While climate models are primarily designed to examine large-scale features of the climate system, it is regional- and local-scale projections that are ultimately needed to inform those addressing impacts of, and adaptation to, climate change. The models are less accurate at regional scales and when dealing with extremes and variability. With the aim of providing useful climate projections, we discuss the implications of coupled model biases such as the location and movement of the South Pacific Convergence Zone, rainfall teleconnections, and the mean state of the ocean-atmosphere system including the cold tongue bias and erroneous location of the warm pool.

In addition, models have problems with El Niño Southern Oscillation, and yet this is the major driver of Pacific climate. The range of ENSO behaviour in models for the present day is far larger than anything we might expect from global warming. Furthermore there is no consistent ENSO change in the models under global warming, leaving very little idea of how, if at all, the ENSO of the future might behave. Individual island predictions are also sensitive to the significant bias in location and strength of ENSO.

These limitations are important for anyone using model output to understand how the future climate may change on regional scales. Here we address these biases and discuss the implications for how to interpret climate model predictions. Any application using coupled models to assess future climate or downscaling from any climate model must be aware of these inherent biases and inconsistencies and how to account for them.