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WHAT'S NEXT FOR SCIENCE
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Does the Mélange in Crane Glacier Fjord Control Glacier Calving And Speed?

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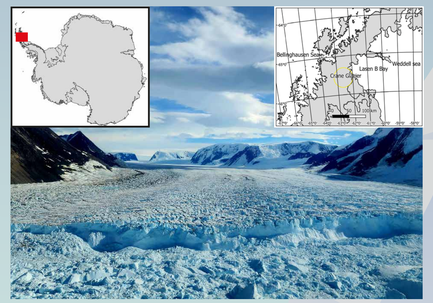
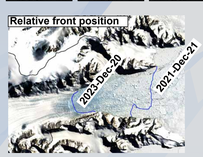
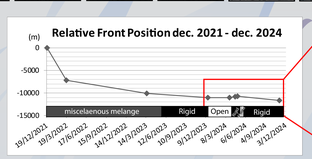


Crane Glacier's initial response was a rapid break-up of the floating ice tounge that had formed between 2011-2021. Following this, a rigid melange formed from toppled icebegs and sea ice in the narrow fjord, which could be impacting on the glacier front stability. We are still investigating the links between glacier behavior, local climate, and melange dynamics.

After disintegration of the Larsen B Ice Shelf in 2002, Crane Glacier, a tributary to the ice shelf, entered a phase of rapid calving and retreat, spanning 2002 and 2012. During this time, sea ice concentration in the embayment and the Crane fjord was variable. Beginning in 2011, persistent fast ice formed in the Larsen B embayment, and Crane Glacier advanced and thickened from 2011 to 2021. However, in January of 2022 the fastice broke up, causing a new round of retreat and ice loss.

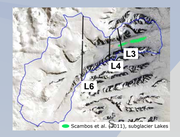
MODIS imagery of fastice occupation (minimun summer extent):

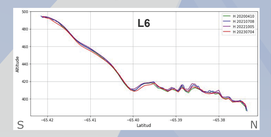


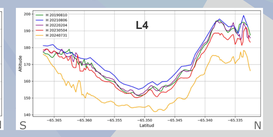


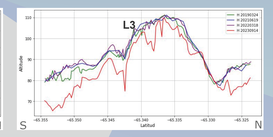
Date	2024 Relative Front Position
20/12/2023	0 (reference)
25/3/2024	+75 m (advanced)
20/4/2024	+225 m (advanced)
2/5/2024	+310 m (advanced)
11/7/2024	-640 m (retreated)
15/10/2024	-270 m (advanced)
8/11/2024	-655 m (retreated)

Elevation surface (From ICEsat-2)



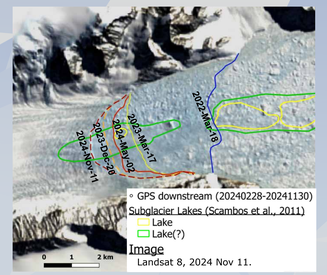




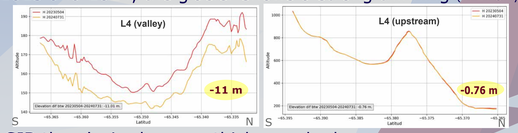


L3 2019-preSIB H diff. 1.04 m
L4 2019-preSIB H diff. 3.14 m
L6 2019-preSIB H diff. 0.88 m

L3 2019-2023 H diff. -5.96 m
L4 2019-2023 H diff. -2.71 m
L6 2019-2023 H diff. -0.16 m



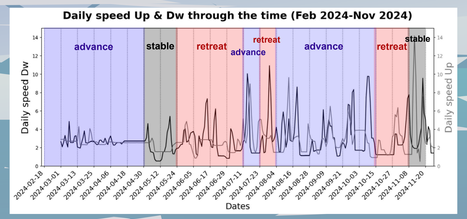
Between 2019 and 2021 (first ICEsat-2 data and pre Sea Ice Break-up -SIB-) the glacier thickened. It is remarkable how the track (L4) behind the limit of the subglacial lakes mentioned by Scambos et al., 2011, shows greater thickening than anywhere else.
Between 2023 and 2024, the glacier shows a strong thinning (in L4 only icesat-2 track available):

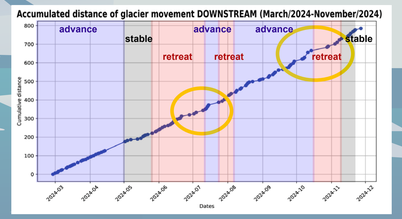


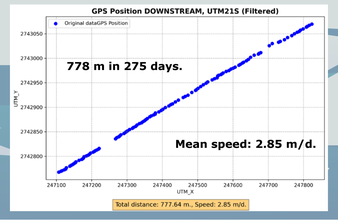
- ☆ Pre SIB the glacier became thicker and advance.
- ☆ After SIB the glacier lost thickness and retreated quickly.
- ☆ In 2024 the glacier thinned significantly while the retreat continue constantly.

In February 2024 we went to Antarctica:

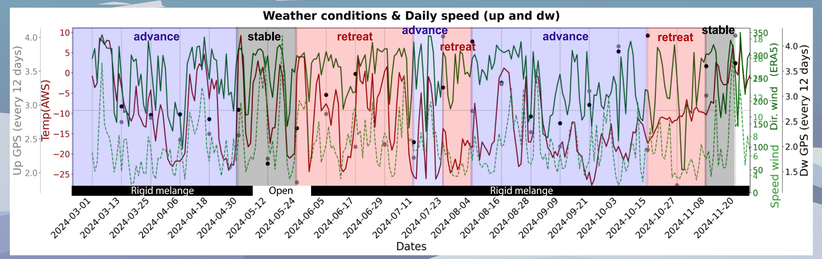
We installed 2 GPS units on the Crane Glacier surface, and placed one weather station, three time lapse cameras, and one GNSS base station on top of bedrock overlooking the fro nt of the glacier.



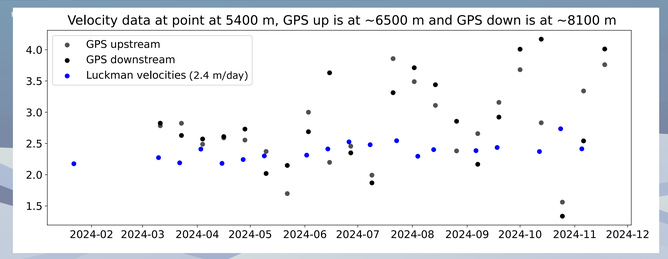




The GPS data shows erratic flow, going faster or slower relative to the mean speed (see the yellow circles as examples).



We try to understand if this behavior was controlled by local weather conditions, but we do not find a correlation at present. However, we find the first big glacier retreat was just after an open water period in front of the glacier.



We compare the GPS speeds calculated and Sentinel-1 radar velocities, but we didn´t find the same response.

Discussion and Next Steps

- ☆ The movement, ~1000 m/yr, is ~300 m/yr faster than the pre-fastice break-out speed (Ochwat et al., 2024).
- ☆ The glacier flow behavior, near the ice front, is possibly linked to diferent packing of the mélange. Packed mélange can stabilize the glacier front (Murray et al., 2015).
- ☆ Bed geomophology may explain some of the changes.
- ☆ We think the GPS data since May is not 100% reliable. So, we are still waiting for more GPS data with better weather conditions.
- ☆ We plan to revisit in January and gather camera data.

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