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卫星测高揭示的海面变化经纬向耦合特征及其对ENSO事件响应

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Coupling characteristics of zonal and meridional sea level change revealed by satellite altimetry data and their response to ENSO events

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摘要

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摘要 本文引入3阶主分量分析方法对1993~2008年赤道太平洋地区卫星测高数据进行解析,前两个主分量可有效表征海面变化的经、纬向耦合特征,重构与对比了该时段内6次ENSO事件海面变化的经、纬向演化的空间构型与耦合作用过程.结果表明:海面的经向变化可表征ENSO强度变化,纬向变化表现为受ENSO影响的年周期波动;经、纬向张量的时间系数与MEI以及EMI指数间多尺度分析表明,两者均受El Niño Modoki影响,但在耦合尺度、能量共振关系以及相位关系上存在差异;海面变化对不同ENSO事件响应差异主要表现在高、低海面位置、振幅以及高、低值区分布形态与空间范围等方面.其中常规的El Niño多表现为东太平洋型ENSO,El Niño Modoki则表现为中太平洋型.不同类型的ENSO在经纬向耦合演化轨迹的周期性、规则性和方向性特征可在一定程度上作为ENSO类型区分依据.

关键词: 赤道太平洋 海面变化 ENSO PTA3 El Niño Modoki

Abstract: Principle Tensor Analysis of Rank 3 Method (PTA3) was applied to Equatorial Pacific satellite altimetry data during 1993 to 2008. The coupling process of the zonal and meridional sea level changes were reconstructed by the first two principle tensor components and compared using the longitude and latitude components indexes during six typical periods when different kinds of ENSO events occurred. The multi-scale energy coherence and phase relations between temporal index of each principle tensor and MEI series revealed that both zonal and meridional sea level changes are strongly impacted by the El Niño Modoki. Differences exist in coupling scale, the energy resonance relations and phase relations. Reconstructed spatial patterns of both zonal and meridional sea level changes suggest that the location of high and low sea level, the amplitude of tidal waves, the distribution patterns and spatial range of the high- and low-value areas are different among kinds of ENSO events. Most of the classical El Niño perform as the East Pacific type, while the El Niño Modoki is usually shown as the Middle Pacific type. To some extent, differences in cyclical characteristics, regularity and direction of their trajectories could be used for classification of different types of ENSO events.

Keywords: Equatorial Pacific Sea level change ENSO PTA3 El Niño Modoki

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