Sea ice in the ACCESS-OM2-01
Exploring near-coastal processes

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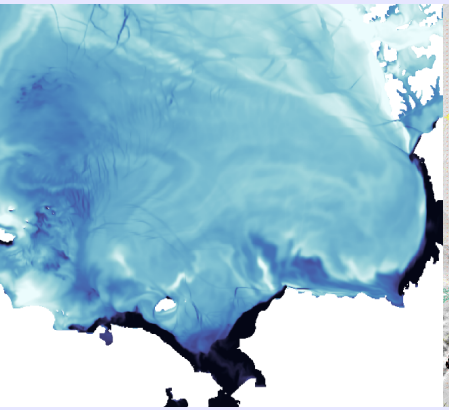
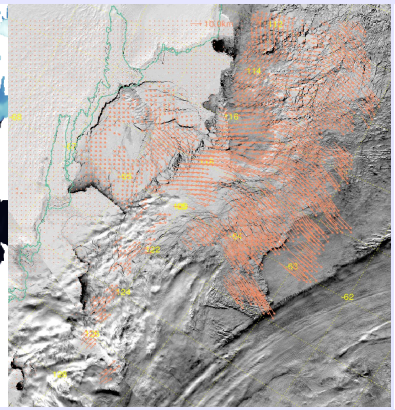
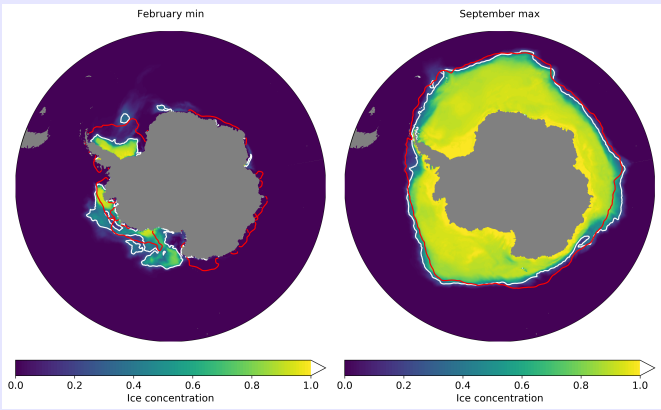






Australian Government
Department of the Environment and Energy
Australian Antarctic Division

ACCESS-OM2_01

→ High-resolution ocean-ice model:

Modular Ocean Model (MOM) 5.1

Community sea-ice model (CICE) 5.1

OASIS3-MCT coupler

JRA55 atmospheric forcing (0.5625°, 3h)

Initial condition & salinity restoring: World Ocean Atlas 2013v2

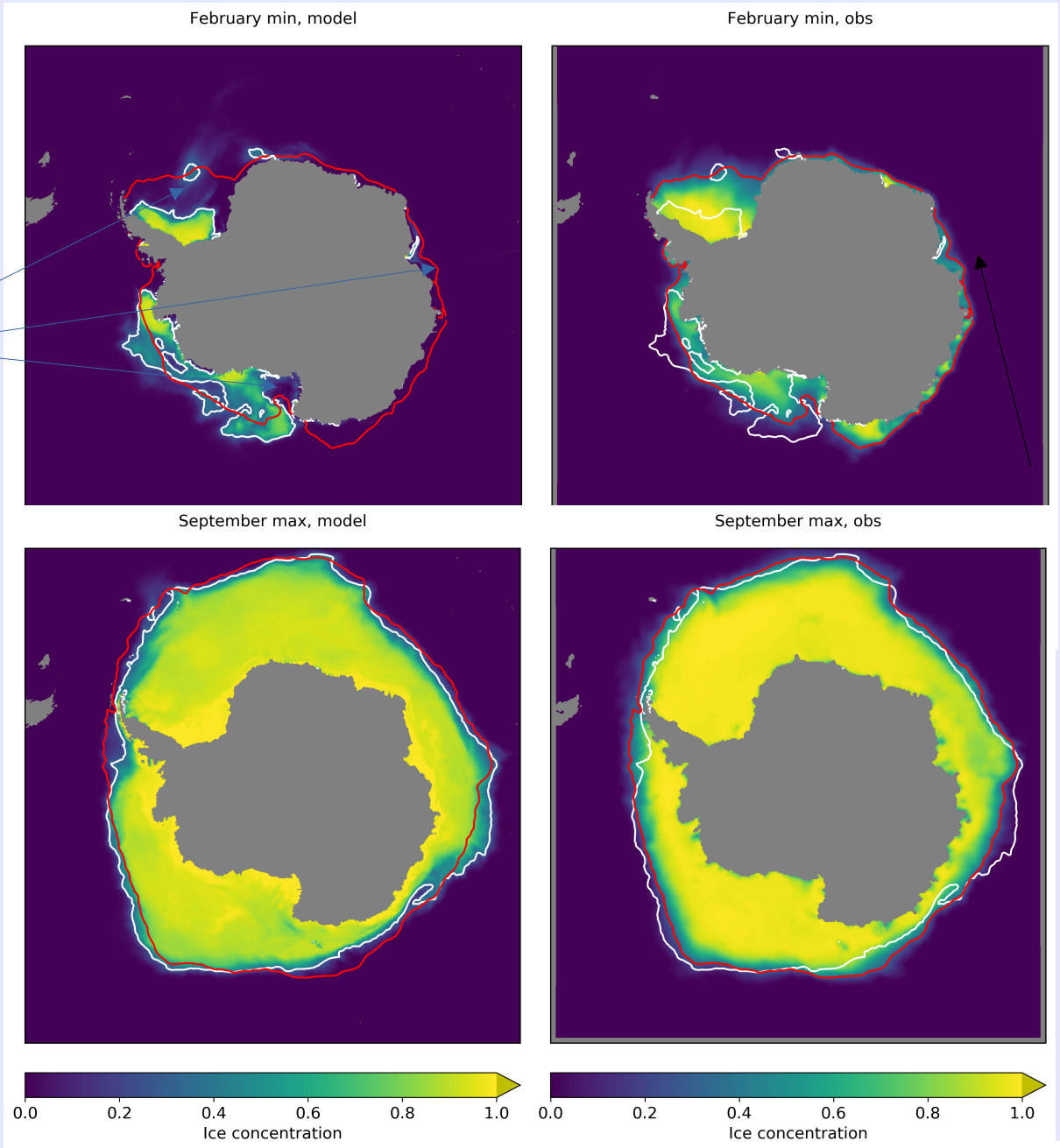
Grids: global (90°N – 81°S); tripolar in Arctic; Mercator for 65°N – 65°S

Spin-up: Repeat year forcing (May1984/Apr1985)

ACCESS-OM2_01

Too little summer si.

Low si conc in the winter interior.



Sea-ice assessment/validation in ACCESS-OM2_01

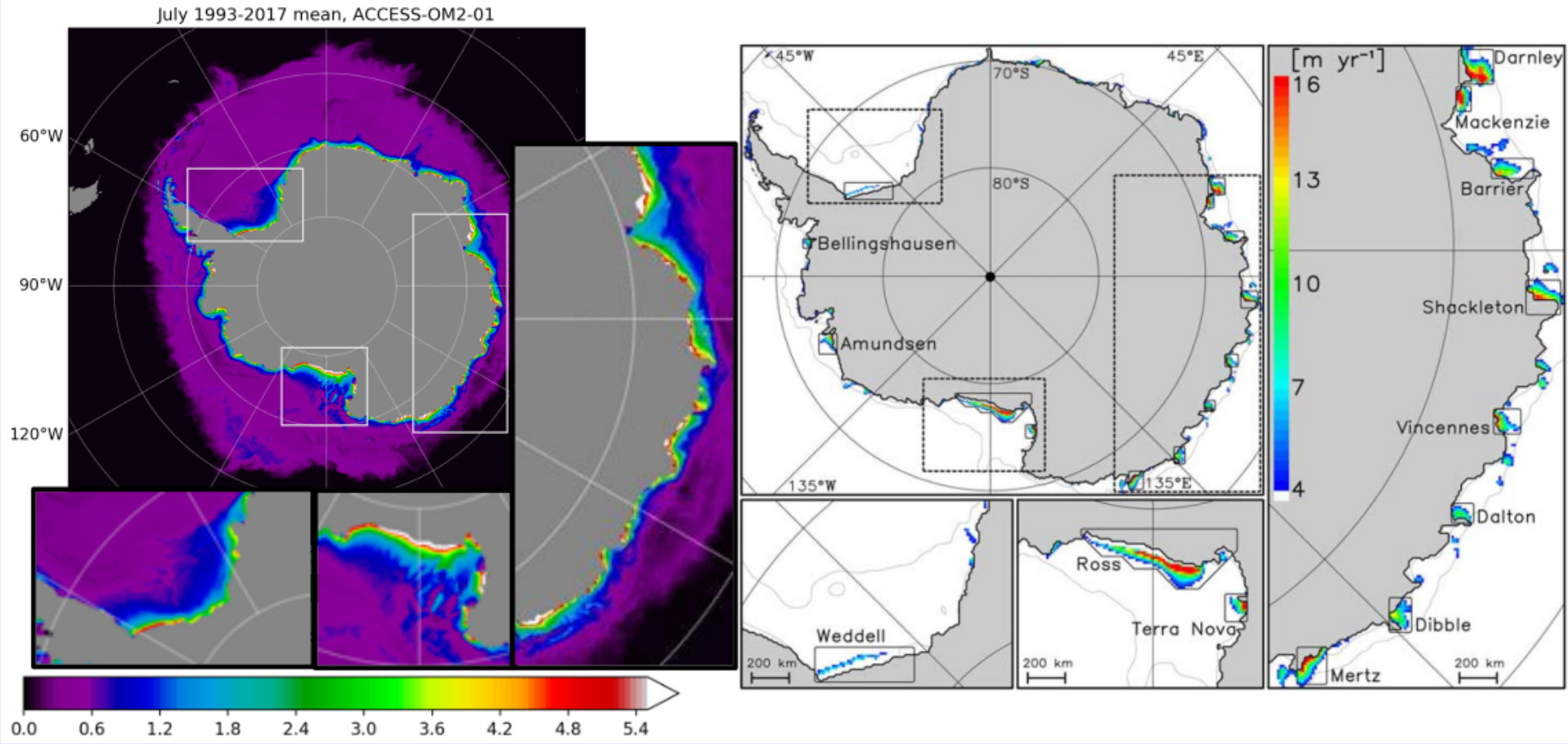
* Ice dynamics, incl. wind-forced components:
  - Beauford Gyre/TransPolar Drift → Fram Strait transport
  - Circum-Antarctic ice transport
  - Near-coastal ice conditions
  - Coastal polynyas
* Ice-thickness redistribution:
  - Thickness distribution → SIC?
  - Sea-ice volume
* Seasonality in ice growth/decay
  * Arctic ice volume
  * Ice thermodynamics → Melt ponds?

19/03/2014

19/03/2015

MODIS LANDS archive

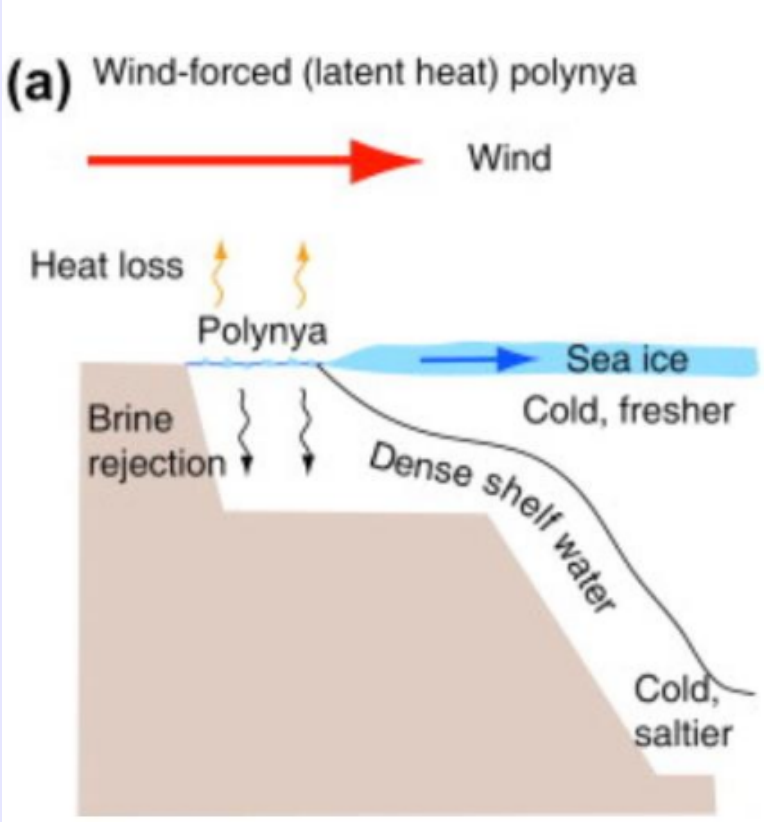
Sea-ice production:
Observational estimates versus ACCESS-OM2_01



Sea-ice production [cm/day]

Annual sea-ice production [m]

Role of katabatic winds in latent-heat polynya:



From Talley et al. 2011

Strong offshore (katabatic) winds

↓

Divergent ice motion

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Areas of open water

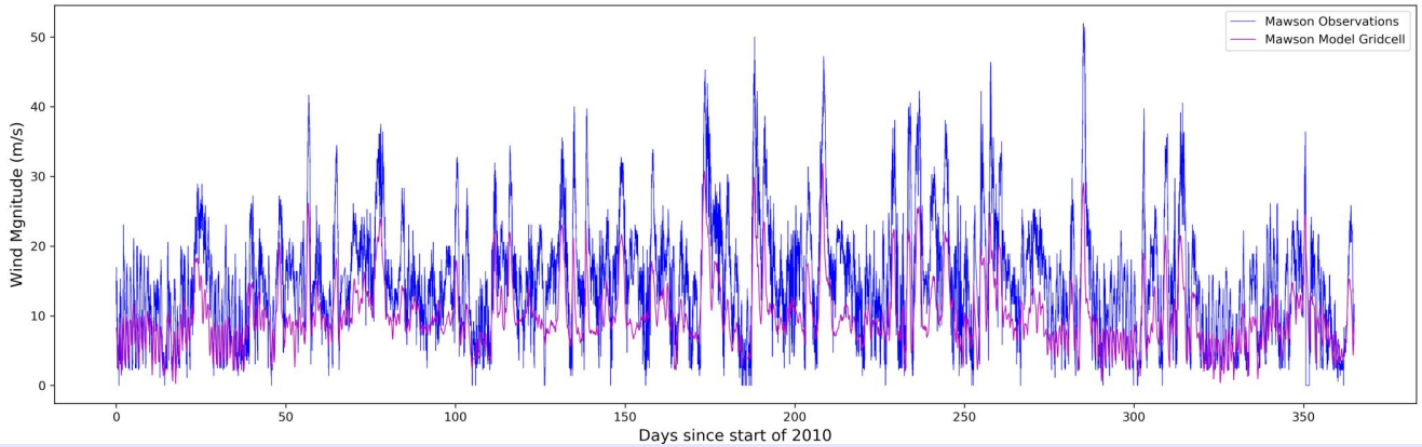
↓

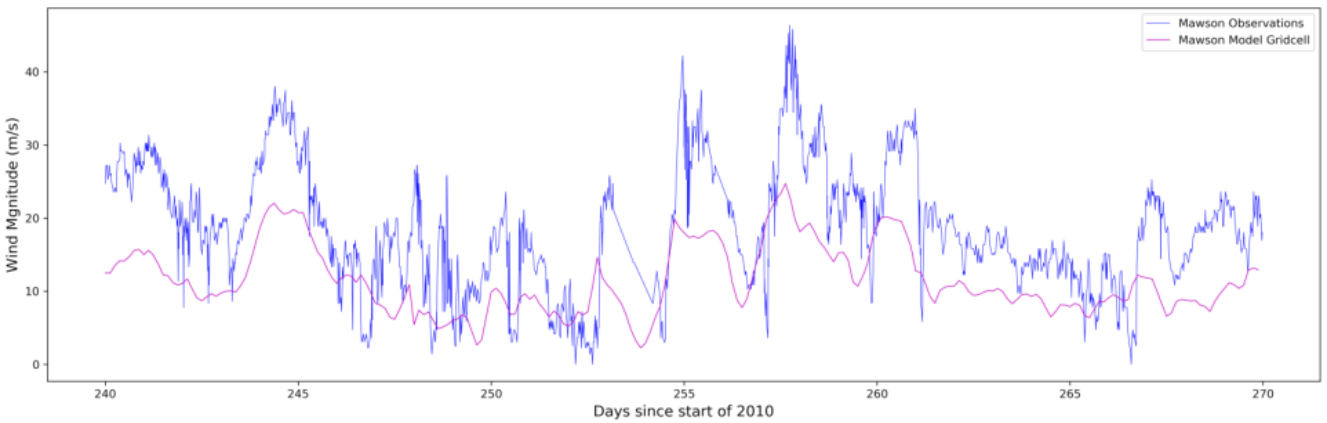
Air/ocean heat exchange

↓

Ice continually produced and advected away

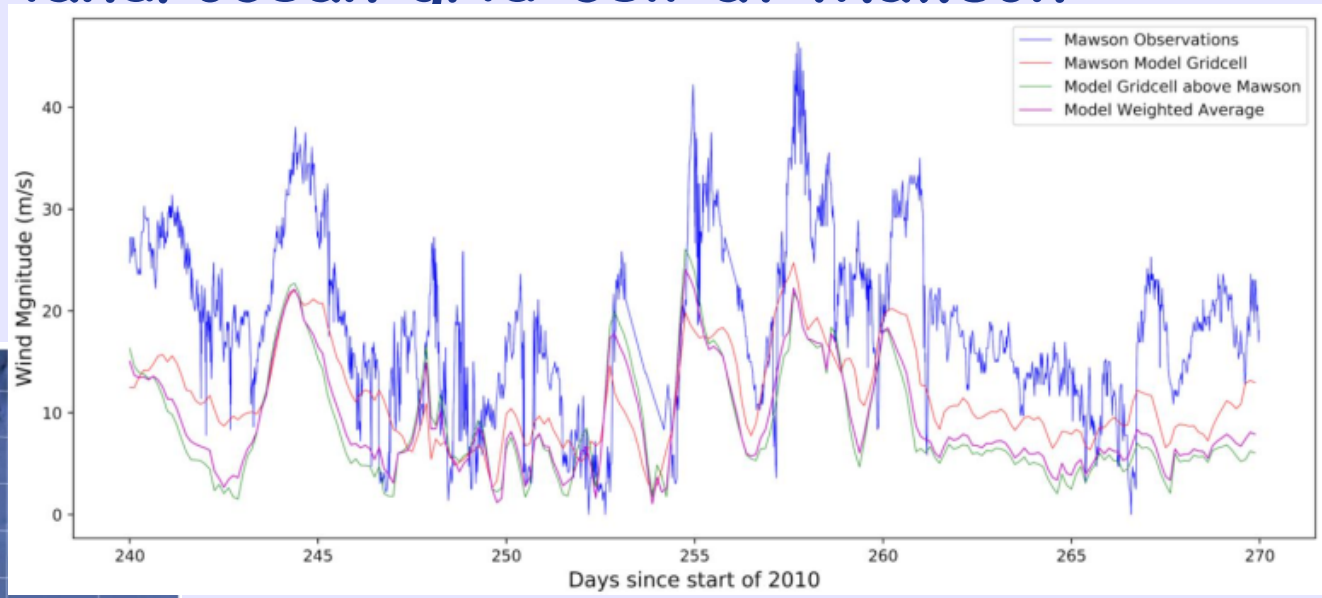
Wind-speed observations: Mawson Station, 2010

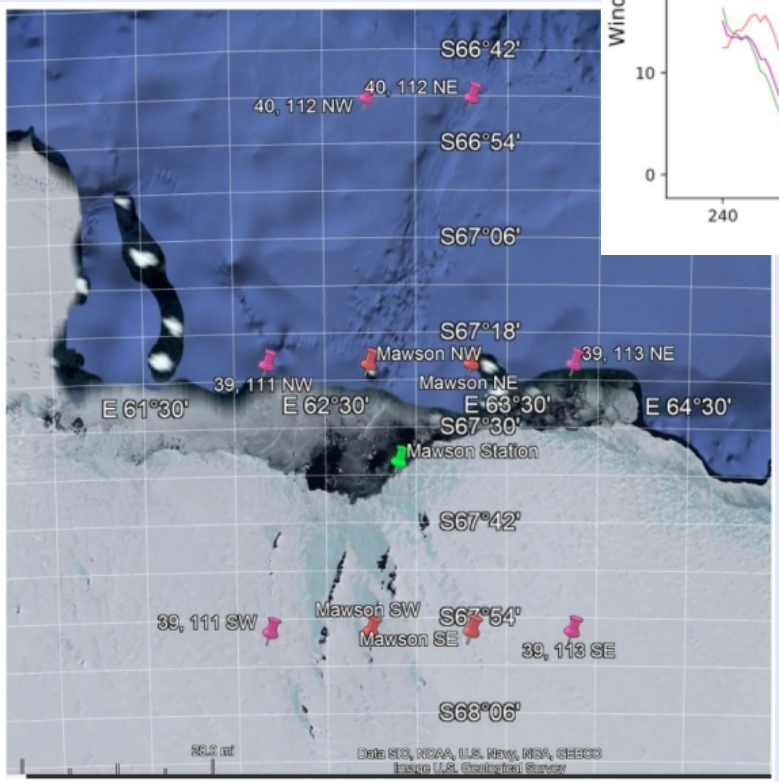




- Mawson experiences STRONG katabatic winds [vanBrocke et al.,2004]
- JRA55 captures general trend but underestimates magnitude.

Assessing mixed land/ocean grid cell at Mawson

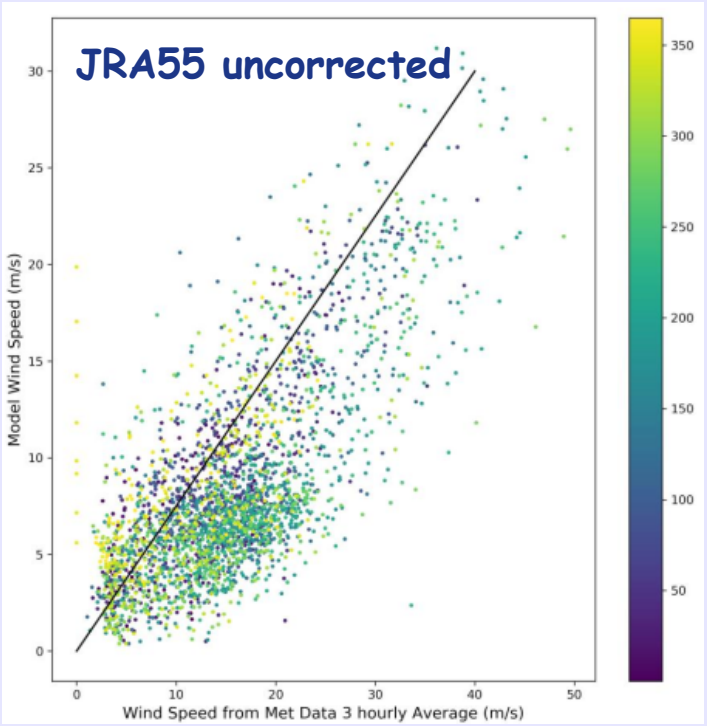




Google Earth Map of Mawson + Adjacent Gridcells

- Severe change in wind over land versus over ocean.
- JRA55 grid cell at Mawson represents quiescent winds but not storm events.
- Test by including weighted average from grid cell to the north (ocean).

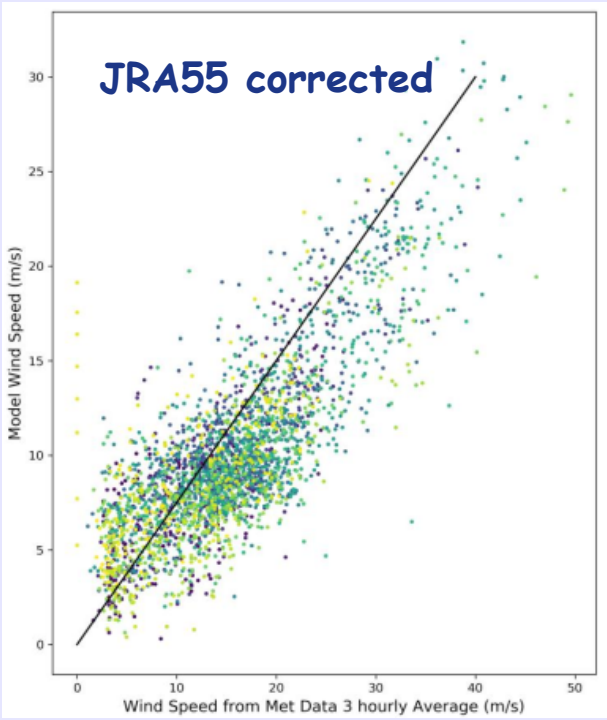
Attempt to correct JRA55 wind speed at Mawson



$$u(z_2) = u(z_1)\frac{\ln((z_2 - d)/z_0)}{\ln((z_1 - d)/z_0)},$$

(Kent et al. 2018)

$$u_{10} = u_2 \frac{\ln((10-0.05)/0.01)}{\ln(2-0.05/0.01)} > 0.75 * u_2$$



- Improves JRA55 winds for low wind speeds, not for high wind speeds.
- Increased spread from weighted average.
- Note: Plotted agains 1:0.75 line.

Explore JRA55 winds in ACCESS-OM2: What next?

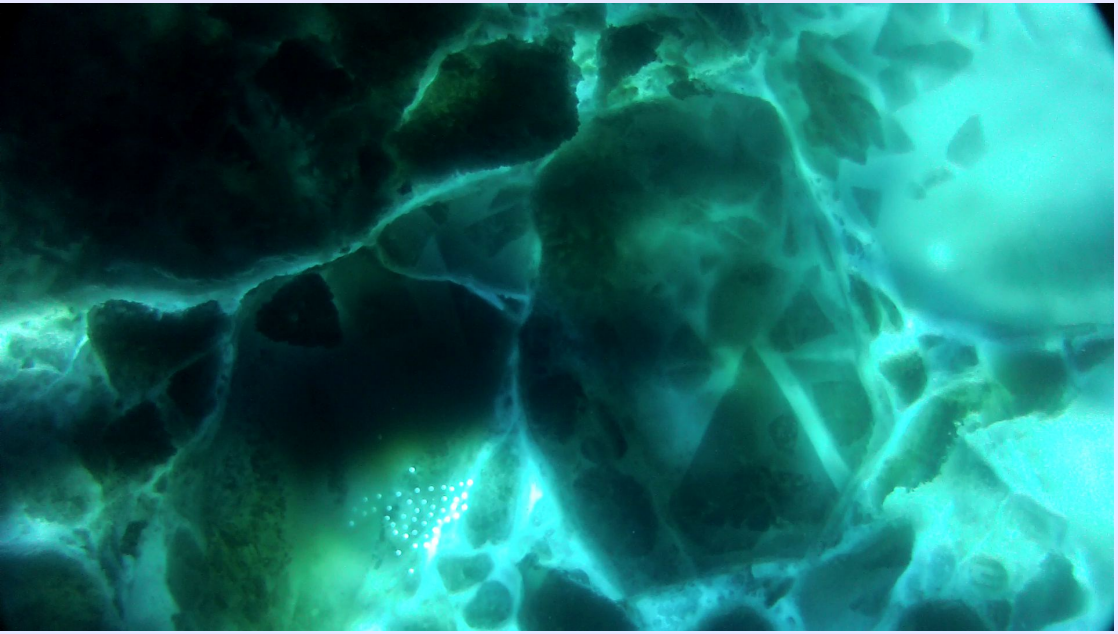
* Possible lower winds speeds → Weakend "East Wind Drift" and Coastal Current → Weaker polynya

* Investigate JRA55 winds around Antarctic continent.

→ Check impact on ice advection off the coast and polynya strength.

→ Check ACCESS-OM2 for wind affecting sea-ice evolution in model.

View from underneath (Oct 2012)



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