Where does the energy of North Atlantic tropical cyclones come from?

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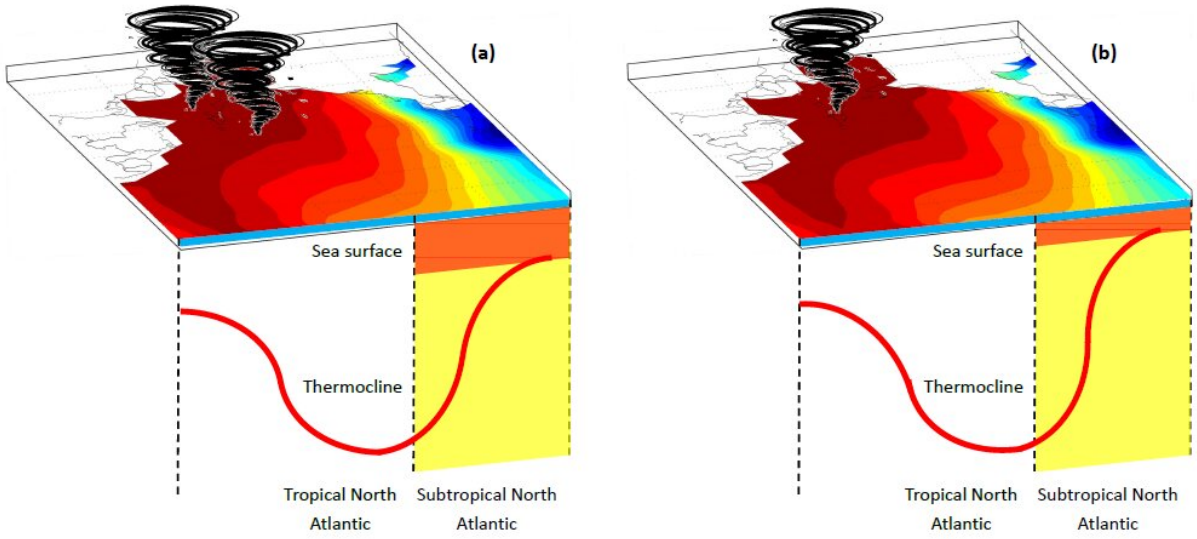

Schematic illustration of the oceanic thermal forcing of North Atlantic tropical cyclones. Credit: Zhenxi Zhang

Landfalling North Atlantic tropical cyclones (TCs) cause serious economic damage to human society. In the period 1900–2017, 197 North Atlantic TCs resulted in 206 landfalls in the continental United States, producing about $2 trillion in losses. As natural weather disasters, TCs possess enormous destructiveness related to their intensities.

But why do TCs have such huge destructive energy? Previous work by

Professor Kerry Emanuel proposed a "heat engine" theory of TC intensity, which explained the intensity of a TC from the perspective of the energy cycle and pointed out that the energy comes from the warm ocean.

Following this idea, Prof. Zhenxi Zhang from the Inner Mongolia University of Technology, China, and Prof. Wen Zhou from Fudan University, China, further explored the spatial characteristics of the energy driving North Atlantic TCs. The findings have recently been published in *Atmospheric and Oceanic Science Letters*.

TC intensity is the kinetic energy of a TC, which essentially comes from the energy in ocean heat content because energy is conserved. Among all TCs, the peak intensities of strong TCs are the most related with the ocean heat content, especially that of the extratropical North Atlantic. Therefore, the ocean heat content in this ocean region is the limiting factor of strong TC peak intensity.

Moreover, coastal upwelling off northwest Africa and southern Europe can affect subsurface ocean temperatures in the extratropical North Atlantic. "Therefore, the peak intensity of strong TCs is also directly correlated with the water temperature in these two upwelling regions on an interdecadal timescale," concludes Prof. Zhou.

More information: Zhenxi Zhang et al, Oceanic thermal forcing of North Atlantic tropical cyclones, *Atmospheric and Oceanic Science Letters* (2022). DOI: 10.1016/j.aosl.2022.100286

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