Supporting Information

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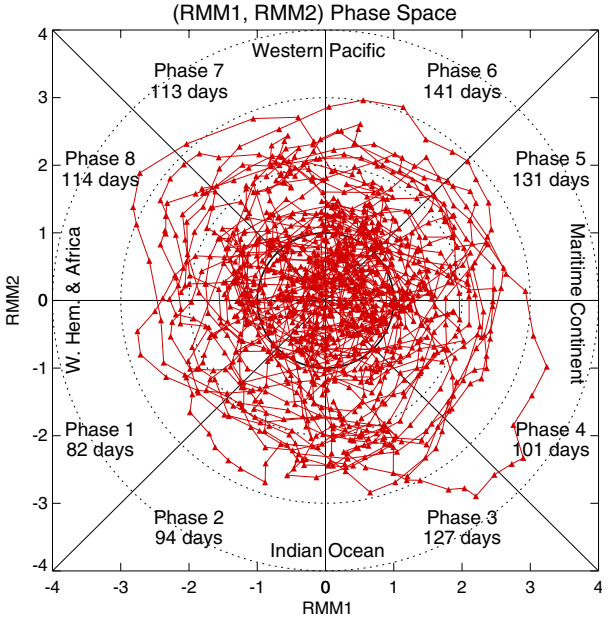

Fig. S1. Real-time multivariate Madden–Julian oscillation (RMM_1, RMM_2) phase space for all days in boreal winter from November 2002 to February 2010 and the number of days for each phase of the composite Madden–Julian oscillation (MJO) cycle. Each triangle represents one day. The solid circle defines the threshold $RMM_1^2 + RMM_2^2 \geq 1$ for strong MJO events. Only days outside the threshold were included in the MJO-composite average shown in Figs. 1 and 2 and S3.

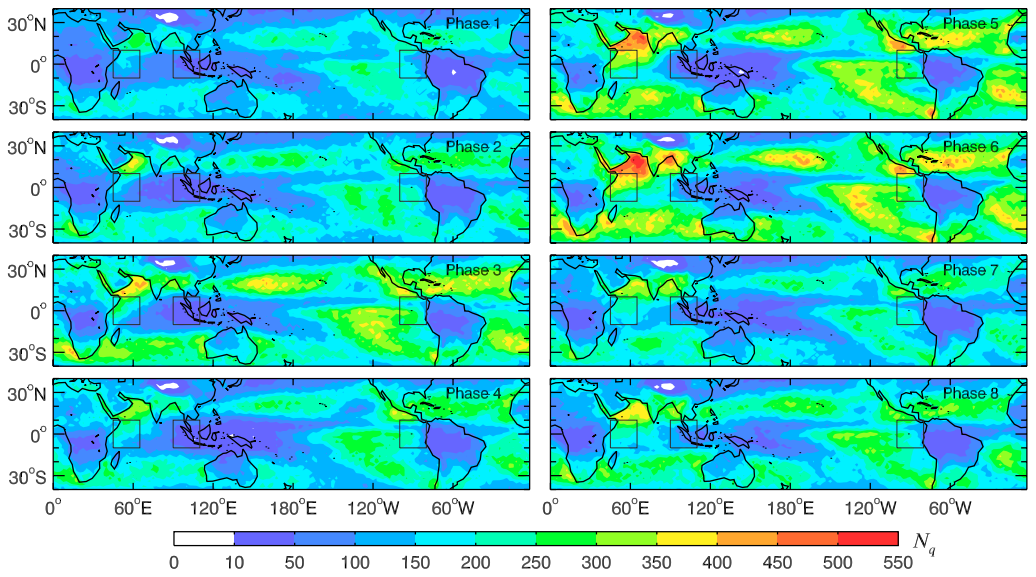

Fig. S2. Total number of Atmospheric Infrared Sounder (AIRS) CO_2 retrievals N_q being averaged for each phase of the composite MJO cycle on the 2.5° longitude × 2° latitude grid. No spatial smoothing has been applied. The spatial variations are due mainly to the local cloud conditions that affect the cloud-cleared radiances for AIRS CO_2 retrievals. Note that depending on the local cloud conditions, there may be zero or multiple CO_2 retrievals at each grid point on each individual day. Hence N_q may be less or more than the number of days in each MJO phase of the composite MJO cycle shown in Fig. S1. N_q may range from ~10 for cloudy regions (e.g., eastern Indian Ocean) to ~500 for cloud-free regions (e.g., eastern Pacific). The 20° × 20° square boxes enclose the representative regions for Fig. 5. The total number of retrievals being averaged in each square box $\tilde{N}_q$ is the sum of N_q at individual grid points within that box.

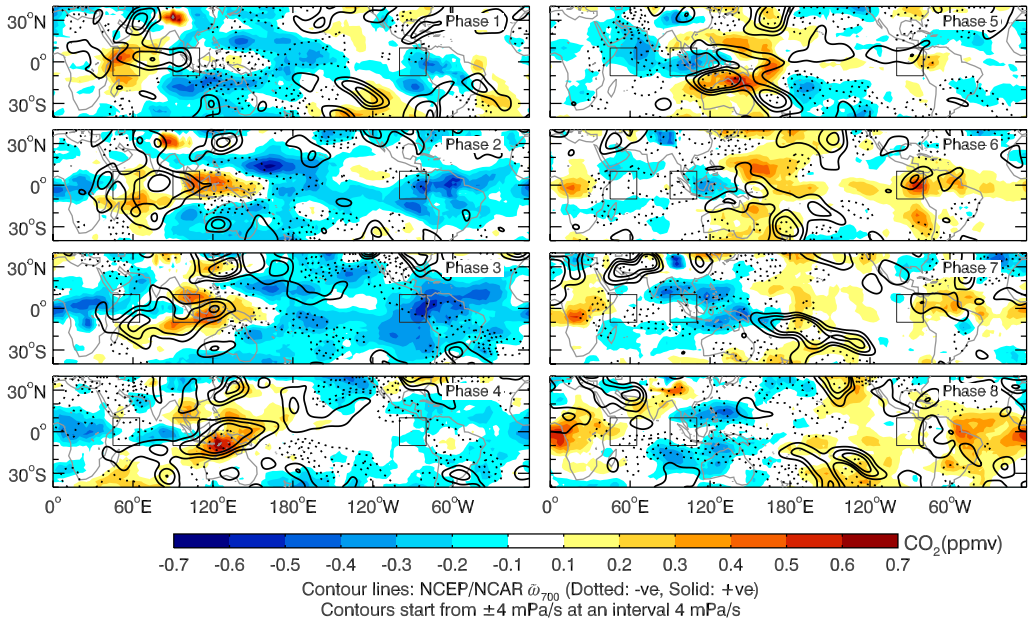

Fig. S3. Same as Fig. 3 except that National Centers for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR) 700-hPa pressure velocity anomalies $\tilde{\omega}_{700}$ are overlaid. The pressure velocity data are of spatial resolution 2.5°longitude × 2.5°latitude and cover the same period as AIRS. For visualization, a 10°longitude × 8°latitude running average is applied to CO_2, and a 10°longitude × 10°latitude running average is applied to $\tilde{\omega}_{700}$, to remove high-wavenumber spatial fluctuations.