Abstract: The ocean and atmosphere are fluids with scales of motion from millimeters to 10,000s of kilometers, from seconds to millenia, studied by physical oceanographers and atmospheric scientists using traditional fluid dynamics in the Earth’s rotating coordinate system. The ocean and atmosphere interact with other environmental systems to create the Earth’s climate system. We study them using observations, theory, and complex computer modeling.

At the long climate time (> several years) and space (> 1000 km) scales, the international community of climate scientists has been working steadily for many decades, with results synthesized repeatedly at local to international levels, including in the U.N.’s Intergovernmental Panel on Climate Change (IPCC) assessments, most recently in 2014. The second part of the talk reviews the evidence for climate change in the oceans: how it has been observed, what it means, and what is projected for the future. Physics-related changes are found in temperature, salinity, ice, sea level, circulation, and biogeochemistry including carbon.

The third part of the talk delves into how the Southern Ocean, which broadly surrounds Antarctica, affects and is affected by global climate and climate change. Our interest in this region stems from interaction of the ocean and atmosphere with the Antarctic ice sheet, which is losing mass, leading to potentially major global sea level rise; from the Southern Ocean's major role in sequestering additional heat in the deep ocean; and from its role in absorbing a sizeable fraction of anthropogenic CO₂.

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