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Ablation rate, ELA, AAR, and net mass balance estimation using satellite estimated transient snowline variations on Mittivakkat Gletscher, SE Greenland

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Identification of the transient snowline (TSL) from high spatial resolution Landsat imagery on Mittivakkat Gletscher, Southeast Greenland, was used in identification of ablation rates, the equilibrium line altitude (ELA), and the accumulation-area ratio (AAR). The rate of rise of the TSL during the ablation season on a glacier where the balance gradient is known provides a measure of the ablation rate. On Mittivakkat Gletscher, snow pits were excavated in regions where the TSL subsequently transects. This further provides a direct measure of the ablation rates for a particular year. TSL observations from multiple dates during the ablation seasons 1999–2012 were used to explore the consistency of the TSL rise and ablation rate. The satellite derived mean TSL migration rate was 9.4 $\pm$ 9.1 m d-1. The mean ablation rate was 0.051 $\pm$ 0.018 m d-1 estimated by applying a TSL-mass-balance-gradient method, and 0.047 $\pm$ 0.019 m d-1 by applying a snow-pit-satellite method, respectively, illustrating a significant agreement between the two different approaches. Also, satellite-derived ELA and AAR, and estimated annual mass balance (Ba) conditions were in agreement with observed ELA, AAR, and Ba conditions for Mittivakkat Gletscher.