台湾海峡及其邻区现今构造应力场数值模拟

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Numerical modeling of the current tectonic stress field in Taiwan strait and its adjacent regions

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摘要 本文将台湾海峡及其邻区划分为多个具有不同弹性参数的等厚区块,并利用基于弹性理论的有限元数值模型,以GPS观测速度和由震源机制解(FMS)得到的主应力轴方向为约束条件,计算了该研究区的现今构造应力场.结果表明:(1)最大主应力轴在台湾海峡中部和台湾岛弧中部大致为NW-SE向,在东北部呈顺时针旋转,而在南部呈逆时针旋转;(2)研究区水平位移场大致以23°N为界,南强北弱,且在北部呈顺时针旋转,南部呈逆时针旋转;(3)东沙-澎湖-北港隆起因强度大于周边盆地区而成为"阻挡带",导致在其南北出现两个反向的构造逃逸区,并且隆起东南区形变特别强烈,而其西北区则相对较弱.

关键词 台湾海峡, 构造应力场, 数值模拟, GPS速度场, 震源机制解(FMS)

Abstract: This paper presents the current tectonic stress field in the Taiwan Strait and its adjacent regions, which was calculated with a 3D finite element model based on the elastic theory. When doing so, we divided the study area into several sub-regions which had same thickness but were assigned different elastic parameters, and the model was constrained by GPS observed velocity data and the directions of principal stress axes deduced from focal mechanism solutions (FMS). The results show that: (1) The direction of the maximum principal stress is about NW-SE in the centers of the Taiwan Strait and Taiwan mountain belt, and experiences clockwise rotation in the northeastern part, and anticlockwise rotation in the southern part, respectively. (2) The horizontal displacement field can be divided into two areas by the Latitude 23°N and it is much stronger in the southern area than in the northern one. In the northern area, the displacement field shows clockwise rotation, while it shows anticlockwise rotation in the southern area. (3) The Dongsha-Penghu-Peikang Basement High becomes a barrier because it is stronger than surrounding regions. As a result, there are two tectonic escapes in the north and the south of the High. And the deformation is much stronger in the southeastern part of the High than its northwestern part.

Keywords Taiwan Strait, Tectonic stress field, Numerical modeling, GPS velocity field, Focal mechanism solution (FMS)

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