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The 1979-2005 Greenland ice sheet melt extent from passive microwave data using an improved version of the melt retrieval XPGR algorithm

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Analysis of passive microwave satellite observations over the Greenland ice sheet reveals a significant increase in surface melt over the period 1979-2005. Since 1979, the total melt area was found to have increased +1.22 x 10ˆ7 kmˆ2. An improved version of the cross-polarized gradient ratio (XPGR) technique is used to identify the melt from the brightness temperatures. The improvements in the melt retrieval XPGR algorithm as well as the surface melt acceleration are discussed with results from a coupled atmosphere-snow regional climate model. From 1979 to 2005, the ablation period increases everywhere over the melt zone except in the regions where the model simulates an increased summer snowfall. Indeed, more snowfall in summer decreases the liquid water content of the snowpack, raises the albedo and therefore reduces the melt. Finally, this melt acceleration over the Greenland ice sheet is highly correlated with both Greenland and global warming suggesting a continuing surface melt increase in the future.