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Yanchao Gu, Linguo Yuan, Dongming Fan, Wei You, Yong Su

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Seasonal crustal vertical deformation induced by environmental mass loading in mainland China derived from GPS, GRACE and surface loading models

Yanchao Gu^{a,b}, Linguo Yuan^{a,b,*}, Dongming Fan^{a,b}, Wei You^{a,b}, Yong Su^c

^a*Faculty of Geoscience and Environment Engineering, Southwest Jiaotong University, Chengdu 610031, China*

^b*State-province Joint Engineering Laboratory of Spatial Information Technology of High-speed Rail Safety, Chengdu 610031, China*

^c*School of Civil Engineering and Architecture, Southwest Petroleum University, Chengdu 610031, China*

Abstract

Obvious seasonal crustal vertical deformation largely related to mass redistribution on the Earth's surface can be captured by Gravity Recovery and Climate Experiment (GRACE), simulated by surface loading models (SLMs), and recorded by continuous Global Positioning System (GPS). Vertical deformation time series at 224 GPS stations with more than four-year continuous observations are compared with time series obtained by GRACE and SLMs with the aim of investigating the consistency of the seasonal crustal vertical deformation obtained by different techniques in mainland China. Results of these techniques show obvious seasonal vertical deformation with high consistency at almost all stations. The GPS-derived seasonal vertical deformation can be explained, to some content, by the environmental mass redistribution effect represented by GRACE and SLMs. Though the mean weighted root mean square reduction is 34% when remove the environmental mass loading from the monthly GPS height time series (up to 47% for the mean annual signals), systematic signals are still evident in the residual time series. The systematic residuals are probably attributed to GPS related errors, such

*Corresponding author

Email addresses: guyanchao@my.swjtu.edu.cn (Yanchao Gu),
lgyuan@swjtu.edu.cn (Linguo Yuan), dmfan@swjtu.cn (Dongming Fan),
youwei1985@foxmail.com (Wei You), suyongme@foxmail.com (Yong Su)

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