Earth & Environmental Systems Modeling

G. Extremes Breakout Summary

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U.S. DEPARTMENT OF ENERGY | Office of Science

2024 EESM PI Meeting
August 6–9, 2024

Predictions vs Predictability

Strengths:

- Deep expertise in ESM prediction; unique capabilities of E3SM wrt other models
- Several existing hindcast initialization efforts in DOE

Research Needed: Predictions & Predictability

- Improved understanding of predictability sources for extreme events
- Learning about the predictability of extremes requires systems for producing high-quality hindcasts

Opportunities and Ways Forward

- Build on existing initialization efforts
- Explore data assimilation methods & AI for initializing E3SM

Characterizing & Reducing Uncertainty

Strengths:

- Uncertainty characterization & reduction is pervasive across DOE research

Research Needed: Characterizing & Reducing Uncertainty

- New forms of uncertainty continue to be identified
- Observational record continues to contribute to uncertainty

Opportunities and Ways forward

- Continue efforts to seek new forms of uncertainty: e.g., MCSMIP, ARTMIP
- Leverage model hierarchies to characterize & reduce uncertainty
- Apply new techniques to maximize quality & signal from observational record

Gap 3: Connections Across DOE

Strengths

- Wide range of extremes research across most DOE projects: lots of expertise and internationally recognized research!

Work needed: coordinating & connecting across DOE

- Efforts across projects often are not well coordinated, except in isolated instances
- Hard to know what is going on across DOE
- Difficult to find datasets (e.g., simulation outputs) from other projects

Opportunities and Ways Forward

- Adopt *communities of practice* concept from MSD