



Compensation of Meridional Heat Transport: Testing the Bjerknes Hypothesis in a Freshening World

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The compensation between the meridional heat transports in the atmosphere and ocean is studied through a coupled model water hosing experiments. It is found that the Bjerknes compensation hypothesis is valid in the extratropics. In the tropics, the atmospheric heat transport (AHT) overcompensates the total oceanic heat transport, because of an enhanced wind-driven oceanic heat transport (OHT) in the Pacific-Indian Oceans. The water hosing in the high latitude Atlantic weakens the Atlantic meridional overturning circulation and thus the northward Atlantic OHT significantly. This leads to an enhanced interhemispheric SST gradient across the global tropics and in turn an enhanced (weakened) atmosphere Hadley Cell in the Northern (Southern) Hemisphere. The enhanced Hadley Cell itself increases the northward AHT, compensating the reduced Atlantic OHT. Meanwhile, it increases the surface trade wind and in turn the wind-driven northward OHT in the Pacific-Indian Oceans, leading to an overcompensation of the northward heat transport.