Tropical cyclones: How they contribute to better forecast in the Maritime Continent

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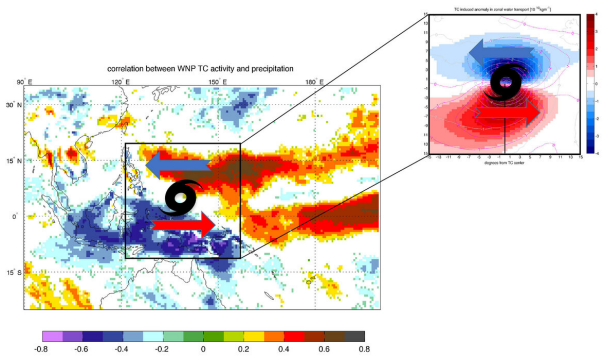

Correlation between the activity of tropical cyclones and precipitation over the region (left) and the reason behind: the tropical cyclones-induced meridional water transport (upper right, where red represents an eastward water transport and blue represents a westward water transport). Credit: Enrico Scoccimarro

Tropical cyclones are important players within the Earth's climate system. While literature usually investigates their role in determining flood events and inducing precipitation, a new study led by the CMCC Foundation—Euro-Mediterranean Center on Climate Change points out for the first time that they can also create drying effects in other regions due to induced zonal wind anomalies.

Through observational data for the period 1979-2015, the study shows that tropical cyclones in the West-North Pacific not only increase precipitation in the areas where they transit from June to August, but also decrease precipitation in the Maritime Continent—the region between the Indian and Pacific Oceans including the Southeast Asian archipelagos—that is not directly affected by typhoons. This is explained by an eastward water transport anomaly in the equatorial region of the Northwest Pacific induced by tropical cyclones developing in the basin.

"Tropical cyclone-associated winds that move around its center reach 200 to 300 km/h. Winds move not only the air mass, but also the water present in the air mass itself and they can involve an area of about 10,000 km from the center of the cyclone," explains Dr. Scoccimarro, senior researcher at the CMCC Foundation under the Climate Simulation and Prediction Division and principal investigator of the study. "In a tropical cyclone, winds spiral toward the center in a counterclockwise direction in the Northern Hemisphere. Therefore, in the southern part of the cyclone, the vertically integrated water content is moved to the east, while in the northern part of the cyclone water is moved to the west."

The eastward water transport anomaly is responsible for moving the water that would belong to the air column of the Maritime Continent to the east, thus reducing the humidity of the area: The result is that in years with the most tropical cyclones, the Maritime Continent is dryer.

The findings were confirmed by numerical experiments using the high-resolution General Circulation Model developed by the CMCC Foundation (CMCC-CM2-VHR4). "Using one of the three models able to resolve intense typhoons, thanks to its high horizontal resolution of 25km in both atmosphere and ocean components, we could exclude other external factors potentially interacting with both tropical cyclone activity and Maritime Continent precipitation, such as El Nino Southern Oscillation," explains Scoccimarro.

The study highlights that forecasting tropical cyclones activity in advance over the northwest Pacific may help in forecasting the onset and duration of the dry season over the Maritime Continent, thus helping to improve the forecasts for all the processes associated with the circulation in the area. This has important implications, as the Maritime Continent plays a role in the global circulation pattern, due to the energy released by

convective condensation over the region which influences the global atmospheric circulation.

The paper, just published in the *Proceedings of the National Academy of Sciences* (*PNAS*), is titled "The typhoon-induced drying of the Maritime Continent."

More information: Enrico Scoccimarro el al., "The typhoon-induced drying of the Maritime Continent," *PNAS* (2020). www.pnas.org/cgi/doi/10.1073/pnas.1915364117

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