

Importance of Stratosphere-Troposphere Coupling in Polar Atmosphere and Climate

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It has been revealed that the weather and climate of the troposphere and surface in polar regions are strongly influenced by the stratosphere. In the recent, many topics based on the relation of stratosphere-troposphere (S-T) coupling have been flowing out. One is “Arctic warming - sea ice reduction - and mid-latitude link” through stratosphere processes. Sea ice reduction in the late autumn in Kara and Barents Sea is affecting winter cooling and heavy snow in east Eurasia and Japan (Nakamura et al., 2015), which was the topic intensively studied in GRENE Arctic Climate Change Research Project (2011-16). Another is a “suppressing of warming in East Antarctica under global warming”, explained by the ozone hole through S-T coupling (e.g. Thompson and Solomon, 2002), and has been a pronounced scientific discussion in the long term observation at Syowa Station in our Japanese Antarctic Research Expedition. Both issues are in the processes of opposite direction of S-T coupling, one through weakening the polar vortex and another through intensifying the polar vortex.

These are highly targeted scientific issues in the polar atmospheric science and climate now. Although general explanations are done for both the processes, the mechanisms underlying these dynamics are not fully understood yet even from the models or observations (Kidston et al., 2015). In this regard, PANSY radar is expected to derive detailed dynamics of S-T coupling, especially through the results of an interhemispheric intercomparison experiment (ISCOM) and comparison with the high resolution modeling. Ozone holes in the Antarctic and Arctic are also still needed to be studied, not only for the dynamics but also as an indicator of stratosphere change.

Key words: S-T coupling, Arctic amplification, mid-latitude link, ozone hole, East Antarctic warming suppression

References

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