Strategy to align with DOE BER priorities

- E3SM leadership and team members are **well informed** of the BER priorities and **contribute to identifying gaps and opportunities** addressed by the BER priorities
  - Workshop organization and participation
  - Advisory committee (e.g., BERAC)
- E3SM plays a key role in BER priorities:
  - **E3SM is a glue**, providing a modeling framework to integrate BER-wide capabilities and a tool for hypothesis testing and advancing use-inspired science
  - Many E3SM team members are also **PIs and team members of other DOE projects** (e.g., SciDAC, RGMA, MSD, ARM/ASR, TES, SBR, ECA), facilitating collaborative efforts to address BER priorities
- E3SM has **flexible project management** to invest in seed efforts in preparation for the next phase
  - E3SM initiated two new NGDs in 2020 recognizing the need for more focused efforts in ocean modeling and the need to start a small effort to inform our strategy on large ensemble modeling

Strategy to align with DOE BER priorities

- E3SM's science goals are well aligned with BER priorities: **coastal**
  - Water cycle science driver addresses coastal vulnerability associated with storms and storm surge (v3, v4)
  - BGC science driver addresses BGC (e.g., hypoxia) in the coastal zone (v3, v4)
  - Cryosphere science driver addresses sea level rise and coastal inundation (v4)
  - E3SM RRM capability particularly relevant
- E3SM's science goals are well aligned with BER priorities: **earth system predictability**
  - A coupled cloud resolving atmosphere and eddy resolving ocean model is an important tool for addressing earth system predictability
  - E3SM science drivers are addressing aspects of earth system predictability related to water cycle, BGC, and cryosphere
  - Large ensemble simulations will be an important phase 3 element to address predictability of low probability, high impact events

Strategy to align with DOE BER priorities

- E3SM's science goals are well aligned with BER priorities: **ML/AI**
  - E3SM leadership has already begun developing ideas for use of ML/AI in phase 3
  - An ML/AI breakout session at the PI meeting seeded ideas for E3SM and potential larger collaborative efforts with the ESMD community

🔵 Develop/emulate parameterizations
🟢 Model sensitivity / UQ / model tuning
⚪ Other: analysis/evaluation of model outputs, process understanding, generation of data

40%   40%

20%
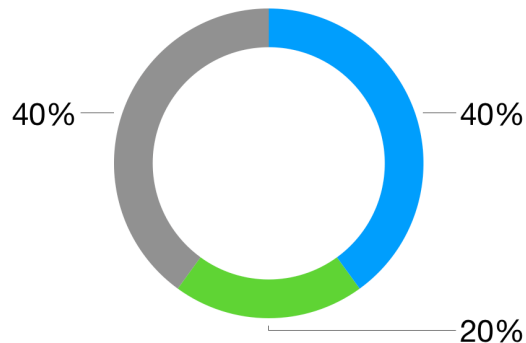
Shared interest:
- ML approaches constrained by physics
- Using ML to tease out the physics in the inferred relationships
- Collaborative efforts to tackle infrastructure challenges in ML-E3SM integration
- Evolving principled practices towards: Robustness, interpretability, stable integration of NN parameterization

Is E3SM synergistic with other comparable efforts? Is E3SM leveraging the larger scientific community effort appropriately?

- E3SM **participates in the US Climate Modeling Summit** (USCMS) and collaborates with US modeling centers on **synergistic activities**
  - 2016: A joint paper on **model tuning** resulted from the 2016 USCMS
  - 2017: Participated in the 2017 USCMS **workshop on Arctic** processes
  - 2018: **Co-organized** the 2018 USCMS **workshop on land-atmosphere interactions** that resulted in two multi-center collaborative **Land CPT projects** on representing the effects of land surface heterogeneity in land-atmosphere interactions
  - 2019:
    - Participated in the 2019 USCMS workshop on climate modes of variability and resulted in a joint paper on **evaluating modes of variability in the US models**
    - A joint paper on methods to **estimate the equilibrium climate sensitivity**
    - Ongoing study of the implications of the **US Clean Air Act on air quality and climate**
  - 2020: A DOE led proposal on **constraining aerosol-cloud interactions** follows the 2020 USCMS workshop on cloud feedback and aerosol-cloud interactions

Is E3SM synergistic with other comparable efforts? Is E3SM leveraging the larger scientific community effort appropriately?

- E3SM contributes to and leverages **international model intercomparison** efforts
  - Participated in CMIP6 **DECK, HighResMIP, C4MIP, ScenarioMIP** and leveraged the experimental protocols and input data for addressing our water cycle and BGC science questions
  - Participating in **DYAMOND** intercomparison of global cloud resolving models
  - Participating in internationally organized **COVID simulations (DAMIP)**
- E3SM adopts and contributes to **community modeling infrastructure**
  - NCAR collaboration on CIME
  - Community tools: github, SCORPIO, OpenMP, NCO, ESGF, etc
- E3SM leverages and contributes to **community diagnostic packages**
  - E3SM_diags, MPAS-Analysis, ARM-diags, PMP, CMEC, iLAMB
  - COSP and new aerosol CALIPSO simulator
  - In-situ diagnostics