The challenges of maintaining a meteorology program on a floating ice shelf

Steve Colwell

Overview

- The history of the Halley stations.
- The station move and decision to close Halley for the 2017 winter.
- The future.


0
kilometres
1000
South America
Falkland Islands
Bird Island
King Edward Point
South Georgia
Larsen
Rothera
Fossil Bluff
Butler
Limbert
Sky-Blu
Halley
West Antarctica
East Antarctica
Baldrick
60°S
75°
120°W
105°
90°
75°
60°
45°
30°
15°
0°
15°E

Halley I

- This station operated from 1956 until 1967.
- By the time Halley I was abandoned it was 14 metres deep, and the temperature of the living and sleeping facilities had dropped to -18C.

Halley II

- Operated from 1967 until 1973.
- It was also made up of a series of wooden huts, but the roofs were reinforced with steel supports to help support the weight of the snow. Unfortunately this proved no more successful

Halley III

- Operated from 1973 until 1983
- It was the first station specifically designed to be able to cope with being buried by the ice. The buildings were prefabricated huts surrounded by corrugated steel conduits, which helped prevent the movement of the ice from crushing the structures inside.

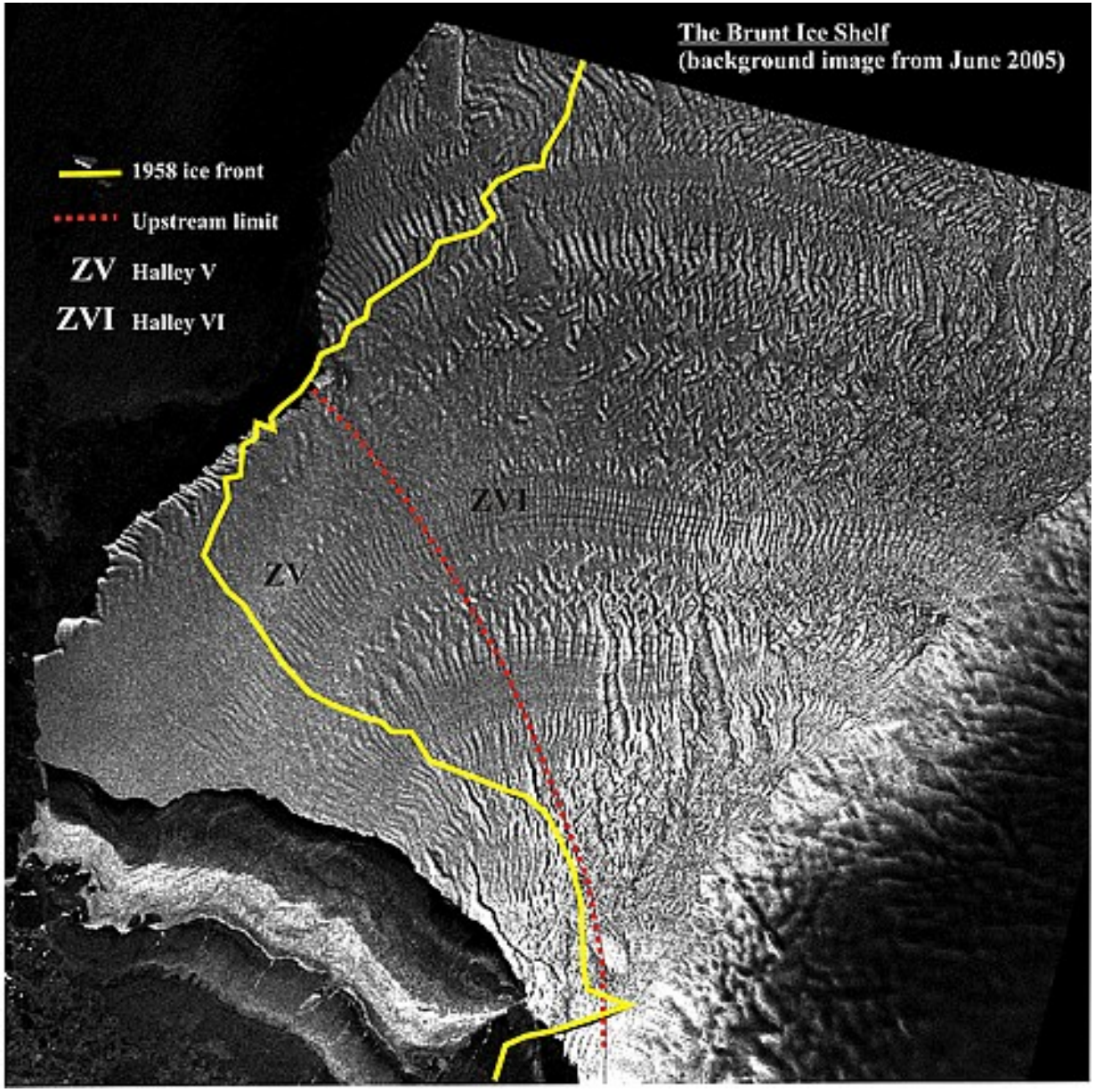
Halley IV

- Operated from 1983 until 1991
- Unfortunately windtails that formed while the base was being buried warped the cylindrical shape.
- Voids had to be created in the snow above the station to stop it being crushed.

Halley VI

- Operated from 1990 until 2011.
- It consisted of three wooden structures built on jackable steel legs to keep them above the snow surface.

Why build Halley VI?

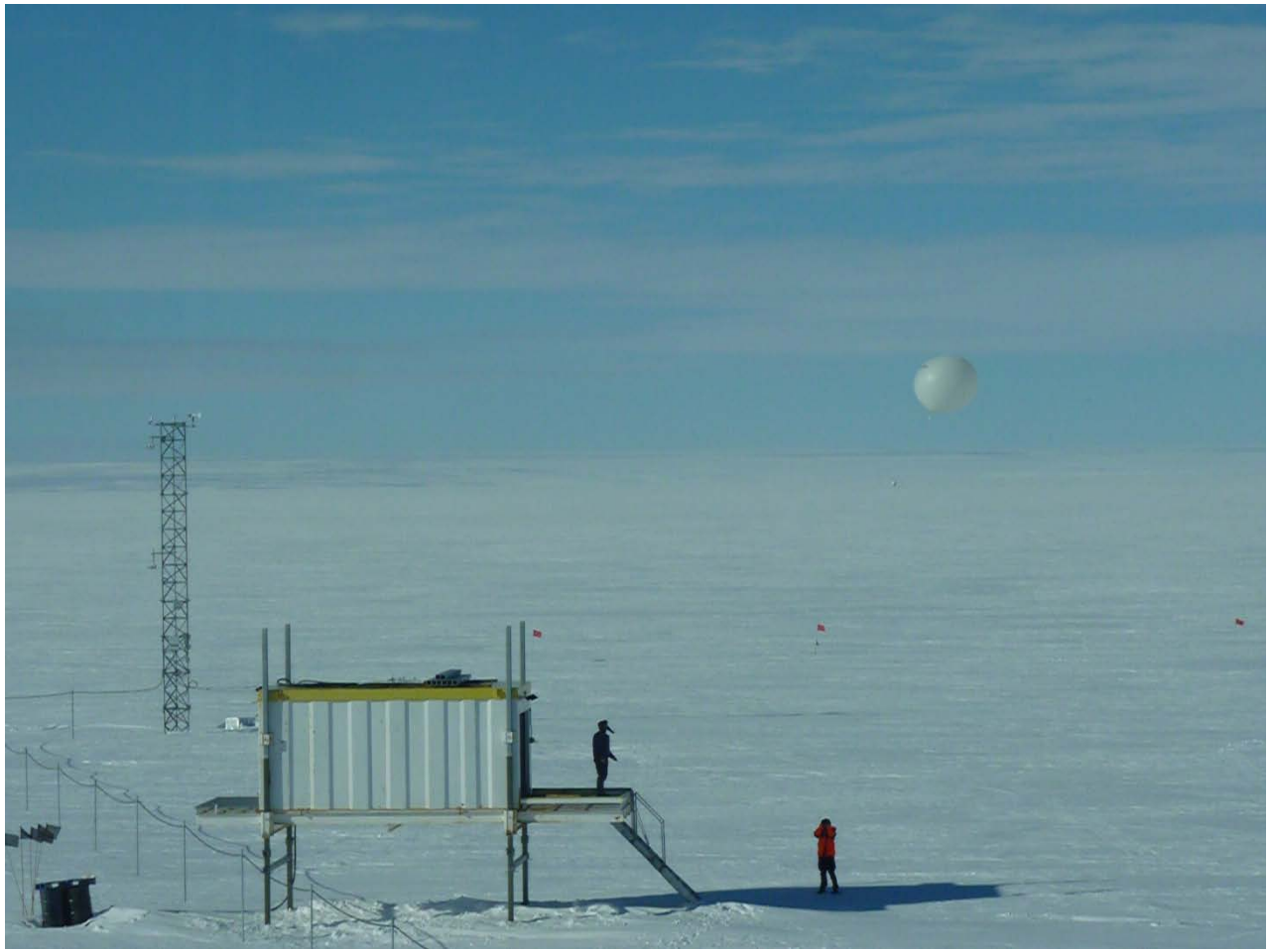


JAWS (Just Another Weather Station)

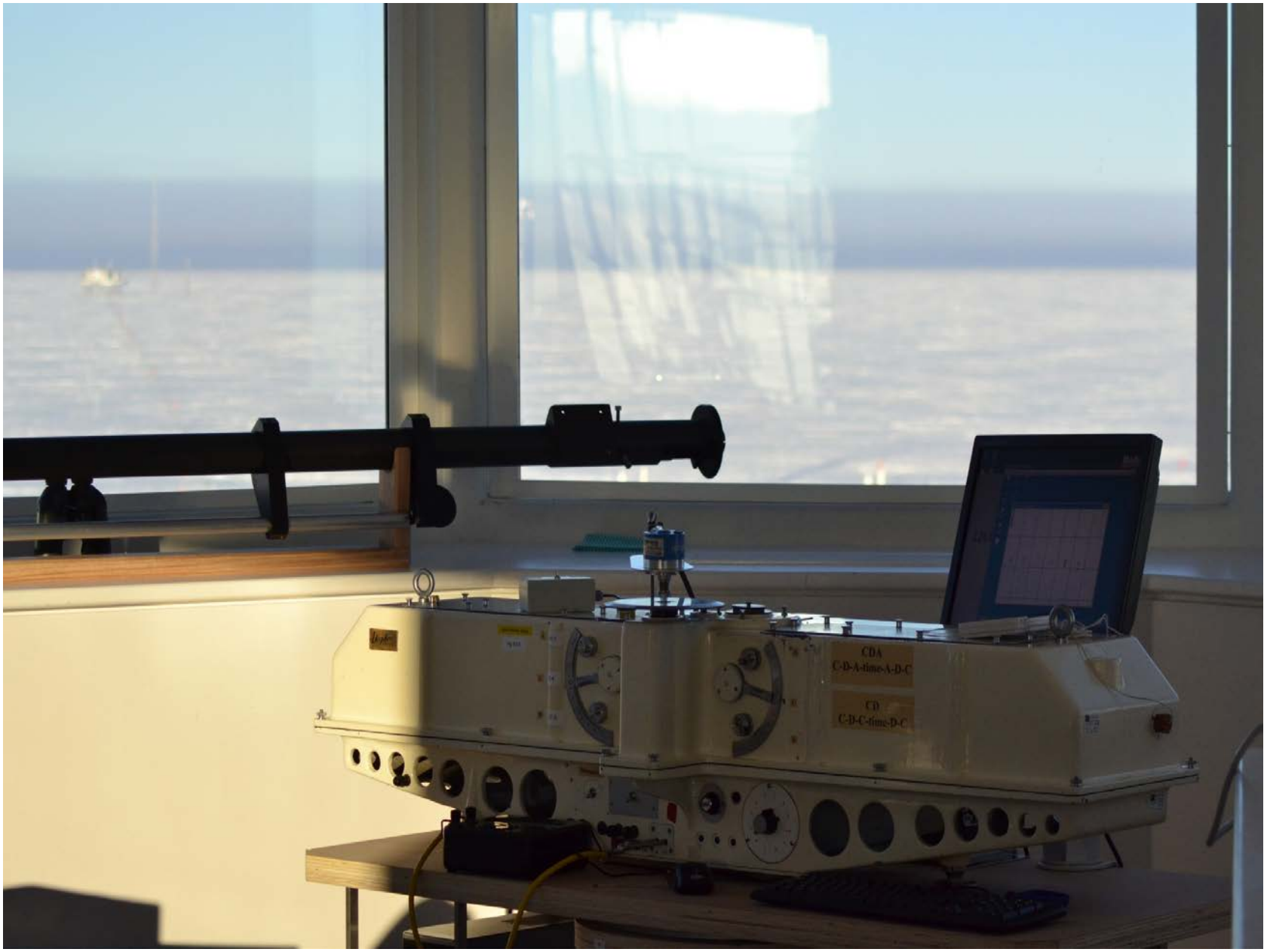
- Based around a Campbell CR1000 logger.
- Druck pressure sensor.
- Temperature is obtained via a PRT in an aspirated radiation shield.
- Humidity is obtained from a Vaisala HMP 45 probe also in an aspirated radiation shield.

- There are two wind sensors, a Vaisala WS 425 sonic anemometer is the primary source of the wind data but there is also an RM young aerovane as a backup .
- A CNR4 solar radiation sensor is attached to the system that can measure incoming and outgoing long and shortwave radiation.
- Sunshine is recorded using a CSD1.

Daily radiosonde launches at using a Vaisala MW31 ground station, RS92 radio-sondes and 350gram balloons. Due to be upgraded to an MW41 system next season.

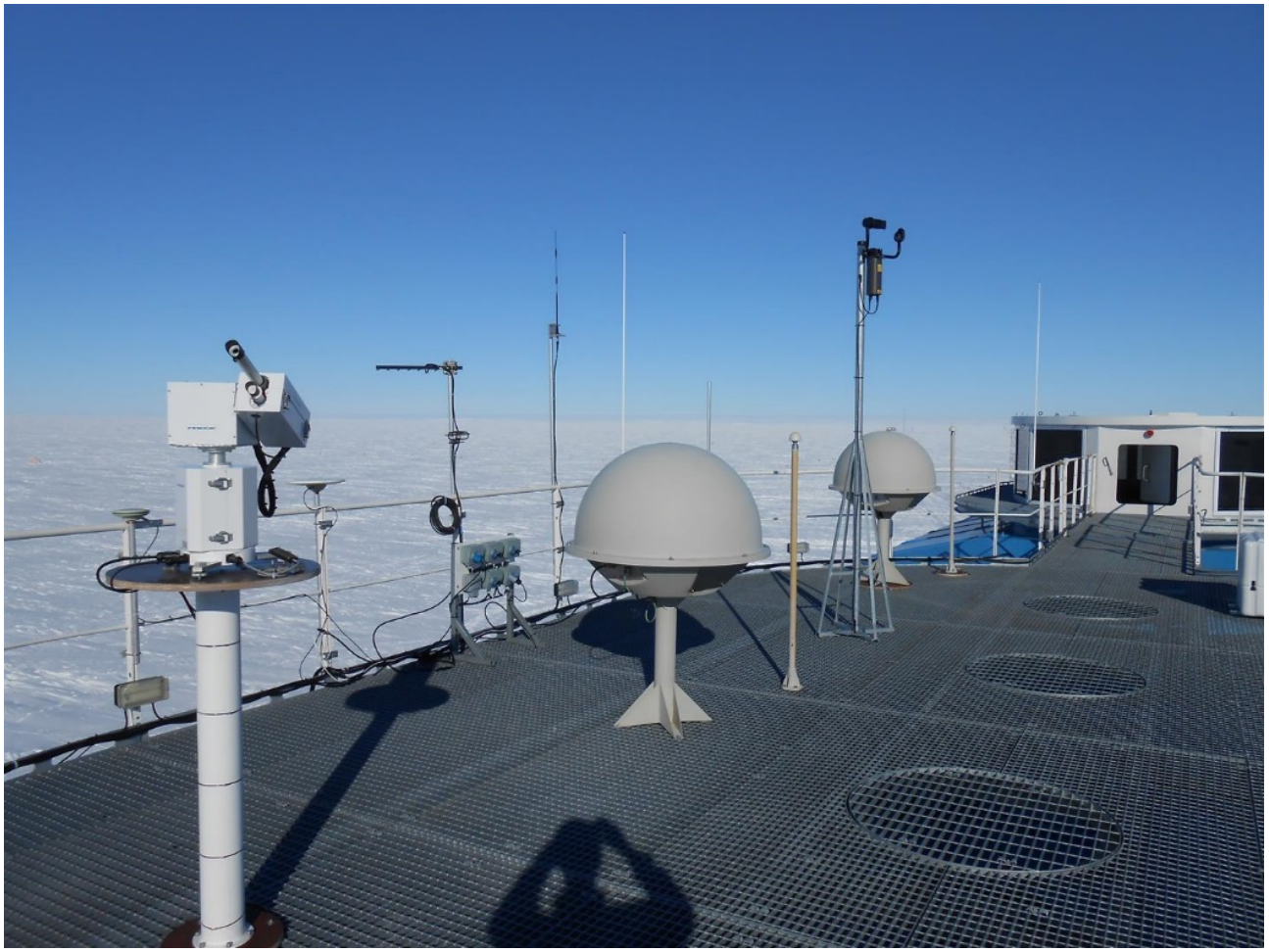


Ozone is measured using a Dobson spectrophotometer



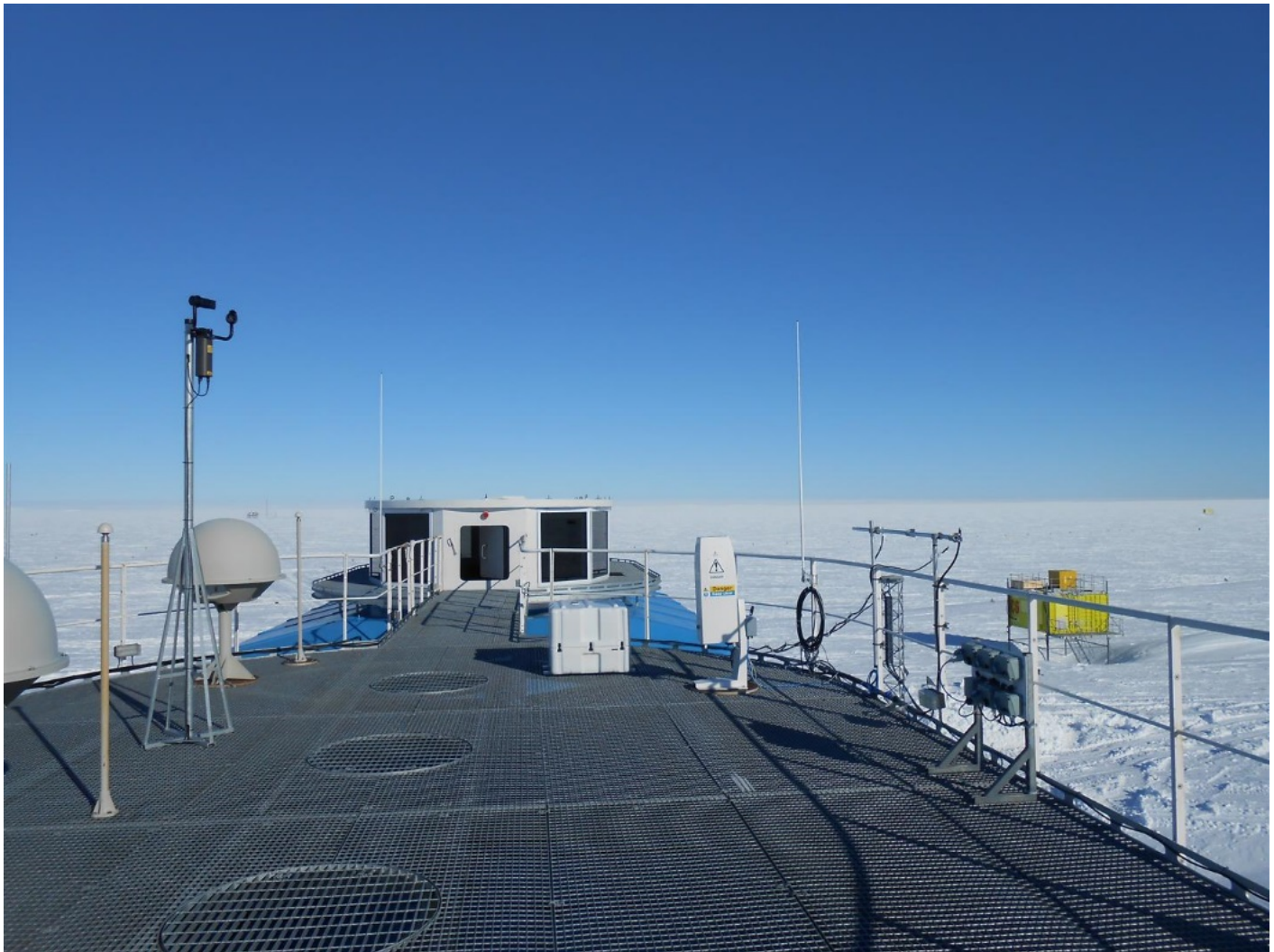
Atmosphere aerosol is measured using a Prede POM-01 sun photometer.

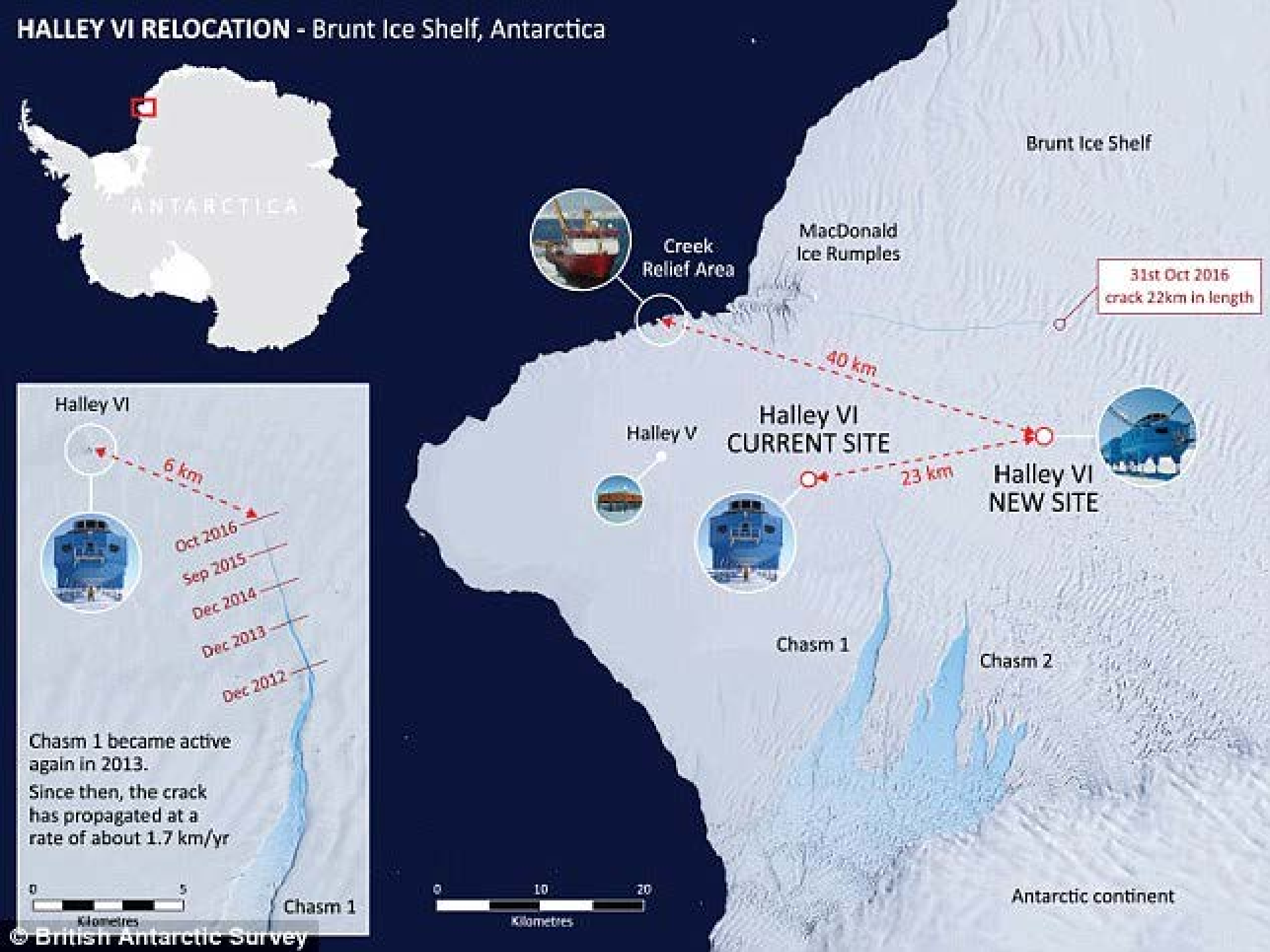
Radiosonde receiver antennas and visibility sensors are mounted on the open deck.



Cloud height is measured using a Vaisala CT25K Ceilometer.

Ozone and NO2 are measured using a SAOZ.





HALLEY VI RELOCATION - Brunt Ice Shelf, Antarctica

Creek
Relief Area

Brunt Ice Shelf

MacDonald
Ice Rumples

10th January 2017
crack 44km in length

40 km

Halley V

Halley VI
CURRENT SITE

23 km

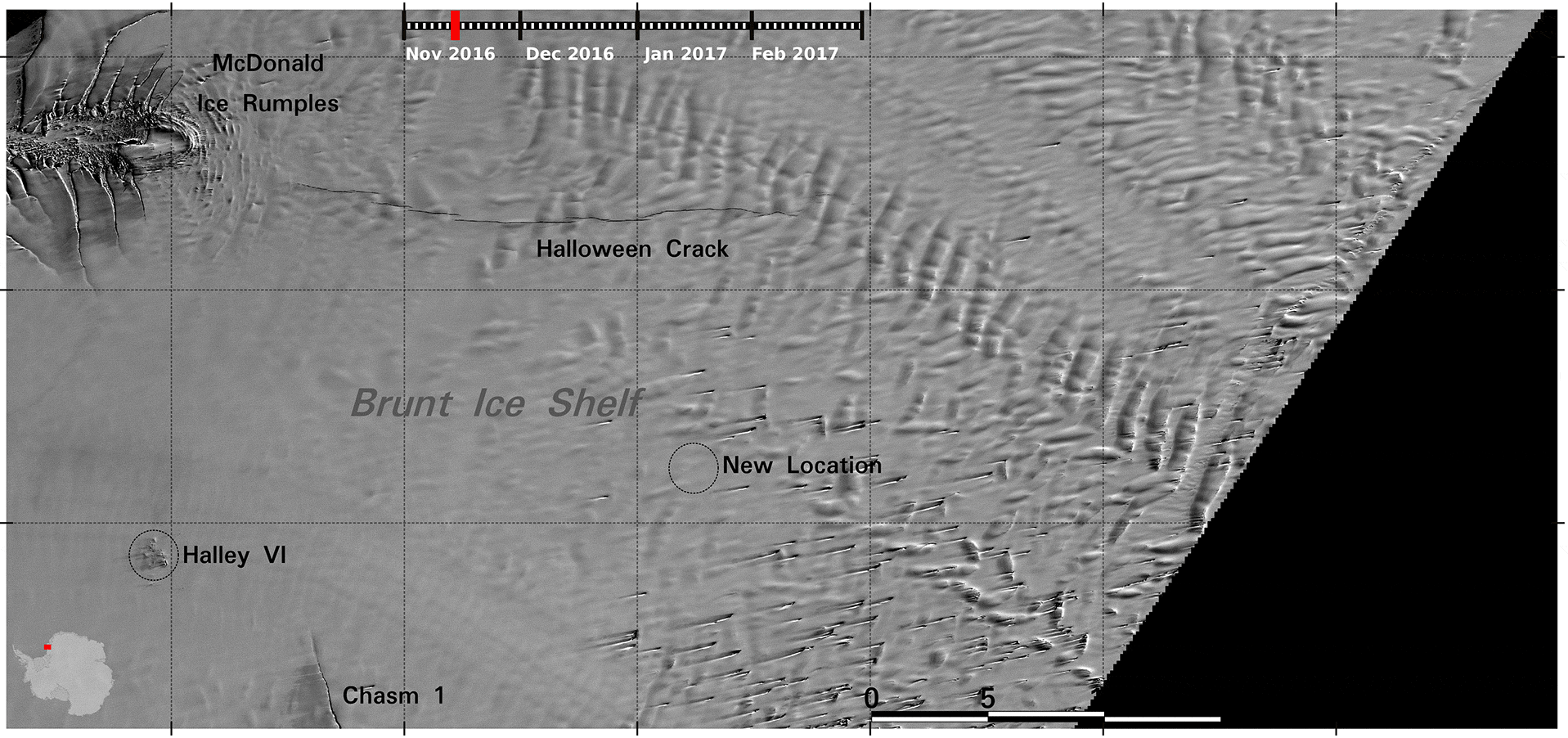
Halley VI
NEW SITE

Chasm 1

Chasm 2

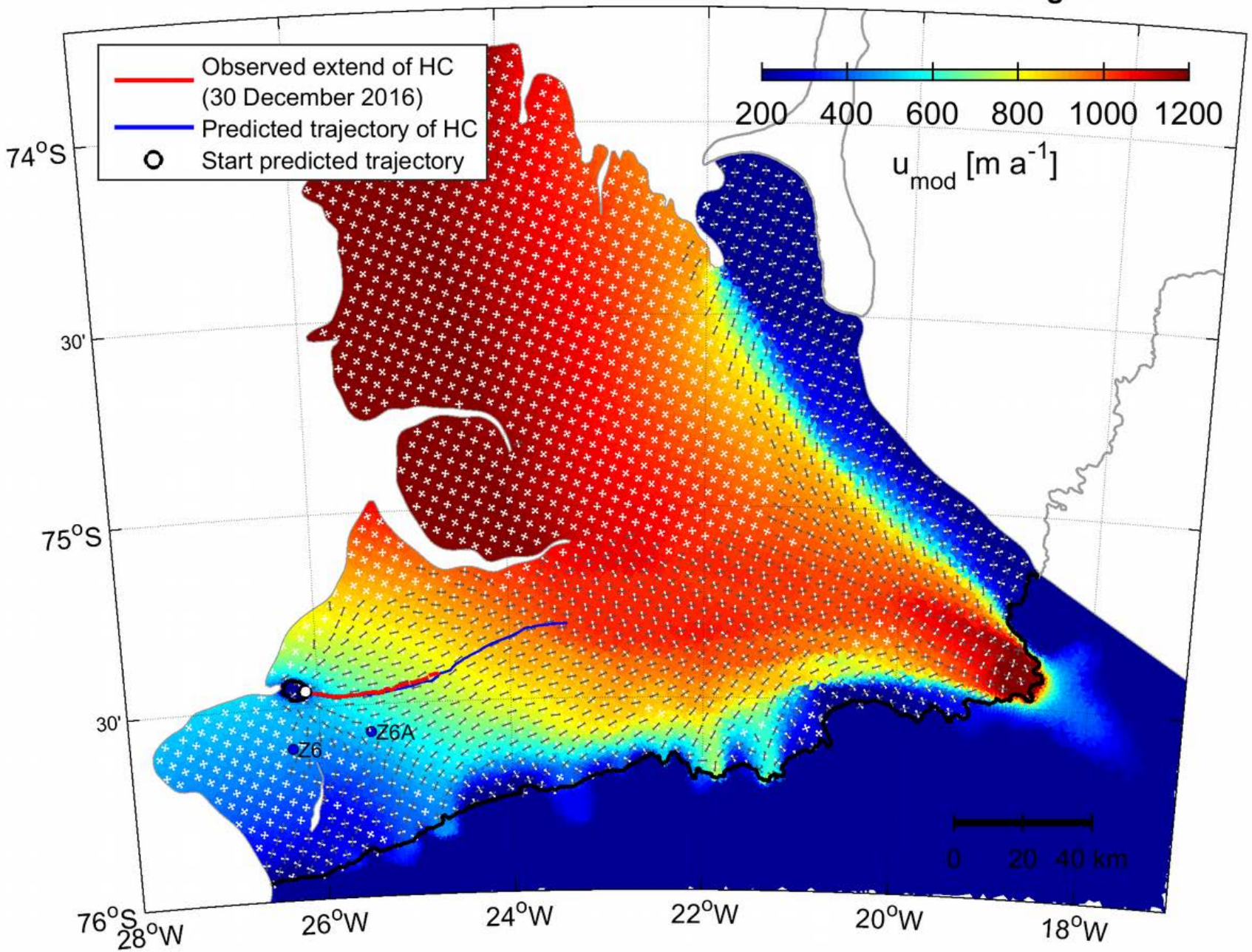
Antarctic continent

0 10 20
Kilometres


Nov 2016
Dec 2016
Jan 2017
Feb 2017
McDonald
Ice Rumples
Halloween Crack
Brunt Ice Shelf
New Location
Halley VI
Chasm 1
0
5

7th January 2017

27th January 2017


Model velocities for Brunt Ice Shelf and Stancomb Wills Tongue
Observed extend of HC
(30 December 2016)
Predicted trajectory of HC
Start predicted trajectory
200 400 600 800 1000 1200
u mod [m a-1]
74°S
30'
75°S
30'
76°S
28°W
26°W
24°W
22°W
20°W
18°W
Z6
Z6A
0 20 40 km

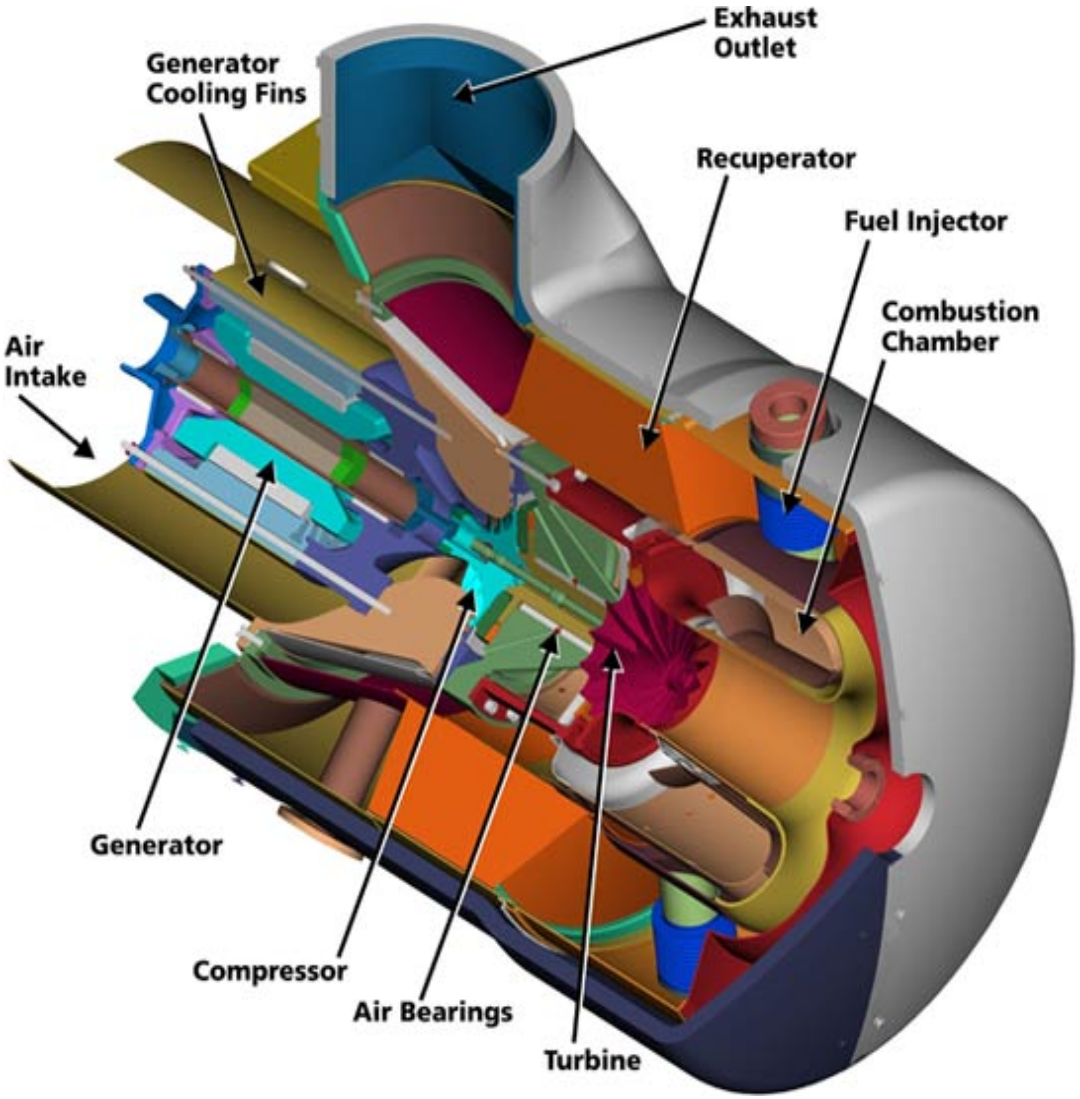
The future

- BAS is planning on wintering at Halley in 2018, a final decision will be made in January 2018.
- We are planning to automate many of the instruments but then there is a remote power requirement.
- Some instruments require mains power and heating.
- Some can run on lower power 100-200W
- Some very low power ie up to 5W


2
3


HC100

Micro-jet turbine



https://www.youtube.com/watch?v=_-hTEb-nsJw

Methanol fuel cell

Automation

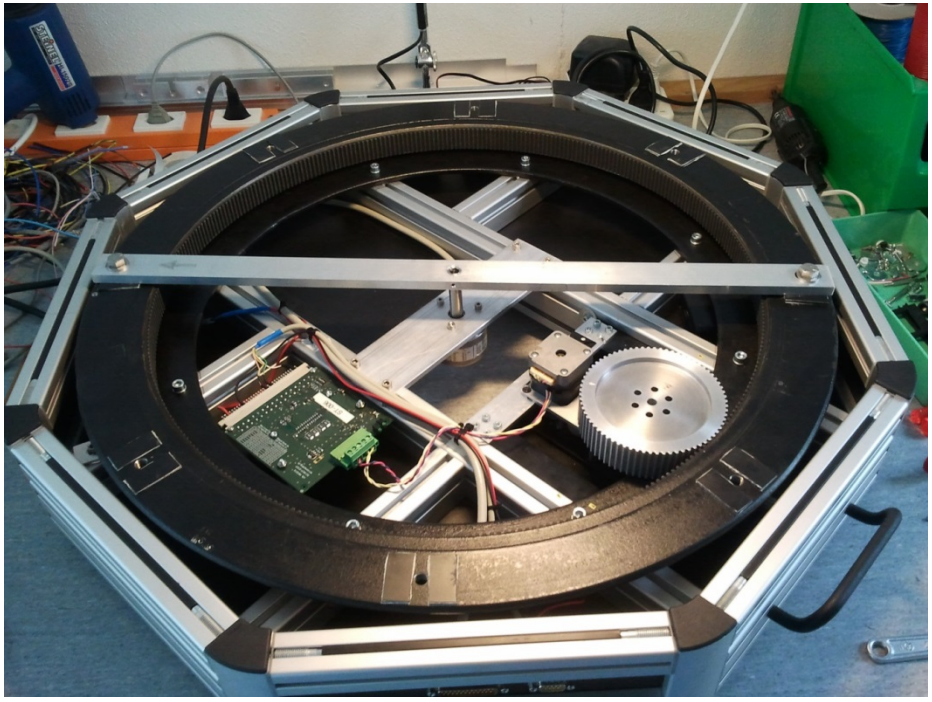
- It is not possible to automate the radiosonde launches for a whole winter (8 months).
- There are two AWS already on site for the basic meteorological data, these are running on solar panels and batteries.
- The SAOZ instrument will be powered by a methanol fuel cell.
- Meto-swiss have already automated a Dobson and we are going to copy this system but this will require mains power.

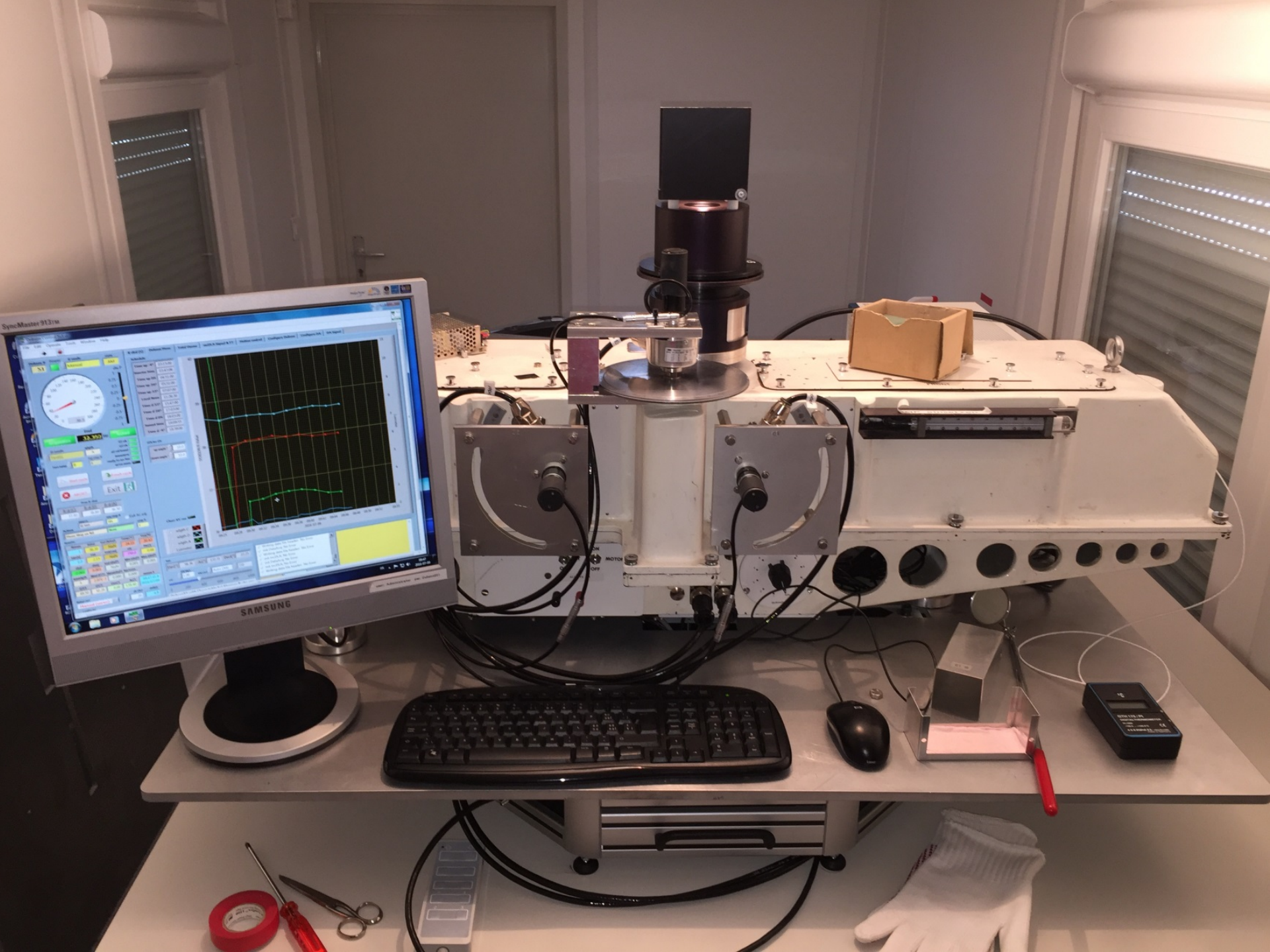
Auto-Dobson

Dobson + electronic

Rotating table

Lifting table




SyncMaster 913m
SAMSUNG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