Midlatitude oceanic fronts and the stratospheric polar vortex

Kazuaki NISHII[1], Bunmei TAGUCHI[2,3], Akira KUWANO-YOSHIDA[4], Hisashi NAKAMURA[2,3], Takafumi MIYASAKA[2] , Yu KOSAKA[2]

[1] *Graduate School of Bioresouces, Mie University, Tsu, Japan*

[2] *Research Center for Advanced Science, University of Tokyo, Tokyo, Japan*

[3] *Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan*

4 Disaster Prevention Research Instutute, Kyoto University, Japan

We have performed a set of 15-member ensemble experiments using an atmospheric general circulation model (AGCM) to evaluate the role of midlatitude oceanic fronts in forming the climatological-mean tropospheric and stratospheric atmospheric circulation. The first set of experiments (CNTL) is forced with satellite-observed sea surface temperature (SST) while the second set (SMTH) is with smoothed SST in which steep meridional gradient of SST associated with confluence of warm subtropical and cool subarctic current is largely reduced. Difference between the two experiments (CNTL-SMTH) highlights the role of frontal SST gradient. Namely, resolving the SST front in the mid-latitude North Pacific leads to enhancement of northward eddy heat flux by transient eddies around the latitudes of the SST front. It also leads to weakening of westerlies just to south of the climatological subtropical jet, while enhancement of the westerlies to the north of it in the mid to upper troposphere. Tropospheric geopotential height response to the frontal SST gradient is characterized by a meridional dipole of negative and positive anomalies over the Sea of Okhotsk and over the midlatitude western North Pacific, respectively, which resembles the Western Pacific (WP) pattern. In association with the WP-like pattern, the upward planetary wave propagation from the troposphere into the stratosphere is enhanced, which leads to warming up of the polar stratosphere and weakening of the polar night jet.

Key words: oceanic front, planetary wave, the Western Pacific pattern, the stratospheric polar vortex