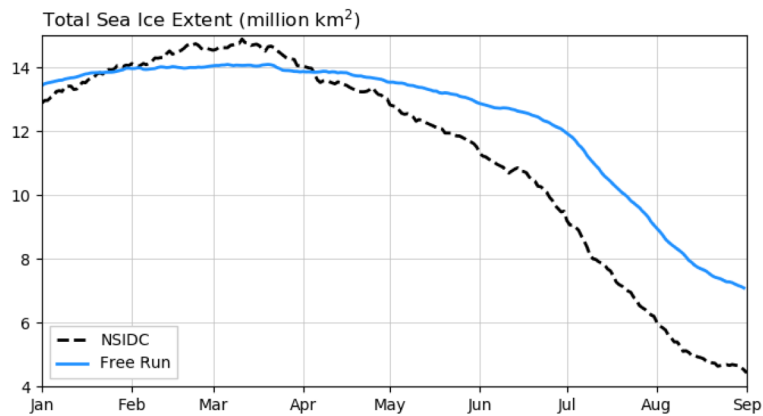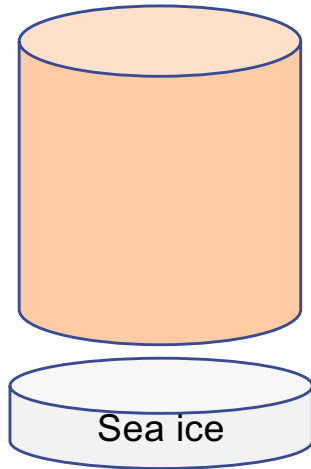# 2019 sea ice response to nudged winds & temperatures in CESM
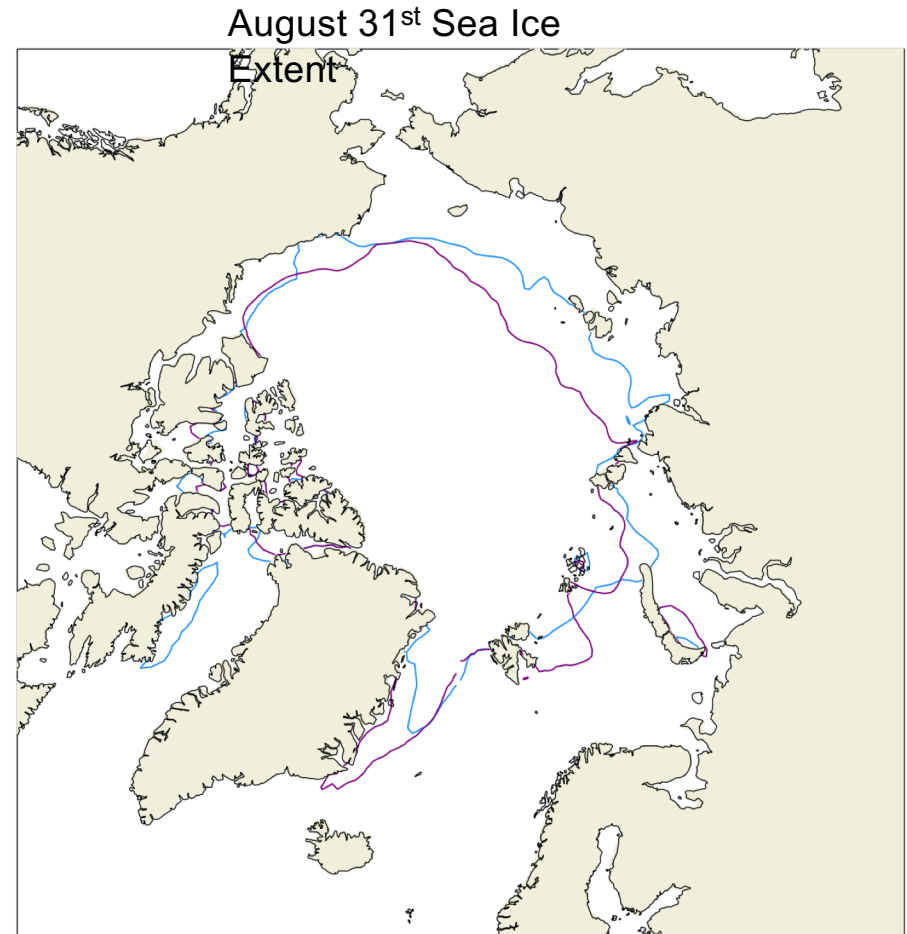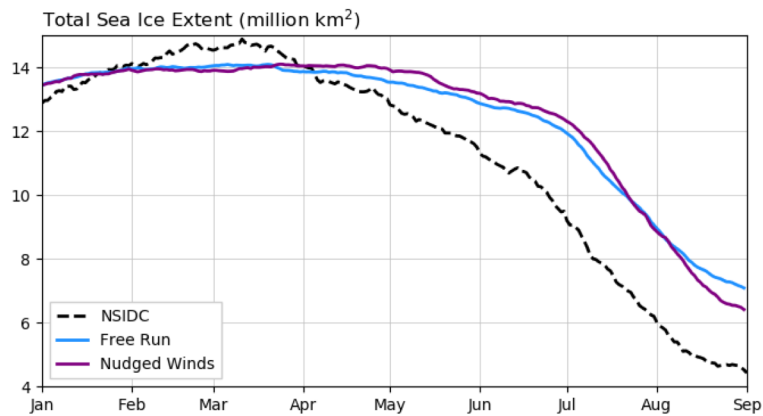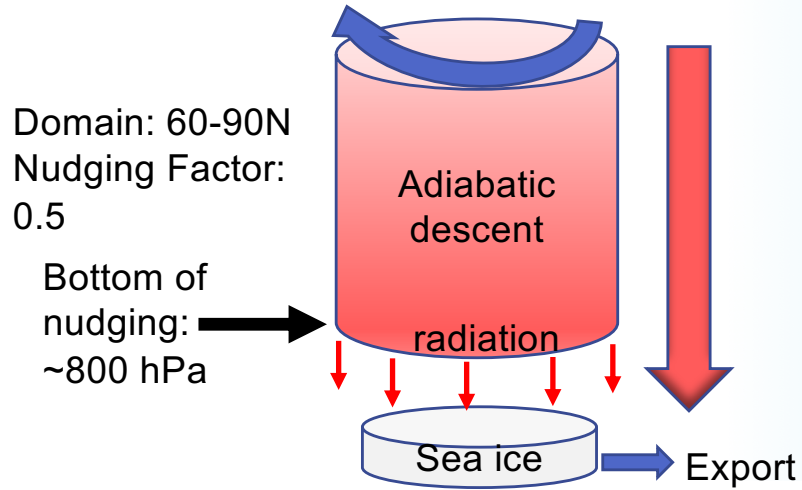
- Ian Baxter, PhD Student

- Geography Department, UC Santa Barbara

- 3 February 2020

2019 Case: CESM Free Run

Sea ice

August 31st Sea Ice Extent

Total Sea Ice Extent (million km²)

- NSIDC
- Free Run

2019 Case: CESM Nudged Winds

Domain: 60-90N
Nudging Factor: 0.5

Bottom of nudging: ~800 hPa

Adiabatic descent

radiation

Sea ice

Export

Total Sea Ice Extent (million km^2)

- - - NSIDC
— Free Run
— Nudged Winds

August 31st Sea Ice Extent

CICE Consortium

2019 Case: CESM Nudged Winds + Temperature

Domain: 60-90N
Nudging Factor: 0.5

Bottom of nudging: ~800 hPa

Adiabatic descent

radiation

Sea ice → Export

Total Sea Ice Extent (million km²)

- - - NSIDC
— Free Run
— Nudged Winds
— Nudged Winds+Temp

August 31st Sea Ice Extent

CICE Consortium

PROMIS: **Pa**rameterizations for **O**ptics, **M**ass, **I**ce and **S**now

Exploring model sensitivity to parameterizations

Maddie Smith, Applied Physics Lab

- How is solar energy partitioned in the seasonal ice system?

- **How is energy portioned between ice bottom and lateral melt, and what are the processes affecting ice-ocean energy exchange (top ~10 m)?**

- What is the role of snow in controlling sea ice mass balance and the spring-summer shortwave radiation budget?
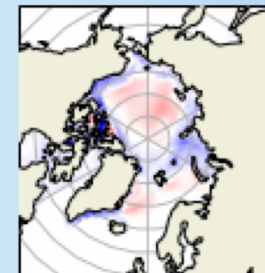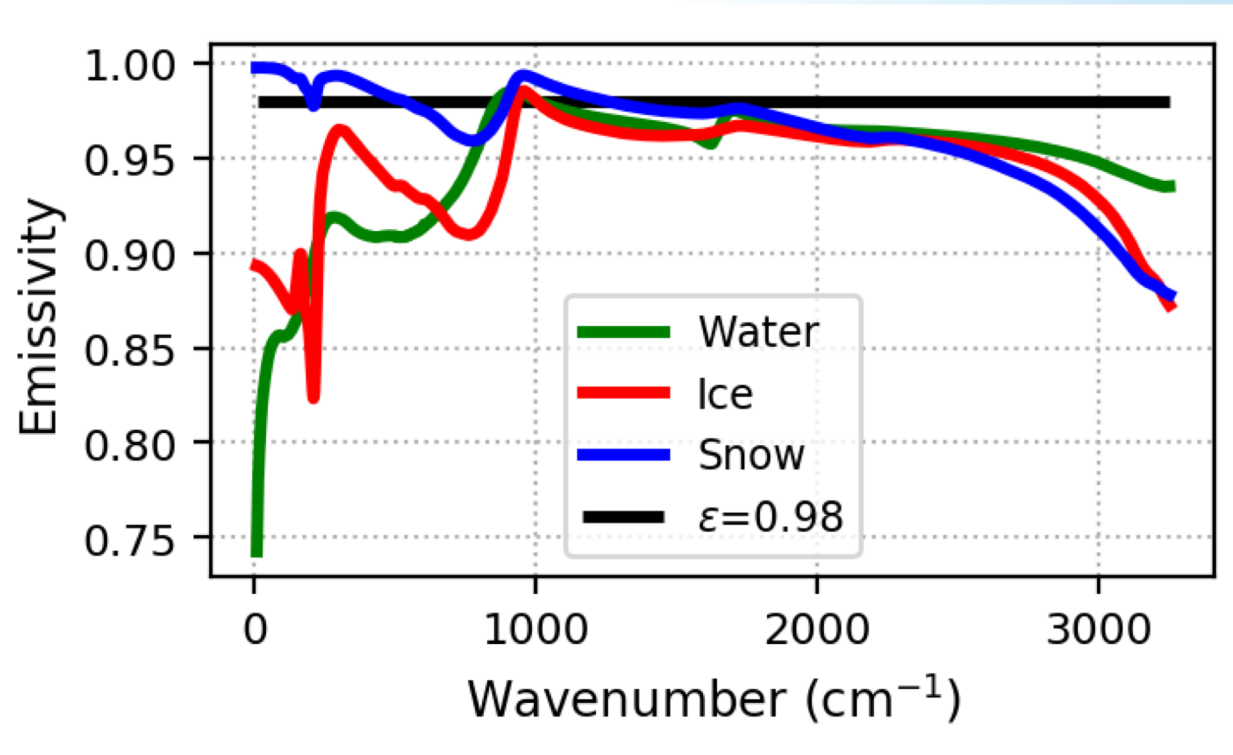
Δ JAS Ice thickness
10x lateral melting

[m]

Process scale **observations** of Arctic sea ice during MOSAiC

OPTICS

HEATING

SNOW
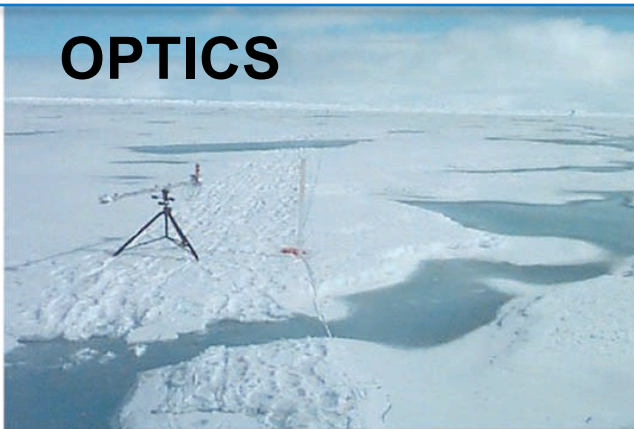
# Effects of Spectrally Resolved Emissivity on CICE Longwave Emission
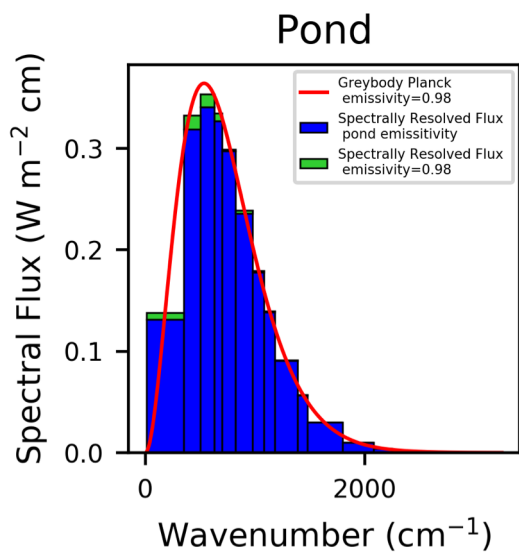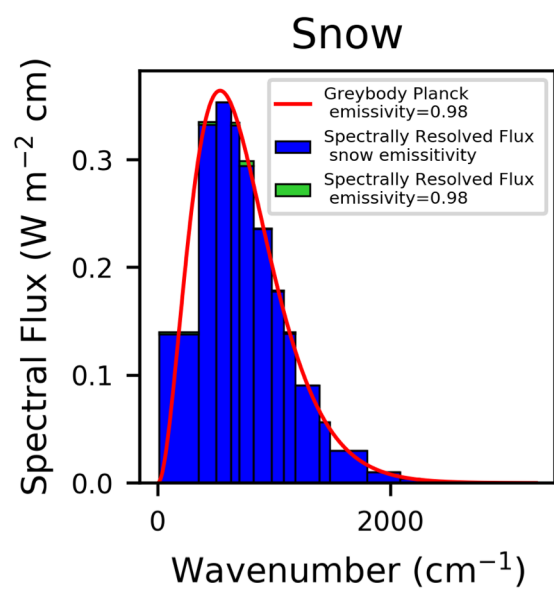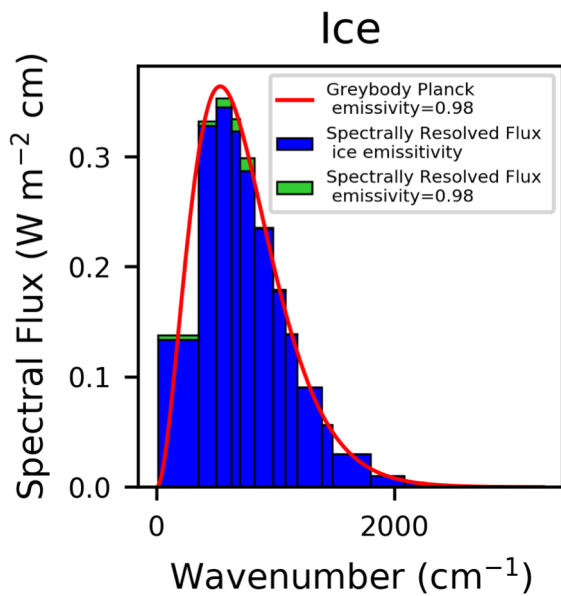
Zachary Wolff and Charlie Zender, UC Irvine, Department of Earth System Science

- CICE emissivity set to greybody.
- Reality: Emissivity varies spectrally with differences between snow, ice, and pond surfaces.
- Sea ice longwave emission re-written to allow for multiple bands of emission and emissivity.

# Methods
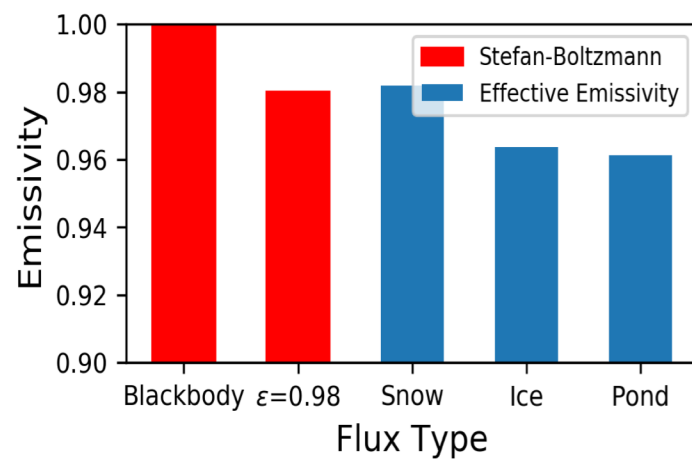
- Discretized longwave emission on to the 16 RRTMG bands
  - Agreement within round off error to blackbody and greybody
- Emissivities of ice and pond from Fresnel reflection and snow from Huang database.
- No changes to underlying thermodynamics asides from longwave.
- CICE v5.1.2 with CORE2 forcing
  - Two years (2005-2006).

Results and Future Directions

- Results as expected based on the emissivity changes.
- Future work:
  - Longer time and coupled simulations
  - Sub-grid scale surface types to align with shortwave code.
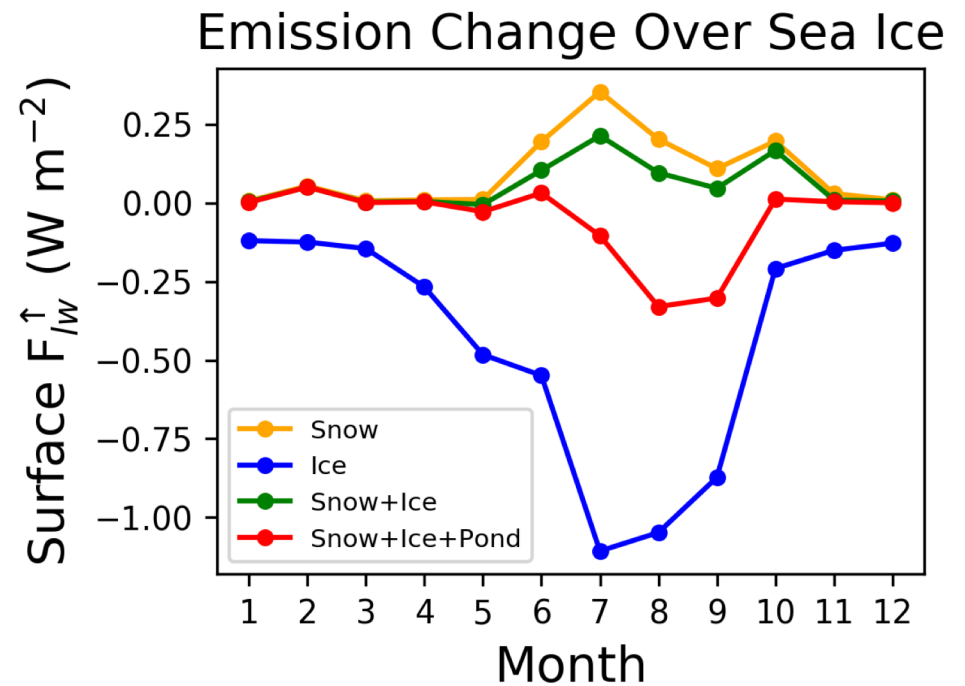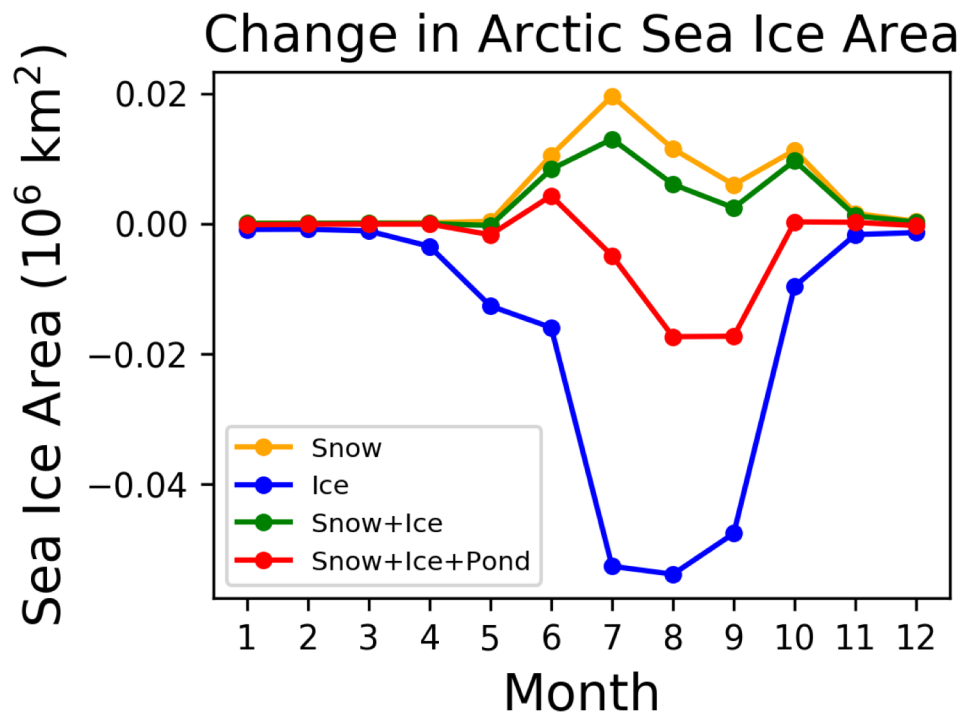
Great Lakes ice forecast application

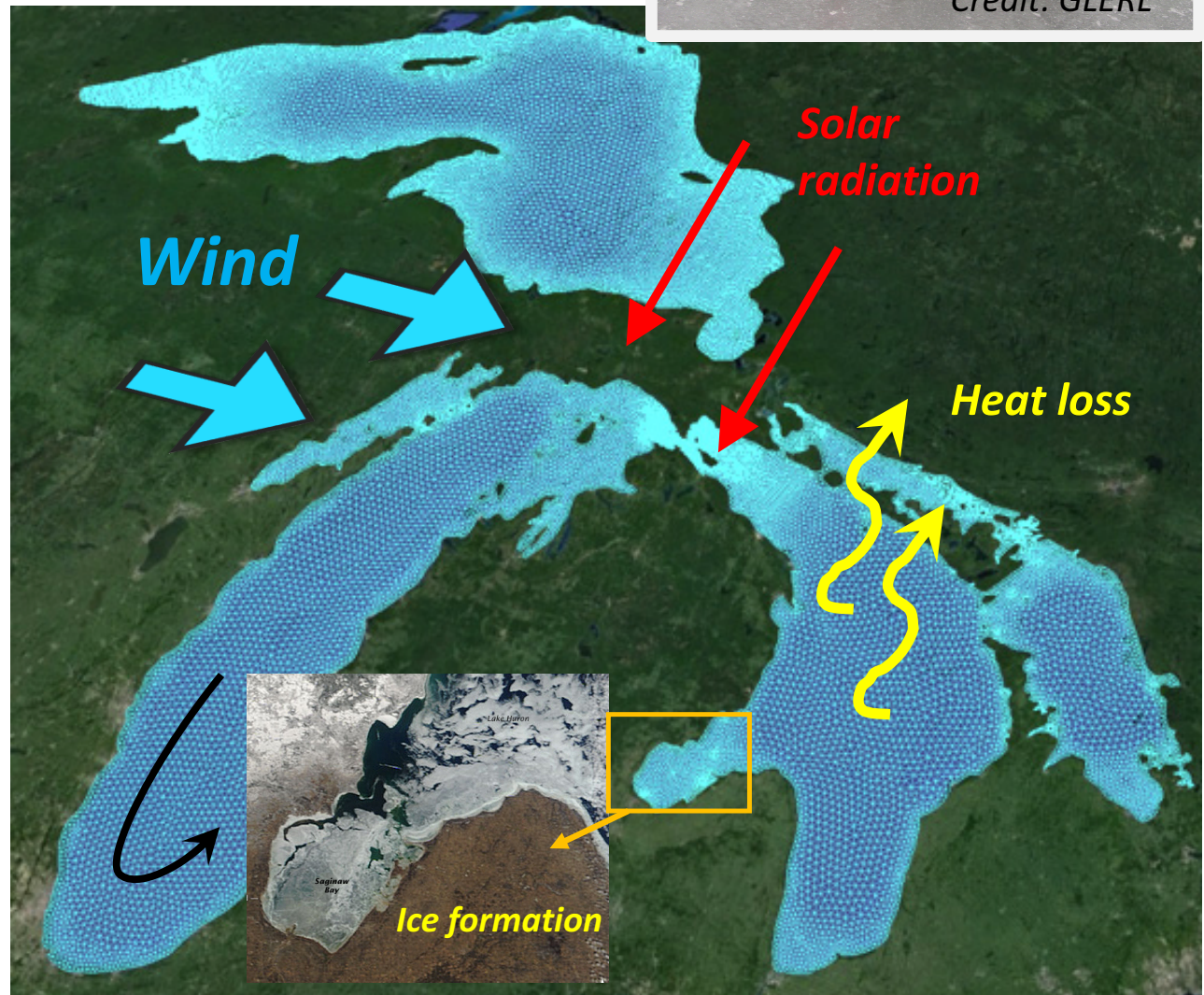Being implemented in NOAA's Great Lakes Operational Forecast System

Coupled with the unstructured grid Finite Volume Community Ocean Model (FVCOM)

Future plans include coupling with a wave model and use of ESMF for ice-hydrodynamic(-wave) coupling.

Credit: GLERL

Wind

Solar radiation

Heat loss

Ice formation

GLERL
Great Lakes Environmental Research Laboratory

CIGLR
Great Lakes Science for Society

UNIVERSITY OF MICHIGAN

NOAA

Questions? Ayumi Fujisaki-Manome (ayumif@umich.edu)

Coupled storm surge-ice-wave model application for western Alaska

To be implemented in Alaska Coastal Ocean Forecast System

Currently testing & verifying CICE6 standalone simulations (forced by Navy's HYCOM and NOAA's CFSv2)

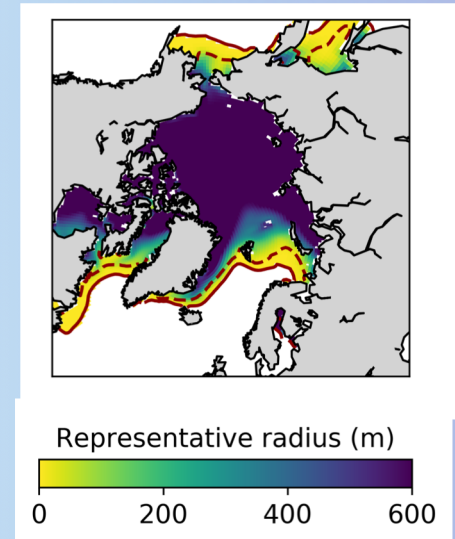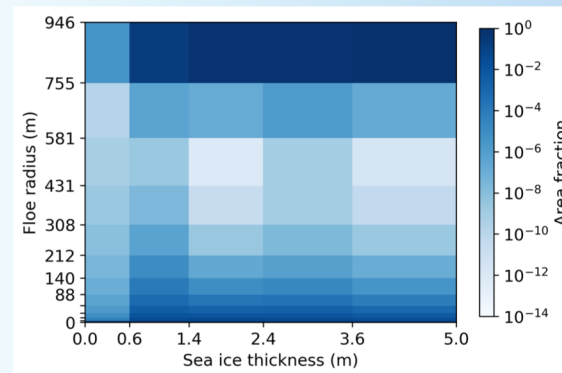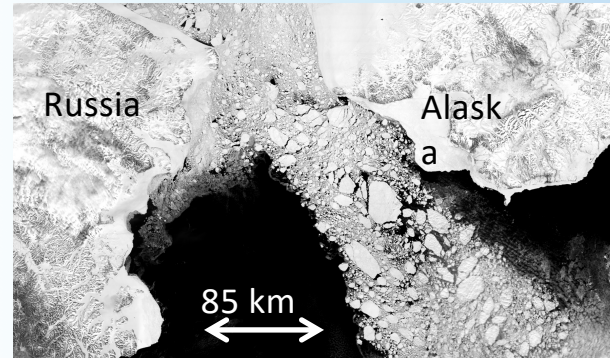To be coupled with ADCIRC (storm surge model) and WAVEWATCH3 (wave model) using the ESMF

Alaska

Bering Sea

CICE6 Feb 24, 2019

sea ice

Alaska

open water

cloud

MODIS Feb 24,
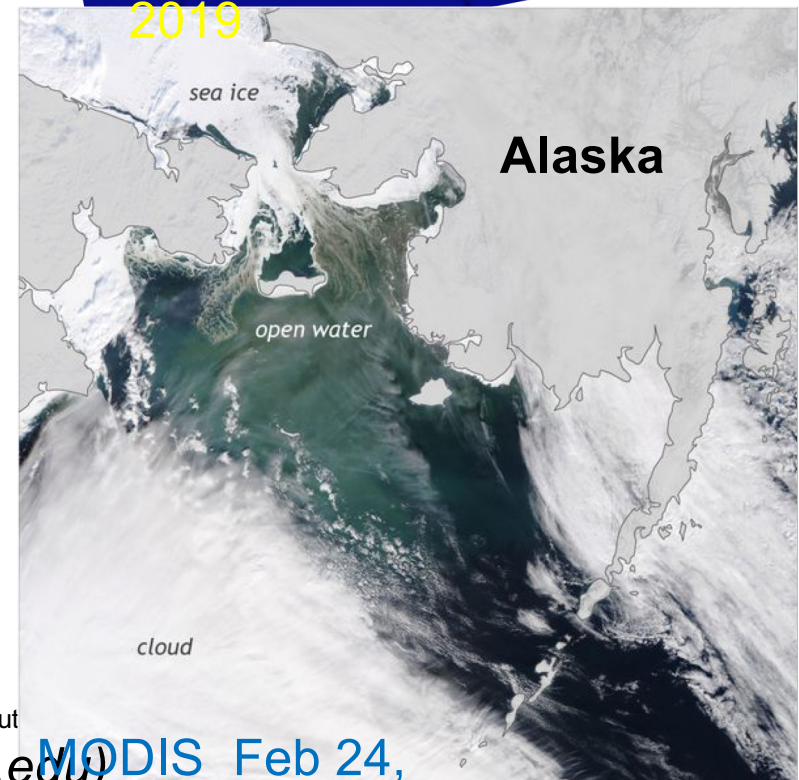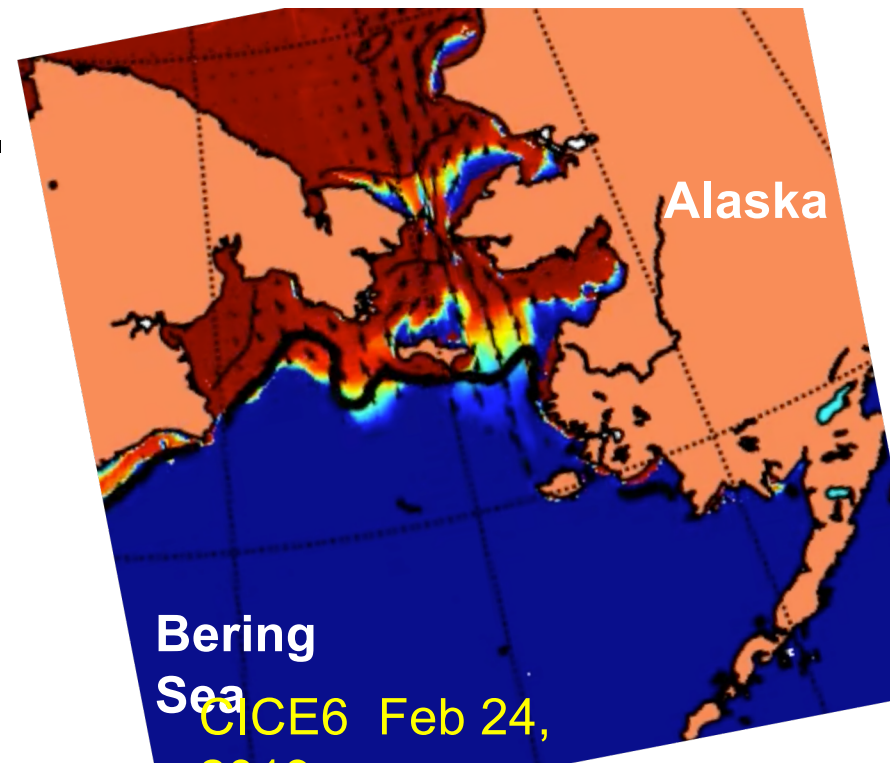
CICE and Icepack Workshop and Tut

Questions? Ayumi Fujisaki-Manome (ayumif@umich.edu)

Lettie Roach

Atmospheric Sciences, University of Washington

- Process-based modelling of the sea ice floe size distribution

- New coupling between ocean surface waves and sea ice

- Application of machine learning techniques to parametrization development

- Impacts of the fragmentation of sea ice on polar climate

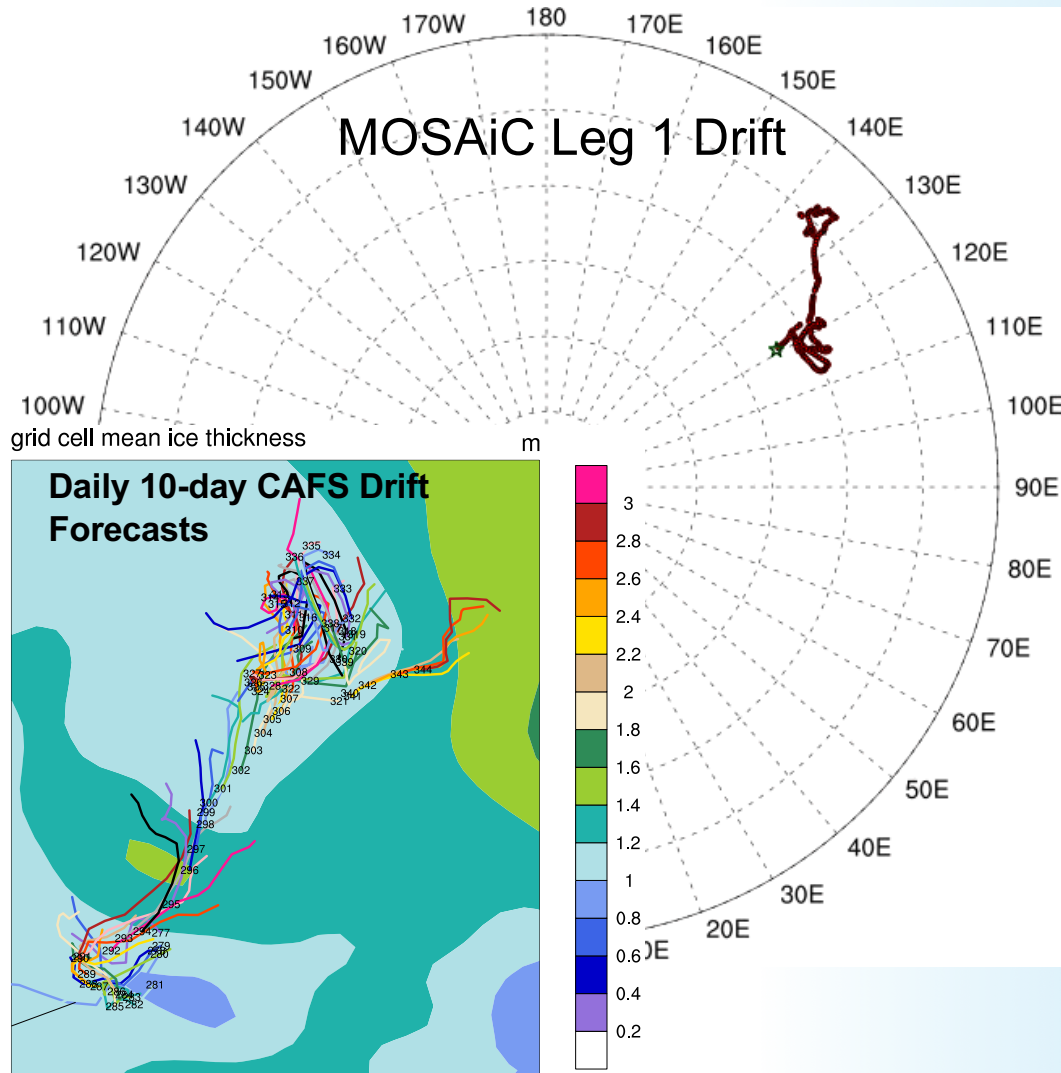- Coupled sea ice—ocean—atmosphere interactions

Seminar tomorrow

11:00

CICE Consortium

CICE and Icepack Workshop and Tutorial   February 3-5, 2020

Amy Solomon, NOAA ESRL

MOSAiC Leg 1 Drift

grid cell mean ice thickness

Daily 10-day CAFS Drift Forecasts

Using NOAA Coupled Arctic Forecast System (CAFS) Drift Forecasts of the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) Campaign to Evaluate and Improve Sea Ice Models

CAFS 10/4-12/10/19: BUOY #POLARSTERN01

9-Day Lead
8-Day Lead
7-Day Lead
6-Day Lead
5-Day Lead
4-Day Lead
3-Day Lead
2-Day Lead
1-Day Lead

1 - Ice Speed
2 - Ice Direction