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全球大洋混合层深度的计算及其时空变化特征分析

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Study on calculation and spatio-temporal variations of global ocean mixed layer depth

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摘要

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摘要 本文利用2005-2009年的全球网格化Argo数据,分别采用温度判据和密度判据计算了全球大洋混合层深度(Mixed Layer Depth, MLD),讨论了障碍层(Barrier Layer, BL)和补偿层(Compensated Layer, CL)对混合层深度计算的影响,得到了合成的混合层深度,并研究了其时空变化特征. 研究表明:(1)在赤道西太平洋(10° S -5° N, 150° E-150° W),孟加拉湾,热带西大西洋(10° N-20° N, 30° W-60° W)是障碍层高发区域. 冬季的北太平洋副热带区域(30° N附近)以及东北大西洋(40° N-60° N, 0° -30° W)是补偿层发生的区域. (2)在各个半球的夏季MLD都比较浅,在各个半球的冬季MLD则普遍比较深. 北太平洋和北大西洋的MLD的分布和变化比较相似,印度洋MLD受季风影响显著,呈现半年周期变化. 太平洋和大西洋的MLD的经向分布大致呈现出"两端深,中间浅"的拱形特点. (3)混合层深度距平场EOF第一模态时间变化为周期的年信号,北太平洋和北大西洋、南大洋(尤其是南极绕流区)都是MLD变化剧烈的海域,第二模态显示全球大洋混合层深度距平存在着一个半年的变化周期.

关键词 Argo, 混合层深度, 障碍层, 补偿层, 等温层深度, 时空变化

Abstract: Argo gridded data over the period 2005-2009 are used to calculate the global Mixed Layer Depth (MLD) based on the temperature criterion and density criterion, respectively. Due to the Barrier Layer (BL) and Compensated Layer (CL), there will be misleading to estimate the MLD. After taking these phenomena into account, this paper obtains the global hybrid MLD and then analyzes its spatio-temporal distribution. The results show that the western equatorial Pacific(10° S-5° N, 150° E-150° W), Bengal bay and western tropical Atlantic (10° N-20° N, 30° W-60° W) are the regions where the barrier layer occurs frequently. The northern subtropical Pacific (near 30° N) and northeastern Atlantic(40° N-60° N, 0° -30° W) in winter are the regions where compensated layer occurs. The MLD is shallow in summer and deep in winter. MLD and its variation in the northern Pacific Ocean are similar to the northern Atlantic Ocean. Monsoon has significant influence on MLD in the Indian Ocean where the MLD shows a semi-annual cycle. The meridional sections show arch-shaped distributions that MLD is deep in the two poles while shallow in the equator. The first mode of the EOF analysis of mixed layer depth anomaly indicates an annual cycle. The northern Pacific, northern Atlantic and South Ocean (especially the Antarctic Circumpolar Current) are the areas where MLD varies significantly. The second mode indicates that the mixed layer depth anomaly contains a semiannual cycle.

Keywords Argo, Mixed layer depth, Barrier layer, Compensated layer, Isothermal layer depth, Spatio-temporal variation

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