기후 분과 [P-028]

Asymmetric Tropopause Height Change to Symmetric CO_2 change

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It has been widely documented how climate systems respond to net zero carbon emissions. While the reversibility of surface climate variables under CO_2 removal has been reported, tropopause height change has not been addressed. By using multi-model simulations where CO_2 concentrations are symmetrically ramped up and down, the present study investigates how zonal-mean temperature distribution and tropopause height respond to varying CO_2 pathway. During the ramp-up period, tropospheric warming and stratospheric cooling get strengthened, causing tropopause to rise in both the tropics and extratropics. Such changes are reversed during the ramp-down period as CO_2 concentrations are reduced. However, their recovery is slower, leaving the tropopause height at the end of CO_2 removal higher than its initial state. Such asymmetric response in tropopause height is mainly attributable to upper tropospheric rather than lower stratospheric temperature changes. This finding suggests that hysteresis behavior of climate systems to CO_2 removal may occur not only at the surface but also at the tropopause.

Key words: Carbon dioxide removal, Tropopause height, Hysteresis