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地幔对流拖曳力对中国大陆岩石层变形的影响

黄建平,傅容珊,郑勇,薛霆虓,刘峡,韩立波

中国科技大学地球与空间科学学院，合肥 230026

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摘要 采用较为符合实际岩石层变形的非线性幂指数本构关系，基于ANSYS有限元平台, 模拟了近20万年来中国大陆地区地表运动及演化过程，探讨了印度板块挤压作用和地幔对流拖曳力各自对于中国大陆地区地表形变运动格局的影响.模拟结果与观测数据的比较表明：在印度板块的挤压和地幔拖曳力联合作用下，中国及东亚大陆岩石层运动形变模式能够和现代GPS观测有较好的吻合； 印度大陆和欧亚大陆的碰撞以及印度大陆的持续向北推进、挤压所产生的应力环境，一直主导了以青藏高原为核心的我国西部地域岩石圈构造、运动和演化，但其影响随着远离青藏高原地区而逐渐变小；地幔对流产生的作用于岩石层底部的拖曳力是中国大陆（特别是远离碰撞带）岩石层运动构造变形的重要驱动力.然而在构造复杂和东部靠近太平洋板块的区域，模型预测结果和GPS观测还存在一定的差距，这说明在未来的中国大陆岩石层变形运动的数值模拟中，应当采用更为复杂的构造模型和驱动力因素.

关键词 地幔拖曳力 大陆碰撞 构造演化 GPS观测

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The influence of mantle convection to the lithosphere deformation of China mainland

HUANG Jian-Ping, FU Rong-Shan, ZHENG Yong, XUE Ting-Xiao, LIU Xia, HAN Li-Bo

School of Earth and Space Science of USTC, Heifei 230026, China

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Abstract In this paper, by using the nonlinear power constitutive relationship of lithosphere, based on the ANSYS finite element method, we modeled the recent 0.2Ma ground movement and evolution of China mainland, and discussed the influence of the pressure from Indian plate and the drag force from the mantle convection on the surface deformation and motion of China mainland. The comparison of the modeling result and the observed data indicates that when considering the combined pressure from Indian plate and the drag force from the mantle convection, the ground movement of the whole east Asia region has a good consistency with the GPS observation; The stress environment caused by the collision with Eurasia and sustaining northward movemen of Indian plate plays an important role in the tectonic movement and the evolution of lithosphere in western China, but the influence diminishes gradually away from the Tibet plateau; the drag force from the mantle convection at the base of the lithosphere is a key force source to the tectonics and deformation of the lithosphere especially in the region far away from the collision zone of Indian-Himalaya. But there still exist some differences between the predicted result and GPS observation in the eastern China region near the western Pacific Ocean, due to the complicated structures and subduction zone in the east boundary of our model. This implies that a more reliable model and more driving forces should be considered in the future numerical modeling study on the deformation and movement of China mainland.

Key words Drag force of mantle convection; Plate collision; Tectonic evolution; GPS observation

通讯作者:
黄建平 jphuang@mail.ustc.edu.cn
作者个人主页: 黄建平;傅容珊;郑勇;薛霆虓;刘峡;韩立波