

EGU24-10497, updated on 15 Aug 2024
<https://doi.org/10.5194/egusphere-egu24-10497>
EGU General Assembly 2024
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UAV placement of GNSS trackers on glaciers

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Commercially available UAVs can carry different types of payload such as cameras, Lidars and GPR. They also feature safety sensors such as collision awareness as well as mission planning with high accuracy RTK GPS. This makes them valuable tools to deploy sensors onto glaciers as long as the payload is within the maximum the UAV can carry.

We have been installing sensor networks inside and under glaciers since 2003 (<https://glacsweb.org>). Our most recent projects designed an RTK GNSS system to measure ice movement on two glaciers in Iceland. They send the location fixes back to a server every day and have been made smaller as well as lighter in our most recent version. The units use a custom aluminium “quadpod” to stay securely on the glacier. This enabled us to investigate methods to deploy and collect them using a DJI Matrice 300. This quadcopter has a maximum payload of 2kg so we designed the system to meet that requirement. This involved testing a lighter frame structure and smaller GPS antenna than the original versions. However they maintained the same high capacity battery, electronics and 5W solar panel. By using a commercially available release and camera module (PTS4) we were able to use a roughly 2m chord to attach the unit underneath the UAV. Once the tracker was positioned and set down onto the ice, with constant monitoring of the downwards facing camera included in the PTS4, the release mechanism was triggered. This was first carried out first at Breiðamerkurjökull then at Fjallsjökull. The first flight of around 1300m was to an easily accessible area in case of placement issues. The second flight was to a central part of Fjallsjökull which is inaccessible due to crevasses.

To test pick-up techniques, we investigated a range of hooks and grabbers as the combination of flight controls and logistics make it an interesting problem to solve. Our initial tests point to a hooking technique rather than a grabber and this aspect will be ongoing for tests of units on the glacier, which sink in a few centimetres when first placed in the summer.



Tracker22 being lifted to Fjallsjokull