NOAA • ESRL • PHYSICAL SCIENCES DIVISION
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Coupled-System Forecasting and Modeling Planned for MOSAiC

Amy Solomon
Matt Shupe
Ola Persson

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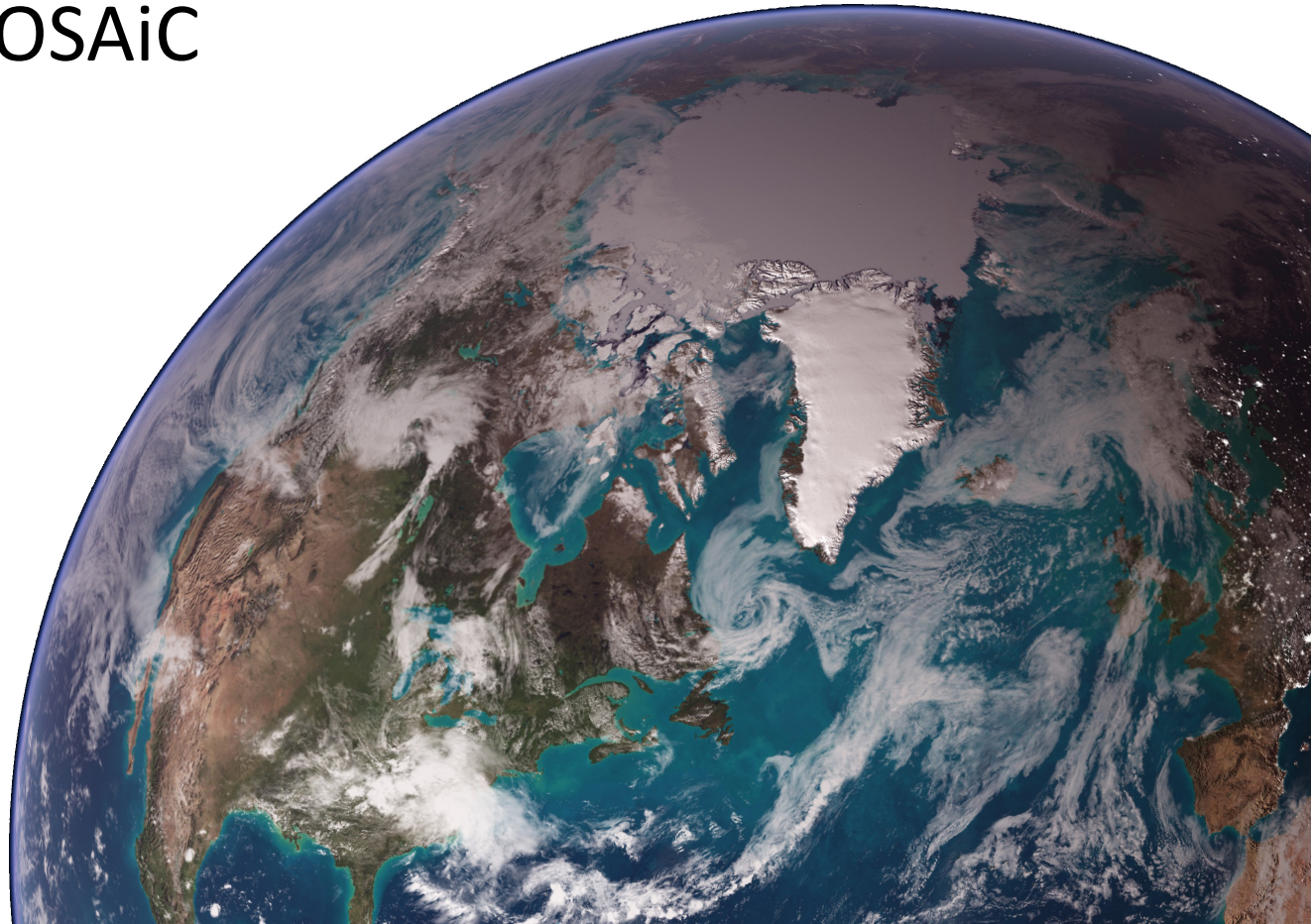
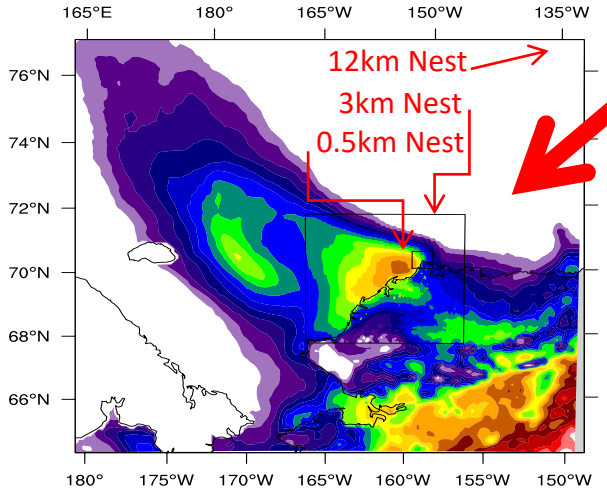
Vienna, VA
19-23 March 2018

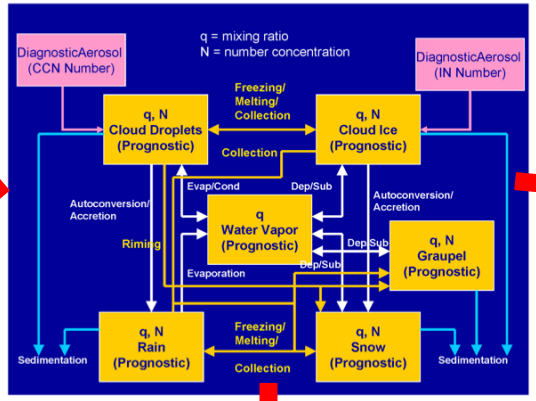


NOAA ESRL Arctic Model Toolbox

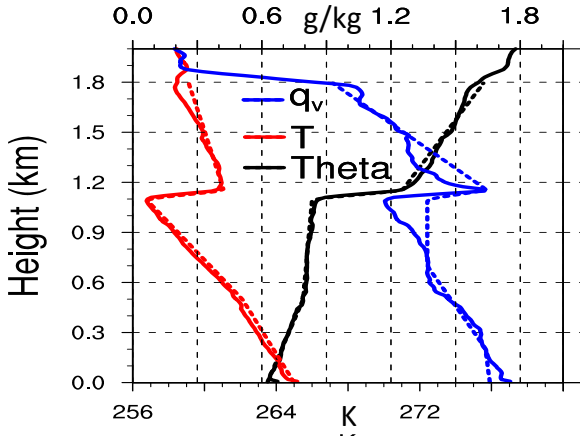
All Models Use the Same Double-Moment Microphysics

WRF Nested Limited-Area Model

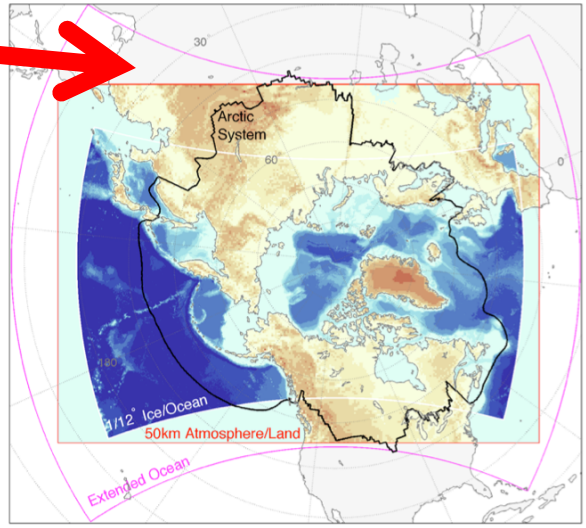




WRF-LES Model

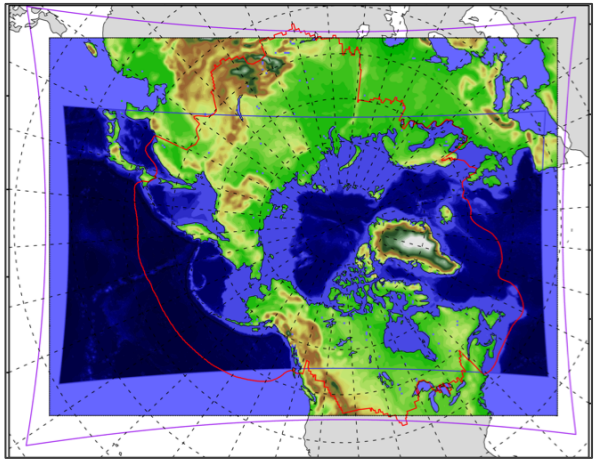


Regional Arctic System Model



Adapting RASM for Sea Ice Forecasting

RASM-ESRL is a modified version of RASM (Maslowski et al. 2012): includes the WRF atmosphere model, LANL CICE5 sea ice, POP ocean model, & the NCAR CLM4 land surface model. All components are run at 10km horizontal grid and the WRF model is run with 40 vertical levels.

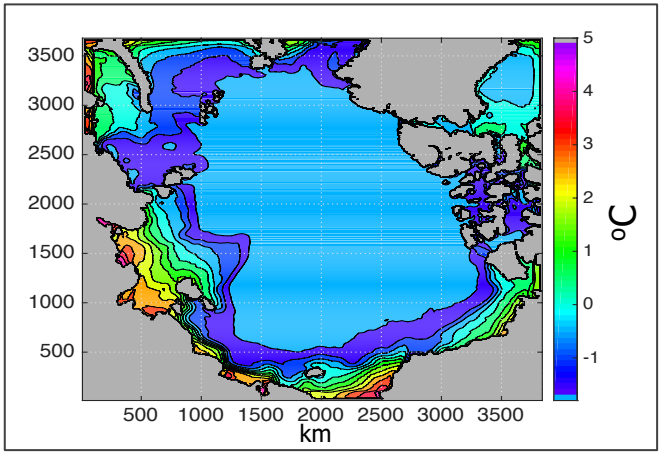


Regional Arctic System Model (RASM)

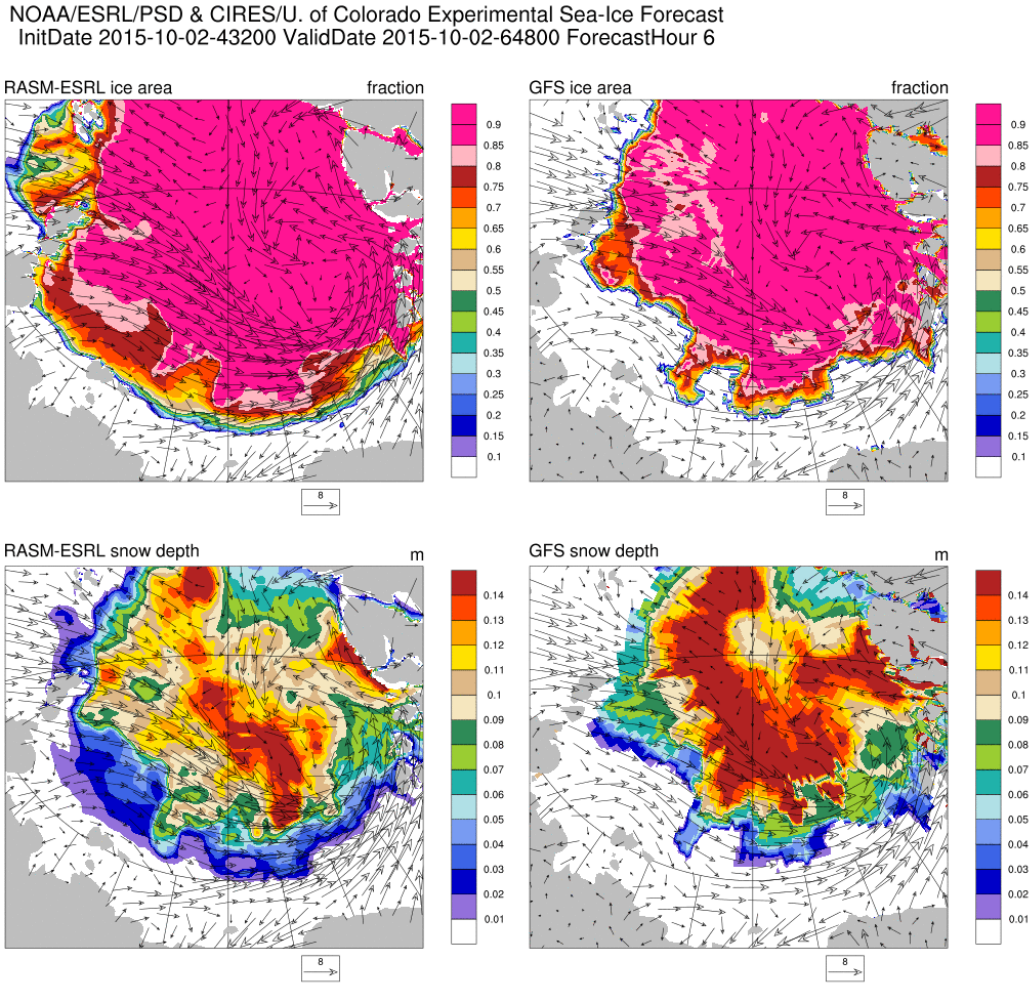
Focus on climate simulations
Includes all Arctic drainages and mid-latitude storm tracks
Medium-range atmosphere resolution (50km)
No initialization of sea ice

RASM-ESRL

Focus on short-term forecasting
Centered on Arctic Basin
High-resolution components (10km)
Dynamical ocean model and mixed layer model
Initialized with GFS/AMSR2 sea ice concentration and CRYOSAT2/SMOS sea ice thickness
Forced by GFS 3-hourly forecasts at the lateral boundaries



Experimental Forecasts in Support of the ONR SeaState Campaign (Fall 2015) and NWS Alaska Sea Ice Desk

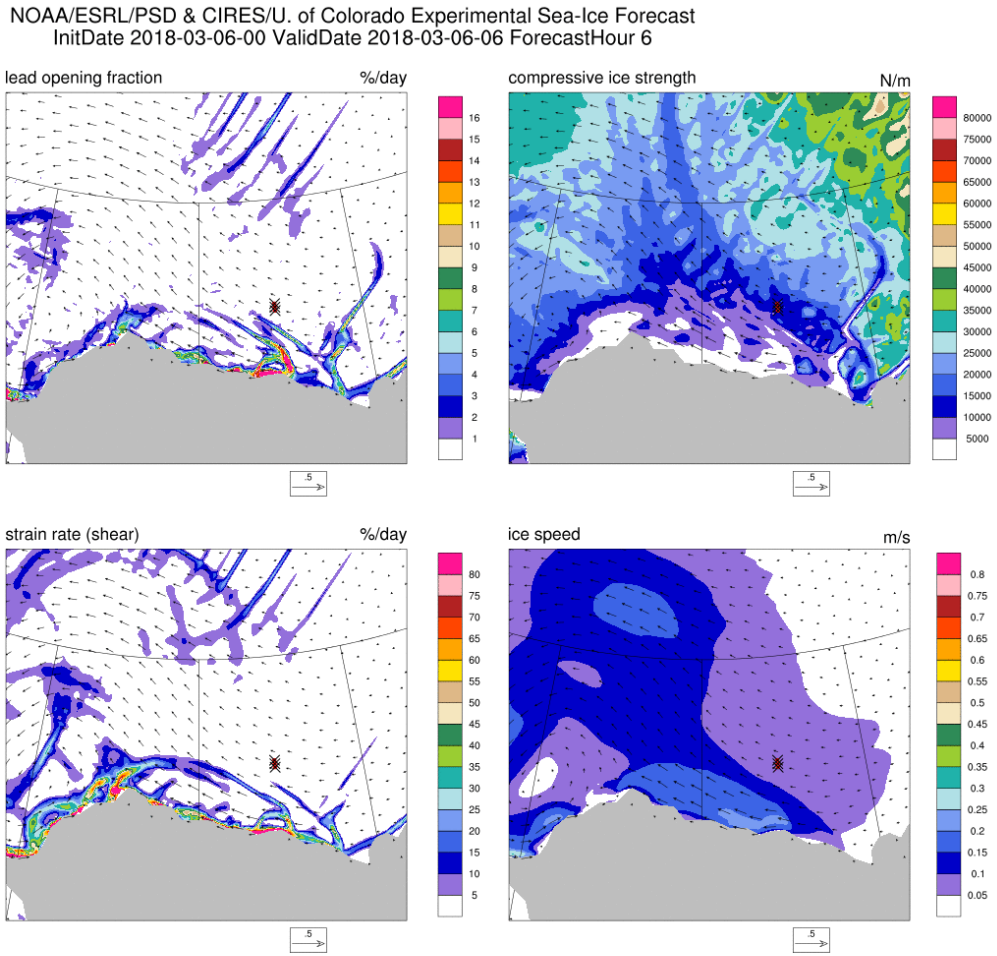


Quasi-Operational Forecast Products Uploaded on the R/V Sikuliaq During the ONR SeaState Campaign

Quasi-Operational SeaState Figures

Model Guidance Needed for Sea Ice Drift and Deformation/Dynamics

Forecasts of Sea Ice Drift and Dynamics in Support of the ICEX2018 Campaign (happening now)



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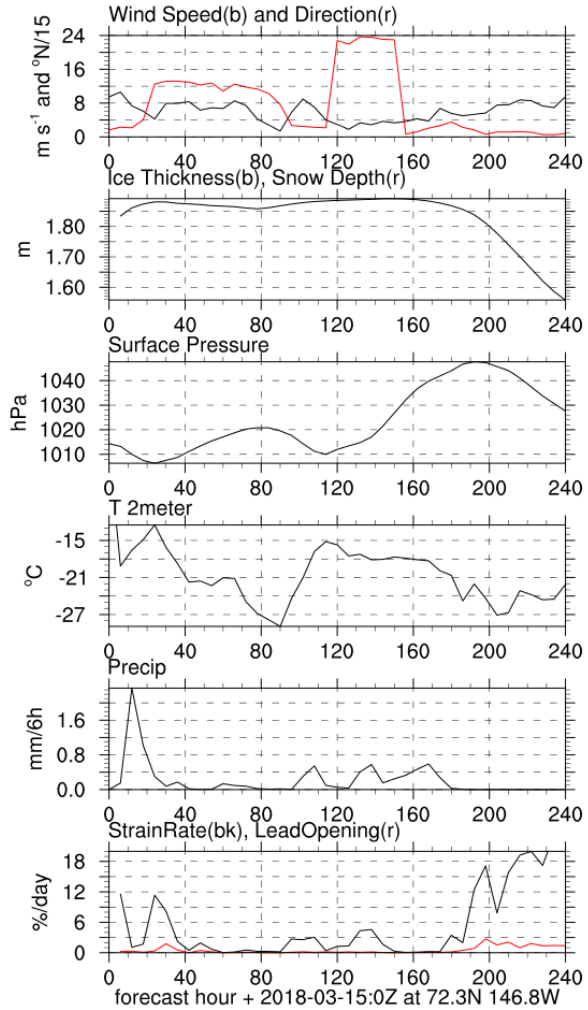
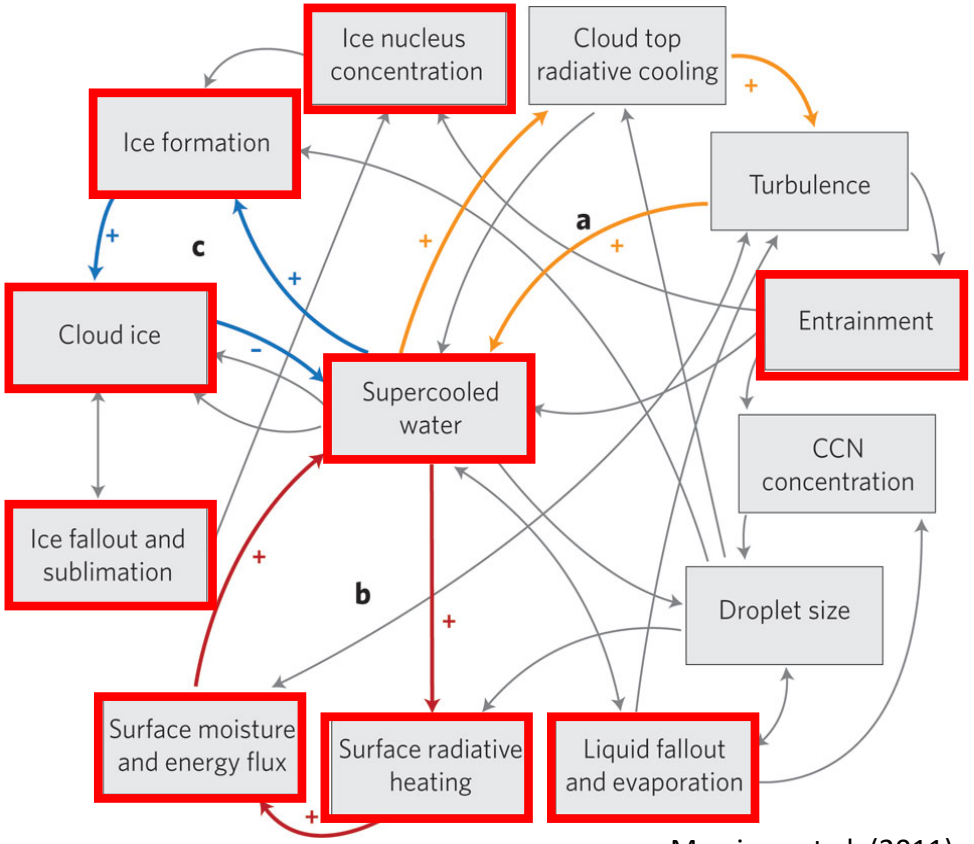


Coupled-Model Process Studies

1) Maintenance and Persistence of Arctic Mixed-Phase Stratocumulus

- ✧Processes that determine phase-partitioning
- ✧Persistence of decoupled systems
- ✧Humidity inversions
- ✧Cloud extending into inversions
- ✧Recycling of ice nuclei

- ✧Surface sources of IN?
- ✧Coupling between surface layer and cloud layer?



Morrison et al. (2011)

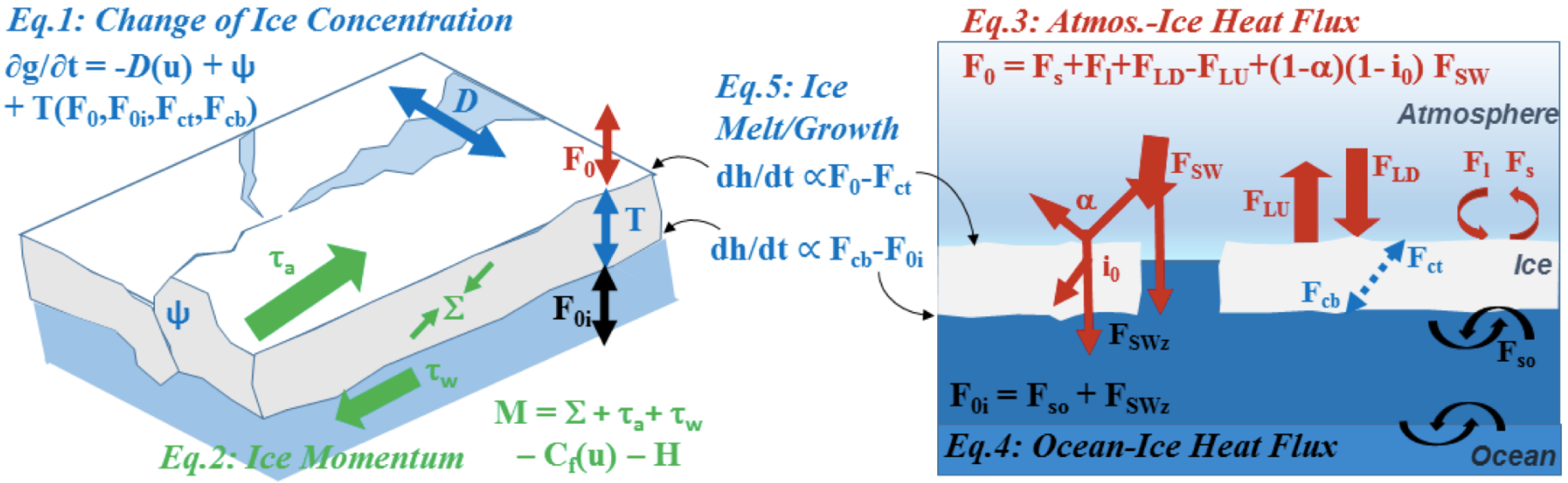
2) Sea Ice Variability: Case Studies

Quantify the role of specific events in the annual evolution of sea ice thickness, deformation, and drift, potentially including:

- Spring melt onset case to examine processes that trigger the energy budget transition.
- A strong ocean mixing event producing larger heat fluxes through the pycnocline.
- An atmospheric storm with strong wind stress or radiative forcing.
- A significant ice deformation event that modifies the ice thickness distribution or open water fraction.
- A winter case that examines the relationship between ice thickness, upward flux of ocean heat, and the impact on low-level atmospheric stratification.

3) Sea Ice Predictability

RASM-ESRL model and detailed observations will be used synergistically to assess sea-ice predictability over varying time scales with focus on associated thermodynamic and dynamic influences.



Thank you for your attention

Questions?