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Observed poleward expansion of Hadley cell driven by Southern Atlantic warming

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There are increasing evidences demonstrating that the observed HC has shifted poleward since late 1970s. No direct evidence has shown to support that the observed poleward shifts of Hadley cells are driven by basin-scale SST warming. We extract the direct response of boreal winter Hadley cells to basin-scale SST warming and inter-decadal Pacific (IPO) by regressing the mass stream function anomalies in boreal winter onto the SST warming trend and IPO index. The Hadley cells in boreal winter in response to the basin-scale SST warming is different distinctly to that of IPO, which are contributed to the poleward shift of southern Hadley cell edge and robust inter-decadal variability of northern Hadley cell edge, respectively. A suit of experiments have been conducted to elucidate where SST warming controls the poleward shift of southern Hadley cell since 1950s and a strengthening of northern Hadley cell over the past six decades. We found that the observed poleward expansion of southern Hadley cell is driven by Southern Atlantic warming.