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基于Cloudsat探测的一次非典型东北冷涡结构及其降水

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An atypical cold vortex structure and its precipitation over Northeast China based on Cloudsat detection

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摘要

采用ERA-Interim气象分析资料、云顶亮温TBB资料、Cloudsat云雷达资料、降雨量资料等,对2009年6月10日至12日我国东北地区的一次冷涡天气过程进行研究,重现了该冷涡的精细三维结构和演变过程.分析表明冷涡发生前,东北亚地区处于南北双槽结构之间,随后北槽向赤道发展切断后形成东北冷涡.南槽背景的冷涡热力结构特殊,强冷空气集中在涡内西北象限,暖湿空气在东北象限,南部为相对中性空气,该配置导致北部暖锋强盛,西部冷锋仅在发展初期较强,冷涡过程没有经典挪威学派的气旋锢囚锋出现.冷涡发展初期,狭长冷舌快速入侵南下,冷舌前冷锋对流降水较强,冷舌后部左侧还有暖锋降水;冷涡发展后期,冷锋减弱,冷锋上的高层云停止降水,系统内主要为冷涡北部的暖锋雨层云降水;冷涡成熟后,中心辐合加强,有较强的对流性降水.

关键词 东北冷涡, 切断低压, 对流降水, 锋面降水, 南槽

Abstract:

ERA-Interim reanalysis meteorological data, black body temperature data, Cloudsat cloud profiling radar data and rainfall data are comprehensively utilized to study the weather process of a cold vortex over Northeast China and reproduce its three-dimensional structure and evolution from June 10 to June 12, 2009. The result shows that Northeast Asia lay between the northern trough and southern trough before that weather system, then the northern trough developed equatorward and was cut off to form a cold vortex over Northeast China. The cold vortex with southern trough background has a special structure. At the early stage of development, strong cold air concentrated in the northwest quadrant, and warm and moist air was in the northeast quadrant, the relatively neutral air lay in the south of the cold vortex, which resulted in the strong northern warm front and the weak western cold front. The narrow cold tongue rapidly intruded southward and convective precipitation occurred ahead of the cold front. At the late stage of development, precipitation mainly occurred on warm front. When the cold vortex matured, convergence was strengthened and the shallow convective precipitation occurred at the center. No occluded front appeared in all the stages of the cold vortex.

Keywords Cold vortex over Northeast China, Cutoff low, Convective precipitation, Frontal precipitation, Southern trough

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