Sea Ice in CESM3

The Good and Bad

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PCWG liaison and co-chair

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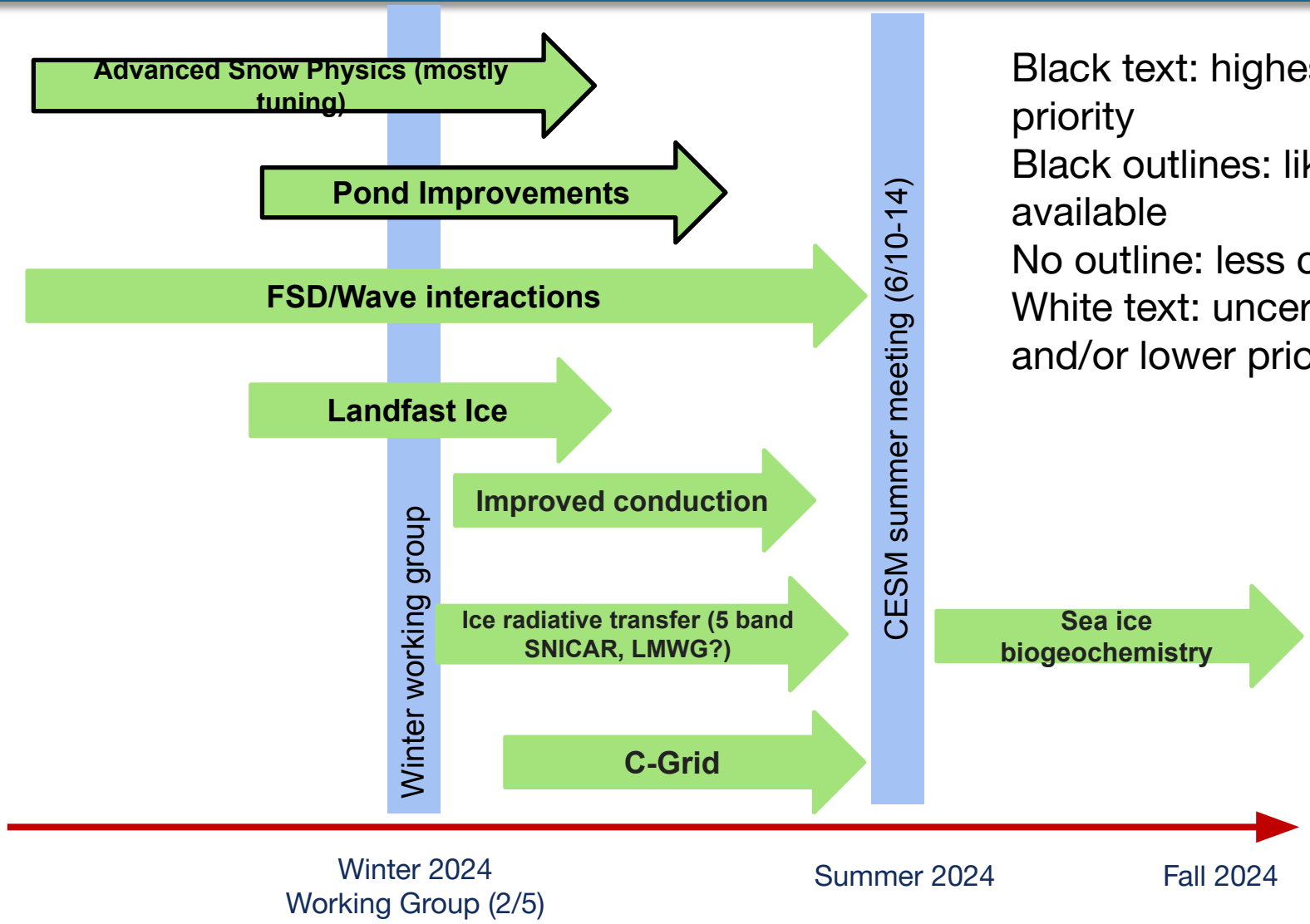
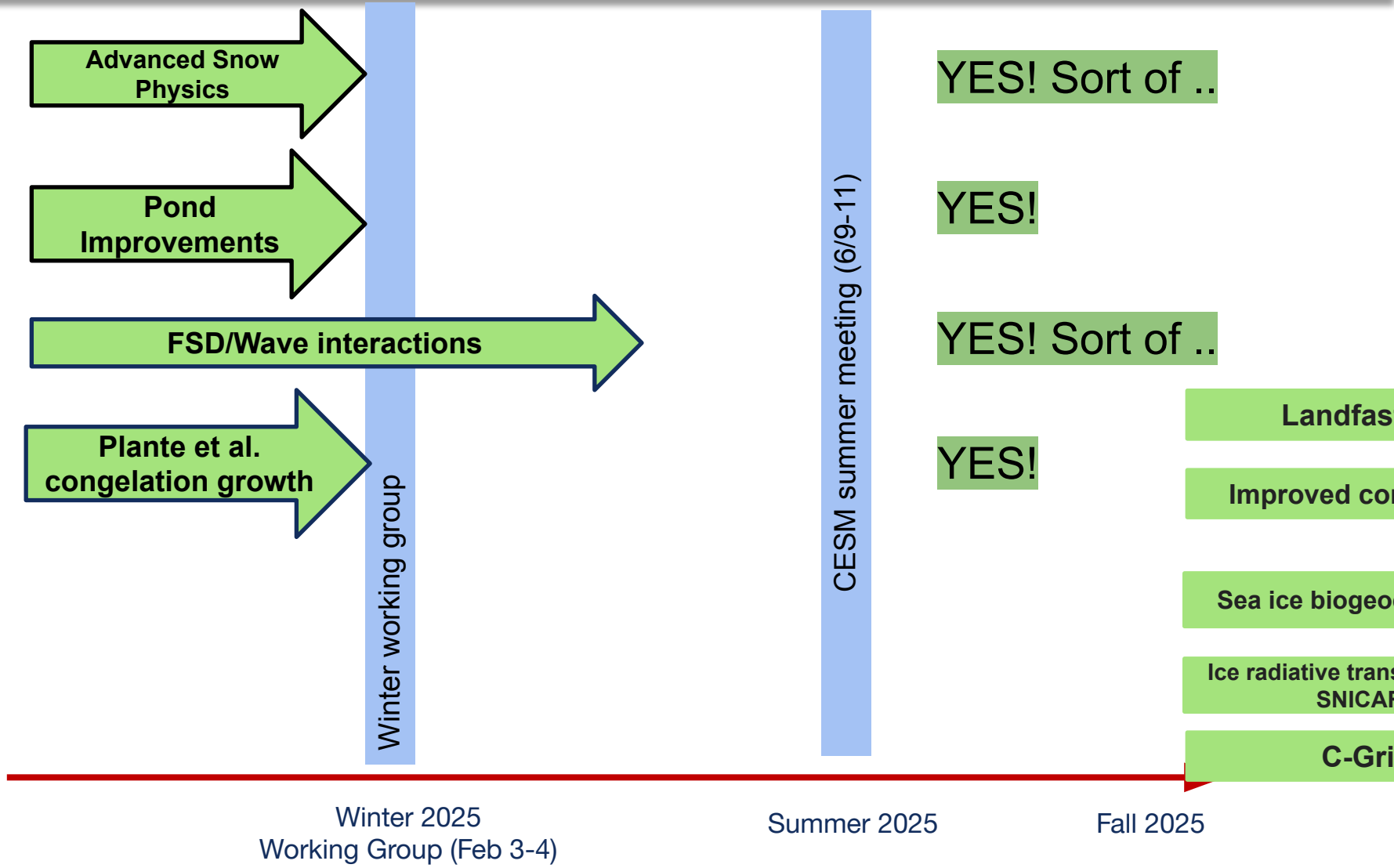
PCWG Sea Ice Plans

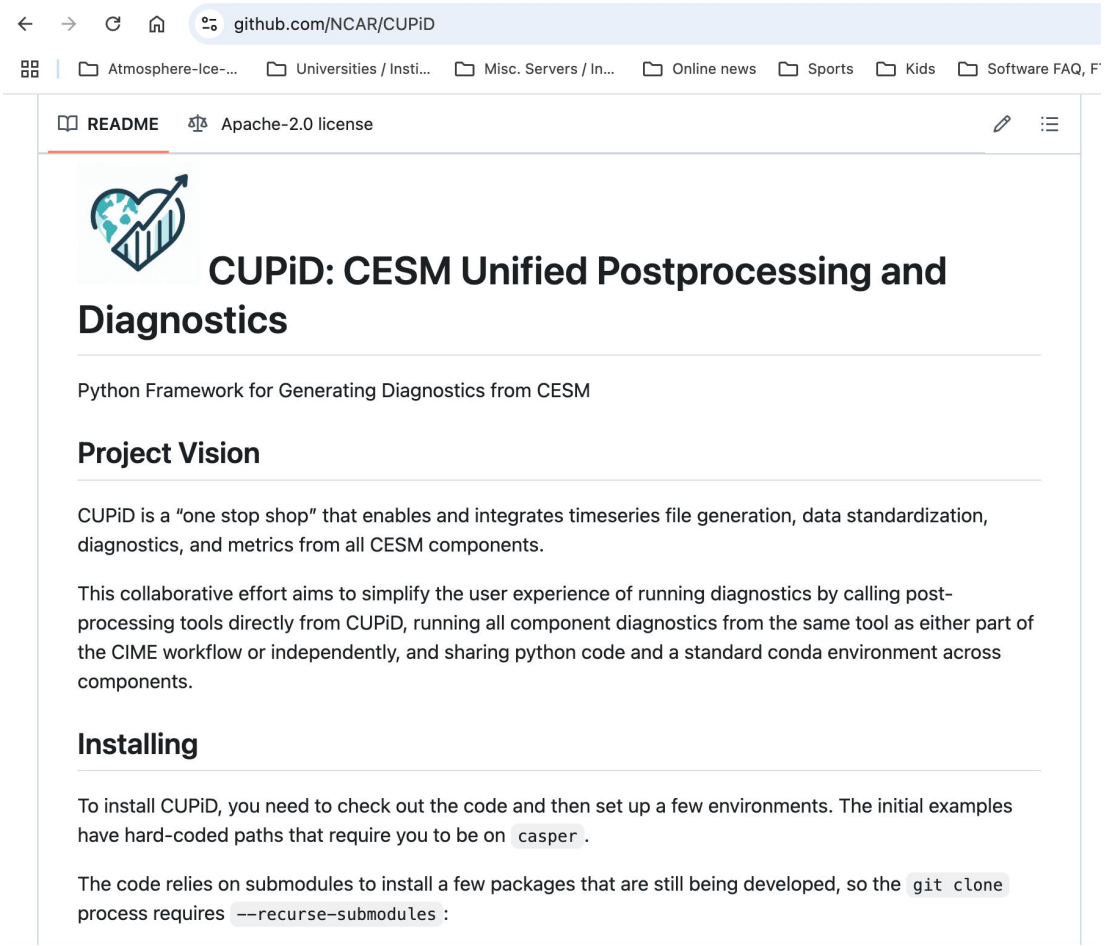


Black text: highest priority
Black outlines: likely available
No outline: less certain
White text: uncertain and/or lower priority

PCWG Sea Ice Updated Plans

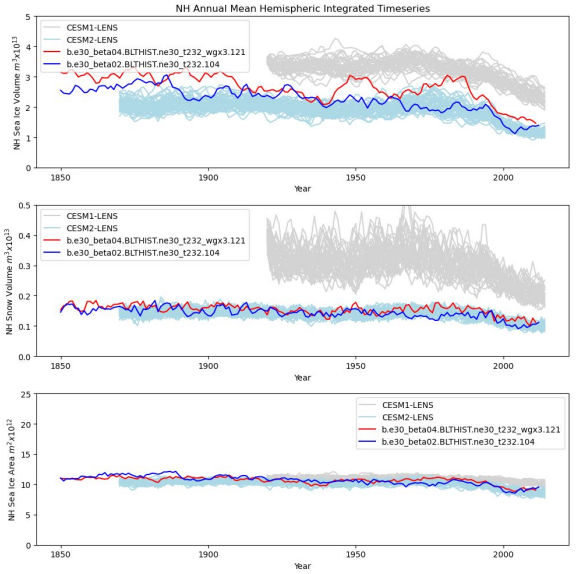


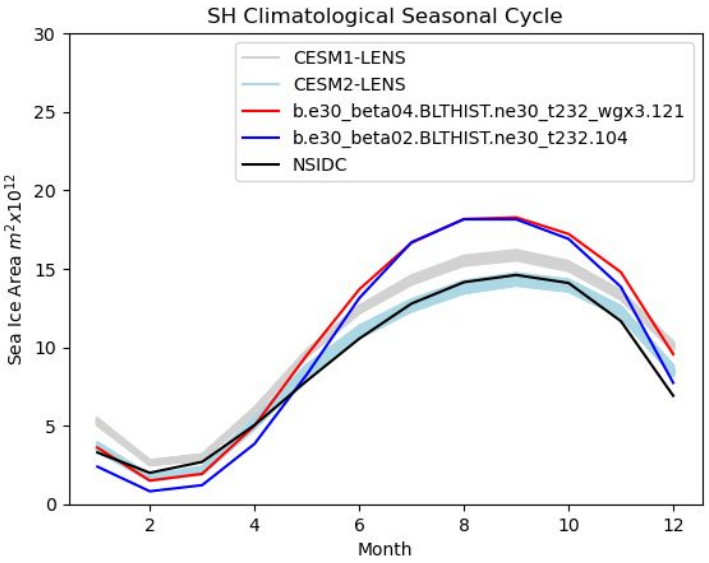
CESM Unified Postprocessing and Diagnostics

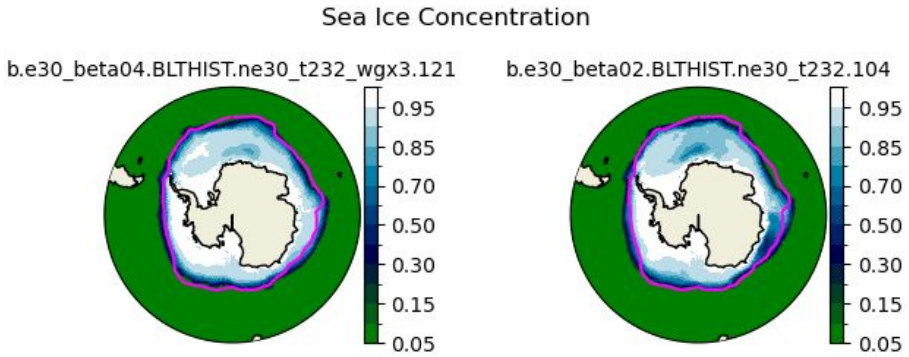


https://github.com/NCAR/CUPiD

Sea Ice Key Metrics Notebooks





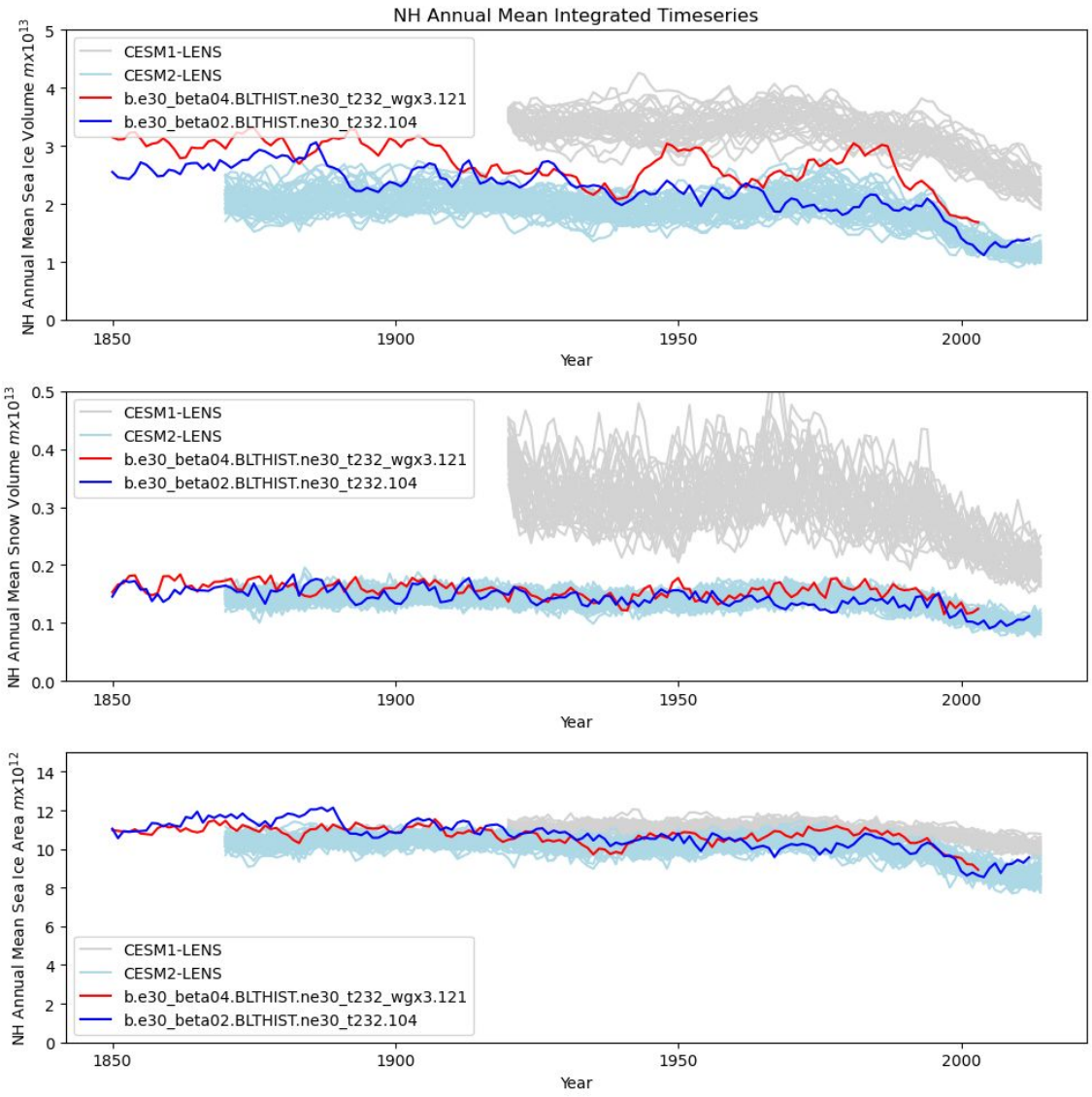


https://webext.cgd.ucar.edu/BLTHIST/b.e30_beta04.BLTHIST.ne30_t232_wgx3.121/ice/html/infrastructure/index.html

Ongoing CESM Runs

- All CESM development runs that are candidates are listed here:
  - https://github.com/NCAR/cesm_dev/issues
- **Run 121** is latest run with both a PI control and Historical
  - PI Control Info
  - Historical Info

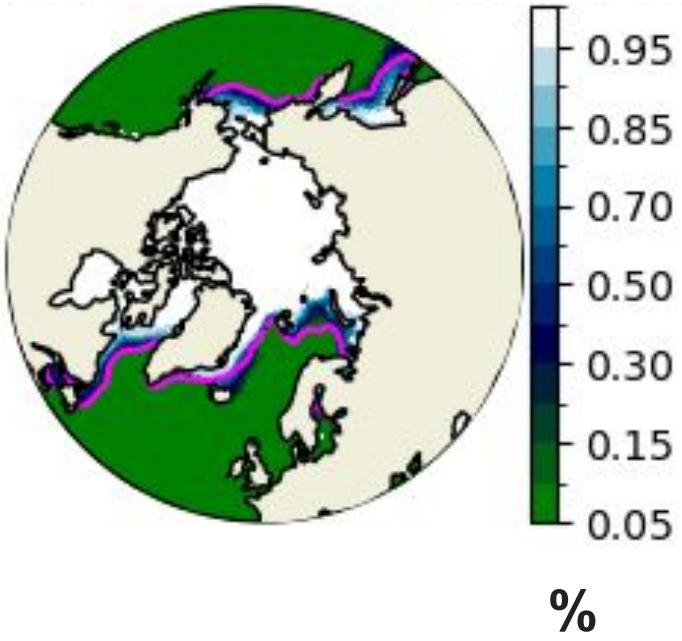
121 Historical - Northern Hemisphere



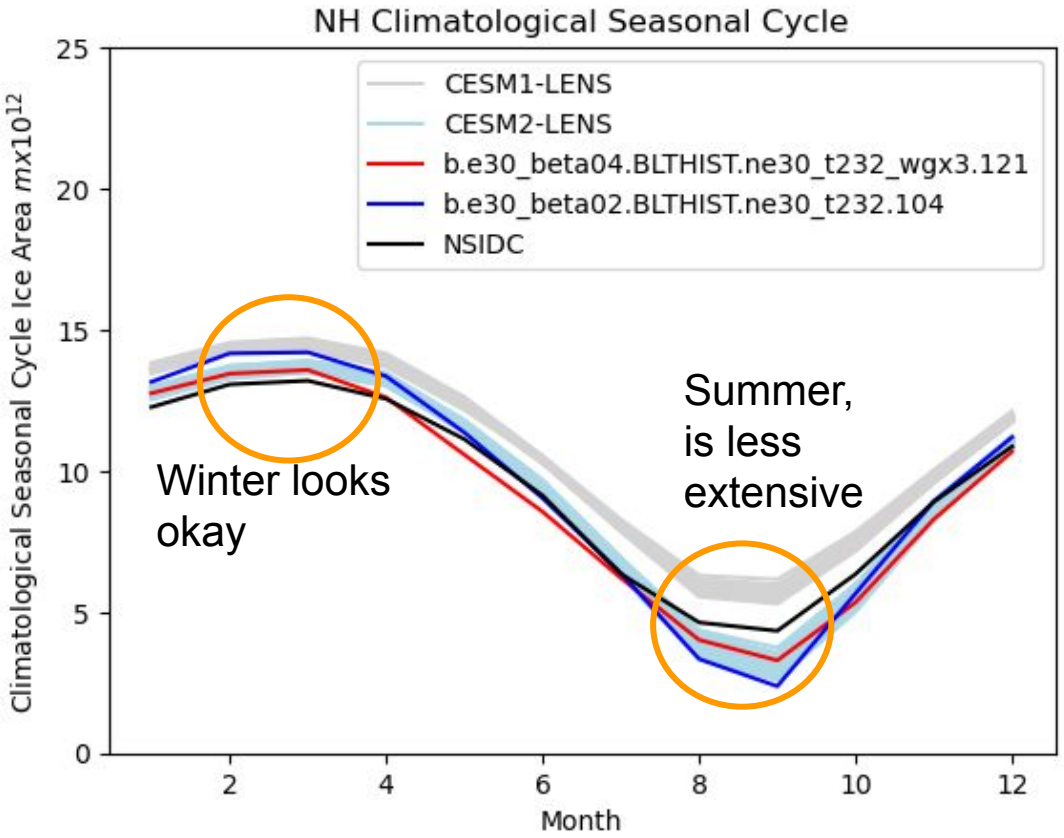
Focus on 121

121 Historical - sea ice concentration

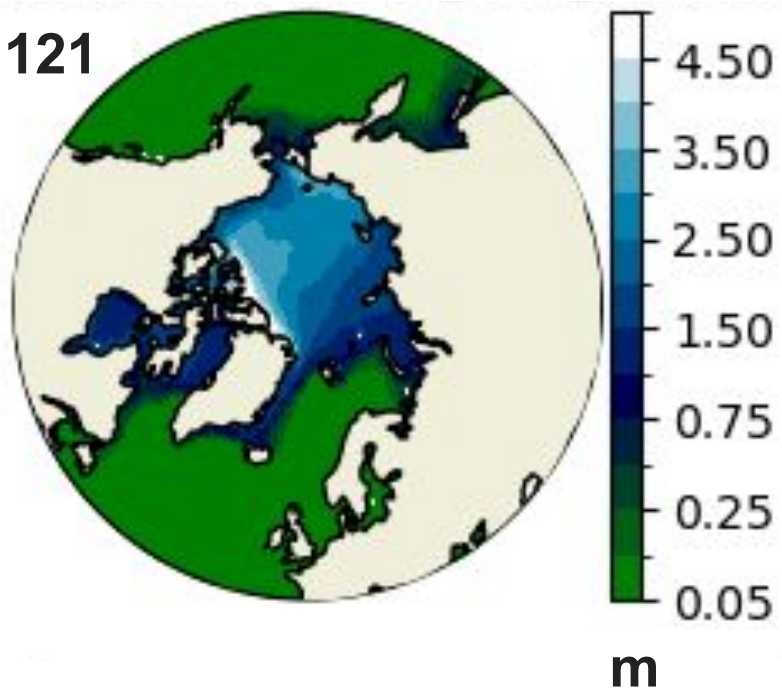
121 and NSIDC



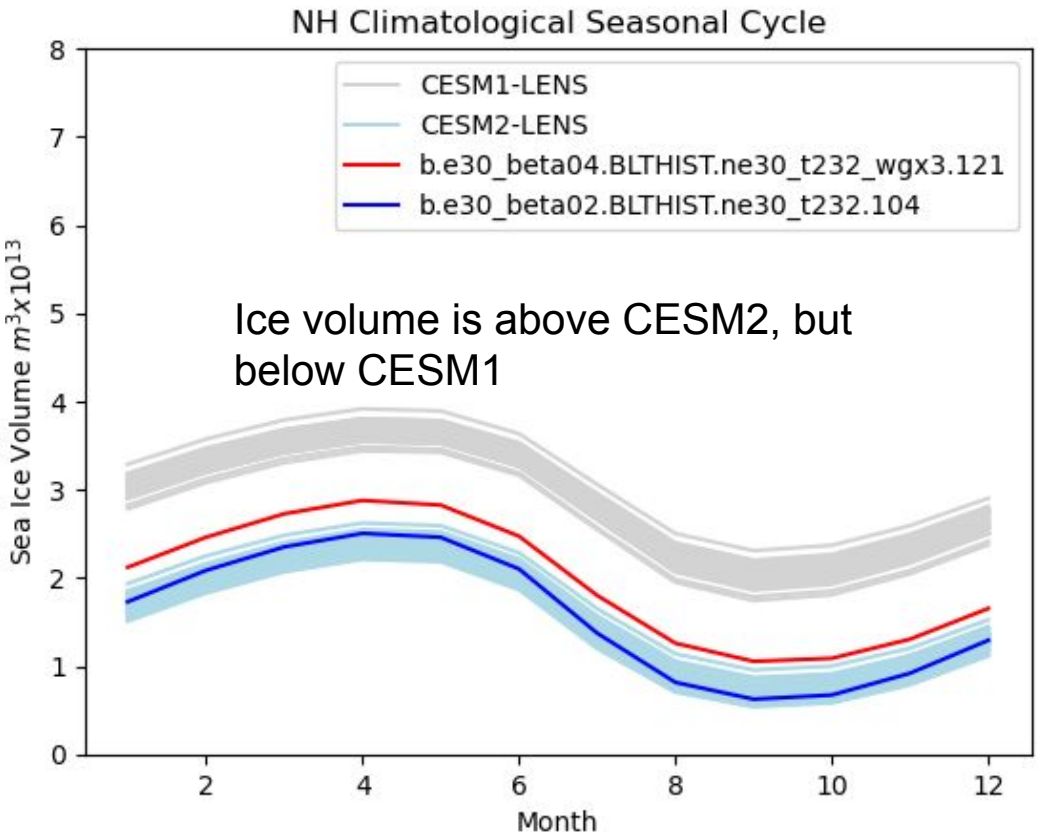
Focus on 121



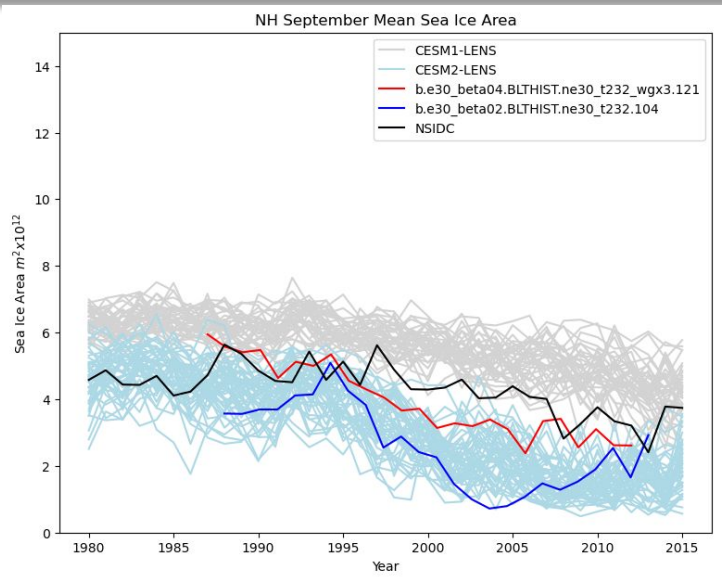
121 Historical - sea ice thickness

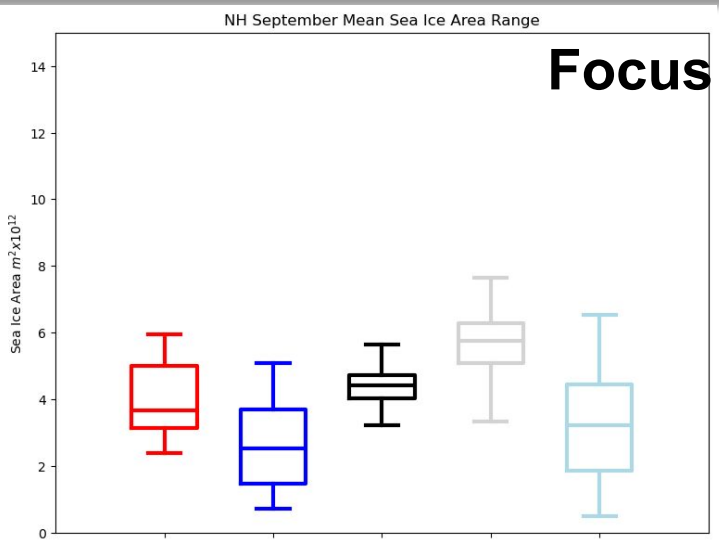


Focus on 121

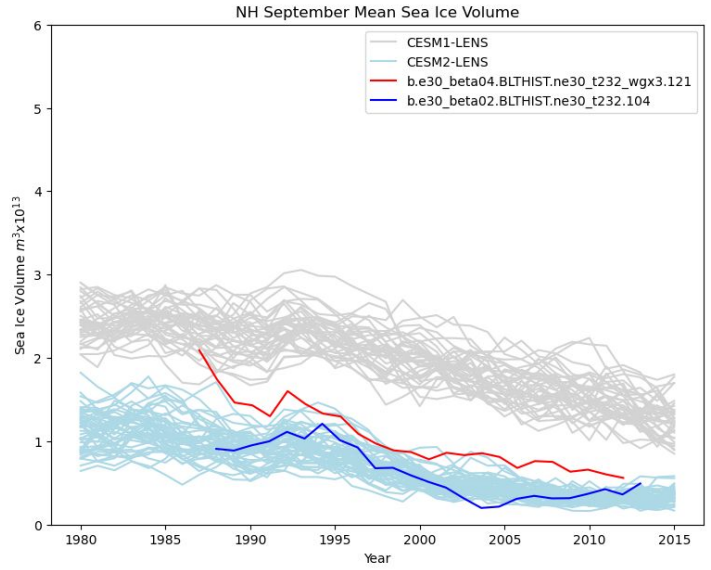


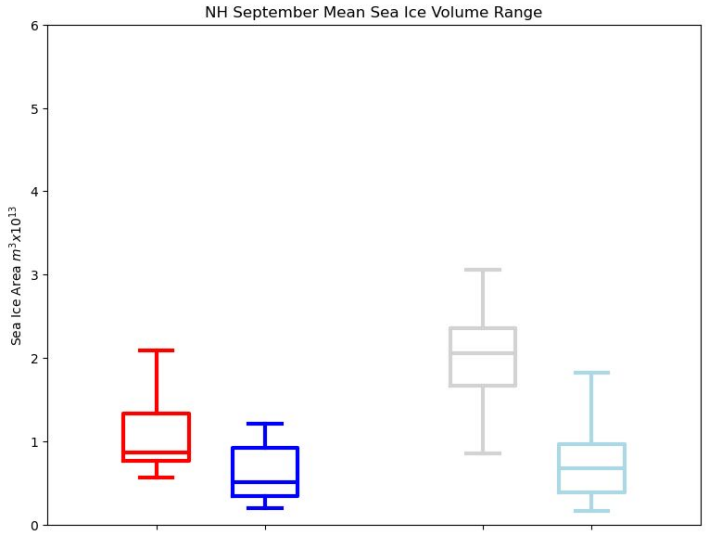
121 Historical - Sept. Ice Area and Volume Ranges



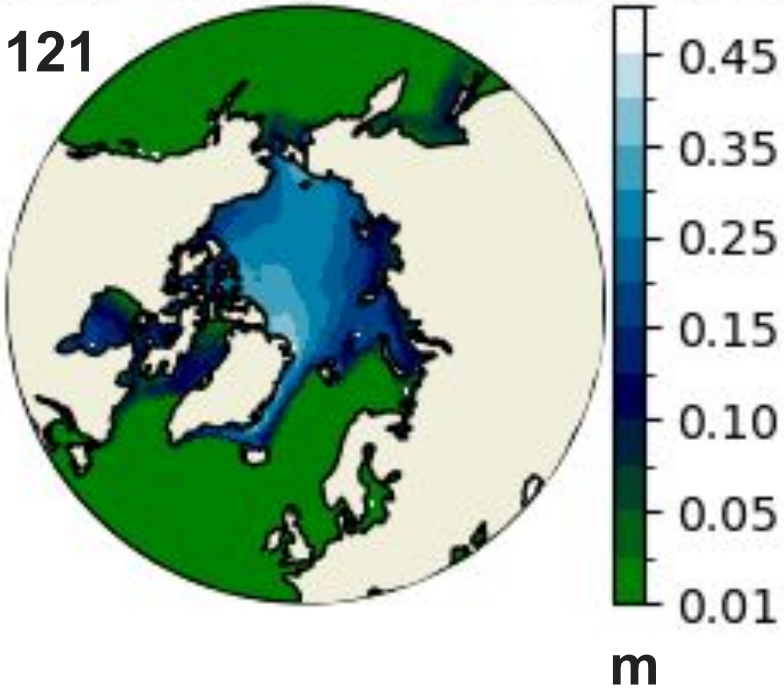


Focus on 121

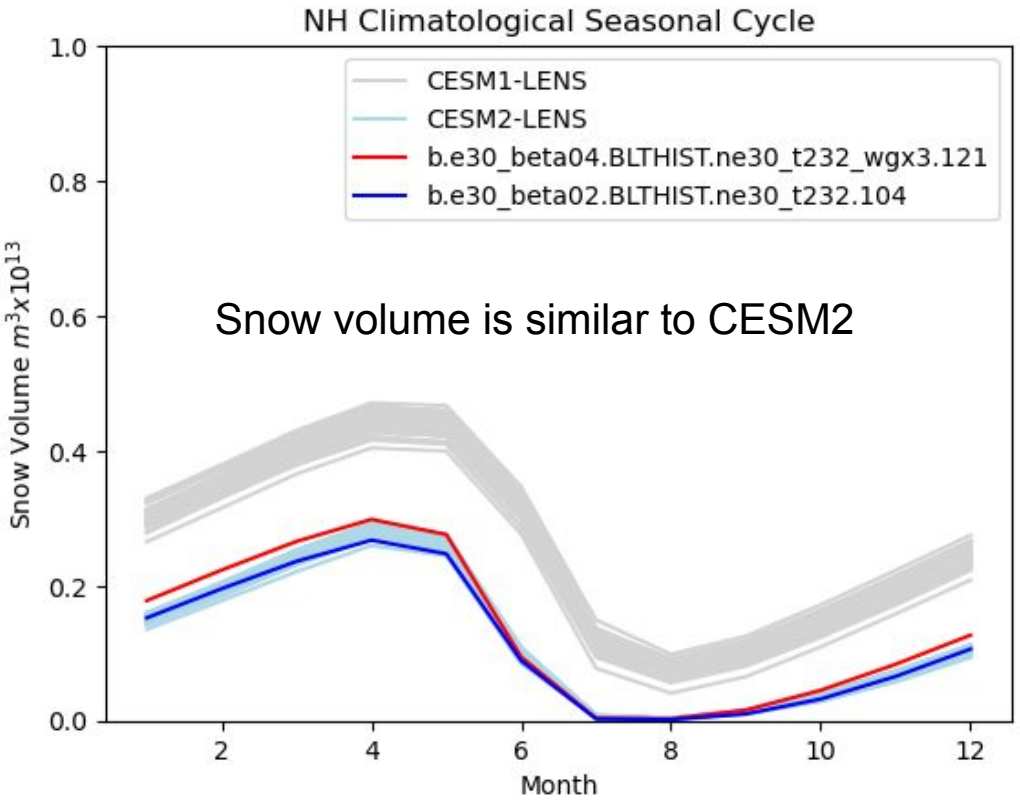




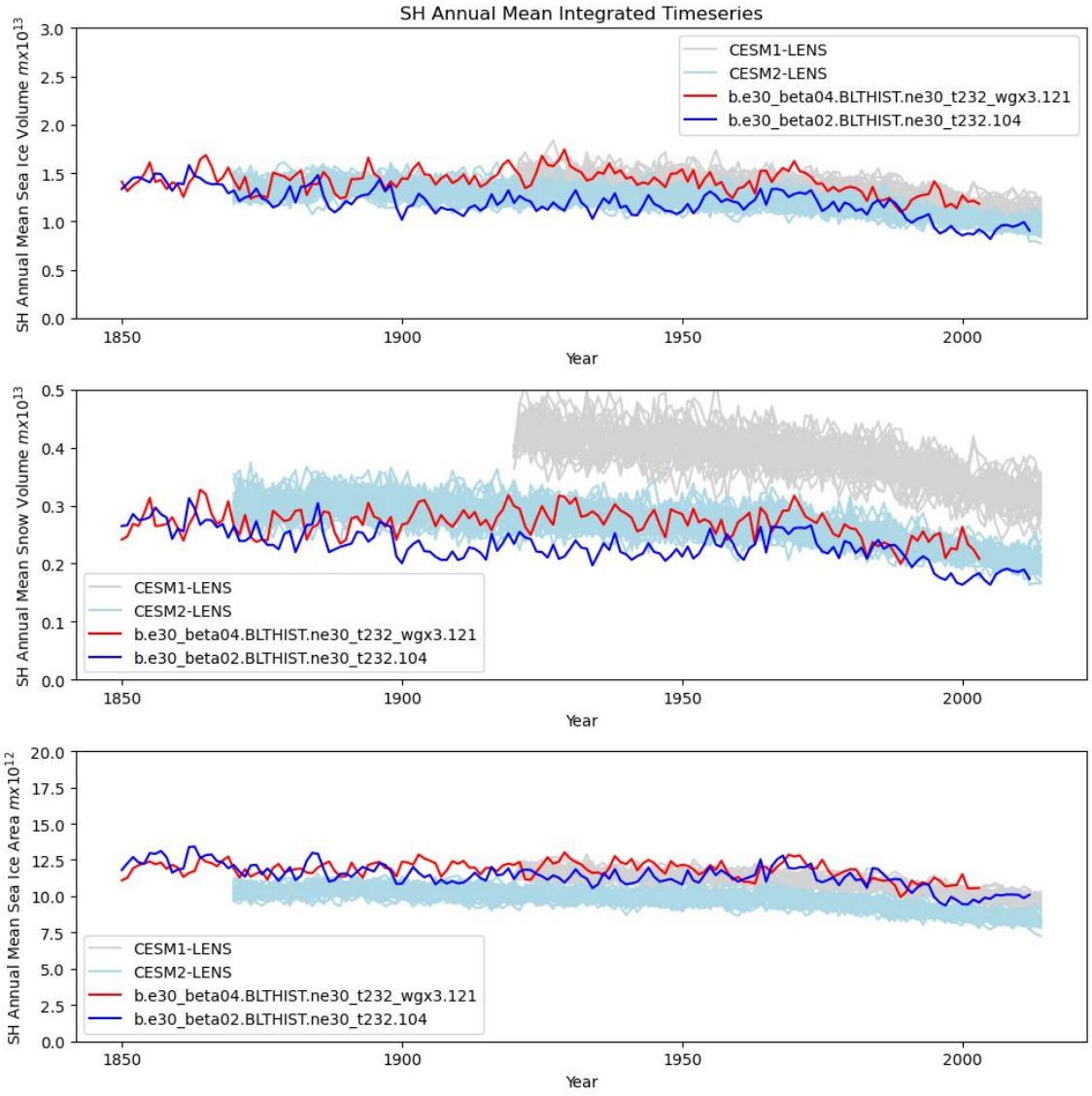
121 Historical - snow on sea ice



Focus on 121



121 Historical - Southern Hemisphere

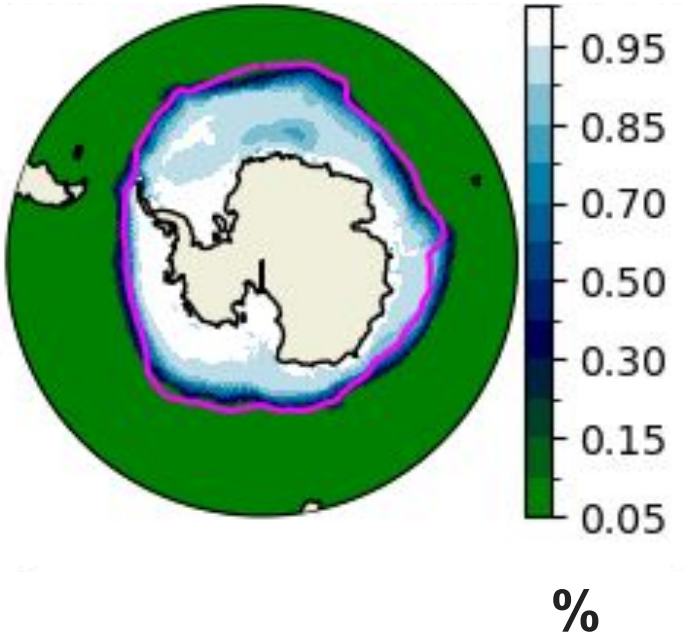


Focus on 121

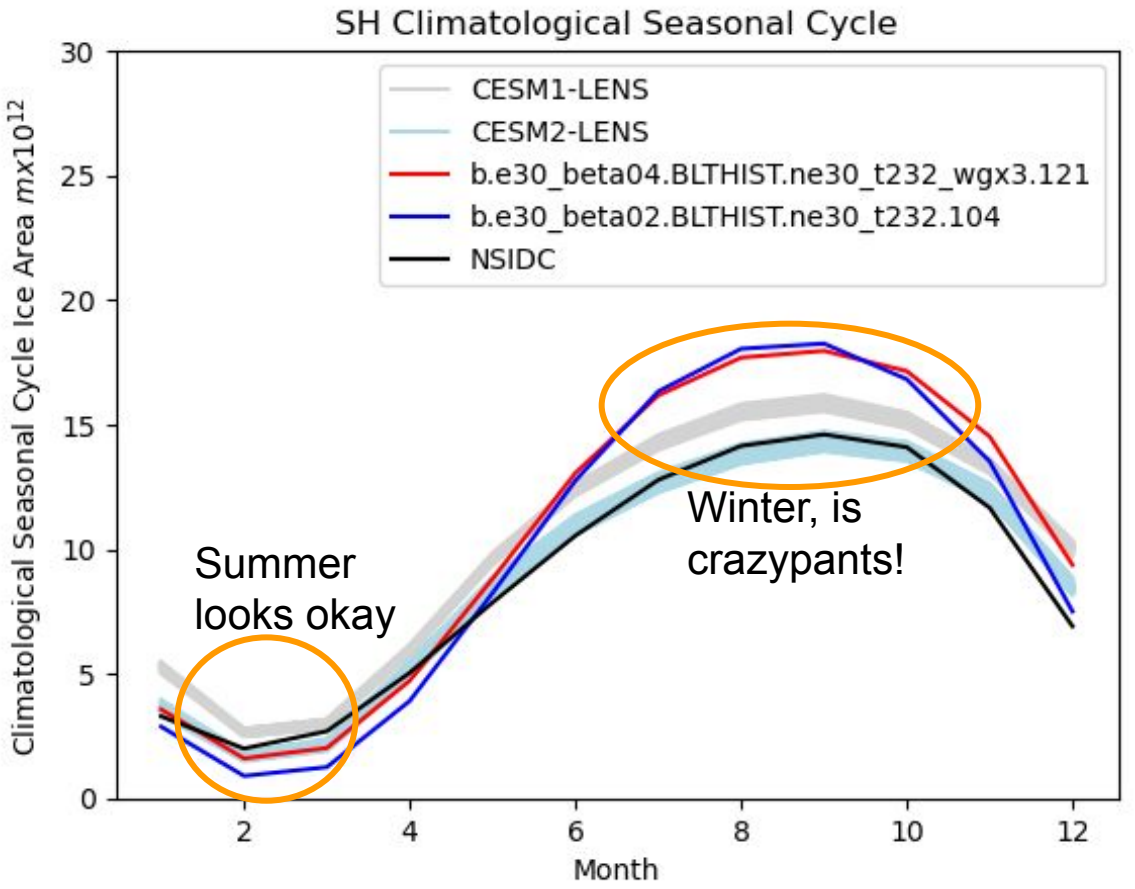
PI Control Info
Historical Info

121 Historical - sea ice concentration

121 and NSIDC

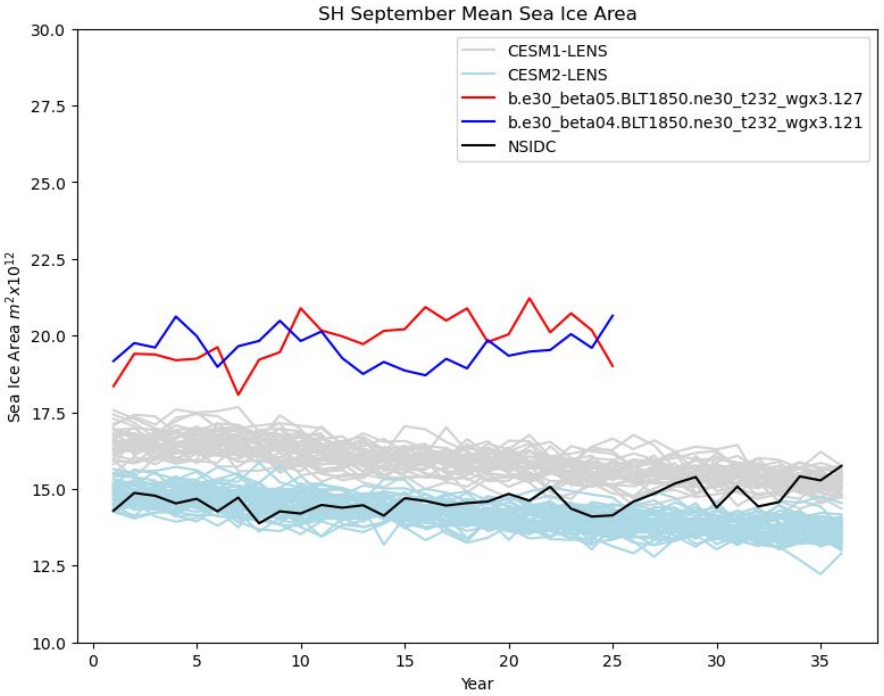


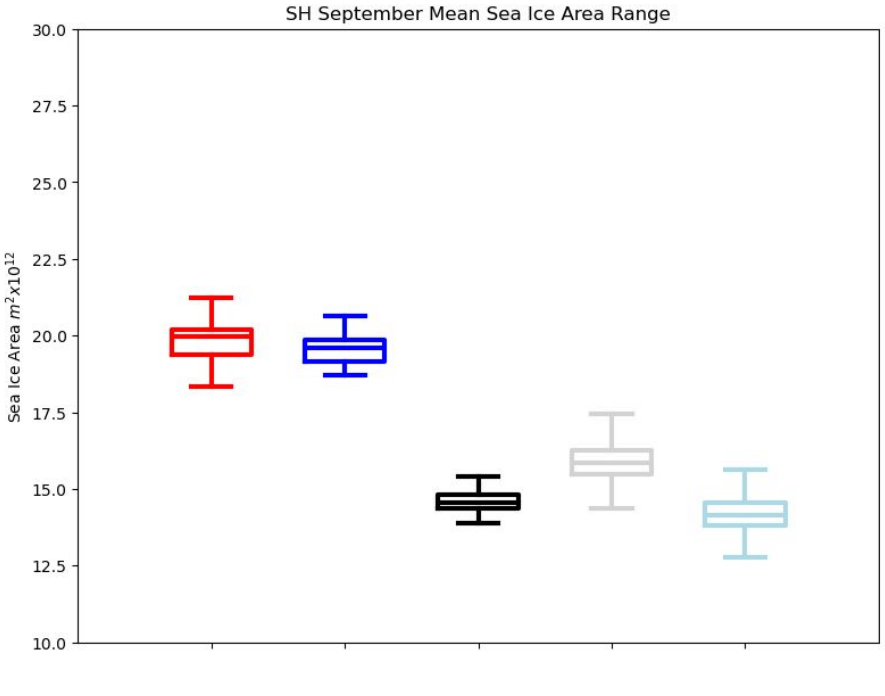
Focus on 121



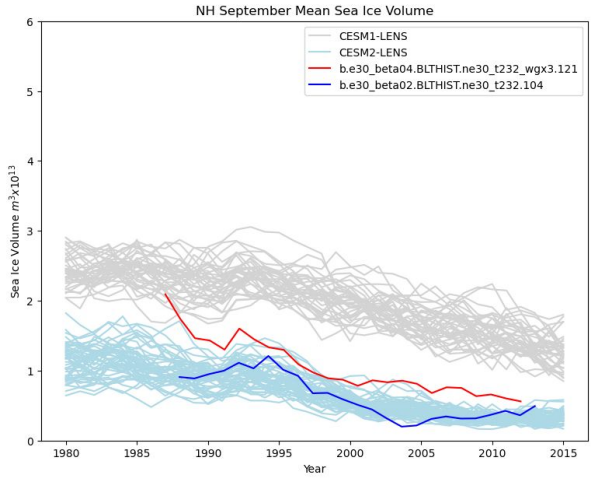
121 Historical - Sept. Ice Area and Volume Ranges

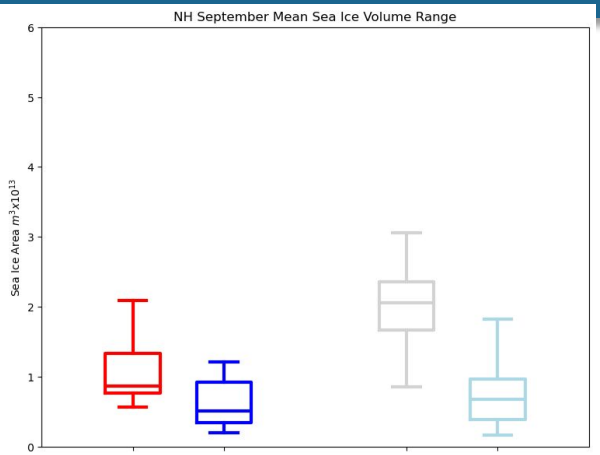
Focus on 121





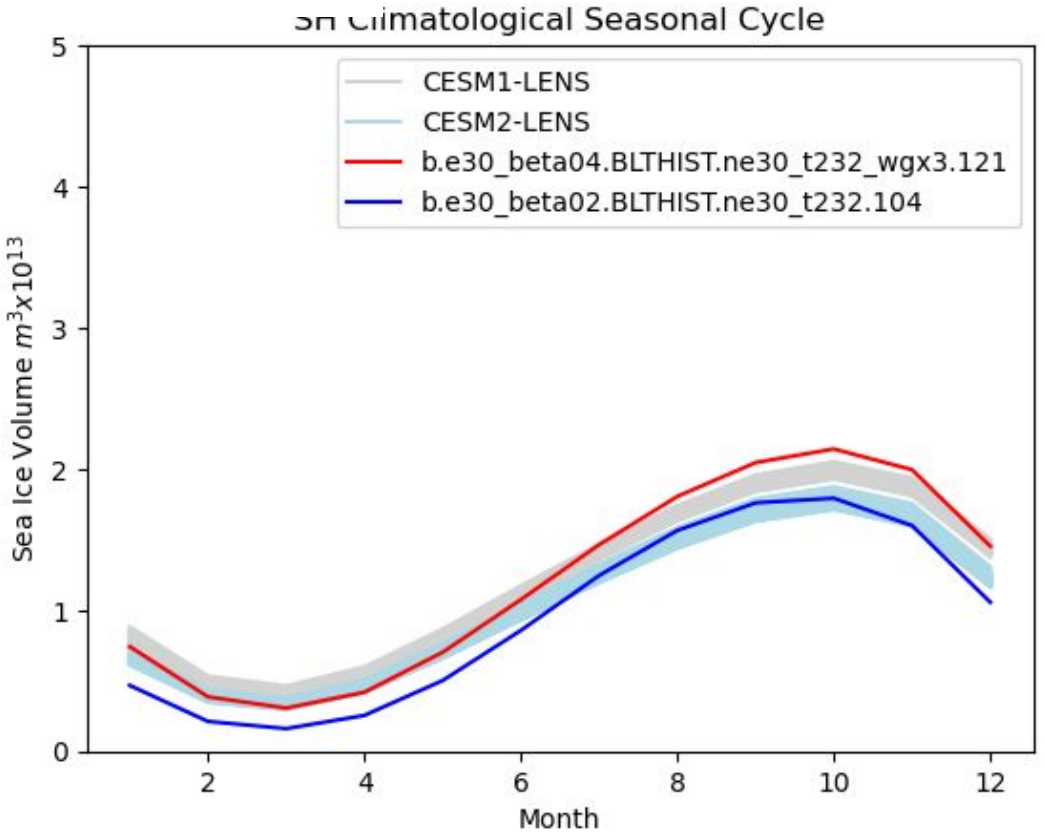
121 Historical - sea ice thickness





Focus on 121

Ice volume is similar to CESM1, but it's more because it's so extensive, not because it's thick.



Southern Hemisphere - What's going on??

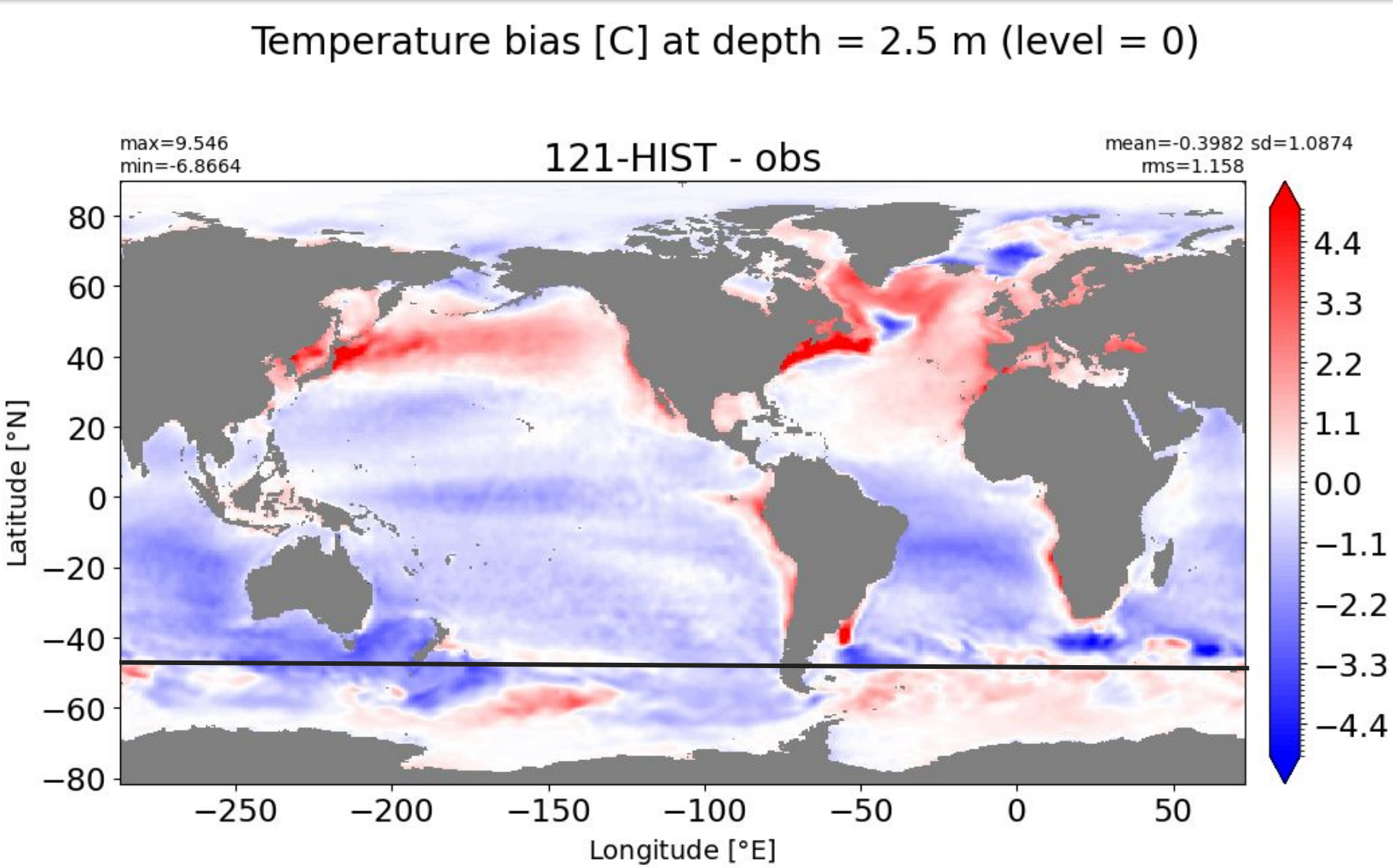
- Antarctic sea ice is a showstopper
  - Not physically realistic
  - Will affect the whole global climate (ocean and atmosphere circulation, etc.)
  - **We want feedback from PCWG community about how this will impact their ability to do science!**

- Sea ice albedo tuning hasn't fixed the problem
  - We need help with this from other WG!
  - Cloud mod testing (e.g. 124) haven't fixed things
  - Ocean mods (e.g. 127) haven't fixed things

Southern Hemisphere - What's going on??

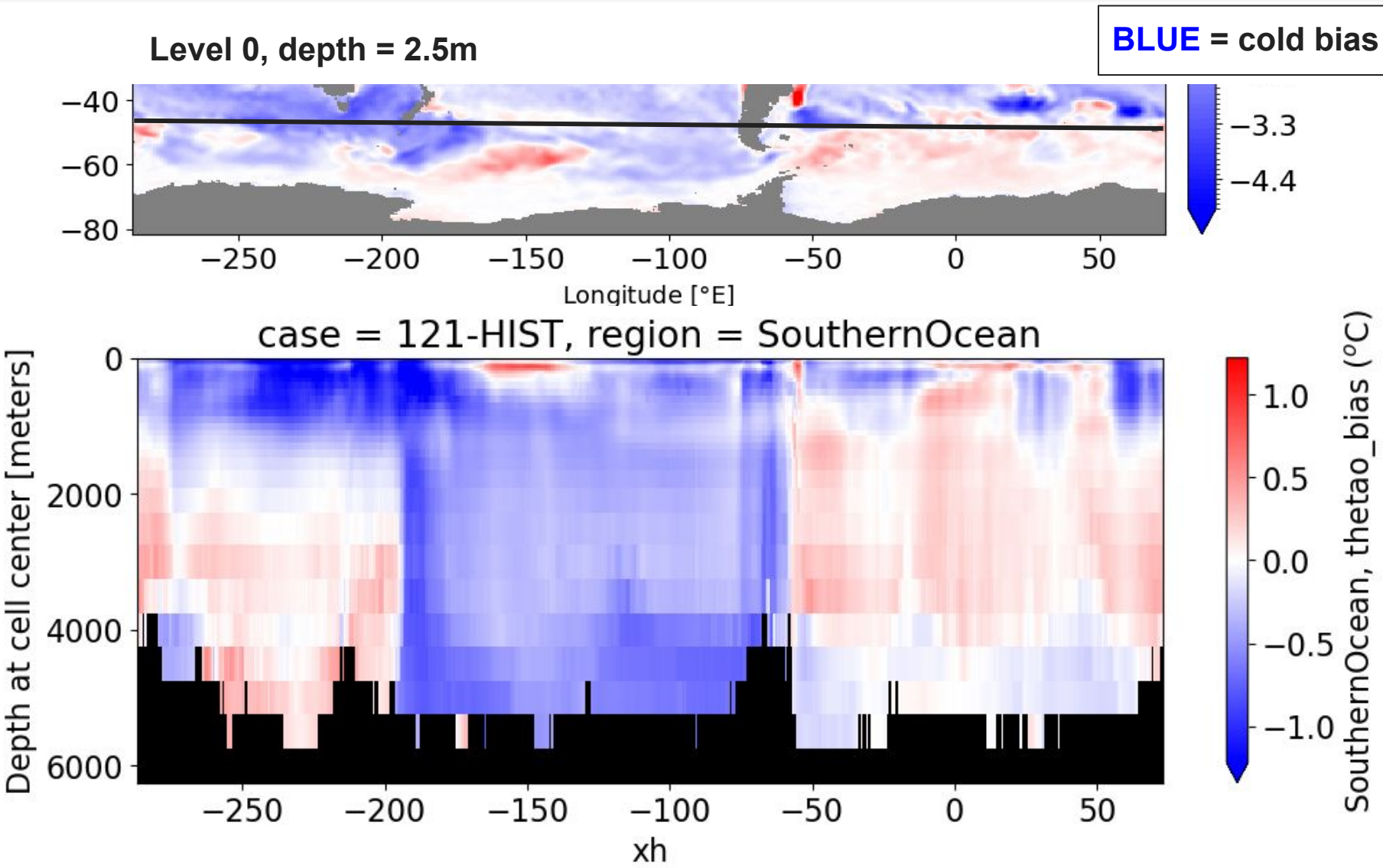
- What is causing the excessive winter ice concentration? (Focus on Winter: June - October)
  - Hypothesis 1: Cold ocean temperatures are leading to excess sea ice growth.
  - Hypothesis 2: Too strong zonal winds may lead to excessive northward ekman sea ice transport.
  - Hypothesis 3: Cloud cover impacting radiation biases may lead to cold surface biases (and ice growth).
  - Hypothesis 4: Too much precipitation could lead to excess sea ice growth (snow ice formation or freshening ocean).

MOM6 Temperature biases: 121-obs (level 0, depth = 2.5m)



MOM6 Temperature biases: 121-obs

BLUE = cold bias



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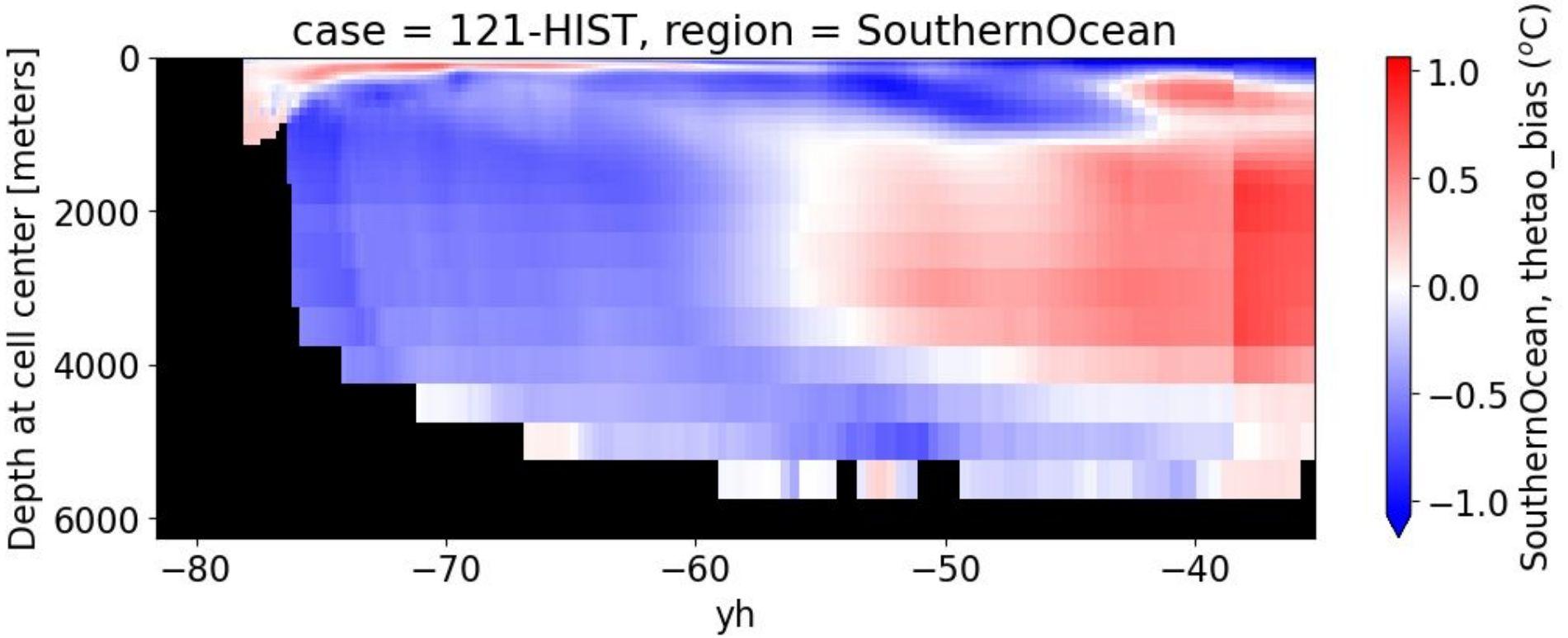
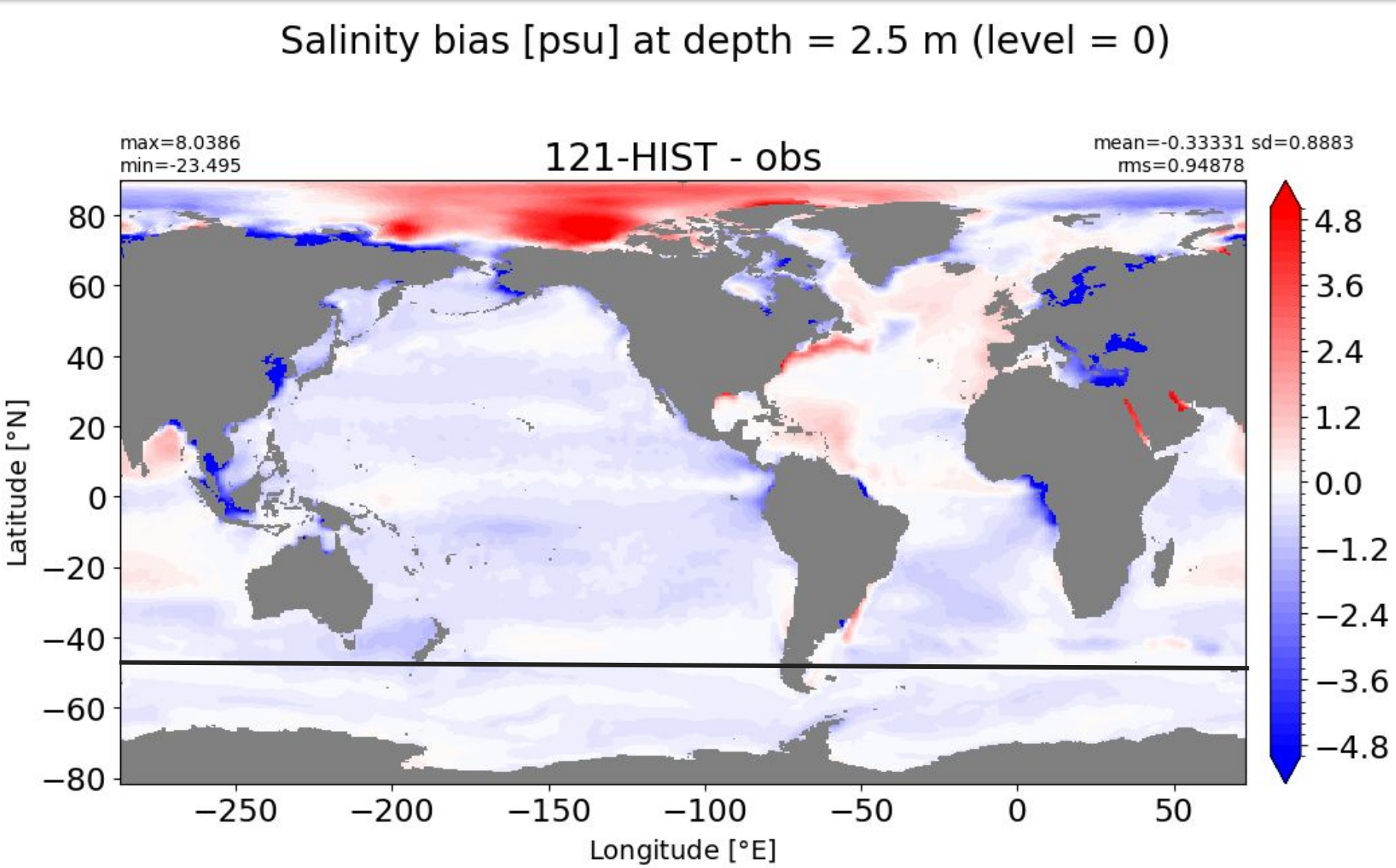
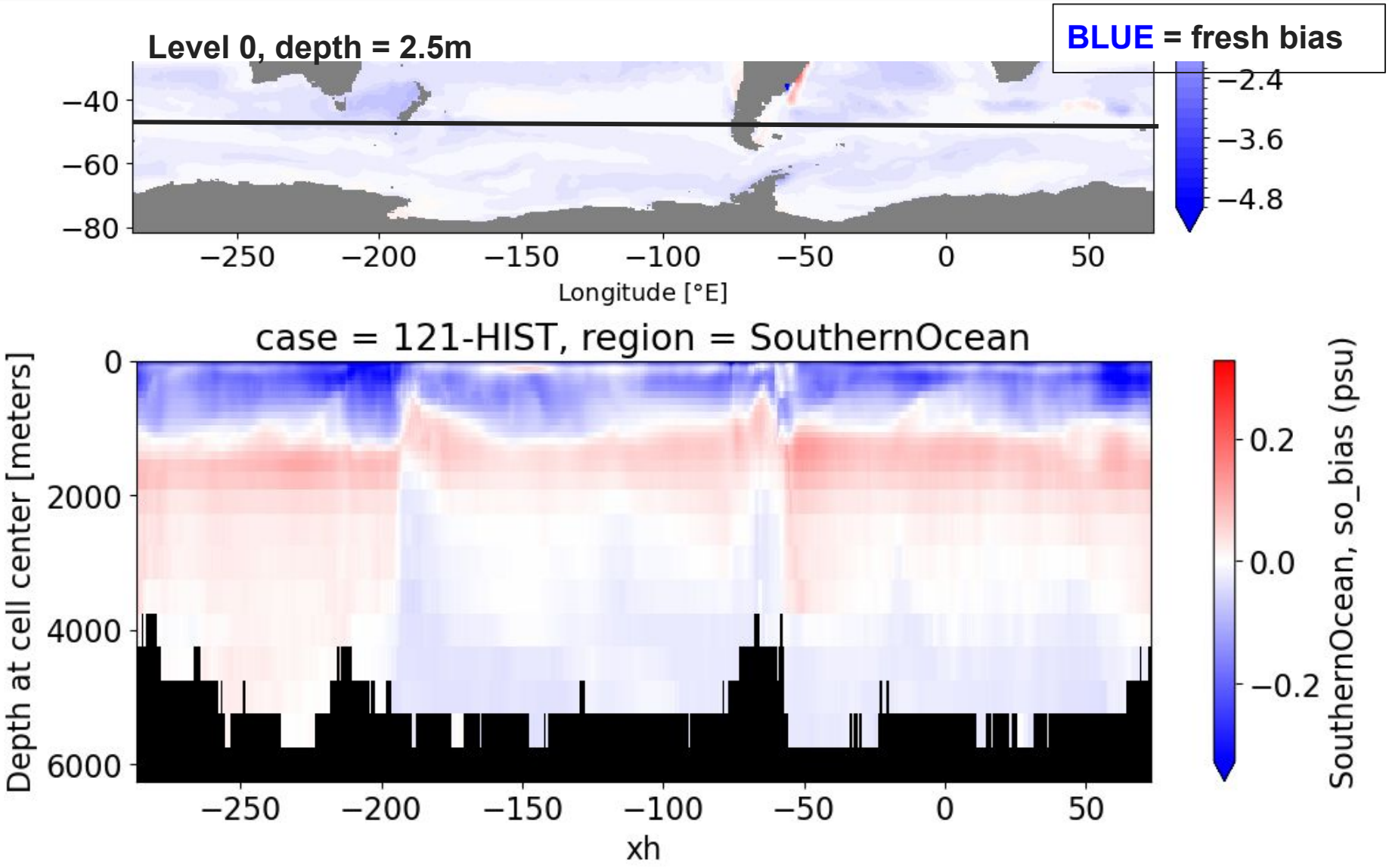


MOM6 Salinity biases: 121-obs (level 0, depth = 2.5m)

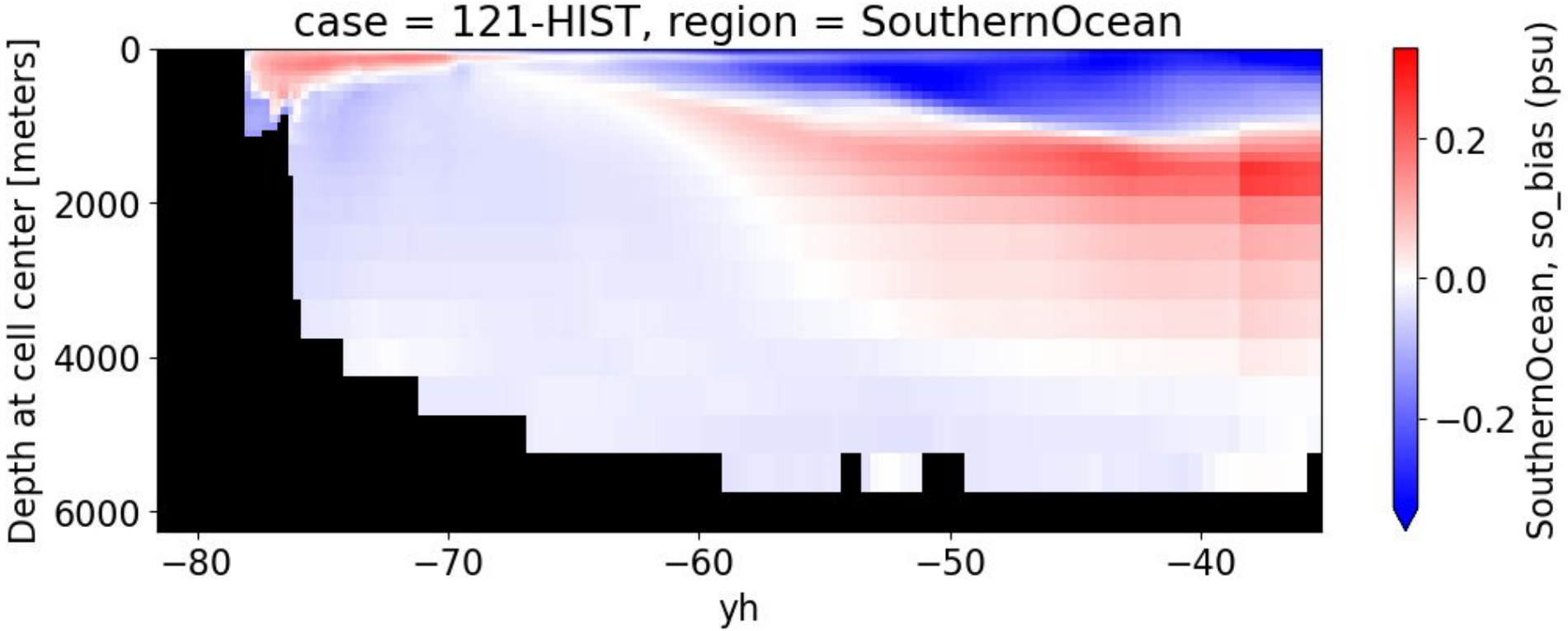


MOM6 Salinity biases: 121-obs

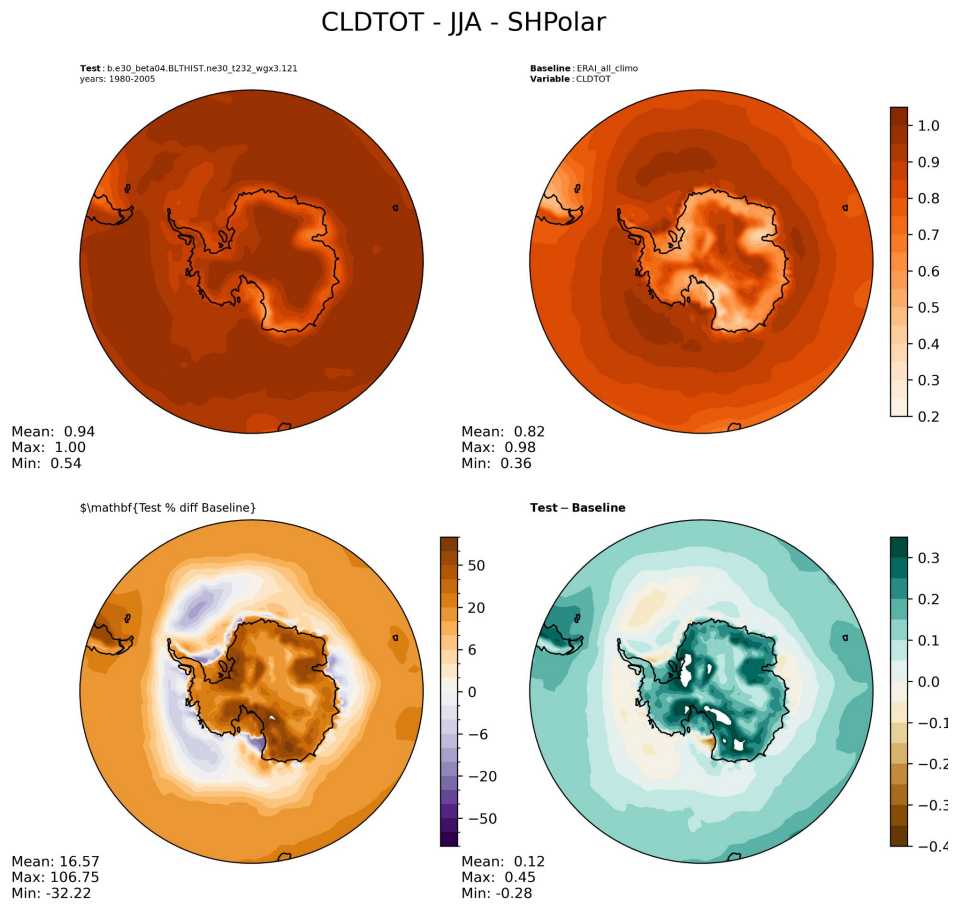


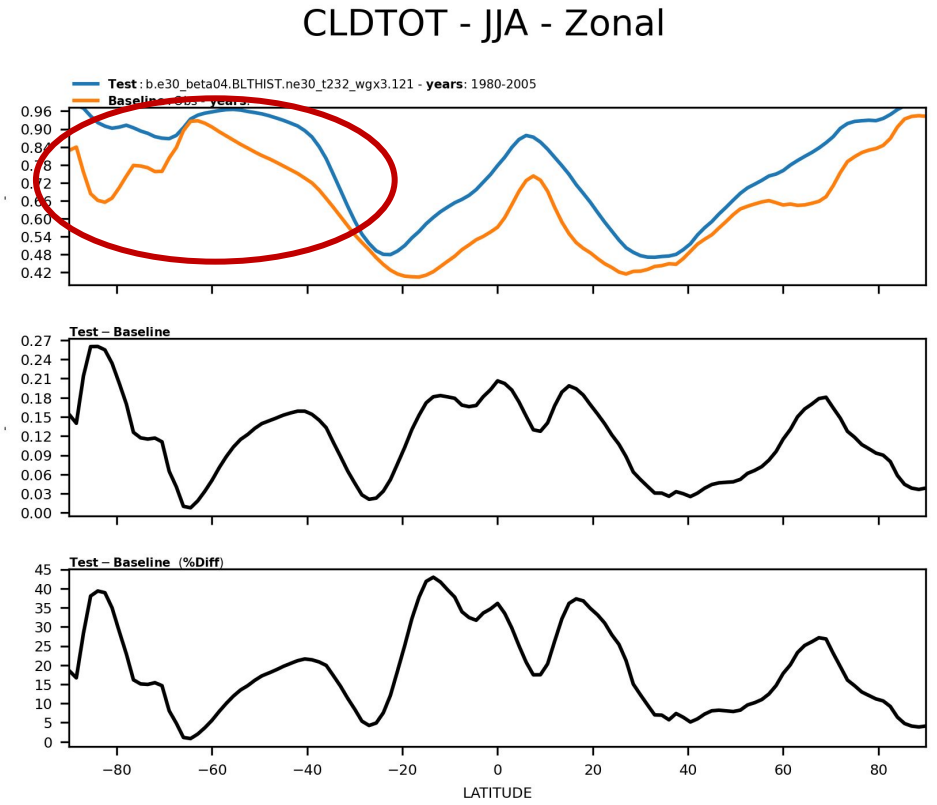
MOM6 Salinity biases: 121-obs

BLUE = fresh bias



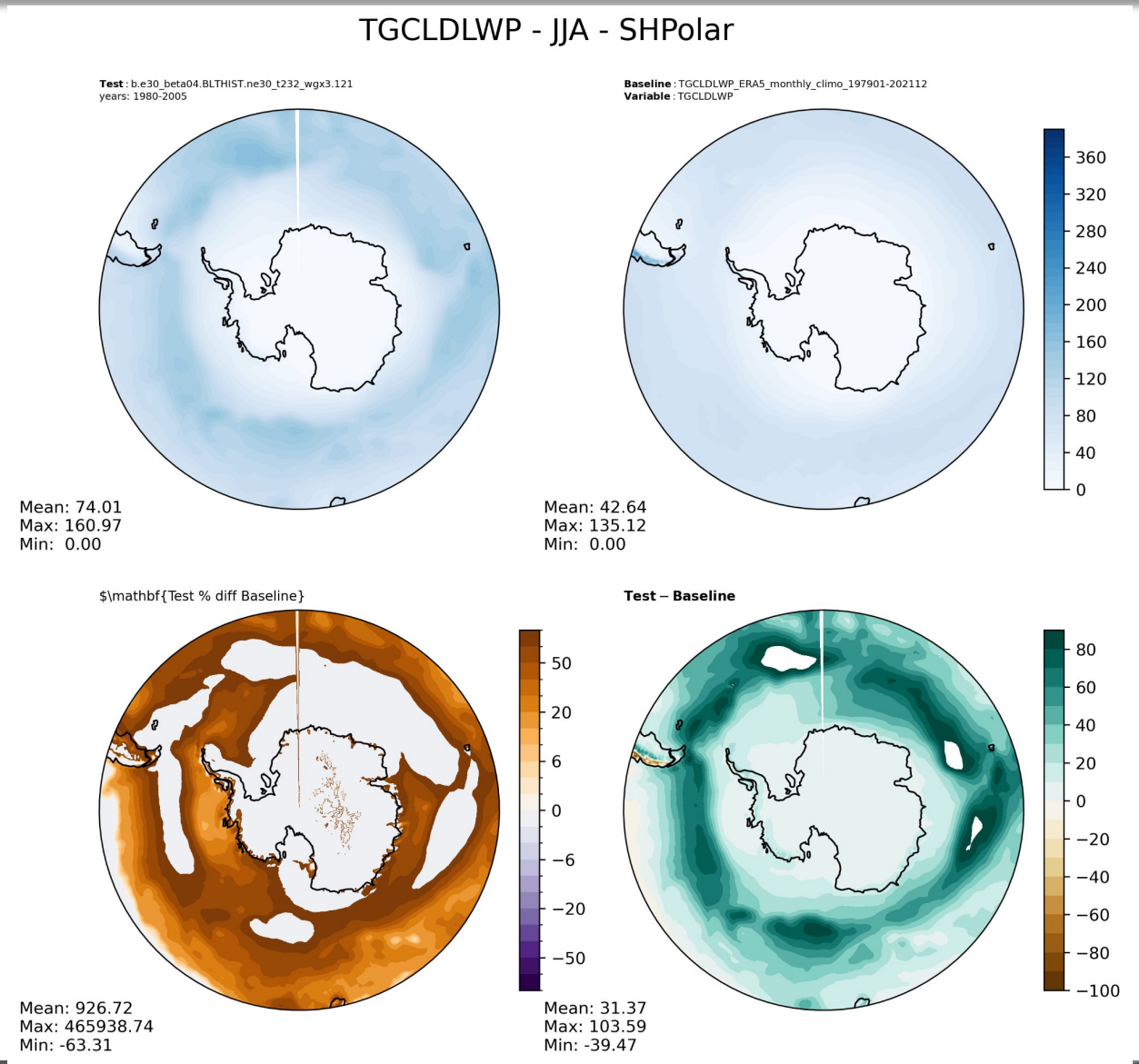
CAM cloud fields: 121- ERA





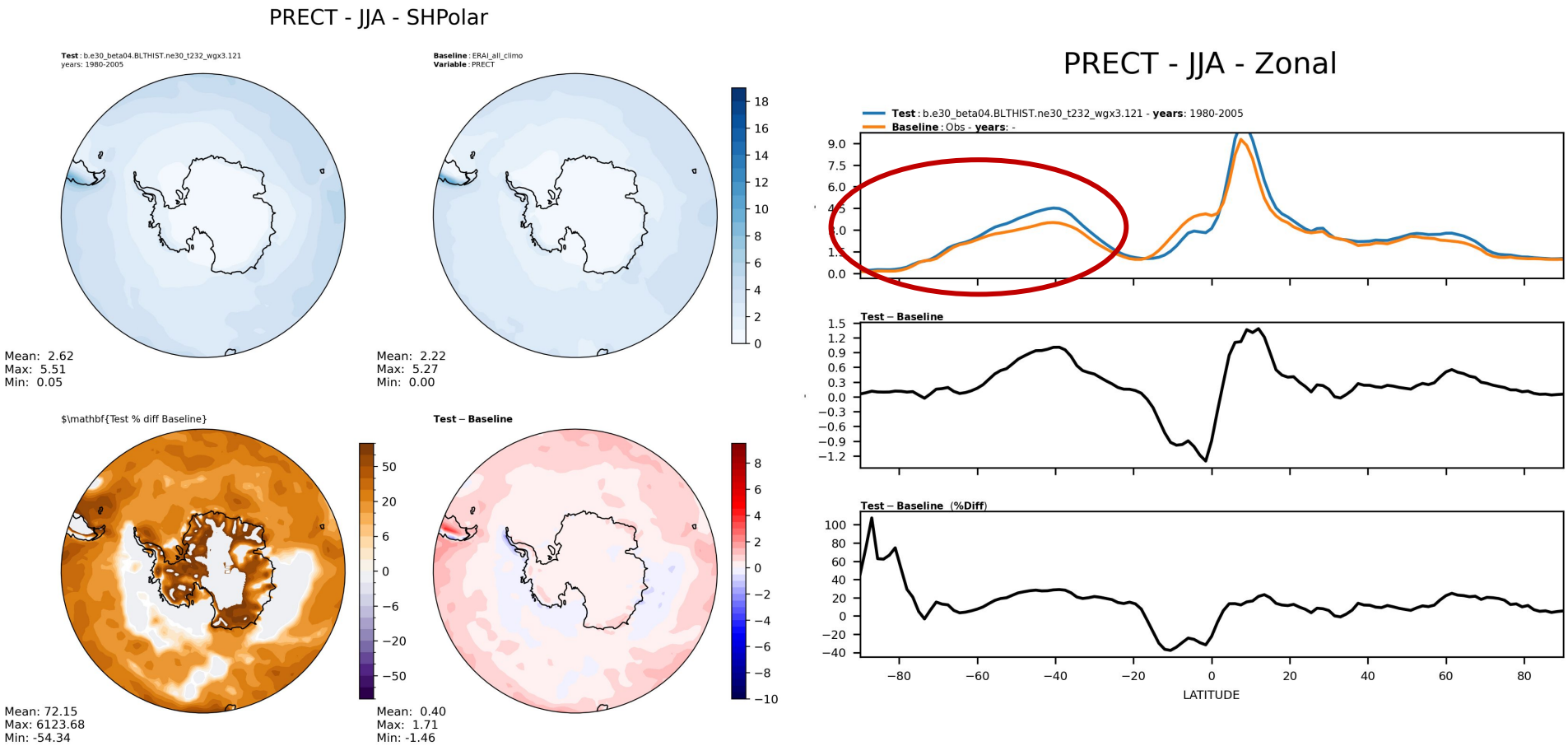
Cloud coverage is much higher in CESM3 than ERA-I

CAM cloud fields: 121- ERA



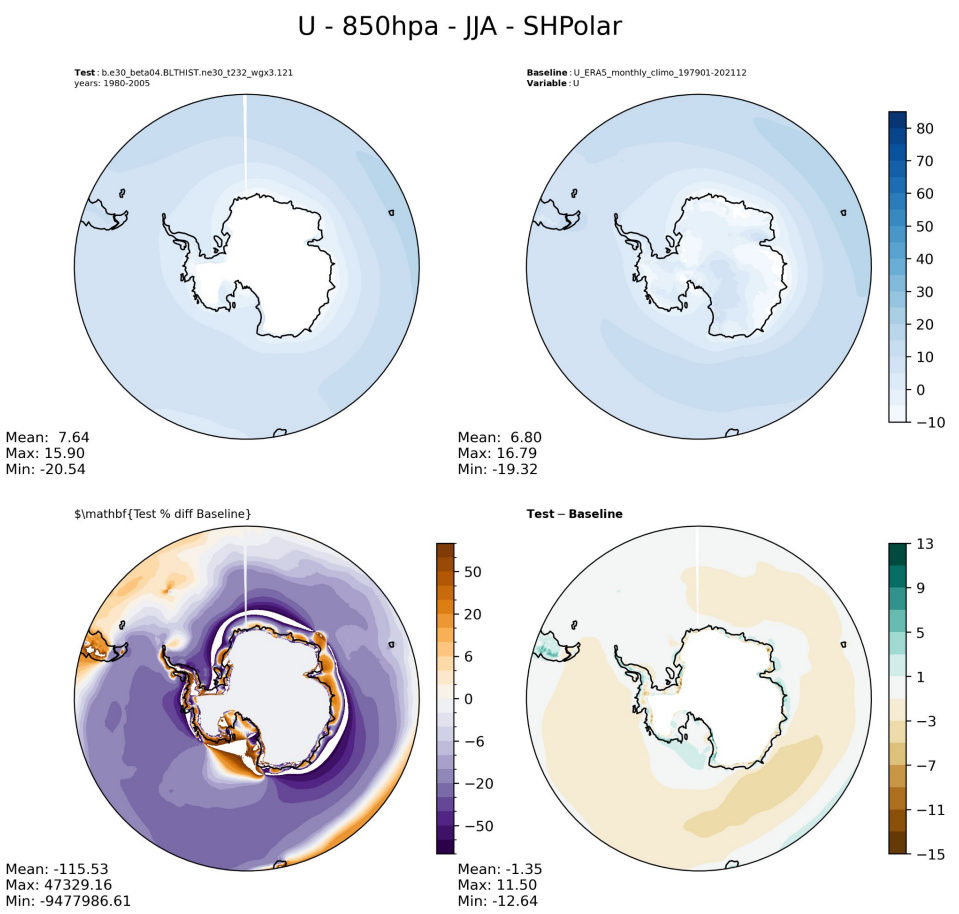
Higher LWP in some areas around Antarctica

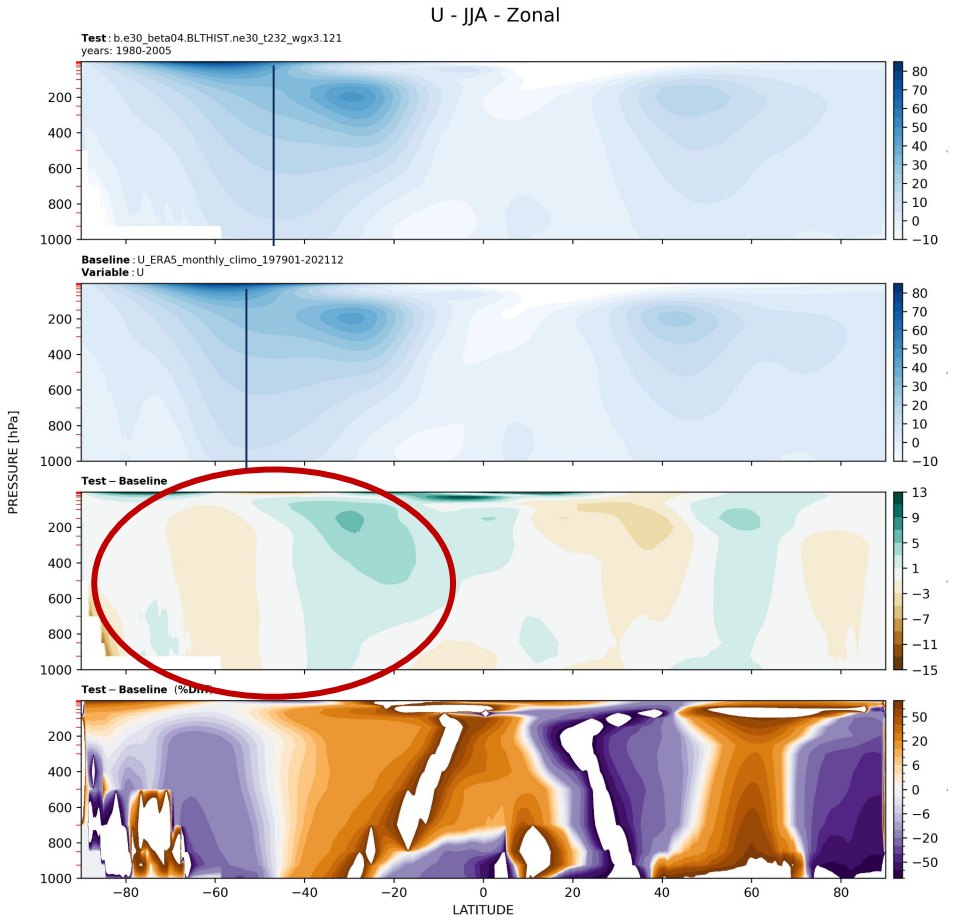
CAM precipitation: 121- ERA



There's more precipitation in CESM3 than ERA-I

CAM winds: 121- ERA





The zonal jet is shifted a bit northward

CVDP shows that SAM looks substantially different in CESM3 from CESM2