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Indian Ocean influence on the ENSO-Indian monsoon teleconnection is mostly apparent

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“Decadal influence” on the El Niño--Southern Oscillation-Indian summer monsoon (ENSO-ISM) teleconnection have been much studied but with plurality and ambiguity about the concept of influence. We provide formal definitions of the apparent influence of a specific factor which enable us to test them as null-hypotheses. Using the recently released Community Earth System Model v2 (CESM2) Large Ensemble (LE) data, we show that a 50% chance for the detection of the apparent Indian Ocean (IO) influence under stationary conditions might take 2000 years of data. However, we find that this influence is mostly apparent indeed, as it originates from fluctuations of the decadal apparent -- as opposed to climatological -- ENSO variability, which causally influences an IOD-like apparent mean state. We also show that no unattributed so-called “decadal influence”, reflected in a deviation from a linear regression model of the teleconnection as a null-hypothesis, can be detected in 20th c. observations even regionally. Only the LE data is sizable enough to reveal this effect.