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The Bjerknes feedback in the tropical Atlantic from reanalysis and CMIP5

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In this work we investigate the mechanism suspected behind the zonal mode of interannual variability in the equatorial Atlantic: the Bjerknes feedback. The Bjeknes feedback is a closed loop consisting of three interactions between the variable pairs named below, and is known to be the driver of ENSO. A similar feedback loop is present in the tropical Atlantic throughout the year, varying in strength on interannual time scales leading to said mode of variability. We detect the components of this loop from reanalysis (ERA-Interim and ORAS4) and compare them to the response seen in CMIP5 model outputs.
From reanalysis the Bjerknes feedback can clearly be identified by correlating the three relevant variable pairs: sea surface temperature anomalies (SST') in the east of the basin with zonal wind stress anomalies (τ_u') across the equator; τ_u' generated in the west of the basin to heat content anomalies (HC') most prominent in the east of the equatorial Atlantic; and HC' locally to overlying SST'. In the models, however, the feedback cannot be identified quite as readily. While the influences of SST' on τ_u' and of τ_u' on HC' are included in the models, the interaction between HC' and SST' in the eastern basin can hardly be seen. A shift in the seasonal cycle (of variance) reduce correlation strengths in the model outputs for the first and the second part of the loop, which can be corrected for by introducing a (one to two months) lag between reanalysis and model. The representation of those parts of the feedback is, then, satisfactory. The response of the SST' to the underlying HC', on the other hand, is and stays weak with and without correction for seasonality. From reanalysis a clear connection between these two variables can be found. The reason for the models' discrepancies with observations most likely lies in the thermodynamic influence on the SSTs, which overshadows the heat content's influence. This is in addition to the fact that the simulated thermocline in the east of the equatorial Atlantic is too deep to efficiently cool SSTs in the cold tongue region, leaving it too warm.