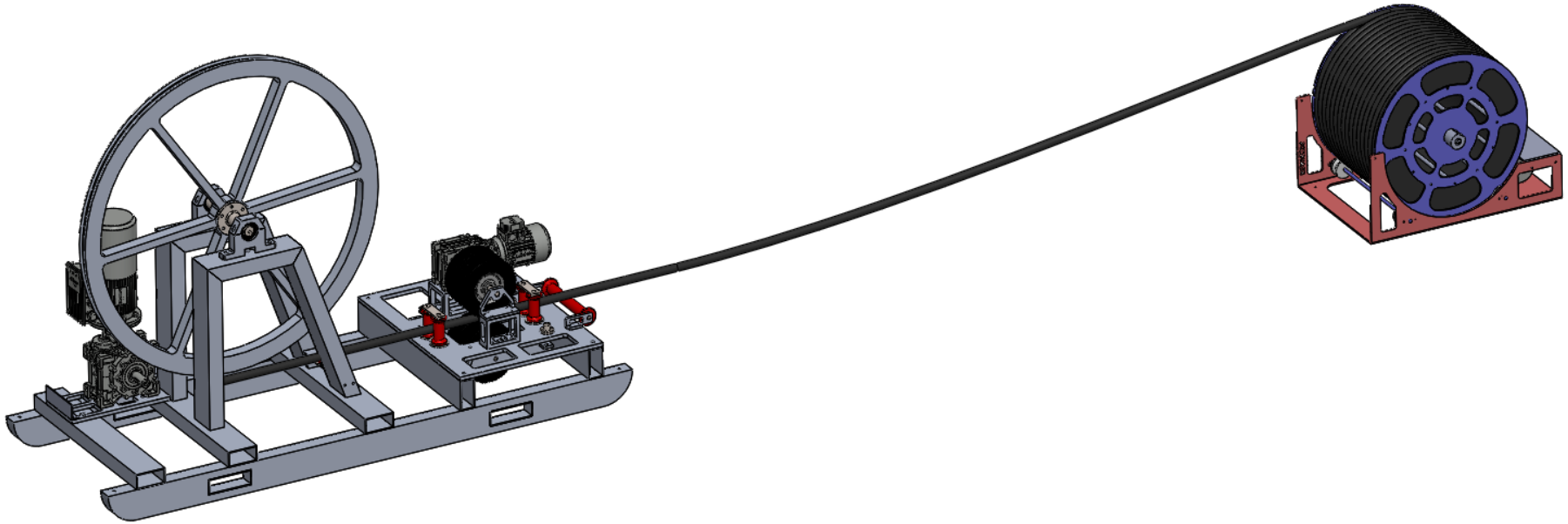
HWD700 : a 700 m Hot-Water Drill
REASSESS project



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9th International Symposium on Ice Drilling Technology,
Potsdam, Germany

European Research Council
Established by the European Commission

ERC REASSESS

The Project :

European Research Council
Established by the European Commission

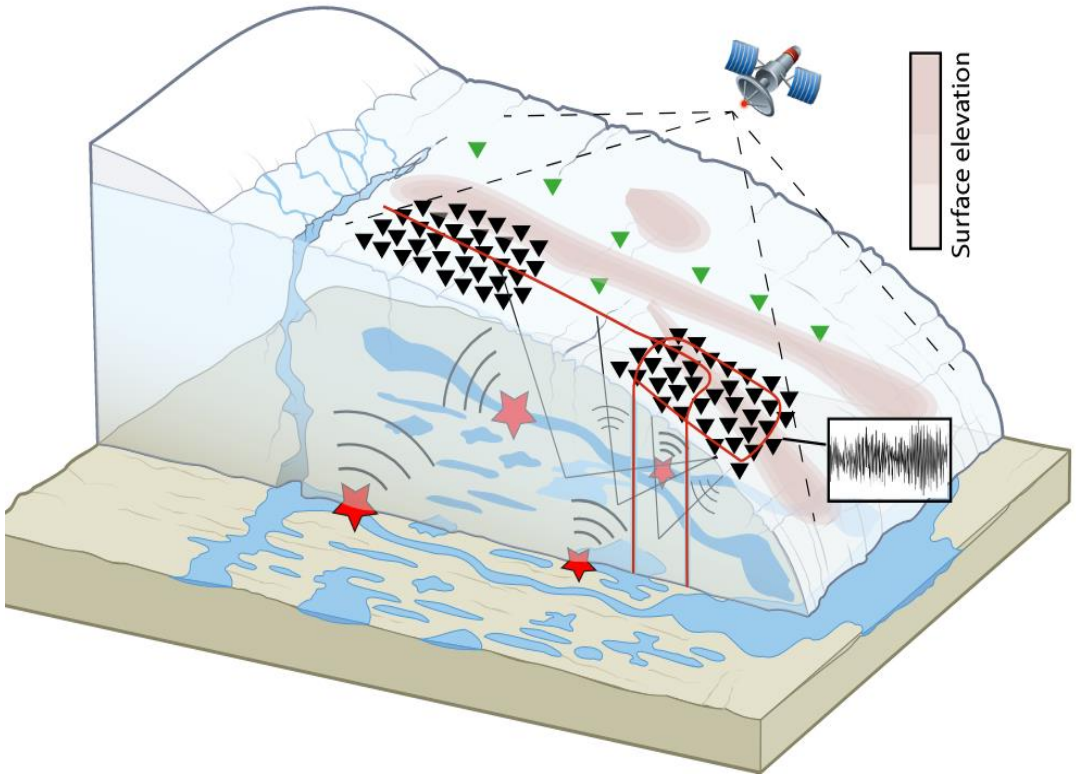
“Probing and predicting the dynamical response of the Greenland-Ice-Sheet to surface melt water” (florent.gimbert@univ-Grenoble-alpes.fr)

Surface deployment :

- GNSS station
- seismic nodes (200)

Borehole deployment (4):

- Optical fibers (DTS , DSTS , DAS)
- Piezometer
- Borehole seismometer



HWD700

Requirements :

- The system shall be capable of drilling to 700 m depth in cold ice.
- The system shall drill at a maximum speed of 120 m/h.
- The drilled hole shall have a diameter of 10 cm.
- The system shall be movable on the glacier surface within a **1 km radius** without requiring heavy logistics (no truck or helicopter).
- The system shall be simple and operable by a team of maximum 3 persons
- The system may use water available on the surface (no recirculation required).

HWD700

Previous experience in HWD:

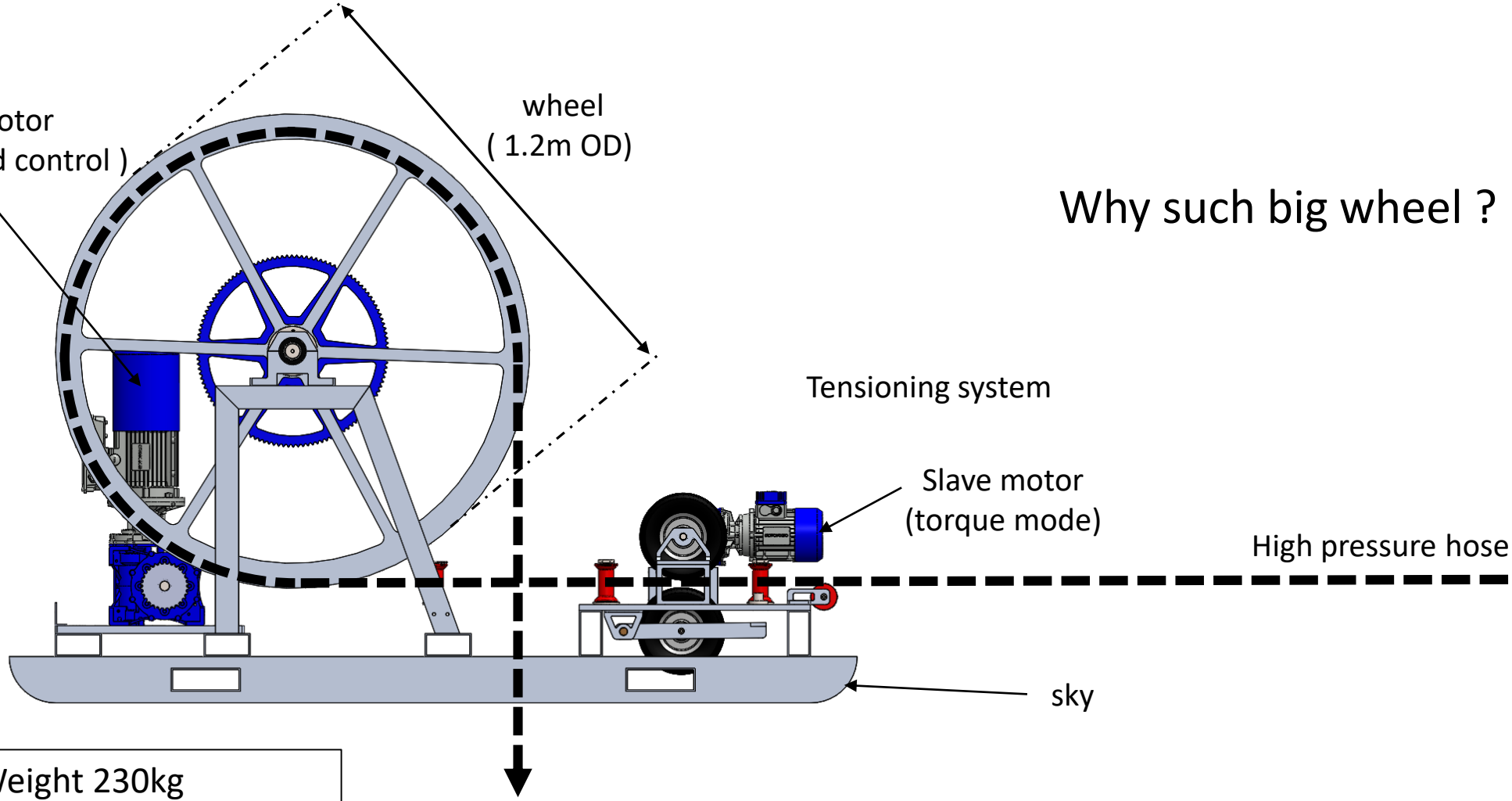
20 years in the Alpes but never in
Greenland !

⇒ So we needed some help !
We contact several team with strong experience in Greenland and they gave us some valuable advices

Finally
We opted for a design similar to the probe used by
Joel Harper
Thanks to him

HWD700

Winch design : capstan principle



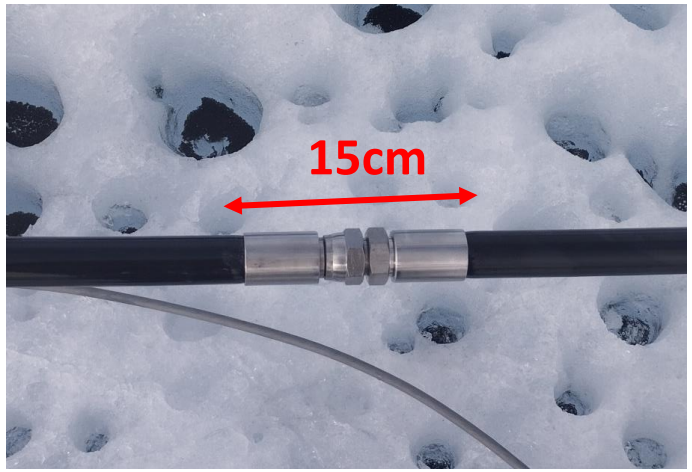
Why such big wheel ?

Weight 230kg

HWD700

Winch design: capstan principle

"To allow hydraulic fittings to pass over the wheel"



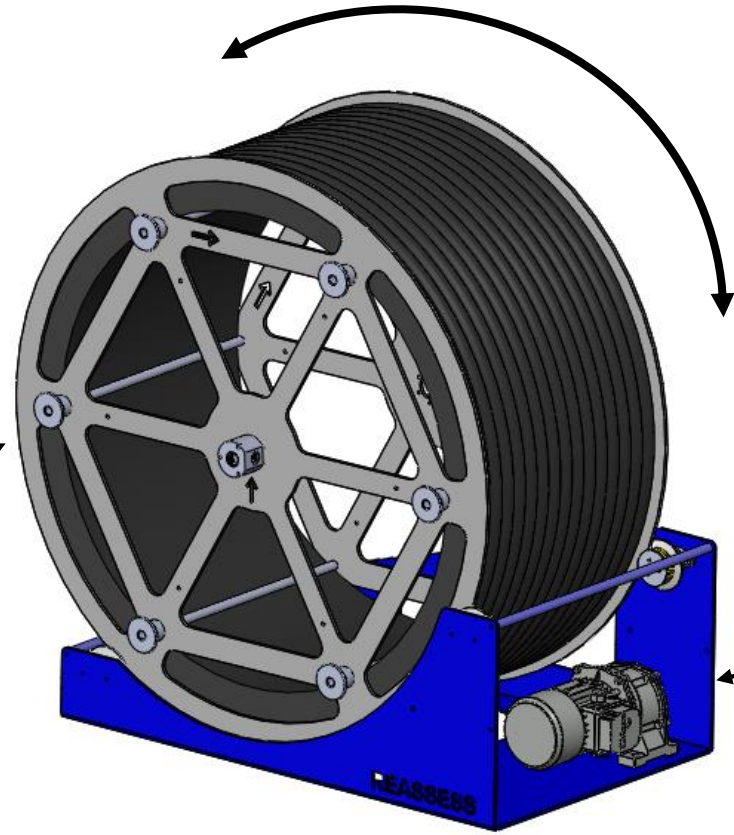
1 reel
load with 700 m hose
≈ 350kg

10 reels
load with 70 m hose
30 kg/each

HWD700

Motorized hose reel

To easily reel in, reel out
And dry the hoses

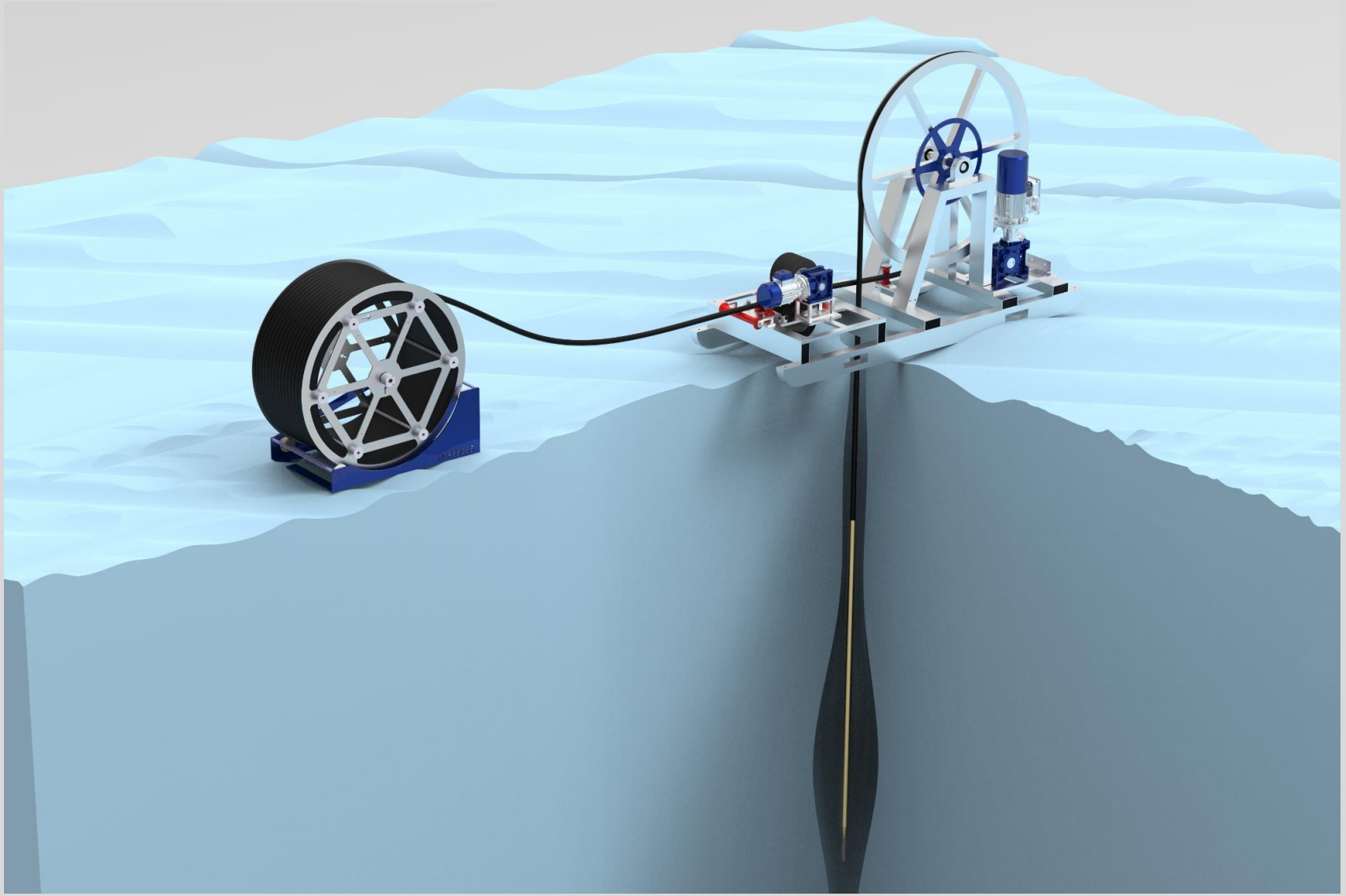


Light weight
aluminum reel

Motor

HWD700

Complete setup



HWD700

Hydraulic considerations

- Thermoplastic hose ¾ “ 200bar (kutting 1A12HP)
- 4 fuel heaters : total heating power 360kW
- 2 pumps total water flow : 70 l/min (max)
- Water pressure up to 100bar (max)

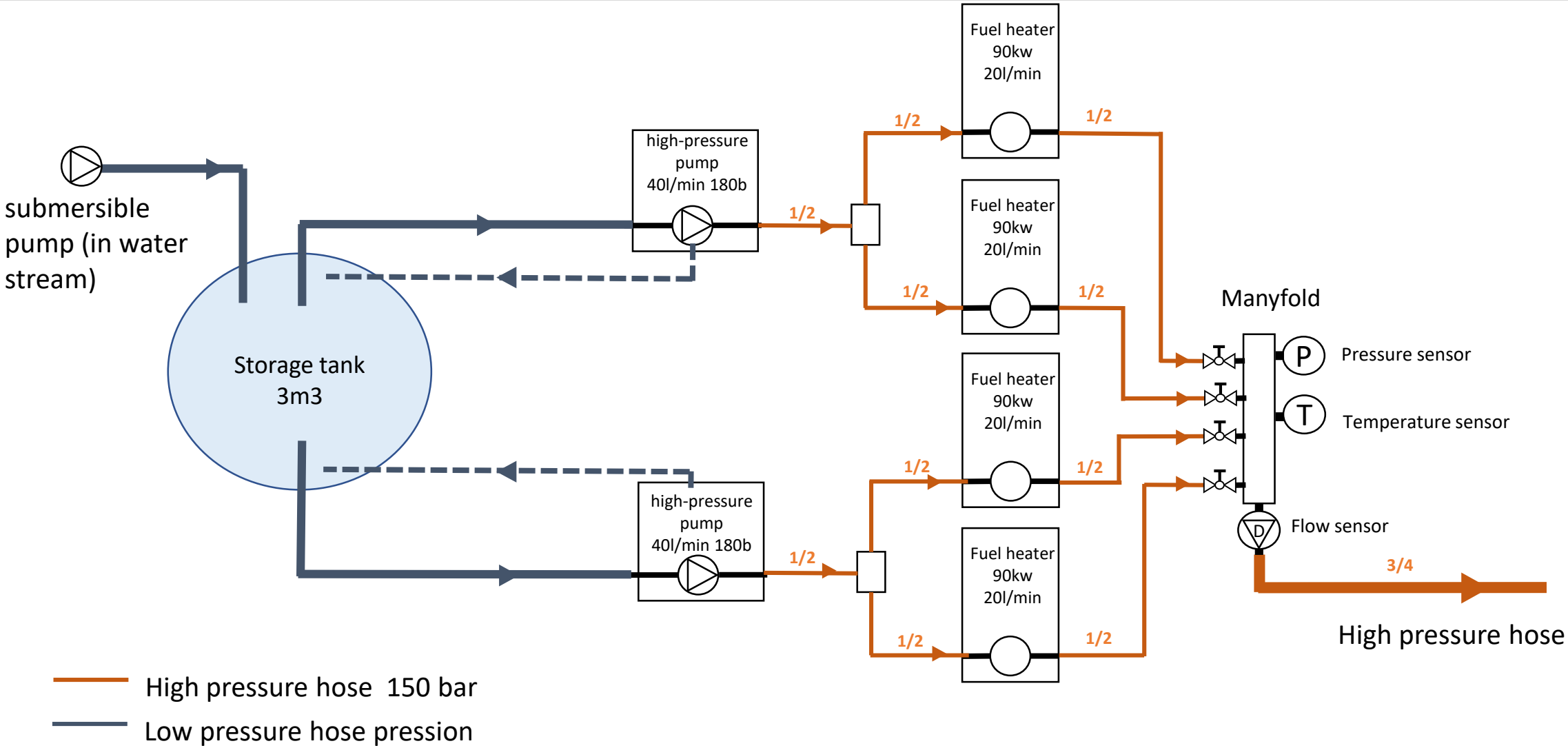
90kW fuel heater
(Comet Hot box)

High pressure pump (Comet
TW11025 drive Honda GX690)

Nozzel stem
2m long , 50mm OD brass pipe (40kg)
equipped with high pressure nozzle
(Size 040 strait jet)

HWD700

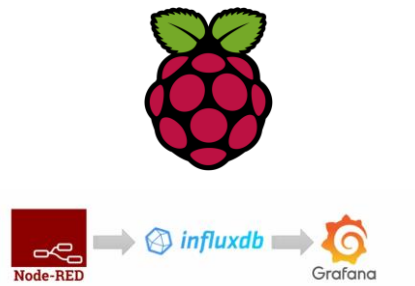
Hydraulic circuit



HWD700

Electric considerations

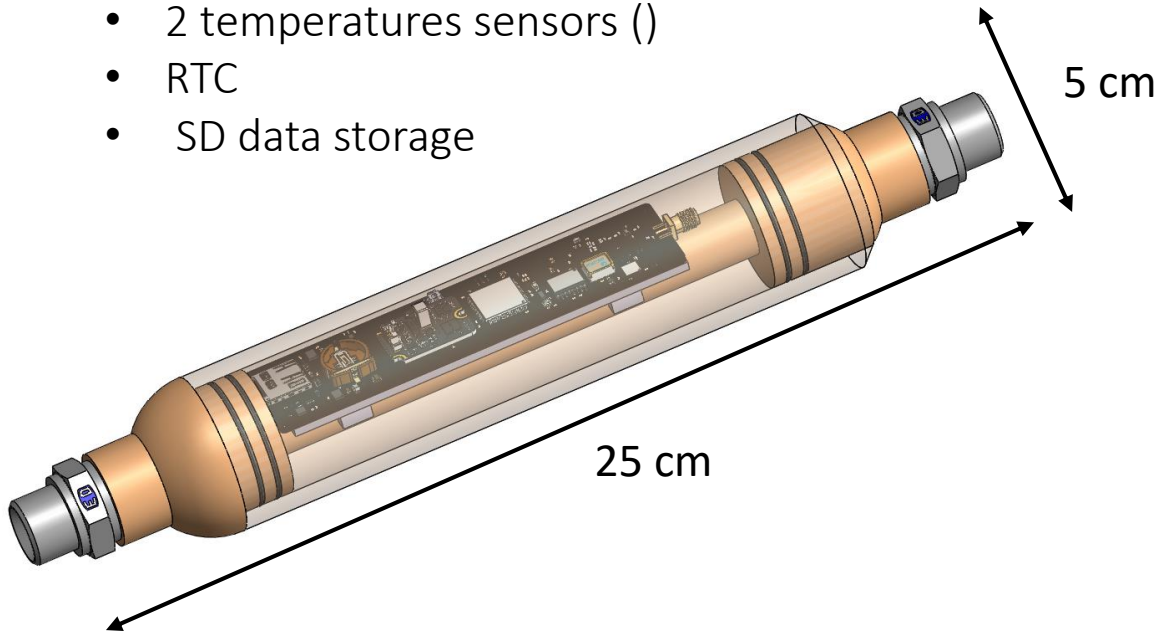
Data display &
Logging system



Winch control
box
(ABB drivers)

Autonomous logger :

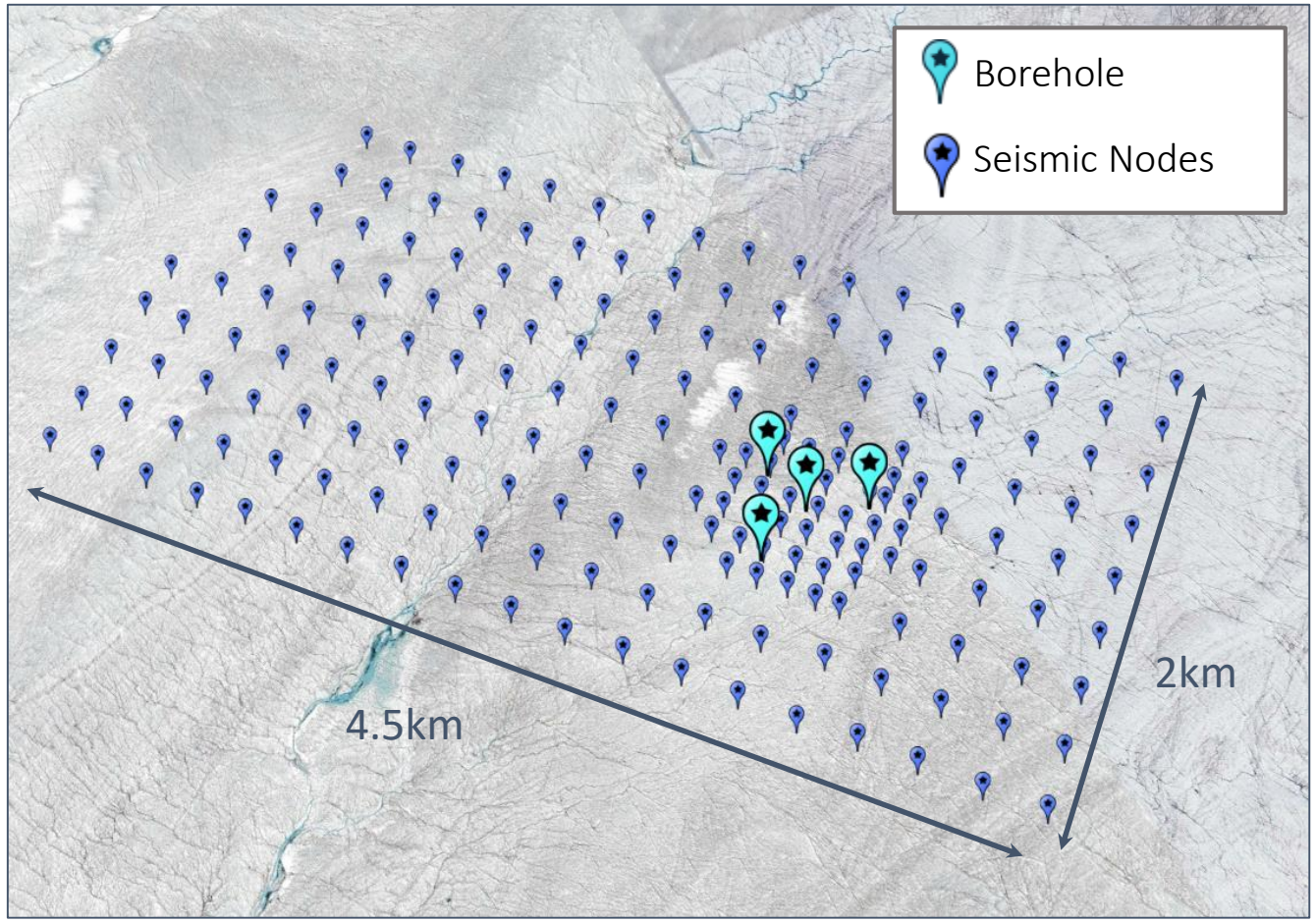
- Borehole pressure
- Inclinometer sensor
- Magnetic sensor
- 2 temperatures sensors ()
- RTC
- SD data storage



Field deployment

Isunnguata Sermia, west Greenland , July 2025

4 boreholes touching the bed between **600m** and **675m**



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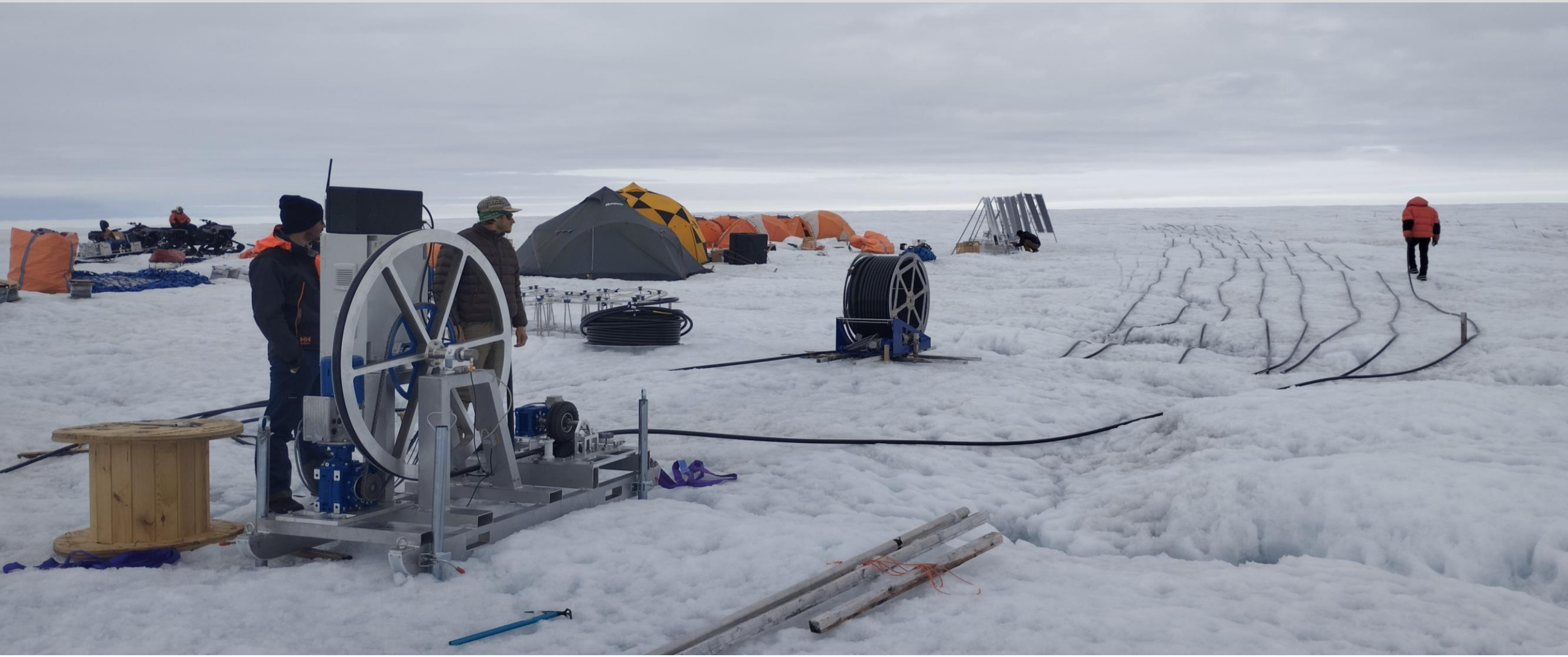

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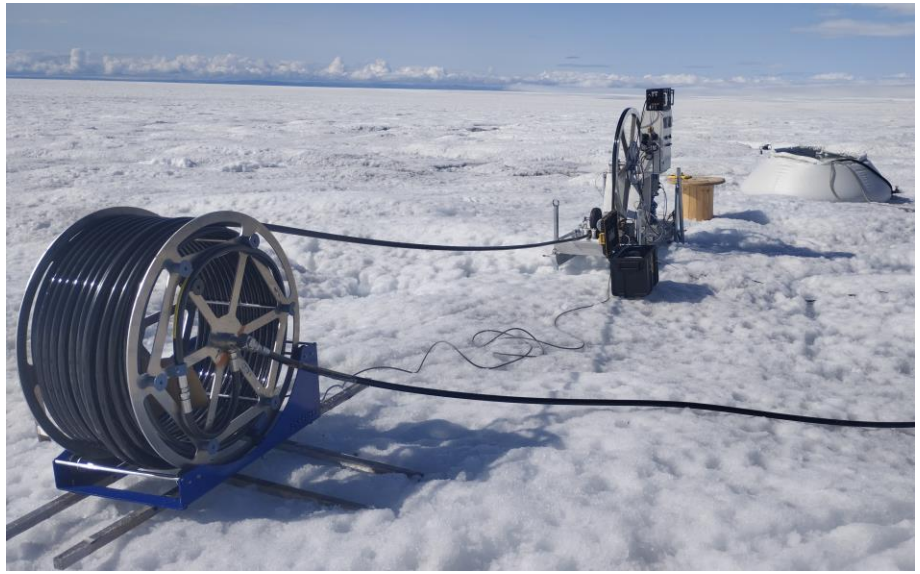
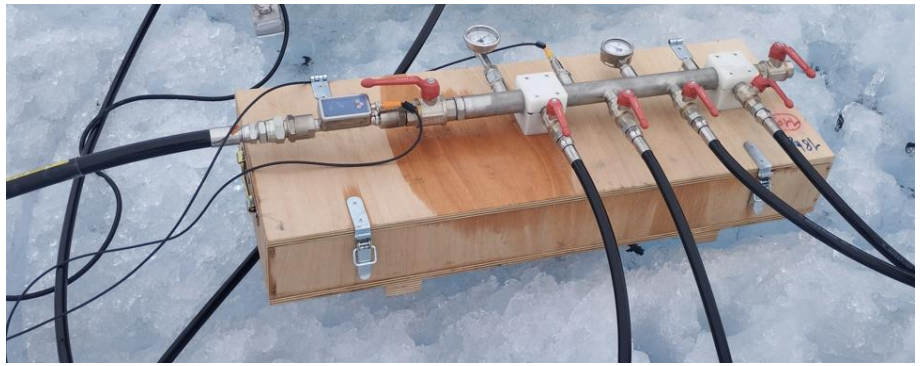
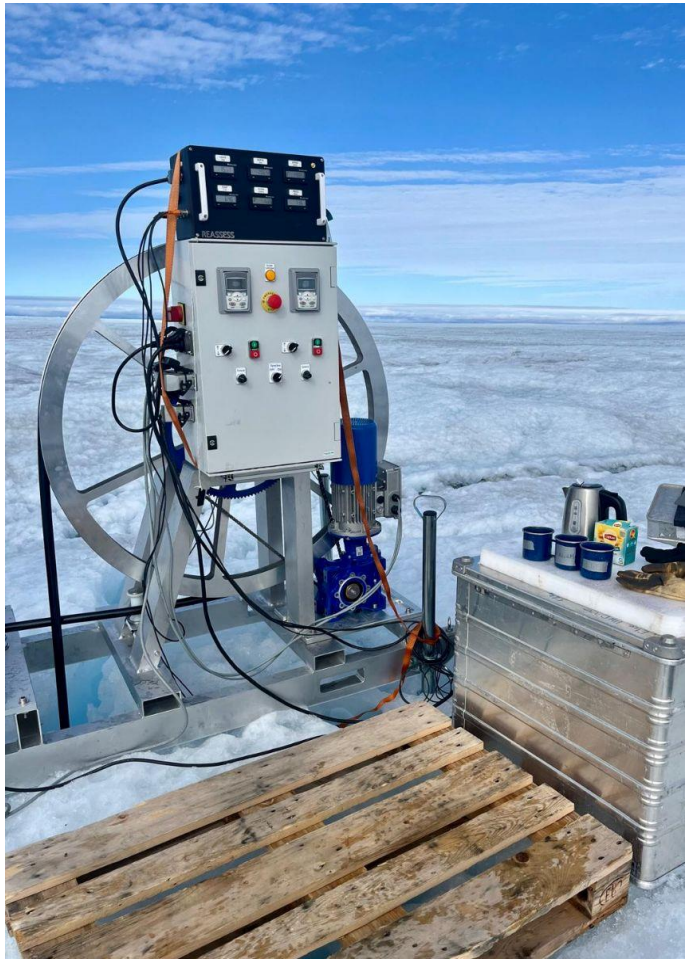
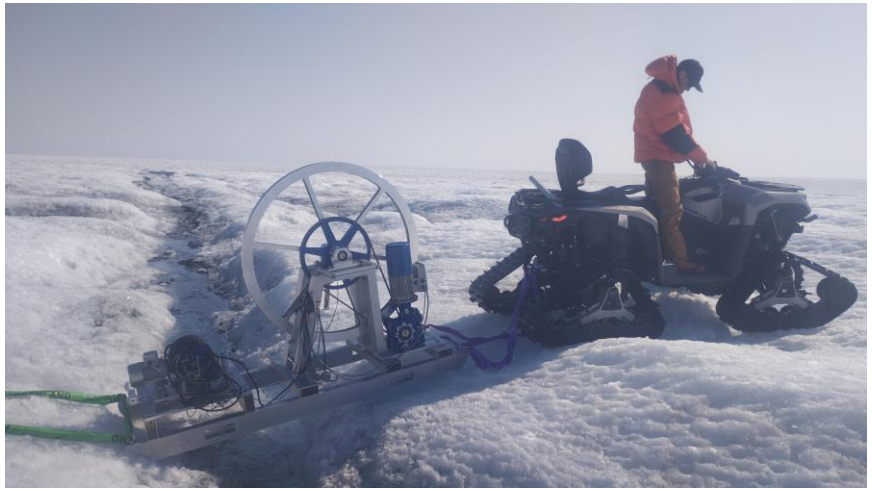
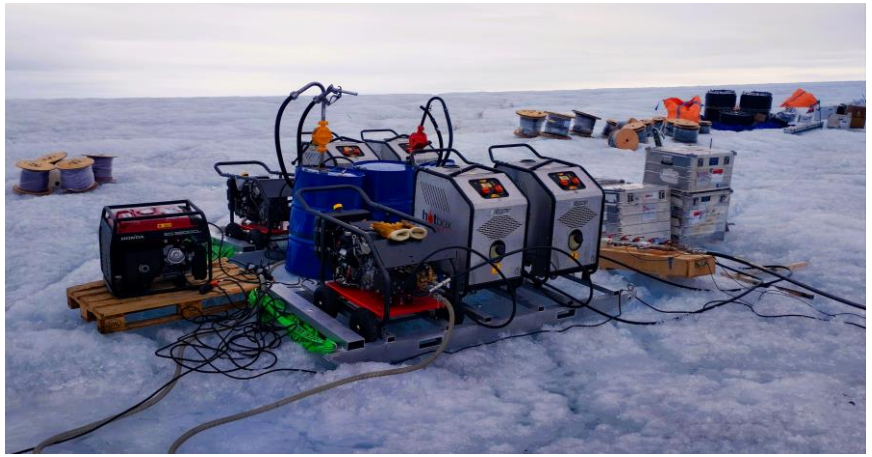




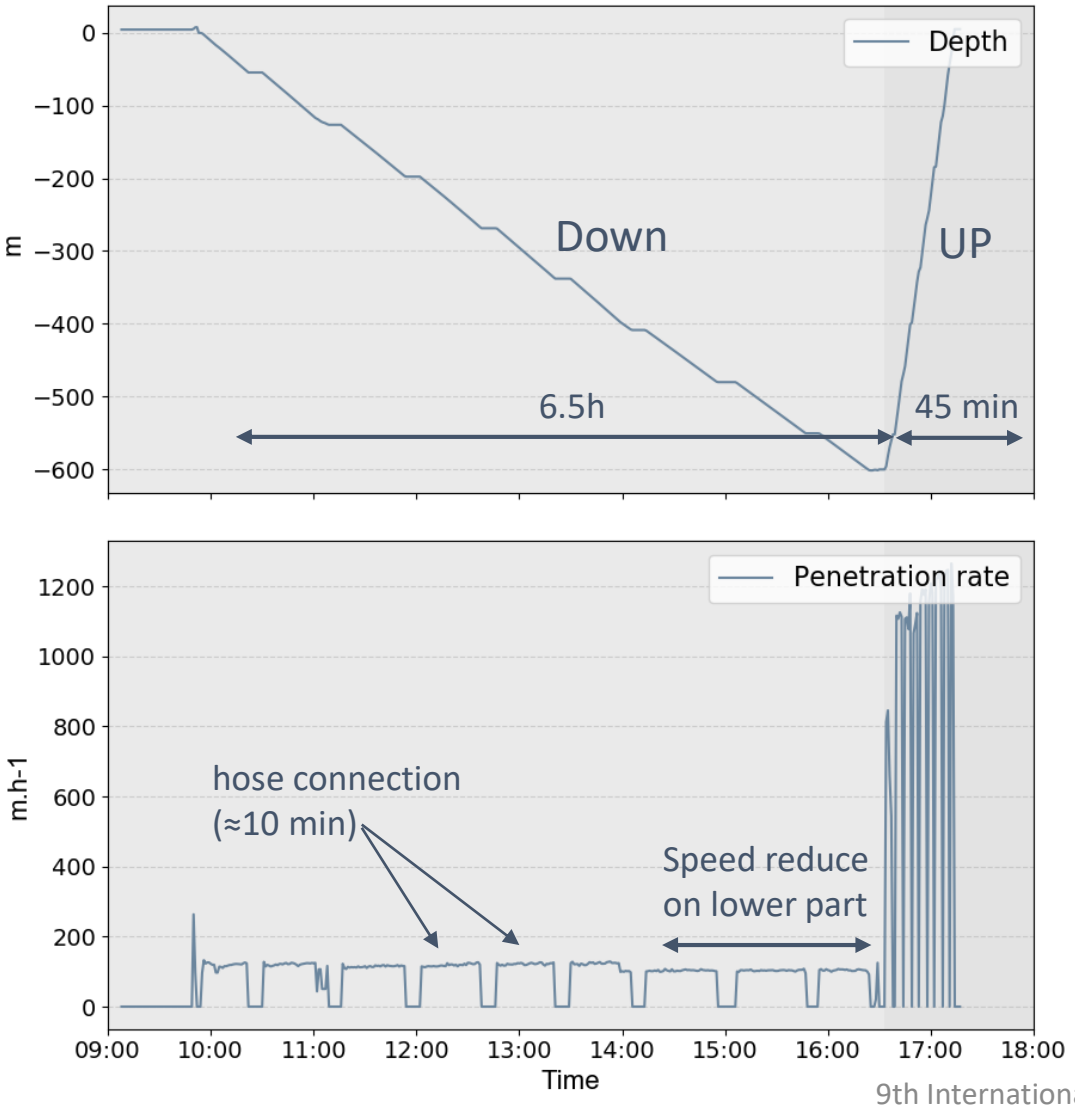






Field deployment

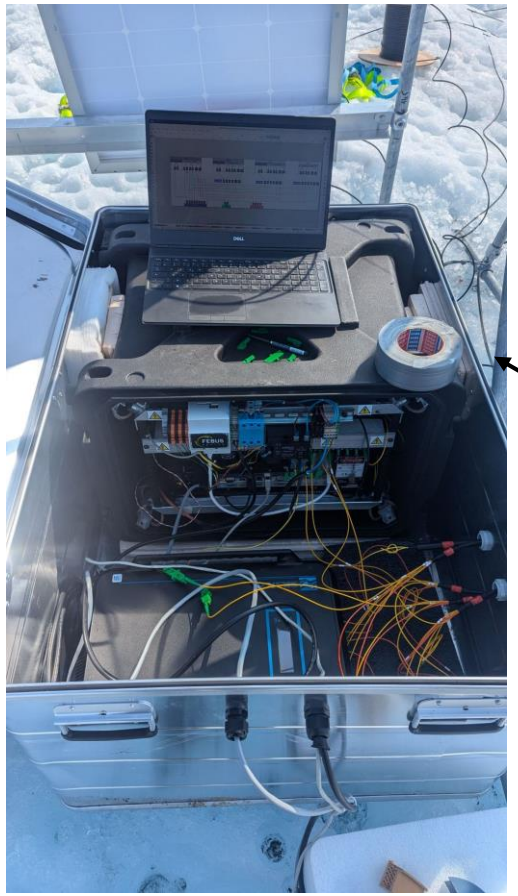
Drilling performances



- Average penetration rate 100 m.h-1
- Retrieval speed up to 1200 m.h-1
- Borehole diameter enough (no data)
- Fuel consumption 240l for 600m borehole
- Gasoline consumption 70l for 600m borehole (pumps + generator)
- It takes one day to move the equipment (with ATV) and one day to drill

Preliminary results

DTS Measurement (Distributed Temperature Sensing)



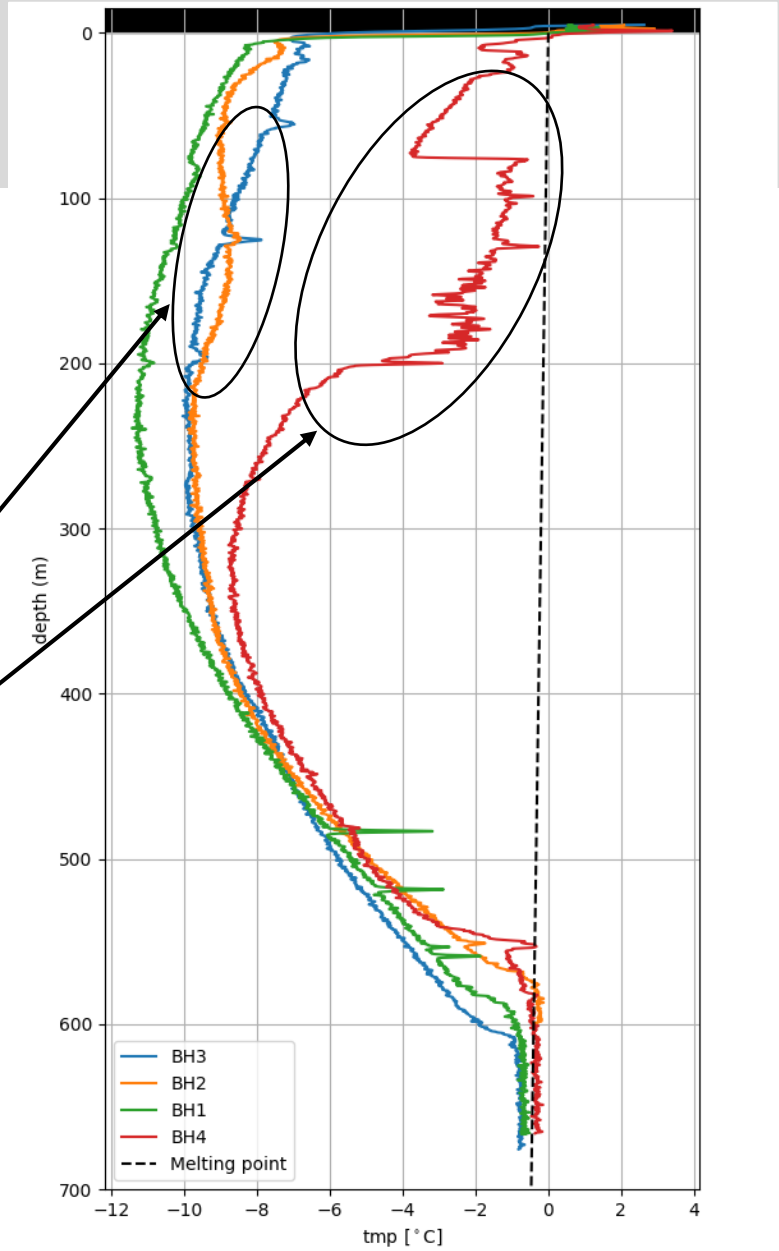
Acquisition

Optical fibers
coming from boreholes

DTS boreholes temperature profiles :

- Vertical resolution 10cm
- Temperature resolution 0.001°C

Temperature anomalies



Conclusions

First field season was a success !

- Drill performances are close to what we expected.
- Splitting the hose into sections was effective .
- We were able to move the drill a 1 km radius .
- What about the autonomous logger ? : it need some software & hardware improvements

Thank you for your intention

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