

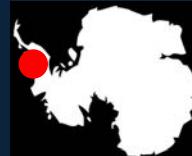
# Sentinel-1: Measuring Ice Speed

A. Hogg & A. Minchella



**CATAPULT**

We work with  
**Innovate UK**

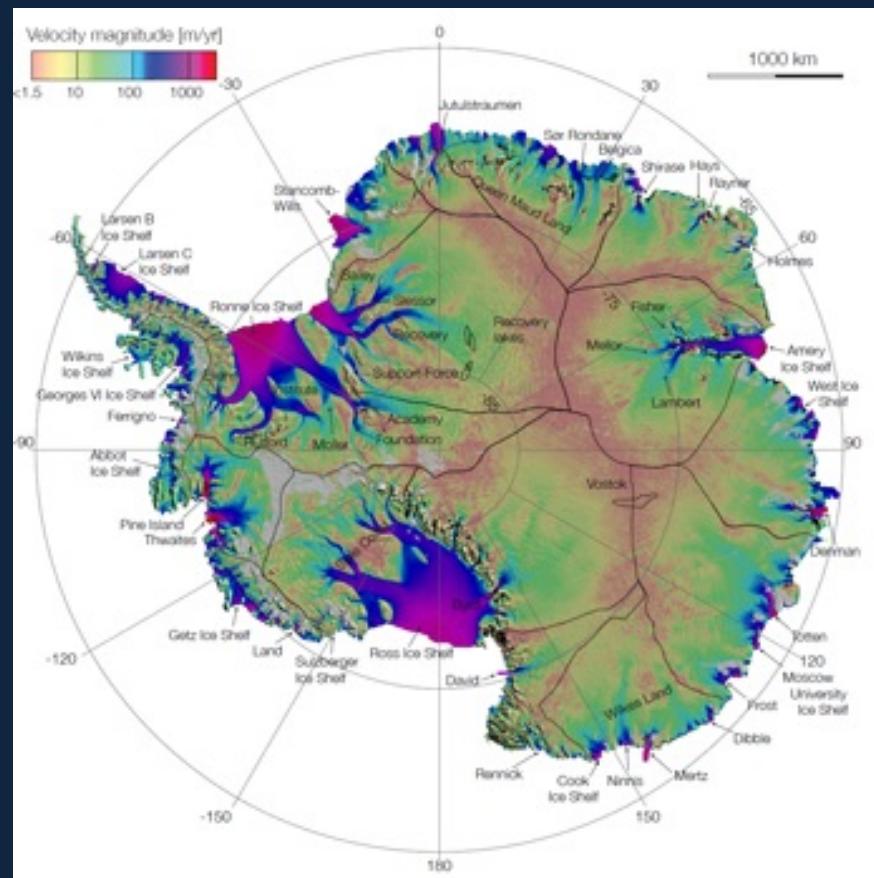


# — Contents —

1. Why is ice velocity an important measurement?
2. Where has change in ice speed been observed?
3. Advantages of Sentinel-1
4. Techniques used for measuring ice speed
5. Overview of study area and data used in this computer practical
6. Overview of ESA SNAP toolbox (A. Minchella)

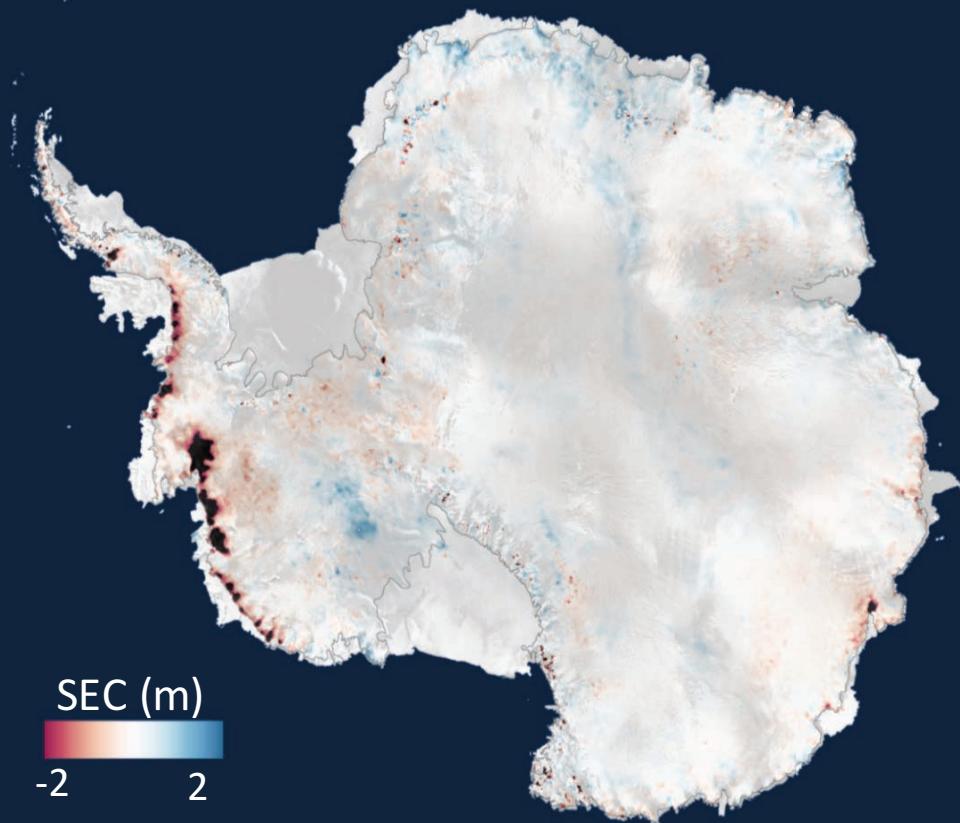
# Importance of ice velocity measurements

- Ice velocities have increased in areas of rapid ice thinning
  - Change in ice speed is indicative of mass imbalance
- Speedup linked to dynamical imbalance caused by ocean warming
  - Informs us about physical processes causing change
- Ice velocity is an important parameter used in ice sheet models
  - Helps us predict the onset and magnitude of ice sheet contribution to future sea level rise



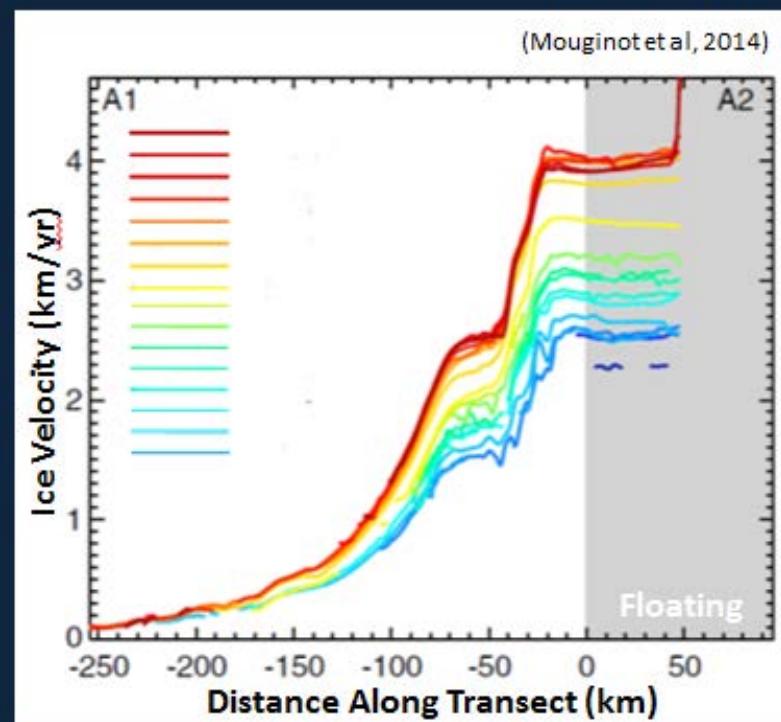
# — Change in ice speed: Long term —

CryoSat-2 Surface elevation change  
2010 - 2014

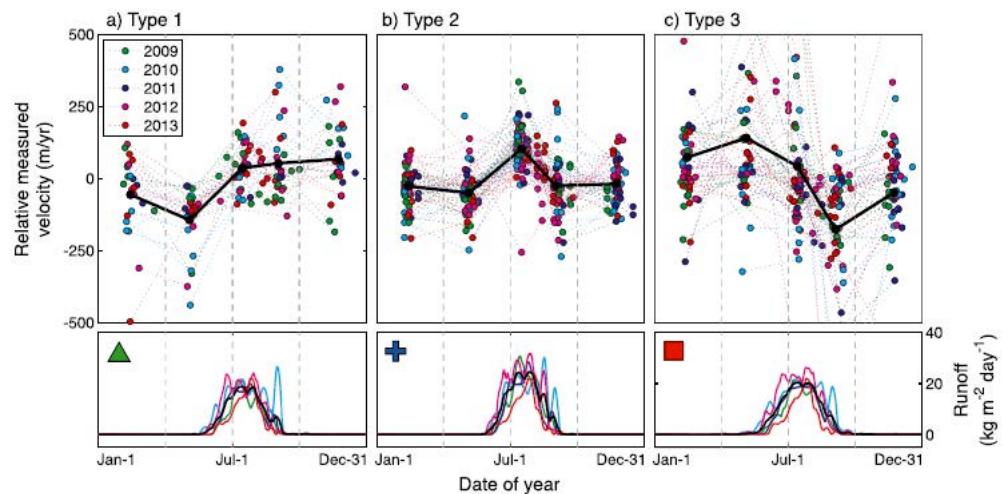
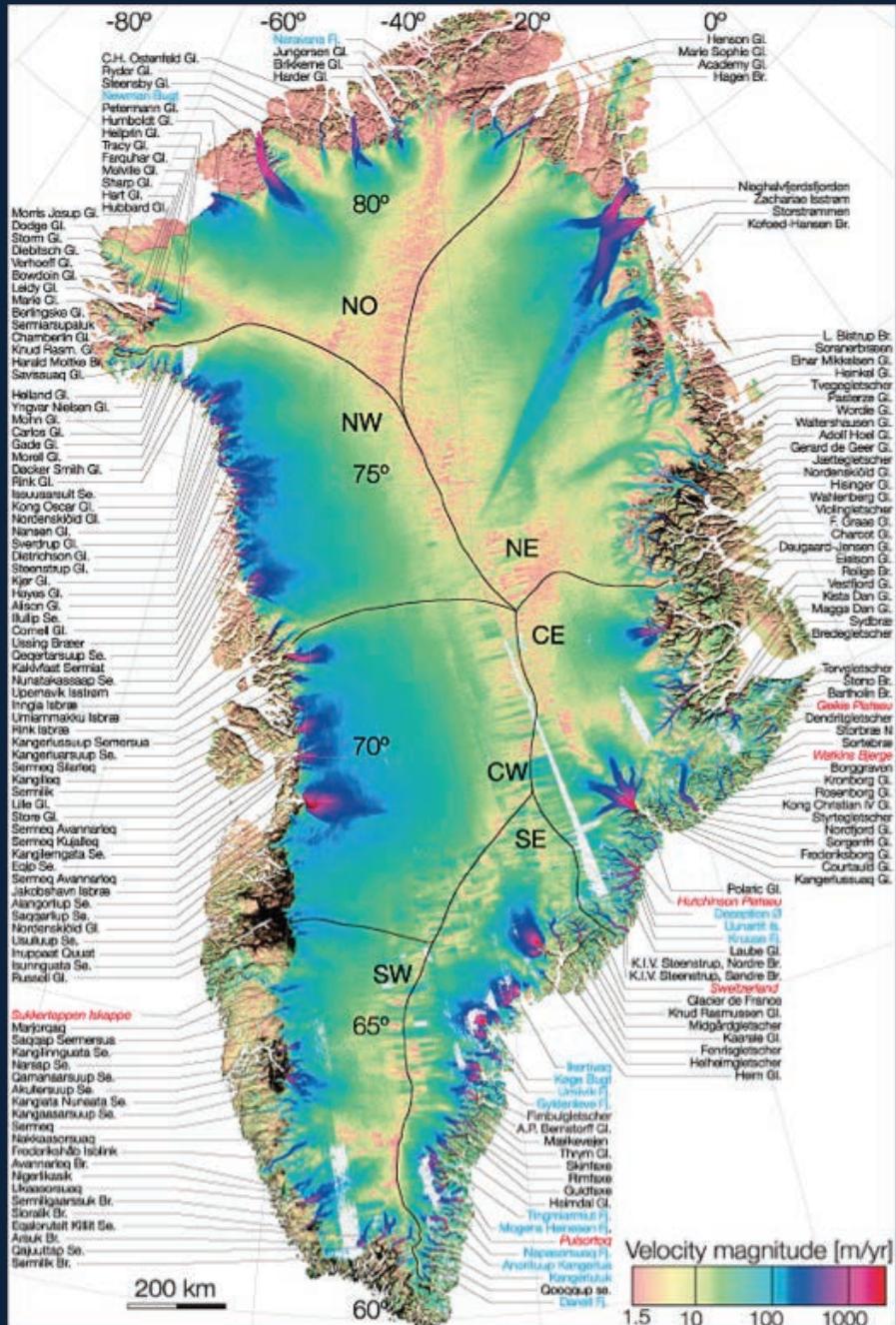


(McMillan et al, 2014)

Ice velocity speed-up  
1994 – 2010



# — Change in ice speed: Long term —

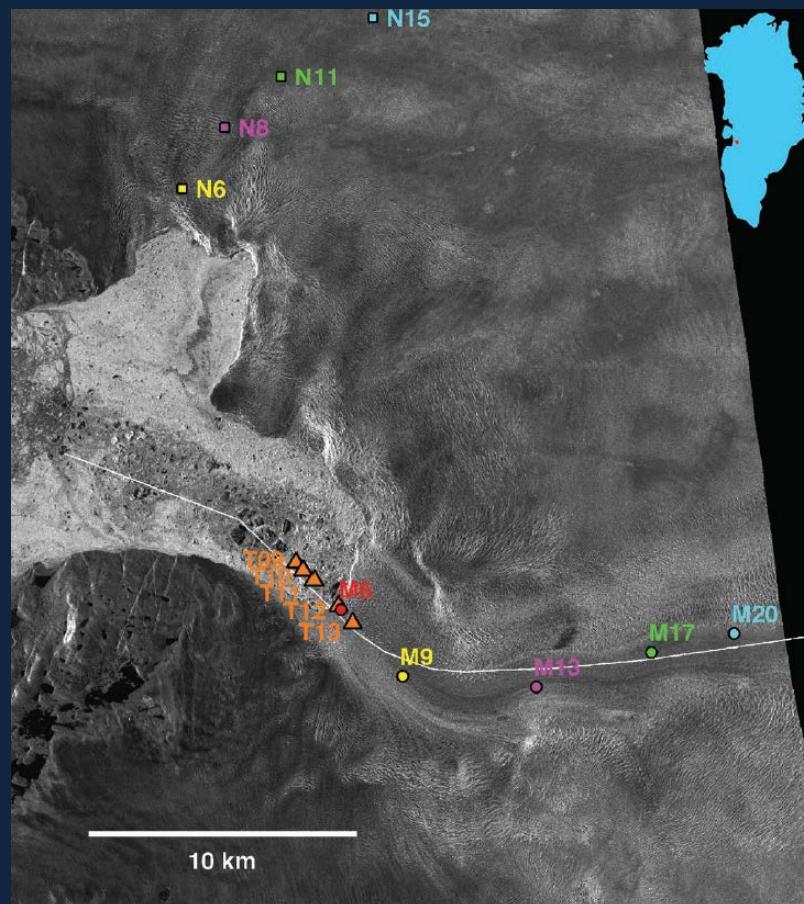
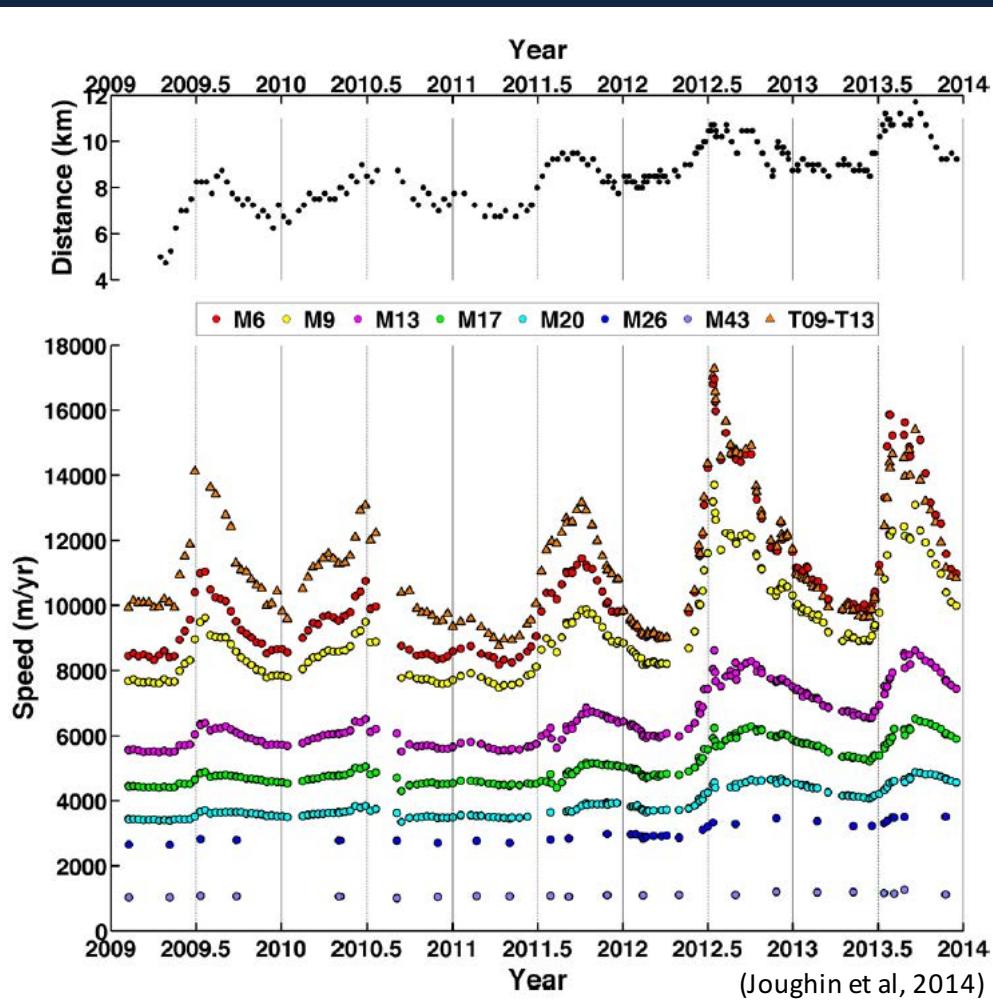


(Moon et al, 2014)

(Mouginot et al, 2014)

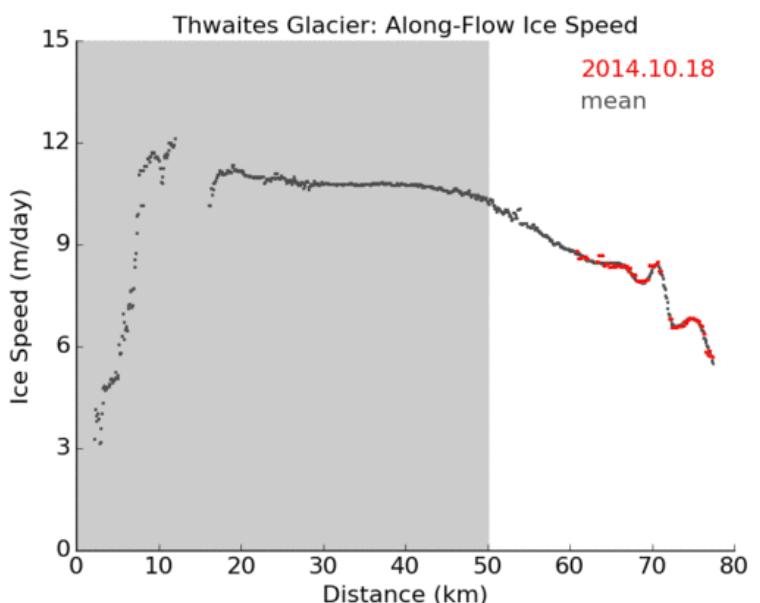
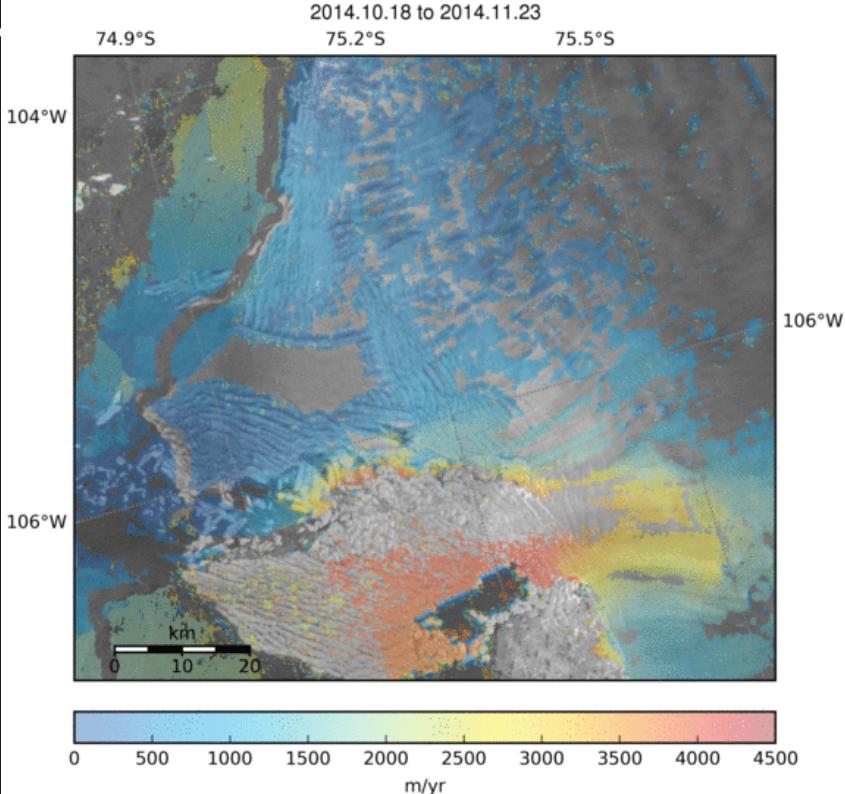
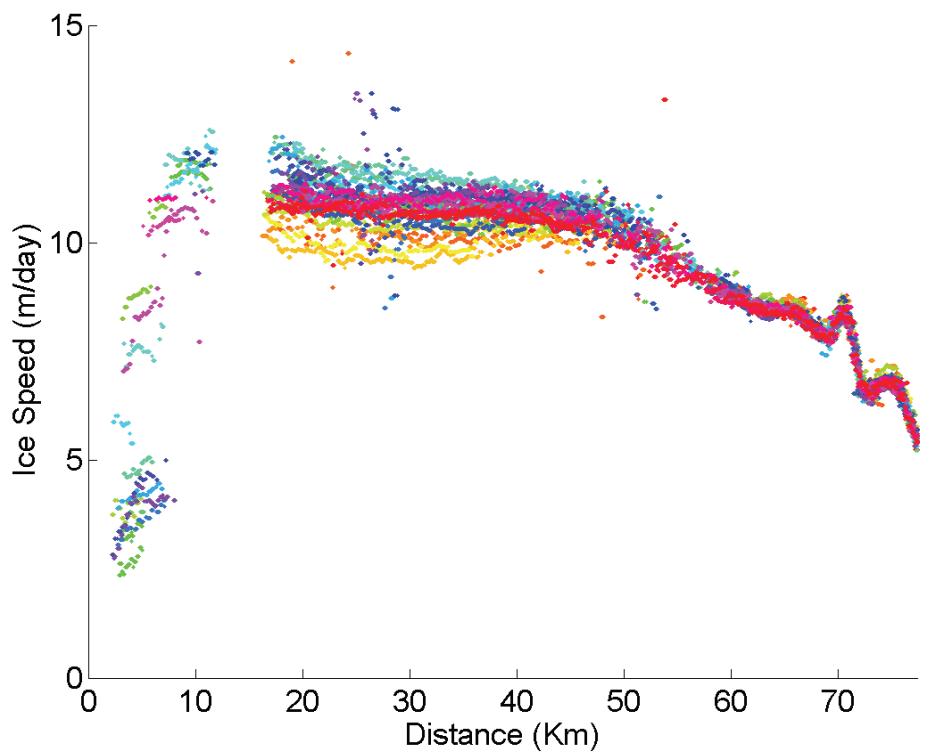
# — Change in ice speed: Short Term —

Seasonal ice velocity speedup on  
Jackobshavn Isbrae, Greenland



# Change in ice speed: Short T

Tidally Thwaites Glacier, Antarctica



# — Advantages of Sentinel-1 —

## Advantage

1. Frequent repeat acquisitions

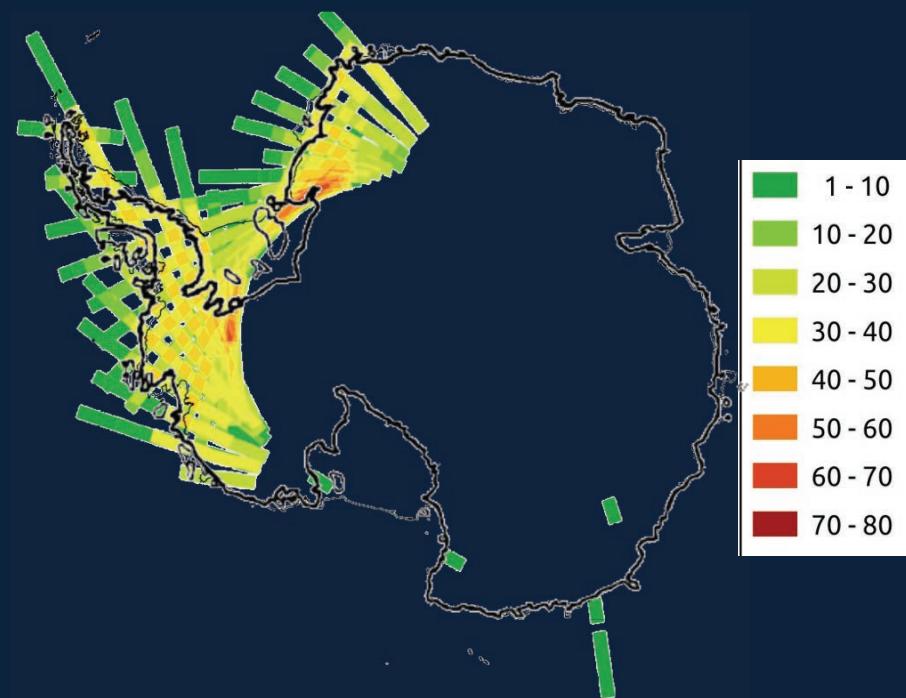
ERS-1/2

35-day

Sentinel-1

12-day

**ERS-1: Ice Phase 1**  
Dec 1991 – March 1992



**Sentinel-1**  
Last Month !!  
(Aug 2016)

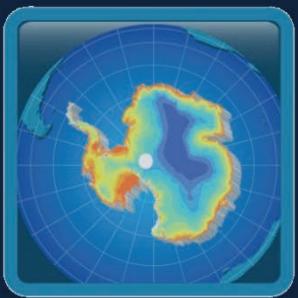


# Techniques used for measuring ice speed

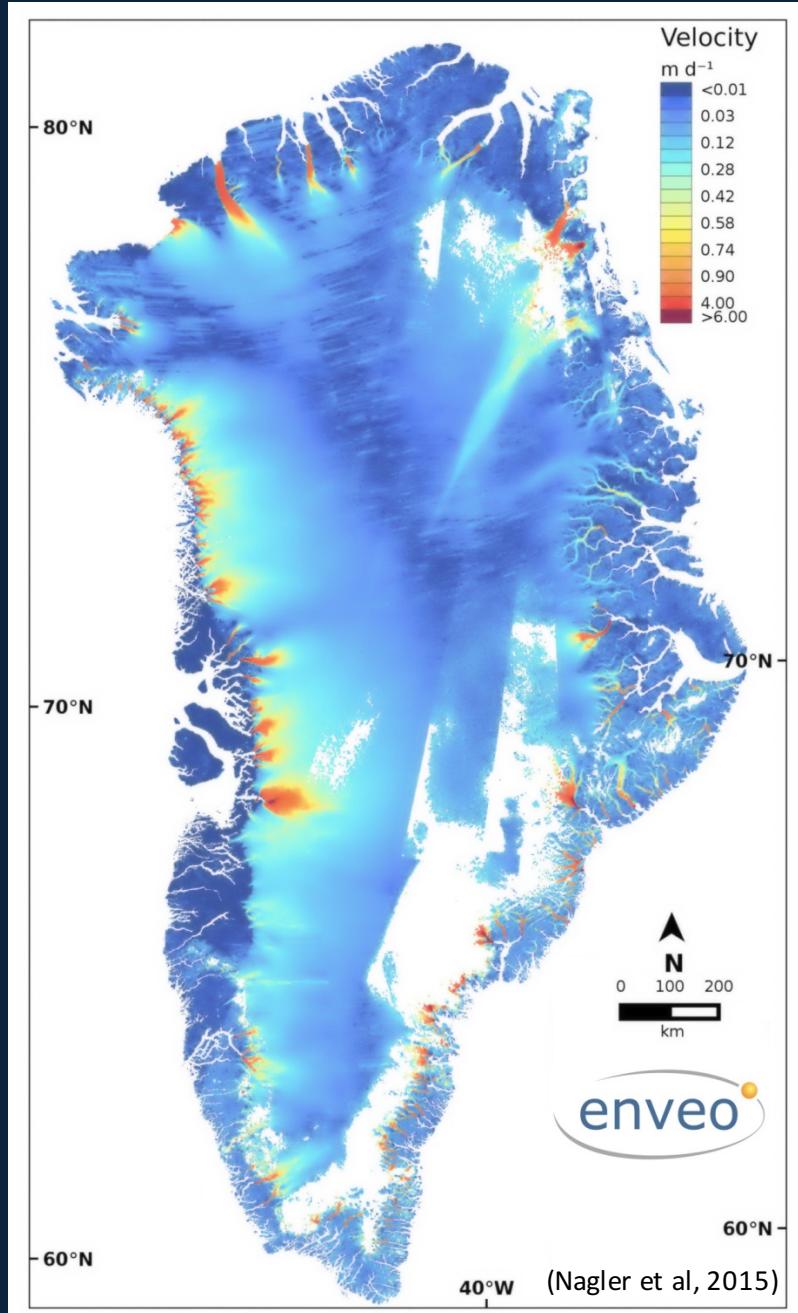
- Full ice sheet coverage
- Greenland – winter 2014/15
- Antarctica – ongoing now



greenland  
ice sheet  
cci



antarctic  
ice sheet  
cci



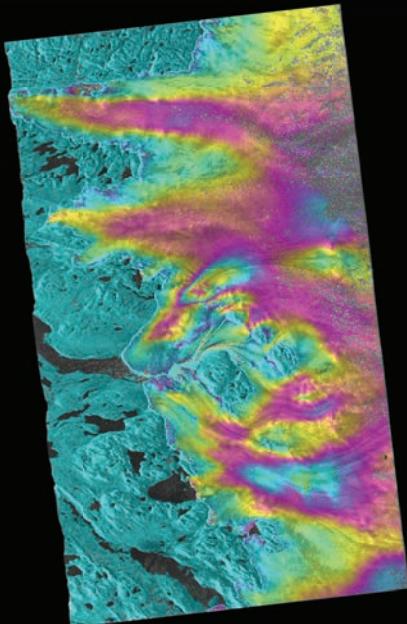
# Techniques used for measuring ice speed

1. InSAR

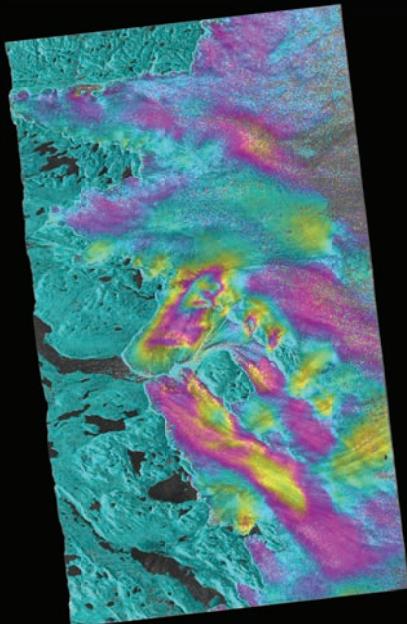
2. Coherent feature tracking

3. Intensity feature tracking

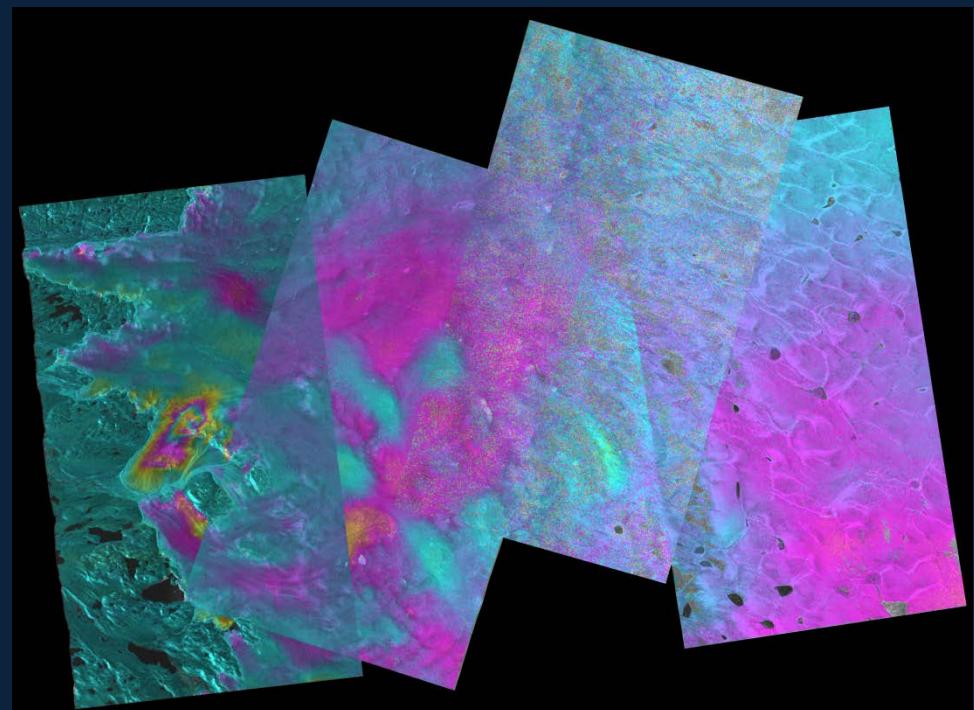
Phase



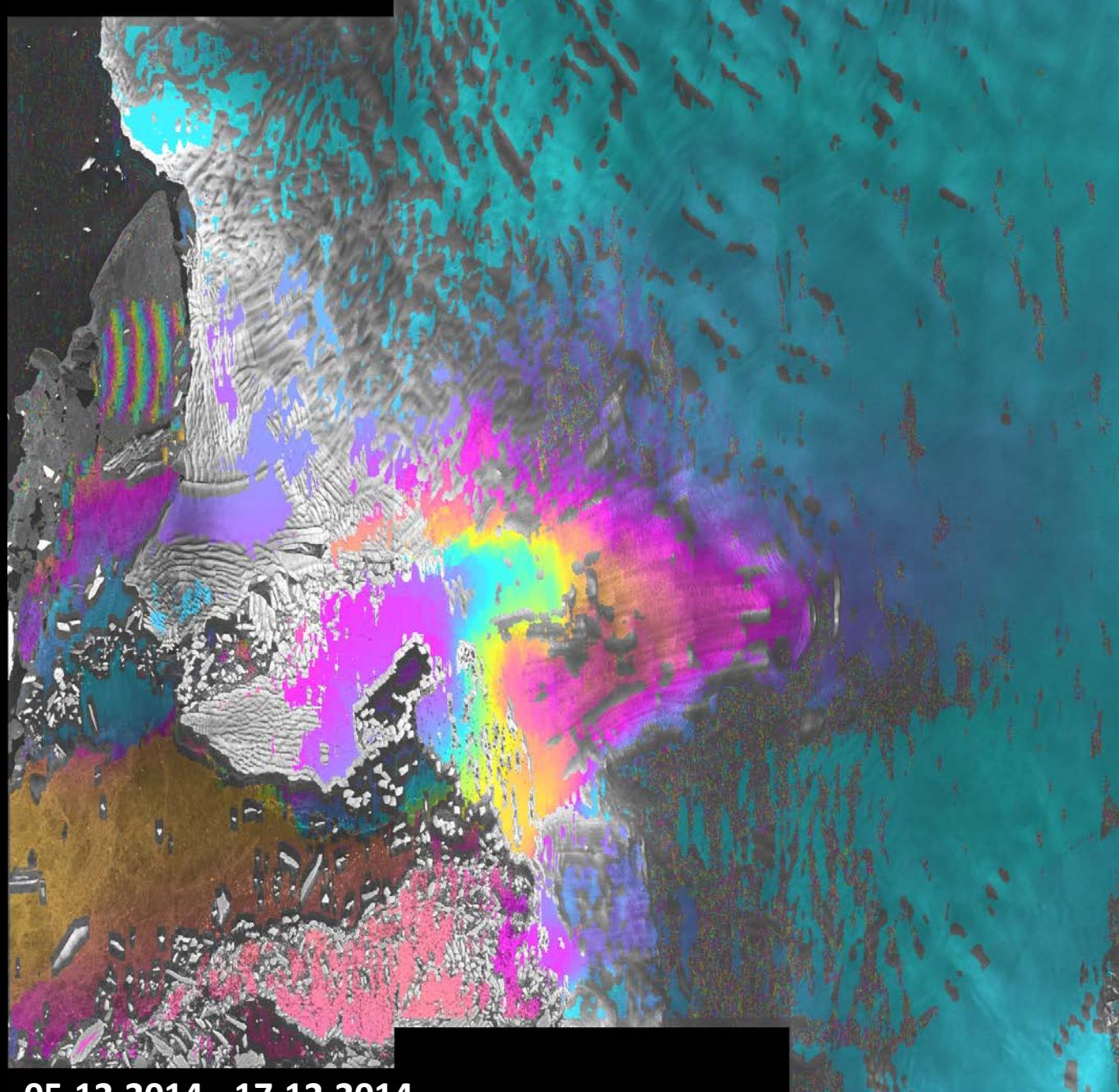
Phase



Amplitude features



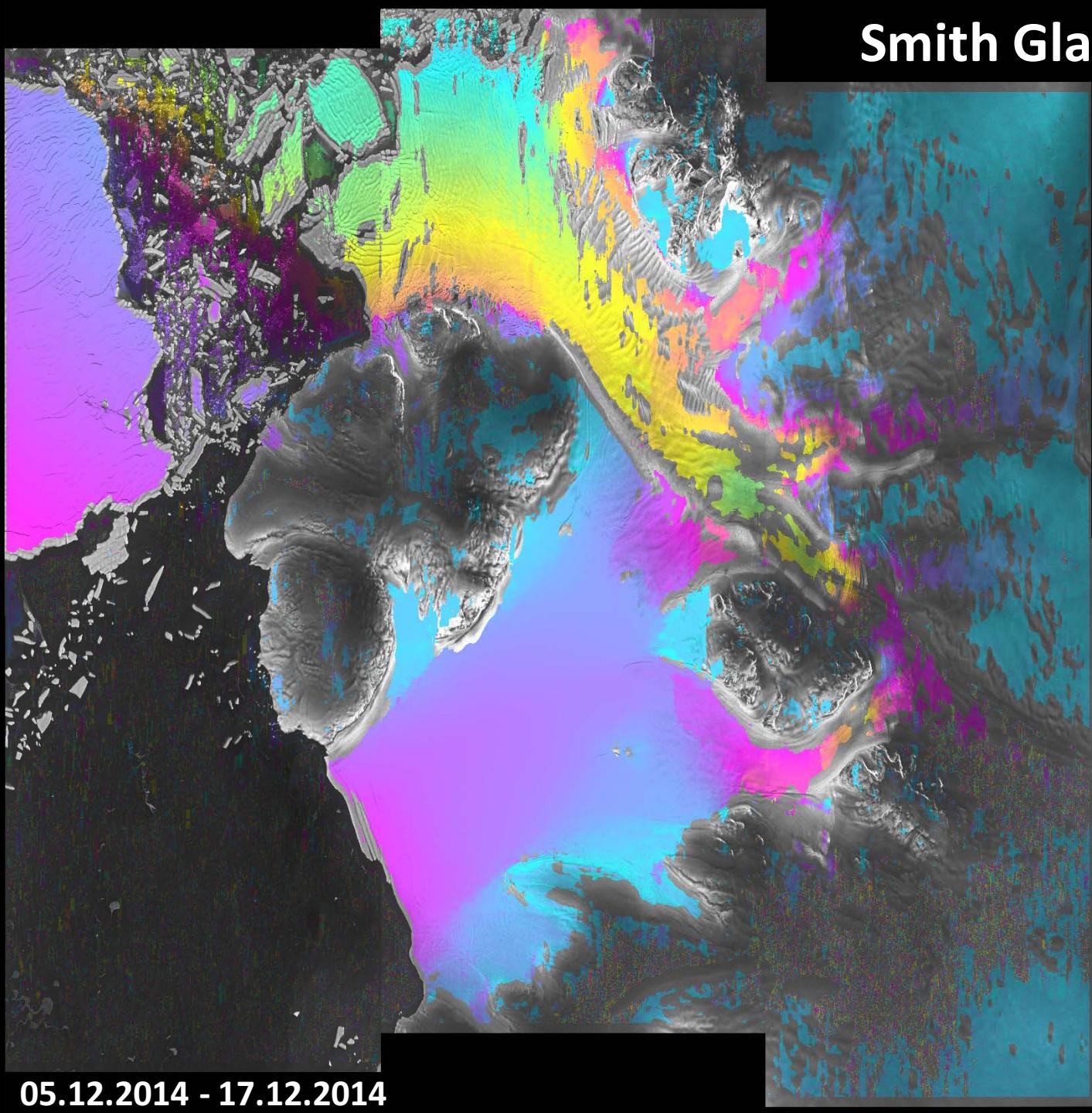
# Thwaites Glacier Ice Velocity



100  
Ice Velocity  
(m per 12-days)  
0

05.12.2014 - 17.12.2014

# Smith Glacier and Dotson Ice Shelf



50  
Ice Velocity  
(m per 12-days)  
0

(Hogg et al, CPOM)

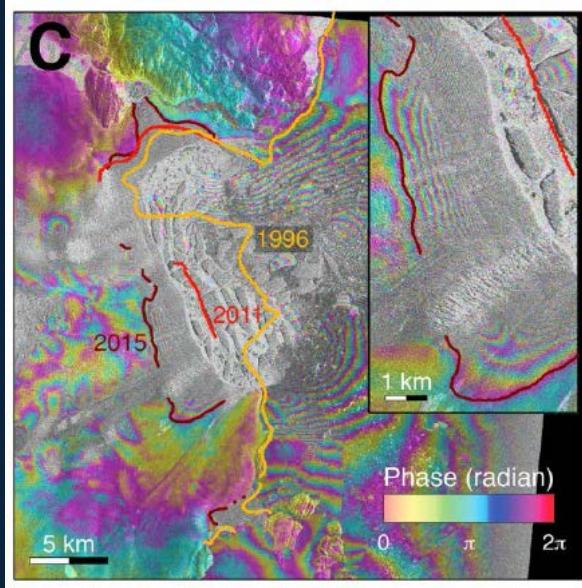
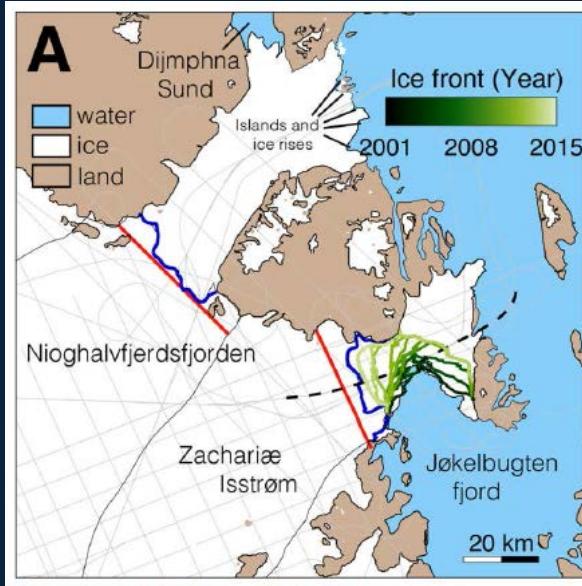
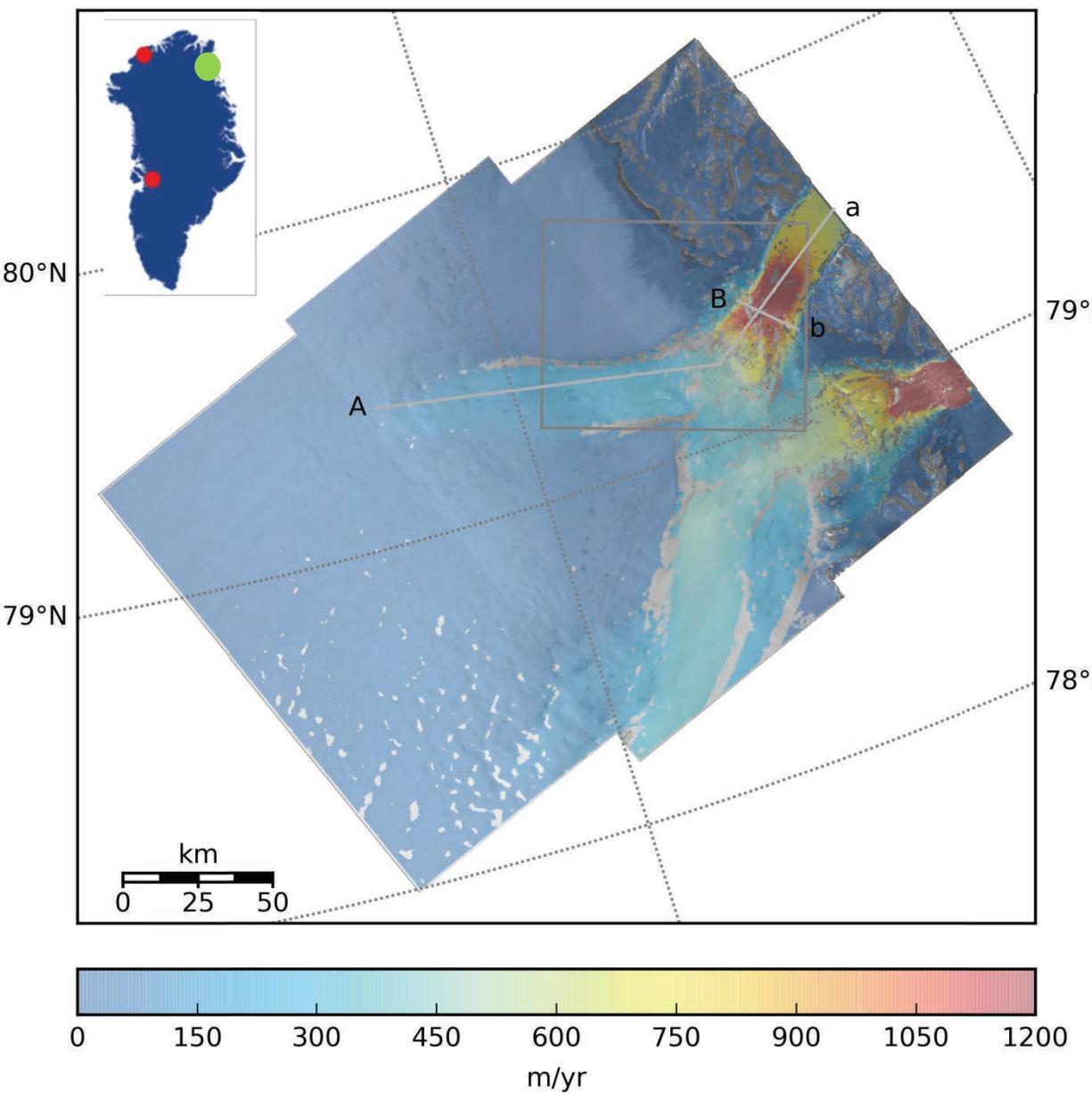
05.12.2014 - 17.12.2014

# Sentinel-1 IV – 79 Fjorden

16.03.09 to 16.04.02

27°W

18°W



# CPOM Ice Velocity Data Portal

Centre for Polar Observation and Modelling Data Portal

Home Sea Ice Ice Sheets Ice Velocity **Ice Velocity** About

**Sentinel-1 Near Real Time Ice Velocity**

This is the CPOM ice sheet outlet glacier velocity service. Through this data portal, we distribute frequent maps of ice velocity for key outlet glaciers of the Antarctic and Greenland ice sheets in near real time. The velocity maps are produced by tracking moving features in synthetic aperture radar data acquired by the European Space Agency's Sentinel-1 satellite.

**Glacier Selection**

Click on the map to select a glacier and show maps and charts of the ice velocity data we have processed so far. Grey shading on the plots is used to indicate the floating part of the glacier.

**Thwaites Glacier**

2016.03.05 to 2016.03.17  
74.9°S 75.2°S 75.5°S

74.9°S 75.2°S 75.5°S

106°W

km

0 300 600 900 1200 1500 1800 2100 2400 2700 3000 m/yr

Thwaites Glacier: Along-Flow Ice Speed

2016.03.05 mean

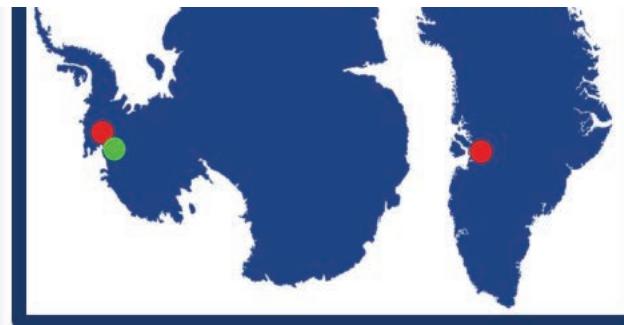
15

10

5

Ice Speed (m/day)

<http://www.cpom.ucl.ac.uk/csopr/iv>



## Register for Data Downloads

To access the Ice Velocity data products we request that you complete a quick and simple registration form. We will not pass on your details to anyone else.

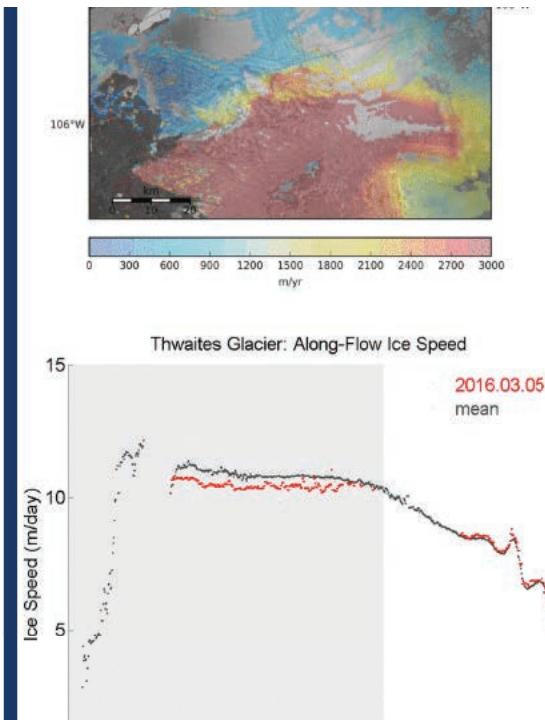
Please either sign in below, or [click here to register](#).

## Login for Data Downloads

Firstname Lastname

Your Email Address

Sign in



# — Process S1 with ESA SNAP toolbox —