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四维变分资料同化在风暴潮模拟中的平流作用分析

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摘要 利用基于三维斜压非线性的普林斯顿海洋模型(POM)及其切向线性伴随模式的四维变分数据同化(4DVAR)系统对一个近岸风暴潮个例进行理想同化试验和模拟，着重分析了四维变分数据同化增水改善中的二维平流作用。试验结果表明，同化后的水位结果明显优于同化前的结果，而且同化对预报的影响主要在前5h，尤其是积分到3—4h时同化和无同化的结果差异最大，在5h后同化的影响变得非常小。从平流作用中分析得知，无论是只同化水位还是同化水位和海表流速，同化的结果都增大了沿岸和向岸的平流。与无同化结果相比，同化试验的增水改善主要是来自向岸平流的增大，但只同化水位时由于水位增大使向岸压力梯度减小从而阻碍了向岸流的进一步增大；而同时同化水位和海表流速时，由于流速也被改善，故增水改善更明显和合理。

关键词: 风暴潮   四维变分   平流作用   资料同化

Abstract： A four-dimensional variational data assimilation (4DVAR) algorithm based on the three-dimensional Princeton Ocean Model (POM) and the adjoint of its tangent linear model was applied to a storm surge simulation using model-generated "pseudo-observations." The analysis was focused on the role of horizontal advection in improving storm surge simulation by the 4DVAR. It is found that the significant impact of 4DVAR on the storm surge simulation is only seen in the first five hours of the simulation, with its maximum impact during the first 3 - 4 hours. The results show that the alongshore currents and the shoreward currents became greater after data assimilation. It is also found that the improvement of storm surge simulation by 4DVAR is from the increase in shoreward flux of water mass. However, the increase of the water level reduced the pressure gradient, leading to the weakening of the shoreward currents when only assimilating water level data. Assimilating both the water level and the surface currents helped to keep the intensity of the shoreward currents, and thus led to a better simulation of storm surge.

Keywords：   storm surge,   four-dimensional variational data assimilation (4DVAR); advection effect; data assimilation

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