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Winter draining lakes on the Greenland ice sheet observed by Sentinel-1

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Supraglacial lakes on the Greenland Ice Sheet influence surface mass balance, the delivery of water from the surface to the bed, and the rate of basal sliding. Summertime lake drainage behavior has been catalogued thoroughly through the use of optical remote sensing with a variety of satellites. Radar results from Operation IceBridge demonstrated the presence of liquid water buried in lakes under ice lids but this platform is limited in its capability to examine short-term changes over the winter season. This study describes the drainage of multiple buried lakes through the winter season using Sentinel-1 C-Band SAR. Sudden positive anomalous changes in mean backscatter of surface lakes that are sustained over time are used to pick out wintertime (October through May) lake drainages over a four-year study period. These changes are confirmed using late-Autumn and early-Spring Landsat-8 photogrammetry changes. Drainages are detected from November through February, pointing to the likelihood of water injection to the bed through the winter season. Our automated techniques involve quantifying patterns and trends in SAR backscatter and are also being developed to contribute to our understanding of water storage vs. refreezing in lakes and firn on the surface and in the shallow sub-surface regions of the Greenland Ice Sheet throughout the year.