Geophysical Research Abstracts
Vol. 21, EGU2019-11888, 2019
EGU General Assembly 2019

Role of remote versus local diabatic forcing for the interannual to multidecadal Tropical Easterly Jet variability over West Africa

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The upper-tropospheric Tropical Easterly Jet (TEJ) is an integral part of the summer-time West African Monsoon (WAM) circulation and is strongly correlated with Sahel rainfall changes on interannual and decadal time scales. To explain the covariability between the TEJ and Sahel rainfall, this study investigates whether the variability of the seasonal-mean TEJ over West Africa is mainly forced by local WAM rainfall changes or whether the TEJ variability is caused by remote atmospheric forcing that might also drive Sahel rainfall variability. For this, AGCM simulations with dry dynamics are driven by different atmospheric diabatic heating patterns derived from reanalyses and observations. To disentangle the effects of remote versus local forcing, either the remote diabatic forcing is varied from year to year while the diabatic forcing over Africa is kept constant to its climatological values or the local diabatic forcing is varied and the remote forcing is fixed. It is found that a major part of the interannual TEJ variability over West Africa can be explained by remote planetary-scale diabatic heating anomalies that are strongly related to well-known modes of SST variability, in particular ENSO. In many cases, remote heating anomalies leading to a more intense West-African TEJ are associated with SST anomaly pattern which were shown to enhance Sahel rainfall. The influence of WAM rainfall anomalies on the TEJ over West Africa is relatively weak on interannual time scales. On decadal time scales, this local forcing becomes more important, though. The increase of West-African TEJ intensity over the last two decades is strongly linked to the coincident recovery of Sahel rainfall. In synopsis, the model experiments strongly suggest that the high correlation between the TEJ and Sahel rainfall is mainly explained by the simultaneous influence of the remote diabatic forcing on the local WAM rainfall and the TEJ and less by the sole effect of the local WAM rainfall variability on the TEJ over West Africa.