



# **Ocean Circulation and Climate: Chapter 1. The Ocean as a Component of the Climate System (International Geophysics)**

*Thomas F. Stocker*

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A broad perspective of the ocean as a key component of the Earth System and of its role in the past, present, and future climate change is provided. The ocean is a huge reservoir of heat, mass, carbon, and many other quantities, and their estimated exchange fluxes suggest characteristic timescales of adjustment ranging from decades to many thousands of years. Surface patterns and meridional fluxes of these quantities highlight the important role of the wind-driven circulation and the deep ocean flow systems through all ocean basins. Ocean-dominated phenomena of natural variability, in particular associated with the tropical oceans, are explained. The relevance of the ocean circulation for abrupt climate change, as recorded from a variety of paleoclimate records, is discussed. This includes the bipolar seesaw concept which explains many features of interhemispheric response during the sequence of rapid warmings in the past ice age. Finally, the ocean's role during the anthropocene, the time epoch which is dominated by the human-caused increase in greenhouse gases to levels unprecedented in the past 800,000 years, is explored. Both the warming and the increase in atmospheric transport of water polewards create conditions for the ocean that may induce large and irreversible changes in the Atlantic meridional overturning circulation.

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