



Strong changes in englacial temperatures despite no change in thickness at Dôme du Gouter glacier (Mont Blanc area)

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In this study, we analyzed the response of the very high elevation glaciated areas located at 4250 m a.s.l. in Mont Blanc area to the climate change from observations and numerical modelling. We observed very few thickness changes, less than 7 m between 1993 and 2017. Similarly, the changes in ice flow velocities and submergence velocities are small, less than 12 %. Conversely, the measurements performed in deep boreholes since 1994 reveal strong changes in englacial temperature exceeding 1.7°C at 40 m deep. Numerical modelling shows that glacier near-surface temperature warming is enhanced by increasing melt-event frequency at high elevation. This result in a non-linear response of englacial temperature to current air temperature rise. According to theoretical analysis, our observations confirm that, at this very high elevation, the climate signal is not visible from the surface but cause invisible changes in depth related to englacial temperatures.