Impact of the upper troposphere and stratosphere on the climate change around Japan

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Impact of the upper troposphere and stratosphere on the climate change around Japan was investigated by analyzing CMIP5 model datasets for historical and rcp8.5 scenarios. Based on previous studies (Zappa and Shepherd 2017, Manzini et al. 2014), two remote drivers of climate were selected; tropical warming defined as temperature changes at 250 hPa in 30˚S-30˚N and stratospheric vortex strength defined as zonal mean zonal wind changes at 20 hPa in 70˚-80˚N. These indices were scaled by annual mean 2-m temperature changes associated with global warming. Here, climate response in cold season (November to April) was investigated by subtracting 1959-1990 from 2068-2099 mean data. Models with low tropical amplification and weak polar vortex projected southward shift of the subtropical jet over the east Asia. Higher SLP anomalies elongated from southeast Asia toward Japan, and negative precipitation anomalies extended from southwest to northeast. On the other hand, models with high tropical amplification and strong polar vortex projected northward shift of the subtropical jet. Higher SLP anomalies with an extreme value over the central Pacific were formed and their western parts covered most of Japan regions. Negative precipitation anomalies were seen in the southern part of Japan while positive anomalies were found in the northern part. These results demonstrate that different responses of global warming in the upper troposphere and lower stratosphere could affect climate changes around Japan.

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