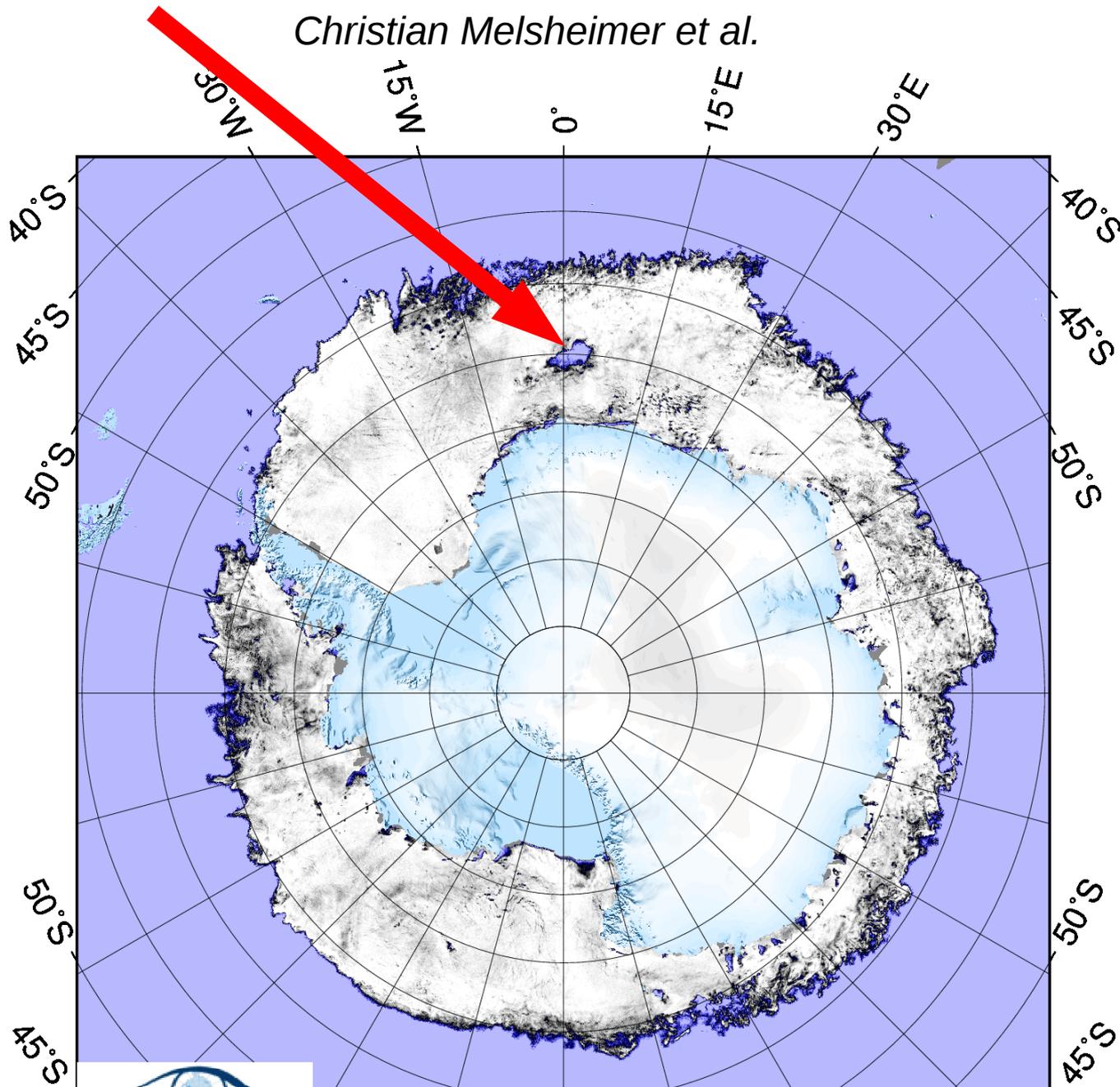


# A Big Hole in the Ice – The Weddell Polynya is Back!

*Christian Melsheimer et al.*



# What is a Polynya?

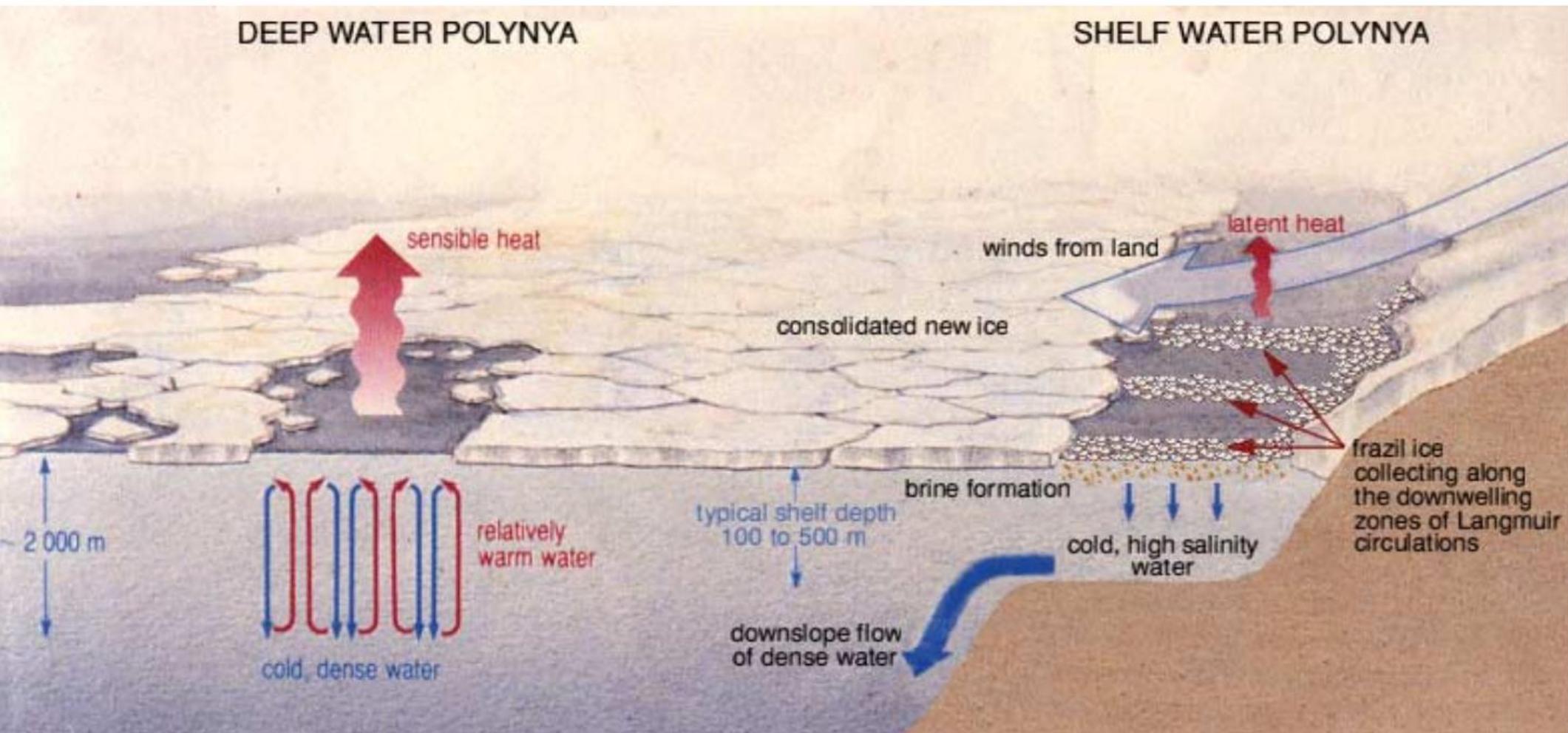
- from Russian word  
По́лынья
- area of open water  
surrounded by sea ice,  
even in freezing conditions
- can persist for days, weeks  
or months



*Polynyas near Oates Coast,  
West of Ross Sea.  
(NASA/NSIDC)*

# Polynya Types

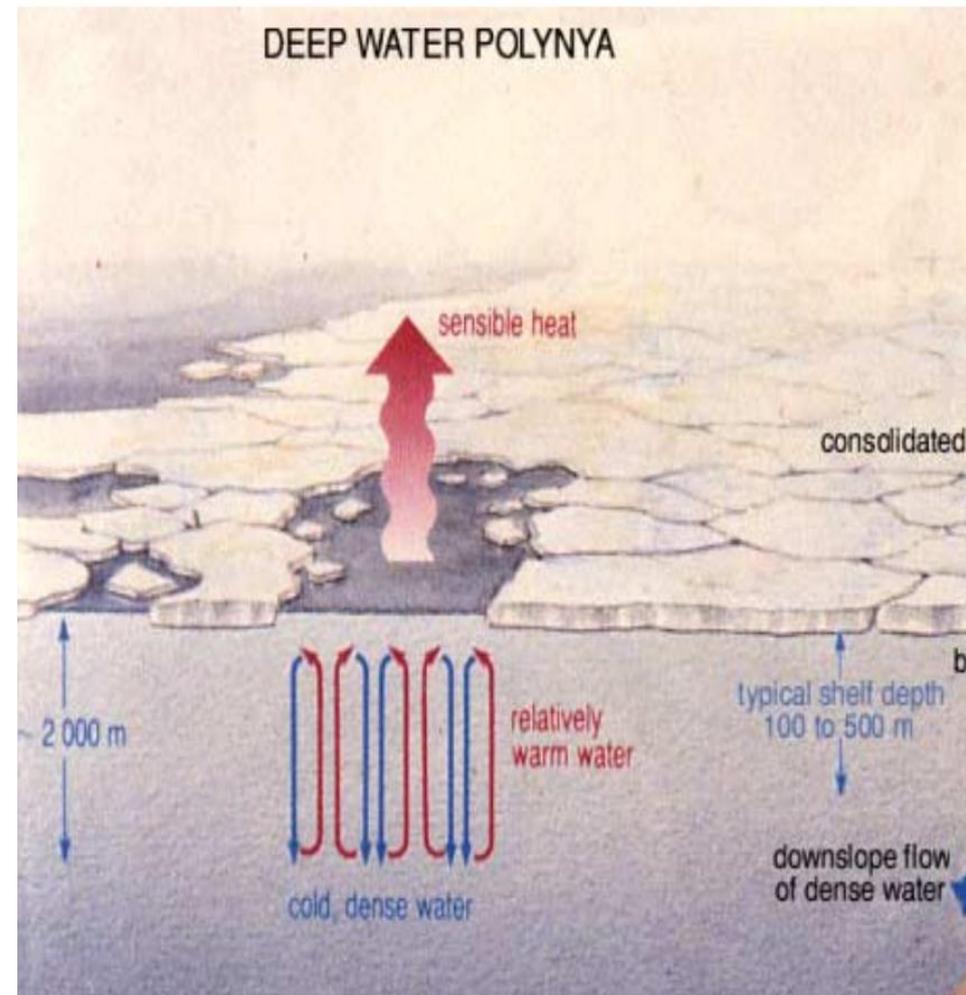
- two possible reasons for opening in the ice:
  - 1) melting from below
  - 2) winds or currents tear apart the ice



# Sensible Heat Polynya

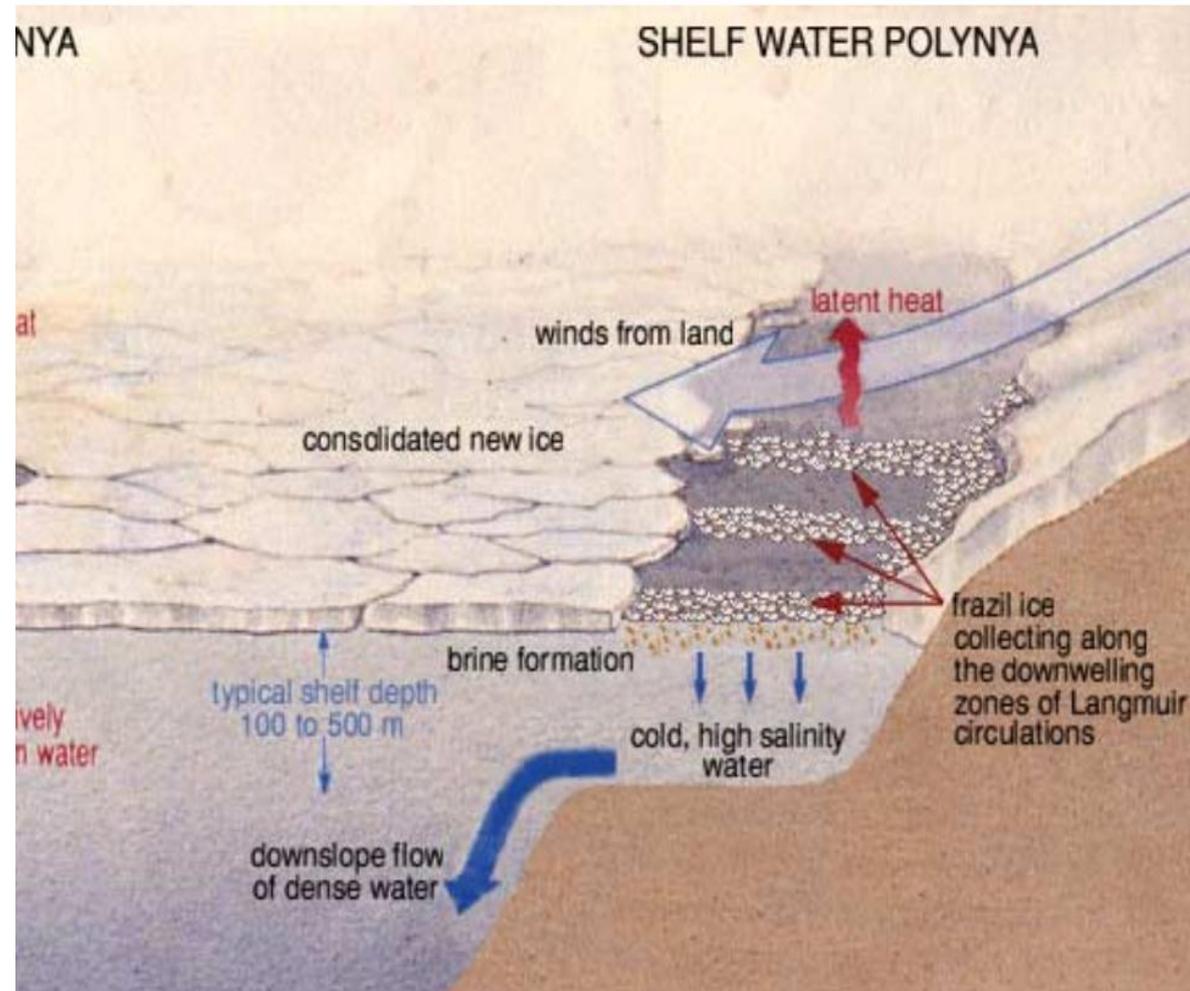
1) thermodynamically driven:

- upwelling warmer water melts the sea ice and/or prevents formation of ice
- also called
  - “sensible heat polynya”
  - “deep water polynya”
  - “open ocean polynya”
- releases sensible heat



# Latent Heat Polynya

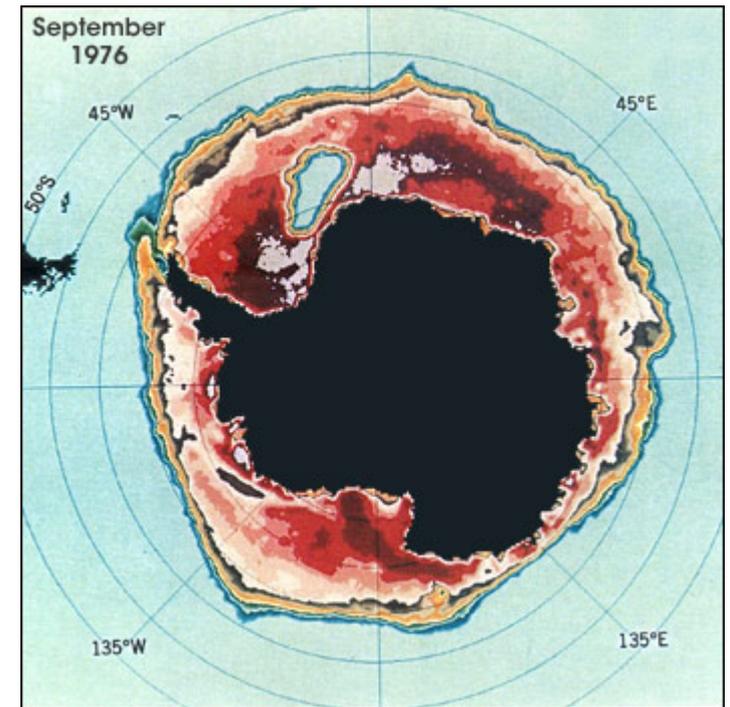
- 2) dynamically driven:  
mobile sea ice constantly driven away from something immobile (e.g. coast, fast ice, ice shelf)
- new ice on the polynya driven away as well
  - driver usually wind (possible: currents)
  - also called:  
“latent heat p.”  
“coastal p.”
  - releases latent heat



# Weddell (Sea) Polynya

- Large polynya in the Weddell Sea, observed 1974-1976
- about 200,000 km<sup>2</sup>

[movie ESMR 1 Aug – 15 Dec 1974]



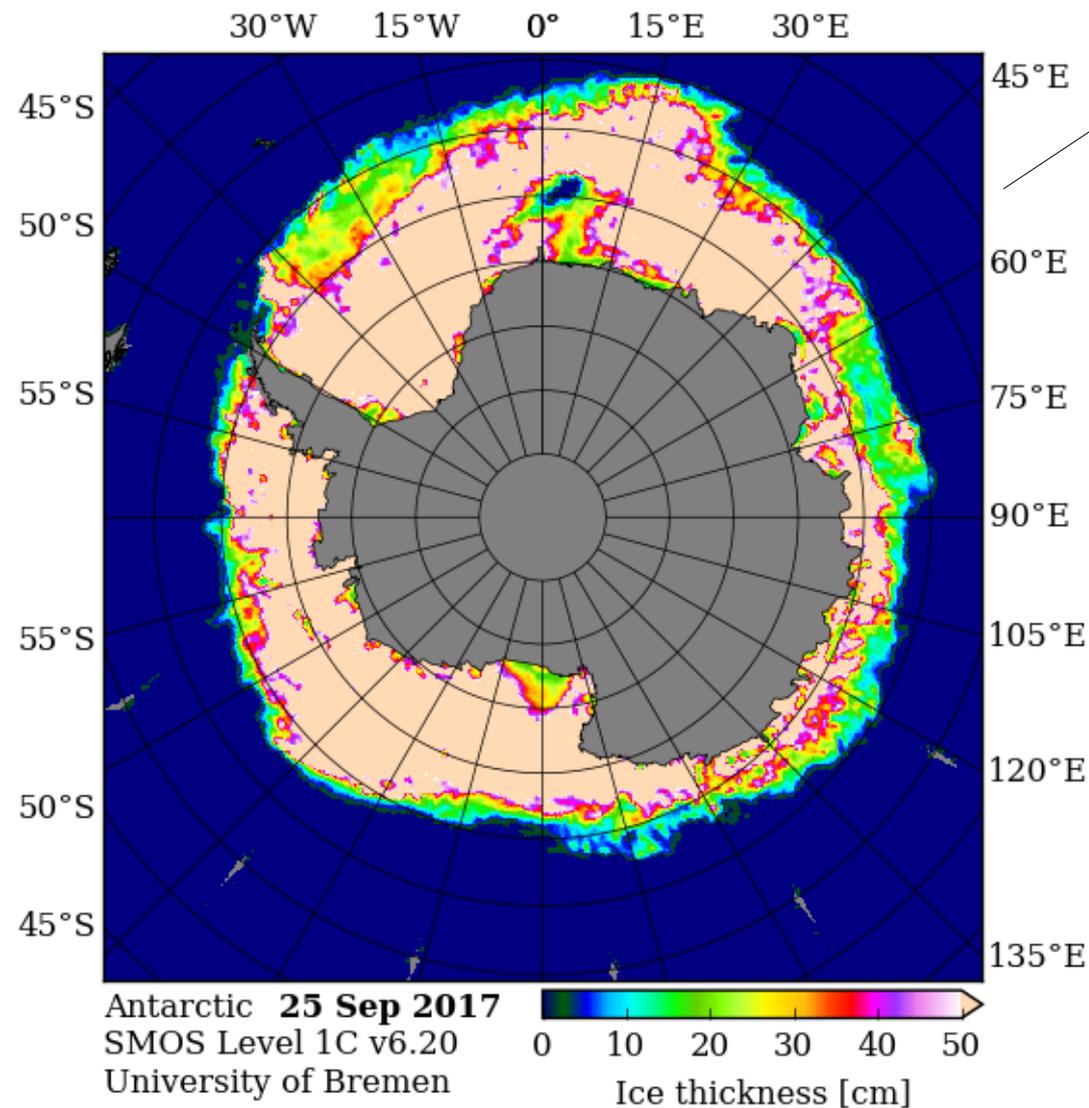
(Smithsonian, NASA/GSFC)

- after that, never observed again, until...
- 2016 and 2017, but considerably smaller < 80,000km<sup>2</sup>
- latent or sensible heat?
- in other words: dynamic or thermodynamic?

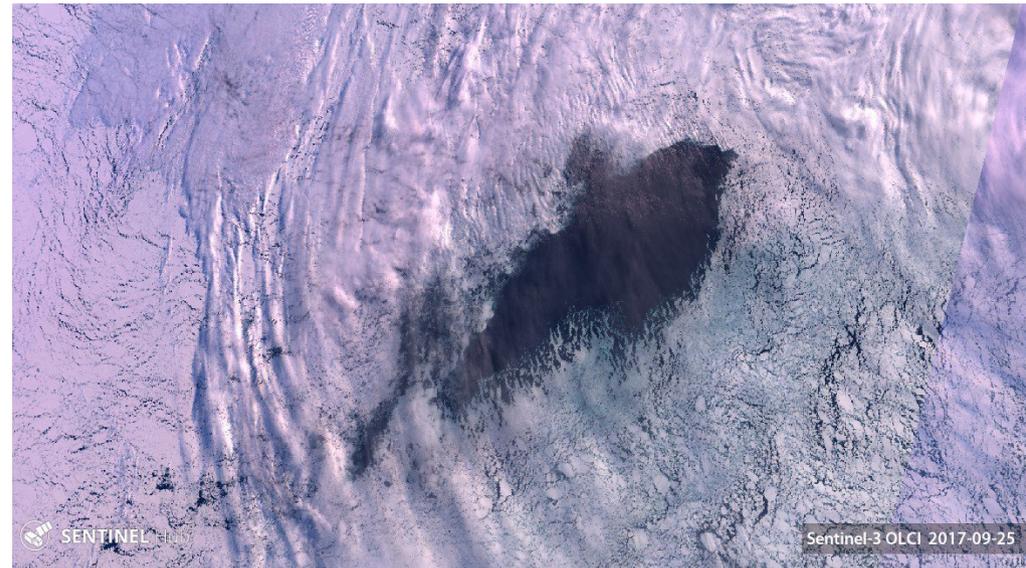
# Weddell (Sea) Polynya 2017

[movie: Icefilm...]

# Weddell (Sea) Polynya 2017



Size  $\approx 2^\circ\text{lat} \times 7^\circ\text{lon} \approx 200 \text{ km} \times 400 \text{ km}$



*True-color image, OLCI on Sentinel 3,  
25 Sep, 2017*

*Sea ice thickness*

# Weddell (Sea) Polynya

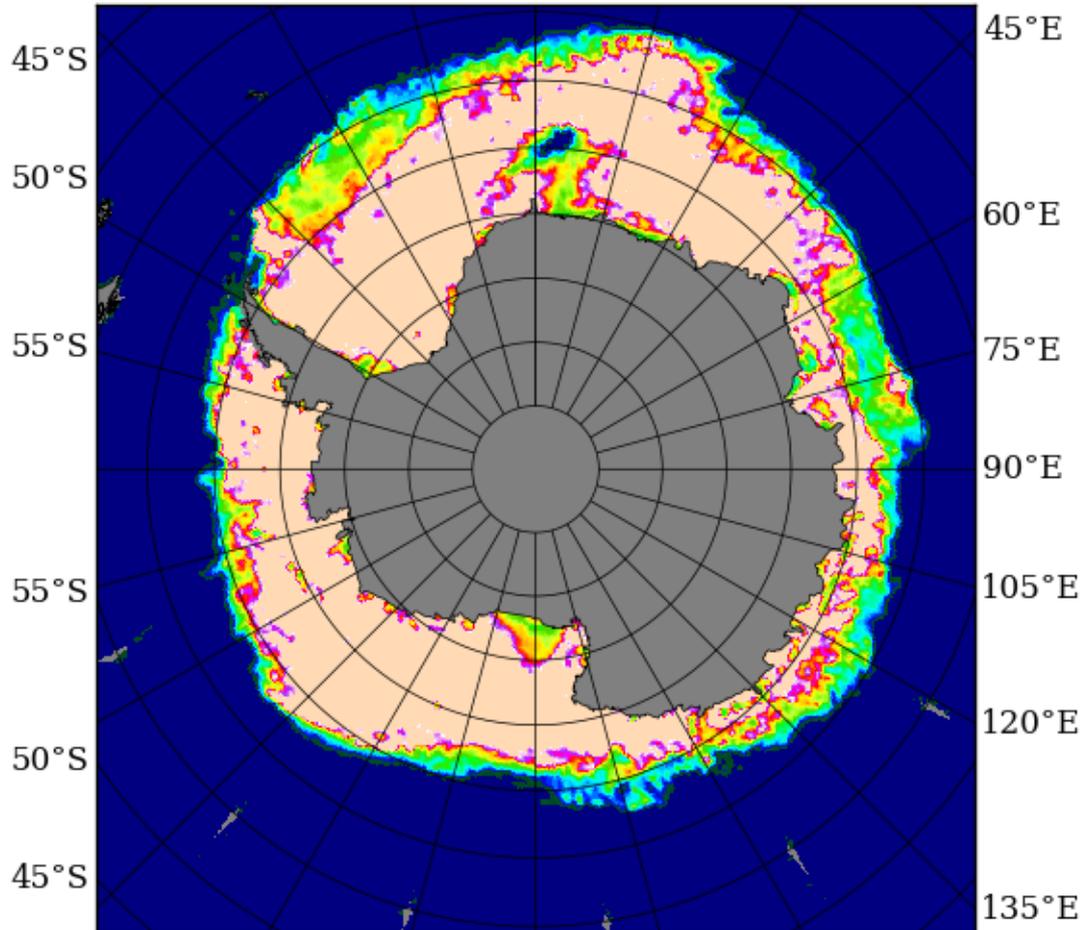
polynya size

2016

vs.

1976

30°W 15°W 0° 15°E 30°E



Antarctic 25 Sep 2017

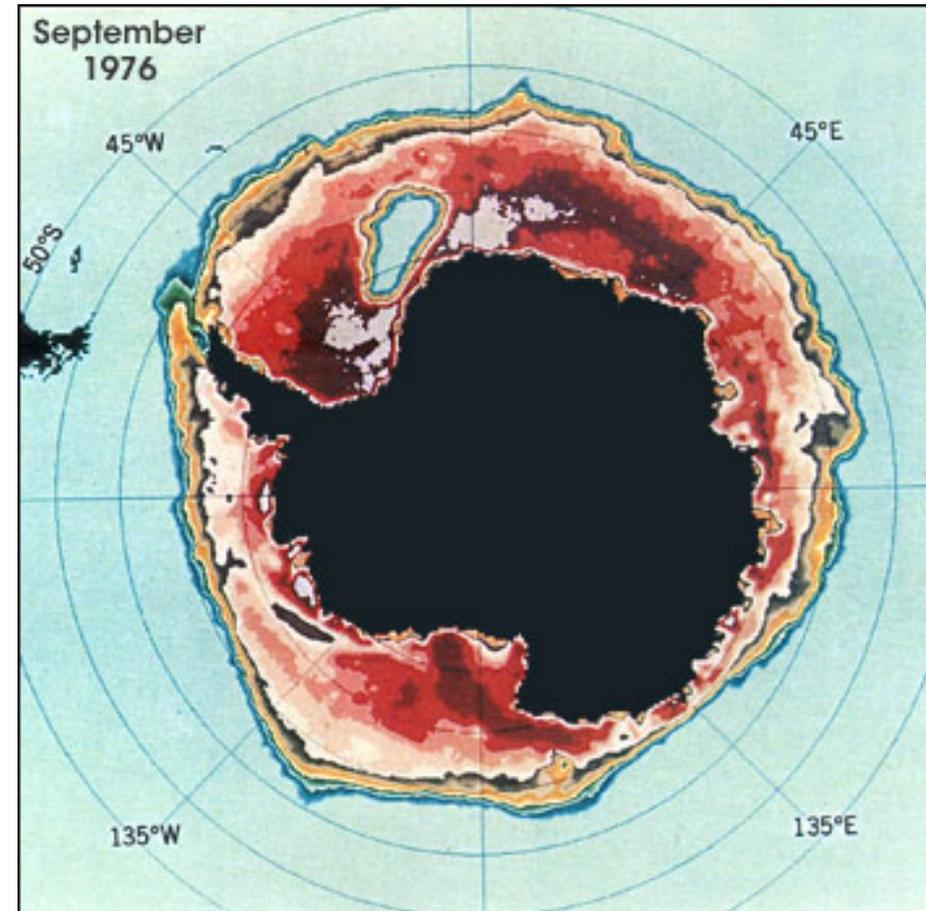
SMOS Level 1C v6.20

University of Bremen

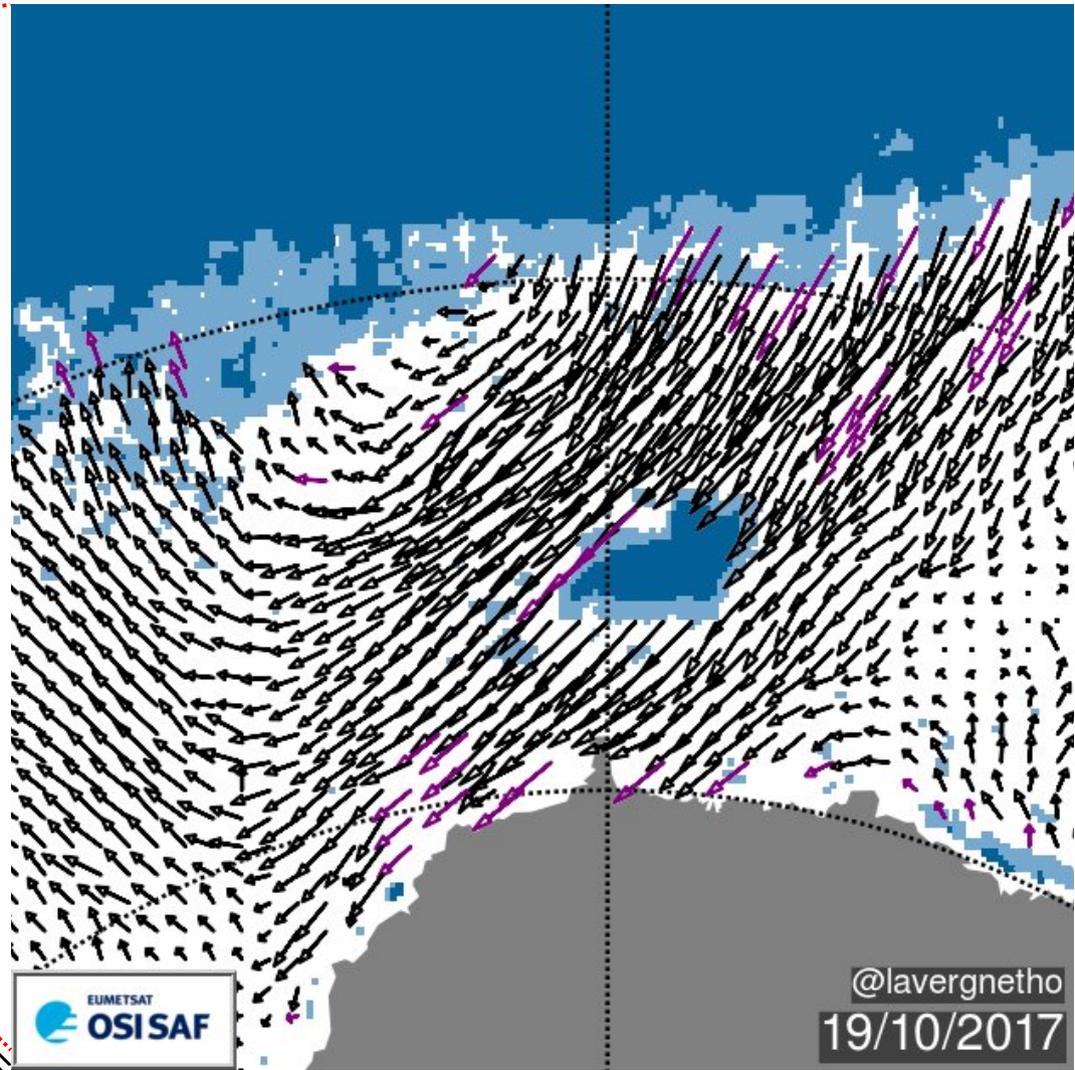
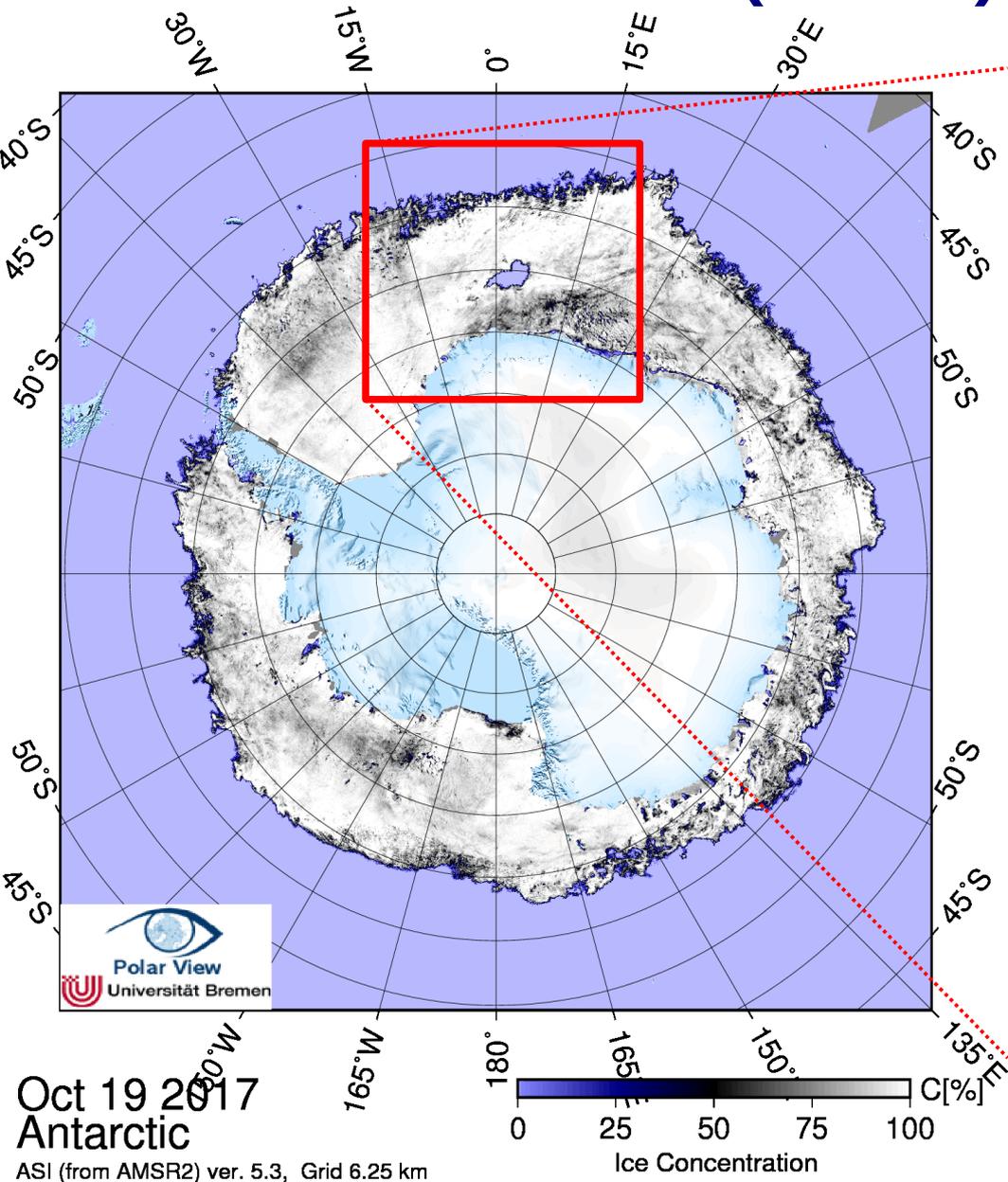


0 10 20 30 40 50

Ice thickness [cm]



# Weddell (Sea) Polynya 2017



Oct 19 2017  
Antarctic

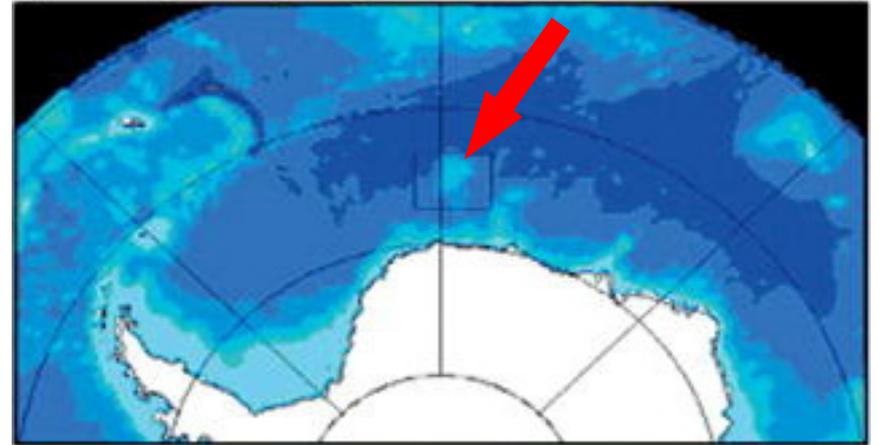
ASI (from AMSR2) ver. 5.3, Grid 6.25 km

Sea ice drift

# Weddell Polynya: How?

- Sensible heat polynya, driven by upwelling.
- Upwelling caused by the Maud Rise (sea mount):
- Oceanic current interacts with Maud Rise eddies are shed etc.

b) Bathymetry Map with Maud Rise



*from Gordon et al. 2007,  
DOI:10.1175/JCLI4046.1*

→ redirects warmer deeper water towards the surface

# Weddell (Sea) Polynya 2017

- Looking at sea ice thickness from SMOS satellite:

[movie: SMOS...]

- long before the polynya appears, the ice seems to be thinning (melting from below)

# Weddell Polynya: Why?

- Large release of heat by the Southern Ocean
- Some models suggest this release happens periodically on a scale of 40 years or so
- Or: Related to global change
  - thinner ice
  - warmer deep water
  - ocean circulation changed

**Follow the current development:**

*Twitter: #WeddellPolynya*

*<https://twitter.com/hashtag/WeddellPolynya?src=hash>*