Antarctic sea ice cover during the Heroic Age of Exploration

Jonny Day (Unv. Reading) and Tom Edinburgh (Unv. Cambridge)

Thanks to:
Philip Brohan (Met Office), Clive Wilkinson (UEA), the ICOADS team and Royal Geog. Soc.
Were the ice conditions unusual?

How have conditions changed since Shackleton's time?
Satellite-era Trends

- Positive trends in the Weddell and Ross sea sectors
- Negative or constant elsewhere.

Parkinson and Cavalieri (2012)
IPCC Chapter 4 (2013)
CMIP5 model trends (Summer sea ice extent)

Turner et al. (2012)
Pre-Satellite observations.

Whaling records:

- Show a 2.8° southward shift in ice edge latitude between 1930s and 1970/80s (de la Mare, 1997 & 2009).

- Controversial due to assumptions made about the position of whale catch to ice edge (e.g. Ackley et al., 2003).

Direct observations from ship logbooks:

- Less abundant, but also less open to interpretation
From South Georgia

ICE REMARKS.

Sea half - White wavy seas.

Long leads - Fresh to strong breeze. Overcast and cloudy with frequent snow squalls.

Sea half - White wavy seas.

Remarks:
- Snow and antarctic gulls. 3 emperor penguins.
- Wind is NW. Current is N. Snow to thick, with wind.
- Overcast, cloudy. Continuous light snow.
Expeditions digitised by ICOADS or us.
Voyage of the Scotia (Scottish expedition of 1902-1903)
Scott’s Terra Nova Expedition (1910-1913)
Difficulties in satellite vs. ship ice edge observations

The ship observed sea ice edge is on average $0.75 \pm 0.61^\circ$ north of PM Bootstrap ice edge (Worby and Comiso, 2004)

(a) Banded high conc. Ice

(b) Brash and old decaying flows

(a) Low concentration ice ~1/10 conc.

(b) 2 Oct 1997

Ice concentration (%) vs. Latitude (°S)
Have things changed?

\[ \Delta = 0.62 \]

\[ \Delta \text{EdgeLat} \approx 0.6 \]
Comparison to HadISST
Tentative Conclusions

• We’ve gathered over 100 ice edge data points from ships logbooks from the Heroic Age of Exploration (1900-1917) from ICOADS or Primary source (actual logbooks).

• The change in sea ice cover is small (Δ~0.6°), only identifiable difference is in the Weddel Sea (where ΔIceEdge~1.9°).

• Useful pinning point for constraining GCMs/Sea ice proxy’s.
Evidence from temperature, SST and sea ice proxies

Proxy records of surface air temperature and sea ice extent were grouped into four different sectors based on cross-correlation and PCA analysis.

Jones et al. (in prep)
Map of points

Δ = -0.0°
Δ = 0.4°
Δ = 0.4°
Δ = 1.9°