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Volume change time series over Antarctic ice sheet since 1992 from satellite altimetry

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In this paper, we choose to compute height time series for bins spaced at 5 minute resolution over Antarctic ice sheet. A bin is a circular region with a given radius for the calculation points. Within a given bin, the raw height measurements from all cycles were least-squares fitted to a space and time function for reduction of heights. We used a robust least-squares estimator that is resilient against outliers to estimate the parameters. In order to obtain a valid estimate of the elevation change rate in a bin, the potential outlier points with residuals larger than 5 m were removed and the parameters for the fitting function were recomputed iteratively untill all residuals were less than the threshold. With this procedure, high resolution height change time series over Antarctic ice sheet were derived from ERS-1, ERS-2, Envisat and Cryosat-2 data, respectively. They are spanning from June 1992 to June 1996, from May 1995 to June 2003, from July 2002 to June 2012, and from July 2010 to May 2016, respectively. It shows that negative height change rates are always shown in Thwaites and Pine Island, and positive height change rates always shown in Kamb. For other regions, positive and negative height change rates are shown in different time span. After removing the offset between different satellite altimetry, we derive the volume change time series between June 1992 and May 2003. It turns out that 10-year seasonal signal are observed in the volume change time series.