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Dengue epidemics linked to high temperatures during strong El Nino season

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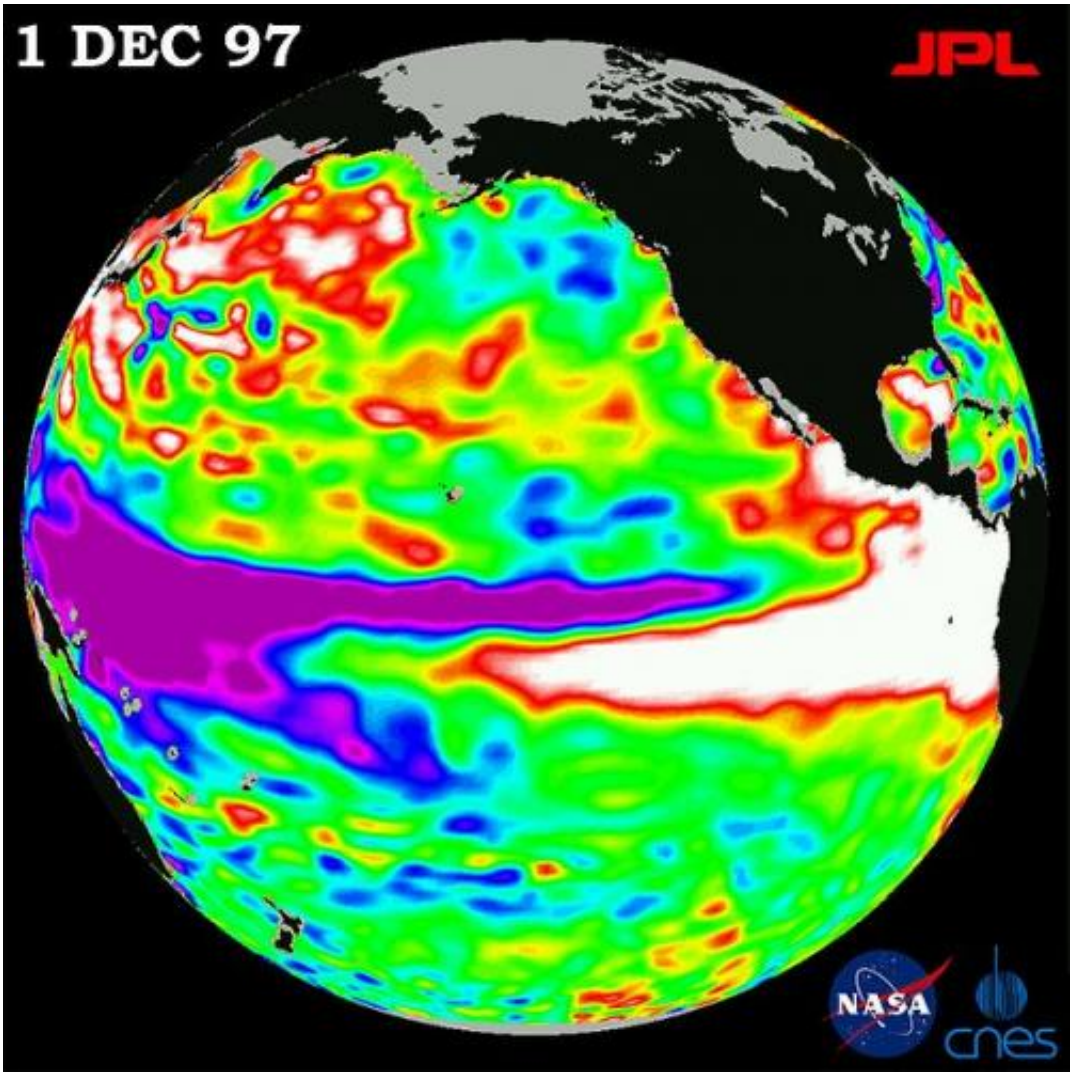

The 1997 El Nino seen by TOPEX/Poseidon. Credit: NASA

An international research team led by the University of Pittsburgh Graduate School of Public Health has shown that epidemics of dengue, which is caused by a mosquito-borne virus, across southeast Asia appear to be linked to the abnormally high temperatures brought by the El Niño weather phenomenon.

Now, as the most intense El Niño in nearly two decades is emerging in the Pacific, the finding - reported in today's issue of the *Proceedings of the National Academy of Sciences* (*PNAS*) - may be a harbinger of a spike in cases of the dangerous hemorrhagic fever throughout southeast Asian countries early next year.

"Large dengue epidemics occur unexpectedly, which can overburden the health care systems," said lead author Willem G. van Panhuis, M.D., Ph.D., assistant professor of epidemiology at Pitt Public Health.

"Our analysis shows that elevated temperatures can create the ideal circumstance for large-scale dengue epidemics to spread across a wide region. The ability to predict and prepare for these epidemics should lead to more effective disease surveillance and control efforts."

Dengue virus is transmitted by mosquitoes in the tropics and subtropics. It causes an estimated 390 million infections each year. Though there is no specific pharmaceutical treatment, supportive therapy can greatly improve outcomes.

In many countries, reported cases of dengue wax and wane during the rainy season following a repeating annual cycle. So far, it has been difficult to predict when these epidemics will become unusually large, spreading beyond country borders.

"This study will contribute toward a better understanding of the cyclical nature of dengue," said co-author Lam Sai Kit, Ph.D., professor at the

University of Malaya in Malaysia. "Based on the extensive data analyzed and the conclusions reached, it will help to improve early warning systems for impending large outbreaks in the region. Now that the new El Niño has started, these findings will help us prepare for a worst-case scenario, and immediate measures can be taken to counter its effect in the next few months."

The research team collected and analyzed 18 years of monthly dengue surveillance reports on a total of 3.5 million reported cases in 273 provinces in eight countries in southeast Asia. By bringing the data together from several countries, the scientists were able to see patterns - or synchronicity - in dengue transmission across the entire region.

"This is another example of extracting valuable information from routinely collected public health data that was just sitting around in basements and computer archives across these countries," said Dr. van Panhuis.

In 1997 and 1998, dengue transmission was very high, matching up perfectly with high temperatures that allowed mosquitoes to reproduce faster and spread dengue virus more efficiently. These high temperatures were caused by an exceptionally strong El Niño season, which occurs when rising sea water temperatures in the eastern Pacific move westward. This phenomenon occurs about every five years, with one of the largest episodes expected in the coming months.

This study also found that urban areas act as dengue epidemic "pacemakers" because of their constant supply of new people who are susceptible to dengue. In addition, traveling waves of large epidemics were found to emerge from west Thailand, central Laos and the southern Philippines.

"Given the increased cross-border mobility of people, strong evidence of

global warming and the potential for rapid global proliferation of infectious diseases, a better understanding of how contagious diseases spread over long distances is essential for global health security," said Dr. van Panhuis. "During this study, we've created a foundation for improved multi-country collaboration to improve infectious disease surveillance, analysis and control. We should systematically combine disease data from multiple countries to continuously monitor the risk of epidemics at regional scales."

More information: Region-wide synchrony and traveling waves of dengue across eight countries in Southeast Asia, www.pnas.org/cgi/doi/10.1073/pnas.1501375112

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