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External forcing as a source for the observed multi-decadal relation between AMV and the Indian summer monsoon

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The instrumental records show a significant positive correlation between the Atlantic multi-decadal variability (AMV) and the Indian summer monsoon (ISM) rainfall, where a positive (negative) AMV is associated with more (less) ISM rainfall. We have used both proxy reconstruction and twelve models from the Coupled Model Intercomparison Project Phase 5 (CMIP5) to investigate if the observed AMV-ISM relation is a persistent internal climate signal or externally forced. A comparison of several annual resolution proxy records both from the Atlantic and for the ISM show that the multi-decadal variability in both indices is persistent, but the link between them is not. The correlation between the two regions is weak, and even negative in some periods, before the instrumental time period. The analysis of CMIP5 simualtions is consistent with these results. While none of the CMIP5 models investigated simulate the significant AMV-ISM connection in the pre-industrial control simulations with fixed external forcing, three of the models reproduce the relation in the 20th century historical simulations with transient forcing. In these models external forcing is linked to the mid-to-upper tropospheric temperature pattern with a strengthened land-ocean contrast over South Asia, consistent with an enhanced ISM, as well as the evolution of AMV. We conclude that the significant AMV-ISM relation found in the observations after the industrial revolution may be associated with external forcing, rather than being internal climate variability.