

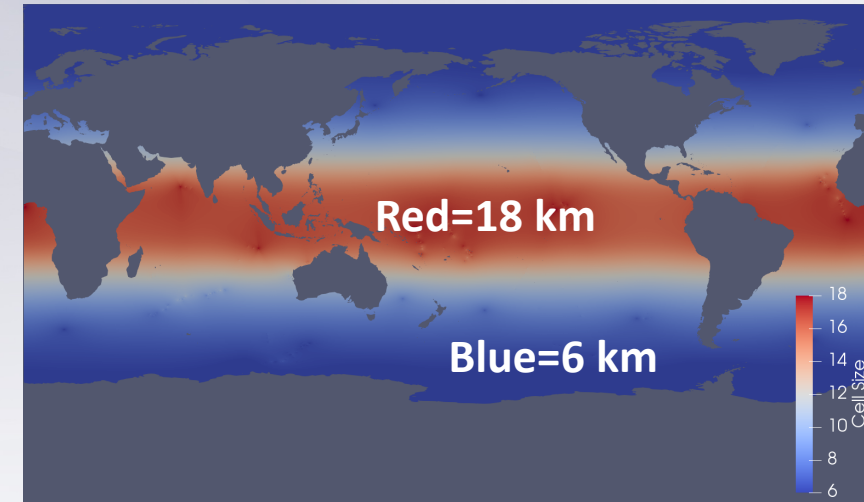


# Status of v1 High-Res Coupled Effort

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# What is v1 High-Res Coupled?

- The v1 high-res target is 25 km for atmos+land and 6-18 km for ocean+sea ice (see graphic)
- High-res is tuned differently than low res (see table)
- Polar winters were way too warm in our original simulation, so we reverted v1's CNT nucleation scheme to v0's Meyers scheme
  - subsequently we heard that warm poles was caused by unrealistically low Bergeron efficiency



*Fig: ocean+ice  $\Delta x$  for v1 high-res runs.*

## List of Res-Dependent Tuning Params:

- |                    |       |
|--------------------|-------|
| • alfa             | • ke  |
| • c0_lnd           | • dp1 |
| • c0_ocn           | • c8  |
| • dmpdz            | • c14 |
| • dust_emis_factor |       |

# High-Res Simulation Plan

- We have completed 50 yrs of a coupled 1950 control run (A\_WCYCL1950S\_CMIP6\_HR compset)
  - “control” means perpetual 1950 conditions chosen because
    - 1950 wasn’t that different than the typical pre-industrial date of 1850
    - high-res transients are too expensive to run through the relatively boring 1850-1950 period
  - This run will be part of our HighResMIP submission and follows HighResMIP guidance except for using interactive aerosol
  - Webpage with info about run, location of output, etc here: <https://acme-climate.atlassian.net/wiki/spaces/SIM/pages/795968371/theta.20180906.branch+noCNT.A+WCYCL1950S+CMIP6+HR.ne120+oRRS18v3+ICG>
- Future plans:
  - Continue the 1950 control for another 100 yrs + complete 1950-2050 transient run(s) following the HighResMIP protocol... once we can create the transient compset!!!
  - Perform Cess climate sensitivity and aerosol sensitivity runs with fixed SST (working on compsets)
  - **Rerun 1 yr of 50 yr simulation with extra output... Any output requests?**



# Background about the High-Res Overview Paper

- Primary purpose is as the citation for research involving the high-res model
- Science question: What is the impact of increasing resolution?
- Authorship:
  - For people who contributed to the high-res model beyond what was already rewarded by low-res paper authorship
  - OR people who actively help with analysis needed for the high-res paper
  - Let me know if you feel you should be a coauthor or want to get involved!



# Paper Outline

- Intro
- Model description (brief, mostly cite other v1 papers and describe tuning)
- Evaluation of large-scale features (skill at resolutions captured by other models)
- Effect of resolution (the main topic of the paper)
- Climate sensitivity (computed from Cess and adjusted-forcing runs)
- Conclusions

<https://acme-climate.atlassian.net/wiki/spaces/EWCG/pages/916030129/High-Res+v1+Overview+Paper+Outline>

# Extra Slides

# The Path to a High-Res Release – Polar Problems

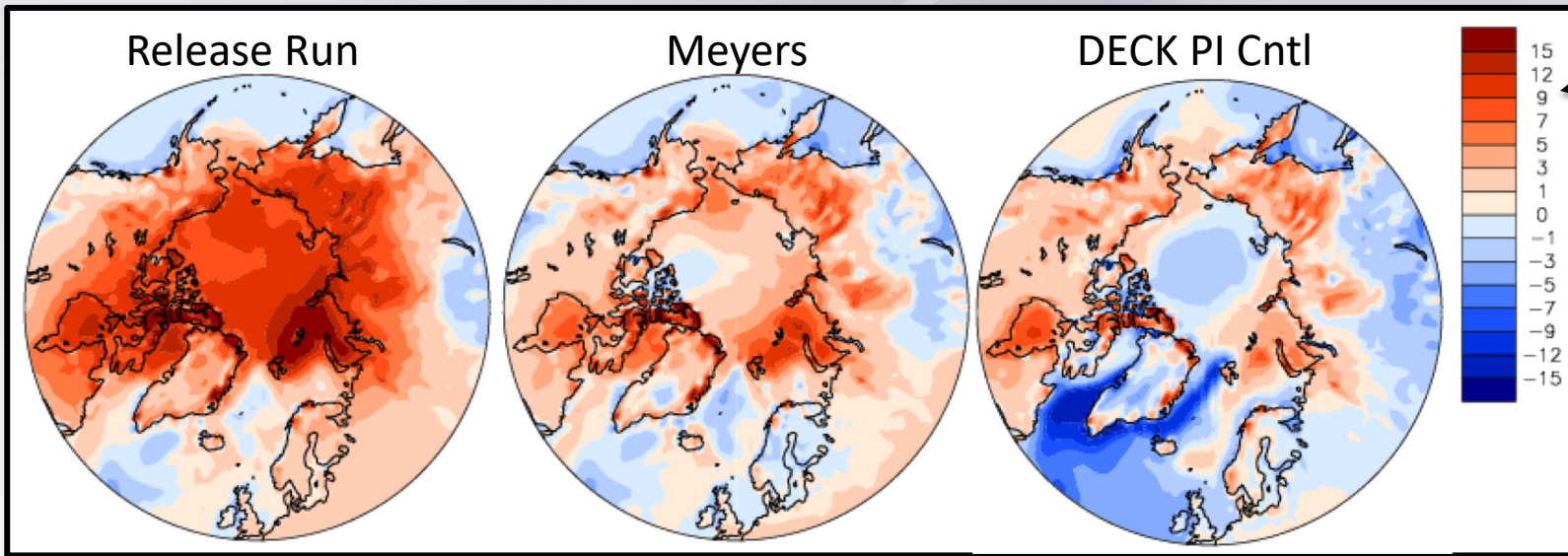


Fig: DJF Surface temperature bias (relative to ERA-Interim)

- In our 1st run, poles were 10K too warm in winter and sea ice ~disappeared in summer!

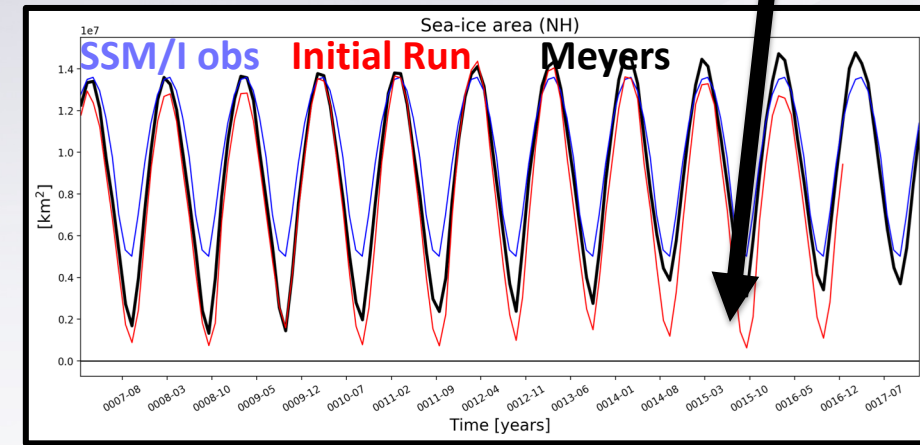


Fig: Seasonal cycle of N. Hemi. sea ice area.

## Reason:

- In v0, the Bergeron efficiency was set unrealistically low to compensate for Meyers mixed-phase nucleation being too strong
- in v1, Meyers was replaced by Classical Nucleation Theory (CNT) without retuning Bergeron efficiency

## Solution:

- Revert to Meyers scheme (because changing Bergeron would require too much retuning)



# 'Impact of Higher Resolution' Topics

- Atm
  - precip (orographic, di cycle, intensity, etc)
  - tropical cyclones
  - blocking
  - impact of coastal jets on boundary-layer clouds
- Ice
  - Labrador Sea freezing
  - Mertz Glacier
  - Issues with low-res topography
- Ocean
  - AMOC differences between resolutions
  - Eddying Gulfstream
  - Nordic Sea SST
  - ENSO variability across resolution
- Land
- Rivers

# Backup Slide: Available High-Res Output

- monthly average: default + IEFLX, extinct\_sw\_inp, extinct\_lw\_bnd7, extinct\_lw\_inp
- daily (h1): FLUT, OMEGA500, PRECT, PS, QREFHT, TMQ, TREFHT, TREFHTMN, TREFHTMX, TS, TUQ, TVQ, U200, U850, UBOT, V200, V850, VBOT, Z500
- 6 hrly ave: PSL, T200, T500, TREFHT, U850, UBOT, V850, VBOT
- 6 hrly snapshot: FLUT, OMEGA500, PRECT, U200, U850 (did we need V?)
- 3 hrly: PRECC and PRECT
- Last 10 yrs: COSP-lite in monthly files
- Planned: rerun a year with more high-freq output