Initial Assessment of the CONCEPTS[1] Global ¼-deg Ocean and Sea-Ice Model

Collaborating Modelers:
Y Lu, J-M Belanger, F Roy, H Ritchie (EC)
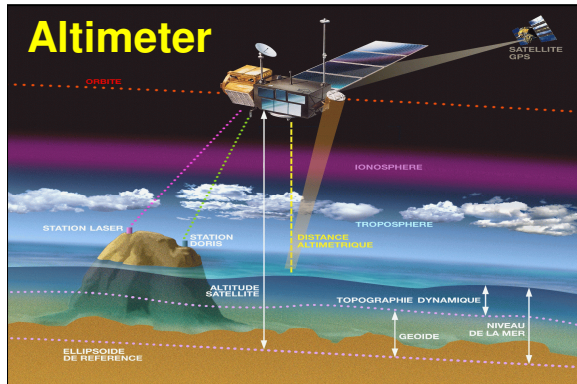**D Wright, Z Wang, F Dupont, G Holloway (DFO)**
G Garric (Mercator-Ocean)

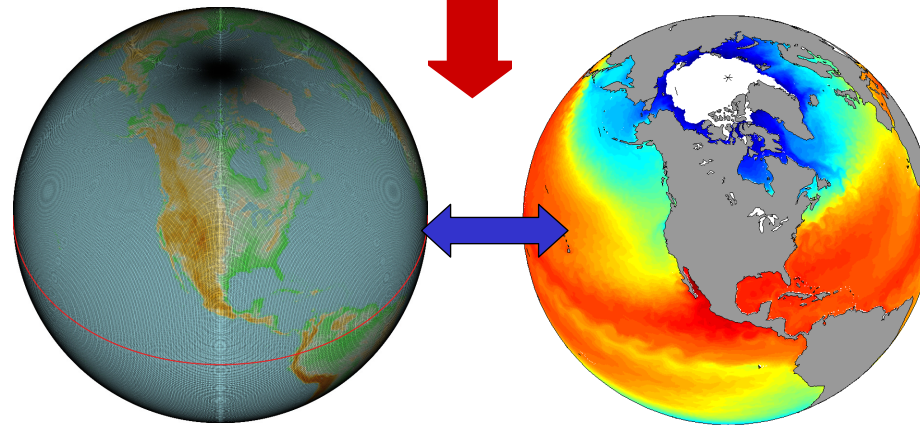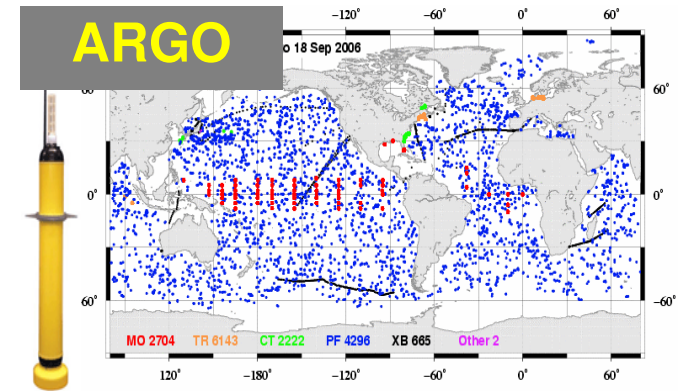**Observations and Analyses:**
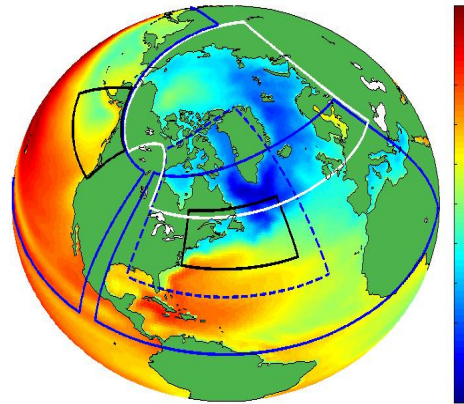**X Zhang, J Su, B Petrie, S Prinsenberg**

[1]**Canadian Operational Network of Coupled Environmental PredicTion Systems**

Summary of Goals
(CONCEPTS, GOAPP, COMDA)

Altimeter

**Ocean modelling &
Data Assimilation**

ARGO

Coupled Global NEMO/GEM

Ocean Model Description

- **Based on NEMO (Nucleus for European Modelling of the Ocean)**

- **Ocean component is OPA (3D, z-level, C-grid)**

- **Sea-ice module is LIM2: 2 layer sea-ice, 1 layer snow (future upgrading to LIM3 or CICE)**

- **Horizontal grids: global tri-polar configuration, nominal 1/4° in lat/long; ~12 km in Arctic, ~6 km in CAA**

- **Vertical grids :50 levels (1 m thick near surface)**

Grid spacing (km)
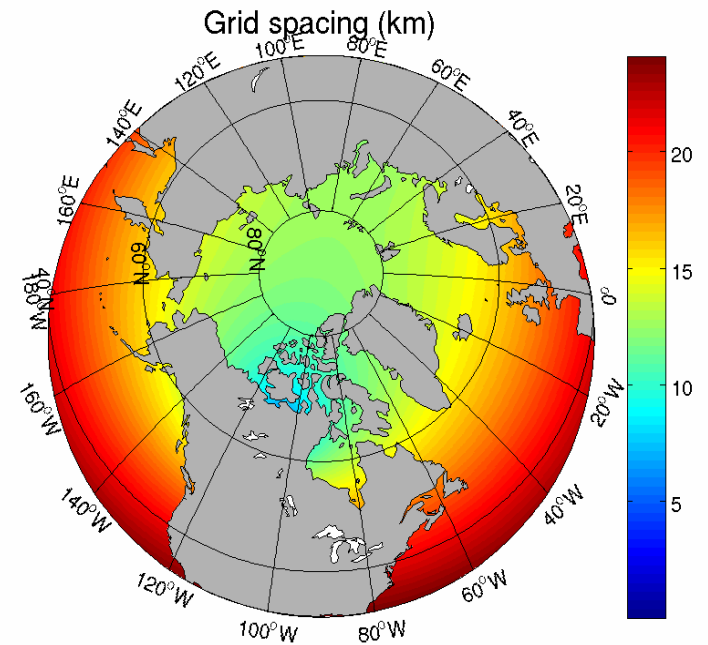
Forcing and Simulations

- Bulk formulae take atmospheric variables (from ECMWF, NCEP, GEM)

  -- 10m wind, surface air temperature, cloud cover, relative humidity, precipitation

- River runoff (adds to precipitation near river mouths)

- No need for sea surface temperature (SST) restoring

- Still needs sea surface salinity (SSS) restoring (to avoid model drifting)

- Spin-up simulation: using daily climatology compiled for OMIP (derived from ECMWF reanalysis); initialized with January T-S climatology; model integrated for 6 years

- 10-day forecast using 3-hourly GEM forcing

Snapshot of Sub-surface flow


Velocity at 10 m, Dec 31, Year 6
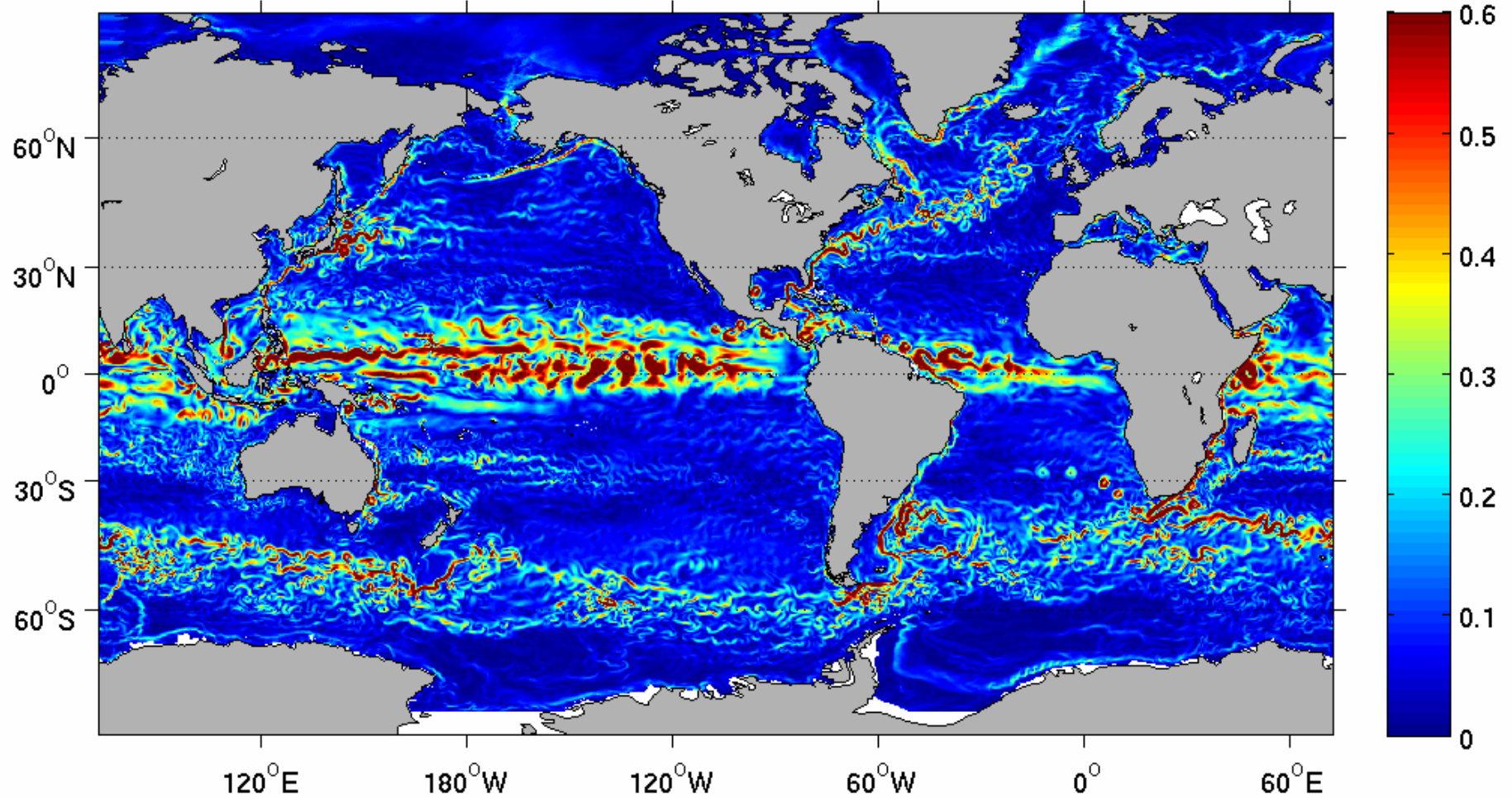
Model Assessment in Progress

- Meso-scale eddy variability

- Intra-seasonal variability in tropics

- Sea-ice and circulation in the Arctic Ocean and the Canadian Arctic Archipelago (CAA)

- North-eastern Pacific hydrographic variability

Meso-scale eddy variability:
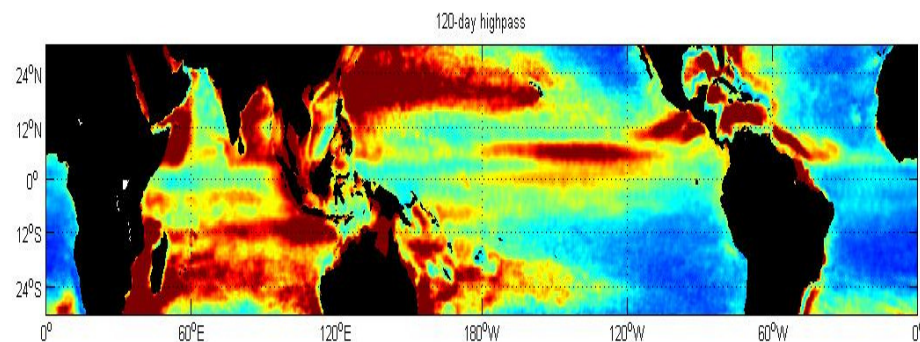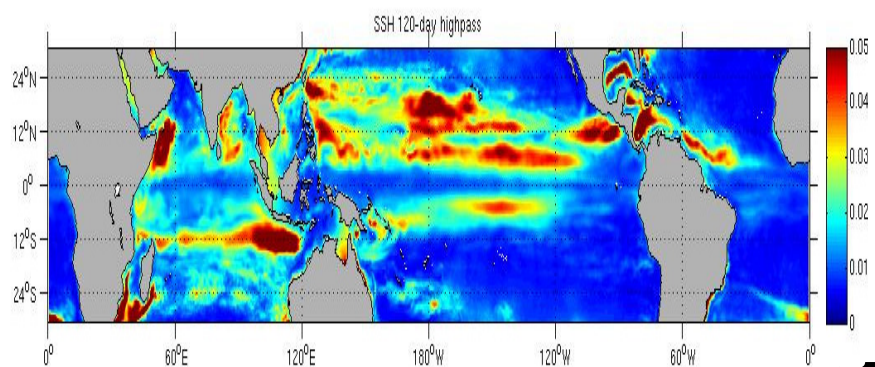## Sea level standard deviation
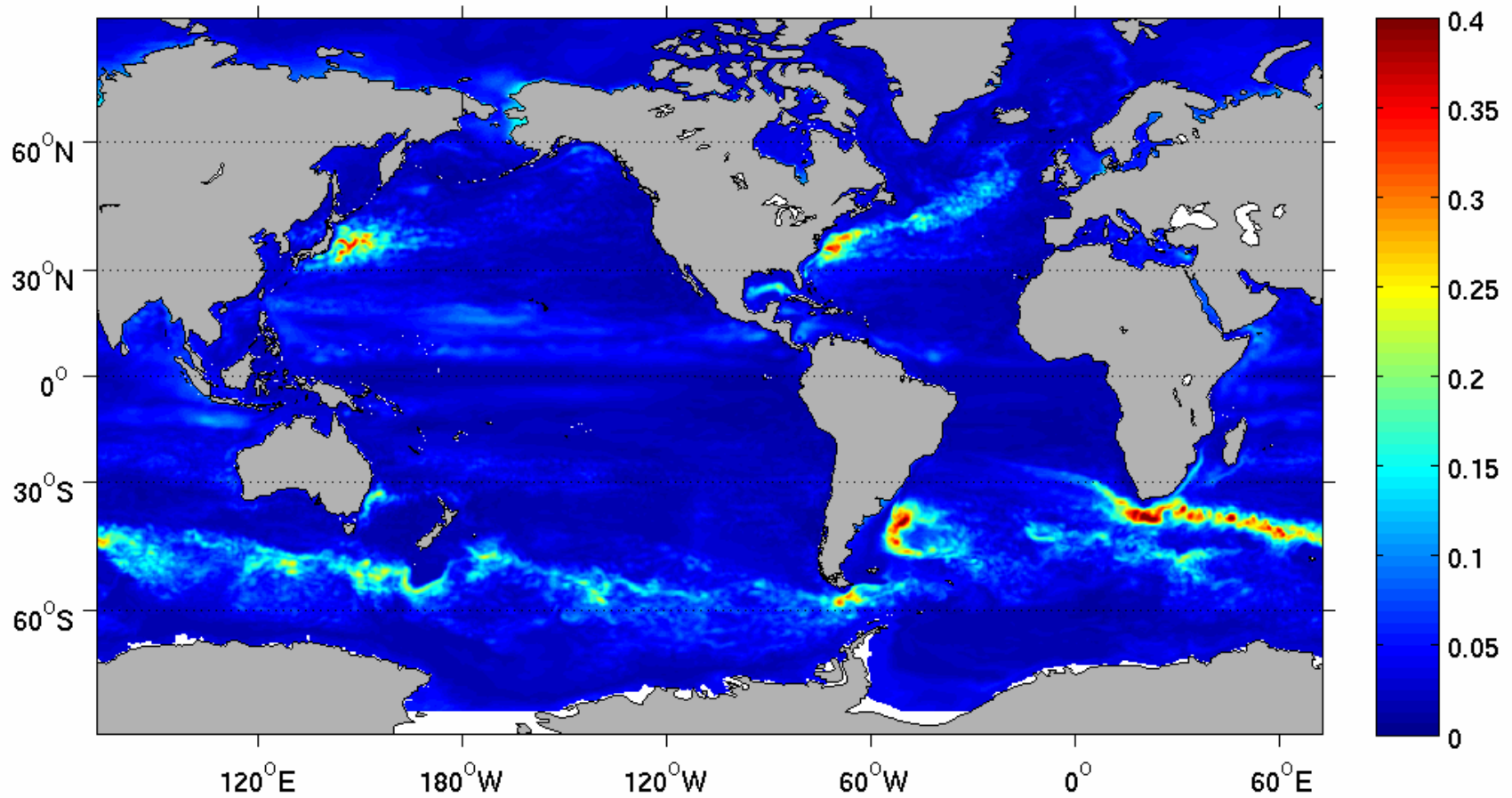
Meso-scale eddy variability:
Sea level skewness
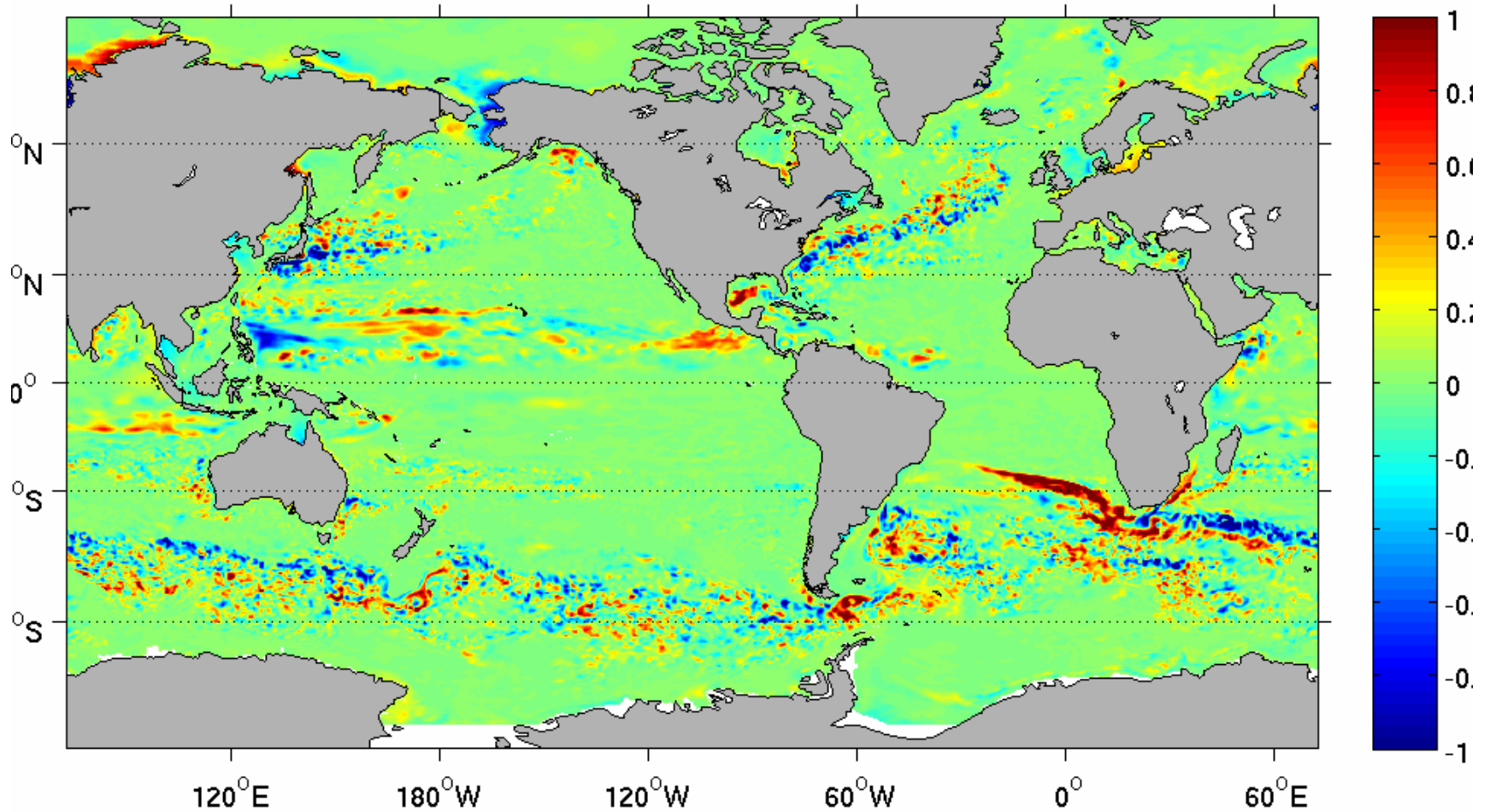
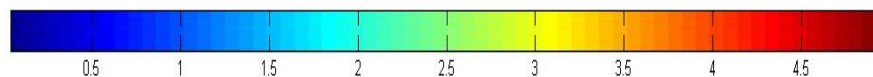# Intra-seasonal variability in tropics:
Sea level standard deviation

Model

Observation
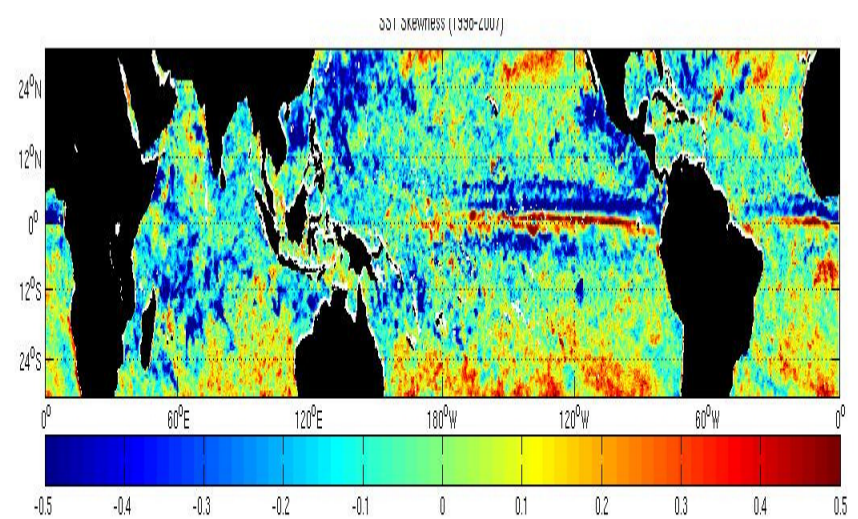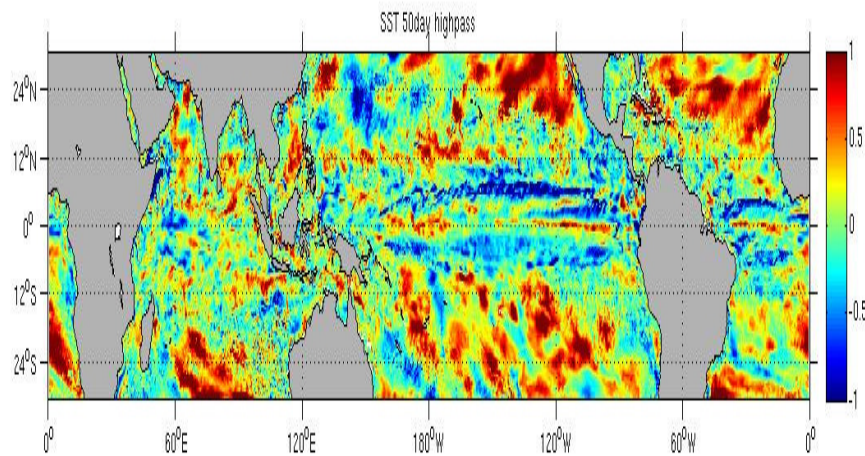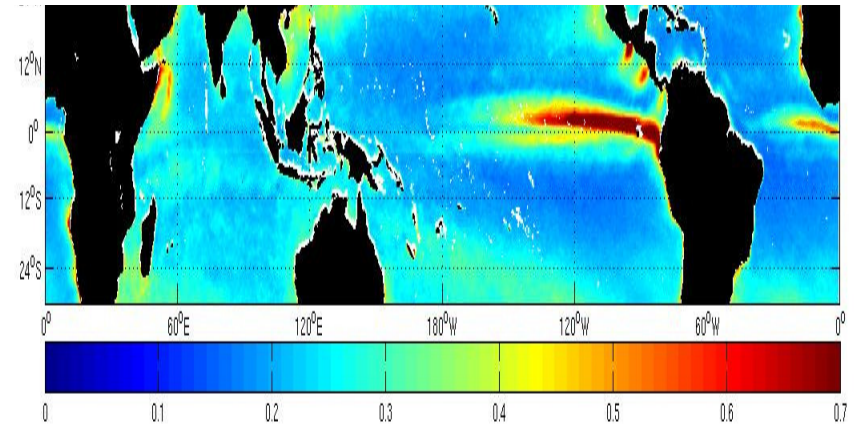

<120d

40-120d
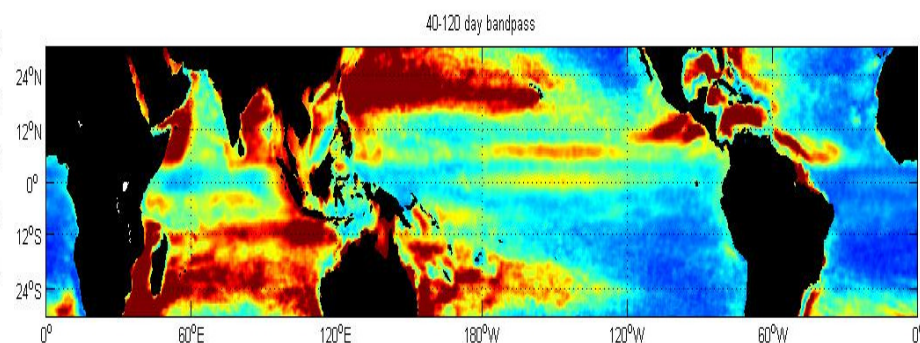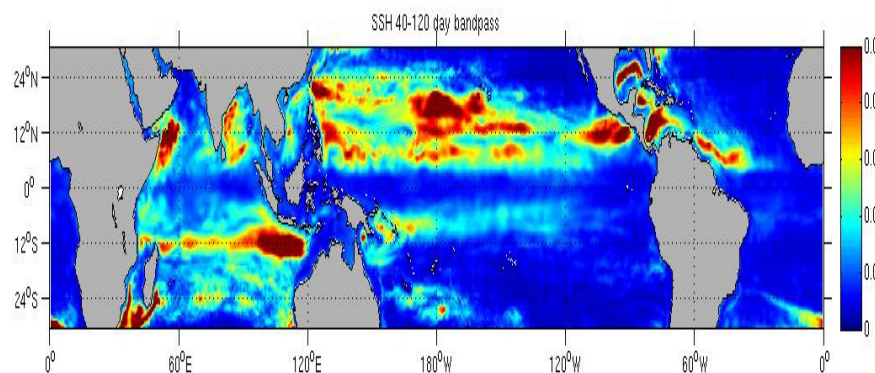
Intra-seasonal variability in tropics:
SST standard deviation and skewness (< 50 day band)

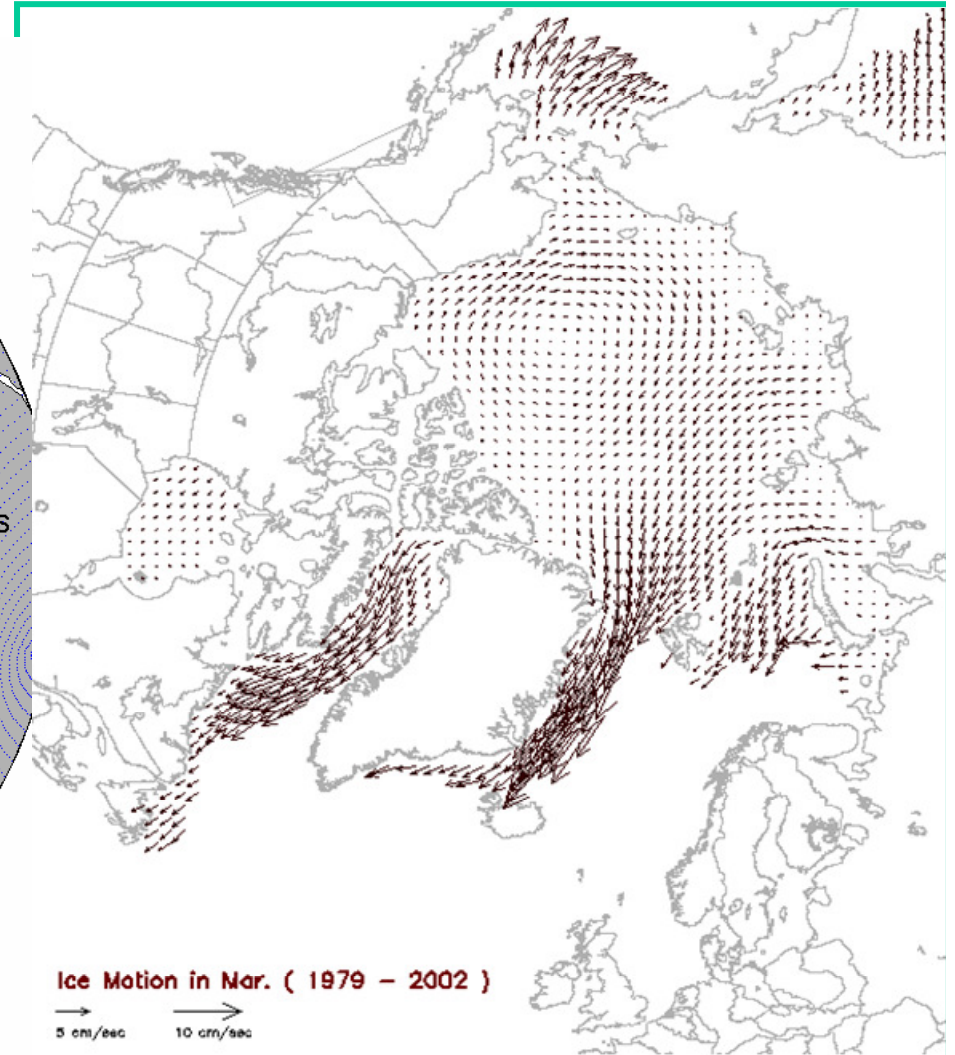**Model**   **Observation**
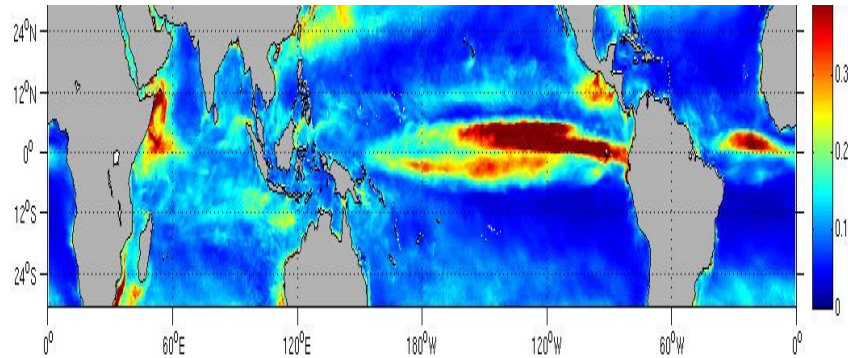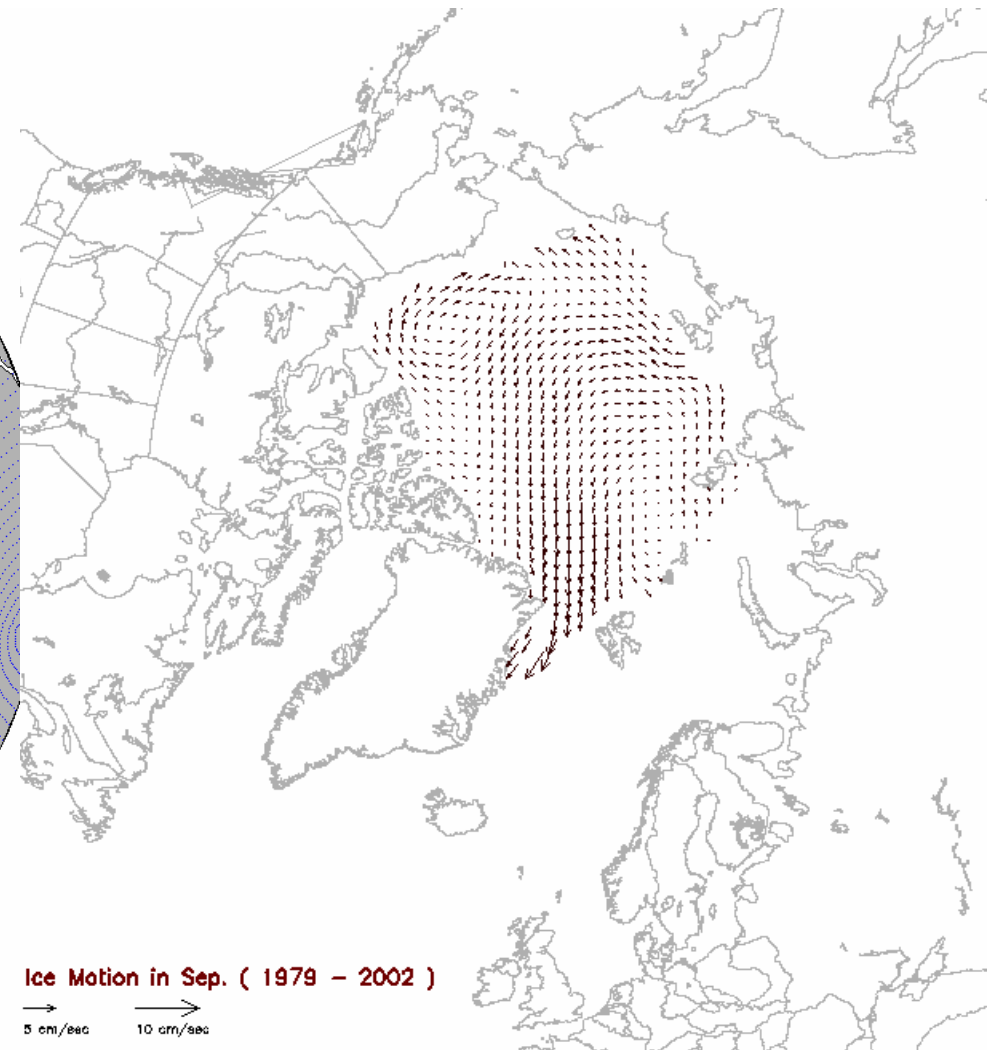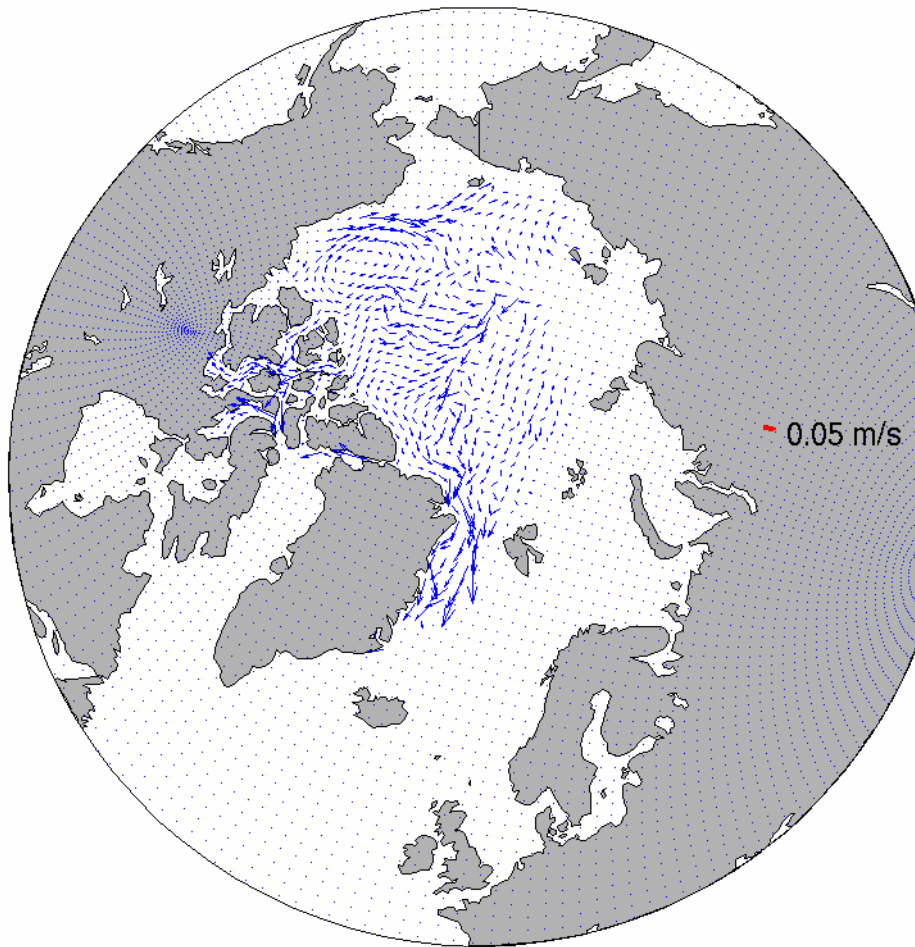
Ice Motion (March)
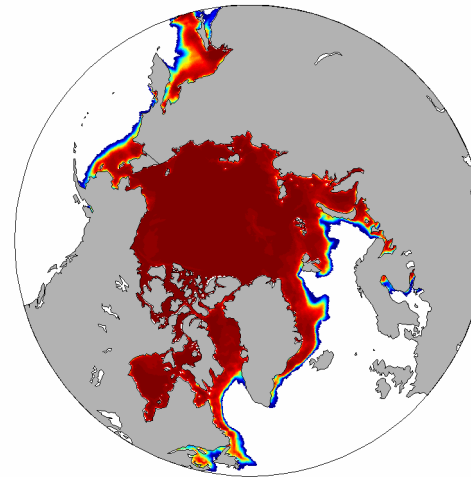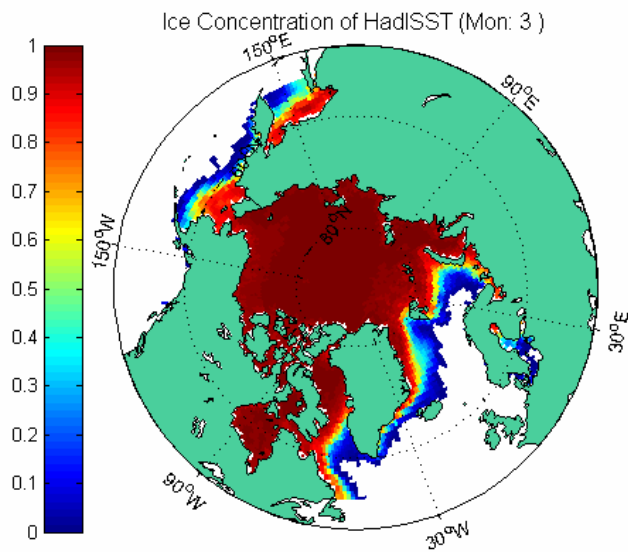
1/4° model
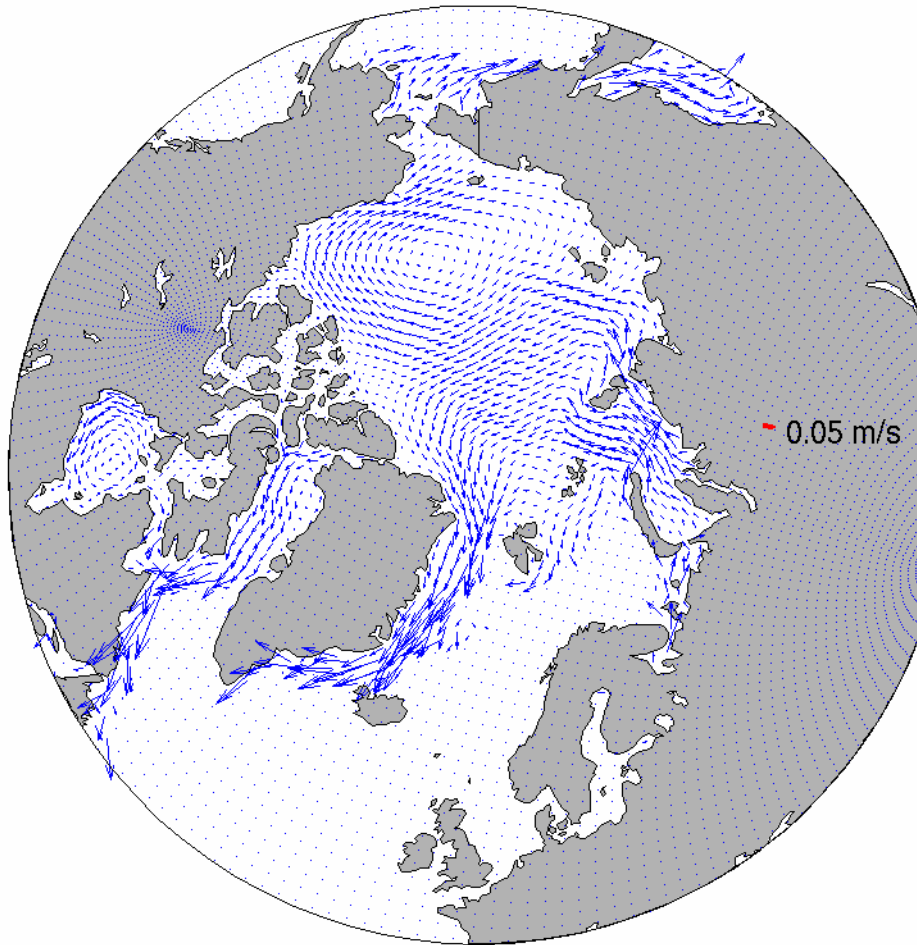
Observations
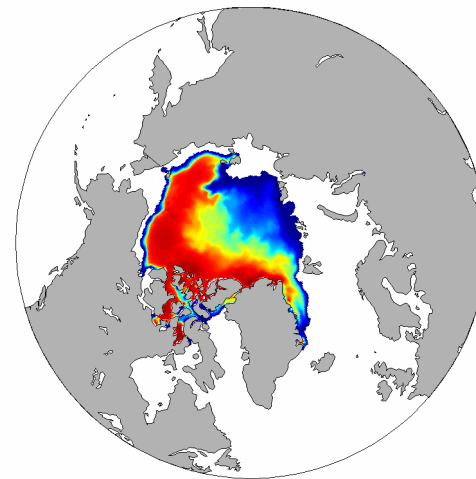
Ice Motion (September)

1/4° model

Observations

0.05 m/s

Ice Motion in Sep. (1979 – 2002)

5 cm/sec   10 cm/sec

N. H. Sea-Ice Concentration

HadISST

1/4° model

Ice Concentration of HadISST (Mon: 3)
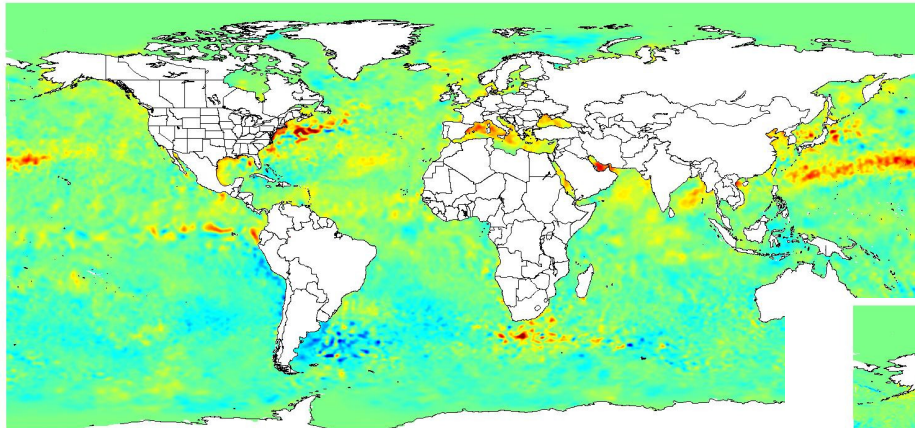
March
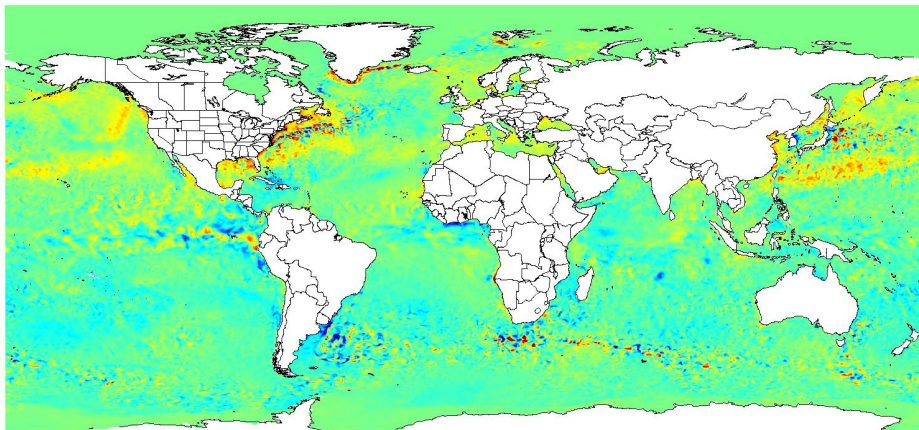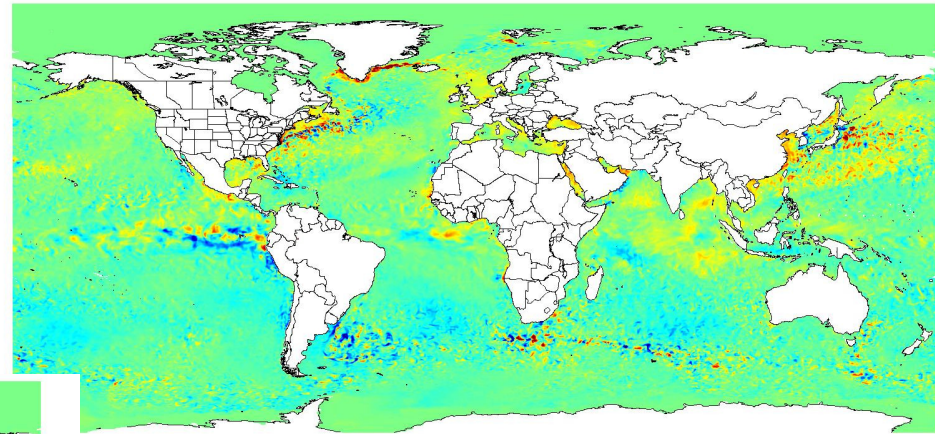
Ice Concentration of HadISST (Mon: 9)
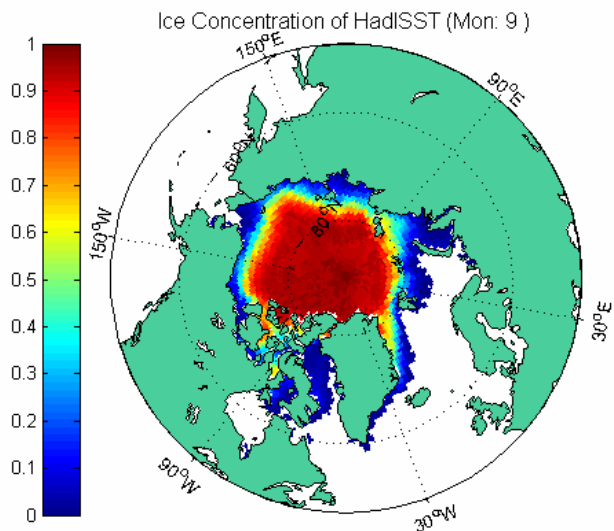
September

Initial Ocean Forecast Assessment
SST trend over a 10-day cycle (April 19-28, 2007)

CMC analysis based on observations

Forecast with ECMWF forcing

Forecast with GEM forcing

Summary: Initial Assessment

Global meso-scale eddy variability:

Eddy distribution and strength reasonable; no spin-down of major ocean currents

Tropical intra-seasonal variability:

Model captures part of the variability associated with tropical instability and Rossby waves (lack of Kevin waves because of using climatological forcing)

Arctic and CAA:

Nearly stationary seasonal cycle obtained 4-5 years into simulation; Sea-ice distribution and drifts agree with observations

(Model reasonably reproduces seasonal flow through Barrow Strait, Bering Strait and Davis Strait)

Initial ocean forecast test:

Forecasts of SST trends are similar using GEM and ECMEF forcing; encouraging for coupled model development

Further assessments:

Other regions (e.g., North-eastern Pacific); Inter-annual (and longer time-scale) variability