NCAR | CLIMATE & GLOBAL DYNAMICS

CGD Seminar Series

Processes and timescales of anthropogenic heat emergence in the ocean

Yona Silvy

Sorbonne

Date: Tuesday, 7 December 2021

Time: 11am – 12pm

For Zoom information, please contact Tracy Baker tbaker@ucar.edu

For live stream information, visit the CGD Seminar Webpage

ABSTRACT

Global ocean warming is a key marker of anthropogenic climate change, representing 91% of the energy increase in the climate system. This warming has however not been uniformly distributed over the ocean, with some regions experiencing pronounced ocean heat content (OHC) change while others have seen much slower changes. Understanding the mechanisms and timescales that control regional ocean temperature changes and their emergence from internal variability is the goal of this study. We propose a new numerical framework, in the spirit of the FAFMIP protocol, to decompose the transient temperature changes in the IPSL-CM6A-LR large ensemble of historical+ssp245 simulations into passive and redistributive components of heat storage. In a set of ocean-only experiments, we apply together and individually buoyancy and momentum surface flux perturbations, constructed from the forced response of the IPSL coupled model to attribute the total change and its timescale to different surface perturbations. We are particularly interested in the balance of processes in time between the passive transport of surface excess heat, and ocean circulation changes that internally redistribute the pre-existing heat. We find that in the upper ocean ventilation pathways associated with mode waters, while circulation changes can have a large role in setting the magnitude of the change at the end of the 21st century, by the time the warming signal emerges from internal variability, they have only delayed the emergence by about 10 years. On the other hand, circulation changes play a much more important role in warming the subsurface and deep ocean in the subpolar Southern Ocean, while they cool the North Atlantic subsurface waters. We find overall earlier signals in the Southern Ocean than in the North Atlantic, which could be coherent with the aerosol forcing delaying the greenhouse gas response in the Northern Hemisphere.