



March 24, 2015

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## Sustained flux increase and grounding line retreat of Amundsen Sea Sector, West Antarctica between 1973 and 2015

J. Mouginot<sup>(1)</sup>, E. Rignot<sup>(1,2)</sup> and B.  
Scheuchl<sup>(1)</sup>

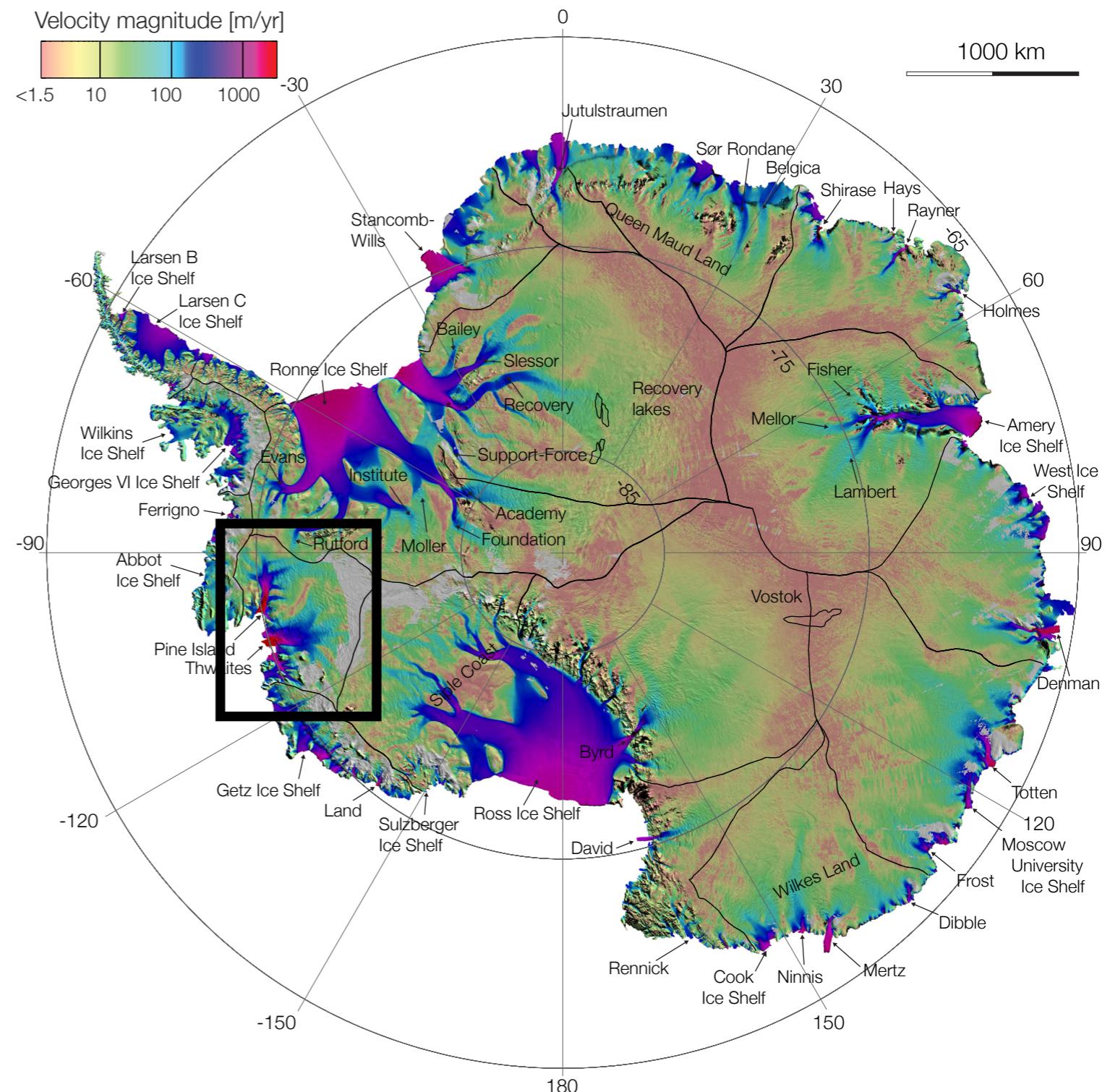
(1) University of California, Irvine

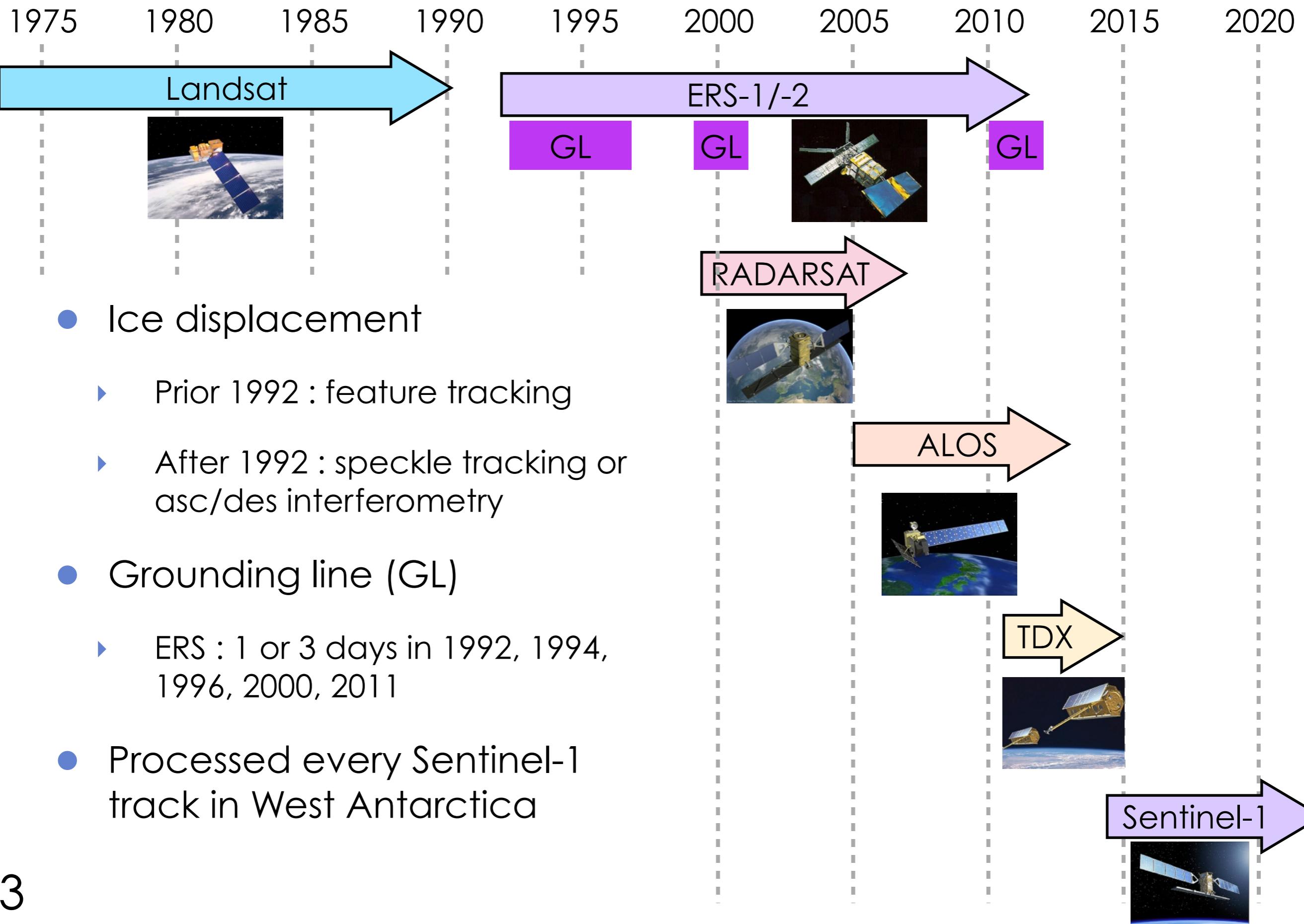
(2) Jet Propulsion Laboratory

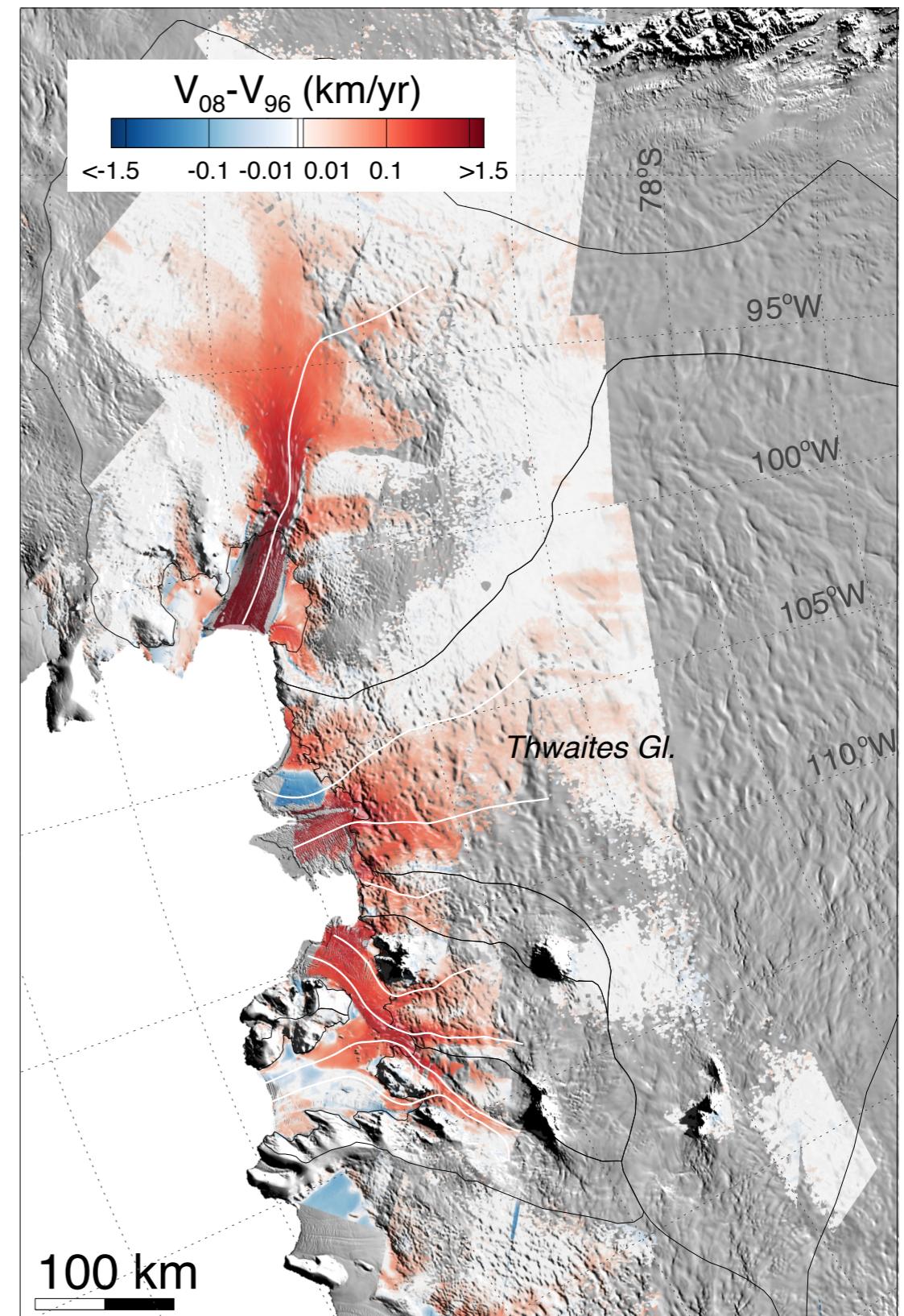
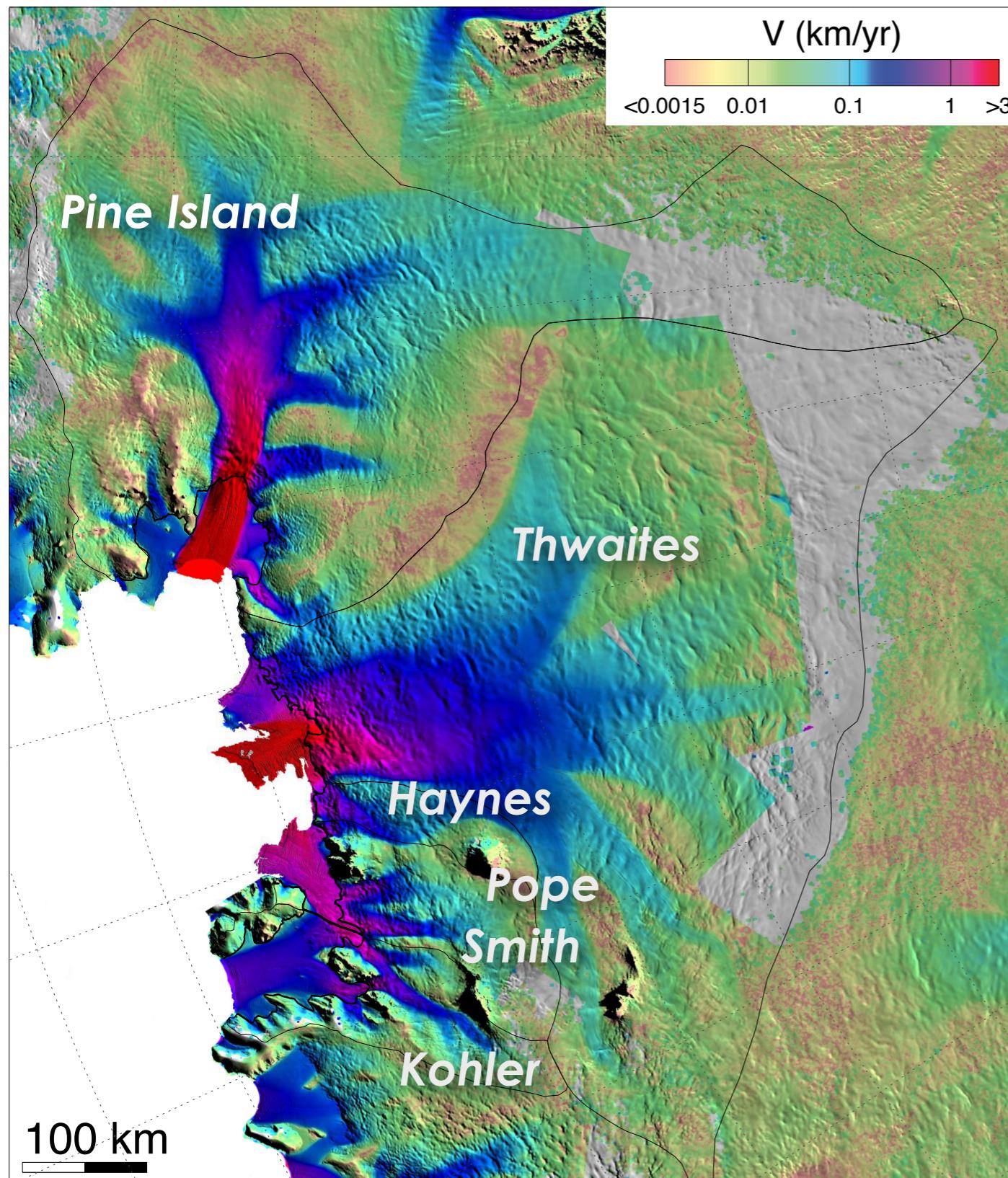


# Amundsen Sea Sector

- Drain by 6 main glaciers
  - ▶ equivalent than 2/3 of Greenland flux
  
- Documentation :
  - ▶ 41 years of glacier flux
  - ▶ 20 years of grounding line dynamic

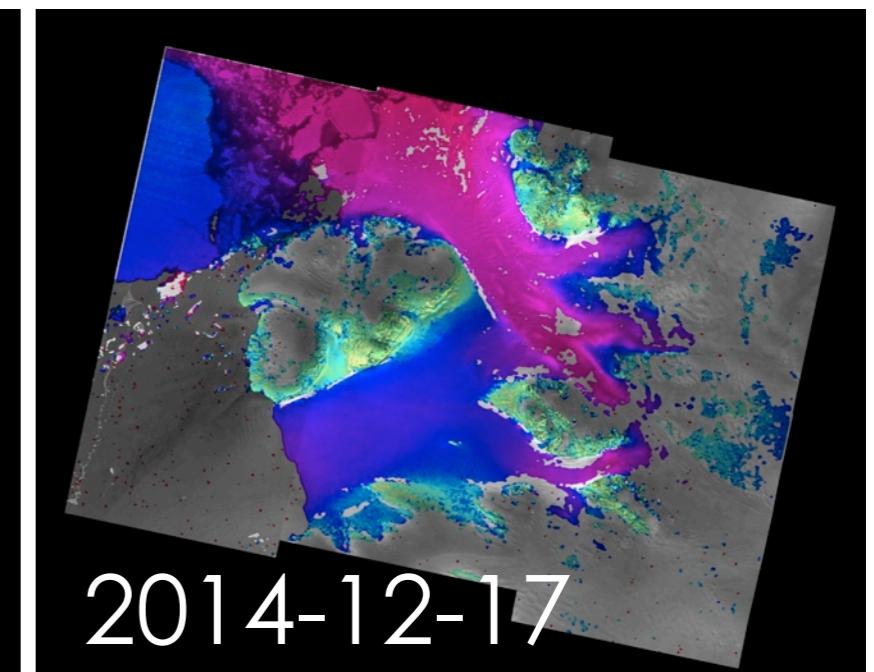
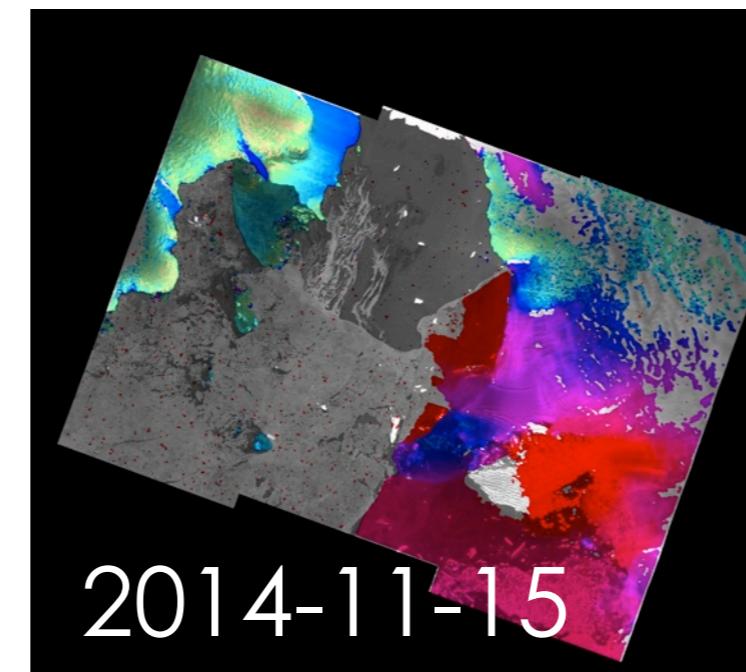
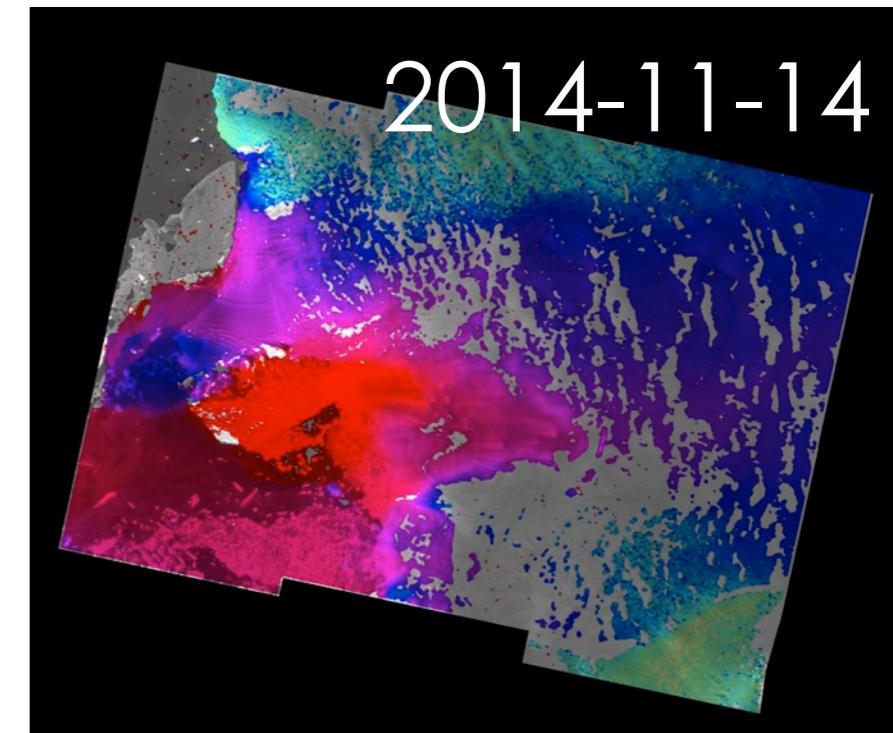
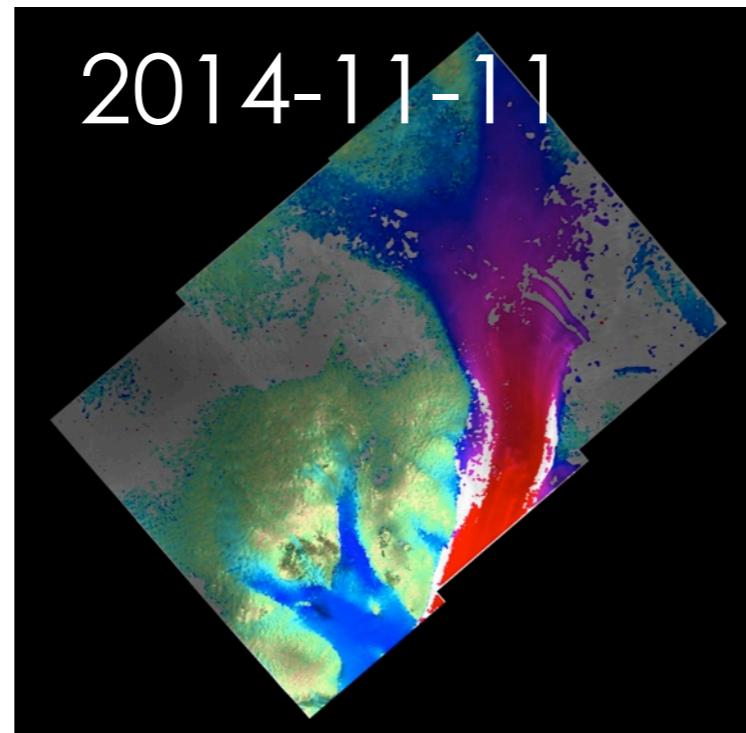




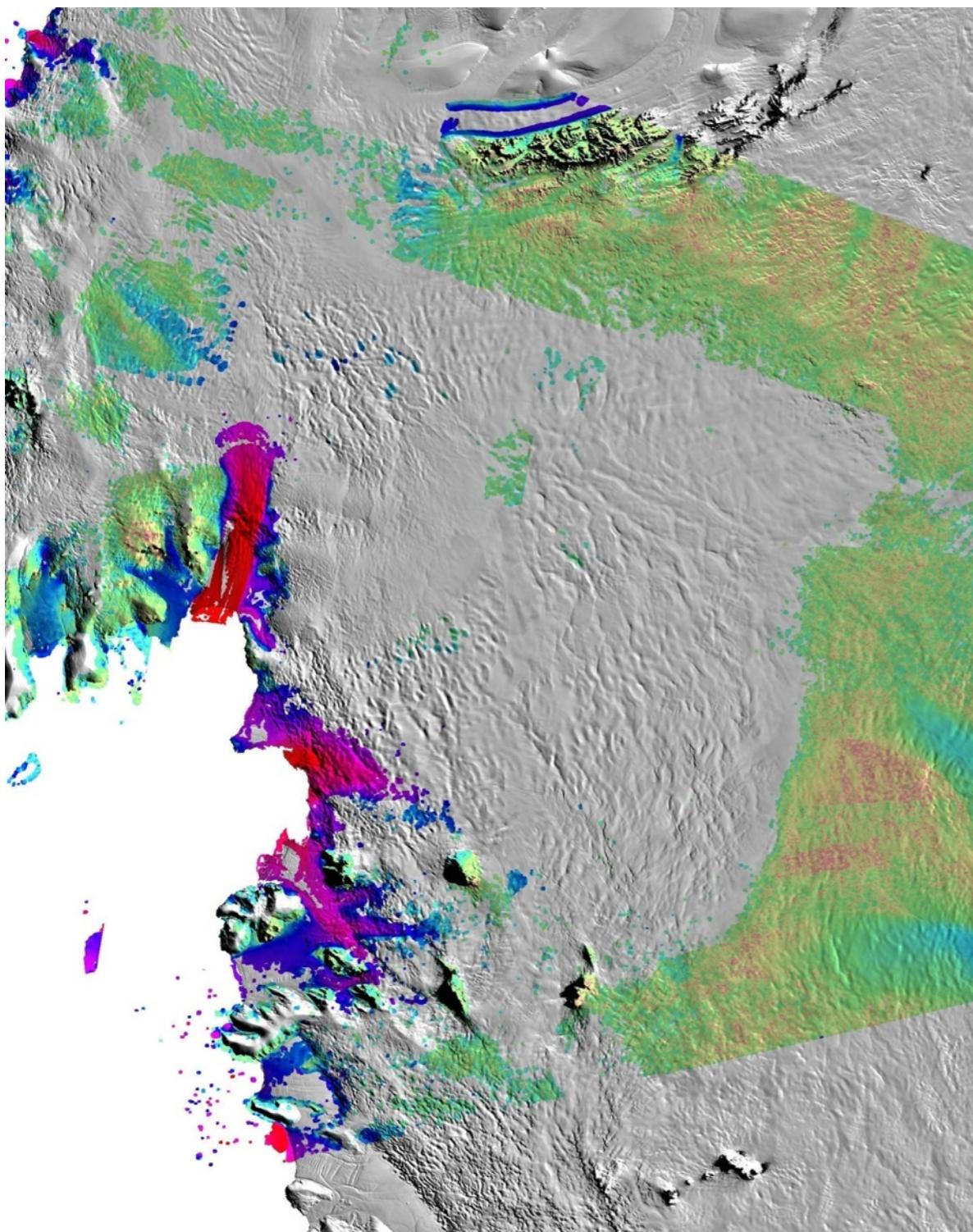


# Sentinel-1 in West Antarctica

- Processed all sentinel-1 acquired in west Antarctica in 2014
- Routinely processing 2015 new acquisitions

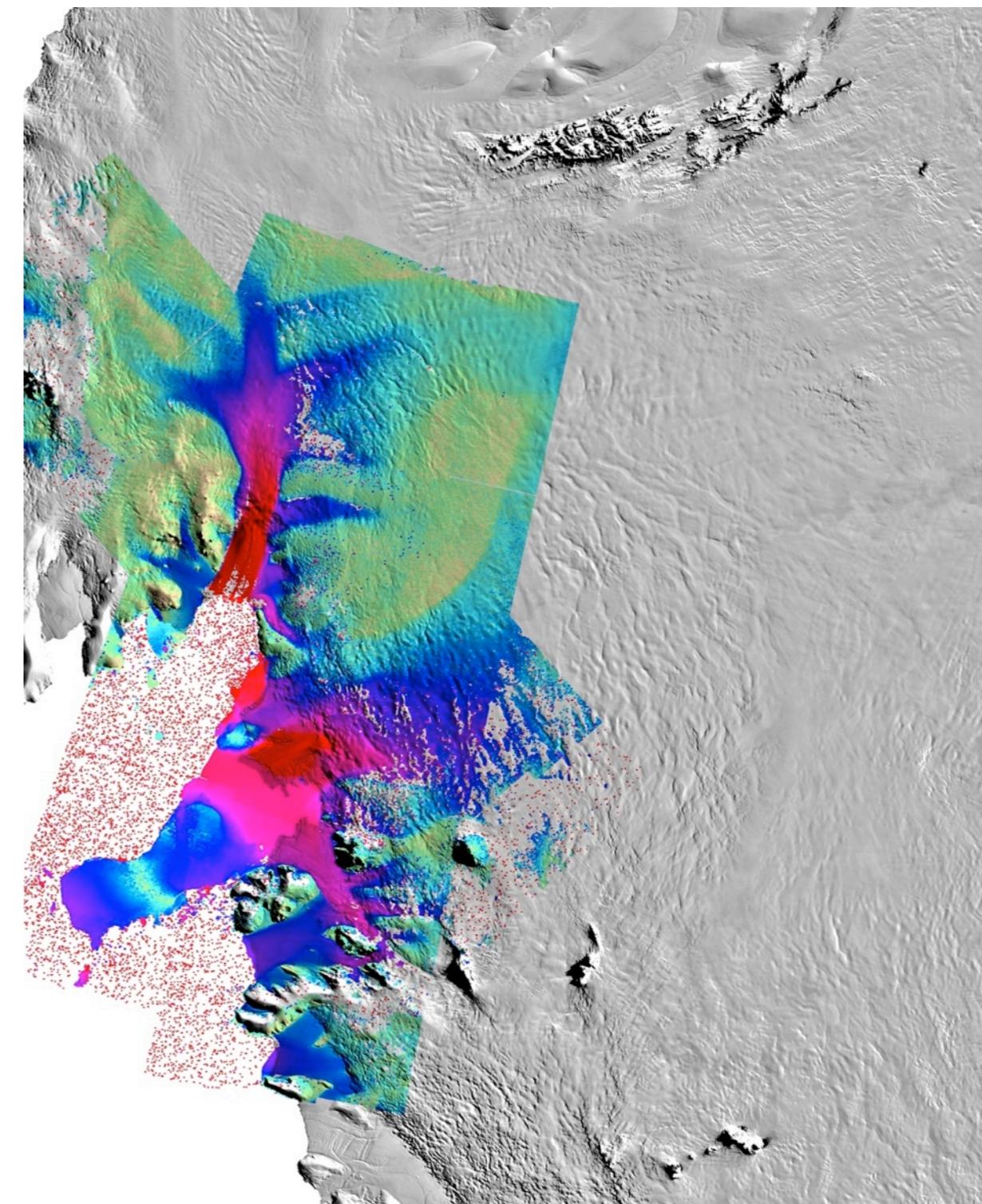


# Sentinel-1 in West Antarctica



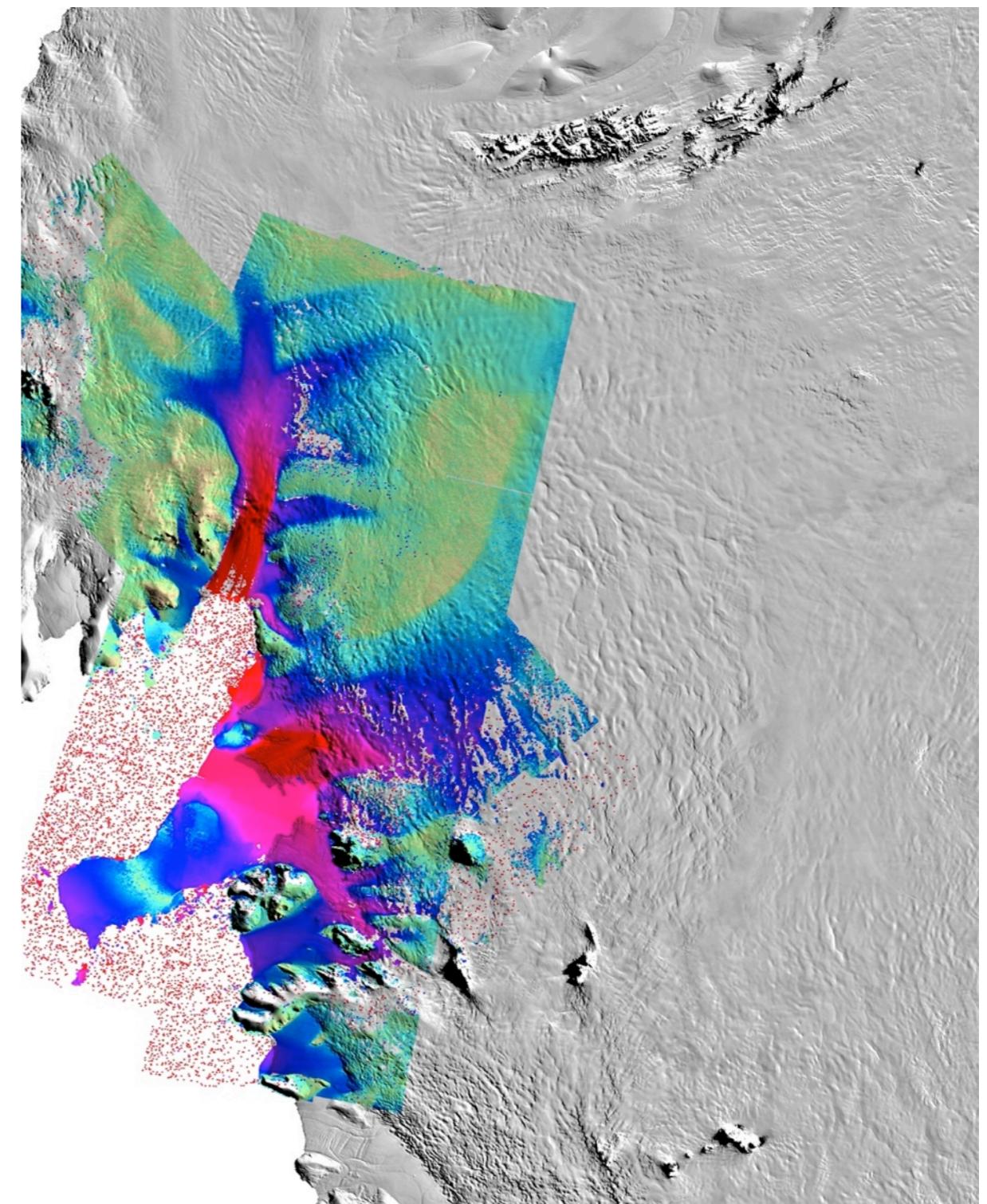
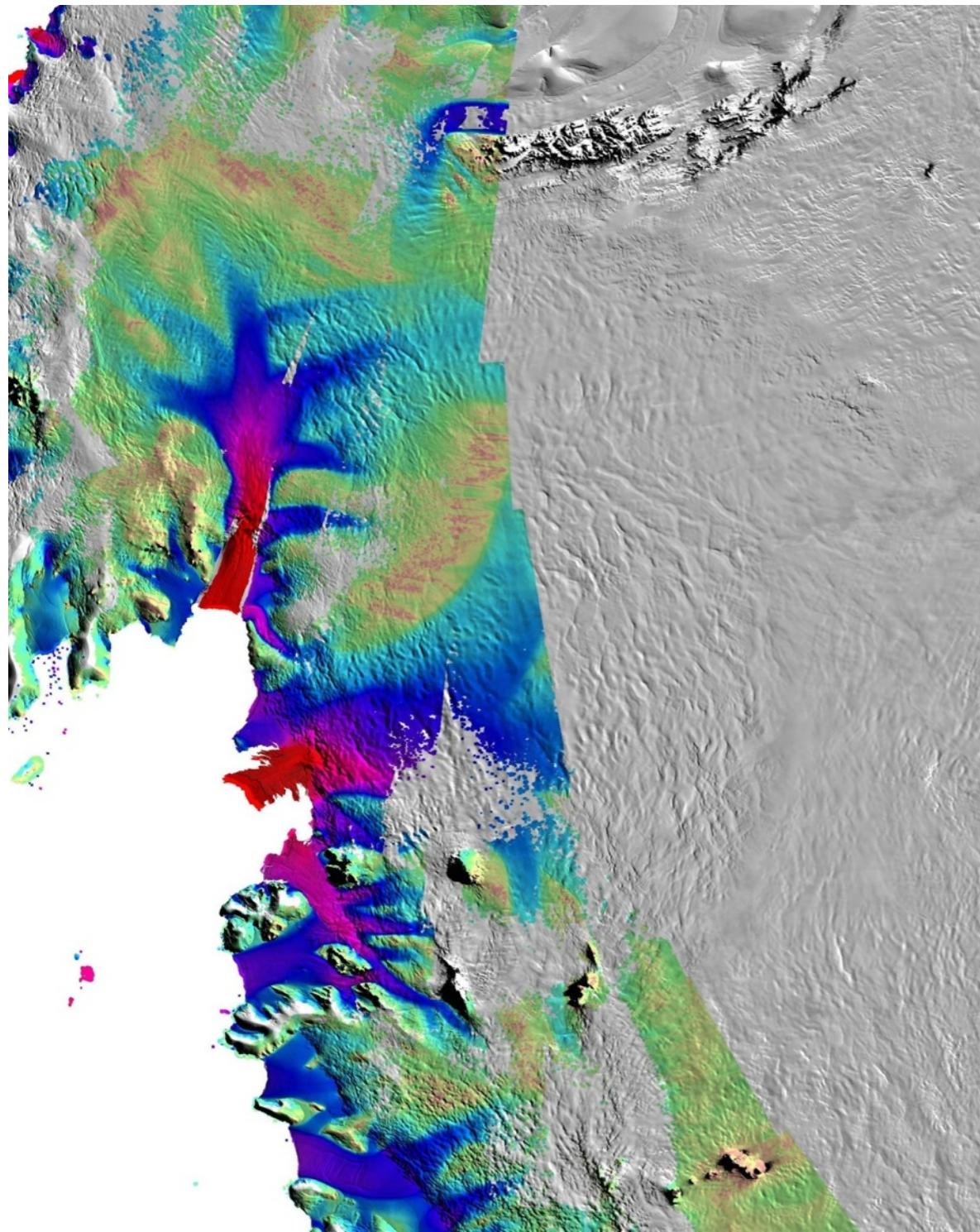
6

RADARSAT-2 2011



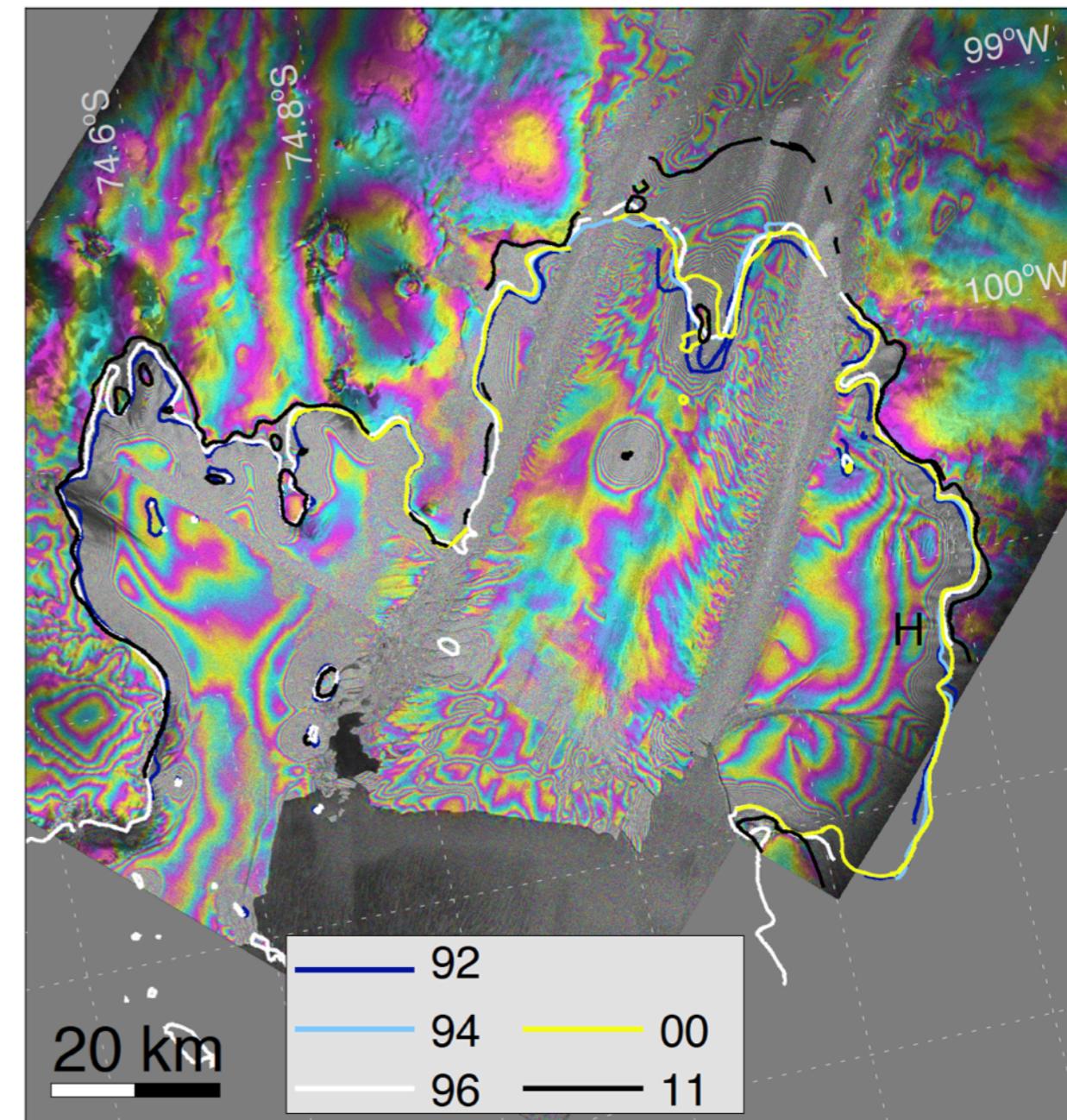
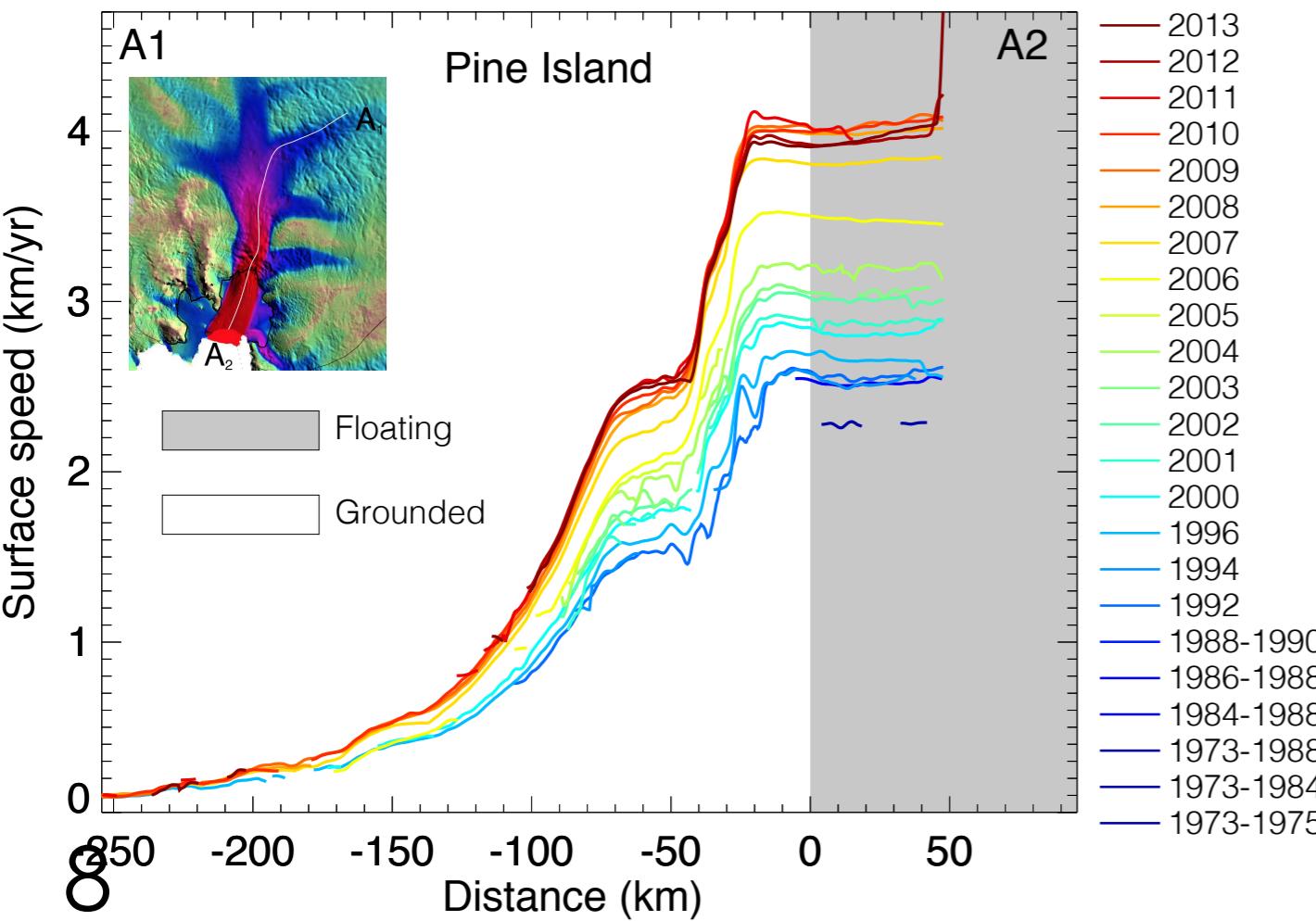
Sentinel-1 Oct-Dec 2014

# Sentinel-1 in West Antarctica



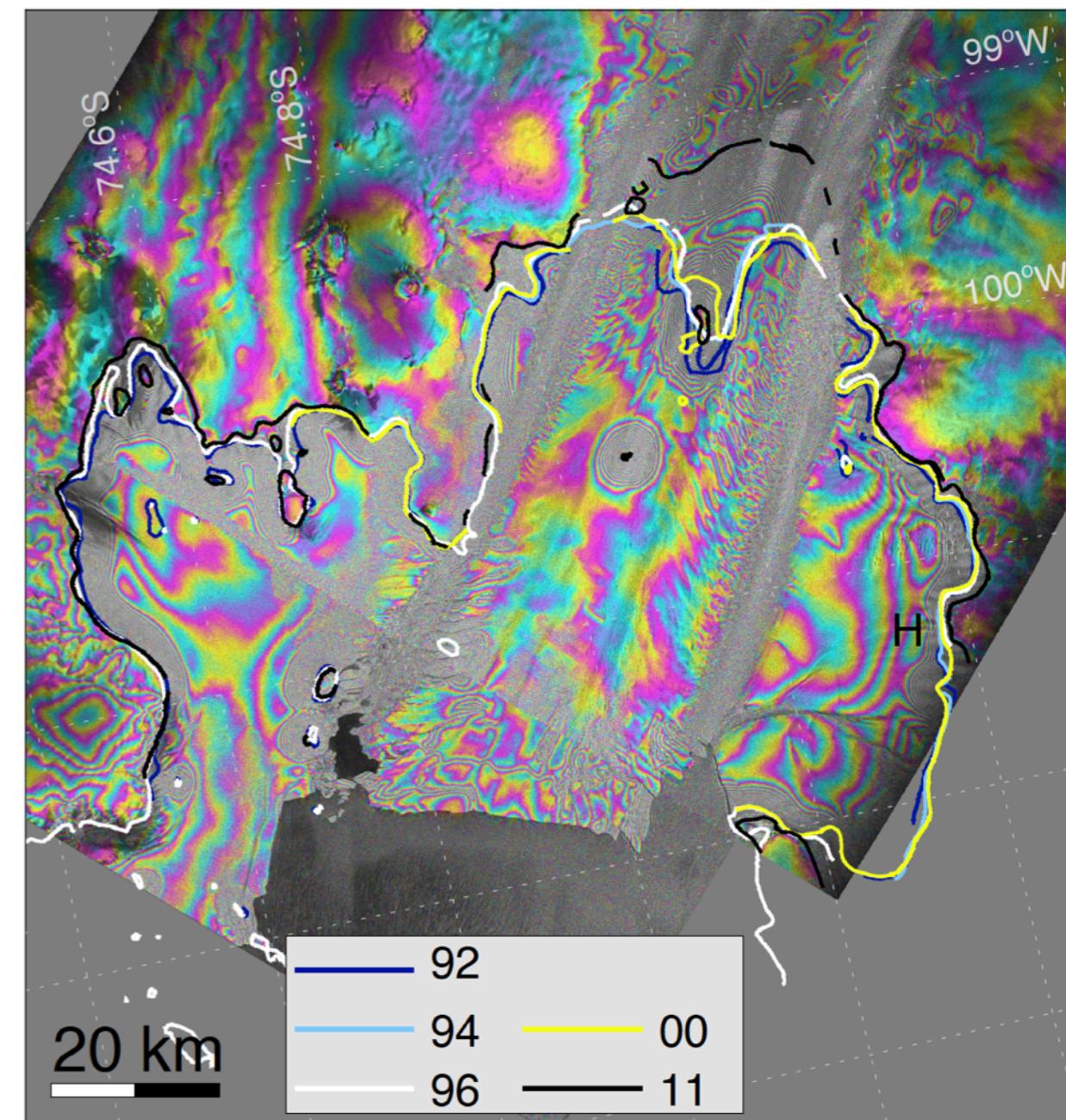
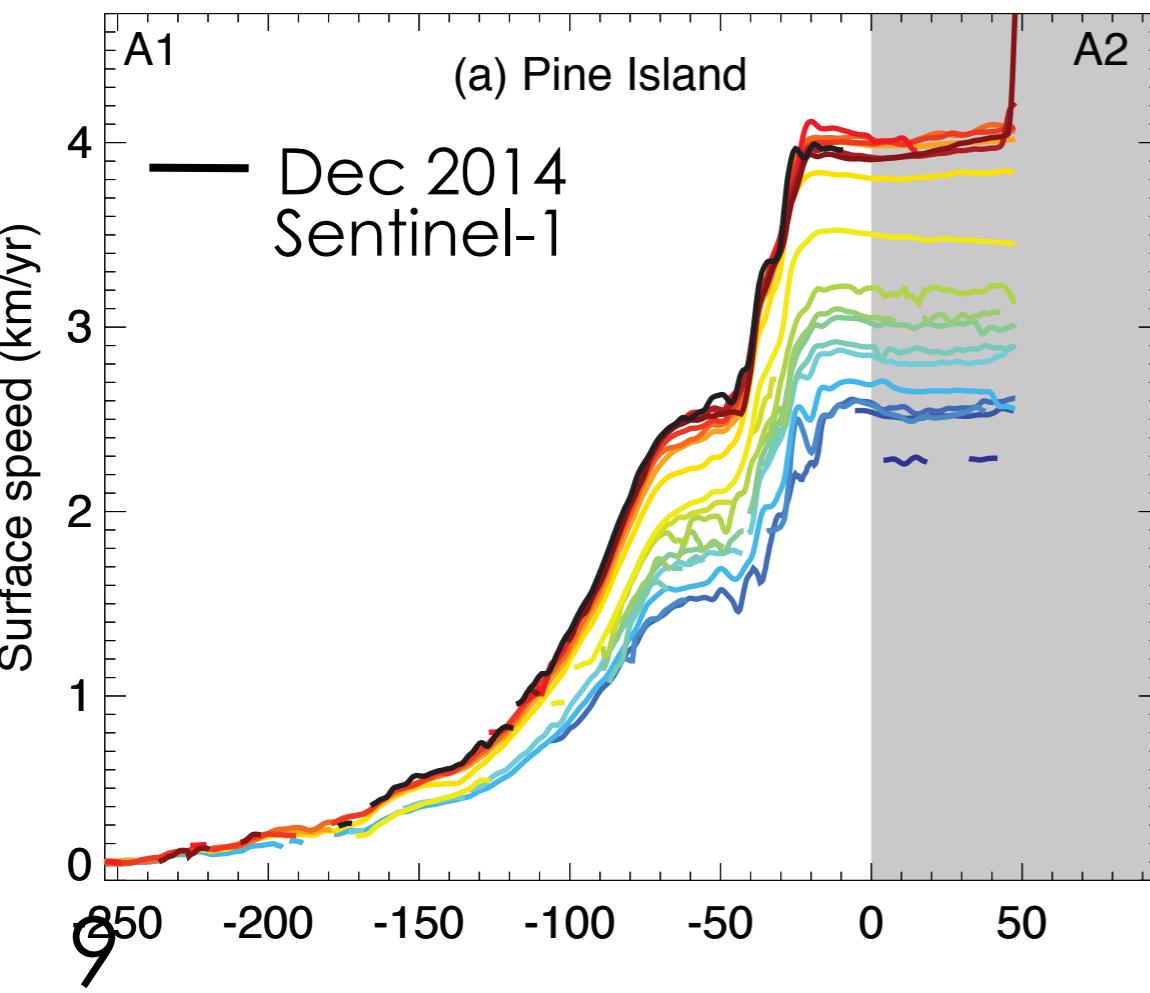
# Pine Island Glacier

- Ice-shelf flow speed increased by 1.7 km/yr or 75% between 1973 and 2010.
- Grounding line is now localized at the inland end of the ice plain.

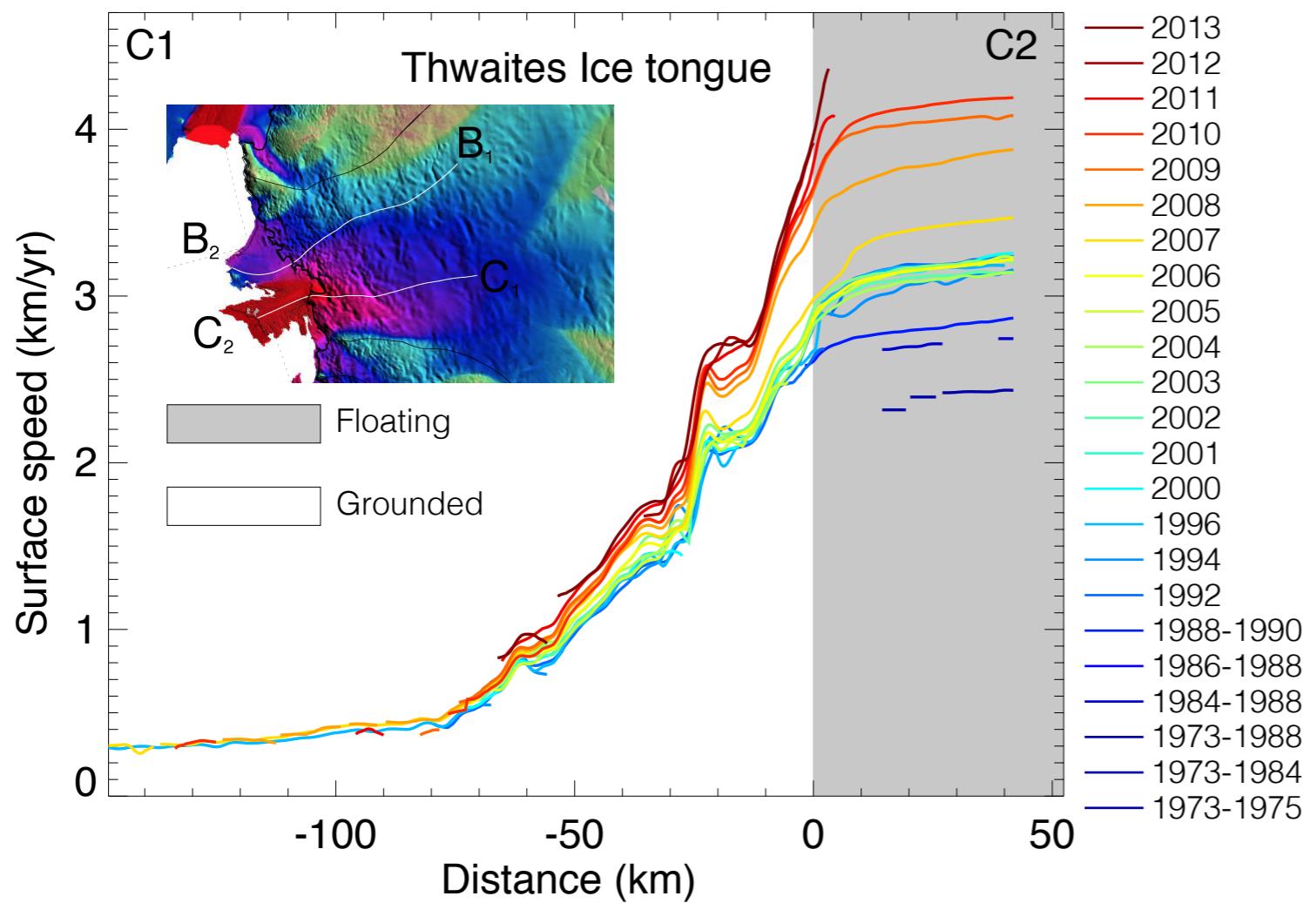


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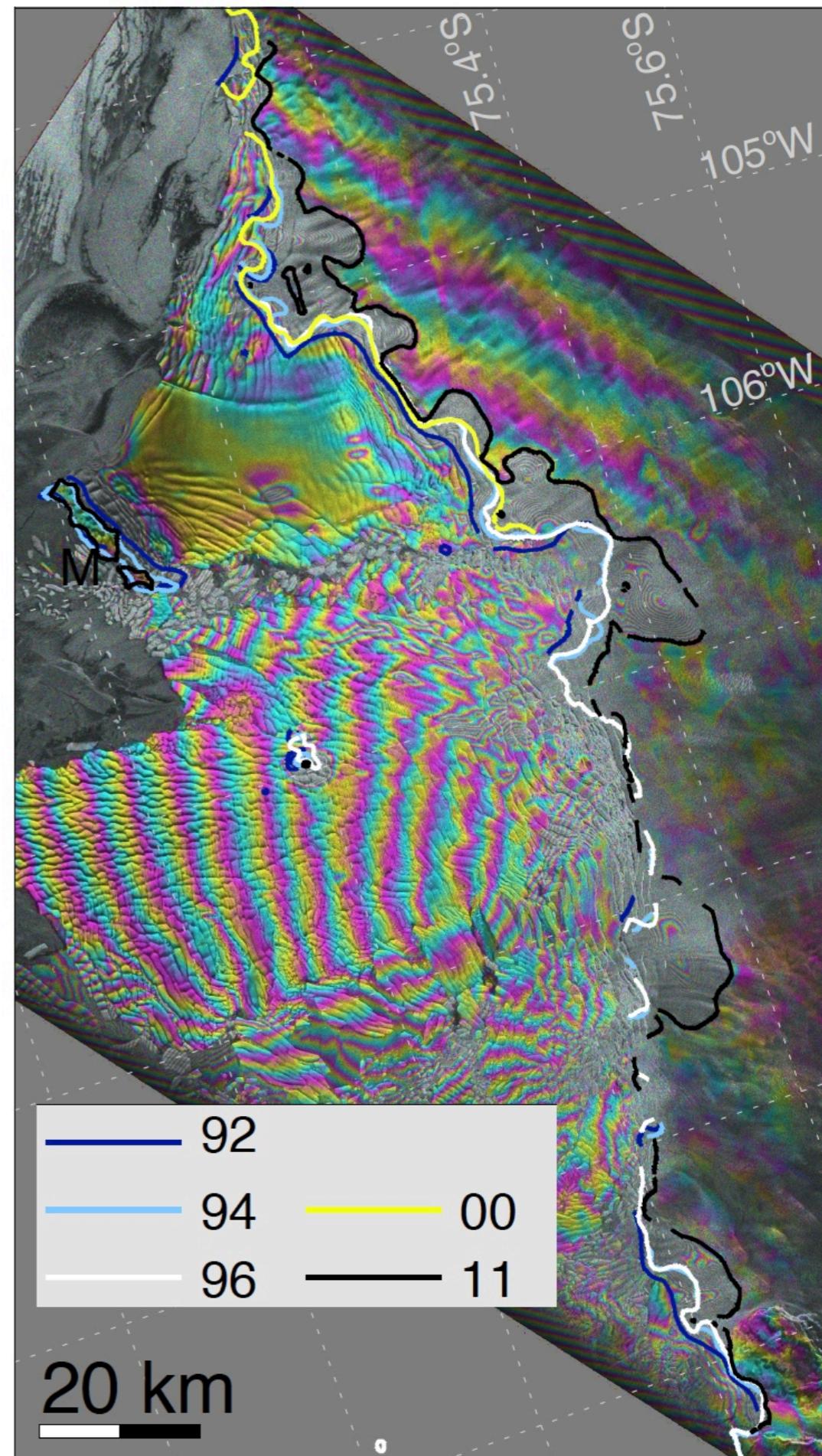
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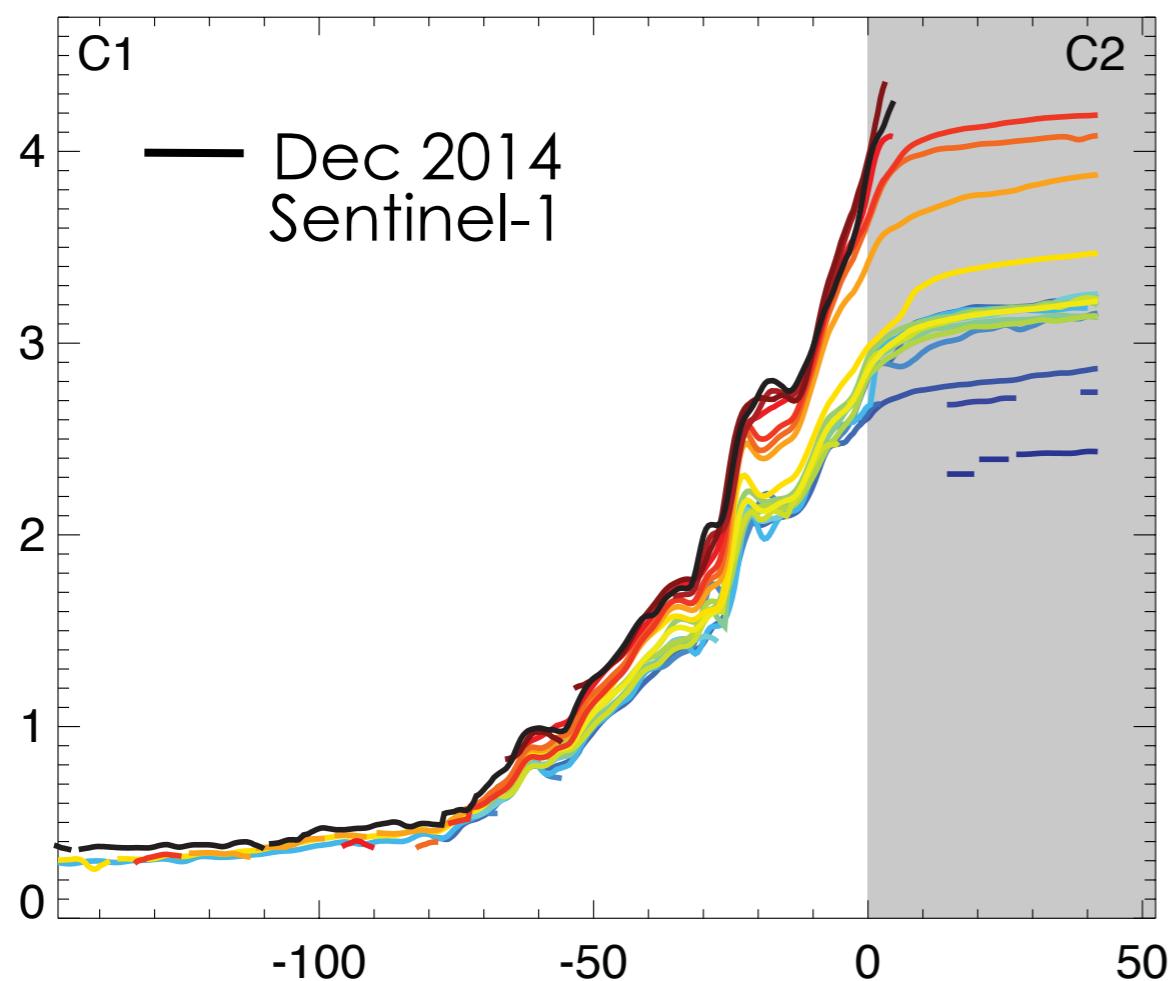
# Thwaites Glacier



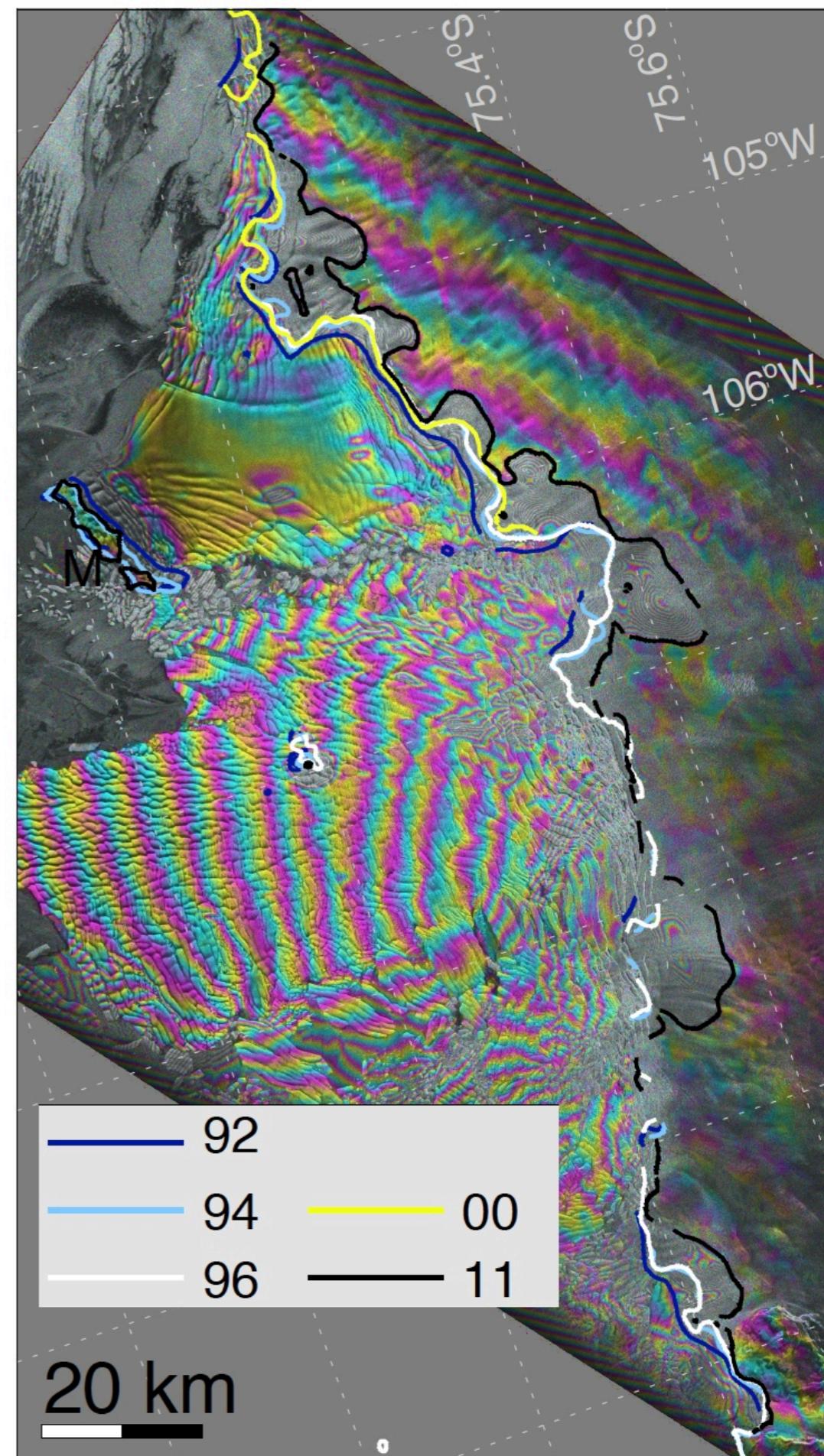
- 3 phases :
  - ▶ 1973-1996 acceleration by 33%,
  - ▶ 1996-2006 stable,
  - ▶ 2006-2013 acceleration by 33%



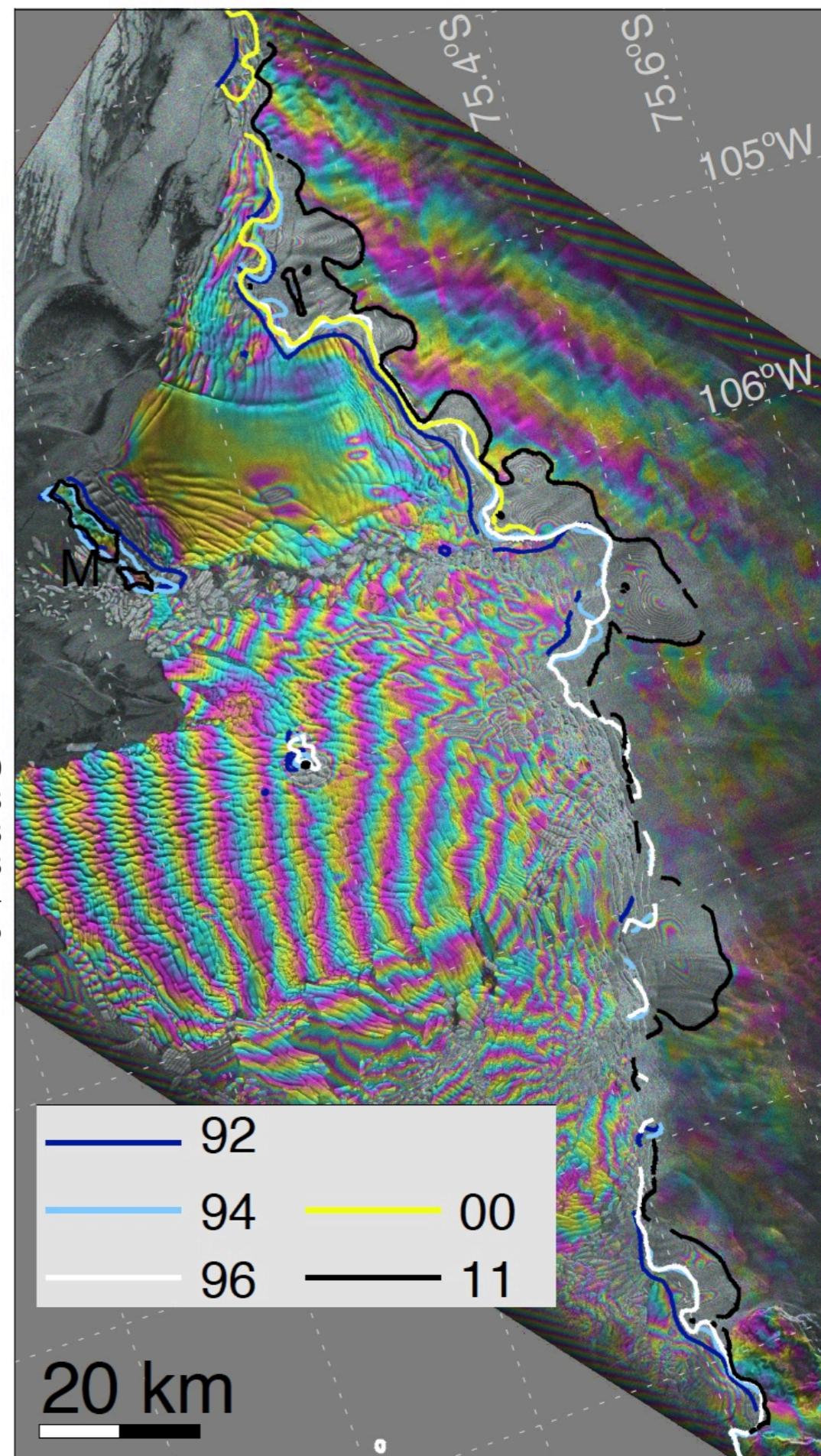
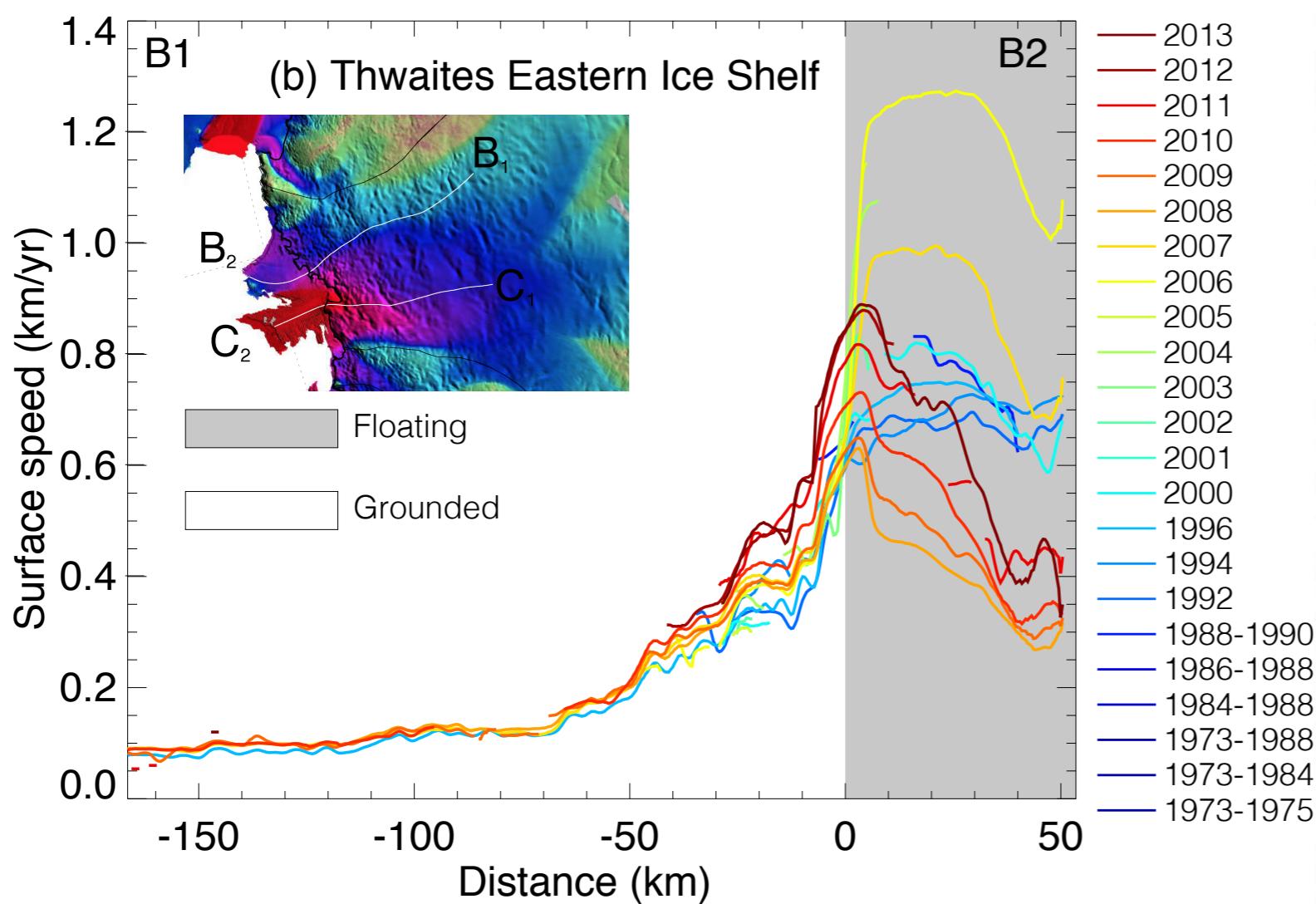
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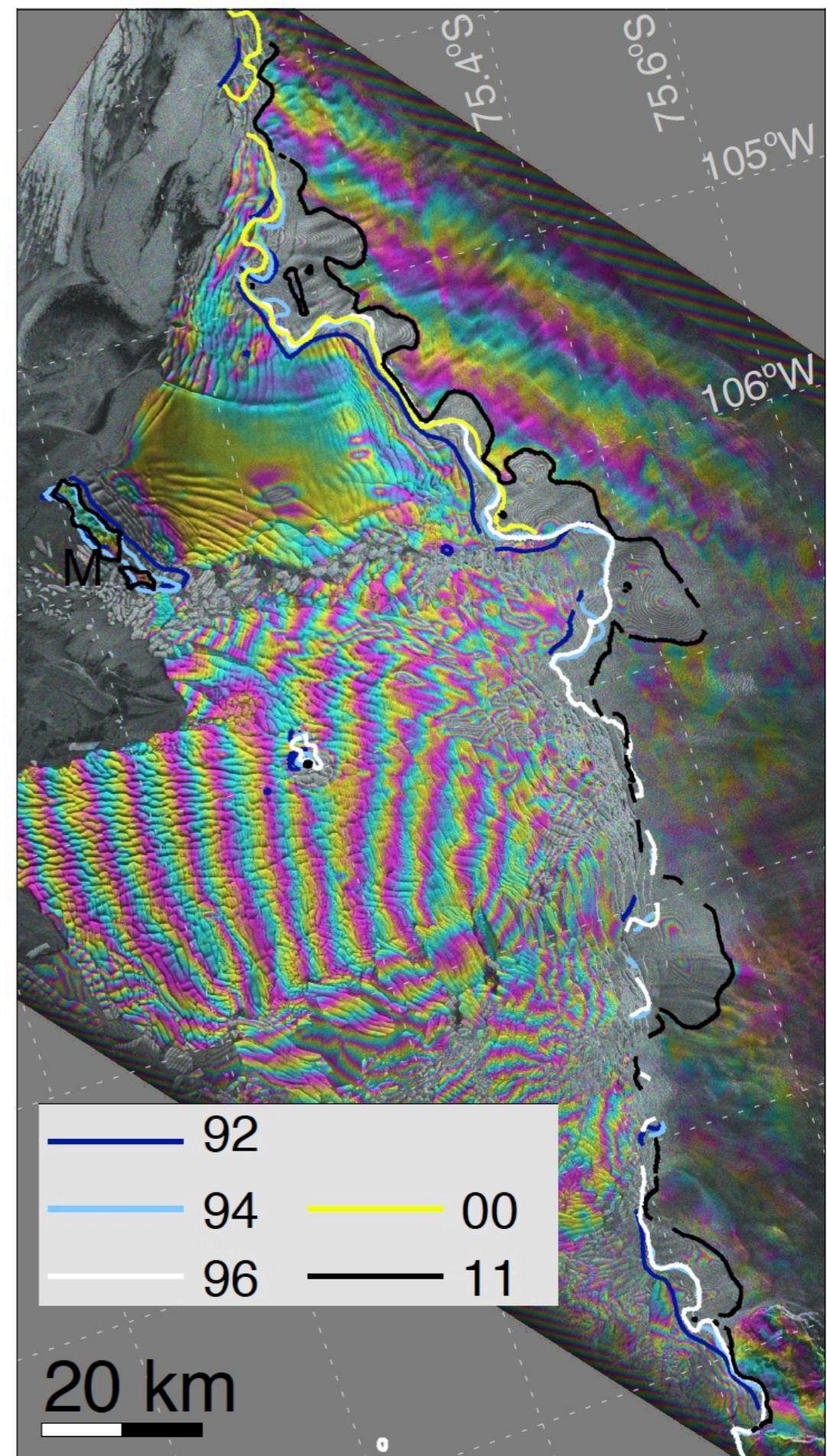
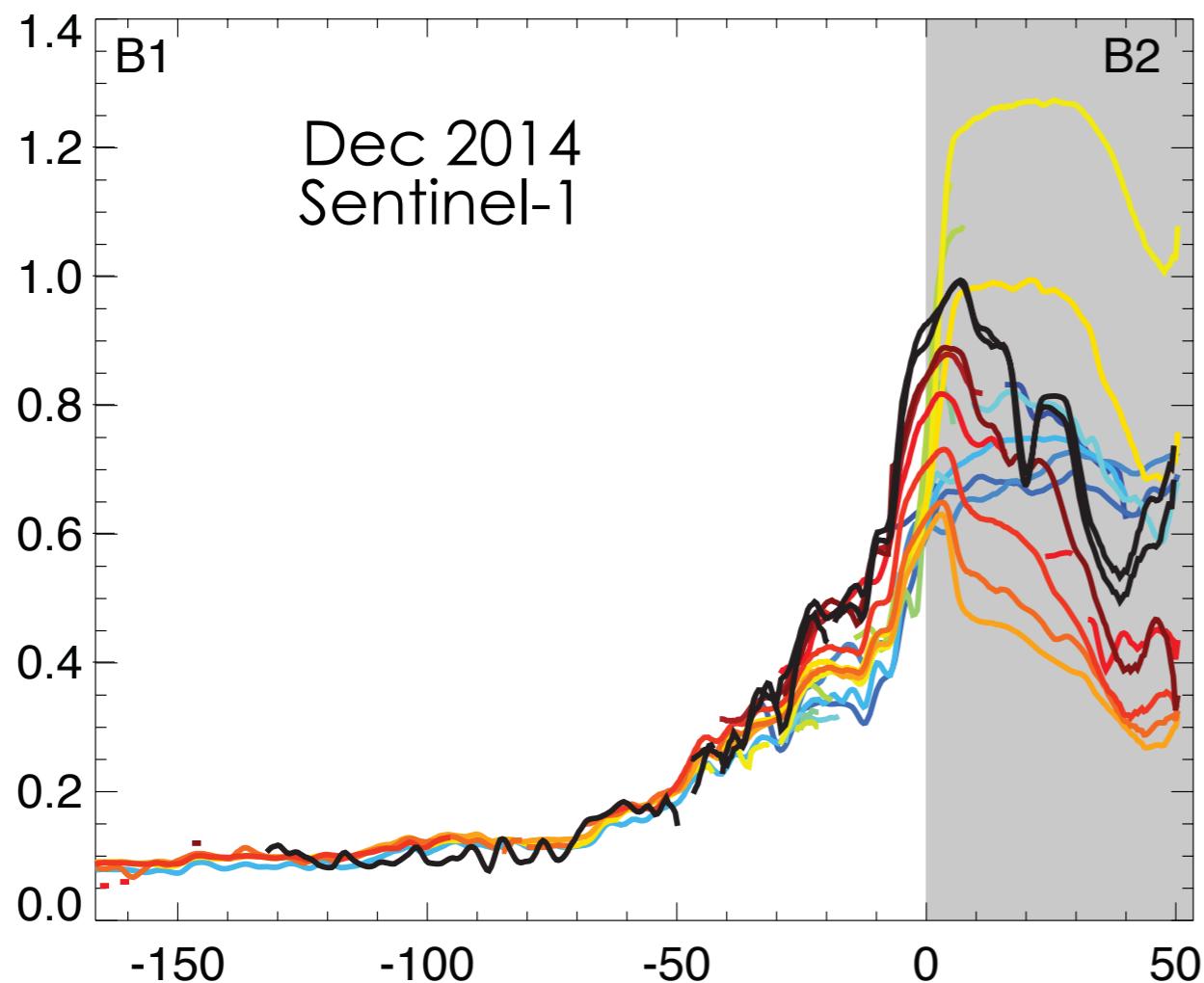
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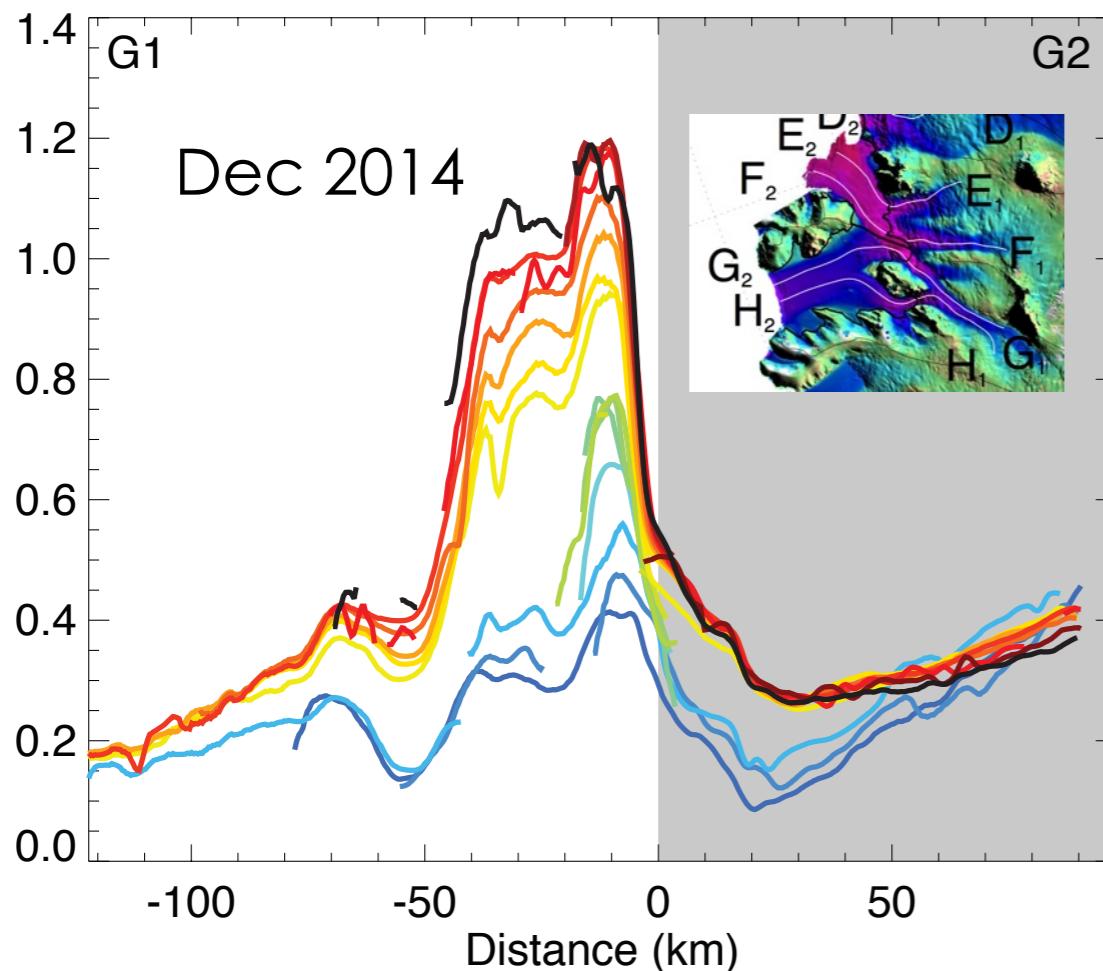
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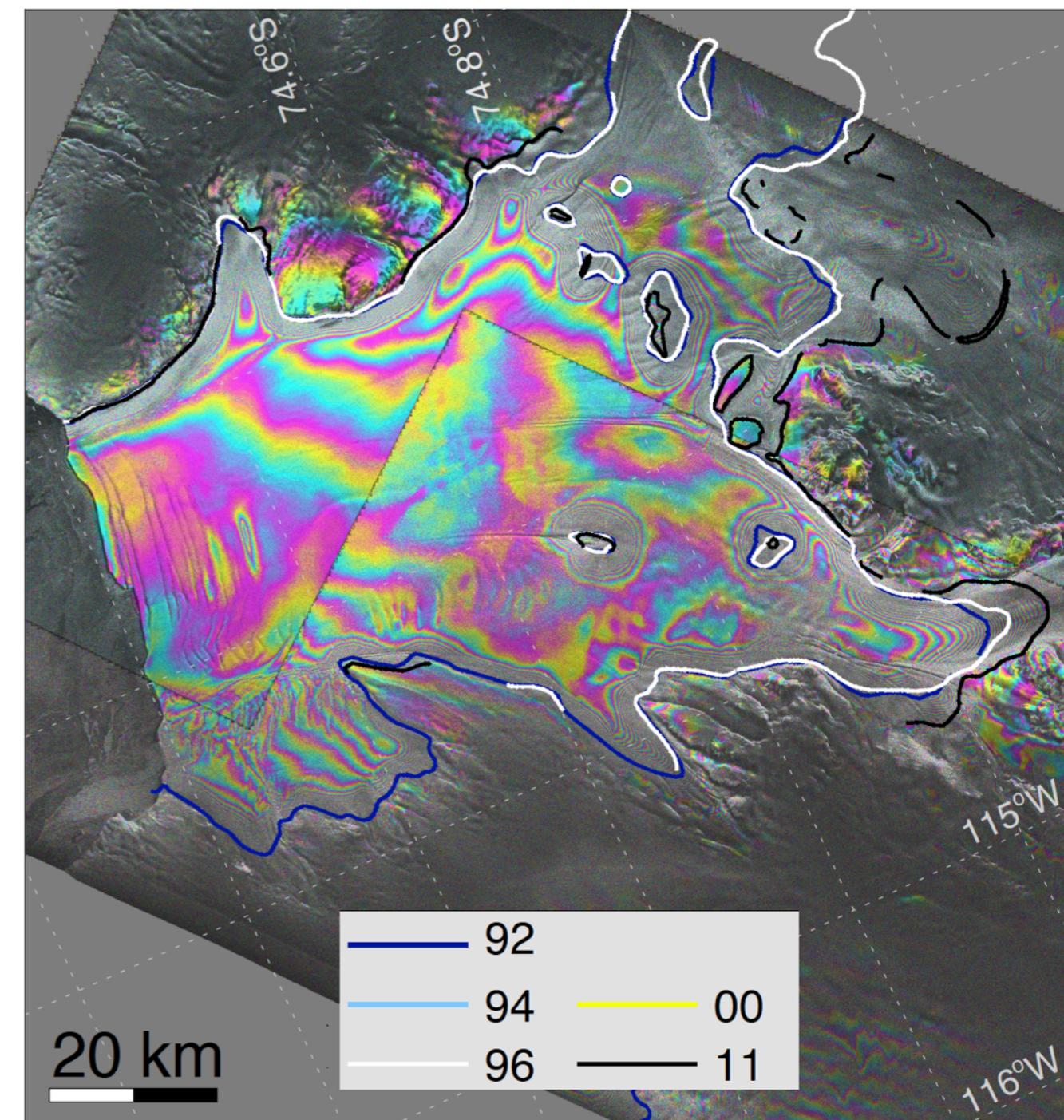
# Thwaites Glacier



# Smith, Kohler, Pope

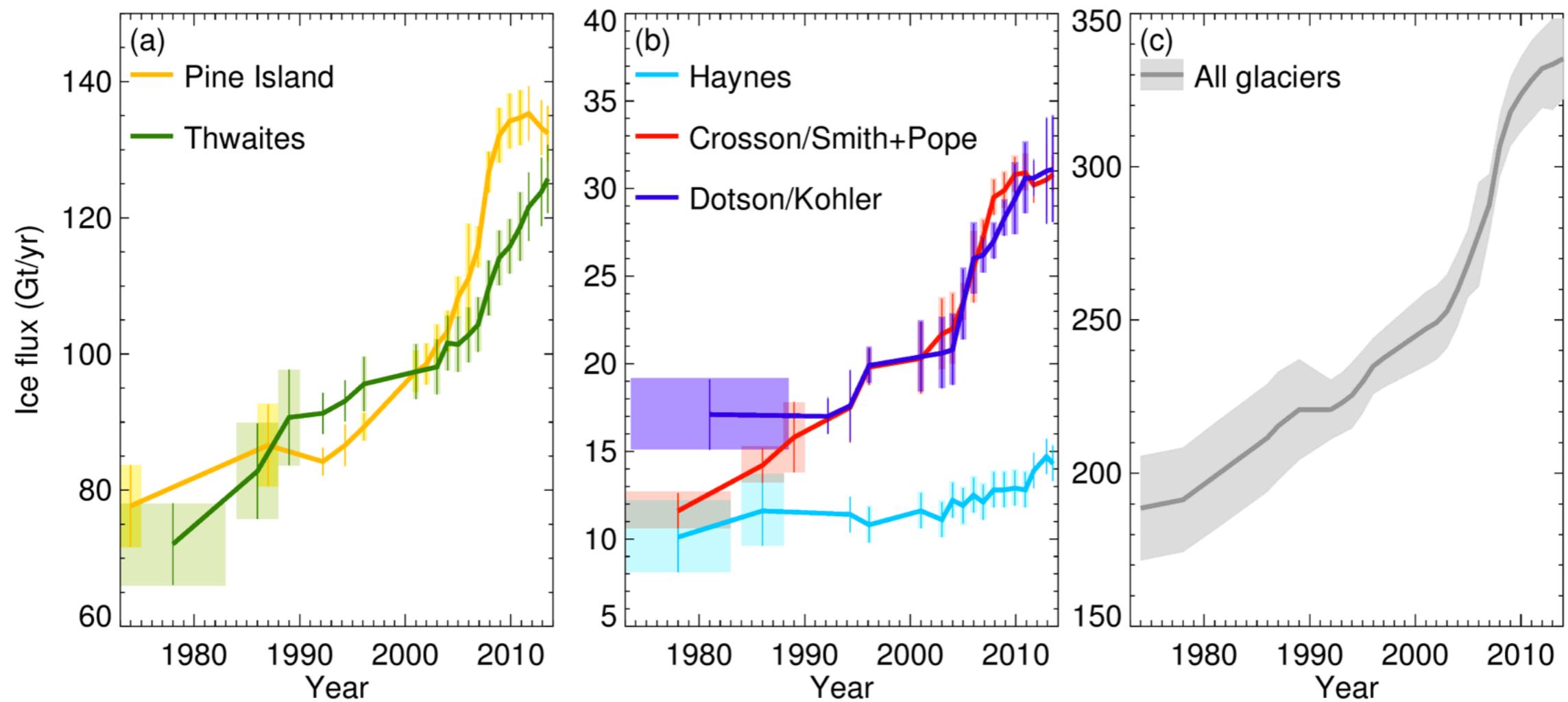


- The flux of Crosson Ice Shelf increased by 170 % from  $12 \pm 2$  Gt/yr in the late 70s to more than  $31 \pm 1$  in 2013.
- Coincides with the largest grounding line retreat, 35 km between 1996 and 2011

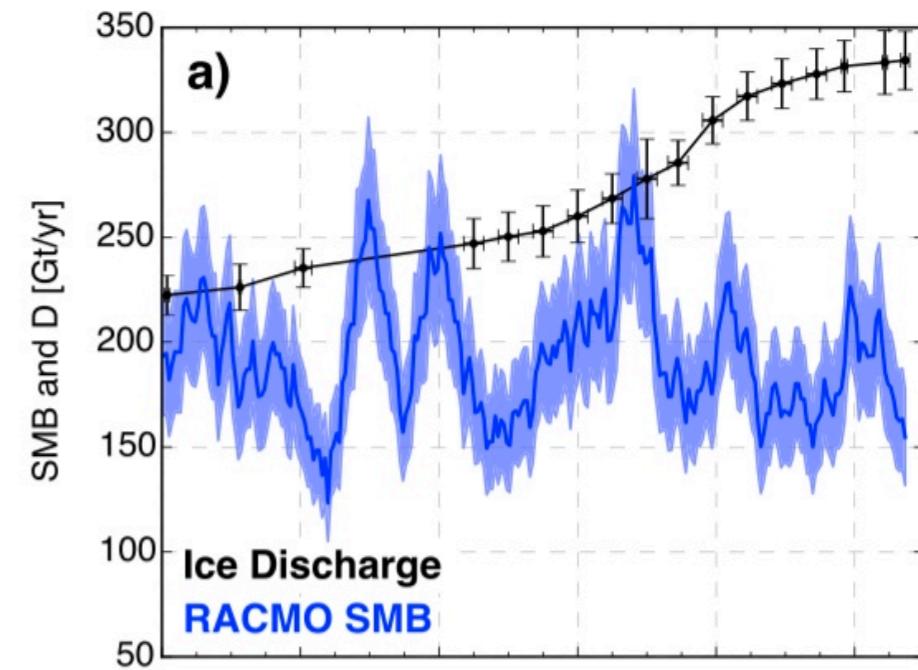


# Flux

- Combine these measurements with ice thickness from BEDMAP2
- Correct for ice thinning using IceSAT measurements.



# Conclusion



- The total ice discharge has **increased** by 77% since 1973. • The grounding lines of all glaciers has **retreated** by tens of kilometers.
  - ▶  $SLR = 4.5 \pm 0.1 \text{ mm}$  for 1992–2013 periods
- **No major obstacles** upstream the actual grounding line that could prevent farther retreat.
- We conclude that this sector of West Antarctica shows strong indicators of the development of a **marine ice sheet instability**.

## Recommendation

- **Sentinel-1** and long-term SAR observations provide priceless insights of rapidly changing glaciers
- **Continuous acquisition** in Amundsen Sea Sector offers new possibilities to study the **dynamic processes**
- If we want to capture and understand the ongoing changes and to be able to predict the future contribution of Ice Sheets, these observations should be extended to other regions in Antarctica and Greenland