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Control of Hadley cell strength by midlatitude eddies in reanalysis and IPCC AR4 models

R. Caballero (1)

(1) School of Mathematical Sciences, University College Dublin, Ireland.

The Hadley cells play a central role in climate. Among other things, they contribute to poleward energy transport, affect the tropical ocean circulation, and control the creation of dry subsidence regions in the subtropics which strongly impact the planetary energy balance. Much past work using simplified atmosphere models has shown that Reynolds stresses due to equatorward-propagating midlatitude eddies are important in controlling the strength of the Hadley cells. Here, we present evidence that this control also exists in nature by using reanalysis data to show that much of the interannual variability in Hadley cell strength is explained by variability in eddy forcing. We then address the question of how well this is captured by GCMs. In particular, we will present an intercomparison of the IPCC AR4 models to examine how much of the inter-model variability in climatological Hadley cell strength can be ascribed to climatological biases in midlatitude eddy activity.