**Title**

September Melt at the Summit in Greenland: An Attribution Study of the September 2022 Extreme Melt Event and a Projection of Future Events

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**Abstract**

In September 2022, Greenland experienced an extraordinary late-season melt event, characterized by temperatures exceeding the melting point at Summit Station for the first time on record and surface melt appearing across one-third of the ice-sheet. This thesis investigates extreme melt events at the Summit in Greenland, focusing on the attribution of the September 2022 extreme melt event to human-induced climate change. The study combines observational data and climate model simulations to assess the influence of climate change on these events and project their likelihood in the future. The research involved identifying melt events in observational and model data. Subsequently, melt-event probability ratios were calculated between the pre-industrial, current, and future climates. These ratios were synthesized to form an attribution statement and provide insights into future scenarios. The study reveals that melt events in any month at the Summit in Greenland have become 20 times more likely in the current climate compared to the pre-industrial climate. This increase in likelihood of melt events in any month is significant and can be attributed to human-induced climate change. However, for melt events specifically in September, although unprecedented in pre-industrial and recent times, no significant increase is found due to a lack of data. Definitive conclusions are expected with more data. Projections based on climate models indicate a substantial rise in future melt event probabilities, reaching up to a 46% chance of Summit melt in September and a 83% chance throughout the remainder of the year. The findings suggest that, while the September 2022 event cannot definitively be attributed to climate change, it highlights the increasing likelihood of such events and their potential impact on sea levels. However, the analysis carries inherent uncertainties due to limited historical and climate model data usage and limited consideration of atmospheric river circumstances. Despite these challenges, these insights contribute to enhancing our understanding of extreme melt events and, in turn, inform the formulation of future climate mitigation and adaptation strategies.