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Super recovery of the Hadley Cell edge to the CO₂ removal

Yeong-Ju Choi¹, Seo-Yeon Kim¹, Seok-Woo Son¹, Soon-il An², Sang-Wook Yeh³, Jong-Seong Kug⁴, Seung-Ki Min⁴, and Jongsoo Shin²

¹Seoul National University, Seoul, South Korea

²Yonsei University, Seoul, South Korea

³Hanyang University, Ansan, South Korea

⁴Pohang University of Science and Technology (POSTECH), Pohang, South Korea

The poleward shift of the Hadley cell (HC) edge by global warming is widely documented. However, its reversibility to CO₂ removal remains unknown. By conducting a climate model experiment where CO₂ concentration is systematically increased and then decreased in time, this study shows that a poleward-shifted HC edge in warm climate returns equatorward as CO₂ concentration decreases. It is also shown that the rate significantly differs between the two hemispheres. While the southern HC edge monotonically changes with CO₂ concentration, the northern HC edge exhibits a super recovery, locating on the equatorward side of the present-climate HC edge when CO₂ concentration returns to the present level. Such a super recovery is associated with the hysteresis of the North Atlantic sea surface temperature. Our findings suggest that the HC edge change may result in the super recovery of subtropical dryness in the northern hemisphere except California.