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Change of transient snow line in Greenland and its attribution

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Over the past decade, Greenland has experienced enormous material losses and become a major contributor to global sea level rise. The material losses mainly come from surface ablation and glacial discharge. As a kind of environmental change indicator, snow line can comprehensively show that how the snow melting range and snow cover material balance change. Former studies have done many researches about surface ablation and transient snow line, used remote sensing images and SSM/I brightness temperature data.In this study, dozens of Landsat images of 2000 and 2015 were used to extract transient snow line by visual interpretation. DMSP SSM/I-SSMIS daily polar gridded brightness temperatures from 2000 to 2015 were used to analyze the change of surface ablation range in Greenland and validate the snow line extraction results. MODIS MCD43C3 Version 6 Albedo Model data set from 2000 to 2015 were used to discuss the influence of ice dimming to snow line retreat. Reanalysis climate data of ERA-Interim during 2000-2015 from ECMWF were used to analyze the attribution of snow line change, including wind speed, wind direction, 2 metre temperature, sea surface temperature, net radiation and precipitation data.Transient snow line experienced dramatic retreat in Greenland during the research years, in some areas such as northeast and west Greenland the retreat distances can achieve to more than 30 km. Moreover, the northeast and west Greenland have suffered from extremely serious surface melting, there have been lots of melt ponds in these areas in ablation season. The variation trends of surface ablation region and albedo can explain the snow line change preferably. Comparing with the ablation season in 2000, the ablation frequency in 2015 has increased rapidly. By analyzing the reanalysis data, it can be speculated that the change of surface ablation in Greenland can be due to climate change to some degree, such as warmer ocean current, air temperature and surface wind. Meanwhile, the snow line changes in West Greenland can be attributed to deposition of black carbon and algae growth to some extent.