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亚洲夏季平流层-对流层水汽交换年际变化与亚洲夏季风的联系

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Relationship of interannual variations of the stratosphere-troposphere exchange of water vapor with the Asian summer monsoon

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摘要

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摘要 亚洲地区是物质由对流层向平流层输送的主要通道,在平流层-对流层交换中扮演着积极的角色. 本文主要利用卫星资料和欧洲中心ERA40再分析资料,借助Wei诊断模式研究亚洲地区夏季上对流层-下平流层(UTLS)水汽分布和平流层-对流层水汽交换特征,重点着眼于水汽交换的年际变化,并探讨其与亚洲夏季风的联系. 结果表明,季风区UTLS水汽较赤道地区偏多,且通过磁带记录信号的传播,可穿越对流层顶影响下平流层水汽的多寡. 夏季平流层-对流层水汽交换表现出明显的年际特征,其年际变化与亚洲季风强弱变化有密切联系,尤其与南亚夏季风的关系更为显著. 在亚洲夏季风影响下,亚洲地区出现异常的大气环流和垂直运动,从而影响平流层-对流层之间水汽的交换. 这些结果对认识其它大气成分的输送过程也具有重要的指示意义.

关键词 平流层-对流层交换, 水汽, 亚洲夏季风, 年际变化

Abstract: As the main passage of mass transport from the troposphere to the stratosphere, the Asian monsoon region plays a vital role in the Stratosphere-Troposphere Exchange (STE). This study investigates the distribution and exchange of water vapor in the upper troposphere and lower stratosphere (UTLS), and focuses on the interannual variability of water vapor exchange and its relationship with the Asian summer monsoon, by using the Wei method with satellite data and reanalysis data from the European Centre for Medium-Range Weather Forecasts (ECMWF) for the period 1958-2001. The results show that the UTLS over the Asian monsoon region is wetter than that over the equator. The STE of water vapor in the Asian monsoon region affects the content of LS water vapor by the propagation of tape recorder. The summer STE of water vapor has obvious interannual variations besides interdecadal variations. Further analysis shows that the interannual variations of the water vapor exchange are closely related to the Asian summer monsoon, especially to South Asian summer monsoon. The Asian summer monsoon activity largely affects them by triggering the anomalous atmospheric circulation and vertical motion. The results have important implications for understanding the transport of other components in the atmosphere.

Keywords Stratosphere-Troposphere Exchange (STE), Water vapor, Asian summer monsoon, Interannual variation

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