Geophysical Research Abstracts
Vol. 16, EGU2014-14939, 2014
EGU General Assembly 2014

Ocean feedback on tropical cyclone intensity in a multidecadal coupled simulation of the South Pacific

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Tropical cyclone (TC)-ocean interactions are essential for cyclone formation and evolution. Surface cooling is observed in the cyclone wake and is expected to exert a negative feedback to the storm intensity. Its quantification is assessed with a coupled regional model of the southwest Pacific developed for present climate simulations at mesoscale resolution. The feedback of the ocean response is investigated for the first time by comparing 20-year forced and coupled experiments. This provides statistically robust experiments filling a gap between coarse-resolution and short-term studies.

The intensity distribution is significantly affected but the SST feedback is of moderate amplitude (5-15 hPa/Celsius) compared with theoretical models. Our analysis contradicts the direct thermodynamic control of TC intensification by surface moisture fluxes in favor of a storm-scale dynamic control. In addition, regional oceanography strongly modulates TC-ocean coupling. It is stronger in the Coral Sea that has shallow mixed layer and numerous eddies but extremely weak in the warm pool that has deep mixed layer, thick barrier layer and no mesoscale activity. These pre-conditions to SST cooling impact the TC distribution.