



Ocean Circulation and Climate: Chapter 29. Ocean Heat Transport (International Geophysics)

Alison M. Macdonald, Molly O. Baringer

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The ability to ascertain the implications of a changing climate are based first and foremost on our understanding the fundamental balances comprising earth's climate. The global energy budget is integral to this understanding, and the poleward transport of heat by the oceans is an intrinsic component of the energy balance. In this chapter, we look to describe what is presently known about ocean heat transport and its role in the climate system. At the end of the last century, as part of the World Ocean Circulation Experiment (WOCE) and the Joint Global Ocean Flux Study (JGOFS), the ocean-going research community completed a decade-long international effort to explore the ocean through the acquisition of a single consistent and comparable set of high-quality, full-depth observations. This global-scale field campaign was designed to determine the mean steady-state basin-scale circulation and meridional ocean heat transport. At the time, it was recognized that this mean was unlikely to be stationary. It was also understood that patterns of variability that had yet to be measured would influence our eventual understanding of these one-time "synoptic" observations. A decade later, time series of ocean heat transport (from moorings, repeat XBT and CTD lines and profiling floats), although still quite short and either spatially and/or temporally sparse, are now becoming available. The WOCE/JGOFS programs of the 1990s have been extended through large international efforts first by the Climate Variability and Predictability program and now by the Global Ocean Ship-based Hydrographic Investigations Program. Through these newly acquired time series, improvements in analysis techniques, and recent modeling advances, we are beginning to describe ocean heat transport variability and to understand its possible response to and role in climate change. In this chapter, we focus on what has been learnt about ocean heat transport through in situ observations. We include some history, a detailed description of ocean heat transport computation and decomposition, and a discussion of the present state of the science, seeking to measure ocean heat transport variability.

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