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Impact of oceanic heat transport on global thermodynamical properties in the climate system

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We investigate how properties of macroscale thermodynamics of the climate system respond to changes in the intensity of the oceanic heat transport by utilising PlaSim, an Earth-like general circulation model of intermediate complexity, in an aqua-planet configuration. By increasing the magnitude of the meridional heat transport in the ocean, characterised by an export out of the tropics and a poleward convergence, we observe a surface warming of about 10K and a decrease in the equator-to-pole temperature difference, while the total poleward heat transport remains unchanged. The Carnot efficiency, the intensity of the Lorenz energy cycle and the material entropy production of the system decline with increasing oceanic heat transport. These results suggest that the climate system becomes less efficient and turns into a state of reduced entropy production, as the oceanic transport of heat out of the tropics is reinforced.