(Ultra-) High Resolution and Regionally-Refined Modeling: Survey Results

Simone Tilmes and Sophia Macarewich

NCAR

JUNE 12, 2023

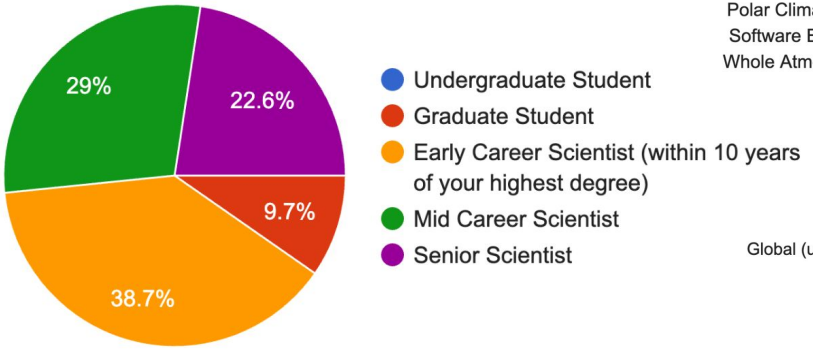
This material is based upon work supported by the National Center for Atmospheric Research, which is a major facility sponsored by the National Science Foundation under Cooperative Agreement No. 1852977.

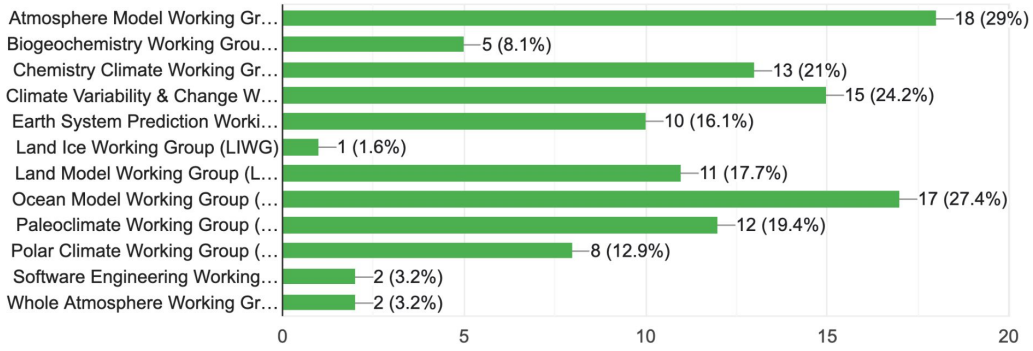
Outline

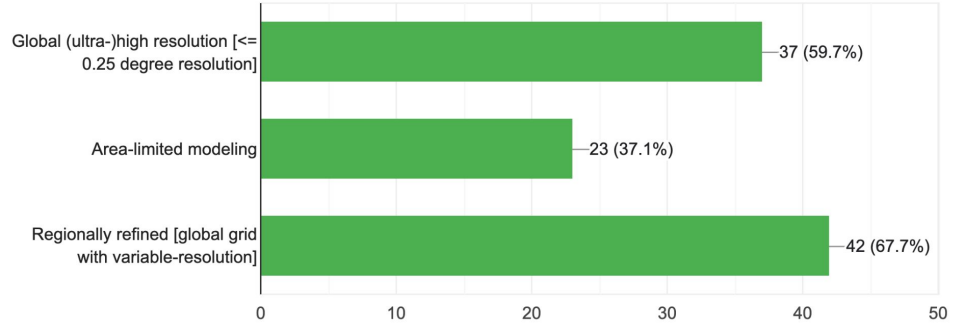
- General overview
- (Ultra-) High-resolution modeling stats
- Variable-resolution modeling stats
- Area-limited modeling stats
- Venn Diagrams for benefits and shortcomings to all 3
- Community resources and needs
- Discussion & Discussion Questions

General Overview

N = 62 responses total



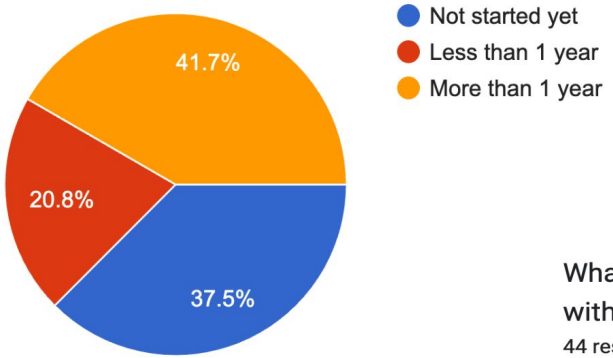


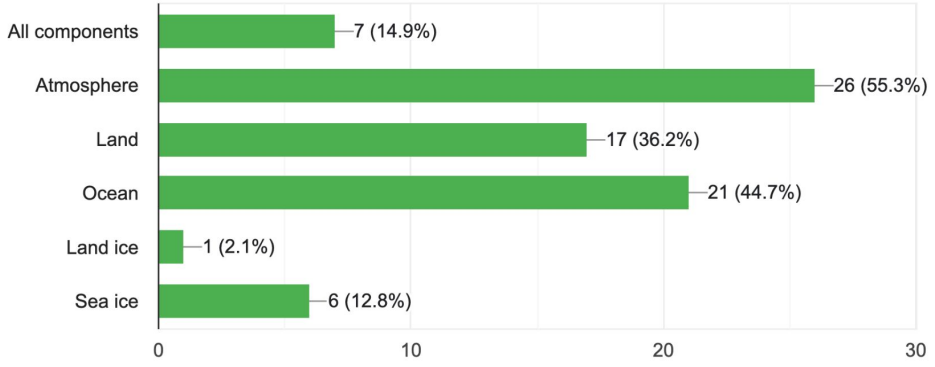


(Ultra-) High-resolution modeling [⩽0.25°]

How long have you worked with (ultra-)high resolution?

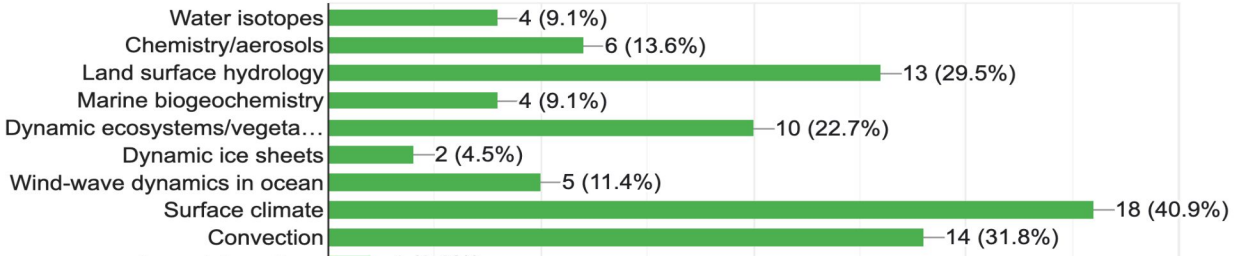
48 responses





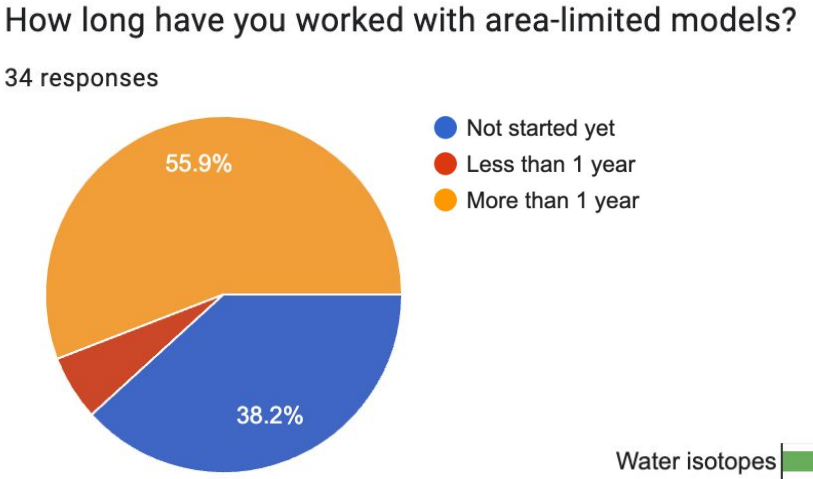
What (ultra-)high resolution modeling capabilities are you working with or are interested in working with? Please fill in any that are missing.

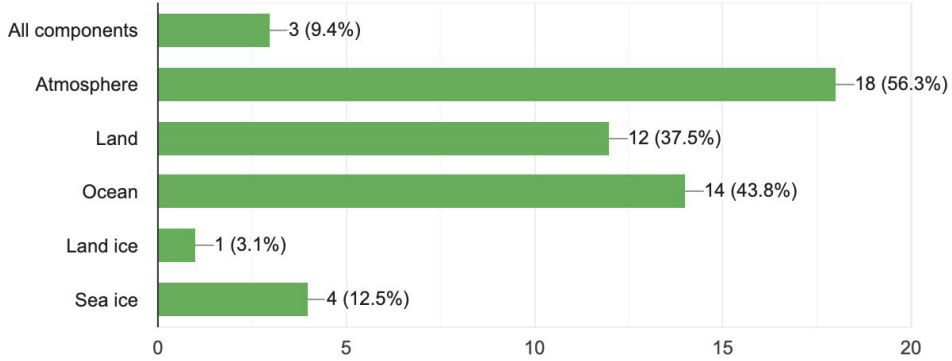
44 responses

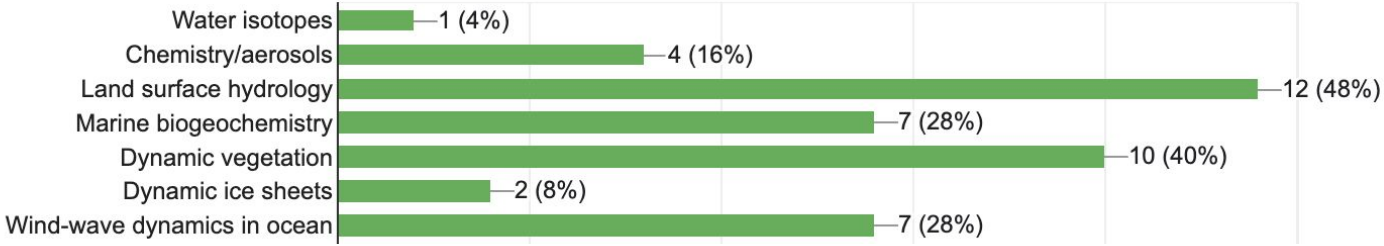


Other: *polar lows, weather extremes, AMOC, air-sea-ice interaction, ocean eddies & currents*

Area-limited modeling

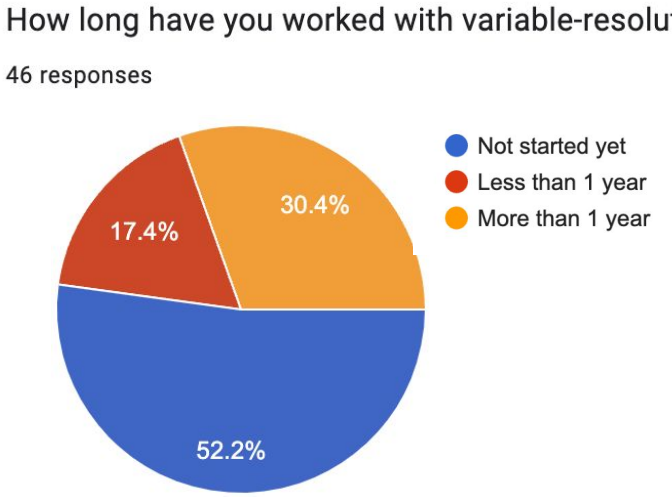


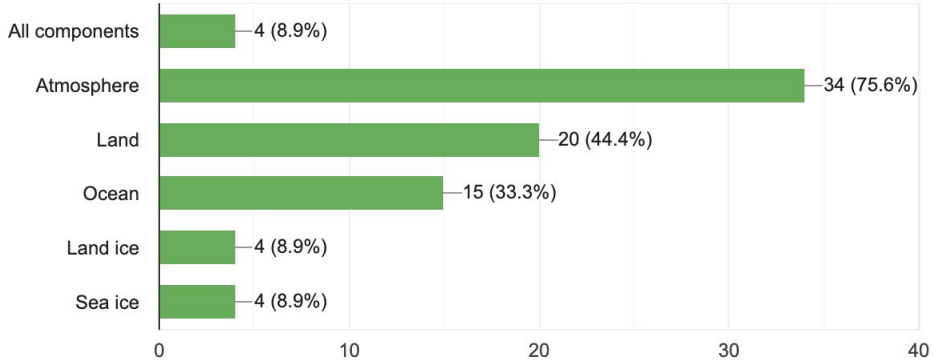




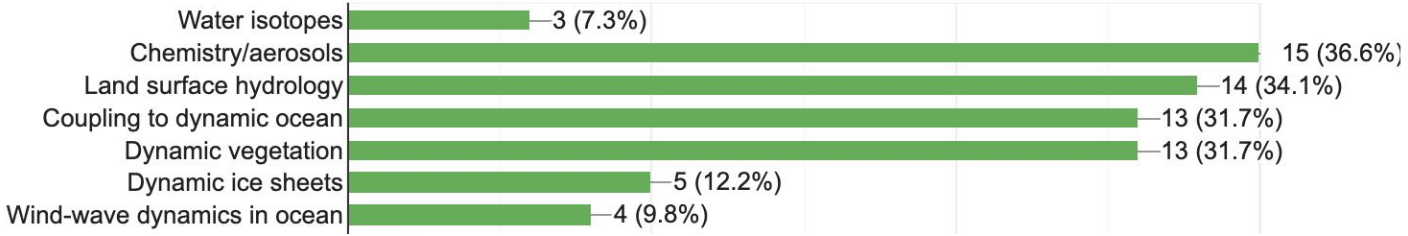
Other: clouds & *turbulence, ocean eddies & currents, coastal impacts, surface climate*

Global Grid with Regional Refinement





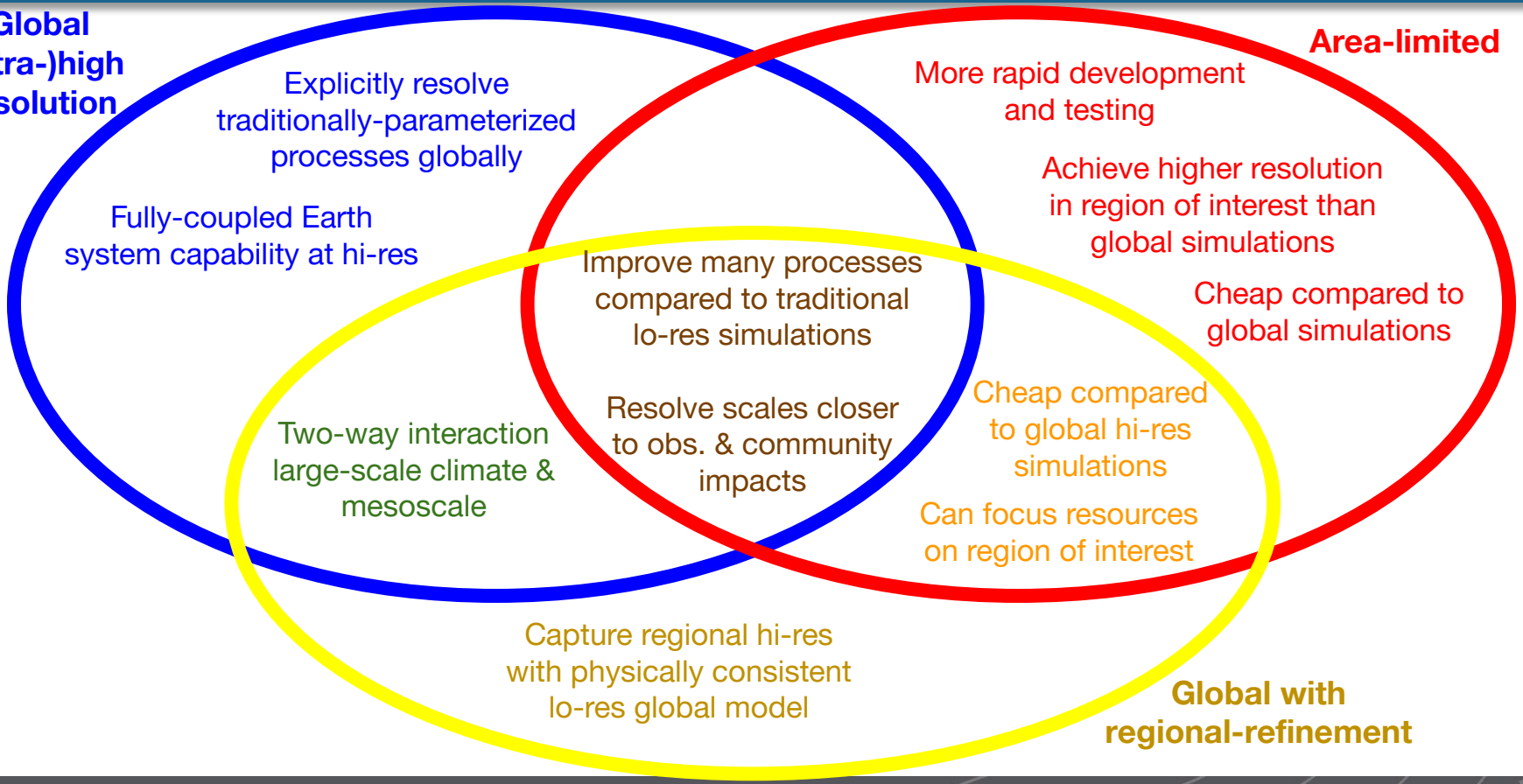
Other: clouds, *surface climate, convection, biogeochemistry*



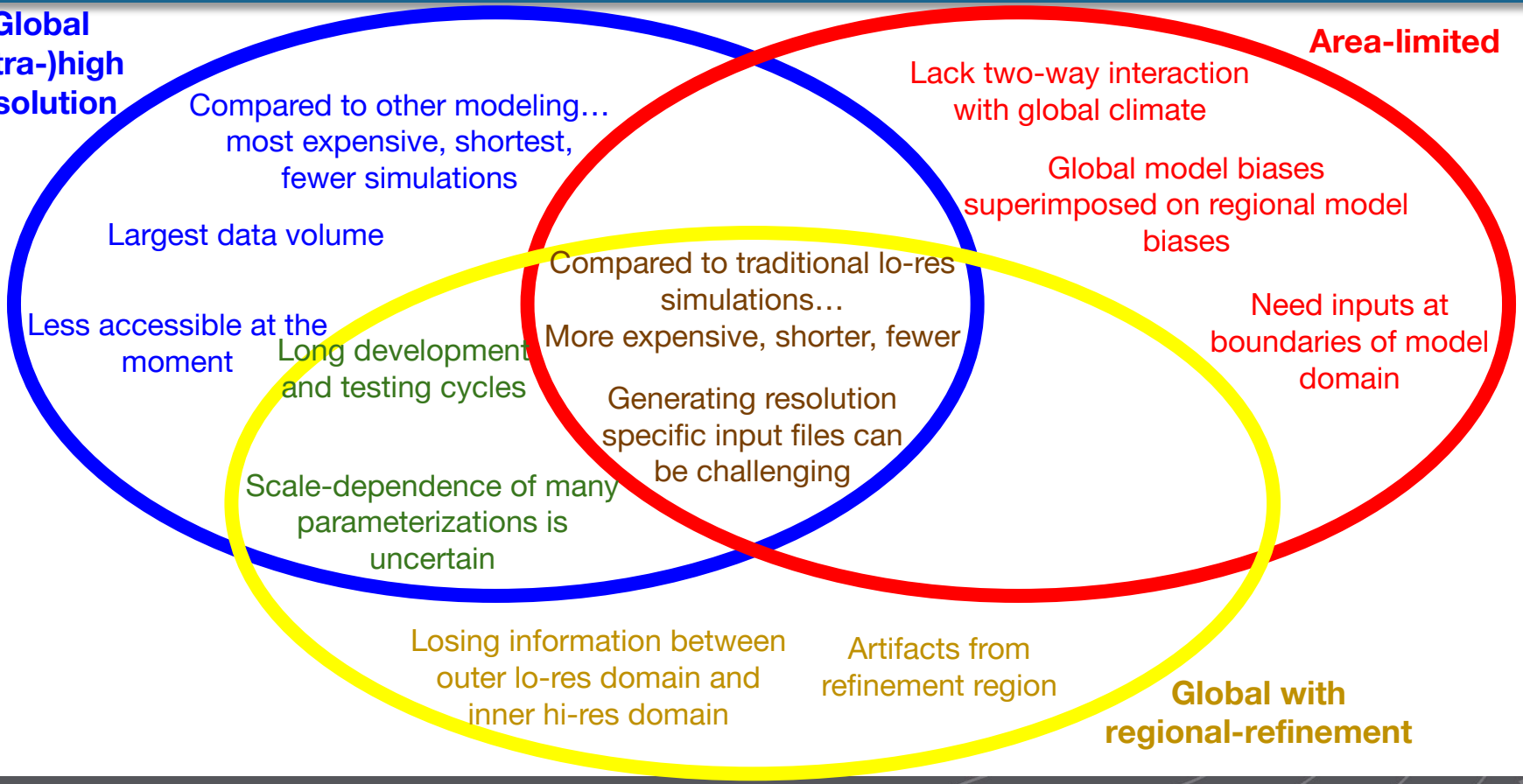
Common Processes

- Processes & features produced by high land surface heterogeneity (e.g., topography, vegetation, urban areas)
- Hydroclimate extremes (e.g. atmospheric rivers)
- Cloud processes
- Atmospheric chemistry and aerosols
- Ecosystems
- Air-sea-ice interactions
- Convection
- Gravity waves
- Surface turbulent fluxes
- Eddies & ocean currents
- Thermohaline circulation
- Marine heatwaves

What are the Main Benefits



What are the Main Shortcomings



Useful Resources & Community Needs

Common resources:

- CESM Forum
- CISL Python lectures
- MUSICAv0 tutorial
- AMWG, CCWG, OMWG, ACOM members

Other resources:

- Python: dask, xarray, xgcm, pangeo
- DRAKKAR and Mercator for NEMO
- Meeting people at WCRP & internal NCAR meetings

Common needs:

- More comprehensive online technical documentation and outreach to empower community and reduce reliance on individual expert support
- Scripts for post-processing data
- More distributed resources (ultra-high)
- More software engineering support

Other needs:

- Extension of CESM Tutorial dedicated to high-res
- VR-CESM2 Workshop

Discussion Questions

- Q1: Do you have any additional questions/thoughts about the survey and/or session talks? Did we capture the Venn diagram content correctly?
- Q2: Do you feel that you are using the right tool for your research question considering the computational expense?
- Q3: Which of these configurations should be supported by CESM, and how could we overcome their challenges?