

ABSTRACT

The compensation between the meridional heat transports in the atmosphere and ocean is studied through a coupled model's water-hosing experiments. It is found that the atmospheric heat transport (AHT) change compensates the oceanic heat transport (OHT) change very well in the extratropics, while the former overcompensates the latter in the tropics. Similar to previous studies, the fresh water input in the high latitude Atlantic weakens the Atlantic meridional overturning circulation and thus the northward Atlantic OHT significantly, leading to a warming (cooling) in sea surface temperature in the Southern (Northern) Hemisphere and in turn a southward shift of atmospheric convection. This results in an enhanced Hadley Cell (HC) and stronger northward AHT, compensating the reduced Atlantic OHT. Meanwhile, the wind-driven Subtropical Cell in the Indo-Pacific oceans is enhanced in response to the HC change, increasing the northward OHT in the Indo-Pacific, which partly offsets the reduced OHT in the Atlantic. The response in the Indo-Pacific is responsible for the overcompensation of the AHT to the global OHT. The Held's mechanism works very well in the tropical Indo-Pacific in our experiments. This is substantially different from previous studies.

摘要

透過一耦合模式的 water-hosing 實驗，研究了大氣與海洋在南方熱傳導的補償關係。研究發現，在溫帶地區，大氣熱傳導(AHT)改變對於海洋熱傳導(OHT)改變有相當良好的補償作用；然而在熱帶地區，前者卻有過度傳遞至後者的情形。

與先前的研究相似，當新鮮空氣進入到大西洋高緯地區，會使得大西洋南方反渦漩和北向的大西洋 OHT 明顯減弱，進而讓南半球(北半球)海表面溫度上升(下降)，使得大氣對流轉至南向，如此將導致增強的哈德里胞(HC)和北向 AHT 對減少的大西洋 OHT 進行補償，同時，為了回應 HC 的改變，受風驅動的印度洋和太平洋副熱帶對流胞增強，增加了兩大洋北向的 OHT，以抵銷在大西洋 OHT 的減少情形。

兩大洋的回應機制源自於 AHT 對全球 OHT 的過度補償。而在本次實驗中 Held 的動力機制在印度洋和太平洋的熱帶地區起相當大的作用，此結果與過往的實驗有實質上的出入。