Tropical western Pacific regional cloudiness appears to form on its own schedule

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Deep tropical clouds are sometimes called the engines of the global climate. They pick up and transport moisture and heat from the ocean into the atmosphere, providing precipitation and driving the global circulation. Credit: ARM Climate Research Facility

(Phys.org) —Tropical cloudiness has its own timeline. That's what researchers at Pacific Northwest National Laboratory found when they compared development of turbulent clouds to the timing of the atmospheric perturbation that rolls over the region every 60 to 90 days. Contrary to past assumptions, they found that the atmospheric phenomenon known as the Madden-Julian Oscillation (MJO for short) does not directly influence the timing of specific rainfall events. Tall turbulent clouds drive rain in the region to change from drizzle to downpour at a faster pace.

Like the ocean tides, the atmosphere has its own cyclic routine. For the tropical western Pacific region, the MJO is a major influencing force. Simple to say, but more complicated to describe or predict. The Madden-Julian Oscillation (see sidebar, Explaining the MJO) brings increased rain and winds in its path, affecting monsoons in the tropics and heavy rainfall and winds as far away as North America. Scientists are trying to nail down the MJO's influence on the climate by simulating the phenomenon in climate models.

In this study, using site measurements, they knocked down a previous assumption that the timing and intensity of local rain would mimic the timescale of the MJO as it passed through. Filling in the gaps on the MJO's impact on the climate will help scientists better understand and model the MJO, and planners better project future events under the influence of climate change.

The PNNL research team used high-resolution, ground-based radar data from an ARM Climate Research Facility site in the tropical western Pacific to evaluate the impact of the MJO on clouds and meteorological conditions over Manus Island. They used data gathered during 13 MJO events over 6 winter seasons to develop a single composite event for their evaluation. Their data included cloud frequency, precipitation, specific humidity, temperature, and wind during the 13 MJO cycles.

Their analysis used a unique view of daily cloud processes, rather than the more typically used 5-day timescale. They found frequent shallow cloudiness driven by time scales shorter than the MJO. Between 8 and 4 days before the MJO convective peak at Manus, deeper convection developed but, likely inhibited by the dry mid-troposphere, it typically did not extend beyond 8 km. The team postulated that some of the features of this process in previous studies may have been masked by the use of 5-year averaged data rather than daily data, or by averaging the cloud and rain characteristics over larger areas.

In contrast to the mature phase of the MJO covered in this research, scientists will next look at the MJO's effect on clouds where it originates over the Indian Ocean region. Data gathered from the ARM MJO Investigation Experiment (AMIE) and Dynamics of the Madden-Julian Oscillation (DYNAMO) field campaigns will contribute to that next phase of research.

More information: Deng, L., McFarlane, S. and Flaherty, J. 2013. Characteristics Associated with the Madden-Julian Oscillation at Manus Island. *Journal of Climate*. DOI:10.1175/JCLI-D-12-00312.1

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