New analysis reveals where marine heatwaves will intensify fastest

August 28 2020

Credit: Johannes Plenio (Pexels)

The world's strongest ocean currents, which play key roles in fisheries and ocean ecosystems, will experience more intense marine heatwaves than the global average over coming decades, according to a paper published today in *Nature Communications* by researchers from the ARC Center of Excellence for Climate Extremes at the University of Tasmania and CSIRO.

Sections of Australia's Leeuwin current and East Australian Current; the United States Gulf Stream; Japan's Kuroshio current; and the most powerful ocean current of all, the Antarctic Circumpolar Current, will all see the intensity of heatwave events ratchet up over the next 30 years.

However, while the intensity of individual marine heatwave events in these areas is likely to increase faster than the global average, the number of marine heatwave days appear to increase at a lower than average rate. And what happens around these currents is even more interesting.

"We know marine heatwaves are on the rise globally, but policymakers, fisheries experts, aquaculture industries and ecologists need to know how this will play out at regional levels, especially in terms of where they will occur and how much hotter they will be," said lead author from the ARC Center of Excellence for Climate Extremes Dr. Hakase Hayashida.

"Our detailed modeling is the first step in peeling back these layers, revealing the temperature variation that occurs across these currents and around them, indicating where the sharpest rises in marine heatwaves are likely to occur. For instance, we found intense marine heatwaves were more likely to form well off the coast of Tasmania, while along the Gulf Stream more intense marine heatwaves start to appear more frequently close to the shore along the stretch of coastline from the state of Virginia to New Brunswick. This will almost certainly change ecosystems in these regions."

The key to this research was the use of two near-global high-resolution (1/10o) simulations over current and future periods developed by CSIRO Ocean Downscaling Strategic Project, which could reproduce eddies 100km across and generate realistic boundary currents and fronts. This detailed approach revealed the, sometimes, stark regional variability in ocean temperature extremes much more variable than coarser global

climate models.

The researchers confirmed the accuracy of their model by comparing the detailed model outputs with observations from 1982-2018. They then used the same high-resolution model to project how marine heatwaves would alter with climate change out to 2050.

In every western boundary current they examined, more intense marine heatwaves appeared. In general marine heatwaves also occurred more frequently.

But on the edge of these currents it was a different story. Eddies that spun off from the main current created areas where the increases in numbers of heatwave days were lower than average and even some regions where heatwave intensity declined.

"Like so many aspects of the climate system, the warming of the oceans isn't the same everywhere, which means the ecology will respond differently to global warming, depending on location" said Assoc Prof Peter Strutton.

"Detailed modeling like this is the first step in understanding which ecosystems will thrive or decline, how the productivity of the ocean will change, and those parts of the food chain most likely to be affected. This is exactly the kind of knowledge we need to adapt to the inevitable consequences of global warming."

More information: Hakase Hayashida et al. Insights into projected changes in marine heatwaves from a high-resolution ocean circulation model, *Nature Communications* (2020). DOI: 10.1038/s41467-020-18241-x