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利用GRACE时变重力场探测2010年中国西南干旱陆地水储量变化

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Terrestrial water storage changes of the 2010 southwest China drought detected by GRACE temporal gravity field

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摘要

GRACE(Gravity Recovery And Climate Experiment)卫星计划为监测陆地水储量变化提供了有效技术手段.本文采用2003至2010年共计8年的GRACE月重力场模型反演中国西南区域陆地水储量变化,与GLDAS(Global Land Data Assimilation System)全球水文模型进行对比分析,其结果在时空分布上均符合较好,同时在2009年秋至2010年春该区域陆地水储量均呈现明显减少,与该时段云贵川三省的干旱事件相一致;比较分析了2009年秋至2010年春GRACE反演陆地水储量变化与TRMM(Tropical Rainfall Measuring Mission)合成数据计算的月降雨量的时空分布,两组结果均与西南干旱事件对应时段与区域十分吻合;对近8年的陆地水储量变化与月降雨量数据进行相关性分析,其结果表明陆地水储量变化与降雨量强相关,即降雨量是导致陆地水储量变化的主要因素;分析该区域地表温度变化,结果显示2009年9月至2010年3月地表温度均比历史同期高,地表温度的升高加剧了陆地水储量的减少.

关键词 GRACE, 时变重力场, 西南干旱, 陆地水储量变化, 月降雨量

Abstract:

Presently global and regional terrestrial water storage (TWS) changes can be observed by the Gravity Recovery and Climate Experiment mission (GRACE). The TWS changes over southwest China was inferred from the GRACE monthly gravity field models over the period 2003—2010, and consist with the results of Global Land Data Assimilation System (GLDAS) on spatio-temporal distribution. The significant decrease of TWS from autumn 2009 to spring 2010 revealed by GRACE coincides with the 2010 southwest China drought conditions. And the spatial distribution of monthly precipitation from the combined data of Tropical Rainfall Measuring Mission (TRMM) is consistent with the GRACE results during the time span from autumn 2009 to spring 2010. By analyzing the correlation between monthly precipitation and TWS changes, the results with the correlation coefficient of 0.569 reveal that precipitation is the main cause of TWS changes. Meanwhile the surface air temperature over the region from September 2009 to March 2010 is a little higher than that of the same time in history, and then the warmer ground surface made the TMS decrease slightly.

Keywords GRACE, Temporal gravity field, Southwest China drought, Terrestrial water storage change, Monthly precipitation

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