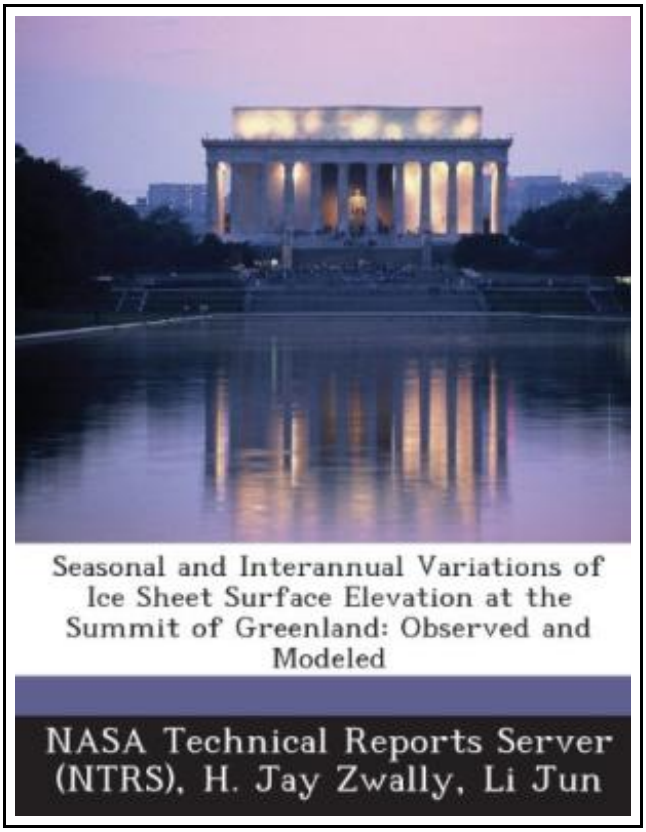
Seasonal and Interannual Variations of Ice Sheet Surface Elevation at the Summit of Greenland: Observed and Modeled



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SEASONAL AND INTERANNUAL VARIATIONS OF ICE SHEET SURFACE ELEVATION AT THE SUMMIT OF GREENLAND: OBSERVED AND MODELED

Bibliogov, United States, 2013. Paperback. Book Condition: New. 246 x 189 mm. Language: English . Brand New Book ***** Print on Demand *****.Observed seasonal and interannual variations in the surface elevation over the summit of the Greenland ice sheet are modeled using a new temperature-dependent formulation of firn-densification and observed accumulation variations. The observed elevation variations are derived from ERS (European Remote Sensing)-1 and ERS-2 radar altimeter data for the period between April 1992 and April 1999. A multivariate linear/sine function is fitted to an elevation time series constructed from elevation differences measured by radar altimetry at orbital crossovers. The amplitude of the seasonal elevation cycle is 0.25 m peak-to-peak, with a maximum in winter and a minimum in summer. Inter-annually, the elevation decreases to a minimum in 1995, followed by an increase to 1999, with an overall average increase of 4.2 cm a(exp -1) for 1992 to 1999. Our densification formulation uses an initial field-density profile, the AWS (automatic weather station) surface temperature record, and a temperature-dependent constitutive relation for the densification that is based on laboratory measurements of crystal growth rates. The rate constant and the activation energy commonly used in the Arrhenius-type constitutive relation for firn densification are also temperature dependent, giving a stronger temperature and seasonal amplitudes about 10 times greater than previous densification formulations. Summer temperatures are most important, because of the strong non-linear dependence on temperature. Much of firn densification and consequent surface lowering occurs within about three months of the summer season, followed by a surface build-up from snow accumulation until spring. Modeled interannual changes of the surface elevation, using the AWS measurements of surface temperature and accumulation and results of atmospheric modeling of precipitation variations, are in good agreement with the altimeter observations.

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