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Teleconnections between ENSO and Southwest Pacific tropical cyclones in a high-resolution GCM

Nicholas Klingaman[†]; Andrew King; Lucy Batt
[†] University of Reading, United Kingdom
Leading author: n.p.klingaman@rdg.ac.uk

The El Niño-Southern Oscillation explains a large fraction of the variance in tropical-cyclone (TC) activity in the Southwest Pacific. La Niña greatly enhances the probability of landfall in eastern Australia, while El Niño shifts TC genesis east, further into the Pacific. With few reliable observations prior to the satellite era, the stability of the ENSO-TC relationship is uncertain, particularly its multi-decadal variability. Climate models often have difficulty capturing this teleconnection, as well as the climatology of Southwest Pacific TCs, limiting confidence in projections of the impacts of climate change. The ENSO-TC teleconnection is examined in atmosphere-only and coupled integrations of the High-resolution Global Environment Model (HiGEM), with 90 km (30km) atmospheric (oceanic) horizontal resolution. The coupled control integration is 150 years long, providing the opportunity to examine the simulated response of TCs to inter-decadal natural variability. The 1979-2002 atmosphere-only integration is forced by AMIP SSTs. HiGEM reliably simulates the teleconnection, shifting TC genesis eastward (westward) in El Niño (La Niña) years and reducing (increasing) landfall probabilities in eastern Australia. HiGEM generates a realistic geographic distribution of TCs, although the atmosphere-only model produces very few cyclones west of the Gulf of Carpentaria. The model produces nearly three times as many TCs as observed across the domain, however, a bias which is reduced considerably when the TC detection criteria are strengthened. Decadal variability in HiGEM is shown to be lower than observed, likely due to the lack of a strong Inter-decadal Pacific Oscillation. The reasonable simulation of Southwest Pacific TCs and their inter-annual variability in HiGEM raises the prospect of using the model to examine the impacts of future climate change on TCs.