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南半球平流层极涡崩溃早晚年环流异常特征

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On the character of early and late breakup of Southern Hemisphere Stratospheric polar vortex

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摘要

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摘要

极涡崩溃是平流层大气环流一个重要的变化过程, 本文利用31年的再分析资料研究了南半球平流层极涡崩溃早晚年的异常特征. 研究表明, 南半球平流层极涡崩溃偏早极涡崩溃前后平流层环流场异常表现为整层一致的变化, 即都为正温度异常、正位势高度异常和负纬向风异常; 而南半球平流层极涡崩溃偏晚极涡崩溃前后平流层环流场异常的整层一致性的变化不典型, 而在符号上与极涡崩溃偏早年的异常相反. 与北半球平流层极涡崩溃前后环流异常相反明显不同, 南半球平流层极涡崩溃偏早或偏晚年在极涡崩溃前后的环流异常保持相同的性质. 进一步分析表明行星波活动在南极极涡的崩溃过程中起到了重要作用, 极涡崩溃早年前上传行星波比极涡崩溃晚年强, 并且持续时间长. 通过波流相互作用, 行星波的异常使得极涡崩溃早年和晚年10月的平流层高纬地区分别为位势高度正异常和负异常, 环流异常持续保持可能最终影响了南半球平流层极涡的崩溃时间. 分析显示南半球极涡崩溃偏晚与La Niña事件之间可能存在一定的联系, 但在极涡崩溃偏早与赤道太平洋海表温度异常(SSTA)并无明显关系.

关键词 南半球, 平流层, 极涡崩溃, 大气环流, 异常特征

Abstract:

Polar vortex breakup is an important circulation transformation process in Stratosphere. The 31 years reanalysis data was used to investigate the character of early and late breakup of polar vortex in Southern Hemisphere Stratosphere. The result shows that the circulation anomalies are consistent from lower to high Stratosphere with positive temperature anomalies and geopotential height anomalies and negative zonal wind anomalies prior to and after the early breakups. Such character is not obvious in the late breakups and the anomalies are contrary with that in early breakups. The consistent anomalies during the process of polar vortex breakup in Southern Hemisphere are different with that in Northern Hemisphere polar vortex breakups, which have opposite anomalies before and after the vortex breakups. Further investigation demonstrates that planetary waves play an important role in the Southern Hemisphere vortex breakup. Upward planetary wave is stronger and lasts longer in early breakups, while it is weaker in late breakups. Through wave and circulation interaction, the anomaly of upward planetary wave leads to the positive and negative geopotential height at high latitude in Stratosphere in October of early and late breakup years. The geopotential height anomalies at high latitude in Stratosphere persist and finally affect the breakup time of polar vortex. The analysis also shows that there may be some connection between the late breakups and La Niña, while the connection is not evident in early breakups.

Keywords Southern Hemisphere, Stratosphere, Polar vortex breakup, Atmosphere circulation, Abnormal character

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