Lawrence Livermore National Laboratory

Benchmarking simulated sea-ice in ESMs: objective assessment of sector scale sea ice – Thu #117

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PCMDI Earth System Model Evaluation Project

HiLAT RASM

DOE EESM PI Meeting
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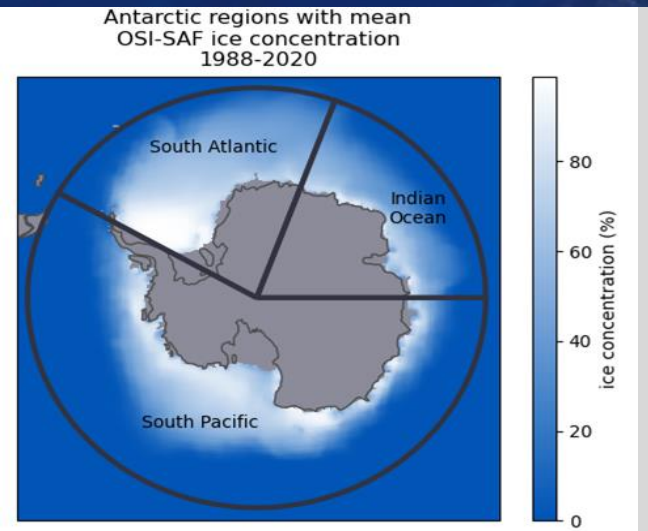
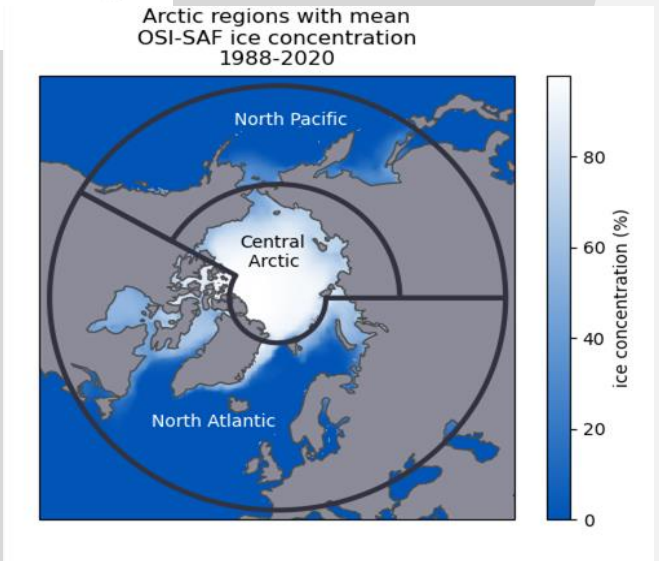
Moving beyond hemispheric sea ice extent

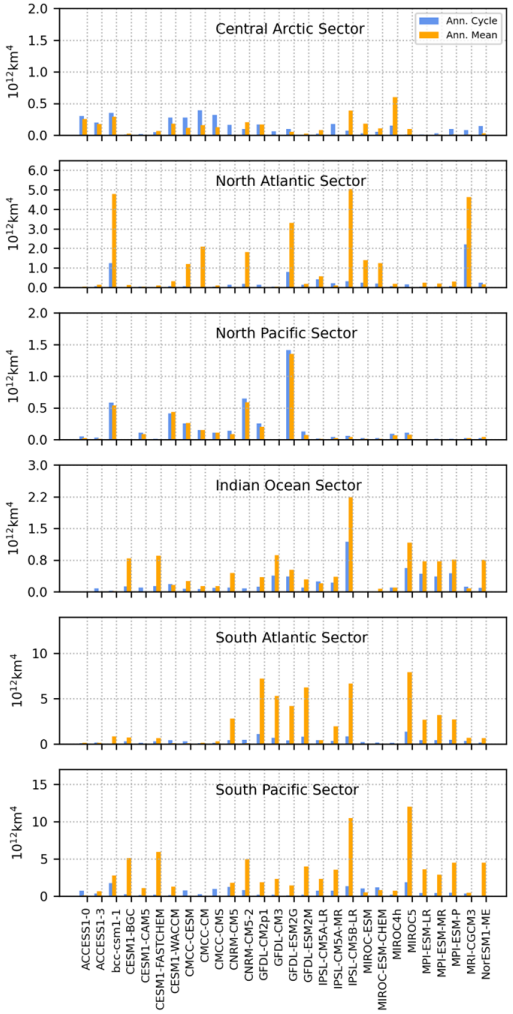




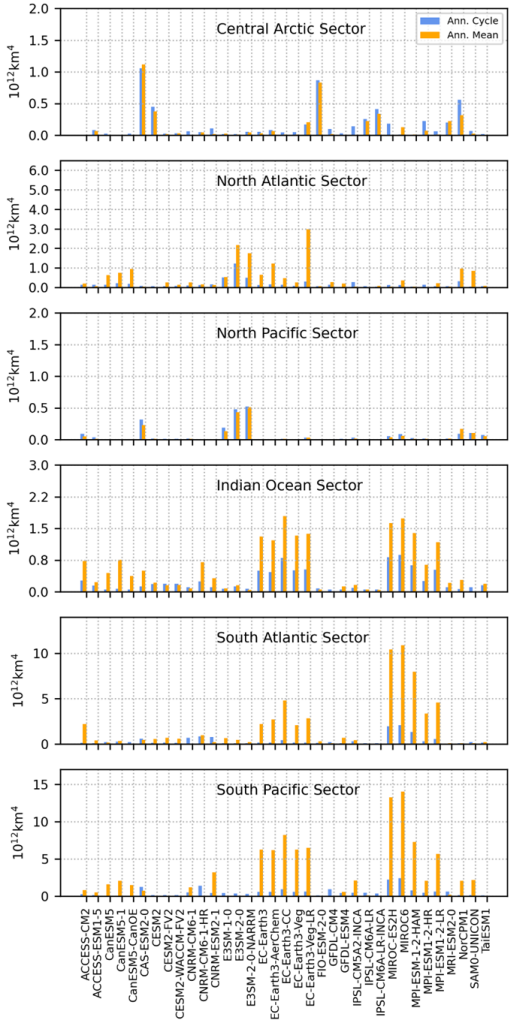
- **Developed for the HiLAT/RASM CAMAS workshop PCMDI Metrics Package (PMP) tutorial, Santa Fe, February 2024**
- Total hemispheric sea ice area is a routine way of large scale evaluation
- Hemisphere-scale assessments hide important compensating errors across basins
- Sector-based approach alleviates deficiencies in hemispheric analysis
- Analysis aligns sea ice behavior to basins, elucidating ocean bias relationships with sea ice

Behaviors across CMIP5 and CMIP6 models

CMIP5

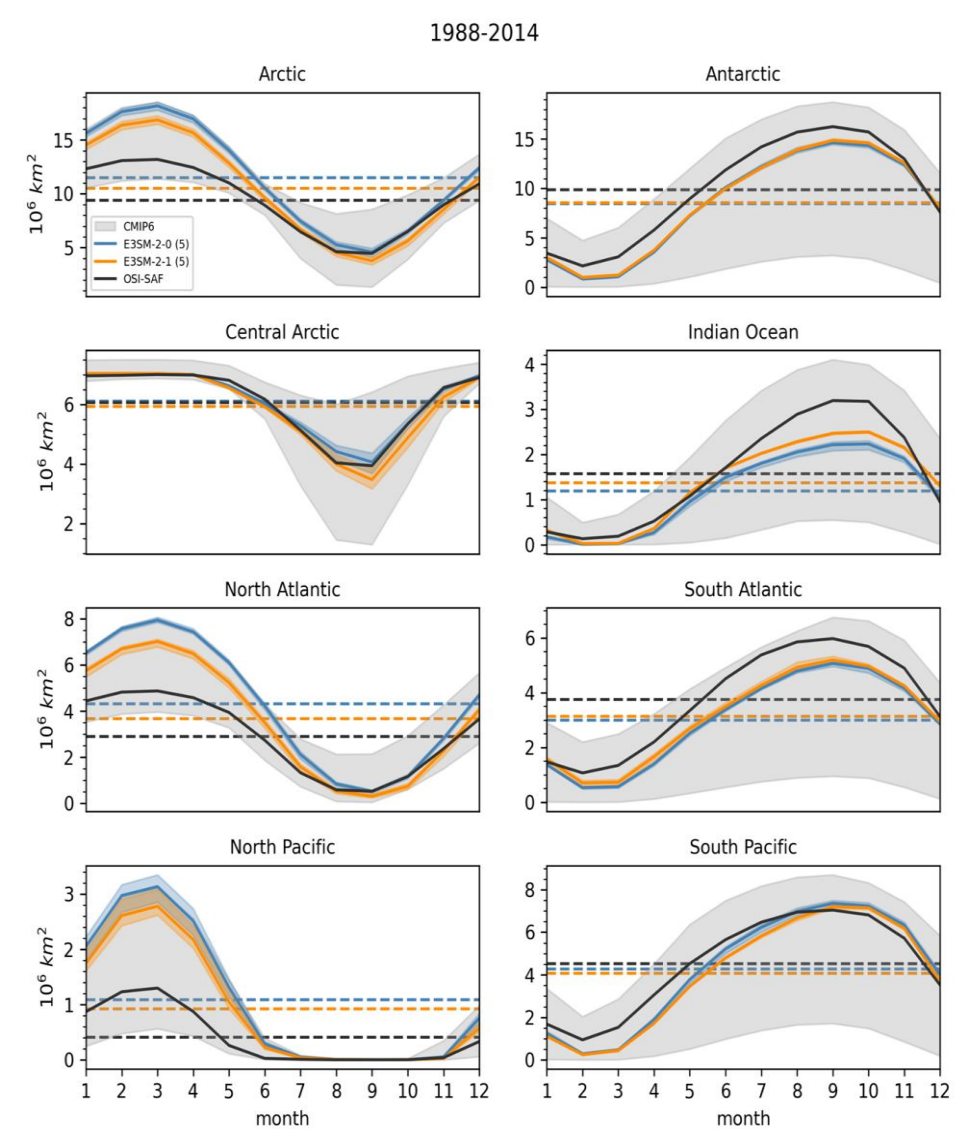


CMIP6

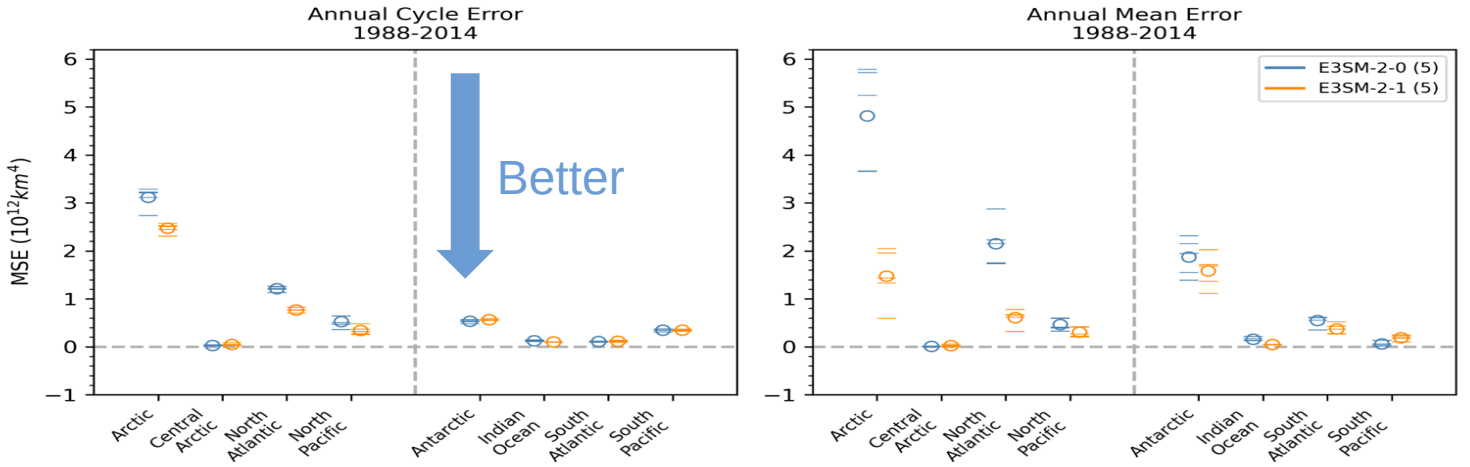


- Target well observed 1988-2005 period, with temporal coverage across CMIP5 and CMIP6 historical
- Little evidence of systematic improvement CMIP5 -> CMIP6 – but true for multi-model mean
- Qualitative improvement in Arctic sea ice – smaller magnitude errors
- Some qualitative improvement in Antarctic sea ice – select models
- Implemented in PMP, in preparation for CMIP7 – Rapid Evaluation Framework (REF)

Improvements E3SMv2 vs E3SMv2.1



- Ocean eddy parameterization amongst other updates E3SM2.0 -> 2.1
- Significant multi-ensemble climatological seasonal improvements toward observed state in both hemispheres (left)
- Reduced absolute errors compared to observations, all sectors (below)



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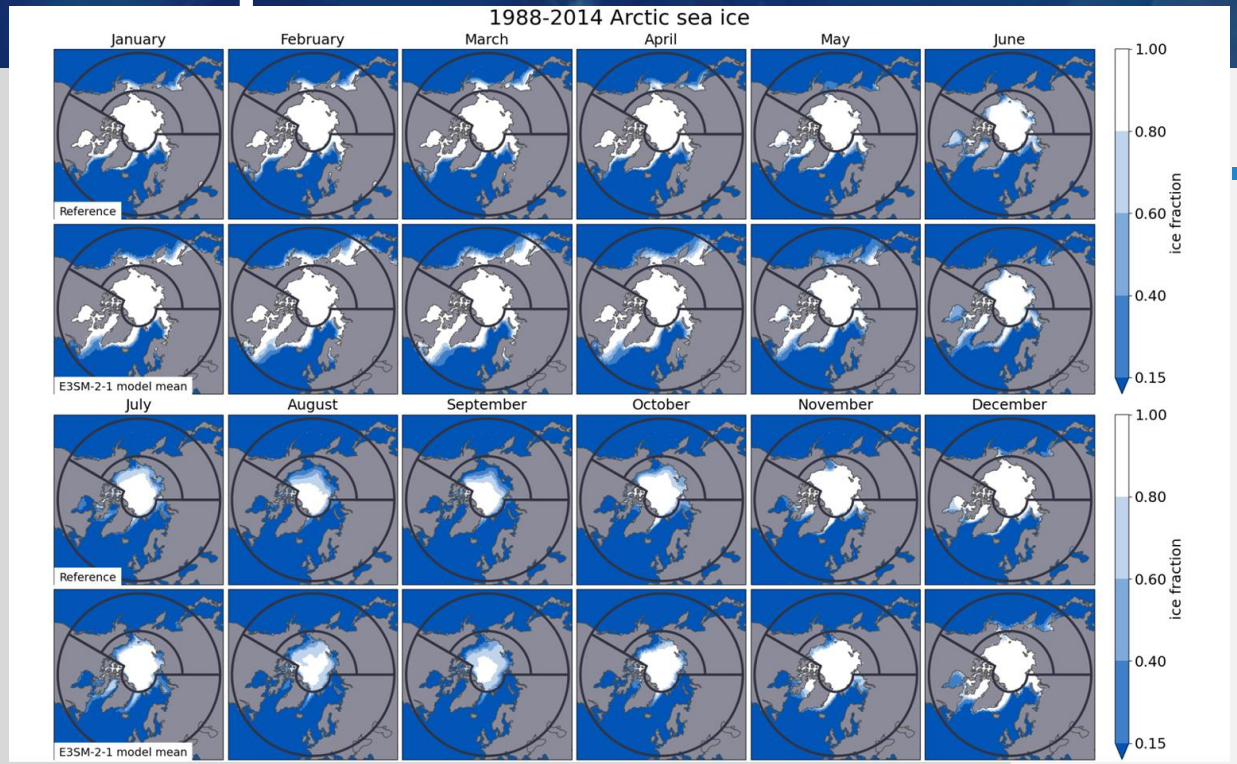
Improvements E3SMv2 vs E3SMv2.1



- Total sea ice area