Decadal climate variability in the tropical Pacific

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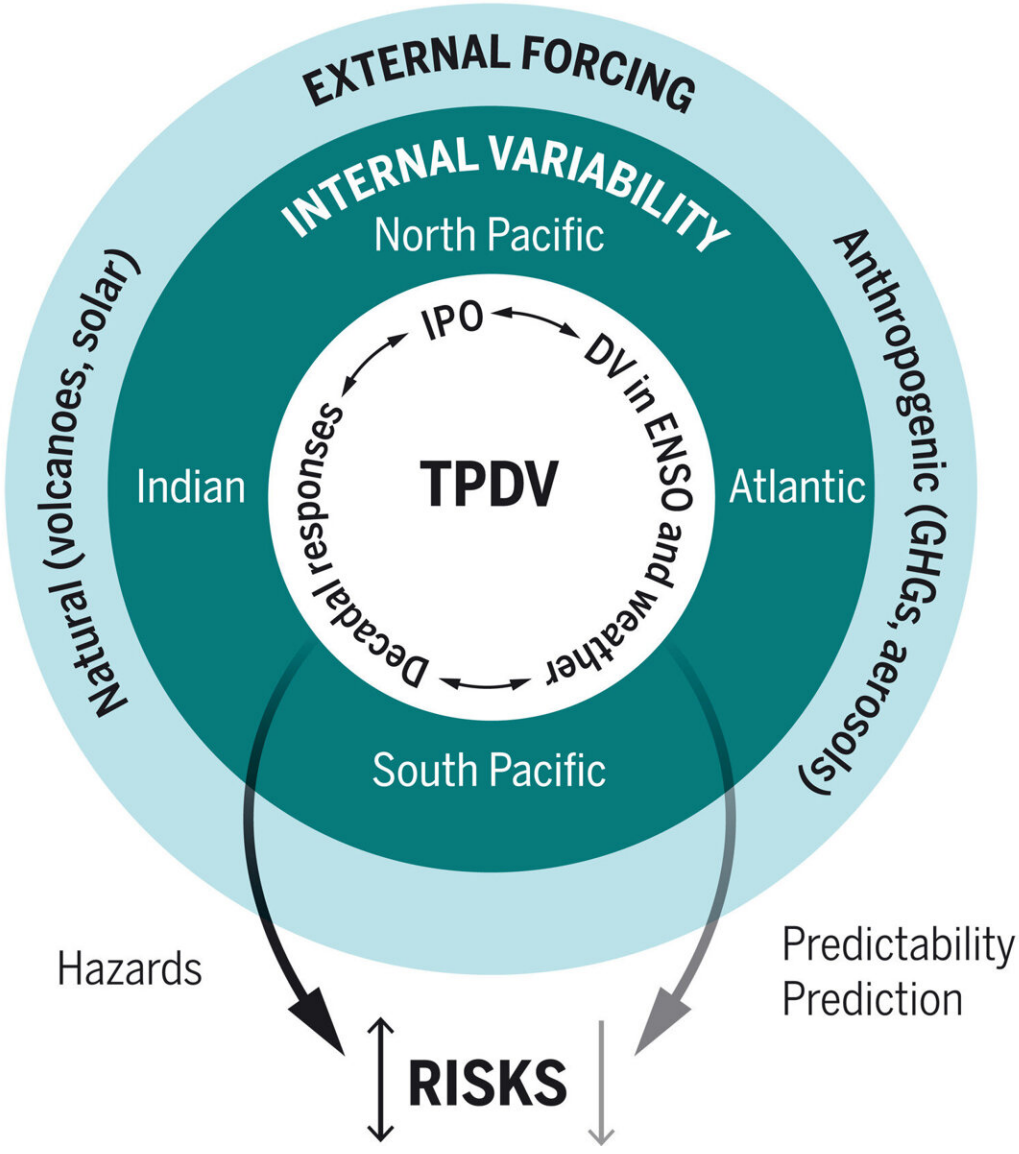

Schematic overview of key issues raised. The inner circle provides a few examples of TPDV, together with some of the processes responsible for TPDV originating in the tropical Pacific. These include the Interdecadal Pacific Oscillation (IPO), decadal responses to external forcing, decadal variability in ENSO and weather, and the impact of this decadal variability on the tropical Pacific. The small, two-way arrows in the inner circle indicate the possibility of two-way interactions between these phenomena. The inner ring describes internal processes that can drive or influence TPDV, indicating that this can originate in the Pacific beyond the tropical Pacific and in the (tropical) Indian and Atlantic Oceans. The outer ring represents external forcing that can drive or influence TPDV. This includes both natural (e.g., volcanoes) and anthropogenic (e.g., anthropogenic GHG emissions) factors. The large arrows extending to the bottom of the figure represent the risks associated with TPDV (e.g., drought). The arrow on the left indicates that TPDV affects such risks. The arrow is dark to indicate that many of the risks are well established. The large arrow on the right indicates that skillful predictions, which depend on the existence of predictability in the climate system, can help to reduce the risks. This arrow is gray to indicate that decadal predictions for the tropical Pacific are still at a formative stage. Credit: DOI: 10.1126/science.aay9165

From devastating floods to raging wildfires, climate variability on a global scale is apparent. These extreme weather events, and the world's climate system as a whole, are heavily influenced by the Tropical Pacific, an expanse that stretches from Australia to the Americas.

A team of 35 international scientists representing 27 climate research centers, led by Professor Scott Power in Australia, Matthieu Lengaigne in France, and Antonietta Capotondi in the U.S., joined forces to study climate fluctuations and changes in this region, referred to collectively as the Tropical Pacific Decadal Variability (TPDV).

"TPDV refers to any form of climate variability or change which occurs

in the atmosphere, ocean and over land within the tropical Pacific," said Professor Power, director of the Centre for Applied Climate Sciences at the University of Southern Queensland.

"Internal TPDV modulates drought, wildfires, floods, polar sea-ice extent, river flow, agricultural production, and the rate at which the planet warms in response to greenhouse gas increases, as well as our ability to predict the El Niño-Southern Oscillation.

"Warming in the western Pacific has been so great that temperatures experienced over the past decade have been beyond the range evident in reliable instrumental records."

University of Montpellier researcher Matthieu Lengaigne said changes in this region could have far-reaching effects, especially in the oceans.

"Further warming in this region is expected to reduce coastal fish populations, shift tuna distribution eastward and cause record-breaking high temperatures to occur more often," Dr. Lengaigne said.

"It is also likely to fundamentally alter coral reefs, with major impacts on biodiversity, Pacific Island communities and livelihoods."

While there are major international efforts under way to provide decadal climate predictions, there is still a great deal of uncertainty about the characteristics and causes of TPDV.

To combat this, Professor Power and his international research partners synthesized a huge amount of research on the phenomenon into one paper, which was today published in *Science*.

"As TPDV affects risks from natural disasters, our ability to predict it has the potential to help communities, governments and industry plan for

future climate impacts," Professor Power said.

"There are many ways we can advance our knowledge in the area," University of Colorado researcher Antonietta Capotondi said.

"It will require improvements in the quality and length of the observational and paleo records, including sustaining and enhancing the ocean and climate observing systems, as well as a deepened understanding of processes, which will allow us to adequately validate and improve models."

More information: Scott Power et al, Decadal climate variability in the tropical Pacific: Characteristics, causes, predictability, and prospects, *Science* (2021). DOI: 10.1126/science.aay9165

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