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The representation of the boreal summer intraseasonal oscillation in a global convection-permitting simulation

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The Boreal Summer Intraseasonal Oscillation (BSISO) is a major mode of intraseasonal variability in the Indian summer monsoon. The characteristic pattern includes northward/north-eastward propagating anomalies of convection and circulation over the Indian longitudes, and concurrent eastward propagating anomalies that move through the tropics from the equatorial Indian ocean. In the Indian monsoon region, the BSISO interacts with other processes to affect the rainfall variability on a range of spatial and temporal scales. Convection-permitting simulations are known to improve the representation of some of these smaller-scale processes, but until recently, it has not been feasible to use convection-permitting simulations to model the entire BSISO because of the temporal and spatial scales on which it occurs. Here we assess how well a global multi-year convection-permitting simulation with a coarse grid-spacing of ~10km at the equator models the BSISO. Using Empirical Orthogonal Function (EOF) analysis, we show that overall, the convection-permitting simulation does not give a substantially better representation of the BSISO, when compared with a simulation which parametrises convection. In the observations, the first two EOF eigenvectors and their Principal Component (PC) time series describe the BSISO. The characteristic northwest-to-southeast slope of the observed EOF 1 and 2 patterns is not captured in the parametrised simulation but is better captured in the convection-permitting simulation. However, the convection-permitting simulation does not capture the observed relationship between the PC1 and PC2 time series that describe the strength and phase of the BSISO. The observed pattern is of a fairly constant phase difference between the PC1 and PC2 time series, but in the convection-permitting simulation, there are periods of both negative and positive phase differences. Our results demonstrate that the BSISO is very sensitive to the representation of convection and future higher resolution runs will provide useful routes for understanding scale interactions in the BSISO.