

【Grant-in-Aid for Scientific Research(S)】

Science and Engineering (Mathematical and physical sciences)



Title of Project : Extreme Weather Variations in the Stratosphere-Troposphere Coupled System : Past, Present and Future

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Research Area : Earth and Planetary Sciences

Keyword : Meteorology, Climatology

【Purpose and Background of the Research】

Stratospheric sudden warming (SSW), which is associated with a breakdown process of wintertime polar vortex, is a typical extreme weather event in the stratosphere-troposphere (S-T) coupled system (Fig.1 is a schematic illustration of the coupled system). Prediction of SSW occurrence and assessment of its impact on the coupled system have been remained as difficult problems, because SSW is a highly nonlinear dynamical phenomenon characterized by a natural internal variation in the coupled system. It is an unresolved problem how this kind of extreme weather events will respond to the variations of natural and anthropogenic external forcings, such as the 11-year solar irradiance variations and volcanic eruptions for the former and the increase of greenhouse gases or ozone depleting substances for the latter.

In this research, we aim to understand the dynamical linkage among these internal and external variations of the S-T coupled system comprehensively, and to contribute for improving our ability of prediction of extreme weather events.

【Research Methods】

This project consists of the following four research groups, including several collaborators abroad: 1) data analyses, 2) mechanistic circulation model and statistical studies, 3) general circulation model and numerical weather prediction model studies, and 4) MRI climate model studies.

We perform comprehensive studies on phenomenological description of the extreme weather events of the S-T coupled system, understanding their dynamical processes with a hierarchy of numerical models, and future projections with a state-of-art climate model.

【Expected Research Achievements and Scientific Significance】

We investigate the feature of these internal and external variations in the current climate by analyzing the observational and forecast datasets, and make validations of climate models by paleoclimate simulations and sensitivity studies.

Based on these studies for the past and present climates, we assess the impact on the future climate of the S-T coupled system with projection uncertainty.

We hope this research project will contribute toward the promotion of international research collaboration, including WCRP/SPARC activities.

【Publications Relevant to the Project】

Kohma, M., S. Nishizawa and S. Yoden, 2010: *J. Climate*, **23**, 6438-6444.

Randel, W.J., K.P. Shine, and S. Yoden, 2009: *J. Geophys. Res.*, **114**, D02107, doi:10.1029/2008JD010421.

【Term of Project】 FY2012-2016

【Budget Allocation】 134,200 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www-mete.kugi.kyoto-u.ac.jp/kakenhi2012/En/index.html>

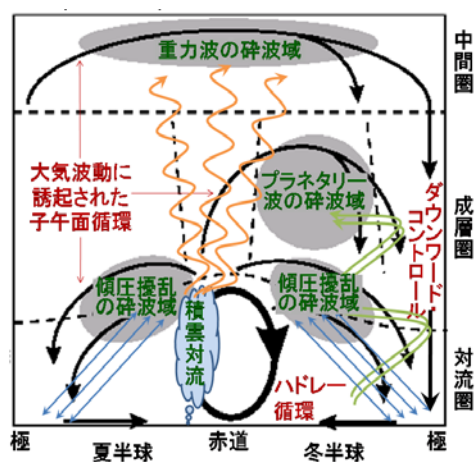


Figure 1 An illustration of the dominant dynamical processes in the stratosphere-troposphere coupled system. A Japanese version of Plumb (2002) Fig. 2 with some additional things.