Abstract

Western boundary currents bring warm tropical water poleward and eastward and are characterized by a sharp sea surface temperature (SST) front on the poleward edge of the current as it extends into the interior basin. One of the most prominent such front is associated with the Kuroshio Extension (KE) as it extends east of Japan (“upstream KE”). Large latent and sensible heat fluxes that warm the atmosphere and cool the ocean project this front into the atmosphere, thereby affecting weather and climate both locally and remotely. While one might assume that these larger surface heat fluxes on the equatorward side would tend to damp the SST front, here we present observational evidence that the surface heat loss actually strengthens the front during October-April in monthly climatology and about 87% of months from October to January during the 2004/05 – 2014/15 period, although the percentage lowers to about 38% for February-April of the same period, suggesting some temporal/data dependency in the analysis. The key to understanding this counterintuitive result for frontogenesis is that the effective heat capacity of the surface water depends on mixed layer thickness. SSTs are more (less) sensitive to surface heat fluxes in regions with shallow (deep) mixed layer.

摘要

西側的海流帶來了向極和向東的溫暖海水，當其延伸至內部海槽時，向極的海流鋒面，表層海溫產生劇烈的溫度變化，其中一個著名的例子，就是在日本東側延伸出的 Kuroshio Extension (KE) (“upstream KE”)黑潮延伸流。

從這個鋒面影響至大氣的潛在但巨大可觀熱通量，會加熱大氣並使海溫下降，藉此區域性或更深遠的影響天氣和氣候。然而假設，在向赤道側越來越大的海表熱通量，將逐漸使海表溫度的鋒面減弱。在此，我們發表一個觀測到的證據，海表溫度的流失，確實在十月至四月的每月氣候變化，使鋒面增強，且在(2004/05~2014/15)期間，有 87%是從十月至一月；然而在同一時期，有低於 38%發生在二月至四月，顯示了在分析中有溫度變化和資料相符。

從客觀角度了解鋒面生成的關鍵,在於海表溫度的有效熱含量受混和層厚度影響，在淺(深)層的混和層，海表溫度對區域表層的熱通量較敏感(不敏感)。