

E3SM Biogeochemical Initialization

ESMD-E3SM PI Meeting

Francois Primeau October 27, 2020

Research Team:

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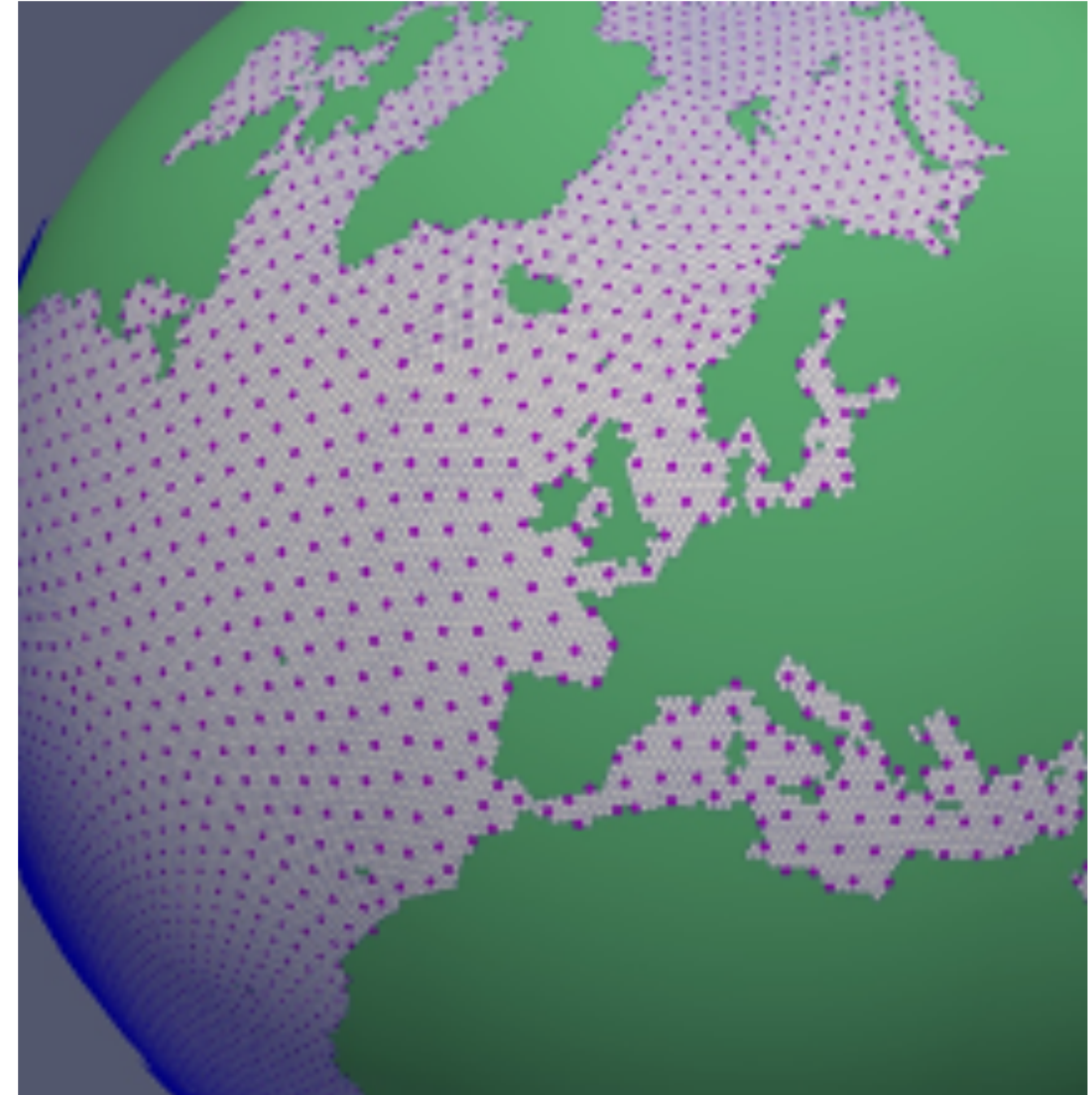
LANL: Mark Petersen

LBNL: William Riley

Motivation: The cycling of nutrients and carbon in the ocean and land systems has adjustment timescales that extend to centuries and millennia. The Earth's carbon cycle is computationally expensive to spin-up.

Planned work

- Implement a small set (~45) of non-interfering Impulse Response Functions (IRF) tracers are used to capture the advective-diffusive transport tendencies from MPAS-O.
- These IRFs are then used to construct a **sparse matrix** that captures the 3D advective-diffusive flux divergence tendency of an arbitrary tracer distribution.
- The resulting sparse matrix is then couple the resulting sparse matrix to the Marine Biogeochemistry Library (MARBL) to facilitate the implementation of fully implicit offline biogeochemical tracer spin-up using Newton Krylov methods.
- In parallel we will explore the application of Newton Krylov spin up methods for the E3SM Land Model (ELM).



The **ultimate goal** is to provide a fully spun-up initial state for the Earth's carbon cycle.