**Mesoscale eddy parameterization affects the linearity of responses to increased CO2**

Anand Gnanadesikan

The representation of mesoscale eddy mixing remains one of the great unknowns in climate modeling. In this talk I will present recent work demonstrating that this uncertainty has implications for the linearity of physical responses such as temperature and biogeochemical responses such as ocean deoxygenation, growth of hypoxic zones, and volume of carbonate undersaturation to increasing CO2. This in turn has important implications for determining the fingerprint of global warming by using large perturbations- the so-called "Green's function" approach. On a global scale, the response to climate change is surprisingly linear in temperature and biological productivity. However, nonlinearities are found when looking at the responses of temperature and biology in the northern subtropical gyres. These nonlinearities arise because of the impact of mesoscale mixing on convective regions- which represents a challenge even at the resolutions associated with E3SM.

References

Bahl, A,  A. Gnanadesikan, and M.A. Pradal, Variations in ocean deoxygenation across Earth System Models: Isolating the role of parametrized lateral mixing,  *Global Biogeochemical Cycles,*33, 703-724,2019.

Bahl, A.A., A. Gnanadesikan and M.A. Pradal, Scaling global warming impacts on ocean ecosystems: Results from a suite of Earth System Models ,  *Frontiers in Marine Science*,7, 698,  <https://doi.org/10.3389/fmars.2020.00698>. 2020.