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Mountain glaciers vs Ice sheet in Greenland - learning from a new monitoring site in West Greenland

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Only 5 out of the 20.000 peripheral glaciers and ice caps surrounding Greenland are currently monitored due to logistical challenges and despite their significance for sea level rise. Large spatial coast-to-icesheet mass and energy balance gradients limit simple upscaling methods from ice-sheet observations, which builds the motivation for this study. We present results from a new mass and energy balance time series at Qasigiannguit glacier (64°09'N; 51°21'W) in Southwest Greenland. Inter-annual variability is discussed and the surface energy balance over two summers is quantified and a ranking of the main drivers performed. We find that short-wave net radiation is by far the most dominant energy source during summer, followed by similar amounts of net longwave radiation and sensible heat, respectively. We then relate these observations to synchronous measurements at similar latitude on an outlet glacier of the ice sheet a mere 100 km away. We find very pronounced horizontal surface mass balance gradients, with generally more positive values closer to the coast. We conclude that despite minor differences of atmospheric parameters (i.e. humidity, radiation, and temperature) the main reason for the strongly different signal is a pronounced winter precipitation gradient that translates in a different duration of ice exposure and through that an albedo gradient. Modelled energy balance gradients converted into mass changes show good agreement to measured surface mass balance gradients and we explore a latitudinal signal of these findings.