



An Aircraft-Deployable GPS Stake Network for Antarctic Glaciers

Design of Aircraft-Deployable Sensors

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Networks of Sensors – Annual Technology Showcase
“Pilot Installations and Practical Outcomes” - 27th January 2014



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Overview

I keep six honest serving-men
(They taught me all I knew);
Their names are What and Why and When
And How and Where and Who.
- Rudyard Kipling



What – Science objectives

Why – Instrumenting the impossible to reach

When – Overview of project

How – development of ADIOS(Air Deployable Ice Observation System)

Where – Pilot installation on to Pine Island Glacier

Who – Thanks to all those involved



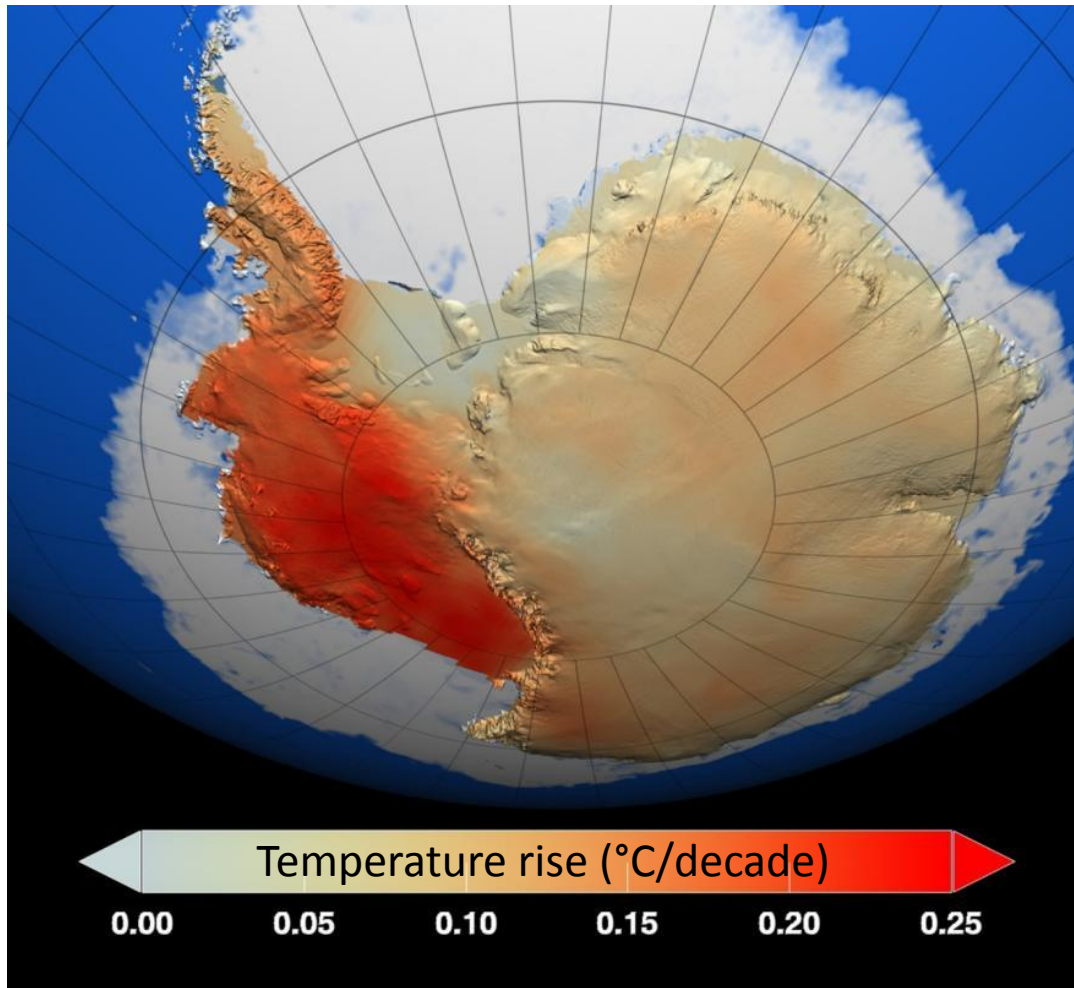
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FOR PLANET EARTH

Science (What)



- Temperature rise



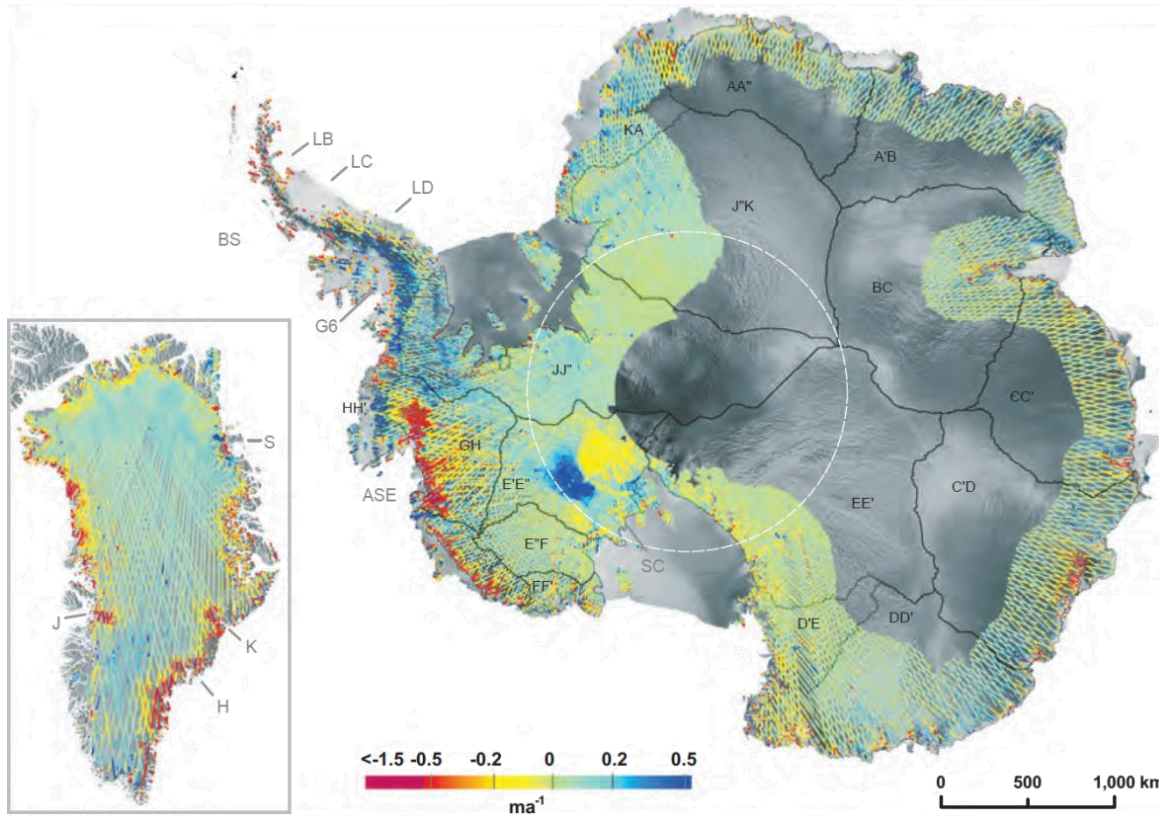
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Science (What)



- Temperature rise
- Elevation

Hamish Pritchard et al



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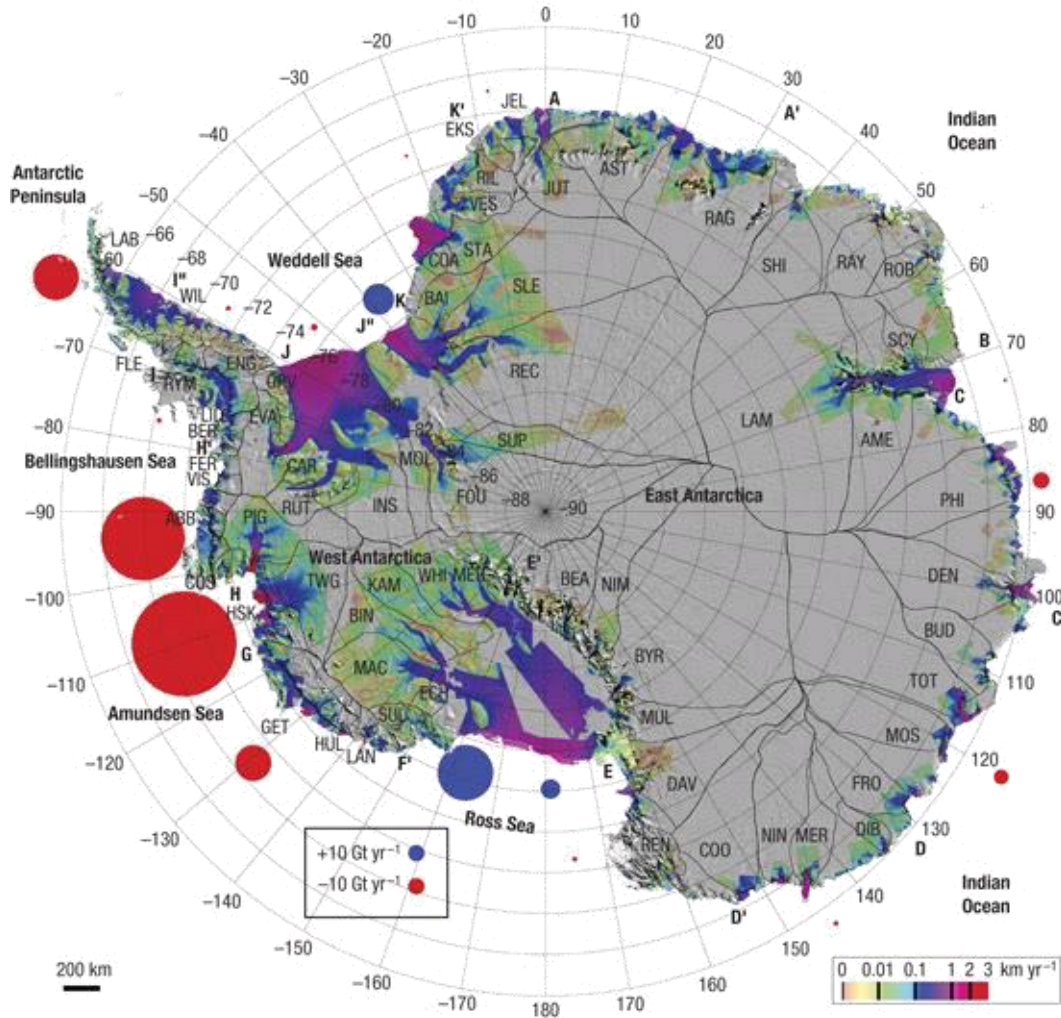
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Science (What)

- Temperature rise
- Elevation
- Mass loss and gain



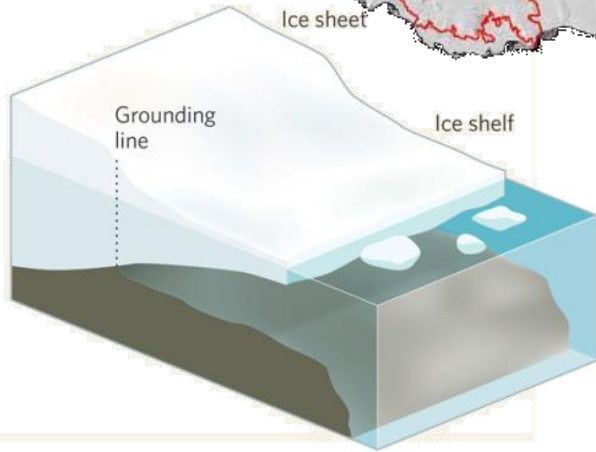
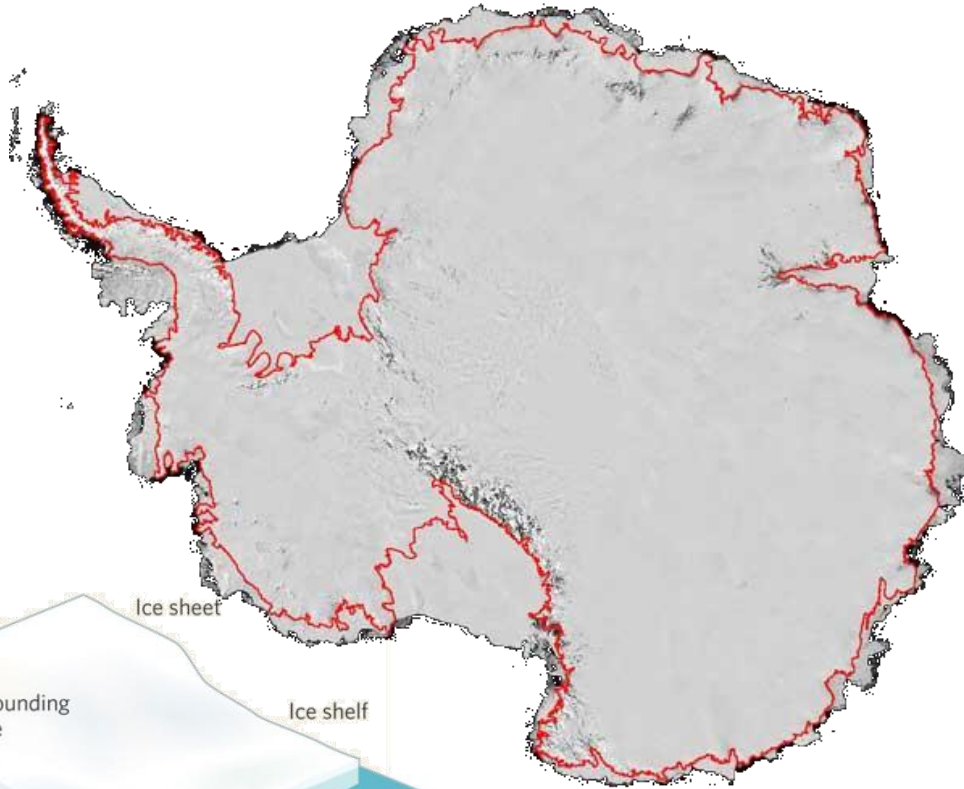
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Science (What)



- Temperature rise
- Elevation
- Mass loss and gain
- Coastal glacier areas of great interest
- Ice sheet models
- Wider modelling



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Why do we need ADIOS



- Inaccessible
- Dangerous
- No near logistical support hub
- No near safe landing for aircraft
- Unsafe for over land traverse



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When



- Air deployable sensor stake conceived
- Grant submission Q1 2010
- Grant awarded Q4 2010
- Initial testing to capture key parameters Q1 2011
- Project team established 2011; David Jones
- 2011 development of concept demonstrators
- 2011/12 season testing and evaluation of demonstrators (7 variants)
- 2012 refinement, testing, validation and productionisation of chosen design
- 2012/2013 season deployment Pine Island 26 and Scar Outlet 5 active ADIOSs
- 2013 further design refinement, testing and certification, test dual band GPS ADIOS created
- 2013/2014 season Thwaites deployment



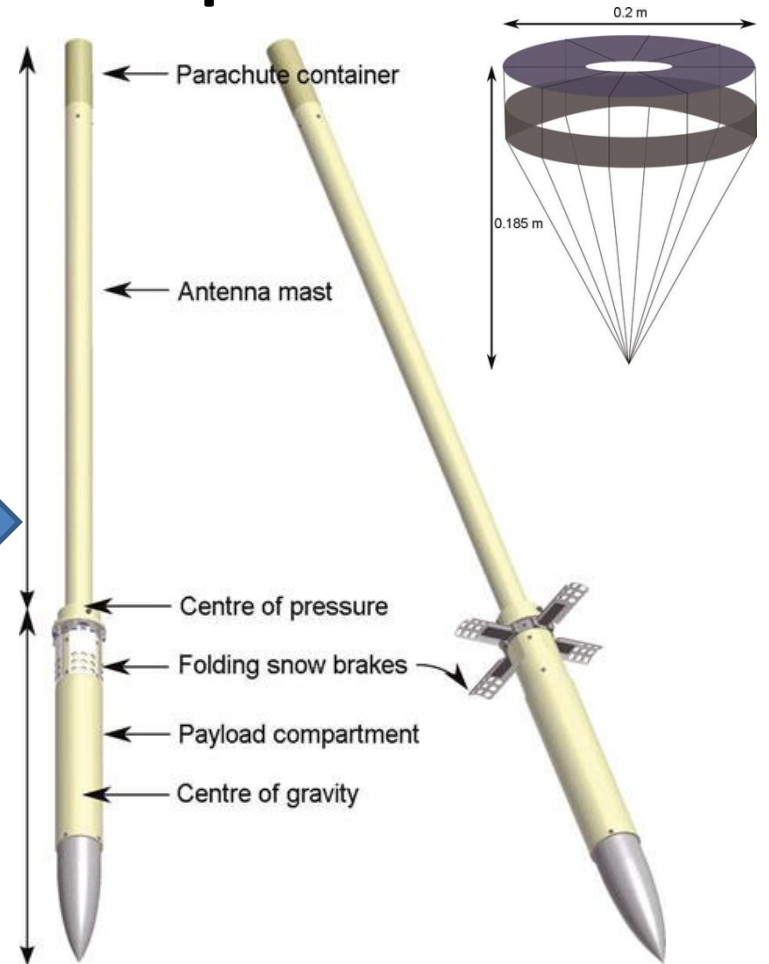
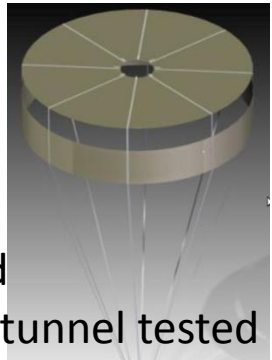
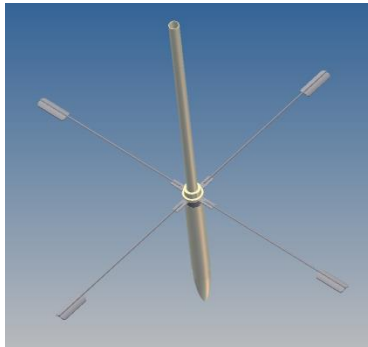
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How - ADIOS Development



4 designs modelled
6 prototypes wind tunnel tested
7 prototypes tested in Antarctica



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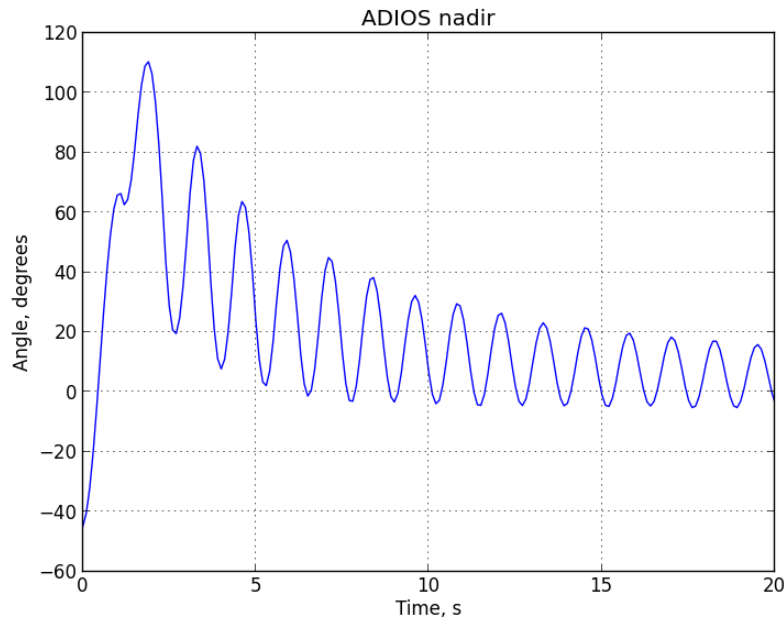


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How - ADIOS Development

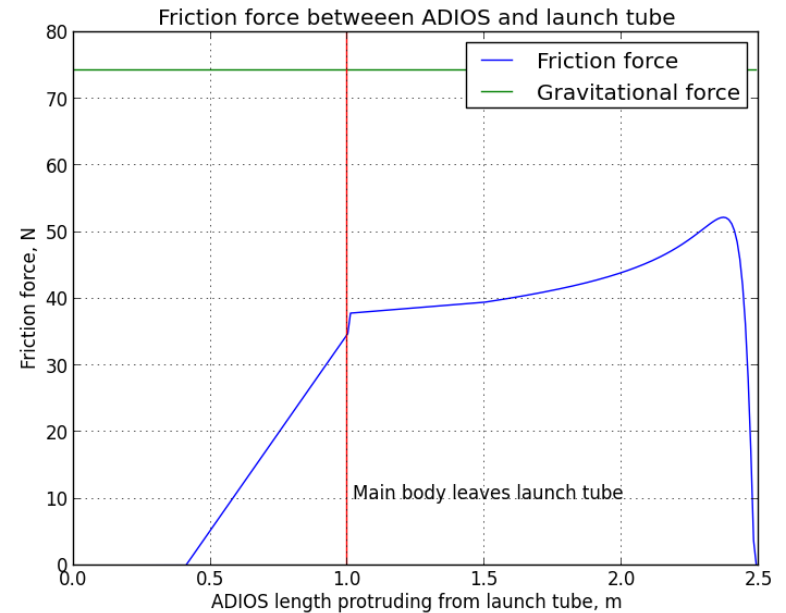
Model

ADIOS Stability Modelling



David H. JONES

ADIOS exit modelling



David H. JONES



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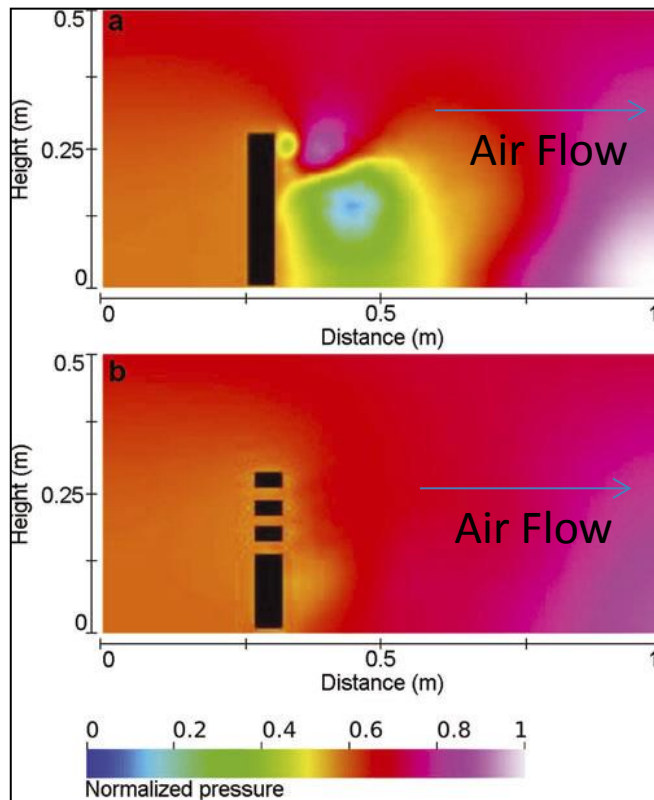


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How - ADIOS Development

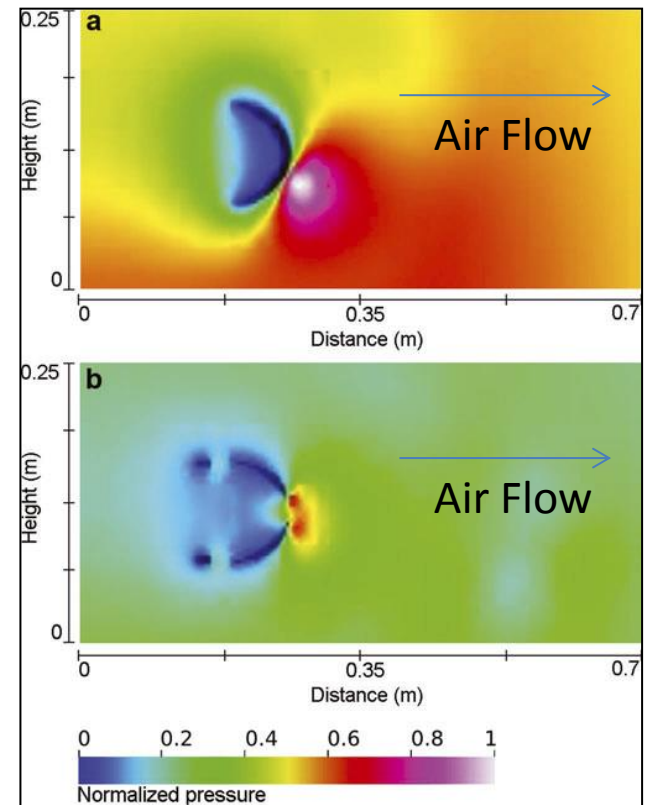
Model

Snow Brake – Finite Element Model



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Chute – Finite Element Model



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How - ADIOS Development

Testing / Analysis / Verification

Wind Tunnel Testing



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Drop Tests



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How - ADIOS Development

Testing / Analysis / Verification

Electronics Testing



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- Signal to noise antennas
- GPS receiver testing
- Iridium testing
- Hardware testing
- Software testing
- Systems testing
- Interface testing
- Environmental testing



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How - ADIOS Deployment

Field Deployment



- 2010 – 2012 deployment and design refining
- 2012/13 season initial practice drops prior to network deployment
- 2013/14 drift sight introduced to improve accuracy of deployment



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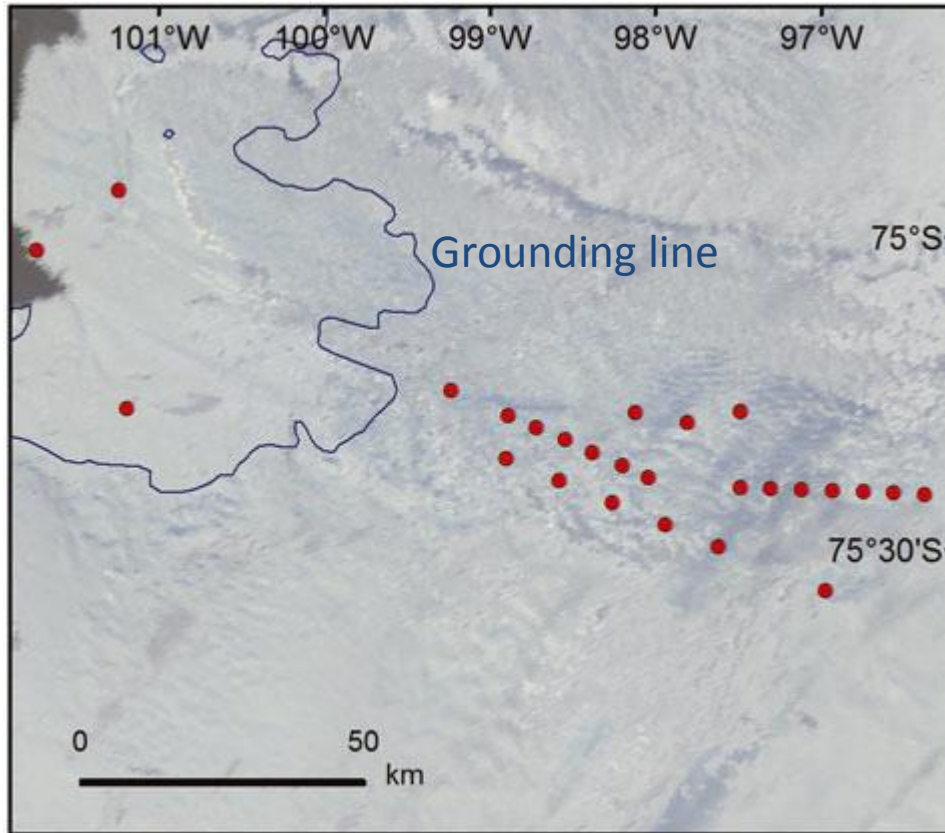
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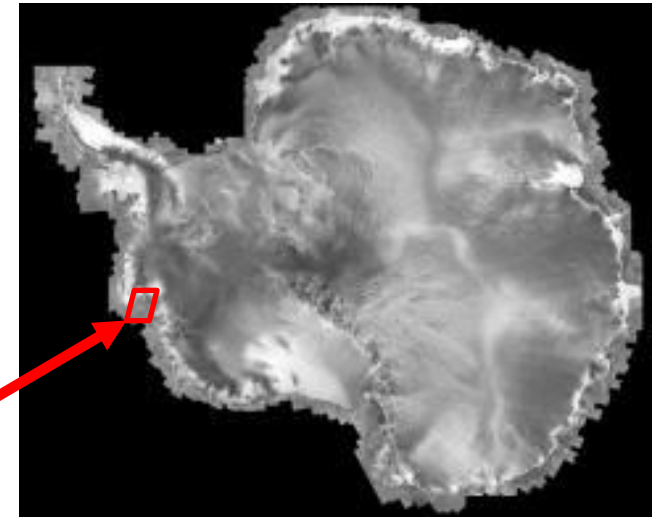
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Where – Pine Island Glacier Deployment

Deployment



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- 37 deployed
- 26 ADIOS active
- 11 lost down crevasses
- 2nd – 10th Jan 2013
(Rothera to Rothera)



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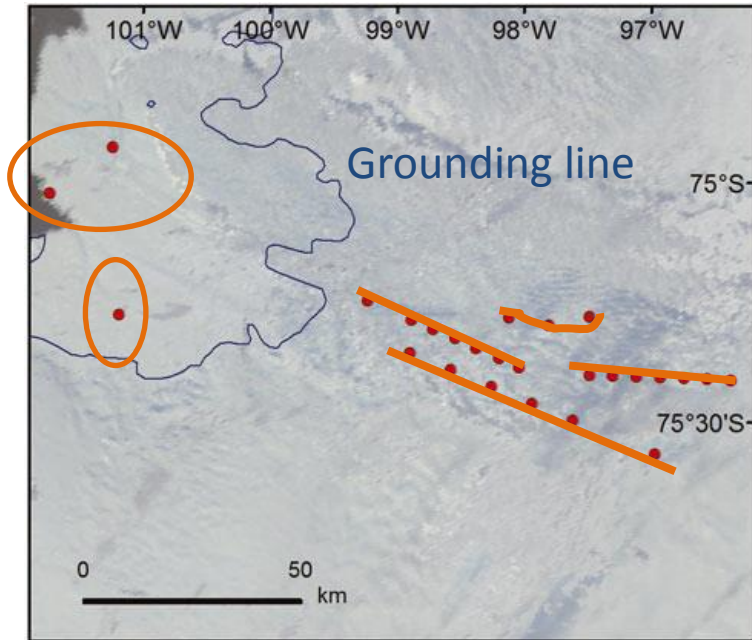
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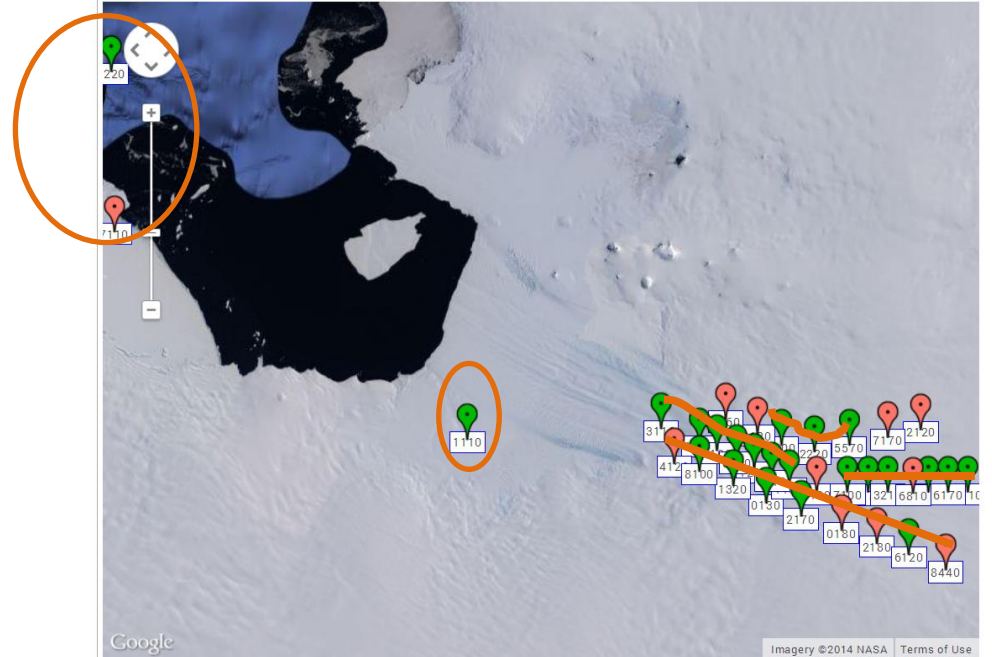
Where – Pine Island Glacier Deployment

Deployed



Today

B31



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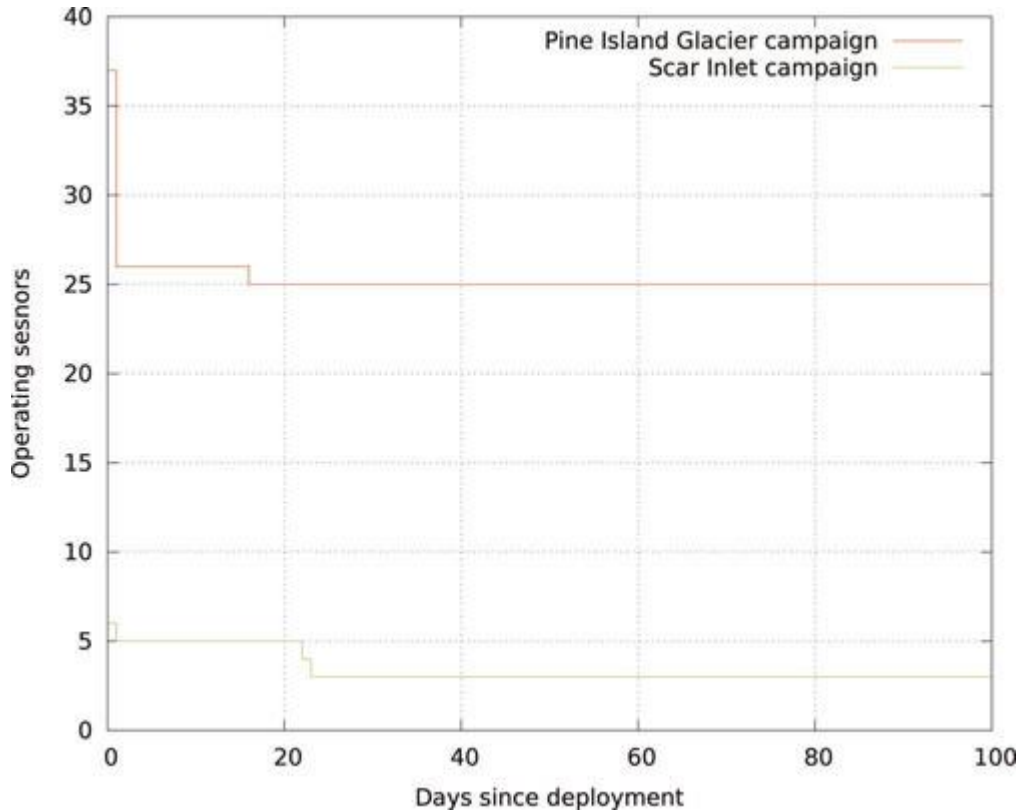
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Where – Pine Island Glacier Deployment

Operational ADIOS



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- 37 deployed
- 26 ADIOS active initially
- 1 disappeared after 16 days crevasse/snow bridge?
- Today 23 Pine Island ADIOSs reporting in daily



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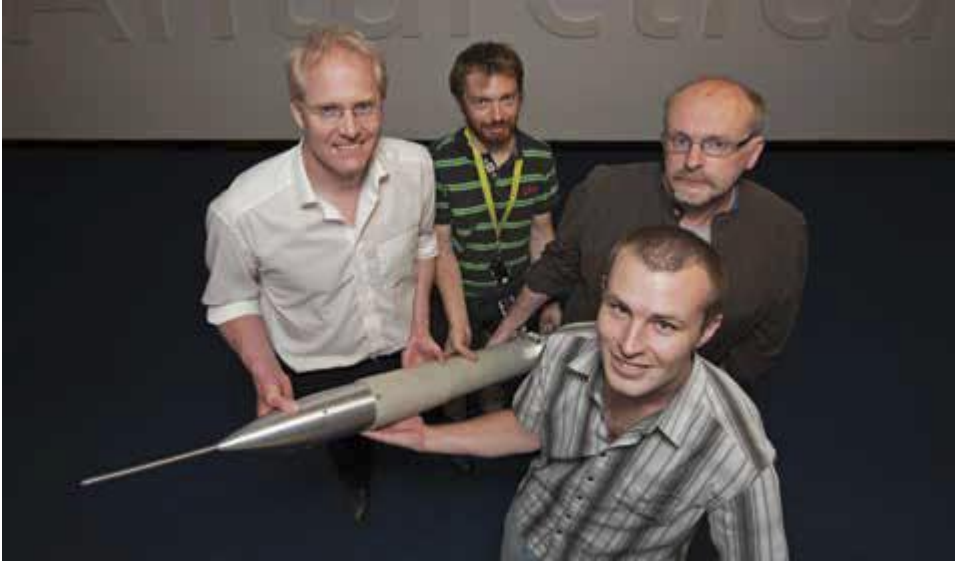
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Who

Project team



Cambridge Staff

- Chief pilot
- Air unit
- Antarctic Marine Engineering
- Logistics
- Operations

Rothera Base Staff

- Chief Pilot
- Pilots
- Field Assistants
- Mechanics
- Air mechanics
- Field operations
- Chefs
- Engineers
- and many more

Thank You!



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Future?

- **Dual band GPS**
- **Thwaites deployment**
- **Sea Ice Sensor neTwork deployed from Aircraft (SIESTA) – Passive gimballed antennas, new chute, refined sea ice platform body**
- **Further sensors**
- **Future deployments**



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A large-scale photograph of an Antarctic ice wall. The ice shows distinct horizontal layers of different colors, from white to deep blue, indicating different ages and compositions of ice. In the foreground, a large colony of penguins is gathered on a flat, dark ground. To the right, a small aircraft is parked on the ground, with several people standing nearby. The scene is brightly lit, suggesting a clear day.

Questions?



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