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Atlantic forcing of Pacific decadal variability: Forcing of long-term trend and Pacific Climate Shifts

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This paper investigates the Atlantic Ocean influence on equatorial Pacific long-term changes and three Climate Shift events that occurred in the 20th Century. The latest of these Climate Shift events has been linked previously to the hiatus in global warming. Using an ensemble of simulations, where the ICTPAGCM ("speedy") is coupled to the NEMO/OPA ocean model in the Indo-Pacific region and forced by observed sea surface temperatures in the Atlantic region, it is shown that the Atlantic warming has had a substantial impact on the long-term tendency for the Pacific Walker circulation to strengthen. The model reproduces the overall tendency for the equatorial eastern (western) Pacific ocean to cool (warm) in the 20th century. From decadal central equatorial Pacific zonal surface wind variability, three major Pacific Climate Shift events are identified that can be characterized by the differences: (i) 1936 to 1950 minus 1910 to 1924, (ii) 1980 to 1994 minus 1958 to1972, (iii) 1998 to 2012 minus 1980 to 1994. From these events, the early 20th century event (i) is reproduced by the model with increased amplitude, the late 20th Century event (iii) is reproduced with reduced amplitude and the mid 70s Climate Shift (ii) is not reproduced in the model. This shows that although the Atlantic has had some role in two individual Climate Shift events, other mechanisms, such as Pacific internal variability are perhaps as important as the Atlantic forcing. The physical mechanism for the Atlantic influence on the Pacific low-frequency variability is consistent with the previously suggested alteration of the Walker circulation, and the resulting low-level wind changes in the central Pacific.