

Sentinel-1: Measuring Ice Speed

A. Hogg & A. Minchella

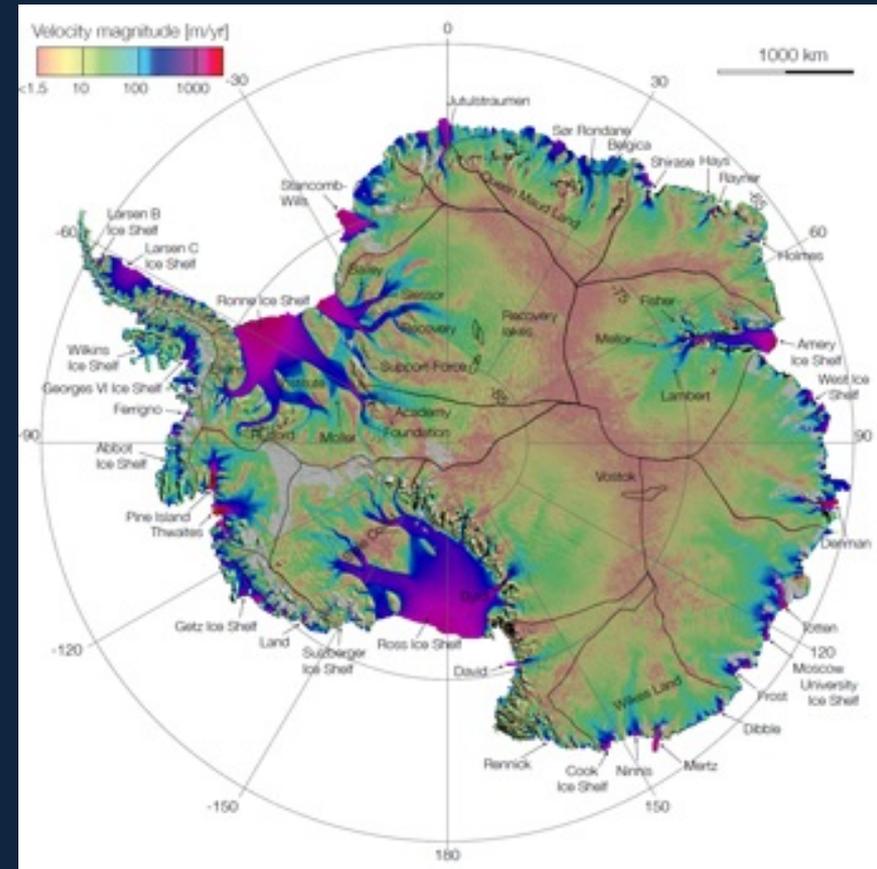


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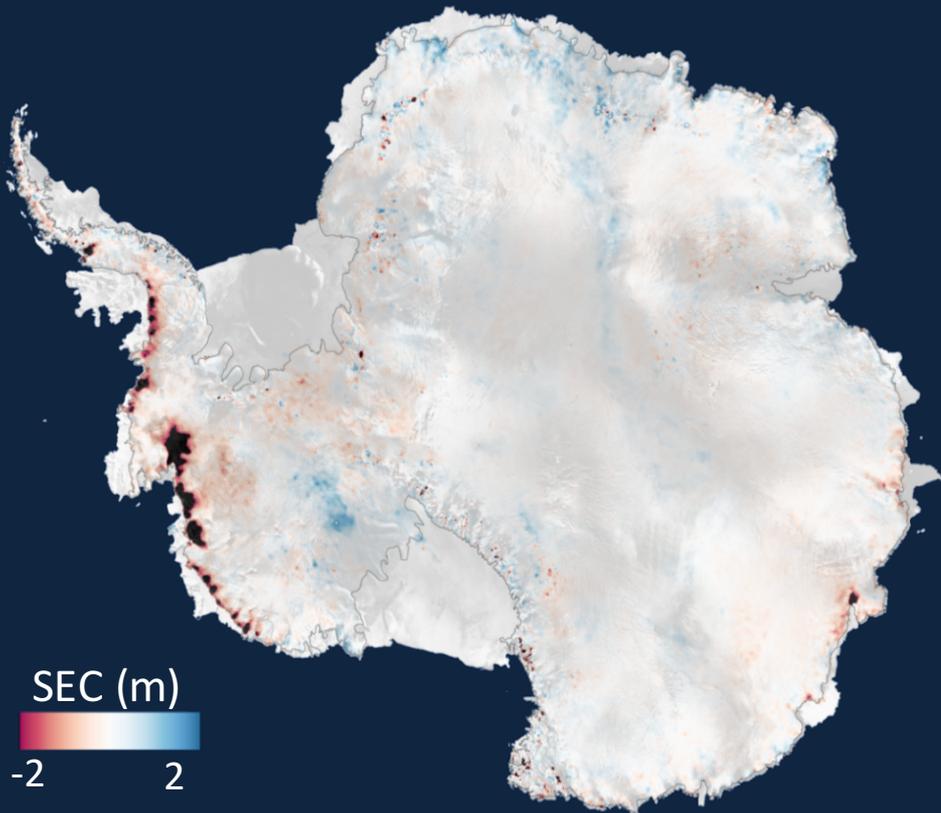
Importance of ice velocity measurements

- 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



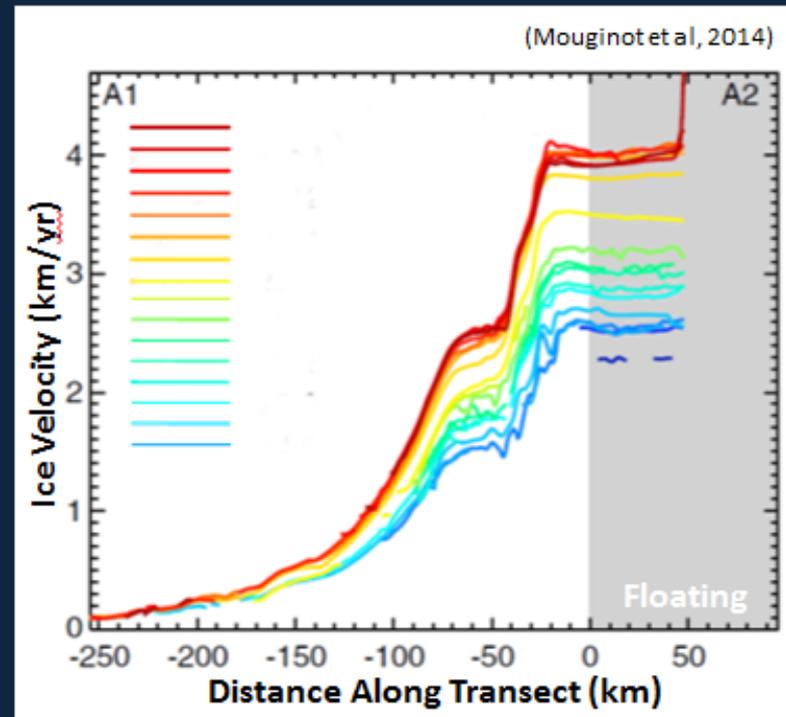
Change in ice speed: Long term

CryoSat-2 Surface elevation change
2010 - 2014

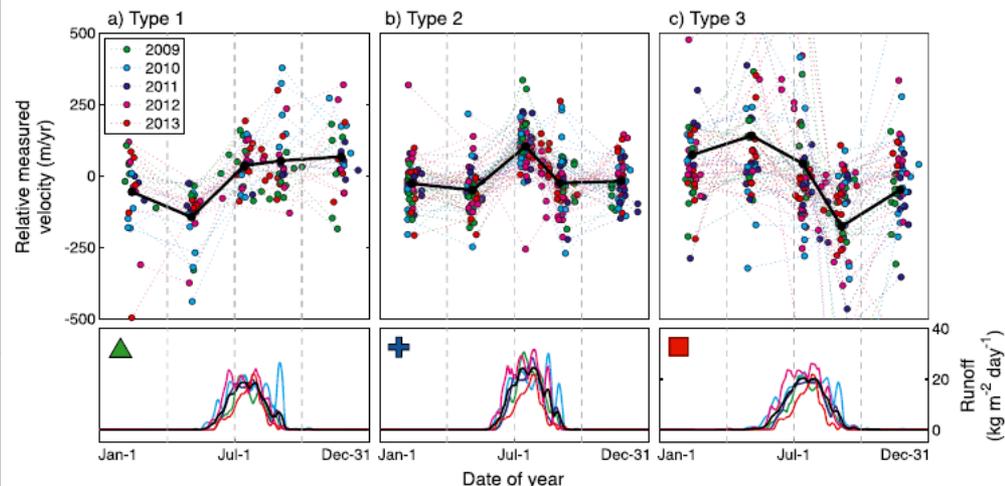
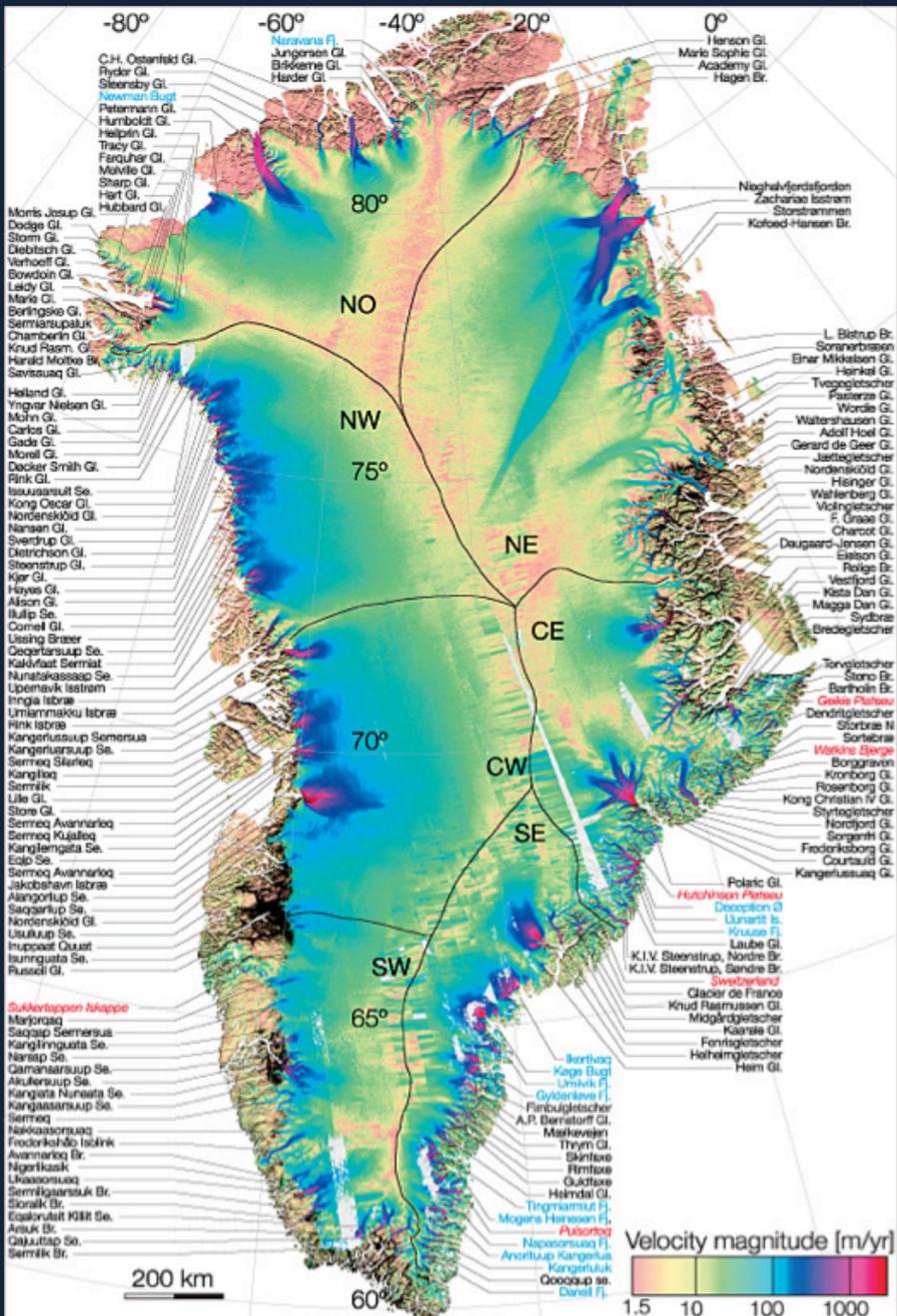


(McMillan et al, 2014)

Ice velocity speed-up
1994 - 2010



Change in ice speed: Long term

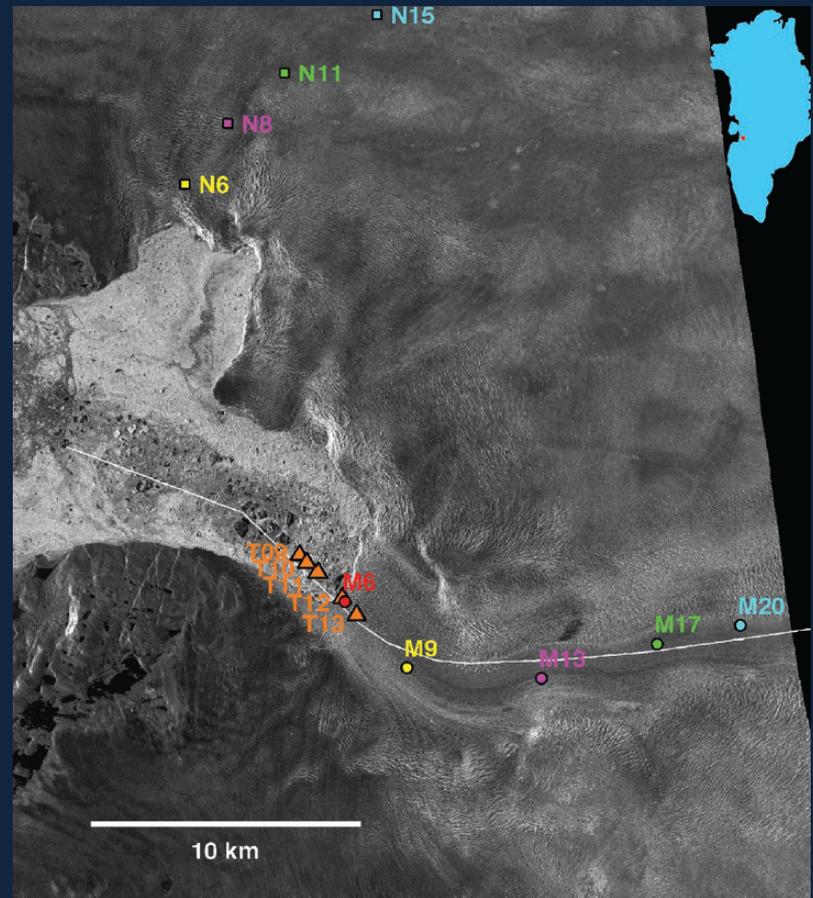
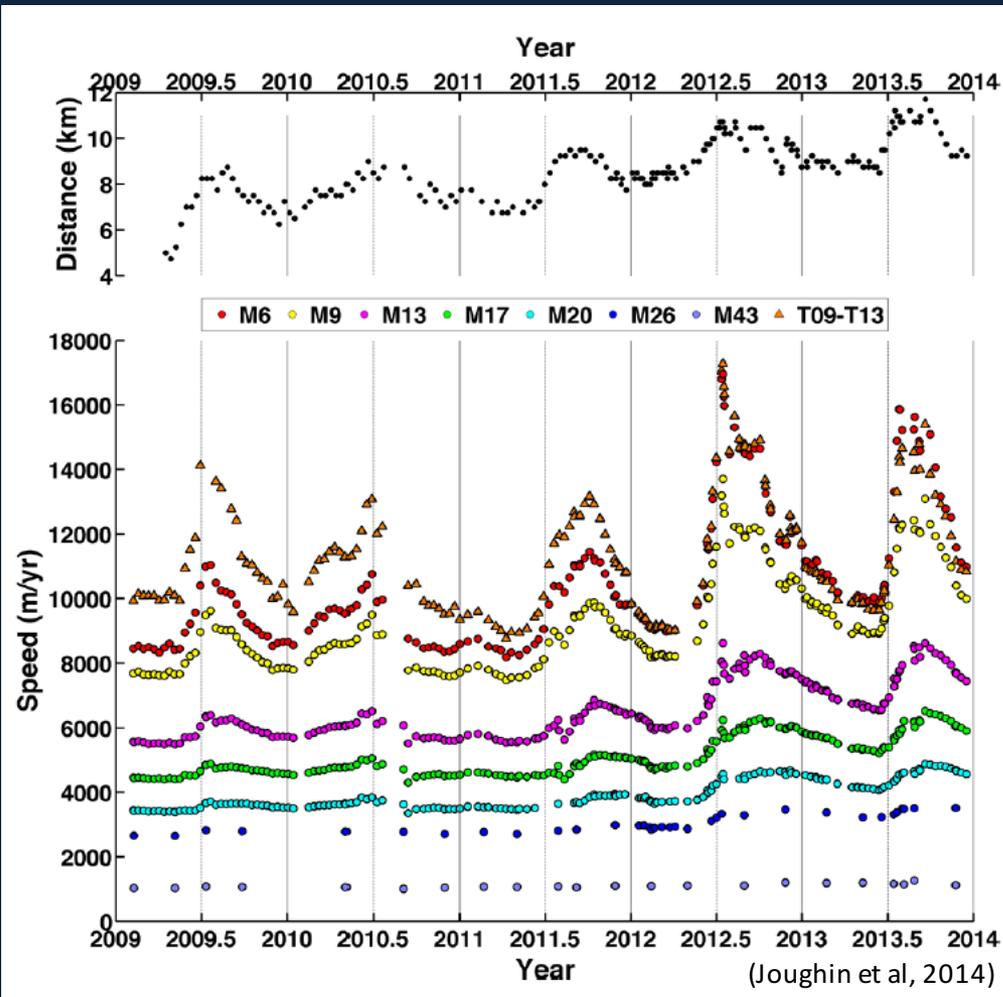


(Moon et al, 2014)

(Mouginot et al, 2014)

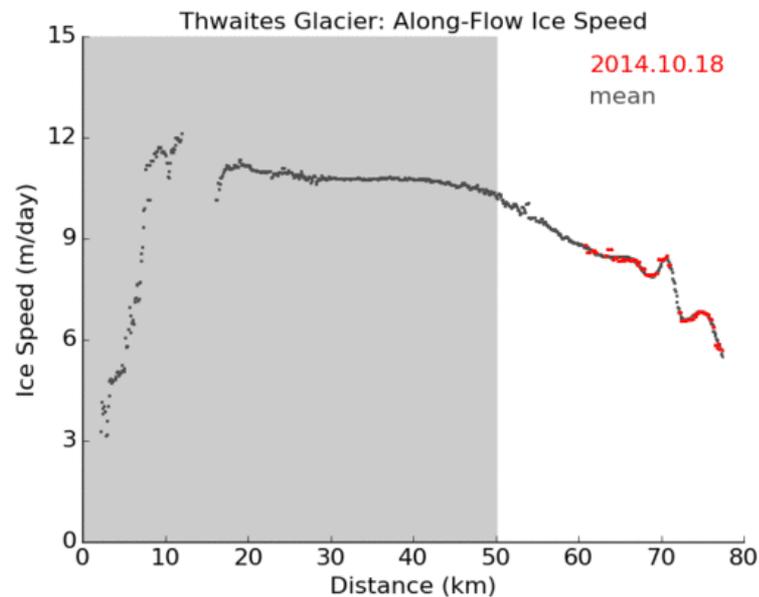
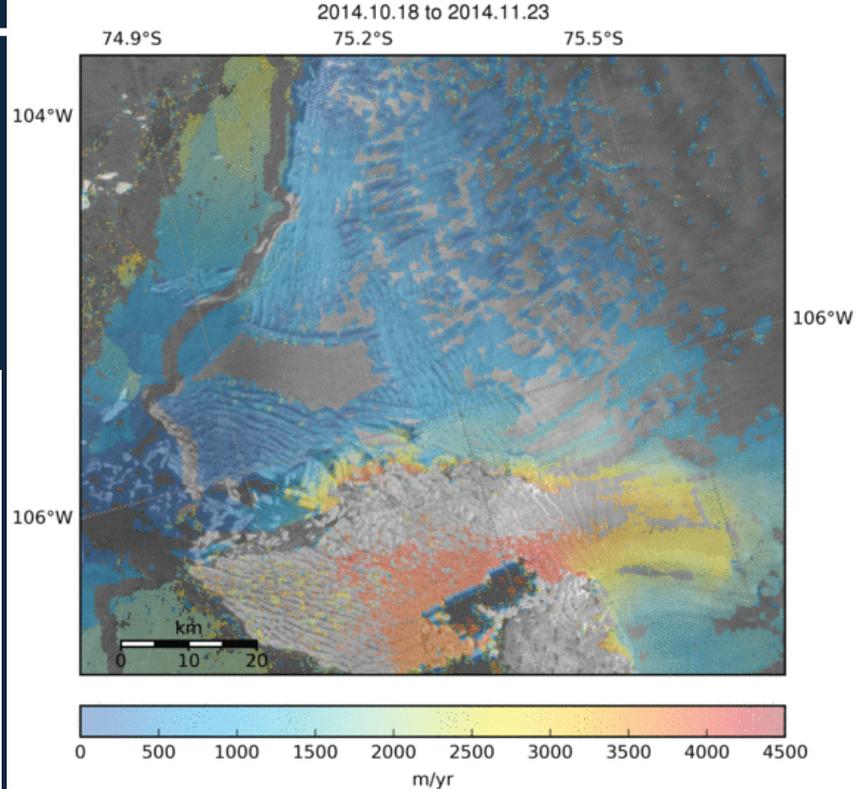
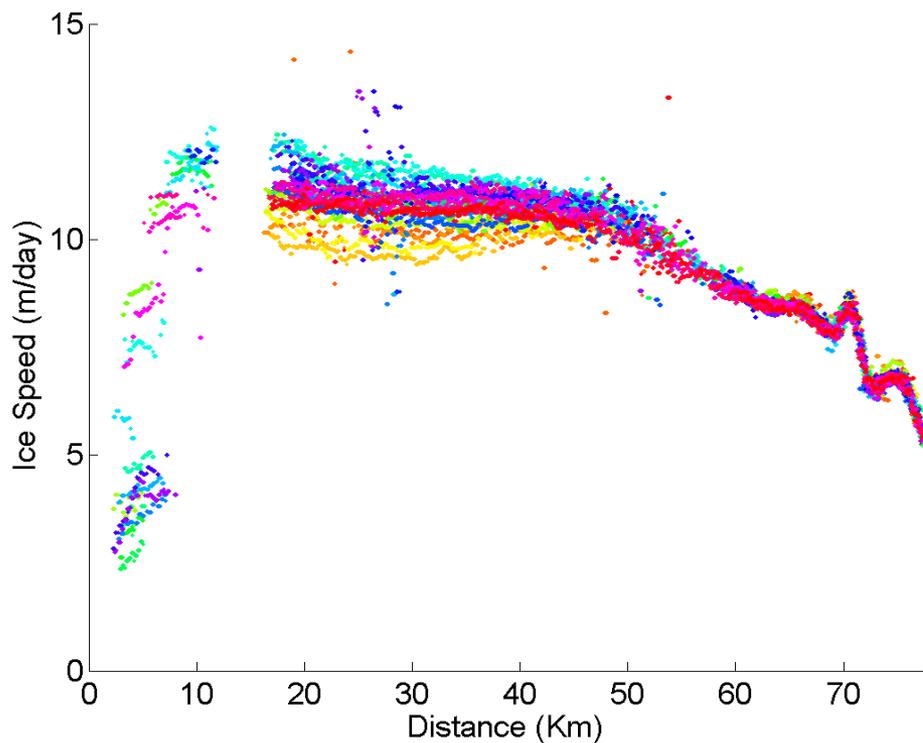
Change in ice speed: Short Term

Seasonal ice velocity speedup on Jakobshavn Isbrae, Greenland



Change in ice speed: Short T

Tidally Thwaites Glacier, Antarctica



Advantages of Sentinel-1

Advantage

1. Frequent repeat acquisitions

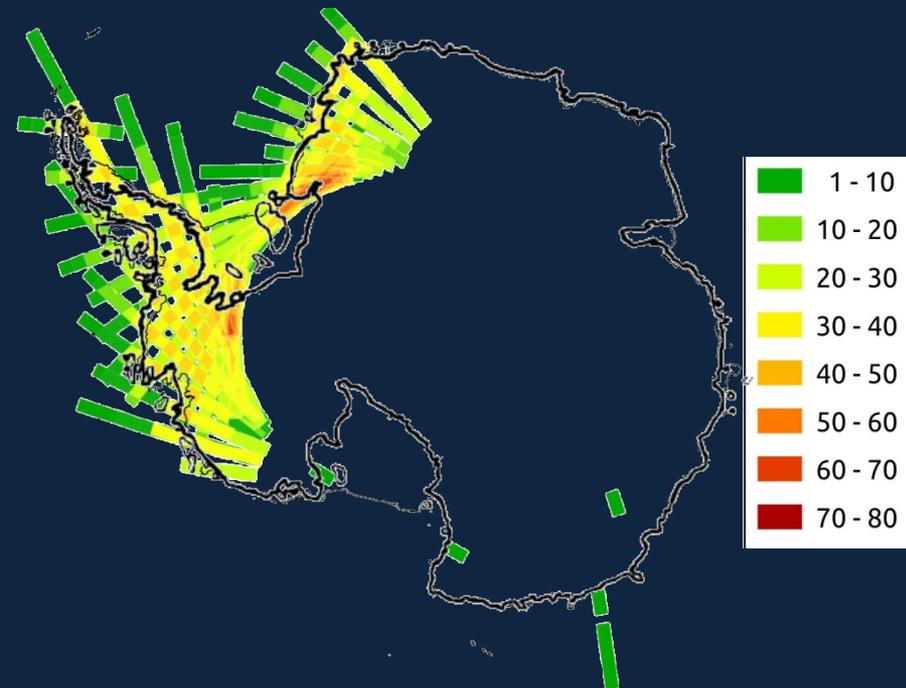
ERS-1/2

35-day

Sentinel-1

12-day

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



Sentinel-1
Last Month !!
(Aug 2016)

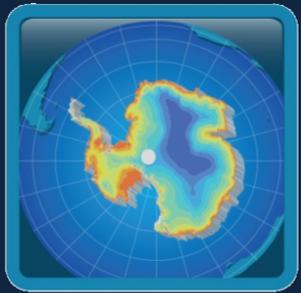


Techniques used for measuring ice speed

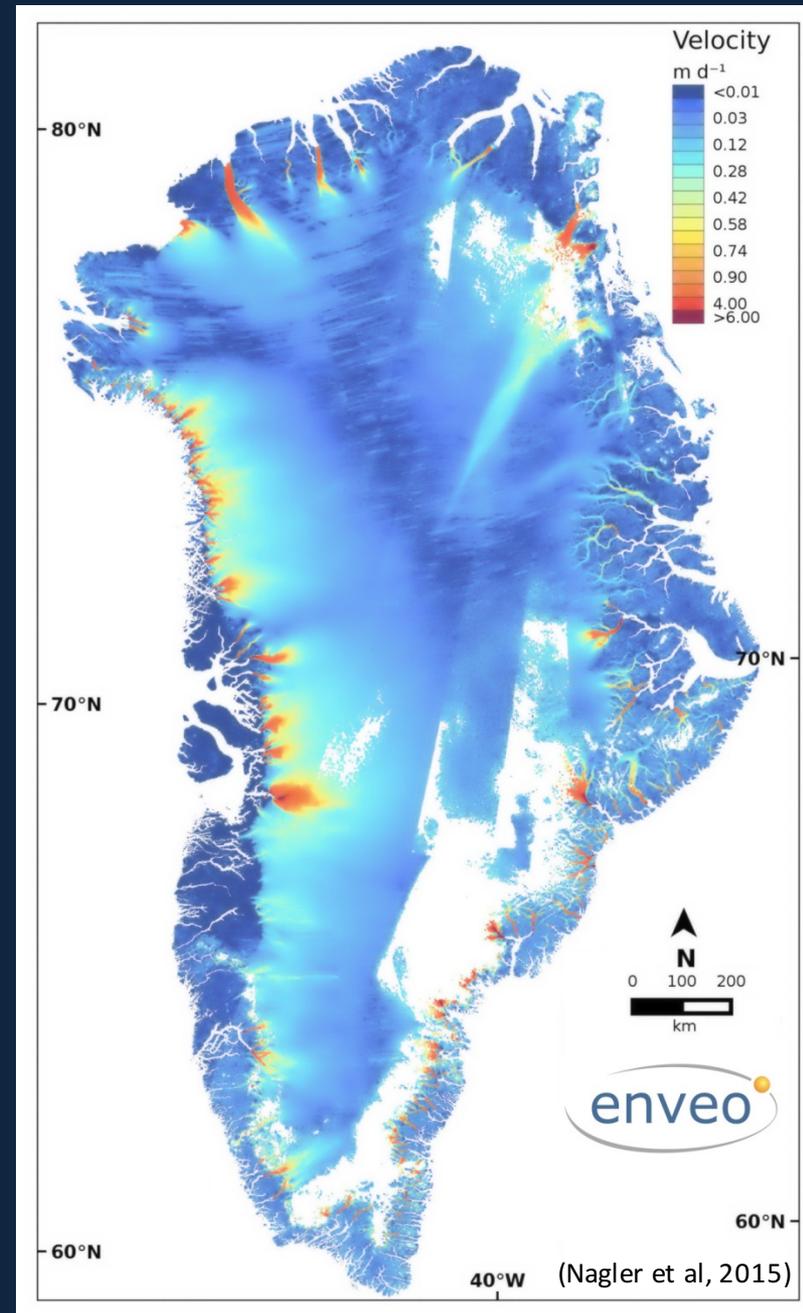
- Full ice sheet coverage
- Greenland – winter 2014/15
- Antarctica – ongoing now



greenland
ice sheet
cci



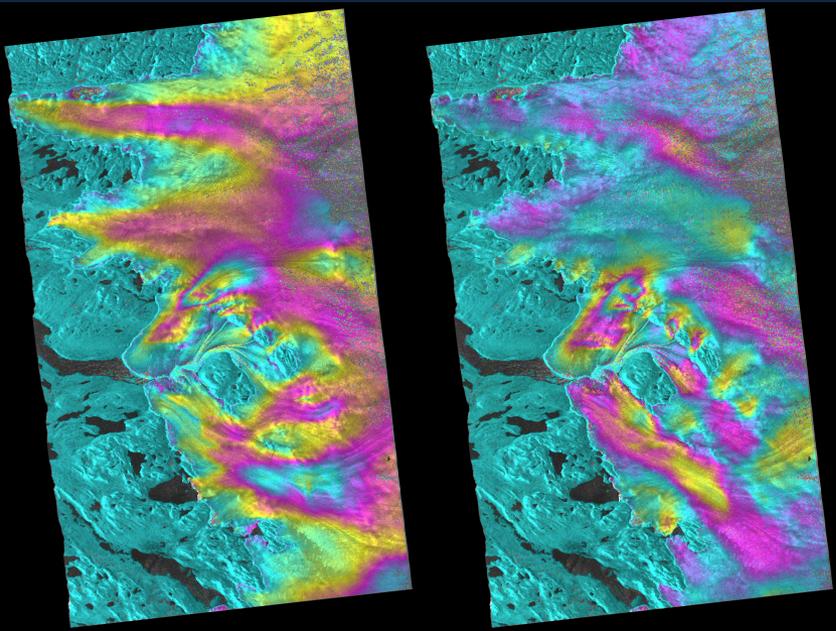
antarctic
ice sheet
cci



Techniques used for measuring ice speed

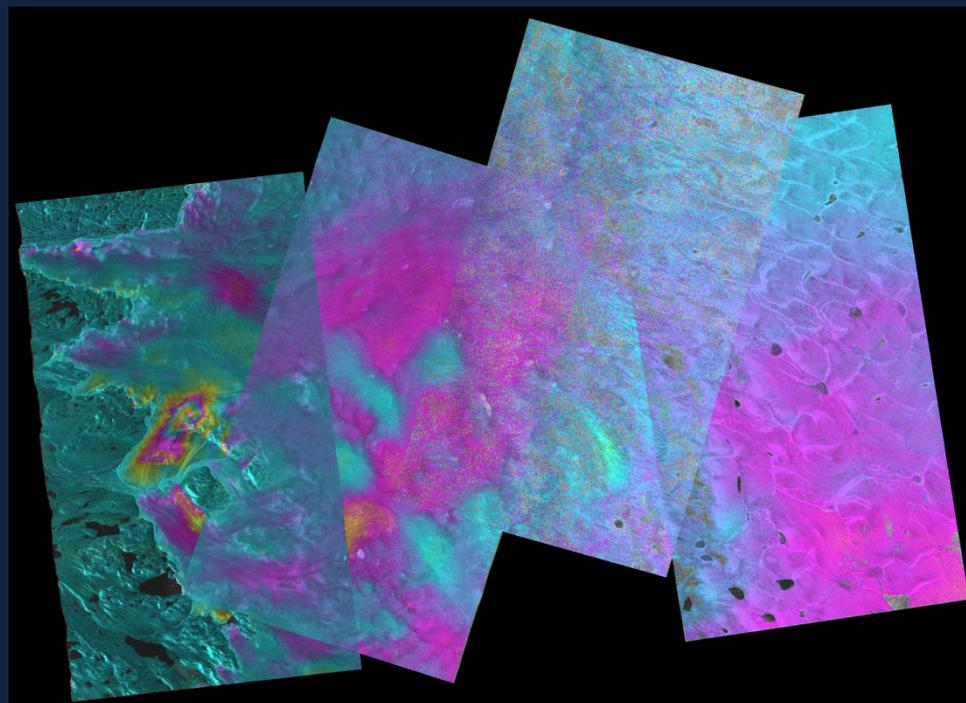
1. InSAR

Phase



2. Coherent feature tracking

Phase

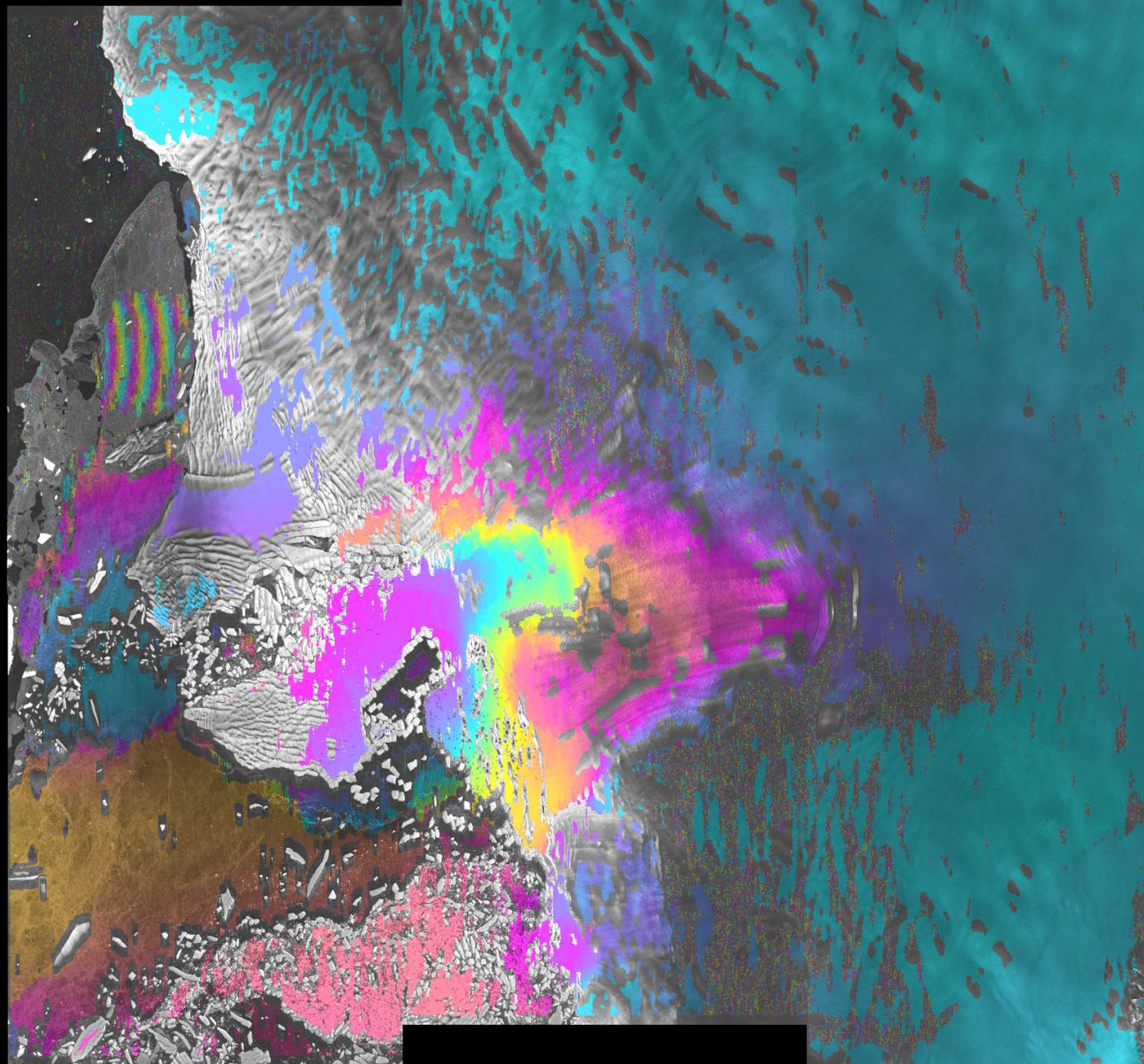


3. Intensity feature tracking

Amplitude features

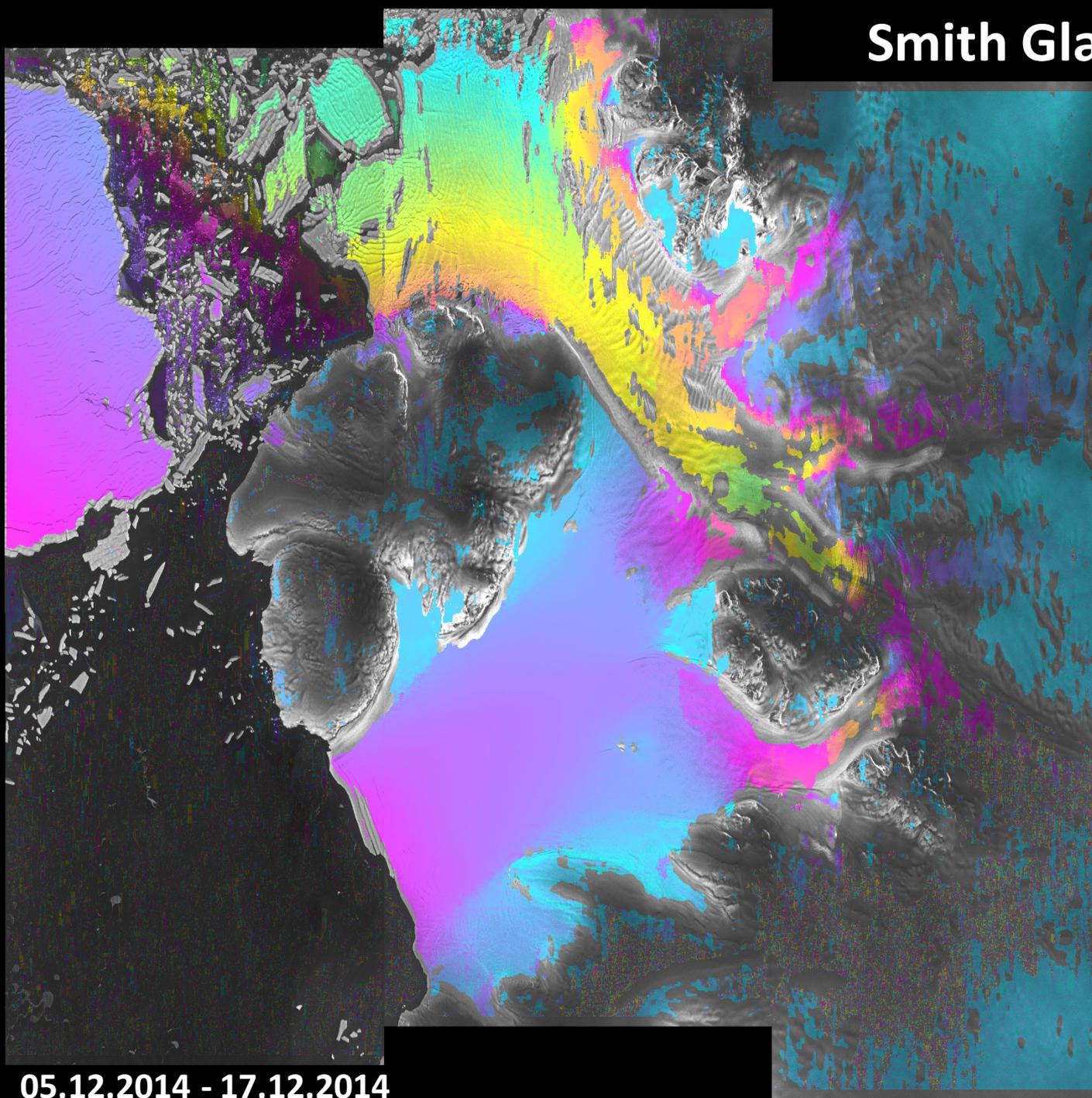
Thwaites Glacier Ice Velocity

100
Ice Velocity
(m per 12-days)
0

A vertical color scale legend for ice velocity. It ranges from 0 at the bottom to 100 at the top. The colors transition from purple at the bottom, through blue, cyan, green, yellow, orange, and red, to magenta at the top.

05.12.2014 - 17.12.2014

Smith Glacier and Dotson Ice Shelf



(Hogg et al, CPOM)

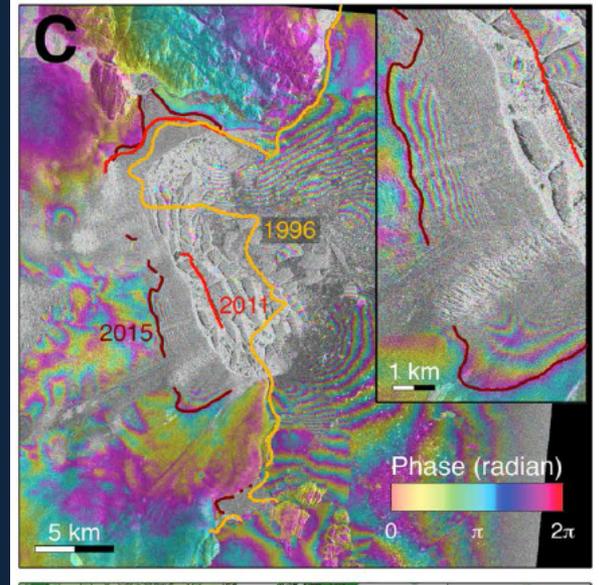
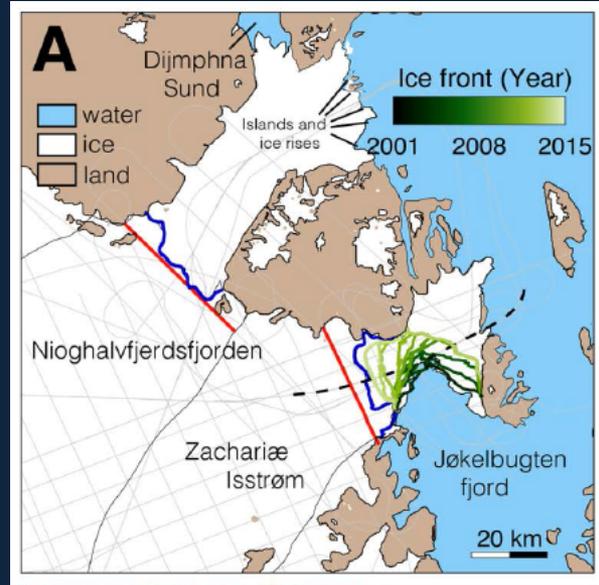
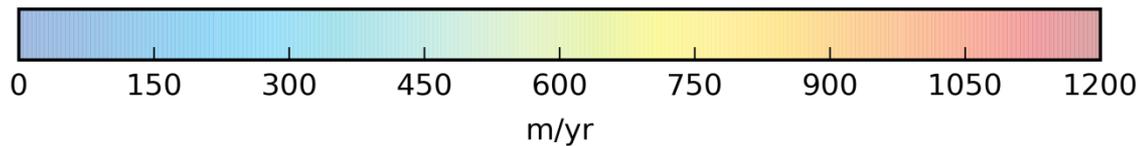
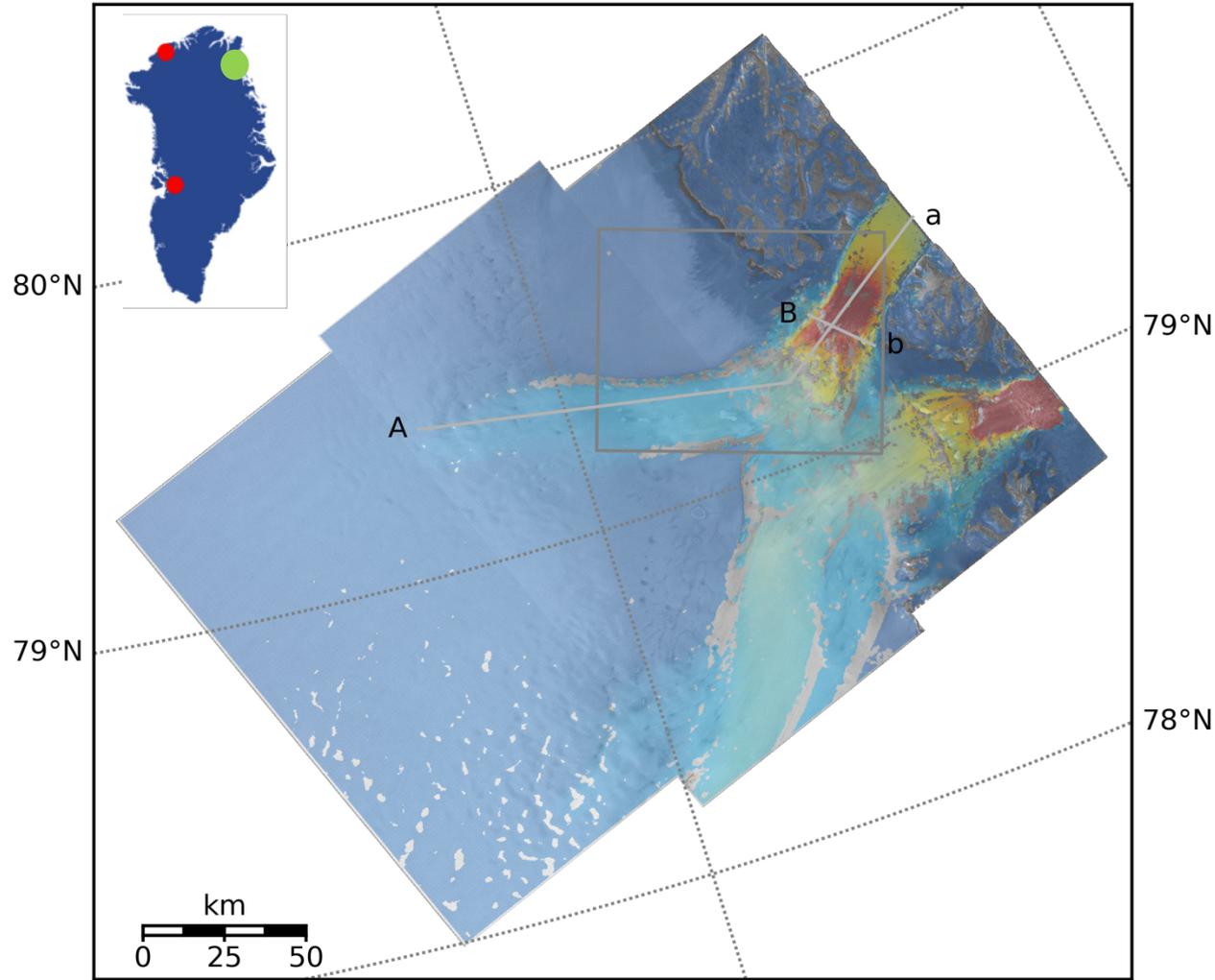
05.12.2014 - 17.12.2014

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

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

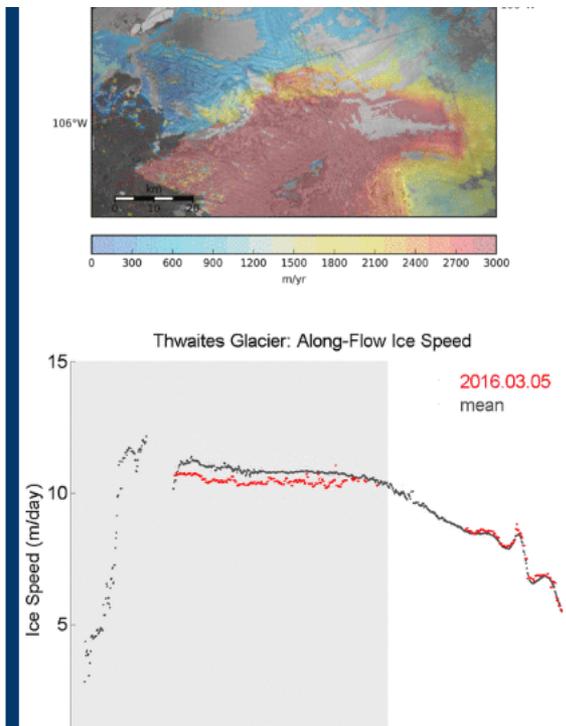


Register for Data Downloads

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



Process S1 with ESA SNAP toolbox