

论文

用GPS和VLBI数据检测固体地球的体积和形状变化

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收稿日期 2005-9-26 修回日期 2006-3-13 网络版发布日期 接受日期

摘要 本文利用2003年GPS和VLBI组合的站坐标、站速度及它们的误差估计,采用Delaunay算法生成的三角形来逼近地形表面,研究了地球的表面积、体积及它们的变化趋势,并利用板块运动模型插值方法得到的全球分布均匀的台站对检测方法进行了检核.结果表明,实测的和插值后的数据给出的结论是一致的,即若以赤道为界,北半球在压缩,南半球在膨胀;若以0°~180°经线为界,东半球处于挤压变形中,西半球处于扩张变形中;若以90°~270°经线为界,包含太平洋的半球处于压缩状态,而包含大西洋的半球则处于扩张变形中.这种变形证明地球仍处于非对称变形中.根据GPS和VLBI组合的数据解算的体积变化率达到  $-1.5937 \times 10^{-12} \text{ m}^3 \cdot \text{a}^{-1}$ ,相当于地球半径每年大约缩短3~4 mm,表明地球整体上处于压缩变形中.

关键词 [地球](#) [Delaunay三角网](#) [板块运动模型插值](#) [非对称性变化](#)

分类号

DOI:

### Detection of changes of the Earth's volume and geometry by using GPS and VLBI data

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Received 2005-9-26 Revised 2006-3-13 Online Accepted

**Abstract** Based on the coordinates, velocities and their error estimations of GPS and VLBI stations in 2003, we use Delaunay arithmetic to form series of triangles to approach the surface area and volume of the Earth and study their changes. And using stations from plate motion model interpolation we verify the feasibility of this detection method. The results show that geodetic and interpolated data give a consistent conclusion: Taking the equator as the boundary, the northern hemisphere of the Earth is undergoing compressive deformation, and the southern hemisphere is undergoing extensional deformation; Taking the longitude line of 0°~180° as the boundary, the eastern hemisphere is undergoing compressive deformation, while the western hemisphere is extended; Taking the longitude line of 90°~270° as the boundary, the Pacific hemisphere is undergoing compressive deformation, and the Atlantic hemisphere is undergoing extensional deformation. The deformation patterns indicate that the Earth is still undergoing asymmetrical deformation. Based on the combined data of GPS and VLBI, the calculated rate of volume changing is up to  $-1.5937 \times 10^{-12} \text{ m}^3 \cdot \text{a}^{-1}$ , equivalent to the Earth radius decreasing by 3~4 mm every year, which indicates that the Earth is undergoing compressive deformation as a whole.

**Key words** [Earth](#); [Delaunay triangle gridding](#); [Plate motion model interpolation](#); [Asymmetrical deformation](#)

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