

MODES OF INTERANNUAL TO MULTI-CENTURY WATER-MASS VARIABILITY IN THE SOUTHERN OCEAN

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Detection of long-term climate change requires knowledge of natural variability in the ocean-atmosphere system. In the Southern Hemisphere, climate variability is evident on time-scales of days to centuries, yet we know relatively little about how this forces interior ocean fluctuations, nor how these fluctuations feedback to the atmosphere. In this paper we will examine the magnitude and mechanisms of Southern Ocean water-mass variability in models and (where available) observations. It turns out substantial heat content anomalies can be generated via natural oscillations in winds, sea-ice and air-sea exchanges.

We find that Subantarctic Mode Water (SAMW) variability reflects fluctuations in the equatorward Ekman transport of cool, low salinity water across the subantarctic front. In contrast, anomalies in air-sea heat fluxes and ice meltwater rates drive variability in Antarctic Surface Water, which gets subducted along Antarctic Intermediate Water (AAIW) density layers. SAMW variations also spike T-S variability in AAIW, particularly in the southeast Pacific and southeast Indian Oceans. Finally, we find that substantial water-mass change can result from a latitudinal shift in the zonal wind-stress maximum associated with the subpolar westerlies. The implications of these findings for climate change/variability are discussed.