

The Thermodynamics of the AMOC: A Historical and Global Context

The Atlantic Meridional Overturning Circulation (AMOC) is a critical component of earth's global climate, transporting vast quantities of heat and freshwater between high and low latitudes and across hemispheres. Simultaneously, the stability of this circulation itself depends on these interior transports and their complex interplay with surface heat and freshwater forcing, a tenet of AMOC dynamics appreciated since Stommel (1961). In this talk, I will review how the thermodynamics of the AMOC-- its capacity to transport heat and freshwater and exchange these properties with the atmosphere-- have been used to understand its flow structure and its stability. Further, I will discuss how thermodynamics can help unravel the relationship between local dynamics and remote processes, in particular surface forcing in the Pacific and Southern Oceans. This thermodynamic perspective highlights that the AMOC is a single branch in the larger global overturning system, one that must conserve heat and freshwater and thus responds to global changes in surface buoyancy forcing.