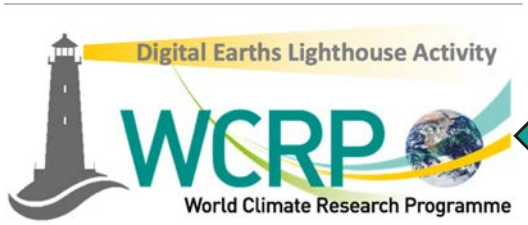
Digital Earth
WCRP Lighthouse Activity
WGNE-WGCM Update

Andrew Gettelman, NCAR/PNNL
Christian Jakob, Monash Univ

Digital Earths Lighthouse Activity
WCRP
World Climate Research Programme



WCRP Structure

Joint Scientific Committee (JSC)

WCRP Secretariat

Lighthouse Activities

International Offices

Core Projects and Research Communities

- Climate and Cryosphere (CliC)
- Global Energy and Water Exchanges (GEWEX)
- Climate and Ocean Variability, Predictability and Change (CLIVAR)
- Stratosphere-troposphere Processes And their Role in Climate (SPARC)
- Earth System Modelling and Observations (ESMO)
- Regional Information for Society (RIfS)

Ongoing Activities and Fora

- Fixed-term projects
- Reference datasets, evaluations and benchmarking
- Rapid updates, syntheses, assessments, gap analysis
- Conferences and workshops
- Diversity and capacity building: ECRs, regions
- Communications and outreach

WCRP Lighthouse Activities

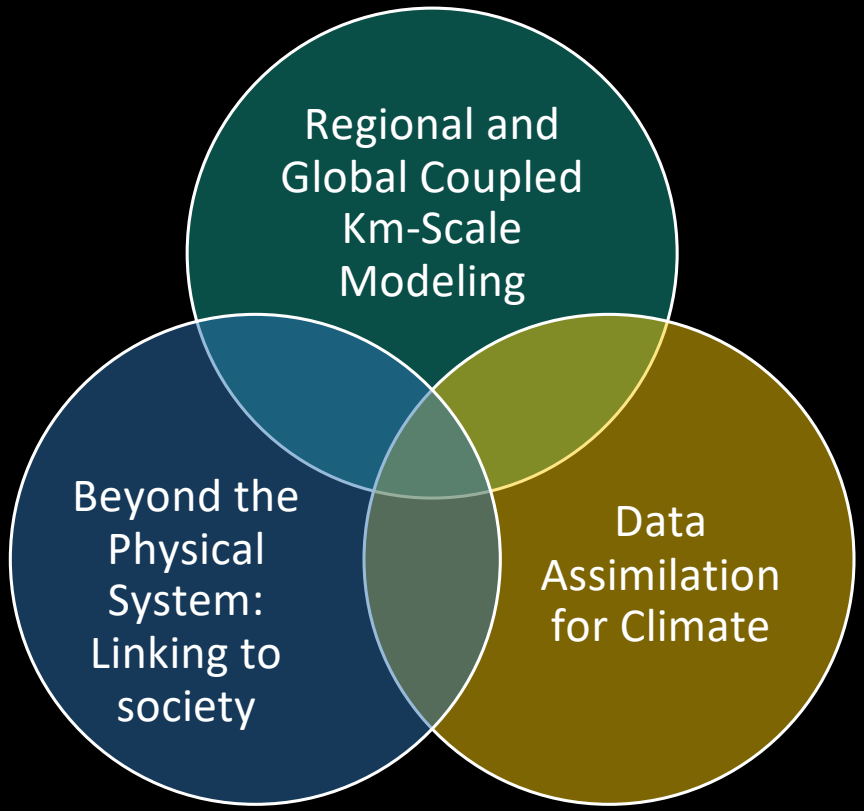
Digital Earth LHA Goal

*Support the research that supports the design and building of **integrated interactive digital information systems** that provide global and regional information on the past, present, and future of our planet, including both natural and human systems.*

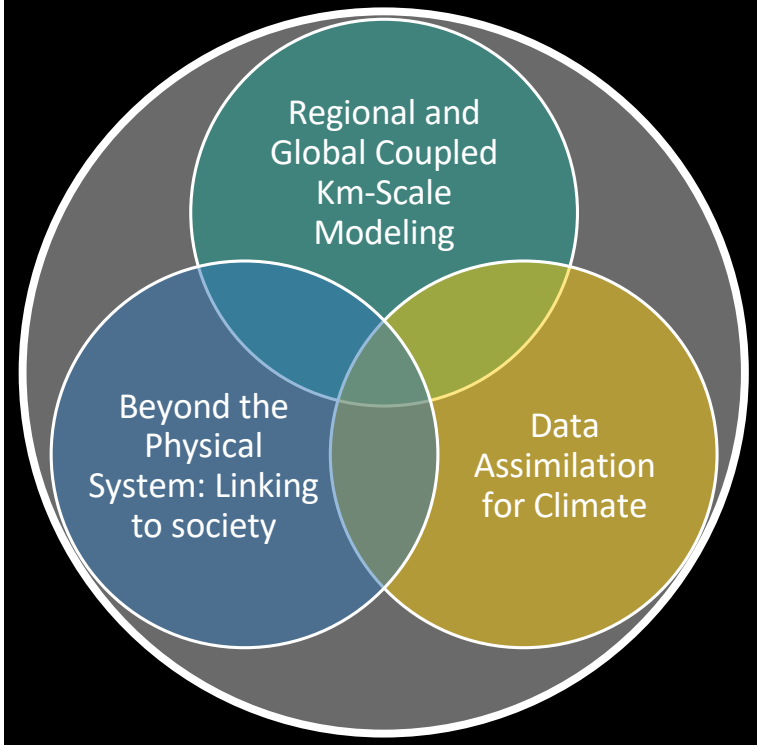
4km MPAS-A
Falco Judt, NCAR

Three main areas of activity

- **Fully coupled km-scale regional and global models:** Need a global research network with expertise in km-scale modeling of the Earth system and its individual components
- **Data assimilation for climate:** Establish an active research community in data assimilation for climate that builds on the excising numerical weather prediction and re-analysis efforts and significantly expands them
- **Beyond the Physical Earth System:** Include human interactions on and impacts to human systems in ESMs



Where we are & where we are headed



- Desire to define DE LHA as the group that supports **the development community** for the three areas
- Desire to **create fora for this community** to get together regularly, discuss progress and issues freely and openly, and provide a voice in the wider WCRP community (and beyond), e.g., WKMC, workshops, sessions
- Desire to create **practical activities** that engage the community. Those need to be developed bottom-up and this workshop is an important first step in the modelling space.

Progress

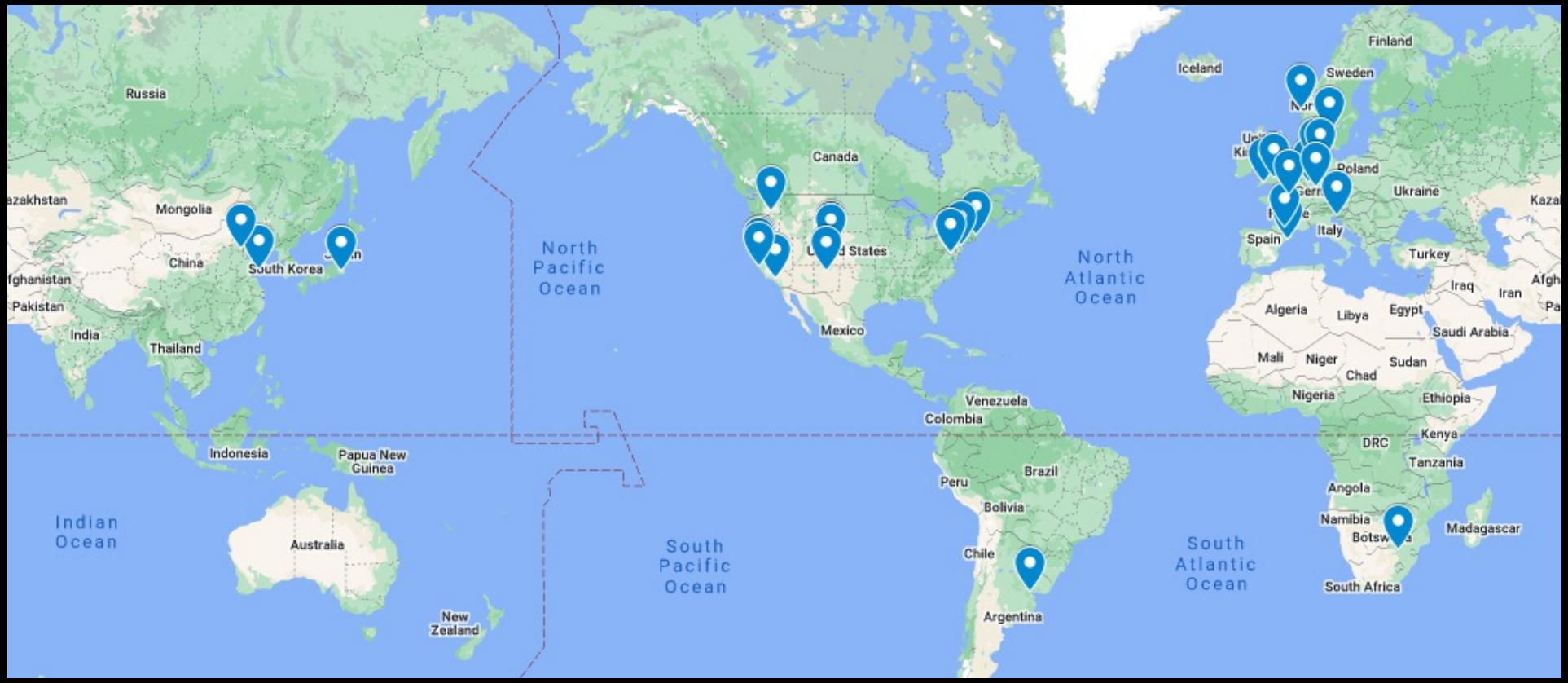
- Km Scale Modeling: Major Workshop (65 in person, 30 online) at NCAR in early October. Lots of activity and starting collaborations in this space. Recommendations being developed now (can present some themes)
- DA: Workshop in May (also at NCAR), Discussion of DA for climate, going beyond traditional DA (Lead: Aneesh Subramanian, Univ. Colorado)
- Beyond the physical system: building bridges. Likely starting with engaging Regional Hydroclimate Projects (RHP)

Km Scale workshop Goals

- ✓ Bring modellers of different communities together: atmosphere, ocean, land, ice but also global and regional
- ✓ Identify common and unique scientific and computational issues faced when moving to ultra-high-resolution
- ✓ Discuss applications and use of ultra-high resolution global models: what we already know works (and doesn’t)
- ✓ Share current progress in ultra-high-resolution modeling
- ✓ Identify key challenges and joint community tasks (1-2 years)

Report and recommendations being developed now

Map of km Scale Model Efforts: Regional & Global



21 different efforts identified. 12 global, 9 regional.
About ⅔ of these groups attended in person or virtually.

Science Issues

- Km scale models (global and regional) should learn from established mesoscale model developers. Build teams including them.
- Key science issues for the atmosphere: Or and intensity of deep convection at 1-4km, shallow convection at 4km-100m, extratropical storms. Collaborate with GEWEX GASS.
- Engage km-scale ocean and sea ice communities with CLIVAR Ocean Model Development Panel and CLiC for process understanding.
- km-scale models could have a big impact improving hydrology simulations: coupling to water at the surface. Engage with existing land modeling efforts (GEWEX GLASS and GHP), and Regional Hydroclimate Projects (RHPs) to improve hydrology in km-scale land models.
- Much of what km-scale models are looking at can be done with regional models. Investigate how better representing processes in at km scales feeds back onto the larger scale circulation and how it improves the simulation of climate & weather phenomena

Technical Issues

- Encourage collaboration and sharing of techniques for (a) new architectures (like GPUs), (b) coupling infrastructure and even (c) ported code (such as shared model physics).
- Need to access and analyze km-scale model output at the location of the data. Discuss federating access to web-based development environments (facilitates cross model investigations & users from under-represented groups).
- Continue and sustain support for development of open-source data analysis tools. Digital Earth can also help by making a list of available tools.
- Invest in the human workforce for model infrastructure. Ensure that data set access and open source analysis tools are freely available and can be used in the easiest way possible.

Ideas for Next Steps

Draft: Open for Discussion

- Encourage cross-scale Process Intercomparison Projects (PIPs) around topics/regions/phenomena. Ensure they are ‘diverse’ with participation from different types of models. See what organically grows
- Work with CORDEX and RIfS co-chairs to ensure strong engagement across regional-global model divide
- Work with the WCRP and ESMO to try to combine modeling meetings (starting 2024) in a single one-week meeting for km-scale modeling. Reserve specific days of that meeting for individual communities attending the meeting to meet separately.
- Organize a hackathon/tutorial targeting PhD Students and PostDocs, on a bi-yearly basis. Starting perhaps in 2024 (See meeting above). Coordinate with other regional/national efforts.

How should DE km-scale get coordinated?

Need some new group/activity: How to relate with existing groups?