Abstract

Super typhoons (STYs), intense tropical cyclones of the western North Pacific, rank among the most destructive natural hazards globally. The violent winds of these storms induce deep mixing of the upper ocean, resulting in strong sea surface cooling and making STYs highly sensitive to ocean density stratification. Although a few studies examined the potential impacts of changes in ocean thermal structure on future tropical cyclones, they did not take into account changes in near-surface salinity. Here, using a combination of observations and coupled climate model simulations, we show that freshening of the upper ocean, caused by greater rainfall in places where typhoons form, tends to intensify STYs by reducing their ability to cool the upper ocean. We further demonstrate that the strengthening effect of this freshening over the period 1961–2008 is ~53% stronger than the suppressive effect of temperature, whereas under twenty-first century projections, the positive effect of salinity is about half of the negative effect of ocean temperature changes.

摘要

西北太平洋的強烈熱帶氣旋，又稱超級颱風(STYs)，在全球自然災害的破壞程度上名列前茅，風暴產生的強風促成更厚的表層海水進行混和，導致表層海水冷卻加劇，且讓(STYs)對海洋密度分層更為敏感。

雖然一些研究調查了海洋熱結構對未來颱風的潛在影響，但他們並未將近表層的鹽度變化納入考量。因此在本實驗中，將觀測結果和耦合的氣候模式模擬結果加以結合，我們發現，因為颱風強降雨使得上層海水濃度低的區域，藉由減低颱風幫表層海水降溫的能力，以增強(STYs)。

我們進而發表了一個論點，在(1961~2008)之間淡化海水對颱風的增強效果，比海溫的抑制效果多了 53%，而我們估計在 21 世紀，鹽度的正面影響將會是海溫變化造成的負影響的一半。