Quasi-adiabatic Global-scale Waves as Diagnostics of Atmospheric Processes

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We will review several studies relating to observations and simulations of global-scale travelling waves in the atmosphere. The waves considered are all characterized by long horizontal scales and high frequencies –far from the synoptic and mesoscale motions that have drawn most of the attention in dynamical meteorology. While the waves considered have rather small amounts of energy, we will show that their properties have great interest as diagnostics of key atmospheric processes including energy dissipation, moist convection and air-sea interaction. Notably for each of the waves we consider there is a well developed theory that describes their properties in the idealized case of adiabatic and inviscid motion. The discrepancies of the observed wave properties from those predicted by the adiabatic, inviscid theory then are indicators of the diabatic and other dissipative processes. The prototypical example of the effects we are considering is provided by the lunar tide which is forced adiabatically and propagates as a global scale wave. We will review the recent work of Sakazaki et al. (2017) on lunar tidal interactions with tropical convection and Sakazaki and Hamilton (2018) on lunar tidal interactions with the sea surface. We will then consider the possible application of observations of solar tides and atmospheric global normal modes in other diagnostic studies.
Sakazaki, T., K. Hamilton, C. Zhang and Y. Wang, 2017: Is there a stratospheric pacemaker controlling the daily cycle of tropical rainfall? Geophys. Res. Lett., 44, 1998-2006.
Sakazaki, T. and K. Hamilton, 2018: Discovery of a lunar air temperature tide over the ocean: A diagnostic of air-sea coupling. Nature Partner Journal Clim. Atmos. Sci., 1:25, 1-7.

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