

利用GRACE卫星重力资料解算气候驱动的地表周年垂直形变

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Climate-driven annual vertical deformation of the solid Earth c

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摘要

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摘要

卫星重力和GPS测量技术可以监测地表流体(大气、海洋和陆地水)质量季节性迁移引起的地表周年形变;与陆地水等地表流合模拟的地表形变相比,卫星重力的形变监测结果避免了模型的精度不确定性带来的误差.本文利用前60阶GRACE卫星时变和“去相关”、组合滤波两类滤波方法分别解算了中国及邻区的地表季节性垂直形变,并与区内42个GPS台站上观测到的形变进行了比较,发现采用“去相关”滤波方法处理后的结果优于采用组合滤波处理后的结果.文中采用“去相关”滤波方法,得到的周年垂直形变的振幅、相位和GPS结果总体上一致;少数站上GRACE和GPS得到的振幅或相位相差较大,主要因素可能与策略、GPS观测资料的连续性或局部大气、水文过程等地球物理因素有关.在中国及邻区的陆地上GRACE解算的周年垂直形变小值出现在TASH台站东南,约 1×10^{-3} m;最大值出现在恒河—澜沧江流域,可达 10×10^{-3} m.文中的结果证实了在中国用GRACE卫星重力这种新手段监测大尺度的地表周年垂直形变.

关键词: GRACE GPS 气候 周年变化 地表垂直形变

Abstract:

Atmosphere, ocean and continent water mass seasonal variations cause variation in surface deformation detectable using Gravity Recovery and Climate Experiment and GPS observation. Comparing with deformation simulated from atmosphere, ocean and continent water models, the deformation derived from GRACE has no errors related with accuracy uncertainty of models. Climate-driven seasonal vertical deformation of the solid Earth in China and neighboring areas are calculated from GRACE monthly time-variable gravity coefficients truncated to degree and order 60, and the results are compared with seasonal signals measured at GPS sites located in the same region. In calculating we use De-stripes and De-stripes plus a 3×10^{-5} m smoothing respectively, and we find the former filtering result is better than the latter one. In the annual crustal deformation from GRACE using De-stripes, we find at all GPS sites the amplitudes and phases of deformation from GRACE are close to those from GPS observations. Obvious discrepancy at some sites that it might be caused by a local geophysical process or GPS site analysis error and GPS time series discontinuity. In the mainland of China and neighboring areas the smallest amplitude of deformation 1×10^{-3} m is in the southeast of site TASH and the greatest amplitude of deformation of 10×10^{-3} m is in the Ganges-Lancang River Basin. These results demonstrate that GRACE can be a new effective tool for monitoring annual vertical deformation on a large scale in China and neighboring areas.

Keywords: GRACE GPS Climate Annual variations Solid Earth vertical deformation

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