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## 利用Yabuki & Matsu'ura反演方法计算 2011年日本东北地区太平洋海域 $M_w$ 9.0级地震同震滑动分布

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Estimation of co-seismic slip distribution of the 2011 Tohoku-Oki  $M_w$ 9.0 earthquake using Yabuki&Matsu'ura's inverse method

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摘要

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**摘要** Yabuki & Matsu'ura反演方法是利用ABIC最佳模型参数选取方法和平滑的滑动分布作为约束条件,由形变观测数据计算发震断层滑动分布.本文基于日本列岛同震GPS观测数据和发震断层曲面构造模型,利用Yabuki & Matsu'ura反演方法计算2011年日本东北地区太平洋海域 $M_w$ 9.0级地震的发震断层同震滑动分布.反演结果表明,断层面上的最大滑动量为35 m,较大滑动分布在于浅于30 km的震源中心上部,最大破裂集中在20 km深度的地方,其地震矩约为 $3.63 \times 10^{22} \text{ N} \cdot \text{m}$ ,对应的矩震级为 $M_w$ 9.0.模拟结果显示Yabuki & Matsu'ura反演方法更适用于倾角低于 $40^\circ$ 的断层模型反演.最后,本文基于上述方法获得的发震断层滑动模型,利用地球体位错理论正演计算该地震在中国及其邻区产生的远场形变,正演计算结果基本可以解释由中国GPS陆态网络观测到的同震形变.

**关键词** Yabuki & Matsu'ura反演方法, Akaike's Bayesian Information Criterion (ABIC), 断层滑动分布模型, 日本 $M_w$ 9.0级地震

**Abstract:** Yabuki&Matsu'ura's inverse method is to find optimum model parameters from geodetic data, combining prior information of both the smoothness of fault slip and maximum likelihood method with Akaike's Bayesian Information Criterion (ABIC). We apply Yabuki & Matsu'ura's inverse method to estimate the co-seismic slip distribution of the 2011 Tohoku-Oki  $M_w$ 9.0 earthquake on a curve fault model from GPS observation data. The estimated maximum slip is 35 m. The strong slips are delineated in an area with depth less than 30 km, shallower than the seismic focus. The biggest ruptures concentrate in an area with depth about 20 km. The total moment is about  $3.63 \times 10^{22} \text{ N} \cdot \text{m}$ . The corresponding moment magnitude is  $M_w$ 9.0. Our simulation results confirm that the Yabuki & Matsu'ura's inversion method is suitable for faults with dip angle less than  $40^\circ$ . Finally, we compute the far-field deformations in Northeast China of the 2011 Tohoku-Oki  $M_w$ 9.0 earthquake using spherical dislocation theory of Sun et al.. Our theoretical predictions agree well with the observed co-seismic displacement from China GPS Observation Network.

**Keywords** Yabuki & Matsu'ura's inverse method, Akaike's Bayesian Information Criterion (ABIC), Fault slip distribution model, The 2011 Tohoku-Oki  $M_w$ 9.0 earthquake

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