Examining forecast drift in the tropical Atlantic

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The tropical Atlantic features variability at interannual and decadal time scales that is known to have a strong influence on the surrounding continents and possibly other ocean basins. Current prediction systems, however, struggle to skillfully predict sea-surface temperature (SST), let alone its impact on rainfall over the adjacent continents. It is often assumed that this poor prediction skill is due to the severe SST biases that most models feature in the region. Some recent studies, however, indicate that the role of biases maybe less important than previously thought and that inherent predictability limits are one major reason for the poor skill relative to the tropical Pacific.

The present study uses seasonal predictions of the SINTEX-F coupled general circulation model (GCM) to examine both the impact of biases on prediction skill and the root causes of the model biases in the tropical Atlantic. For this purpose, we analyze the evolution of biases (the forecast drift) and their relation to prediction skill at daily time-scales. Since the model is initialized with the observed state, the forecast starts out with zero bias and gradually drifts towards its biased attractor during the forecast period.

The results indicate that the link between drift and prediction skill is not very strong. A good example is the Angola-Benguela upwelling region off the coast of southwestern Africa, were SST biases of up to 5 K gradually develop over the 6-month forecast period but the prediction skill often deteriorates within a few weeks. Other regions, such as the equatorial Atlantic and the northern tropical Atlantic, also exhibit relatively little sensitivity to SST bias. This suggests that forecast drift is not the main reason for the poor tropical Atlantic prediction skill of SINTEX-F.

Regarding the origins of eastern equatorial Atlantic SST biases, we find that, irrespective of initialization month, there are two periods of rapid development: July through August and December through February. The former period appears related to westerly wind biases in the western equatorial Atlantic, while the latter period is associated with a weakening of the local cross-equatorial winds.

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