Theme 3: Climate

3.3 Maritime Continent earth system science for improved understanding and prediction of its local variability and global impact

060. Simulating realistic precipitation with convection-permitting models in the Maritime Continent

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The Maritime Continent is a tropical archipelago with an intricate configuration of islands, very complex topography and a warm and shallow ocean. Current atmospheric models fail to represent typical features of rainfall in this region, such as the distinctive diurnal cycle. These limitations indicate that our knowledge of the physical mechanism initiating and developing convective systems in the region is incomplete. Convection-permitting models are a powerful tool with potential for detailed representation of the atmospheric processes and thus exploring the ingredients that improve realism of simulated precipitation in the Maritime Continent.

Using a regional climate model, we investigated the impact of spatial resolution on rainfall amounts and the diurnal cycle. A set of 5-year simulations at resolutions of 50, 10 and 2 km were completed and compared against satellite-derived observational products. While positive biases exist in the model and are exacerbated with explicit convection, our results suggest that precipitation is more realistic in the convection-permitting experiment performed at 2-km grid spacing. For example, features such as the shape and phase of the diurnal cycle, the spatial location of precipitation centres and the convection initiation, which are traditionally misrepresented in models, are much closer to observations in high resolution experiments. The amplitude of the diurnal cycle is also improved over most areas, although deficiencies still exist in that the strength of the cycle is overestimated.

In this talk, the resolution dependence of near-surface temperature, 10-m winds and cross-sections of different variables will also be discussed. Hence, possible mechanisms that contribute to better simulating aspects of precipitation will be put forward, such as finer representation of the land-sea thermal contrast and the local circulation. The recently funded project REHIPRE motivated by these results and aimed at identifying factors that contribute to more realistic precipitation in the Maritime Continent will also be introduced.