

引用本文(Citation):

王秋良, 张立凤, 关吉平. 初值和海温强迫对延伸期可预报性时空分布的影响. 地球物理学报, 2013,56(12): 3988-3998,doi: 10.6038/cjg20131205

WANG Qiu-Liang, ZHANG Li-Feng, GUAN Ji-Ping. Impact of initial and SST forcing on temporal and spatial distribution of extended-range predictability. Chinese Journal Geophysics, 2013, 56(12): 3988-3998, doi: 10.6038/cjg20131205

初值和海温强迫对延伸期可预报性时空分布的影响

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Impact of initial and SST forcing on temporal and spatial distribution of extended-range predictability

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摘要

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摘要 利用全球谱模式T106L19和增长模繁殖法, 分别在气候海温和预测海温强迫下, 进行了动力延伸集合预报试验. 基于方差分析思想, 利用集合预报结果, 定义和计算了初值影响指数、海温强迫影响指数、潜在可预报性指数以及波动活动指数. 通过分析四个指数, 揭示了初值和海温强迫对延伸期可预报性时空分布以及潜在可预报性的影响, 并探讨了其影响机理. 结果表明: 初值影响指数分布具有地域和季节的差异, 初值的影响在中高纬度地区大于热带地区; 相同季节, 海温强迫影响指数分布与初值影响指数分布相似; 潜在可预报性指数呈带状分布, 大值集中在热带地区, 且在低纬度地区, 高层的潜在可预报性大于低层; 初值和海温强迫对延伸期可预报性时空分布的影响, 依赖于大气环流形势, 初值和海温强迫影响的显著区正是大气长波的活跃区和西风急流区, 急流区的强风切变为长波活动提供了斜压不稳定能量, 而长波的发展调控着初值和海温强迫的影响, 这说明延伸期的可预报性具有明显的流依赖性, 大气外强迫的作用也与大气内部的动力过程密切相关.

关键词 延伸期预报, 初值影响, 海温强迫影响, 潜在可预报性, 流依赖性

Abstract: Numerous extended-range numerical ensemble forecasting experiments are performed with a global spectral model (T106L19), which are initialized by Breeding Generated Modes, and each experiment has two sets of model integrations forced by climatic SSTs and predicted SSTs, respectively. Based on model results, an analysis of variance approach is utilized to investigate the impact of initial and SST forcing on temporal and spatial distribution of extended-range predictability and relevant mechanisms. Four indexes are defined that are index of initial error influences (*II*), index of SST influences (*EI*), potential predictability index (*R*), and wave activity index (*WI*). It was shown that the distribution of *II* has significant regional and seasonal differences, suggesting that the influences of initial error conditions on mid-high latitudes are greater than that on tropics for extended-range forecast. *EI* has similar distribution to *II* in same seasons. *R* exhibits zonal distribution obviously, and larger values are located in tropical regions. Within low-latitude belts, potential predictability is larger at high layers than that at low layers, and it is larger in summer and autumn seasons than that in spring and winter seasons. Results show that the impact of initial error conditions and SSTs forcing on temporal and spatial distribution of extended-range predictability relies on general circulation strongly. Further investigation indicates that the regions of significant *II* and *EI* almost overlap the active atmospheric long-wave regions and westerly jets within extended-range. Since strong vertical wind shear close to westerly jets that result in baroclinic instability and provides plenty of baroclinic instable energy for long wave activities. Consequently, evolution of long-wave activities modulates the influences of initial error and SSTs forcing, and it indicates that extended-range predictability is flow-dependent clearly, and the role of external forcing has close relationship with atmospheric internal dynamical process within the extended range.

Keywords Extended range forecast, Initial error, SST forcing, Potential predictability, Flow-dependent

Received 2013-01-25;

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