

地球物理学报 » 2011, Vol. 54 » Issue (4) : 958-965

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SHI Hong-Ling, LU Yang, DU Zong-Liang, JIA Lu-lu, ZHANG Zi-Zhan, ZHOU Chun-Xia. Mass change detection in Antarctic ice sheet using ICESat block analysis techniques from 2003~2008. Chinese J. Geophys. (in Chinese), 2011, V54(4): 958-965, DOI: 10.3969/j.issn.0001-5733.2011.04.010

基于ICESat块域分析法探测2003~2008年南极冰盖质量变化

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Mass change detection in Antarctic ice sheet using ICESat block analysis techniques from 2003~2008

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摘要

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摘要 利用2003~2008年间的ICESat卫星激光测高数据,通过块域交叉点分析提取南极大陆冰盖表面高程变化信息,同时探讨了卫星激光测高不同任务间的系统偏差,结合冰盖地表粒雪密度模型探测南极大陆冰盖质量变化,并对其原因做了初步分析.结果显示南极大陆冰盖高度变化具有明显的年周期信号,平均周年振幅为2.21 cm.在南极大陆的边缘,存在着明显的消融和增长,尤其是在西南极阿蒙森海湾附近的冰川和南极半岛.利用目前常用的三种不同的冰后回弹模型,计算得到南极大陆冰盖整体平均质量变化趋势约为-82~-73 Gt/yr.在由ICESat高度变化到质量变化过程中,冰盖地表粒雪密度和冰后回弹模型的不确定性是影响结果精度的主要因素.

关键词: ICESat 交叉点 块域分析法 南极冰盖 质量变化 最小二乘回归

Abstract: In this paper, the ICESat laser altimetry data is used to obtain an estimate of the mass balance of Antarctic ice sheet from February 2003 to March 2008. The time series of elevation change in Antarctic ice sheet are derived by the block crossover analysis using the ICESat nadir ground track, and the calculation of the campaign basis is discussed. A least square regression of crossover difference is applied to calculate the average elevation change trend and the seasonal cycle, and then the mass changes of Antarctic ice sheet are estimated by combining the elevation change rate with the surface firn density model. The result shows that seasonal cycle signals are obvious in Antarctic ice sheet height changes, and the average annual amplitude is about 2.21 cm. On the coast of the Antarctica continent, there are significant thinning and thickening, especially near the Amundsen Sea embayment of west Antarctic and Antarctic Peninsula. Considering the influence of GIA (three public GIA models), our best estimate of the mass change in Antarctic ice sheet is about -82~-73Gt/yr. For the ICESat, the ice sheet surface firn density model and the GIA model are the main factors in the mass change estimates.

Keywords: ICESat Crossover Block analysis Antarctic ice sheet Mass change Least square regression

Received 2010-06-15;

Fund:

国家自然科学基金(40874037、40974045)、国家863计划(2009AA12Z133、2006AA12Z128)、极地科学战略研究基金(20080207)和中国科学院动力大地测量学重点实验室开放基金(L09-18)联合资助.

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