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Title: Marine Biogeochemical Dynamics in Coastally Refined Earth System Model Simulations

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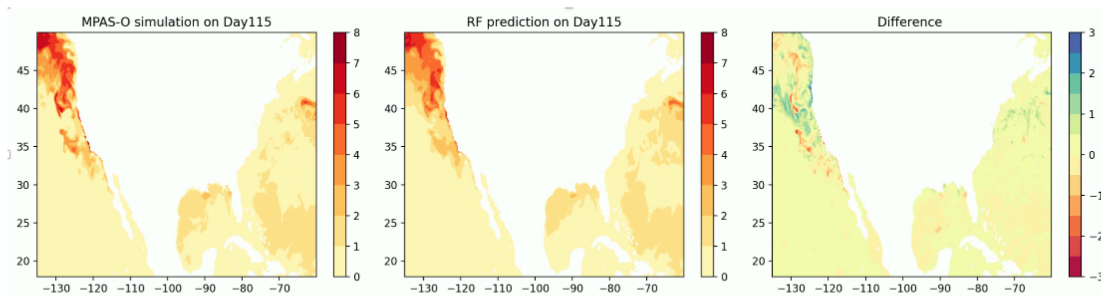
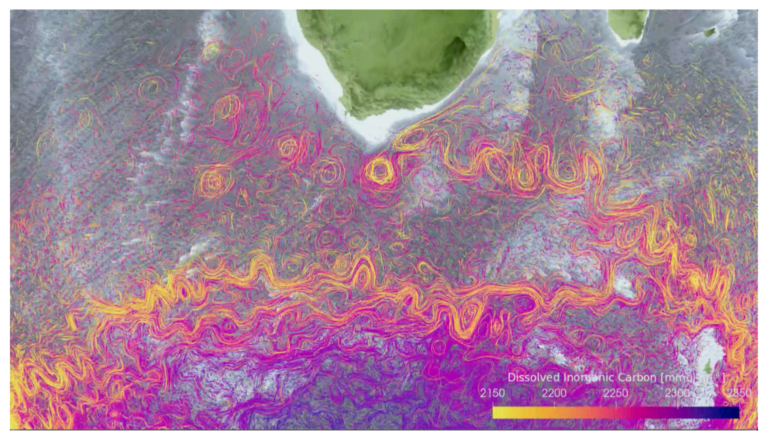
Marine Biogeochemical Dynamics in Coastally Refined Earth System Model Simulations (w20_coastalbgc)

Mathew Maltrud (T-3) and Phillip Wolfram (W-13)

- Interactions between ocean circulation and biogeochemistry (BGC) affect a wide range of important Earth System processes
- Performed multi-decadal Energy Exascale Earth System Model (E3SM) simulations of the ocean circulation with imbedded BGC using a high-resolution mesh to focus on mesoscale (10km to 100km) effects
- Developed a Machine Learning approach to predicting ocean nutrient distributions based on sea surface temperature (SST) and salinity (SSS)
    - Reduces cost of simulations that include full BGC
    - May be applied to the real ocean using satellite observations of SST and SSS
- Included a large number of Lagrangian particles to help understand the relationship of mesoscale circulation on outgassing of carbon dioxide (CO_2) in the Southern Ocean



Surface nitrate concentration (mmol/m³) for a typical day as simulated by E3SM (left), predicted by the Machine Learning Random Forest scheme (middle), and the difference between them (right).



Particle trajectories in the Southern Ocean near the tip of Africa, colored by the concentration of Dissolved Inorganic Carbon (mmol/m³).