Is There a Stratospheric Pacemaker Controlling the Daily Cycle of Tropical Rainfall?

*Takatoshi Sakazaki[1,2,3], Kevin Hamilton[1], Chunxi Zhang[1], Yuqing Wang[1]

1. International Pacific Research Center, University of Hawai'i, 2. JSPS Overseas Research Fellow, 3. RISH, Kyoto Univsersity

Rainfall in the tropics exhibits a large, 12-hour sun-synchronous variation with coherent phase around the globe. A long-standing, but unproved, hypothesis for this phenomenon is excitation by the prominent 12-hour atmospheric tide, which itself is significantly forced remotely by solar heating of the stratospheric ozone layer. We investigated the relative roles of large-scale tidal forcing and more local effects in accounting for the 12-hour variation of tropical rainfall. A model of the atmosphere run with the diurnal cycle of solar heating artificially suppressed below the stratosphere still simulated a strong coherent 12-hour rainfall variation (~50% of control run), demonstrating that stratospherically-forced atmospheric tide propagates downward to the troposphere and contributes to the organization of large-scale convection. The results have implications for theories of excitation of tropical atmospheric waves by moist convection, for the evaluation of climate models, and for explaining the recently-discovered lunar tidal rainfall cycle.

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