



AAPPS-DPP 2018 Plenary speaker Name: Prof. Shigeo Yoden

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Rationale: Dr. Yoden has been working on atmospheric dynamics. He has been an internationally well-known scientist especially in the field of stratospheric dynamics, troposphere- stratosphere coupling and also tropical meteorology. He and his colleagues have recently been accumulating interesting features in rather old subject in Geophysical Fluid Dynamics, namely non-linear oscillation of zonal mean flow caused by to wave-mean flow interactions in the equatorial stratosphere known as Quasi-Biennial Oscillation (QBO), and possible downward influence of the QBO to the tropospheric moist convection and its organizations. His expertise of the fields and communication ability is truly worth inviting as a plenary speaker.

Talk Title: Hierarchy of numerical model simulations on the equatorial QBO-like oscillations in the stratosphere-troposphere coupled system

Short abstract: Dynamical features of the vertical coupling between the stratosphere and troposphere in the tropics are different from those in the extratropics. In the extratropics, large-scale atmospheric motions are largely constrained by the conservation law of potential vorticity (PV) and winds are induced by PV anomaly field. In the tropics, on the other hand, the Coriolis parameter is so small that geostrophic or gradient wind balance cannot be well applied to large-scale motions. In other words, the quasi-geostrophic constraint is not very strong in the tropics. The predominant source to drive the atmospheric motions is baroclinic instability of the zonally symmetric flow field in the extratropics, whereas it is moist convection in the tropics; horizontal scale of the most unstable baroclinic disturbance, $O(1000 \text{ km})$, is much larger than that of moist convection, $O(1 \text{ km})$, over three orders or so.

In the last decade or two, some observational, numerical, and theoretical studies have revealed multifaceted aspects of the two-way dynamical coupling in the tropics, not only upward influence but also downward one, associated with the equatorial QBO that is considered to be driven through the wave-mean flow interactions of upward-propagating equatorial waves and gravity waves generated in the troposphere.

In this talk, research progress on stratosphere-troposphere two-way dynamical coupling in the tropics is systematically reviewed, and contributions my group to the subject are summarized, including Yoden et al. (2014), Nishimoto et al. (2016), and Bui et al. (2017) with a regional cloud-system resolving model, and a recent work with a global circulation model of an aqua-planet configuration.

List of related published papers

1. Shigeo Yoden, Hoang-Hai Bui, and Eriko Nishimoto, 2014: A Minimal Model of QBO-Like Oscillation in a Stratosphere-Troposphere Coupled System under a Radiative-Moist Convective Quasi-Equilibrium State. *SOLA*, **10**, 112-116, <https://doi.org/10.2151/sola.2014-023>
2. Eriko Nishimoto, Shigeo Yoden, and Hoang-Hai Bui, 2016: Vertical Momentum Transports Associated with Moist Convection and Gravity Waves in a Minimal Model of QBO-like Oscillation. *J. Atmos. Sci.*, **73**, 2935-2957, <https://doi.org/10.1175/JAS-D-15-0265.1>
3. Hoang-Hai Bui, Eriko Nishimoto, and Shigeo Yoden, 2017: Downward Influence of QBO-Like Oscillation on Moist Convection in a Two-Dimensional Minimal Model Framework. *J. Atmos. Sci.*, **74**, 3635-3655, <https://doi.org/10.1175/JAS-D-17-0095.1>