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TROPICAL CYCLONES' INFLUENCE ON THE OCEAN : FROM EVENT SCALE PROCESSES TO CLIMATE SCALE CONSEQUENCES

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Résumé :

Strong winds associated to Tropical Cyclones (TCs) trigger intense mixing in the upper ocean. While the resulting surface cooling feeds back negatively on TCs intensity, the associated sub-surface warming has been suggested to substantially modify the ocean heat transport. A ½° global ocean model experiment that realistically samples the ocean response to more than 3,000 TCs over the last 30 years is used to first investigate the processes controlling the TC-induced surface cooling at the local scale and then to assess the impact of TCs at the global scale.

Vertical mixing is the dominant process of the cooling occurring locally close to the TC track. I will show that the cooling magnitude can be described by combining an index measuring the storm's power and an index measuring the resistance to surface cooling by upper-ocean stratification. The cooling is very sensitive to the pre-storm upper-ocean stratification, which can modulate its amplitude by up to an order of magnitude for a given storm's power.

The processes explaining the surface cooling under TCs also participates to modify the mean ocean heat budget. Previous studies have focused on the climatic importance of TC-induced mixing, but cooling is increasingly due to surface heat fluxes as we consider larger space scales. Both heat fluxes and vertical advection associated to TCs are shown to also influence the ocean mean state. Vertical mixing does induce an enhanced ocean heat uptake consistent with previous estimates. However, most of the heat injected into the ocean during TC seasons is re-entrained by the winter mixed layer deepening. As a consequence, we find that the main TCs' climatological impact is to reduce the amplitude of surface temperature seasonal cycle more than to modify the ocean heat transport.

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