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Ocean Heat Uptake and Dynamical Sea Level Rise: Past and Future Uncertainty

The ocean absorbs a large portion of the anthropogenic heat released in the climate system, leading to an increase in global mean sea level rise. The magnitude, pattern and rate of ocean heat uptake are governed by several processes such as deep water formation, Southern Ocean Ekman pumping, and air-sea interaction. The spatial patterns of heat uptake and storage are further impacted by heat redistribution via changes in the ocean circulation, induced by natural variability and anthropogenic forcing.

We use observations, theory and a hierarchy of models to estimate the heat storage and thermosteric sea level rise in the Atlantic due to changes in circulation during the observational period and in future projections. We will show that about 2/3 of the thermosteric sea level rise at the latitude of NYC in the past 50 years is attributed to ocean circulation changes and traced back to surface forcing. We will further explore the link between air-sea forcing, ocean circulation and heat and carbon uptake in future projections. Our findings highlight high-latitude forcing as the cause for the large uncertainty in regional sea level projections, and provide a way forward to constrain regional projections of ocean heat uptake and sea level rise, including the use of anthropogenic carbon to infer circulation changes.