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Extratropical influences on equatorial Atlantic variability

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Prediction of equatorial Atlantic variability remains a challenge for current prediction systems and many dynamical models struggle to beat simple persistence forecasts. Since the simulation of tropical Atlantic variability in general circulation models (GCMs) is plagued by severe biases in sea-surface temperatures (SST) and other fields it has long been assumed that these biases are the reason for poor prediction skill in the basin. Here we suggest that internal atmospheric variability and its linkage to the extratropics constitutes another important cause for low prediction skill in the equatorial Atlantic.

To evaluate the role of internal atmospheric variability three experiments with the SINTEX-F GCM are performed using strong SST restoring. In the control experiment global SSTs are restored to observations for the period 1982-2014. The second experiment is similar to the control experiment but, in the tropical Atlantic (30S-30N), restores SSTs to the observed monthly climatology. In the third experiment SSTs are restored to observed climatology everywhere.

Composites of westerly wind events in the control experiment show a southward shift of the intertropical convergence zone (ITCZ) and accompanying northwesterly surface wind anomalies. They also show pronounced sea-level pressure anomalies away from the equator that resemble those associated with the positive phase of the Arctic Oscillation, including high pressure over the subtropical and northern Atlantic and low pressure over the Arctic. These patterns are reproduced remarkably well in the experiment with climatological tropical Atlantic SST and even in the experiment with climatological SST everywhere. The results suggest that westerly wind events in the equatorial Atlantic are part of large-scale atmospheric variability patterns that do not rely on SST anomalies. Coupled feedbacks in the equatorial region are necessary, however, to reproduce the observed strength of wind events. The role of midlatitude influences in other basins will be discussed.