

Bering10K multi-decadal (1980-2100) simulations

1. refresher of what we covered in Day1
2. classification of simulations & examples
3. sneak peek of decadal projections

What is an ocean circulation model?

- Mechanistic equations describing thermodynamics, fluid dynamics and biogeochemical cycling of elements
- Solved numerically (grid, algorithms, forcing, time stepping, IO...)
- obtain state variables (T/S/U, biomass and so on) at specific spatial points and times (subject to model spatial resolution and archiving interval)

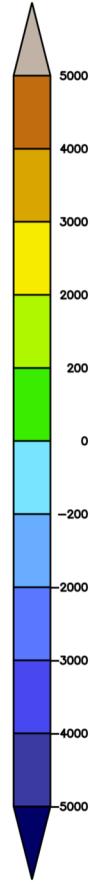
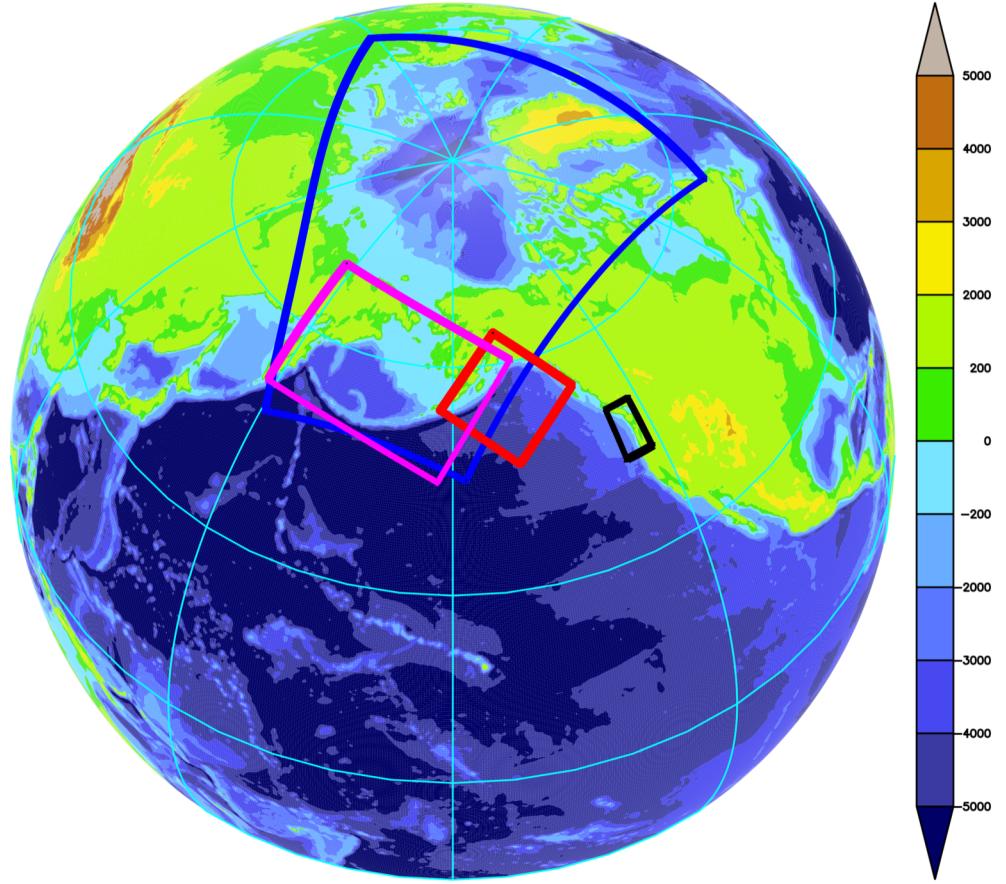
$$S(x_i, y_i, z_i, t_i)$$

where x_i, y_i, z_i is the model “grid” and t_i steps through time

so we have full 3D picture of the evolving system

but ...

- Model simulations should be used with caution
 - they have biases, large or small (bias correction)
 - our knowledge of Nature is incomplete
- a good model (particularly those with data assimilation) still captures Nature's essence
- Model simulations are best used for
 - I. hypothesis testing
 - II. process understanding
 - III. predictions
- “three legged stool” by M. Sigler
 - observations, modeling, and lab experiments



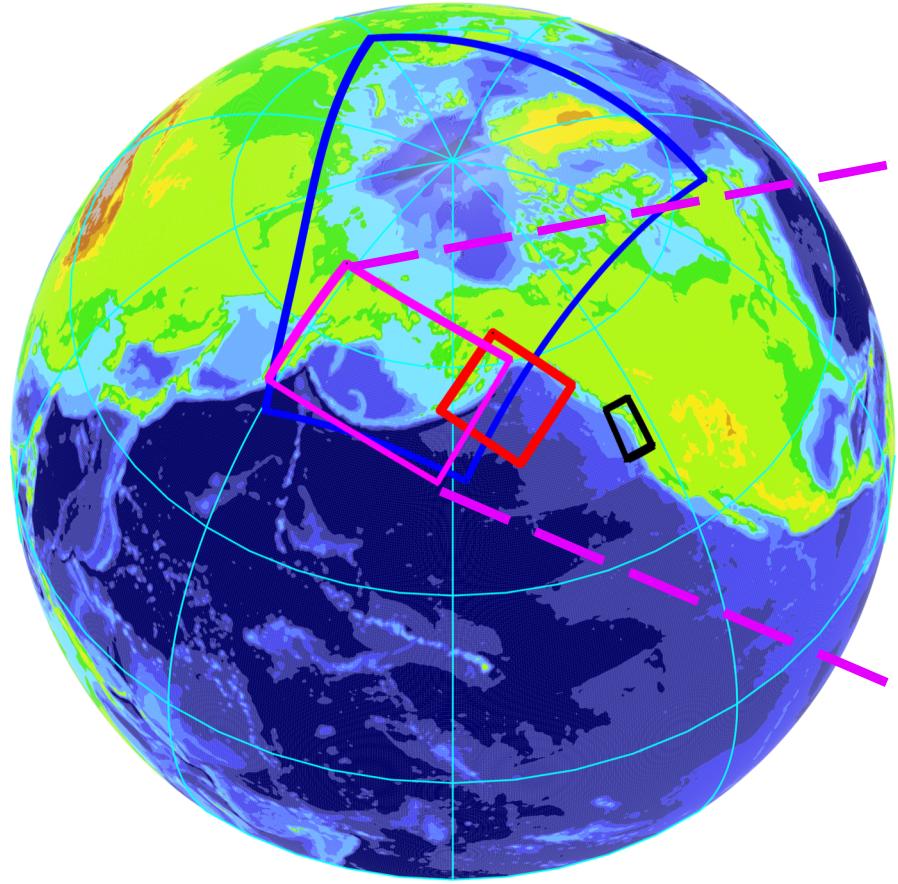
modeling regions and resolution

pan-Arctic: 5-9 km

Bering Sea: 10 km

G of Alaska: 3 km

Pac. NW: 1.5 km



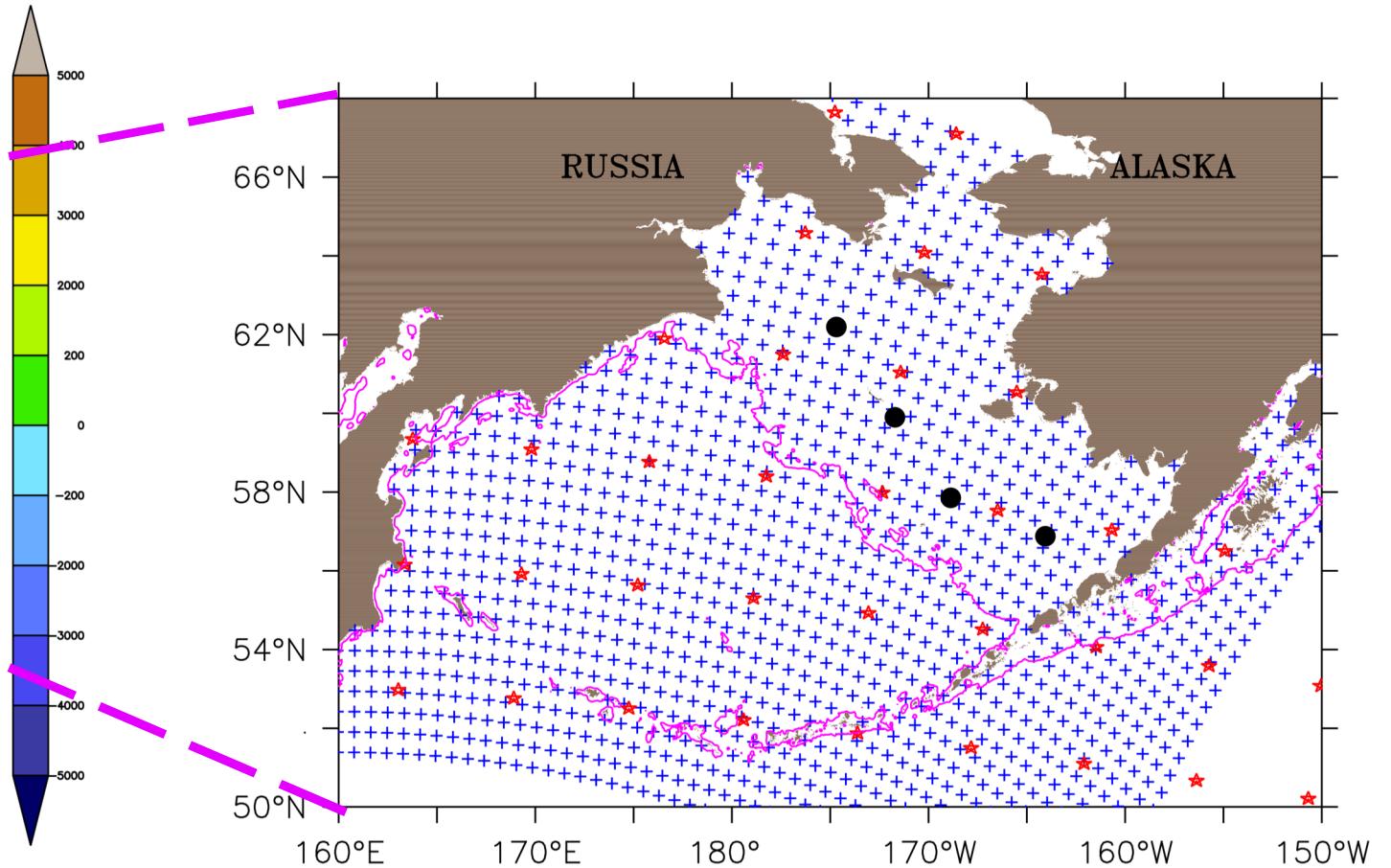
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+ : Bering Sea model 10 km
 ☆: CMIP model nominal 1°
 : PMEL moorings

} 1/5 of grid points in both directions

name calling 😊

1. Reanalysis driven hindcast: ~1980 to present

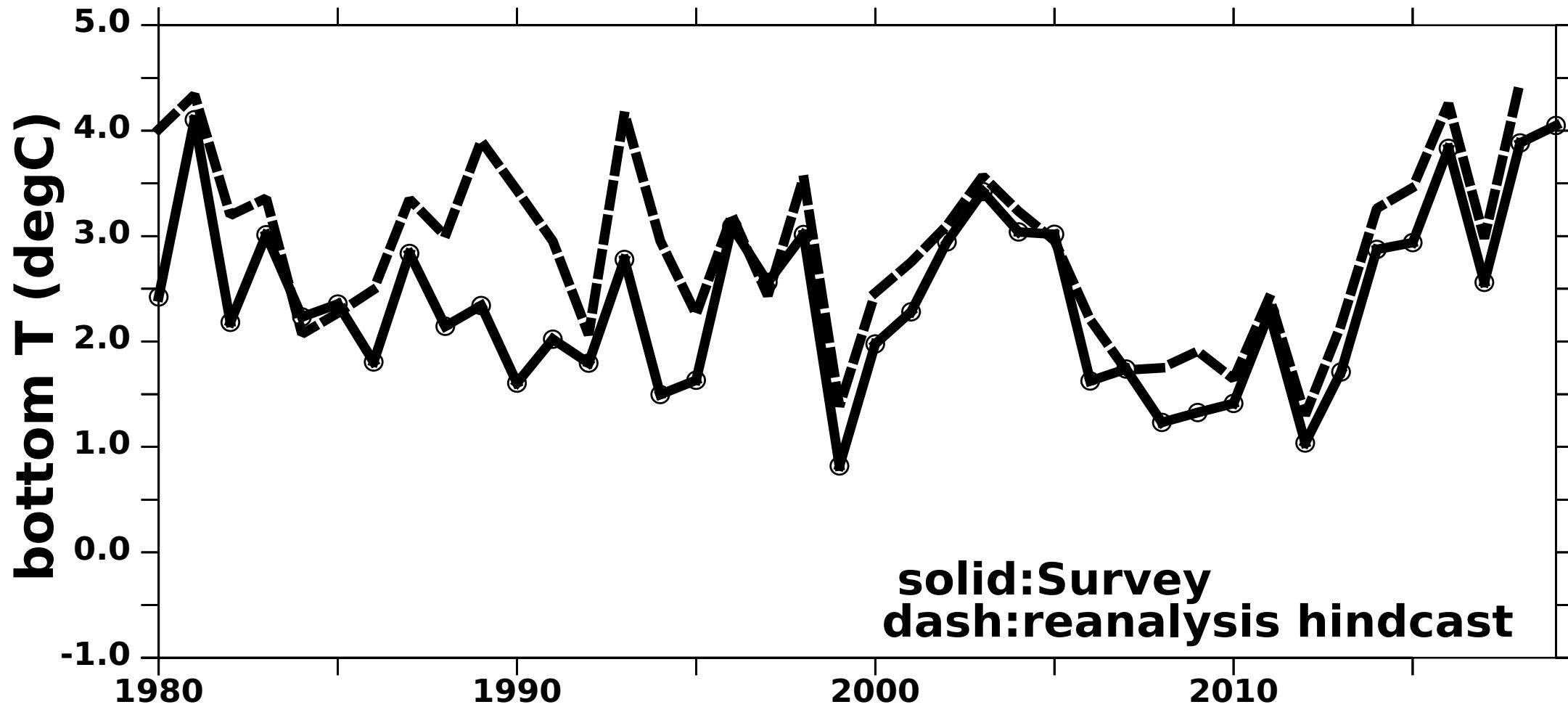
reanalysis is the best estimate of the past, directly comparable to observations
“nowcast” – the most recent hindcast, eg, July 2020 – Dec 2020

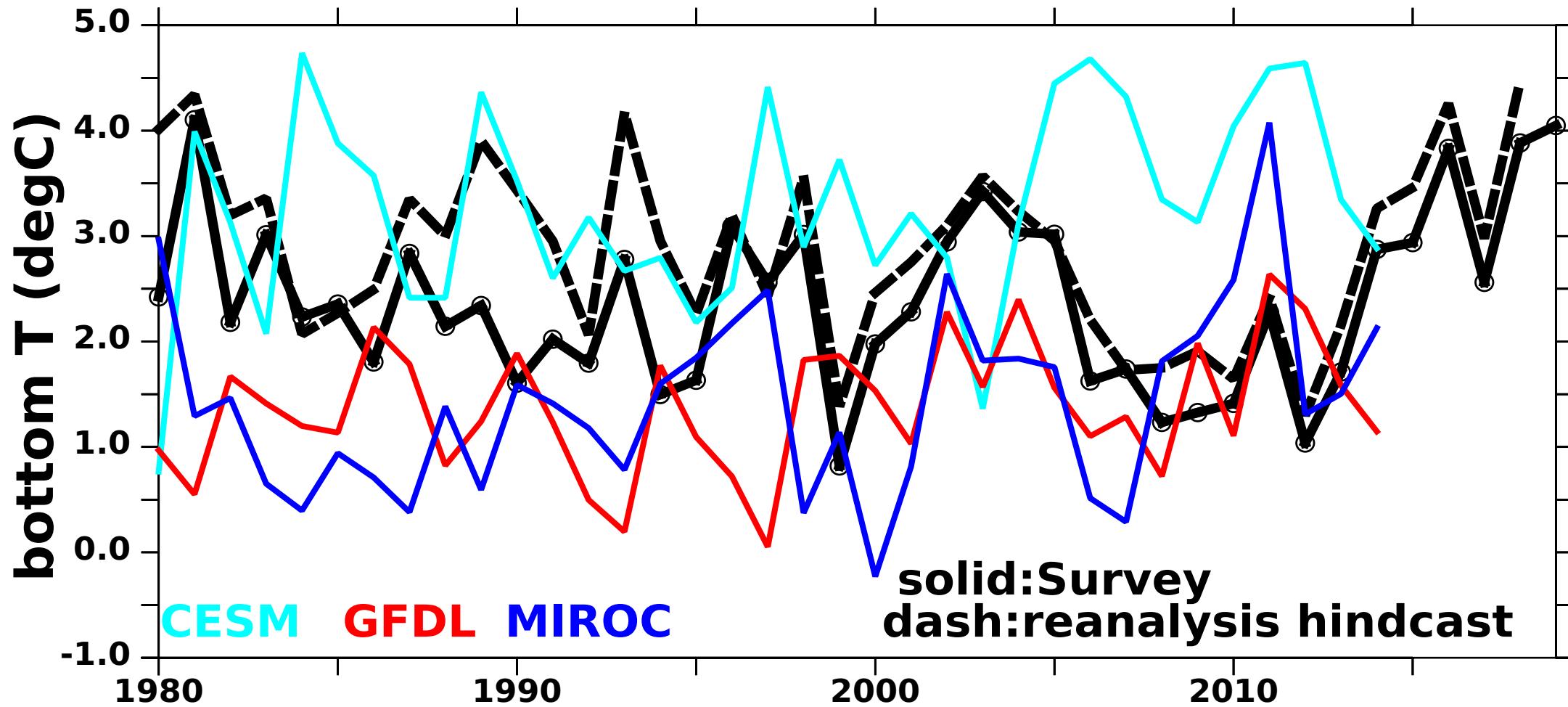
2. Seasonal forecast – initialized now, run forward for 9-12 months, forecasting ocean states every step along the way, but we can not assess skills because the future is unknown

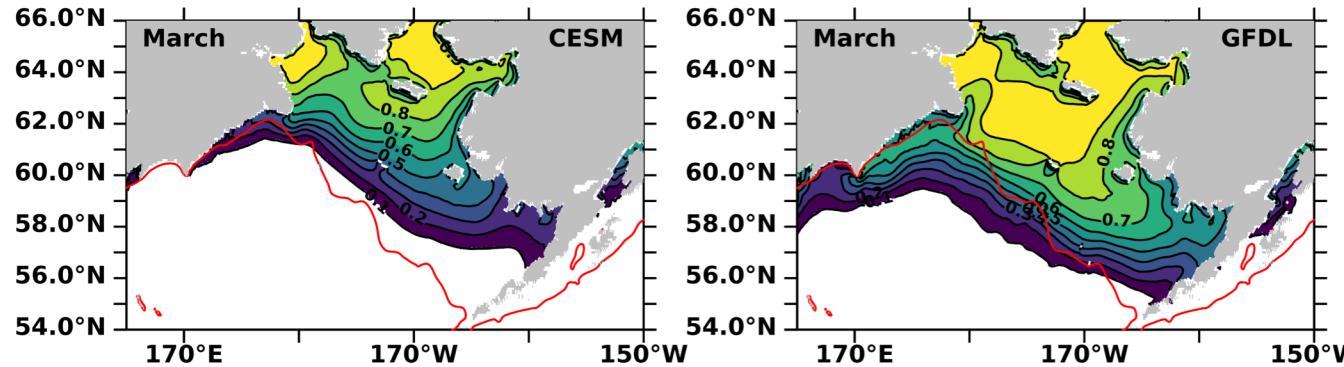
Re-forecast – doing 2 for the past decades, quantify forecast skills (next presentation)

3. CMIP driven “historical” simulation: similar to 1, but forcing is from global ESMs wiggles/phasing are random, but climatology/variability statistics can be compared to observations

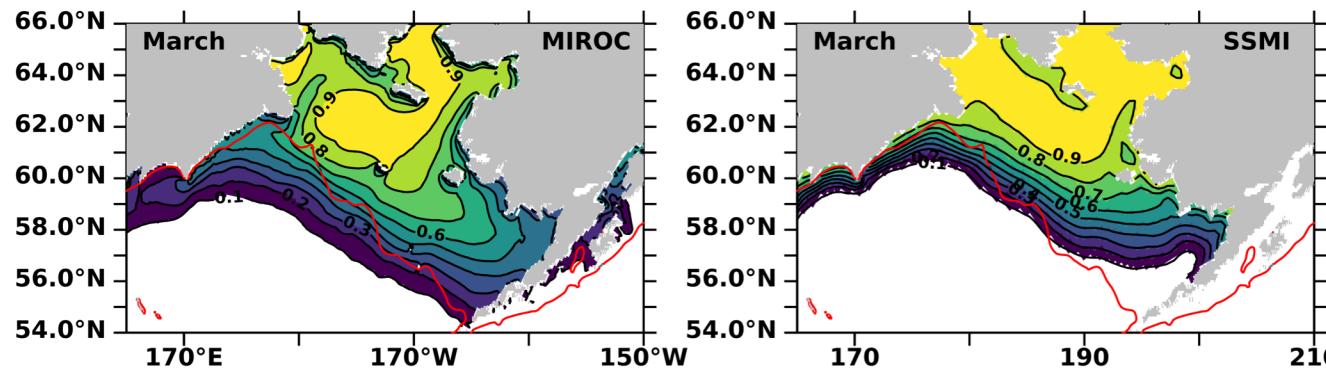
4. Decadal Projections: similar to 3, but run forward into the future (e.g., 2100)



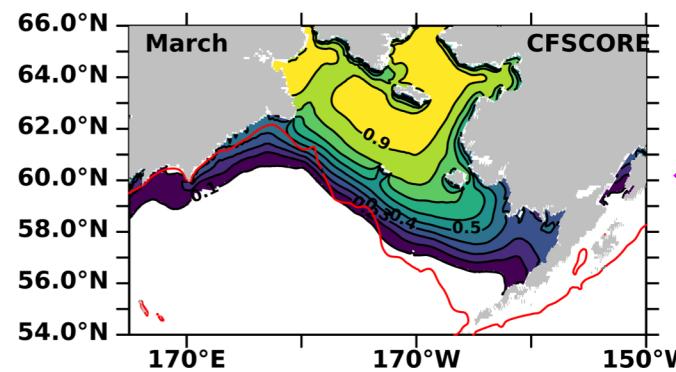
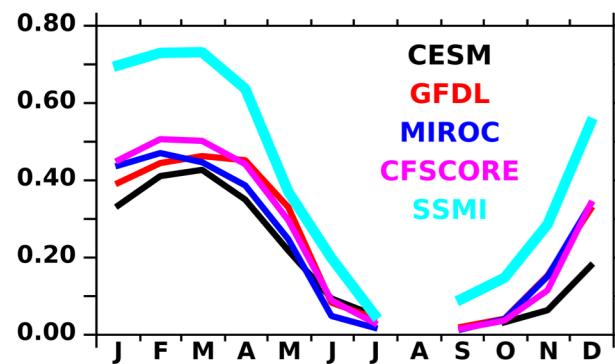




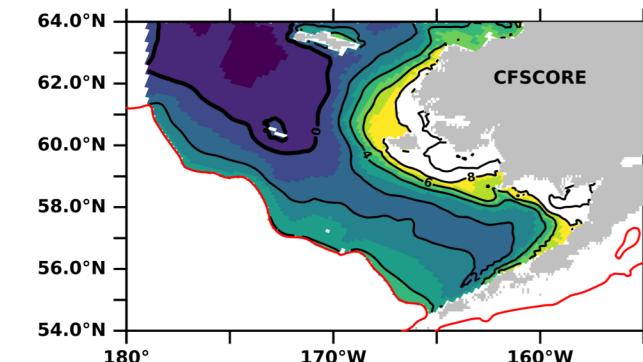
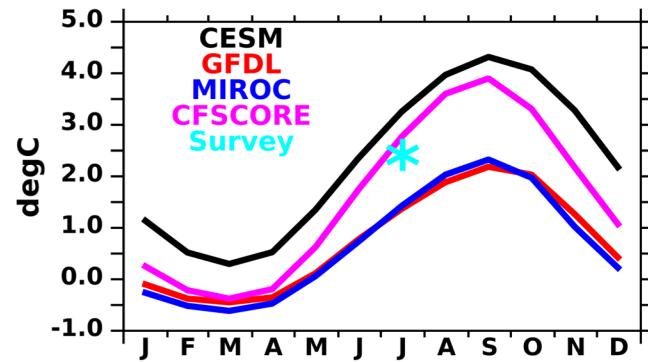
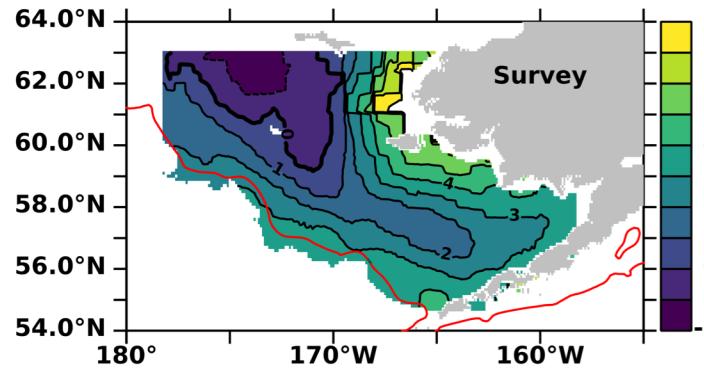
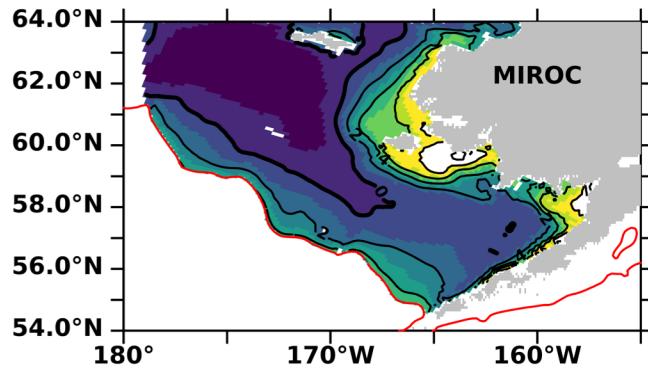
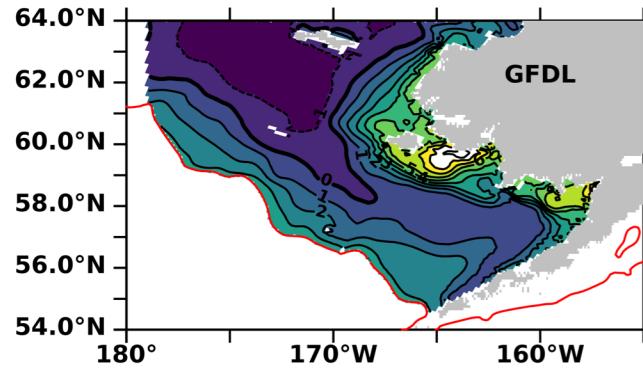
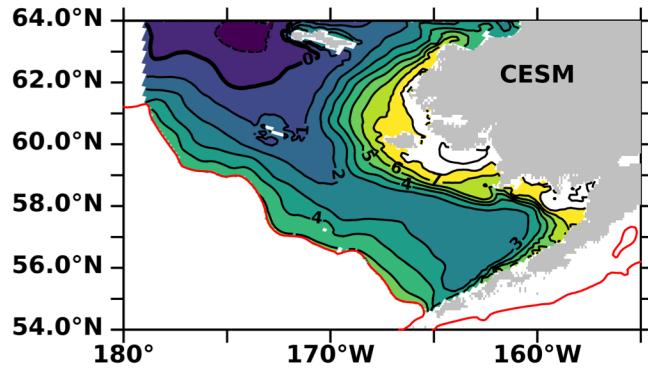
historical (1980-2014)
monthly climatology



← SSMI



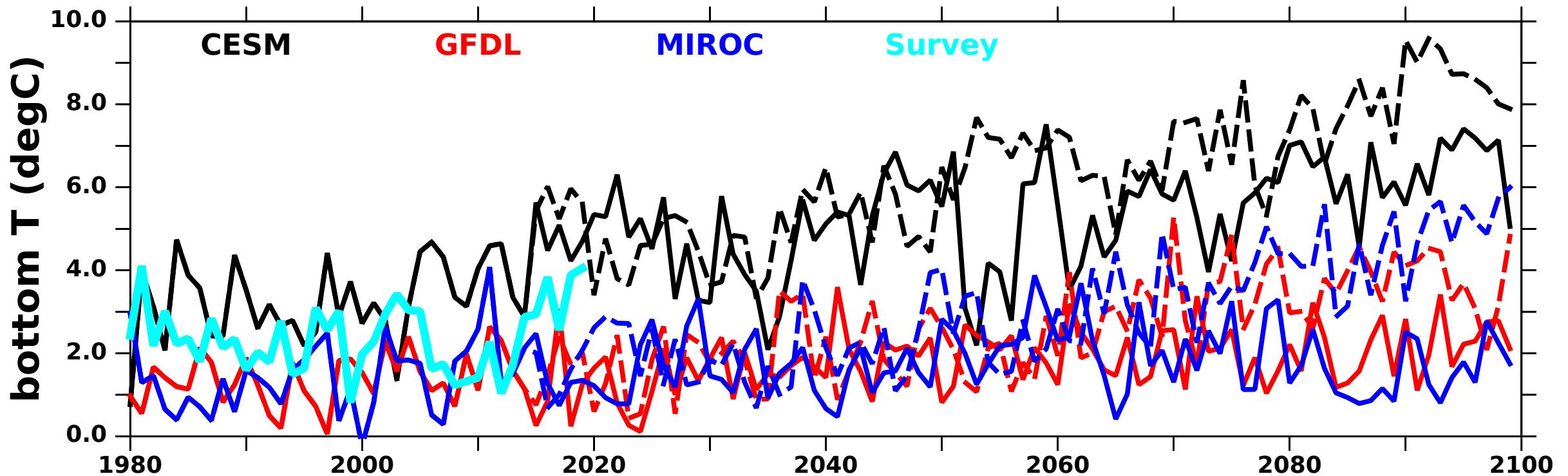
← CFSCORE hindcast



historical (1980-2014)
July climatology

Summer Bottom
trawl survey

← CFSCORE hindcast



Stay tuned for upcoming ACLIM workshop!