The impact of tropical Atlantic SST variability on the tropical atmosphere during boreal summer

The ESTAP_EXP is an AMIP-type experiment conducted with the CAM5.3 model. The experimental setup of the ESTAP_EXP is similar to that of the ESTA_EXP, expect that the SST anomalies (as shown in Fig. 11a) plus the climatological mean are prescribed in both the central–eastern tropical Pacific Ocean and ESTA region. Therefore, the ESTAP_EXP considers both the impacts of the ESTA-related warm SST anomalies in the tropical Atlantic Ocean and La Niña-like SST anomalies in the central–eastern tropical Pacific Ocean. Supplementary Fig. 1 shows the atmospheric circulation responses in the ESTAP_EXP, and supplementary Fig. 2 displays the differences between the ESTAP_EXP and ESTA_EXP during boreal summer, which can be considered as the atmospheric circulation responses to the cold SST anomalies in the central–eastern tropical Pacific Ocean. It is indicated that the atmospheric circulation response in the tropics becomes much stronger in the ESTAP_EXP (supplementary Fig. 1) when compared to the ESTA_EXP (Fig. 7). The atmospheric circulation responses to the SST anomalies in the central–eastern tropical Pacific (supplementary Fig. 2) are obviously stronger than those to the SST anomalies in the ESTA region (Fig. 7). Especially, the La Niña-like SST anomalies in the central–eastern equatorial Pacific can trigger a pair of anomalous low-level cyclones over the eastern tropical Pacific–Atlantic region and a pair of anomalous low-level anti-cyclones over the western tropical Pacific (supplementary Fig. 2b), the pattern of
which resembles that of the observations (Fig. 3b) in the tropics except in the eastern Pacific and Indian Ocean–Maritime continent. It is shown in the partially coupled experiment that the ESTA warming can induce a pair of anomalous low-level anti-cyclones (cyclones) over the eastern tropical Pacific (Maritime Continent) (Fig. 9b), which appears to offset the cyclonic anomalies (anti-cyclones) induced by the central–eastern equatorial Pacific cooling (supplementary Fig. 2b) and therefore leads to insignificant circulation anomalies over there in the observation (Fig. 3b).
Supplementary Figure 1. Ensemble-mean differences in (a) precipitation (unit: mm day$^{-1}$), (b) 850-hPa stream function (shading; unit: 10$^5$ m$^2$ s$^{-1}$) and horizontal wind (vector; unit: m s$^{-1}$), (c) 200-hPa velocity potential (unit: 10$^5$ m$^2$ s$^{-1}$) and (d) 500-hPa vertical velocity (10$^3$ Pa s$^{-1}$) between the ESTAP_EXP and control run (former minus latter) in boreal summer. Amplitude of the response has been divided by a factor of 2 to facilitate comparison.
Supplementary Figure 2. Same as in Supplementary Fig. 1, but for the differences between the ESTAP_EXP and ESTA_EXP.