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Multi-model simulated changes in the upper-level jet streams over East Asia under global warming condition

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Observational results show that there exist two jet stream flows in the upper troposphere and lower stratosphere over East Asia in winter, namely East Asian subtropical jet stream (EASJ) and East Asian polar-front jet stream (EAPJ). The major features of the upper-level jet streams simulated by CMIP5 models are evaluated through analyzing the differences between the coupled model's 20th century simulations and the NCEP/NCAR reanalysis. The results show that the climatological positions of upper-level jet streams are well reproduced in the models. However, statistic features from model's 6-hourly output reveal that the jet core number in the polar-front is significantly underestimated, and the models tend to systematically reproduce weaker transient eddy activities over East Asia. The deficiencies of transient eddy forcing in middle and high latitude regions may contribute to the biases of the simulated upper-level jet streams.
In addition, the effects of enhanced greenhouse warming on the changes of the upper-level jet streams over East Asia are examined for the jet location and intensity. For the enhanced greenhouse warming experiments, the multi-model ensemble simulated an intensification in the westerly jet intensity and a northward migration of jet axis in winter, compared with 20th century simulation results. In summer, the westerly jet intensifies and migrates southward. The temperature increase in low latitudes is stronger than that in the high latitudes, leading to an intensification in the meridional temperature gradient in the lower troposphere over subtropical region. This meridional temperature gradient is responsible for the changes in the location and intensity of the westerly jet over East Asia.