

SIMA Polar

SIMA cross-WG, 2021 CESM Workshop

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Precipitation Rate (mm day^{-1})



Wind Speed (m s^{-1})

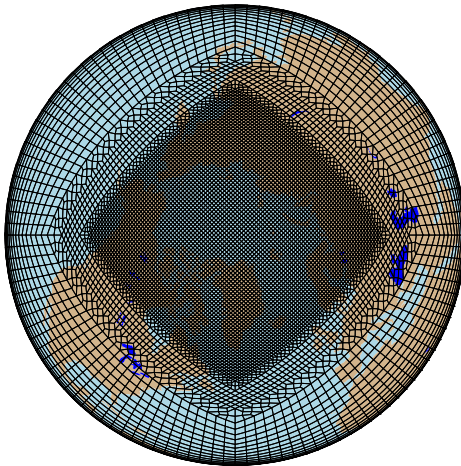


Outline

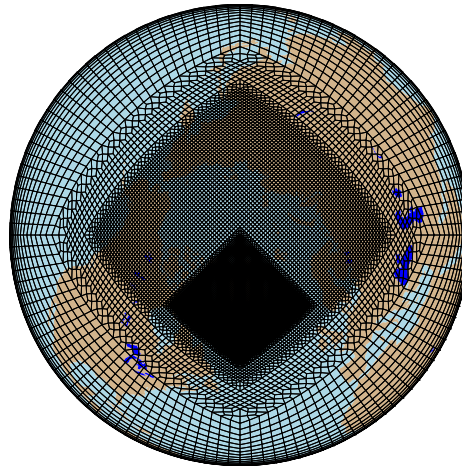
- More science results from the FHIST compset runs (CESM2.2)
 - `--res ne0ARCTICne30x4_ne0ARCTICne30x4_mt12`
 - `--res ne0ARCTICGRISne30x8_ne0ARCTICGRISne30x8_mt12`
- B1850G compset with the ARCTIC grid
- Preliminary results from Antarctic grid (ANTSI)

spectral-element polar grids

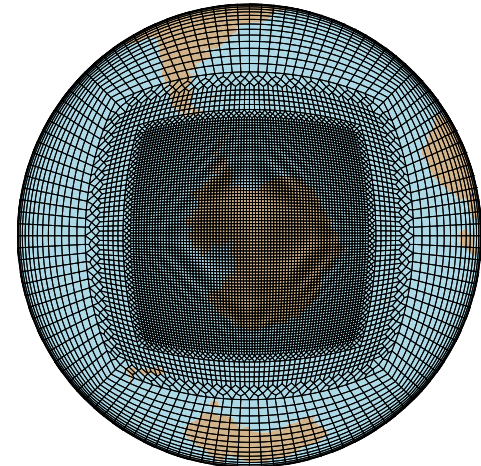
ARCTIC (1/4deg)



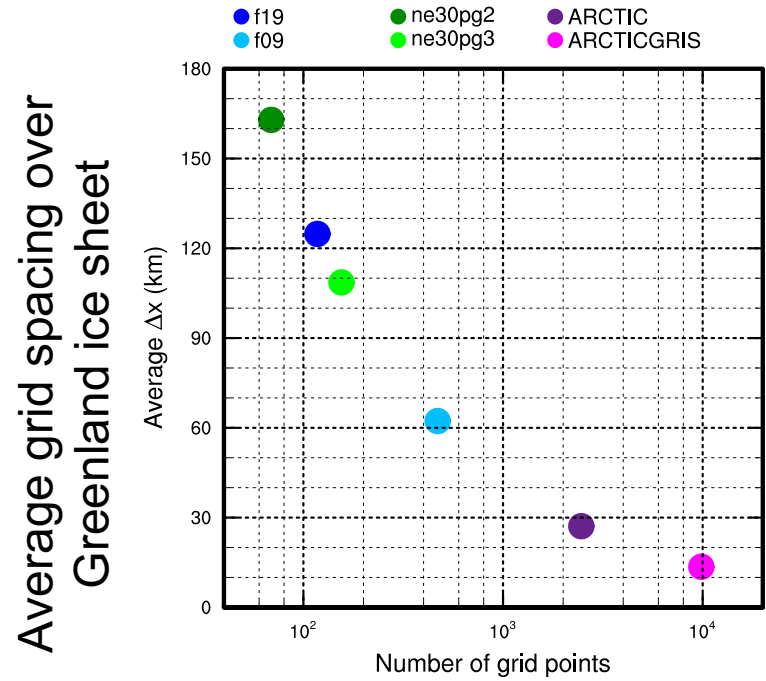
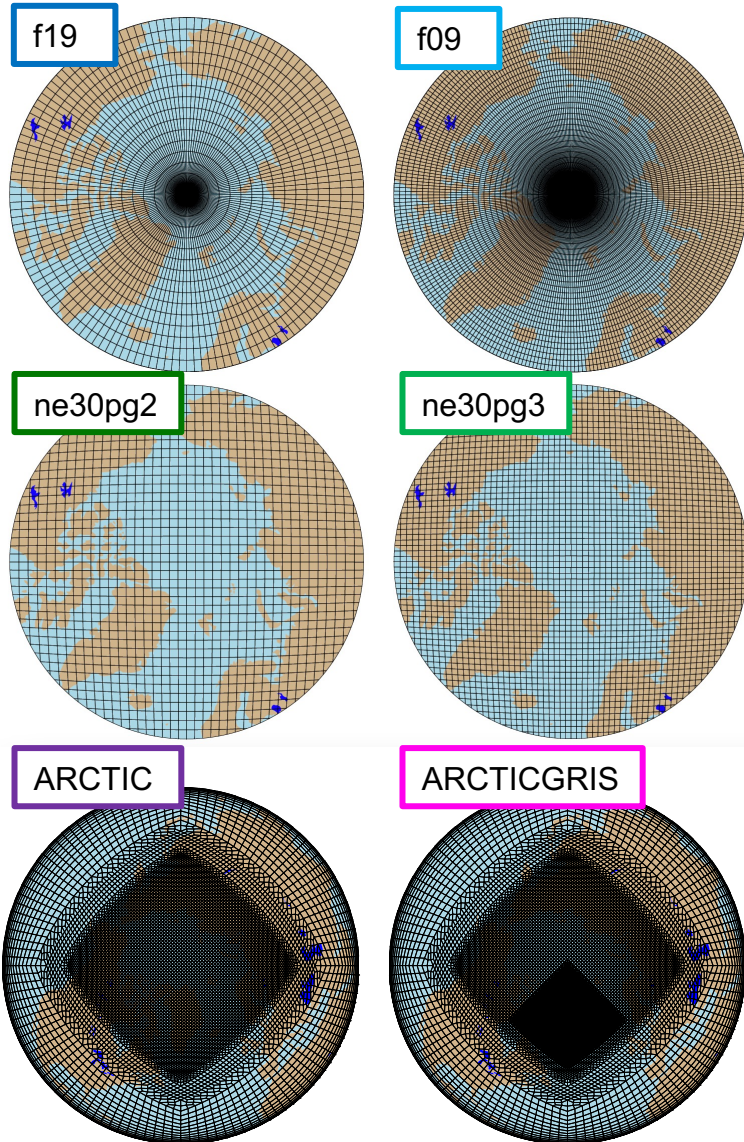
ARCTICGRIS (1/8deg)



ANTSI (1/4deg)



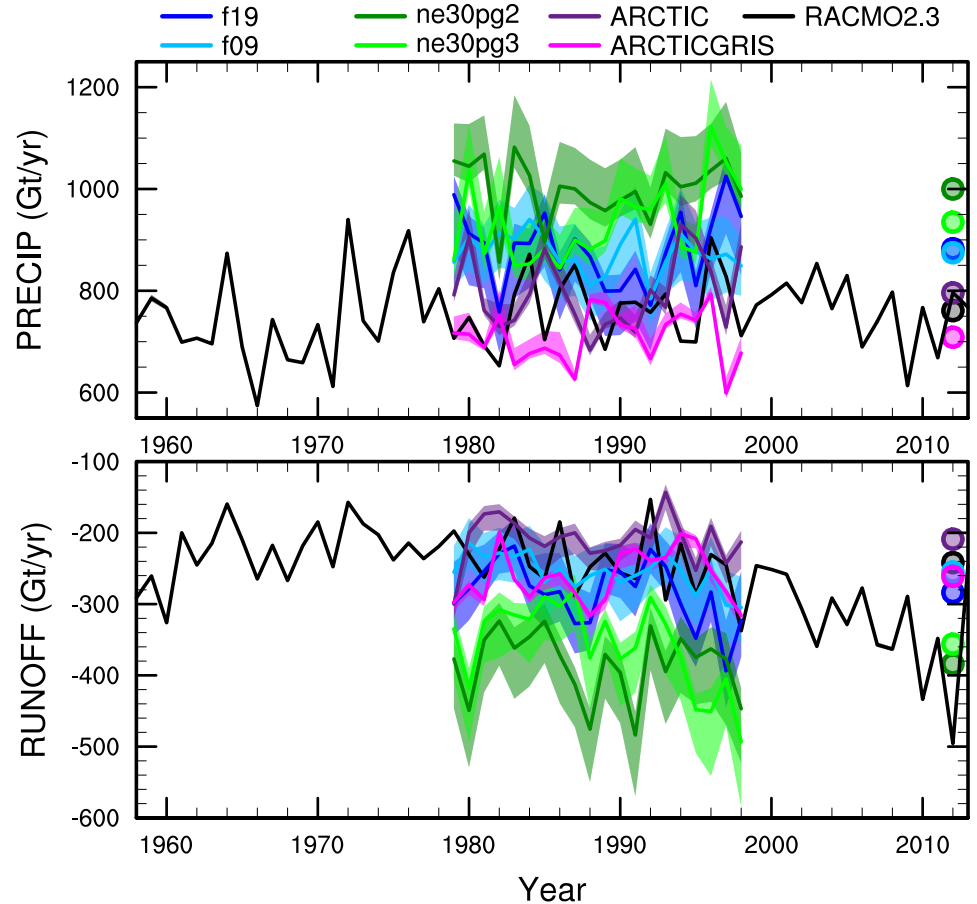
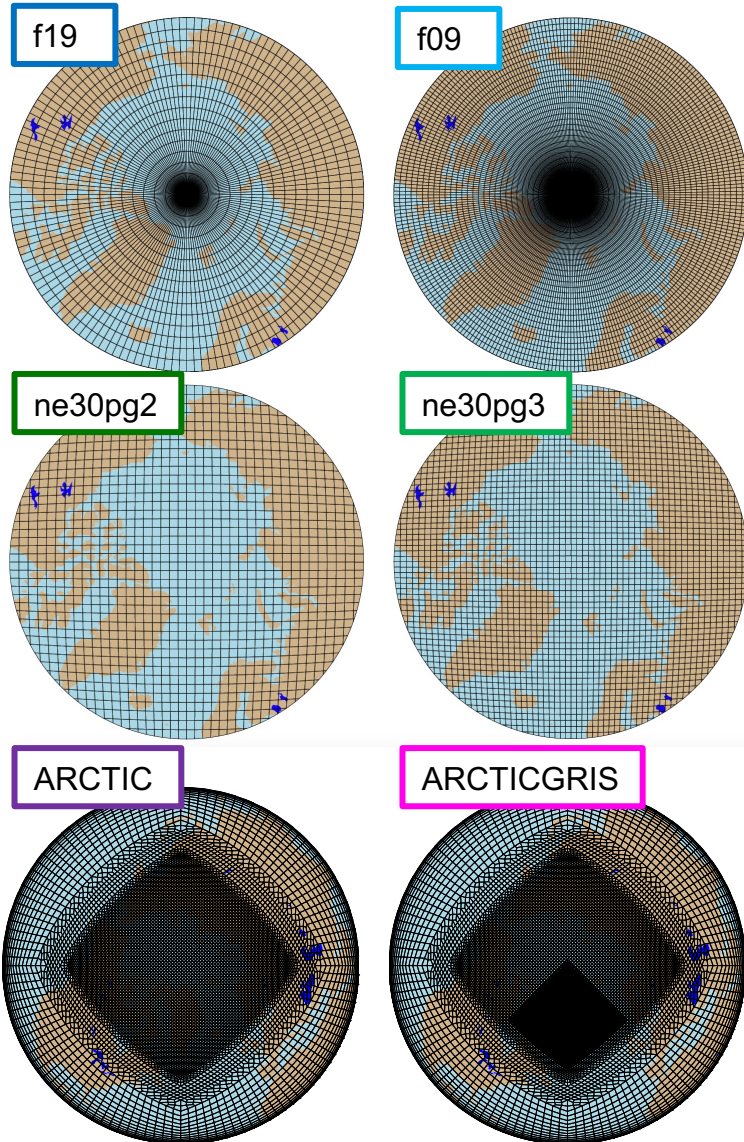
Greenland mask on different grids



Number of grid points over Greenland ice sheet

Greenland ice mask area has $O(1\%)$ differences across (these) grids

Greenland surface mass balance for different grids

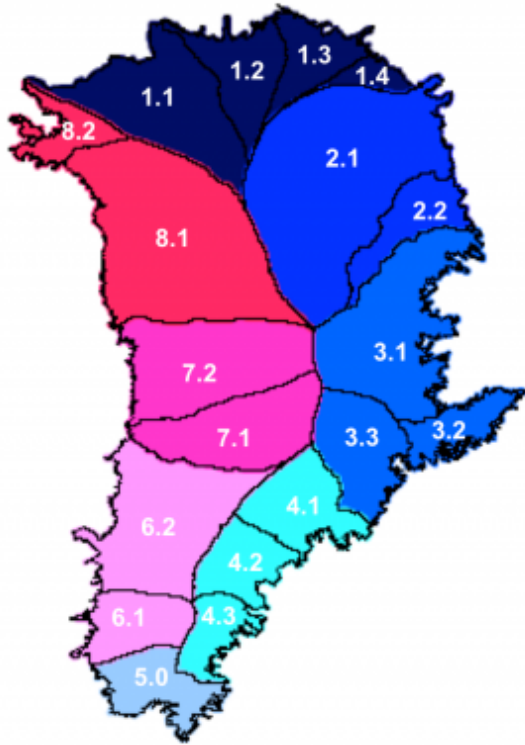


*Integrals computed on a common grid/ice-mask

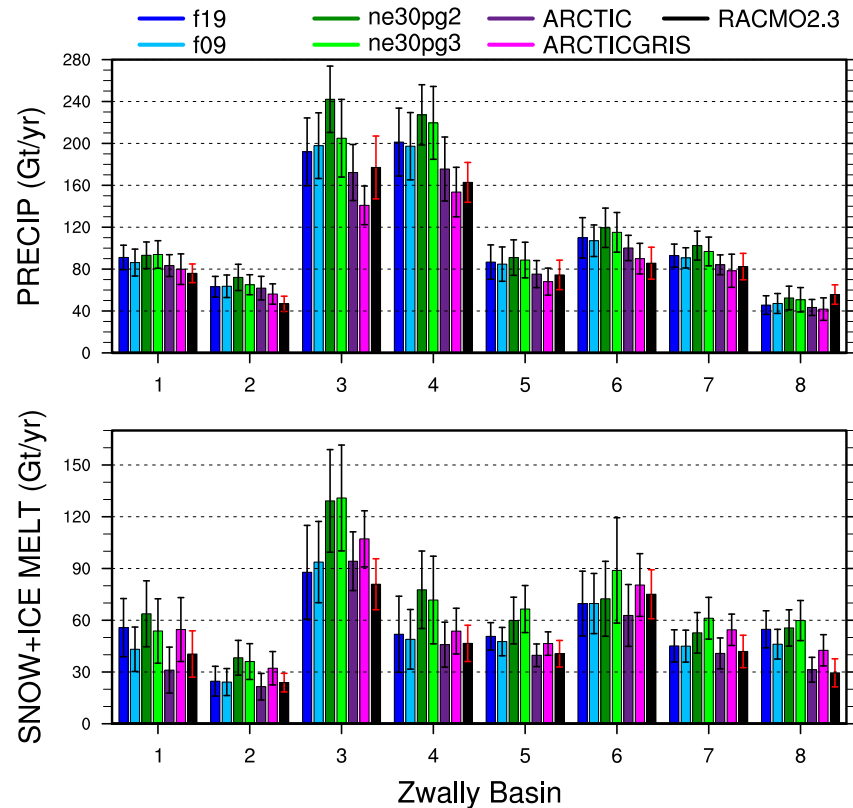
**Shading reflects mapping uncertainties

Greenland surface mass balance by Zwally basin

Zwally et al 2012



1979-1998 Annual Means



Precipitation

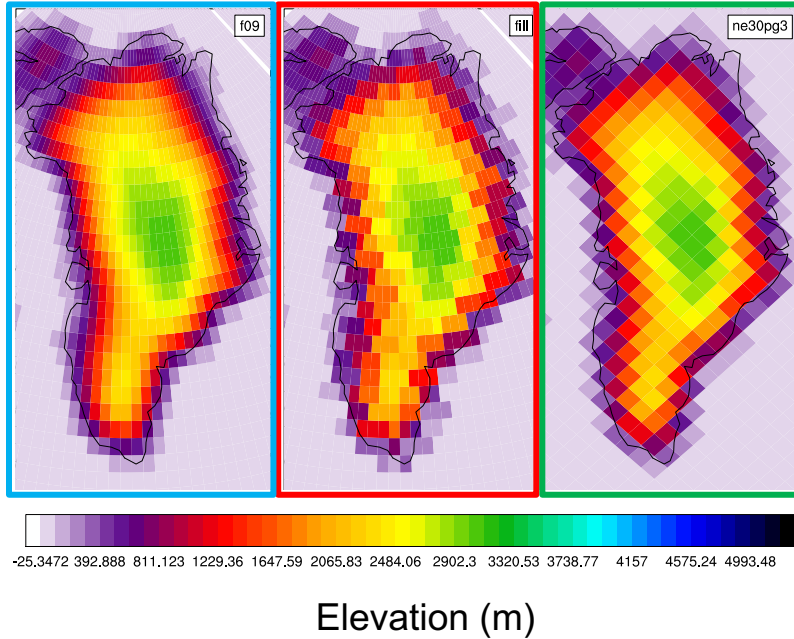
- All 1° grids over-produce precipitation, SE is worse than FV
- var-res reduces bias, due to more realistic orographic precipitation

Melt

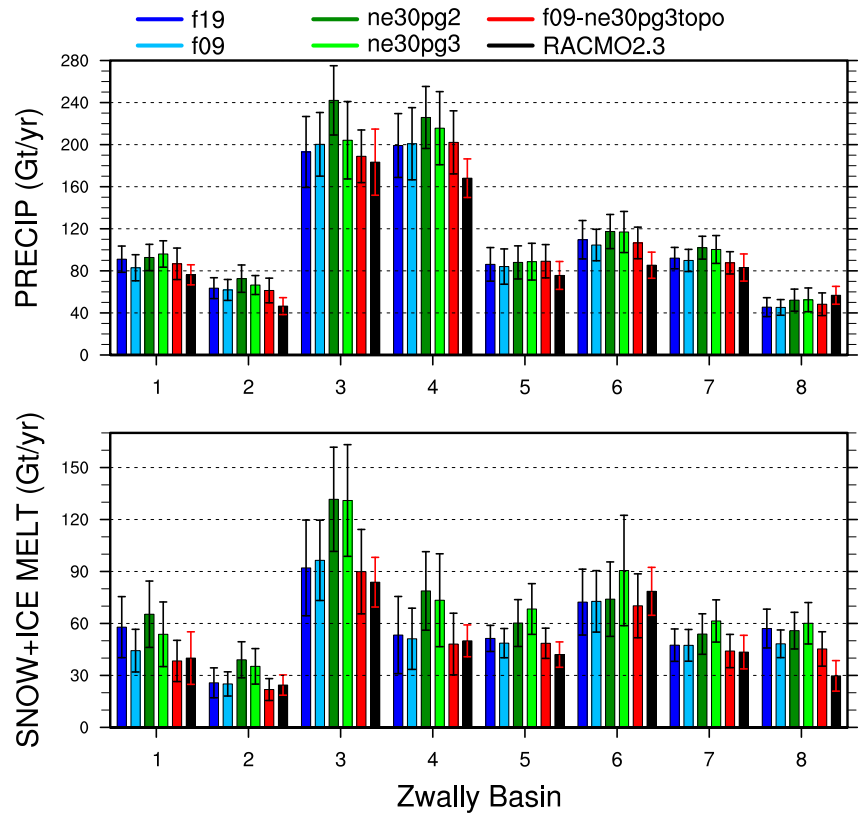
- FV does surprisingly well, SE not so much
- Elevation classes probably help in all cases

Greenland surface mass balance by Zwally basin

ne30pg3 "projected" on to f09



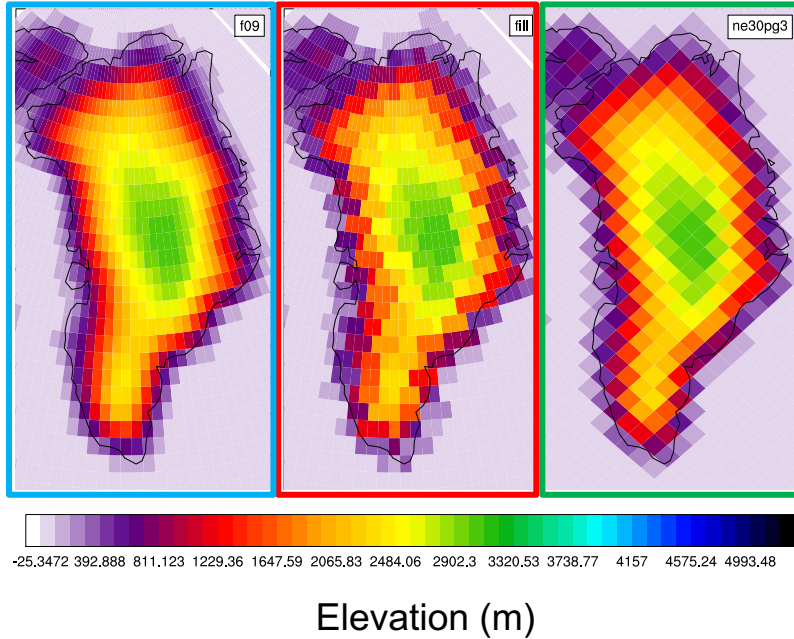
1984-1998 Annual Means



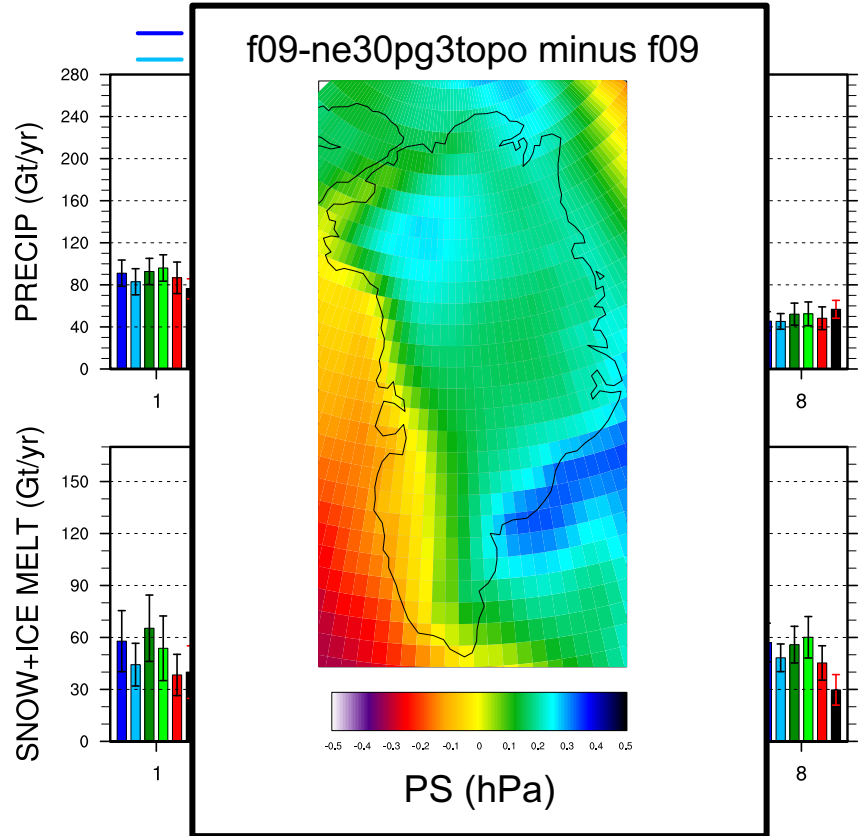
Suggests degradation of ne30pgX grids is not due to coarser topography, but rather coarser dynamical resolution relative to FV

Greenland surface mass balance by Zwally basin

ne30pg3 "projected" on to f09



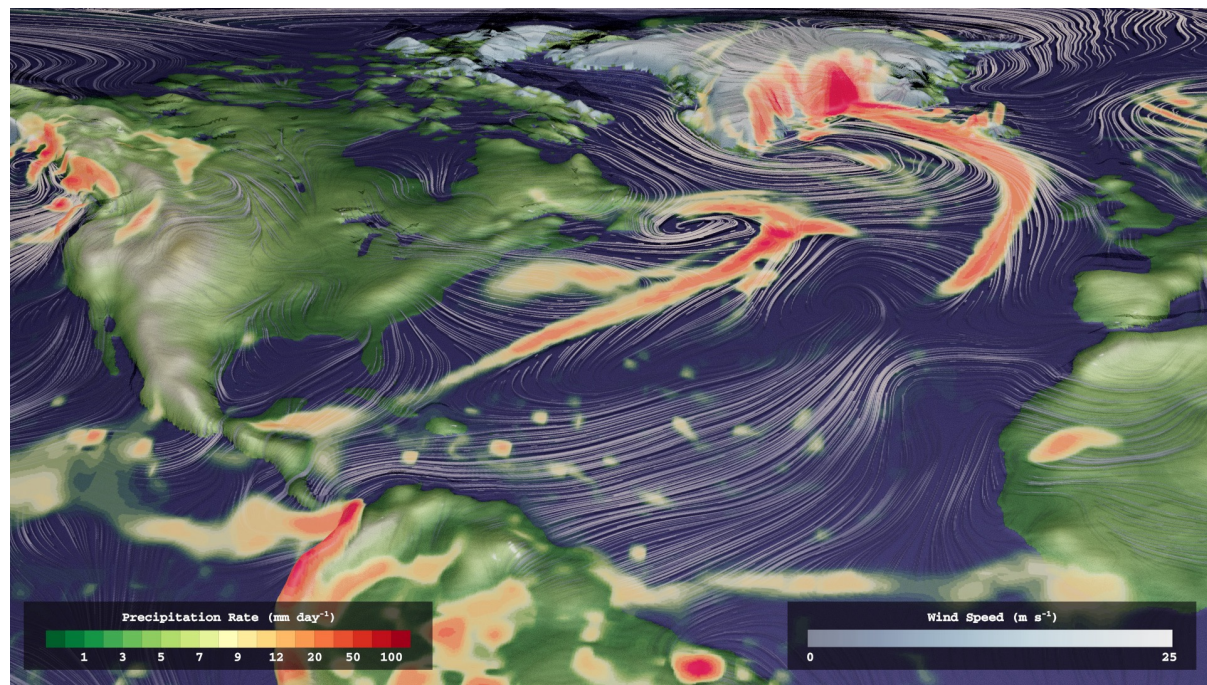
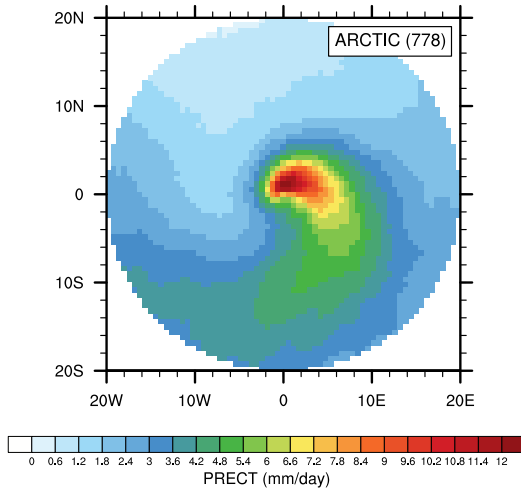
1984-1998 Annual Means



Suggests degradation of ne30pgX grids is not due to coarser topography, but rather coarser dynamical resolution relative to FV

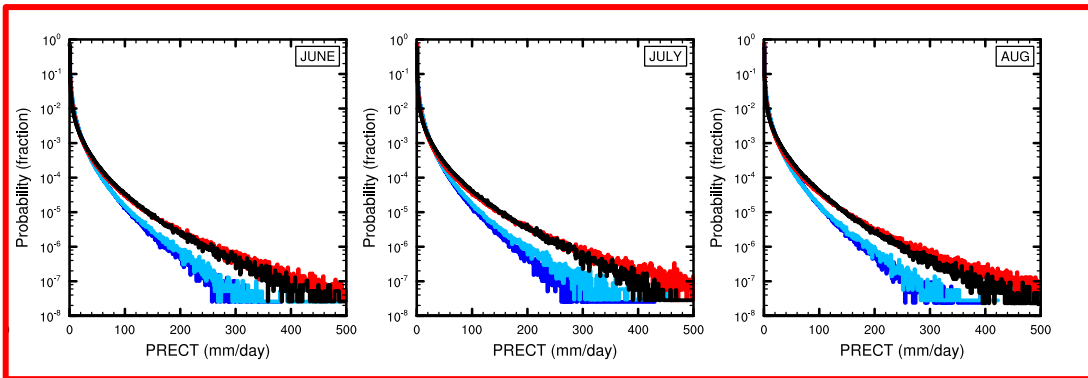
Arctic Storms

Composite mean poleward of 45°N



- ne30pg3
- ne30pg3-NCPL192
- ARCTIC
- ERA5

PDF of all storms poleward of 45°N (1979-1998)

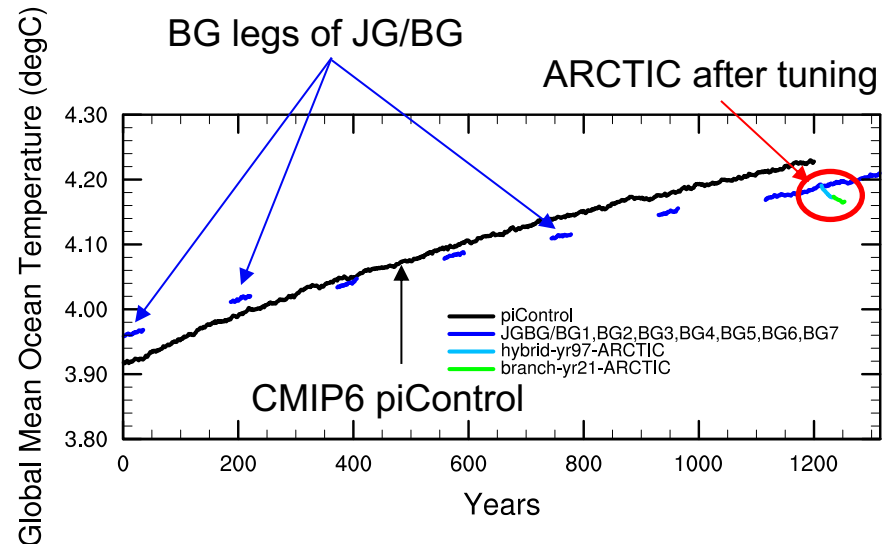
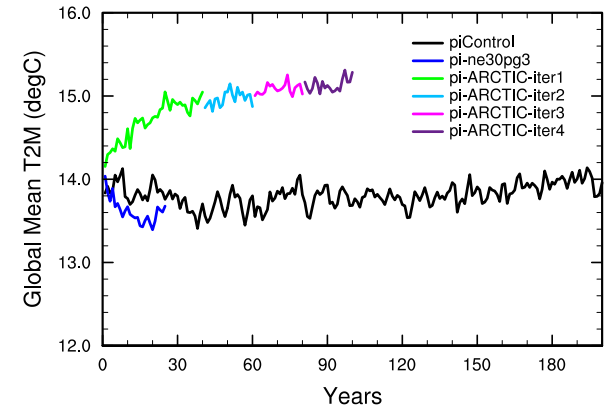


- Realistic orographic precipitation at Greenland ice sheet margins
- Higher horizontal resolution increases extreme precipitation, and is more similar to ERA5
- Polar lows? B1850G ...

ARCTIC B1850G Compset (Fall release)

- var-res tuning approach
 - Tune a 1° model w/ the var-res physics time-step
 - Reasonable spatial patterns of SWCF
 - RESTOM ~ 0.1 W/m²
- pe-layouts (B. Dobbins)
 - ~ 4000 pes, ~ 4 SYPD
 - ~ 8000 pes ~ 7.5 SYPD
- multi-century runs
 - 1850, 1850-2020, 2020-2250
 - 5X 1970-2020 ensemble members
- last (hopefully) hiccup
 - Blockiness on CISM grid using JG/BG restarts

ARCTIC before tuning



JG/BG from Lofverstrom et al 2020. JAMES

Conclusion

- ne30pgX degrades surface mass balance relative to FV
- Arctic grids
 - More realistic extreme storms
 - More realistic orographic precipitation
 - More realistic surface melting/surface mass balance
- Arctic B1850G compset - almost ready for primetime!
- Antarctic grid - initial evaluation stage

Checkout our VisLab visualization
(search youtube for '[vislab greenland](#)')