Respond to Jean Emmanuel

Thank you for this interesting study and this very nice dataset (although the time period is quite short). Have you examined the horizontal turbulent fluxes of heat (v'T' or u'T')? Since you observe significant variations of near-surface air temperature across the glacier, I guess this flux may be significant?

Also: don't you think that adding a stability parameter (such as Ri or z/L) to the analysis would help to better understand the relationships between the turbulent heat flux and temperature or wind speed?

Response: Dear Jean Emmanuel, thanks for your comments. Yes, the time period is quite short but those measurements were associated with a lot of effort which we could not afford for longer time period.

Yes, horizontal turbulent fluxes are significant and are larger than the vertical fluxes. When looking at the fluxes we always use the rotated flux which is called streamwise flux. That is why for disturbed conditions u'T' which is along the transect shows the same tendencies for the stations as does u'w' suggesting that we are most probably above a local jet height at TT1 and below it at TT2 and TT3.

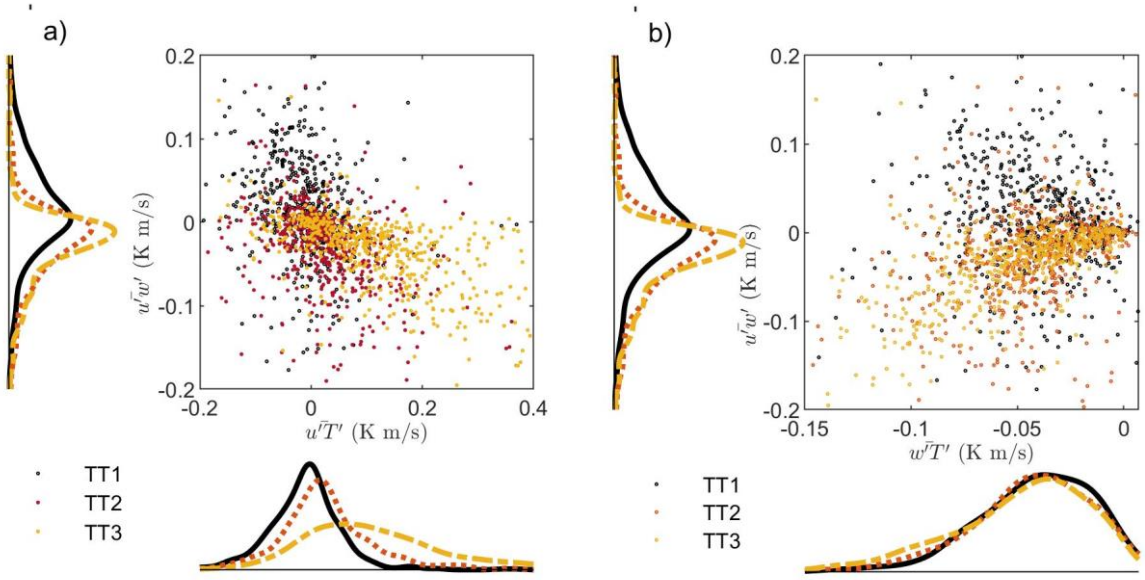
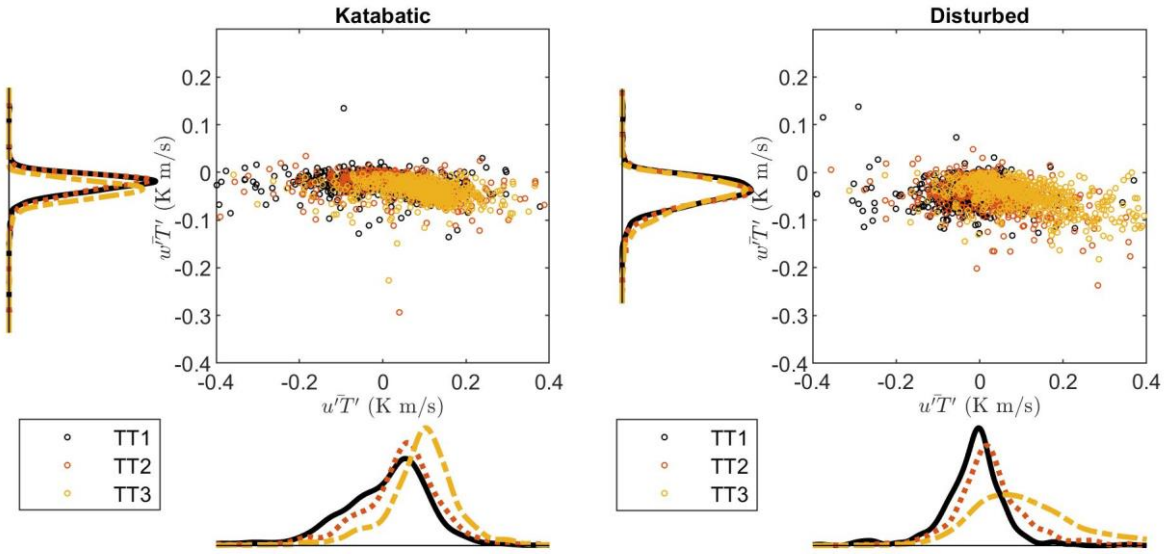


Figure 11: Streamwise horizontal turbulent heat flux plotted against streamwise momentum flux for stations TT1, TT2 and TT3 (a). Vertical turbulent heat flux plotted against streamwise momentum flux for stations TT1, TT2 and TT3 (b). Data are only shown for disturbed conditions and the 60°wind sector from 240° to 300°.

We also add here a plot showing vertical heat flux against horizontal heat flux u'T' for disturbed and katabatic conditions. The horizontal heat flux is larger for katabatic flows than for disturbed ones.



We now also show the horizontal flux divergence calculated only for the narrow wind sector of 250°-290° which ensures that the flow was aligned with the transect. This figure shows that both horizontal and vertical flux divergences are at the same order of magnitude but the vertical heat flux divergence is larger, in particular at the central station.

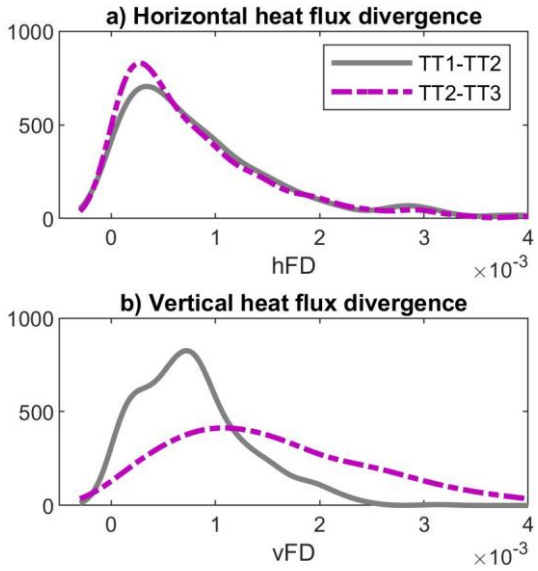


Figure 13: Kernel distribution of horizontal (hDF) and vertical (vDF) heat flux divergence shown only for disturbed situations and the wind sector 240° to 300°.

We analysed stability parameter z/L and plot it against the vertical heat flux, We can detect a tendency of higher turbulent heat fluxes for weaker stability (i.e. during disturbed flows that are more near-neutrally stratified). The decrease of stability during disturbed flows is associated with higher wind speeds and therefore higher friction velocity.

We added a figure describing the stability parameter to the paper:

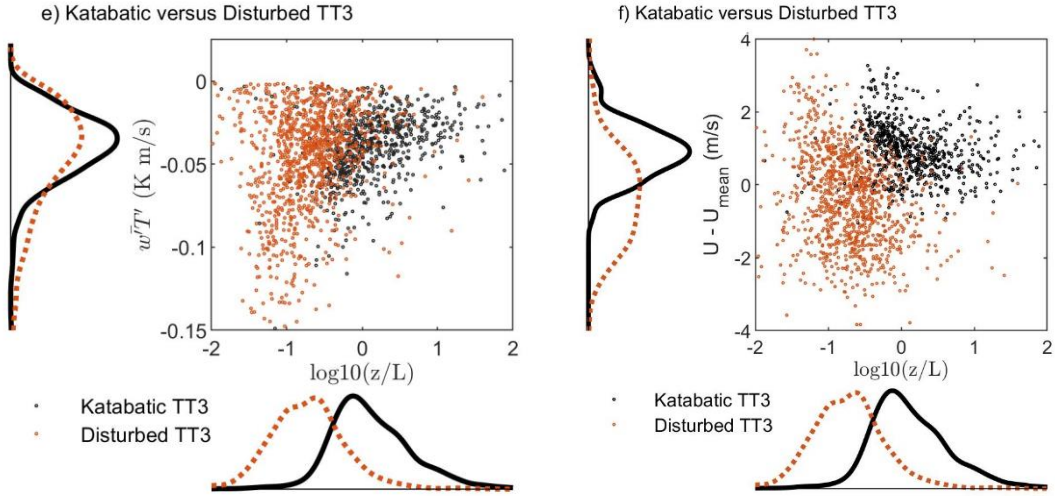


Figure 7: Vertical heat flux plotted against anomalies of wind speed from mean daytime wind speed shown for stations TT1 –TT3 for katabatic situations a) and disturbed situations (b). Vertical momentum flux plotted against anomalies of wind speed from mean daytime wind speed (c) and against anomalies of air temperature from mean daytime air temperature (d) shown for station TT3 for katabatic situations and disturbed situations. Logarithm of Stability parameter z/L plotted against Vertical heat flux (e) and normalized wind speed (f) measured at TT3 during katabatic and disturbed flows.