

# Seasonal sea ice characteristics at the end of the coordinated AOMIP spin up

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# Spin up phase

- Starting from climatological hydrography
- spin up procedure for sea ice
- NCEP/NCAR reanalysis forcing 1948-1978
- surface salinity restoring 1948-1957
- prescribed fluxes 1958-1978
- analysis of seasonal cycle for 1978



# Analysis phase

- NCEP/NCAR reanalysis forcing 1978-2000

# 20<sup>th</sup> century experiments

- Blend of reconstructed atmospheric forcing data and reanalysis

# Model Forcing and Validation Data

- **Bathymetry:** Global merged data product that blends the International Bathymetric Chart of the Arctic Ocean data with the Earth Topography Five Minute data
- **River-runoff:** monthly climatology, gauged & ungauged
- **Sea-ice:** National Snow and Ice Data Center
- **Hydrography:** Global merged data product where Arctic Ocean data sets have been blended with the World Ocean Atlas (2001)
- **NCEP daily SLP**  $\Rightarrow$  surface wind, surface stress (blend of SLP derived winds and NCEP winds for global models)
- **NCEP daily SAT**
- **Relative humidity:** 90% (blended with NCEP product outside of the Arctic for global models)
- **Precipitation:** monthly climatology (Serreze & Hurst, 2000; Xie & Arkin, 1996, 97)
- **Clouds:** monthly climatology based on ECMWF reanalysis

## Differences:

- resolution
- domain (& b.c.)
- numerics/physics

# Data access & management

An **AOMIP-LAS** (Live Access Server) has been created.

The AOMIP common-forcing data sets, archived at the AOMIP website, are available through the AOMIP-LAS. The model results from each AOMIP group are stored on a group's home-institute website but are directly accessible to all through the AOMIP-LAS.

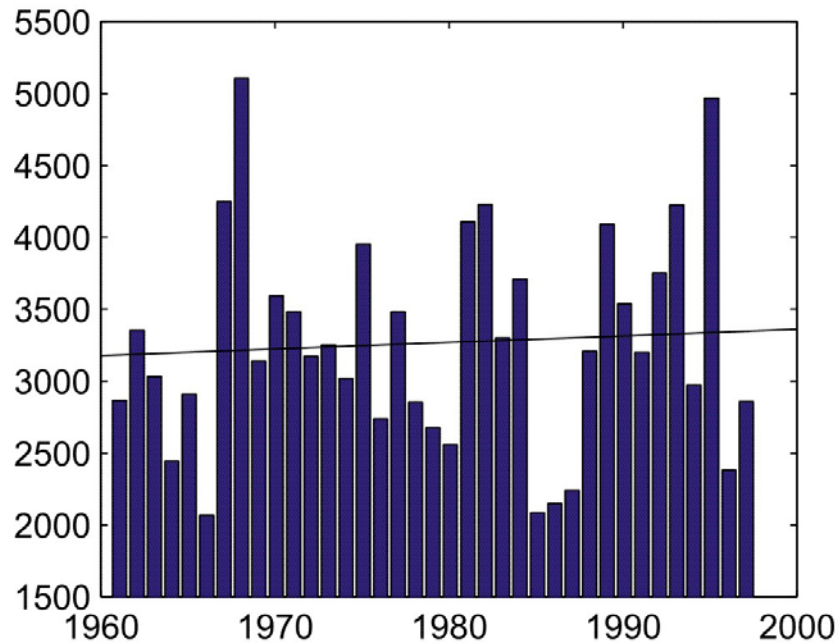
Results are interpolated on a common (relatively low resolution) grid.

We are also investigating the possibility of sharing AOMIP model data through the Joint Office for Science Support (JOSS).

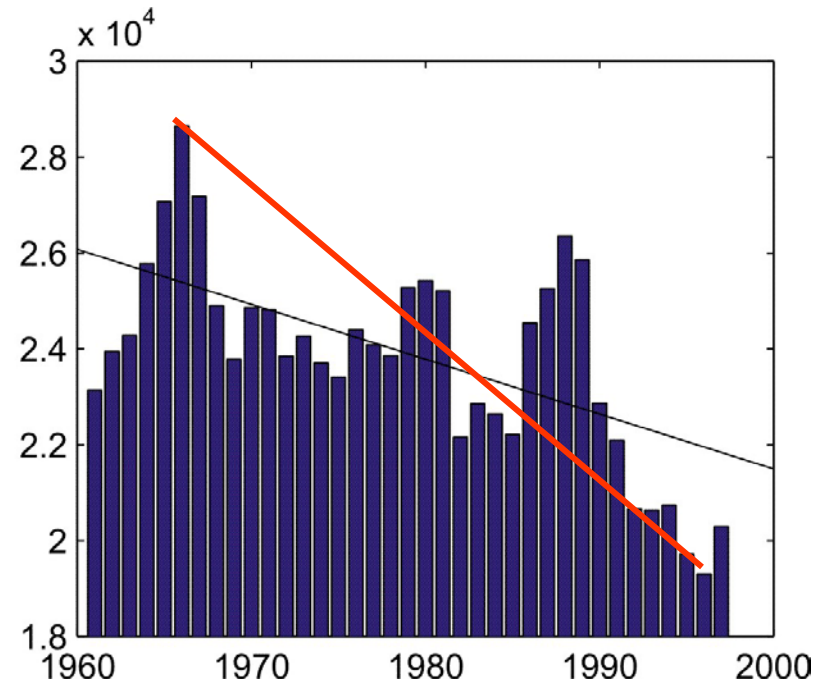
## **Data Format - NetCDF**

We have adopted NetCDF as the AOMIP standard for data format and exchange.

# Long term changes in Arctic ice volume

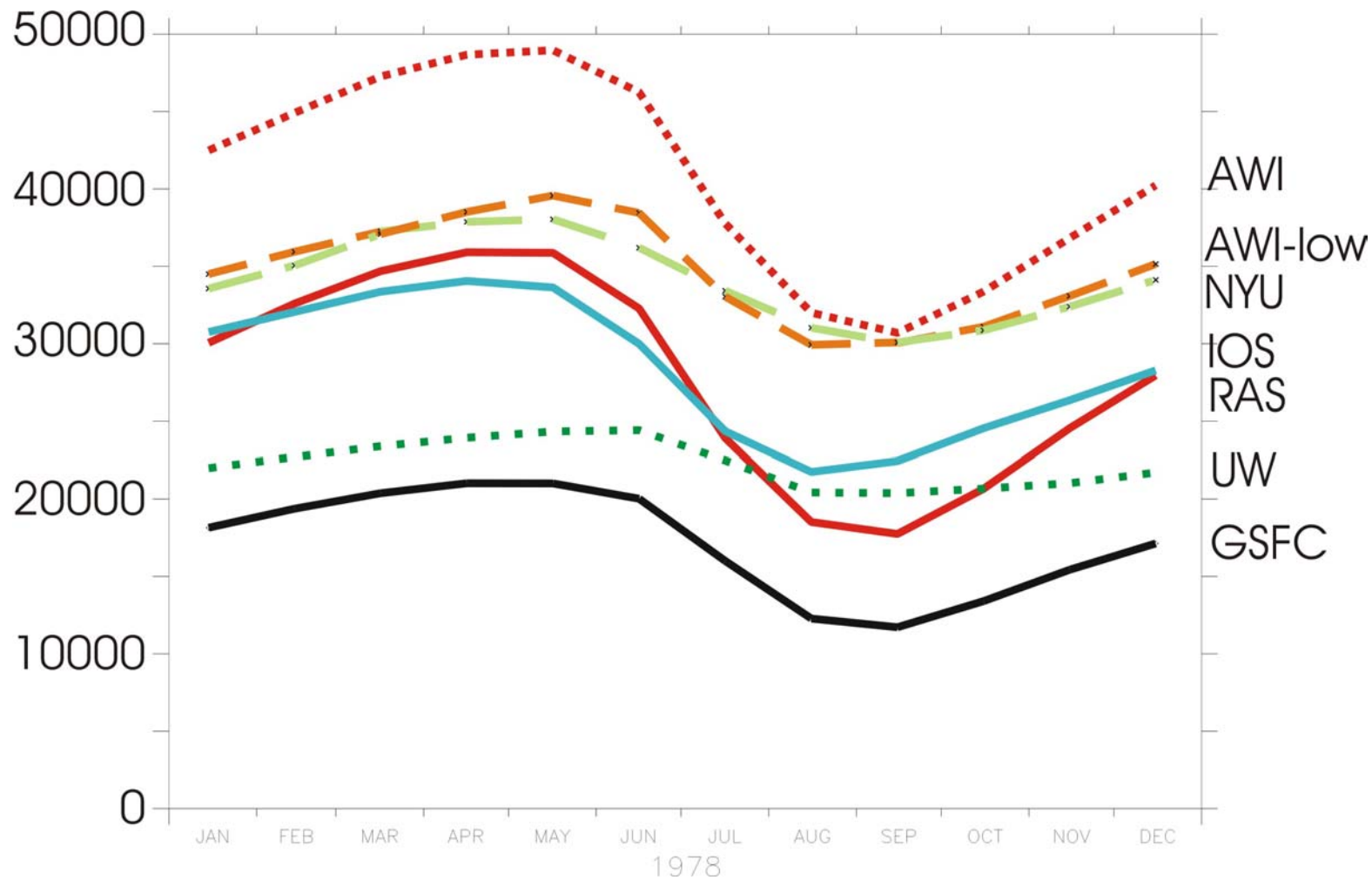


Ice export from Arctic

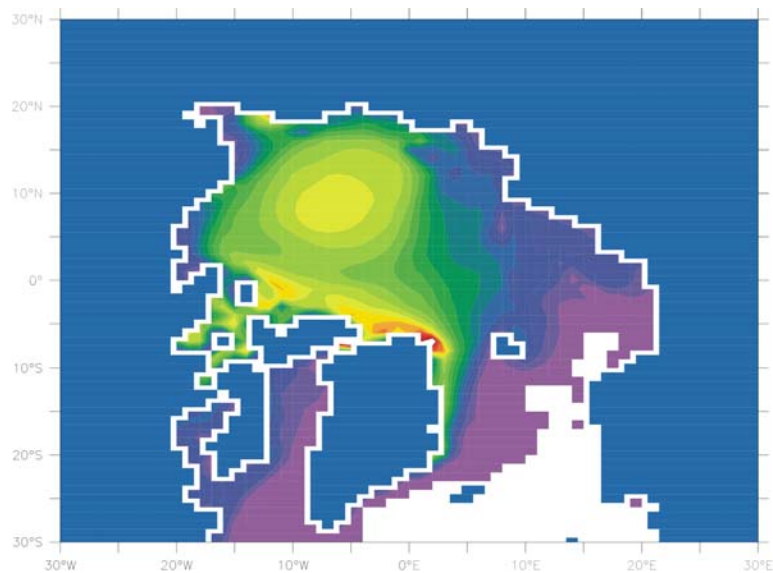


Arctic ice volume

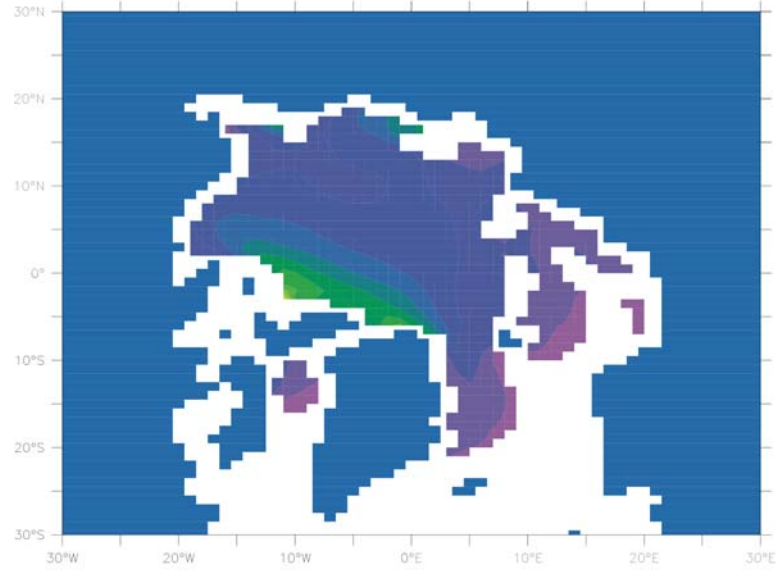
# Ice volume 1978



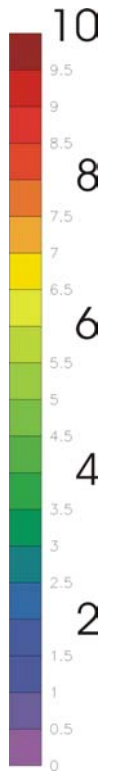
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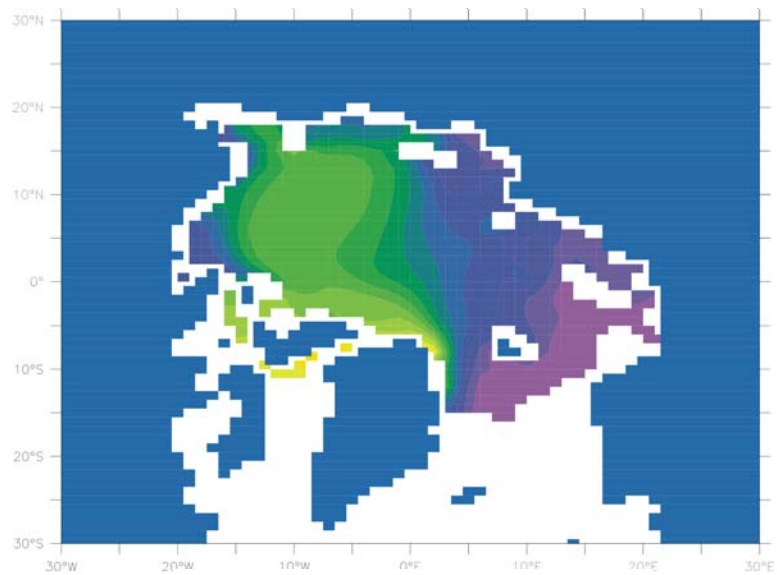


AWI high res

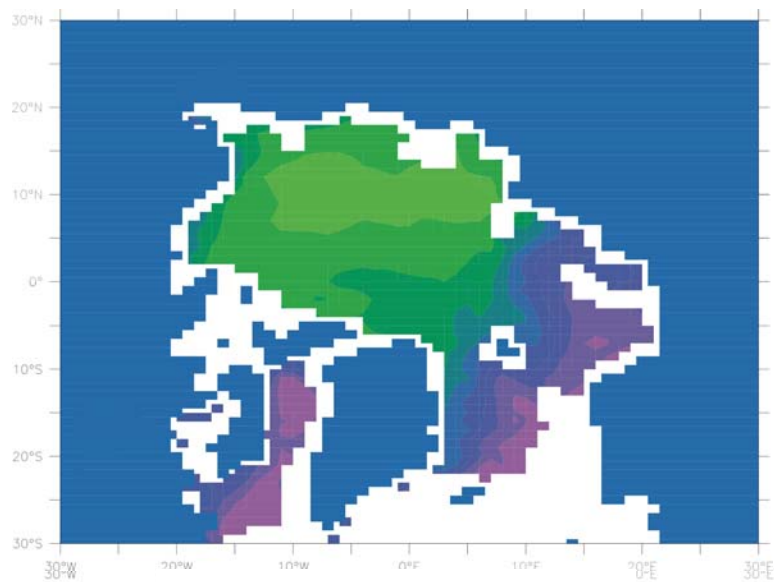


UW

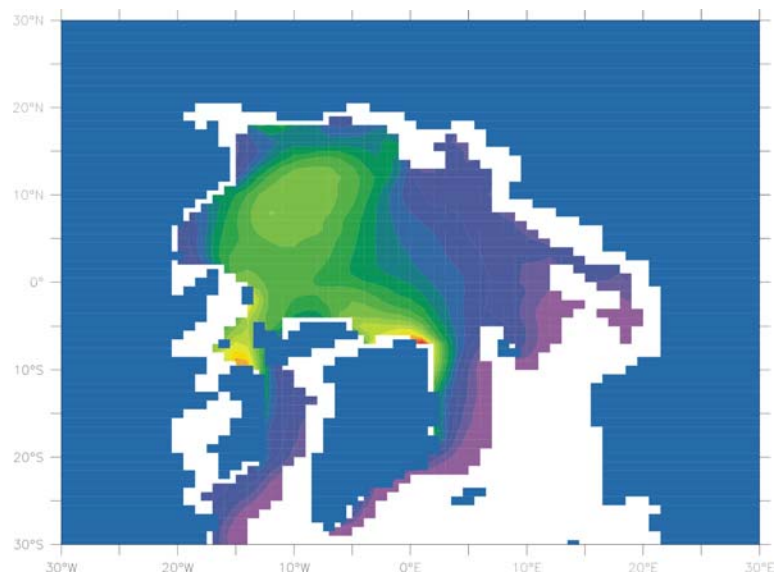




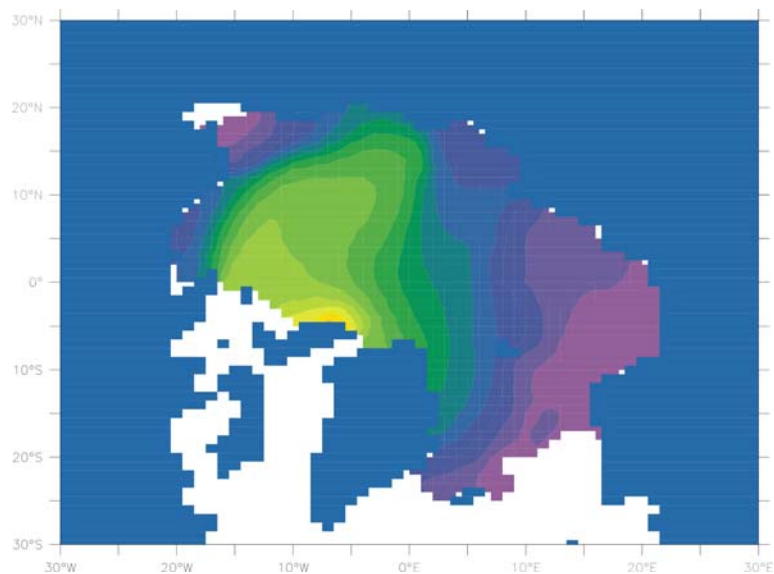
IOS



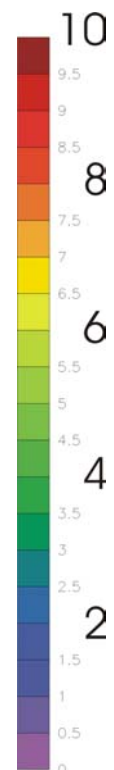
NYU



AWI low res

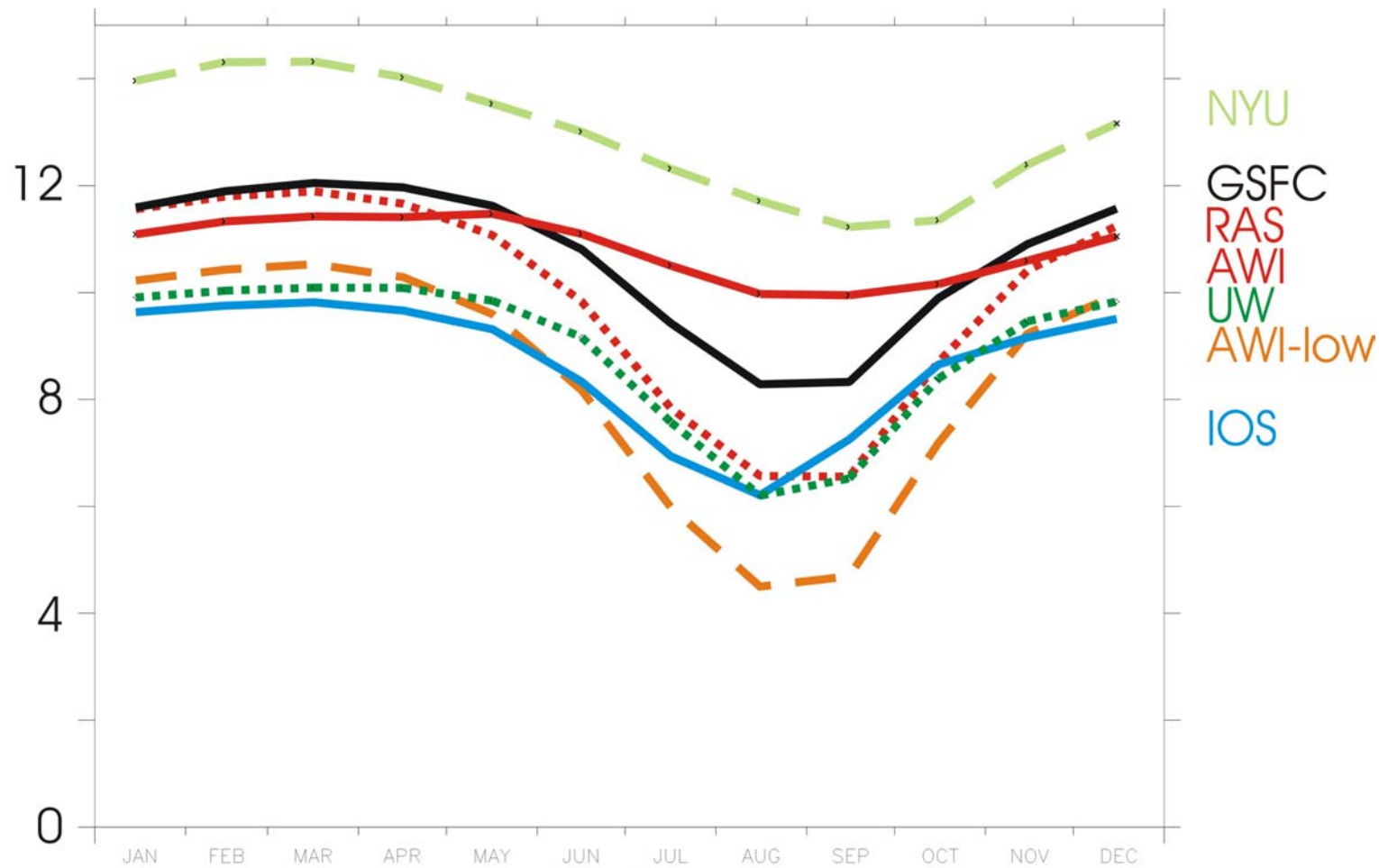


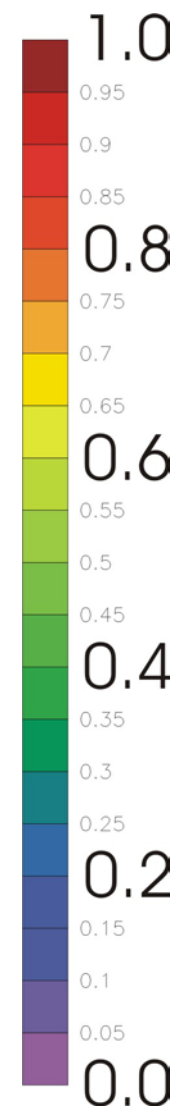
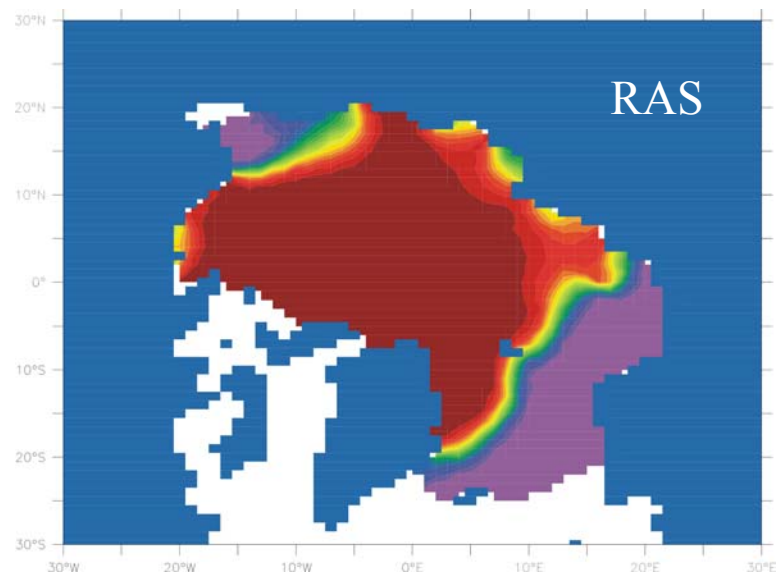
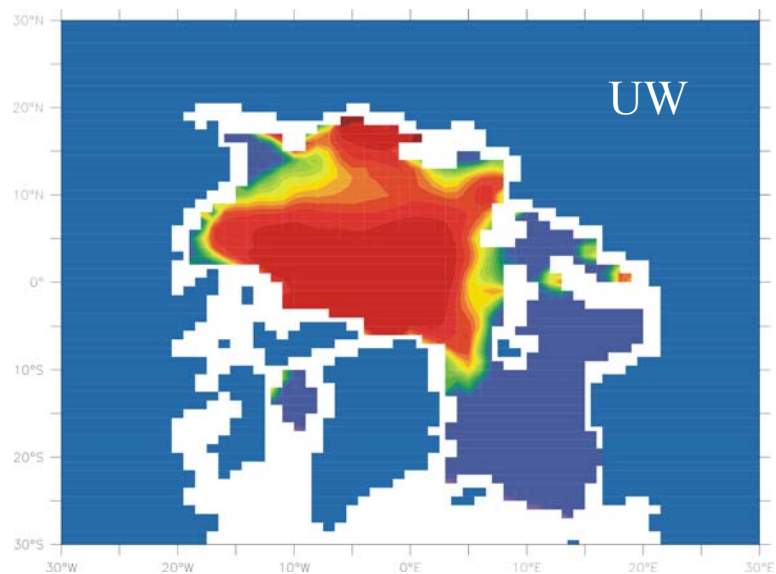
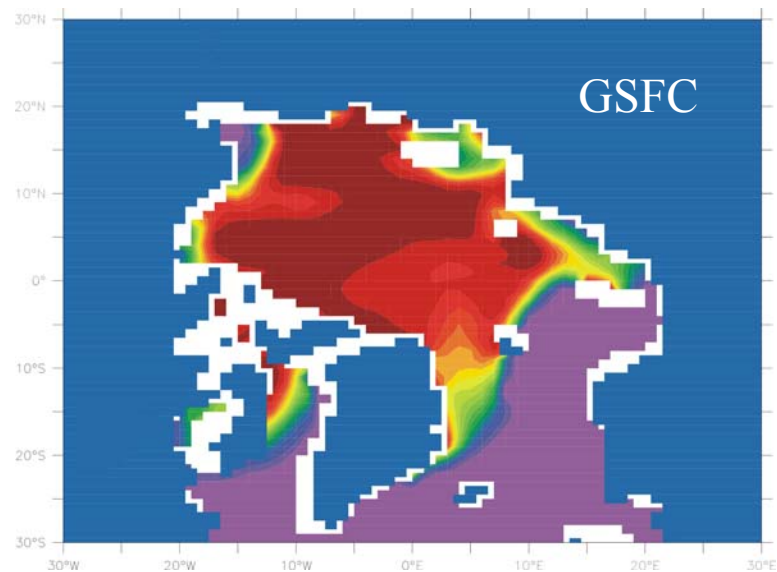
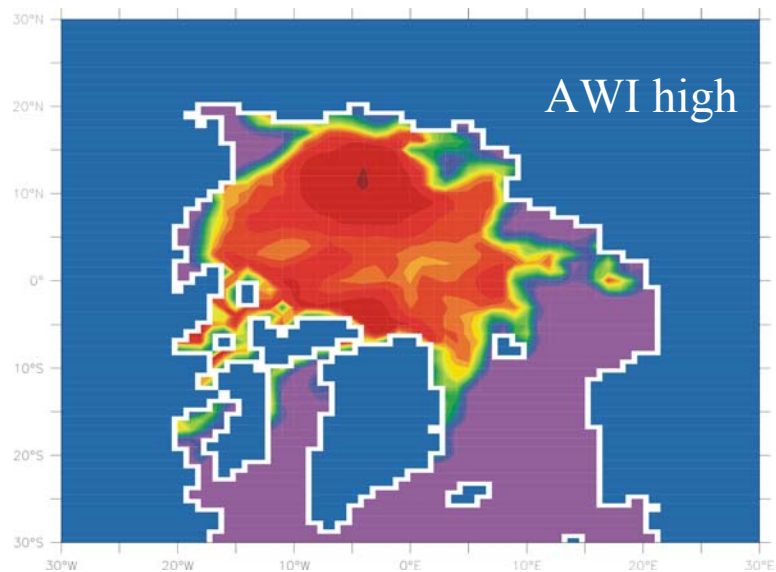
RAS



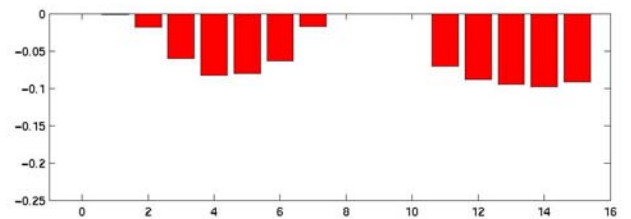
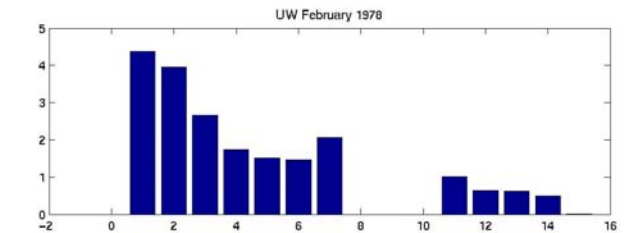
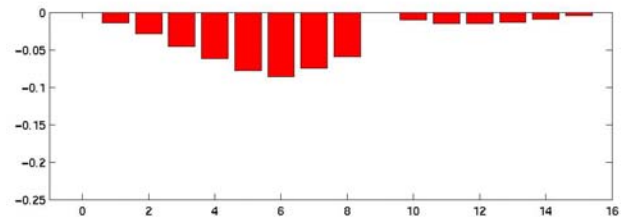
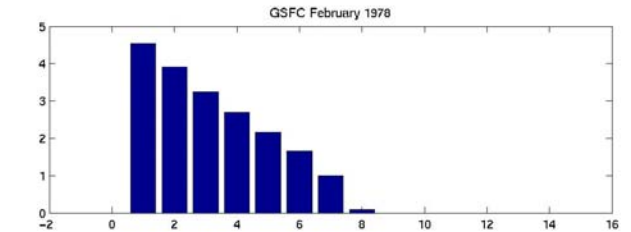
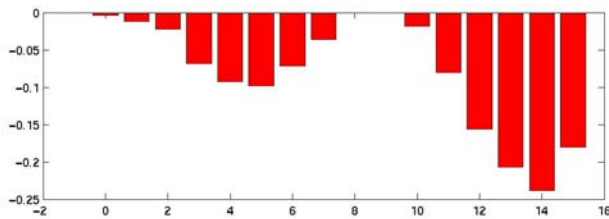
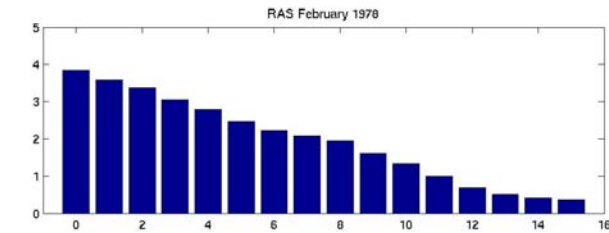
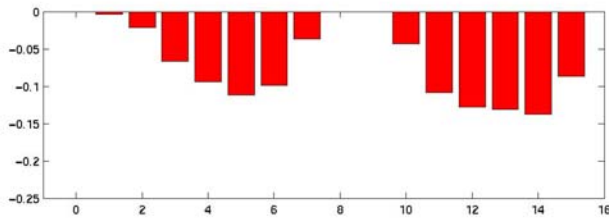
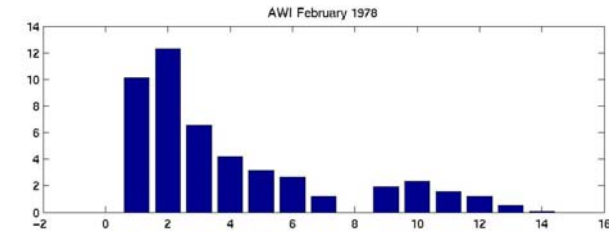


# Ice area 1978

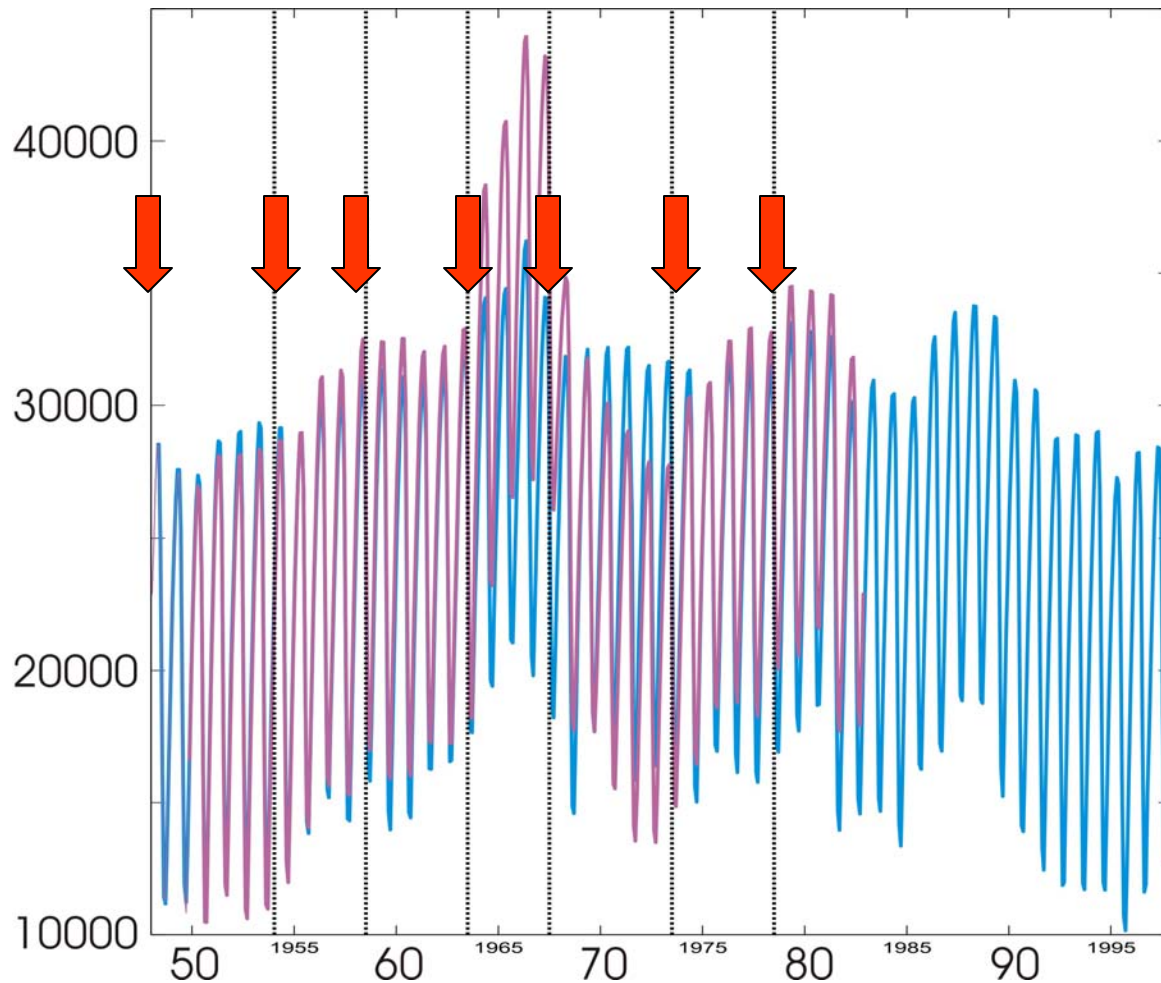




# Fram Strait



# Sensitivity - parameters



$P^*: 15000 \rightarrow 22500$

$P^*: 22500 \rightarrow 8500$

$c_a/c_w: 0.45 \rightarrow 0.55$

$h_o: 1.0 \rightarrow 2.0$

$h_o: 2.0 \rightarrow 0.5$

$h_{oo}: 0.5 \rightarrow 0.1$

$h_{oo}: 0.1 \rightarrow 0.35$

$h_o: 1.0 \rightarrow 1.2$

$$\frac{\partial A}{\partial t} + \nabla \cdot (\vec{u}A) = \frac{1-A}{h_o} G_h + h_{oo} \frac{A}{h} M_h$$

## Other parameters ...

- rheology
- snow model
- ice levels, categories ...
- other differences in ice thermodynamics
- oceanic conditions (stability, Atlantic layer, Bering Strait inflow, ...)
- ...

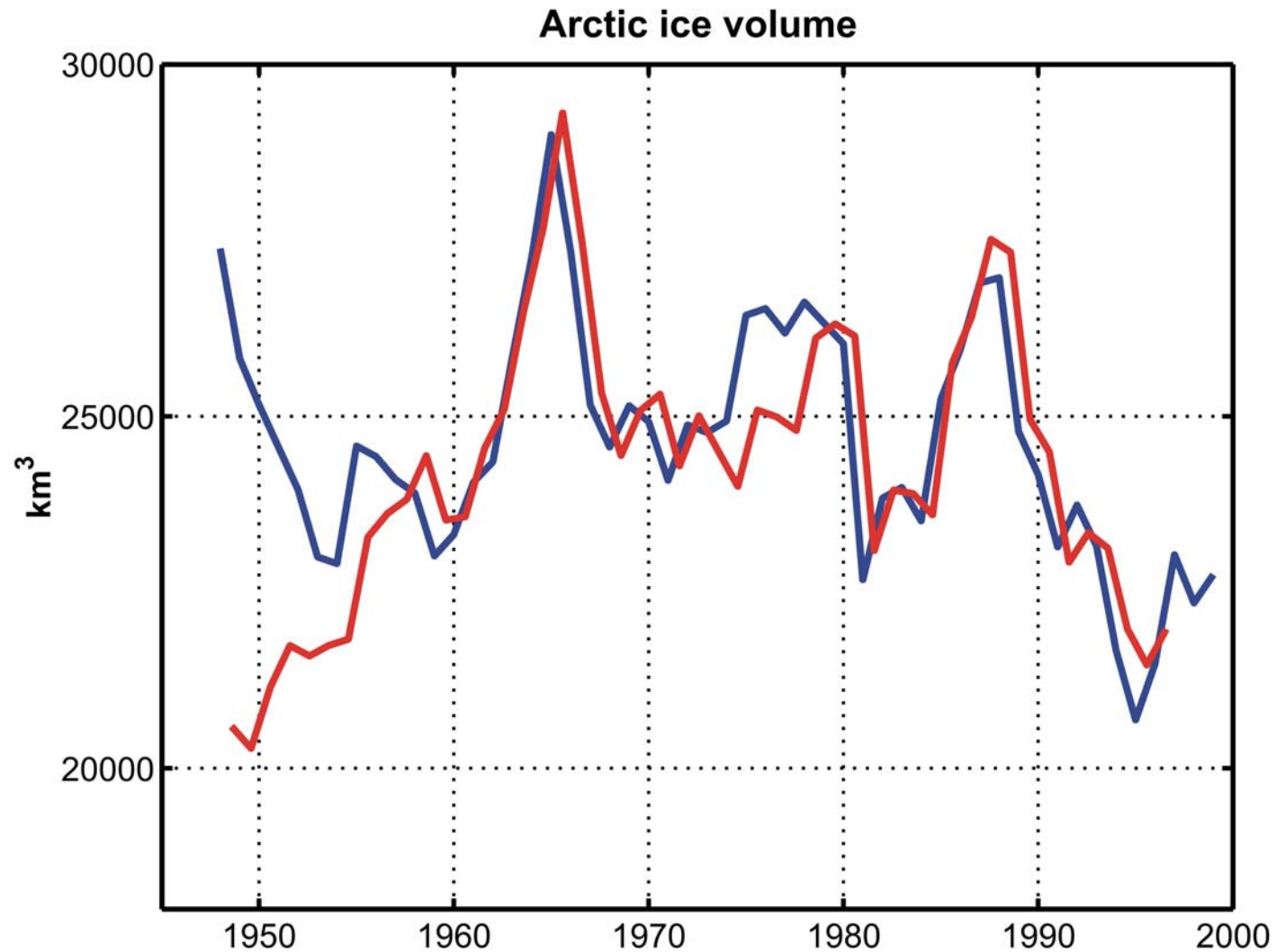
# Sensitivity - forcing



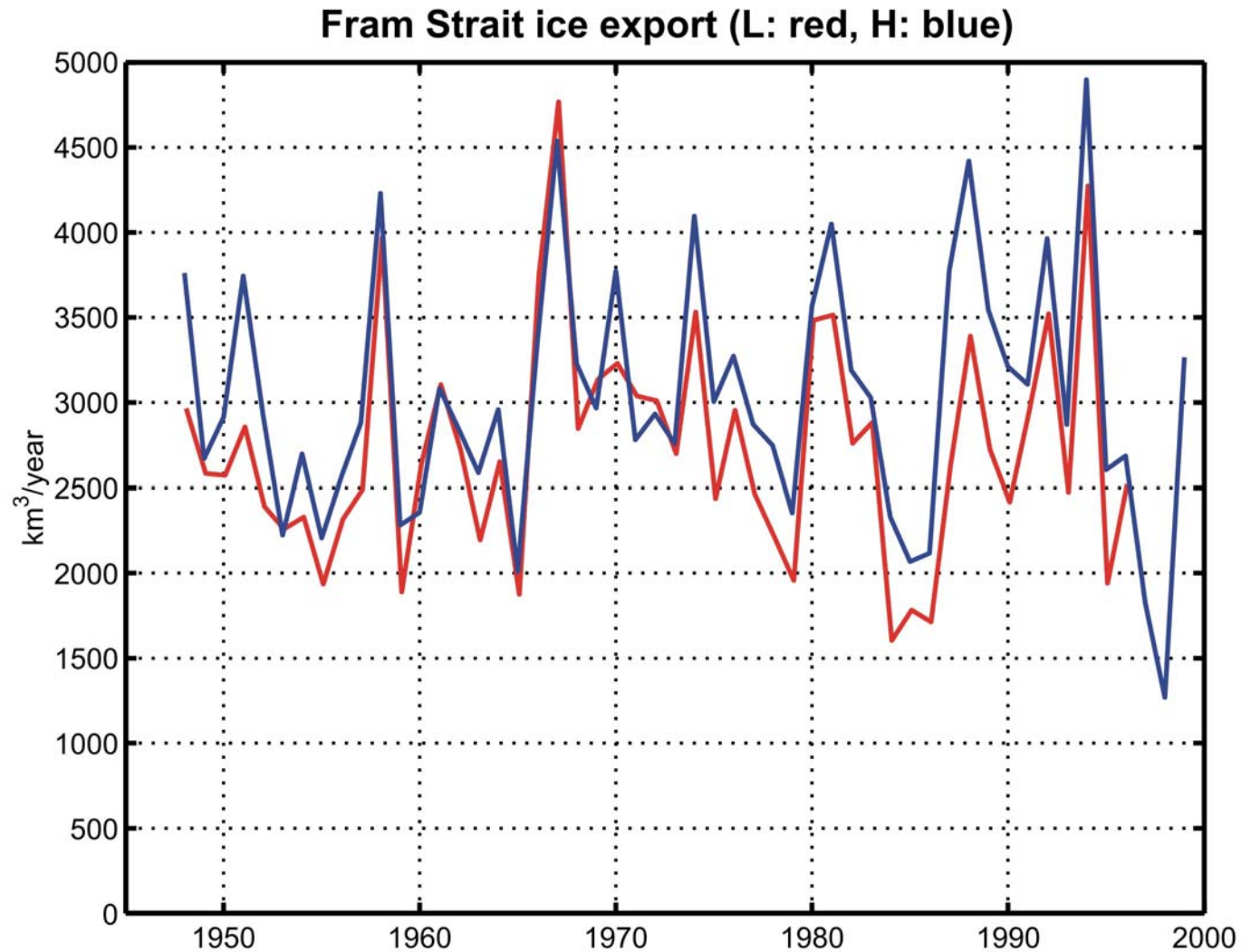
**May 1994: ECMWF**

**May 1994: NCEP**

# Sensitivity - resolution

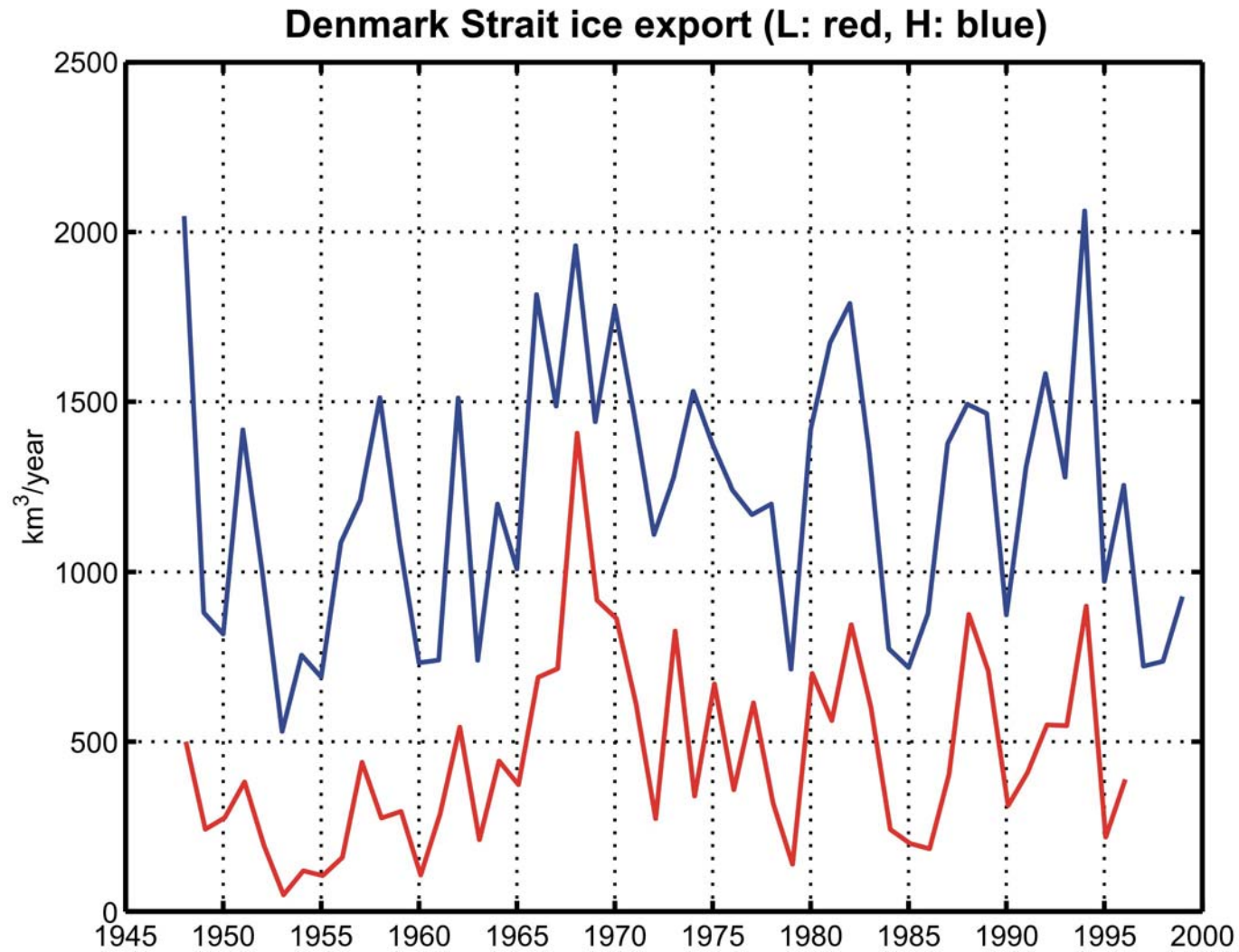


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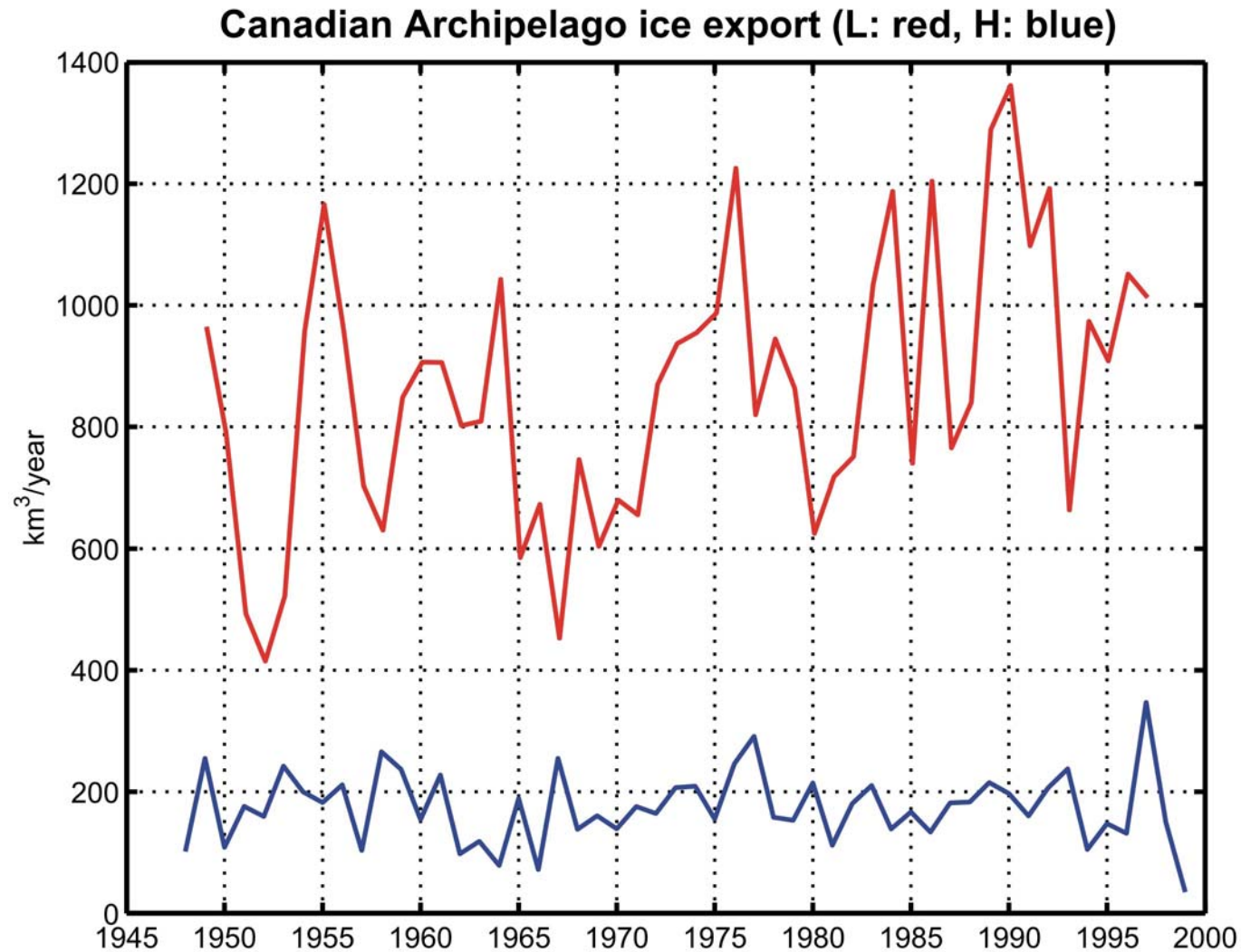




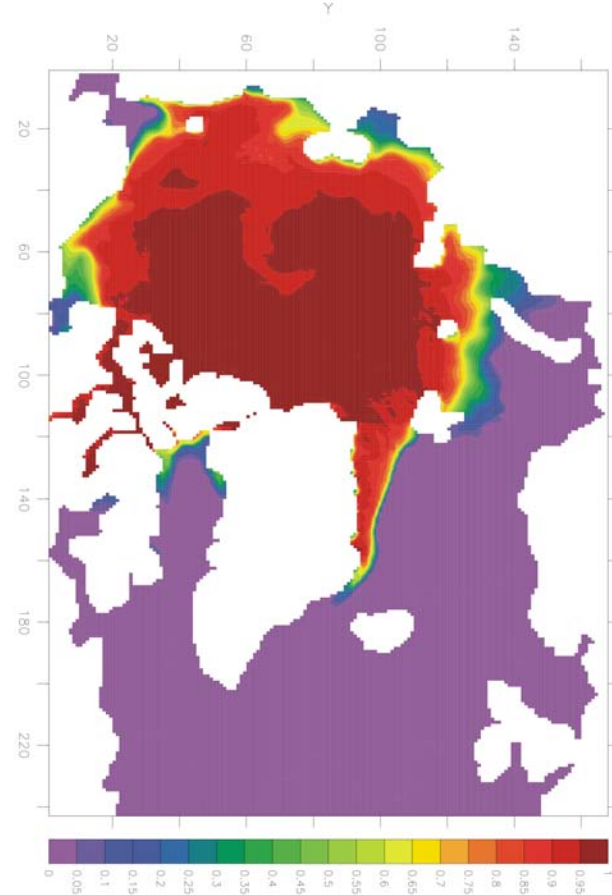
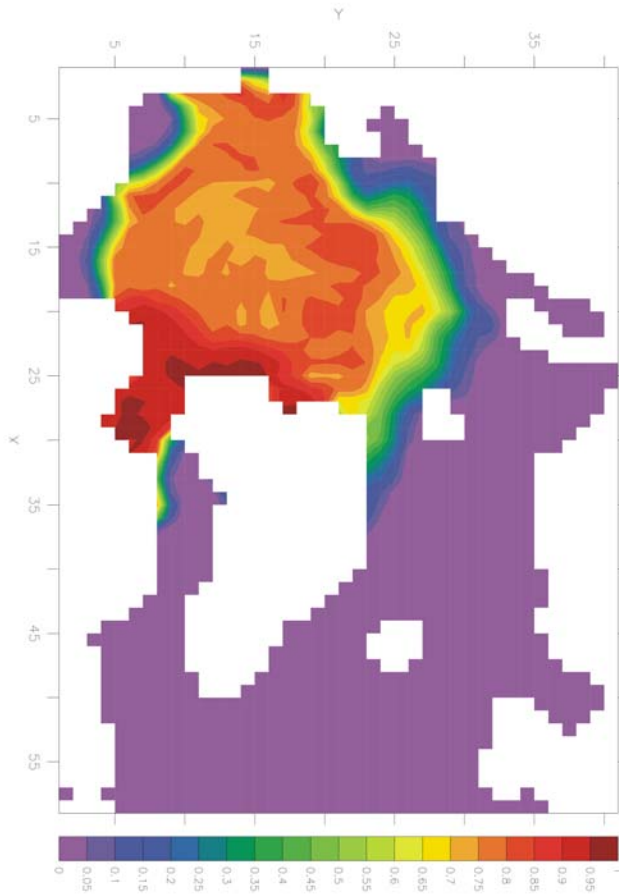
# Sensitivity - resolution



# Sensitivity - resolution

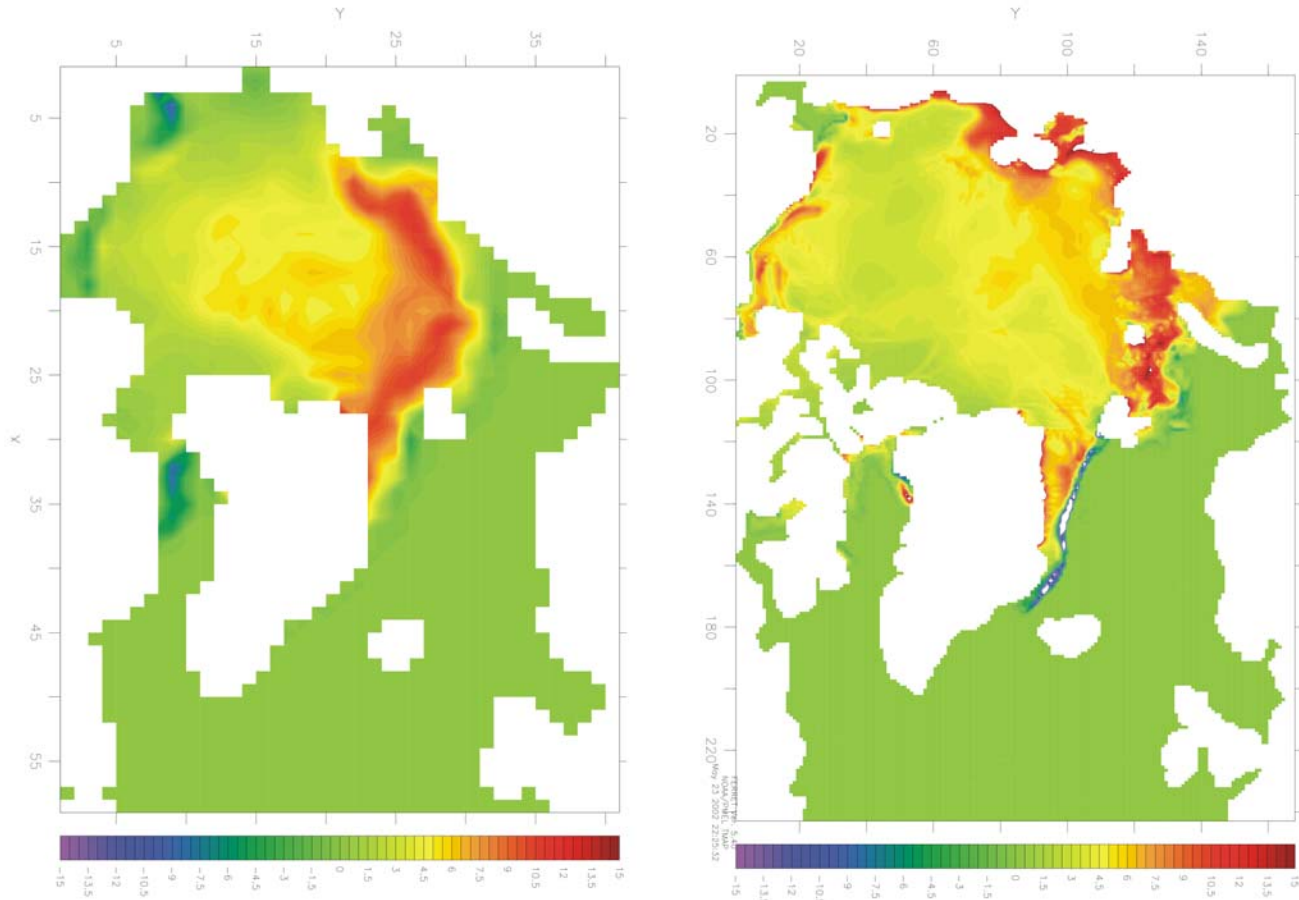


# Sensitivity - resolution



September 1988

# Sensitivity - resolution



September 1988

# Summary

- Large range in ice volume (similar spatial structure in most models)
- Large differences in seasonal range
- Sensitive to basal vs. lateral growth
- Large impact of forcing, esp. clouds
- Effect of Bering Strait on ice concentration