Antarctic verification of the Australian weather forecast model

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Objectives

- Establish the performance of ACCESS-G NWP over Southern Ocean and Antarctica

- Identify opportunities for model development

- Experiment with Antarctic physics, processes and parameters

- Improve ACCESS-G NWP south of 50S

Who is involved?

Ben Schroeter (IMAS)
PhD Candidate

Phil Reid (BoM)
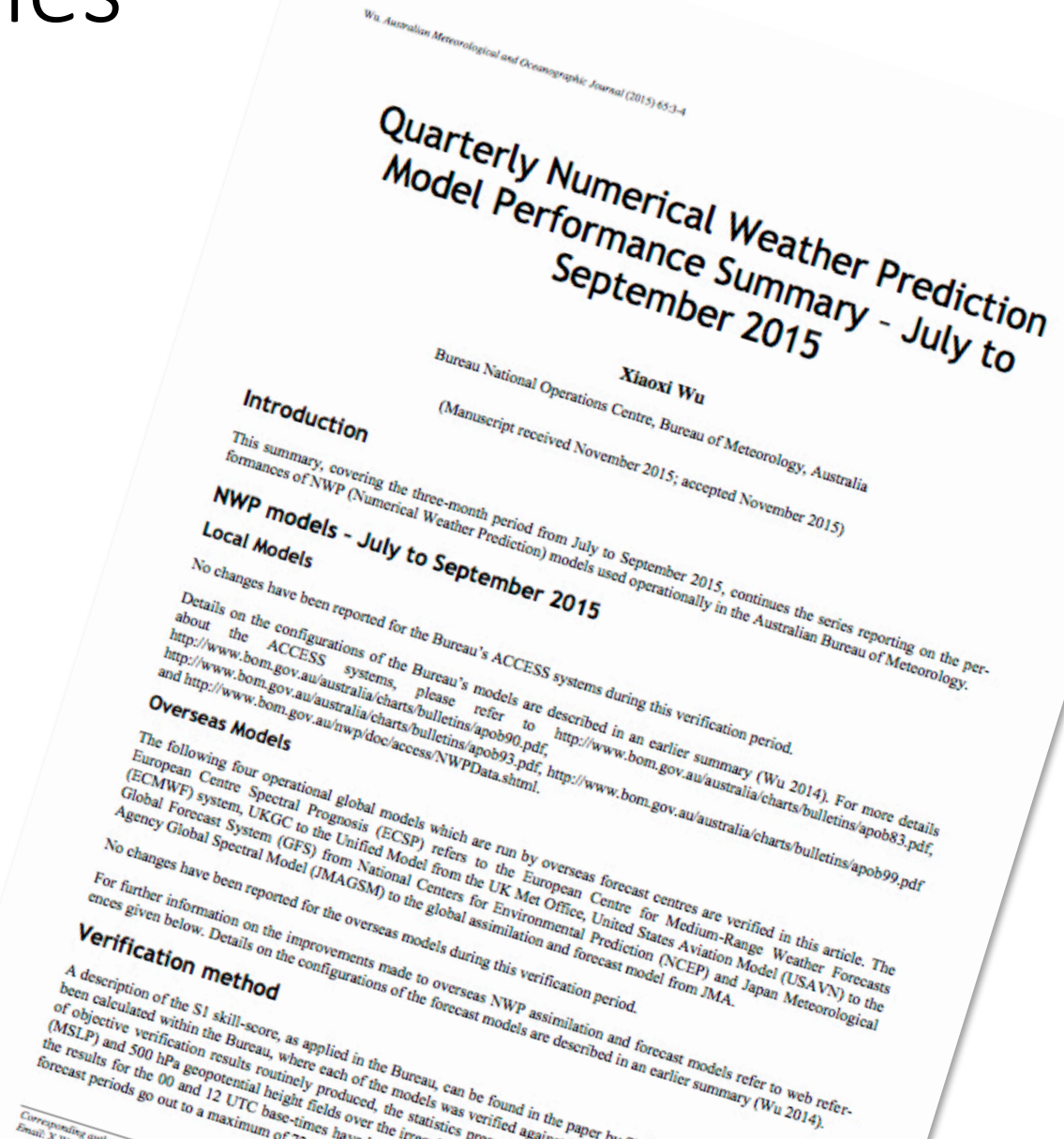Supervisor

Nathan Bindoff (IMAS)
Supervisor

Kelvin Michael (IMAS)
Supervisor

Getting started

Establishing a performance baseline

Current verification activities

- Quarterly Performance Statements
  - Wu (2015)
- Australian Verification Domain (AVD)
- 2.5° resolution
- MSLP and 500hPa
  - S1 skill (Teweles & Wobus, 1954)
  - RMSE

S1 skill - Refresher

$$S1 = 100 \frac{\sum w_i (e_g)_i}{\sum w_i (G_l)_i}$$

$$w_i = \cos(\phi_i)$$

$$e_g = \left| \frac{\delta(f-o)}{\delta x} \right| + \left| \frac{\delta(f-o)}{\delta y} \right|$$

$$G_l = \max\left(\left| \frac{\delta f}{\delta x} \right|, \left| \frac{\delta o}{\delta x} \right| \right) + \max\left(\left| \frac{\delta f}{\delta y} \right|, \left| \frac{\delta o}{\delta y} \right| \right)$$
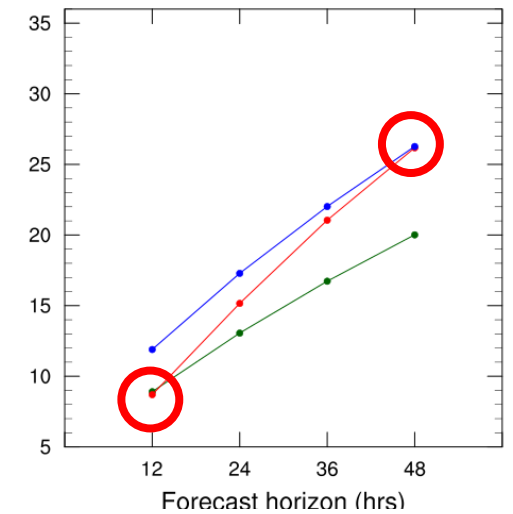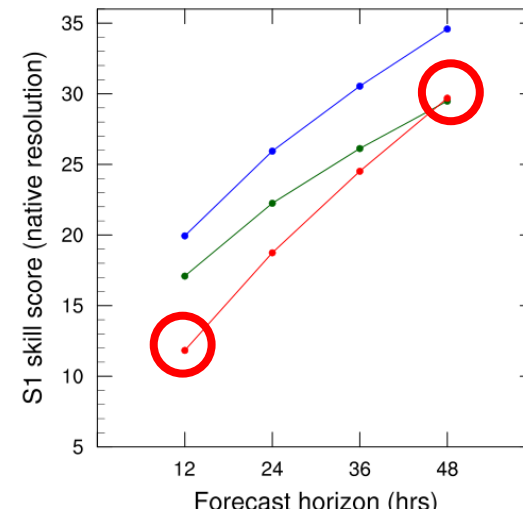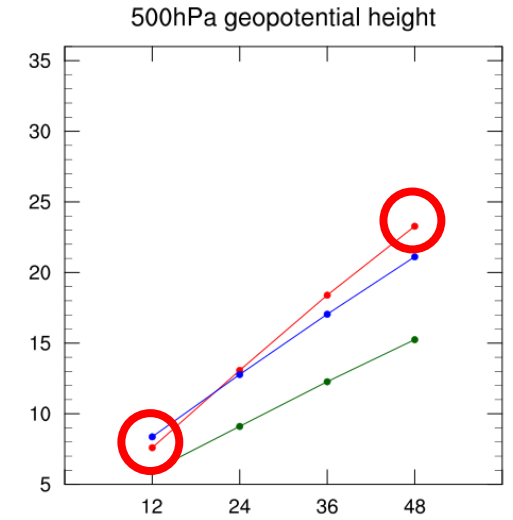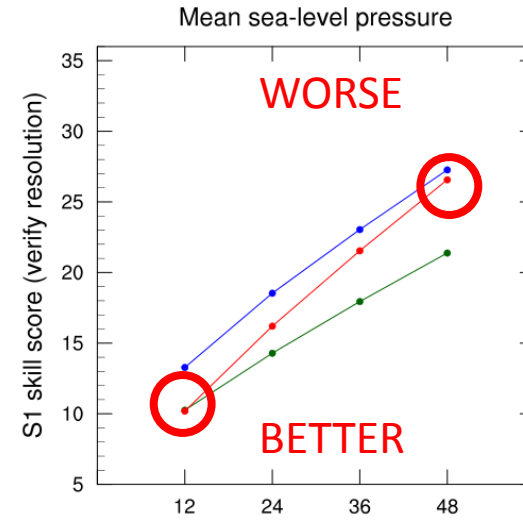
Where:

f = forecast value
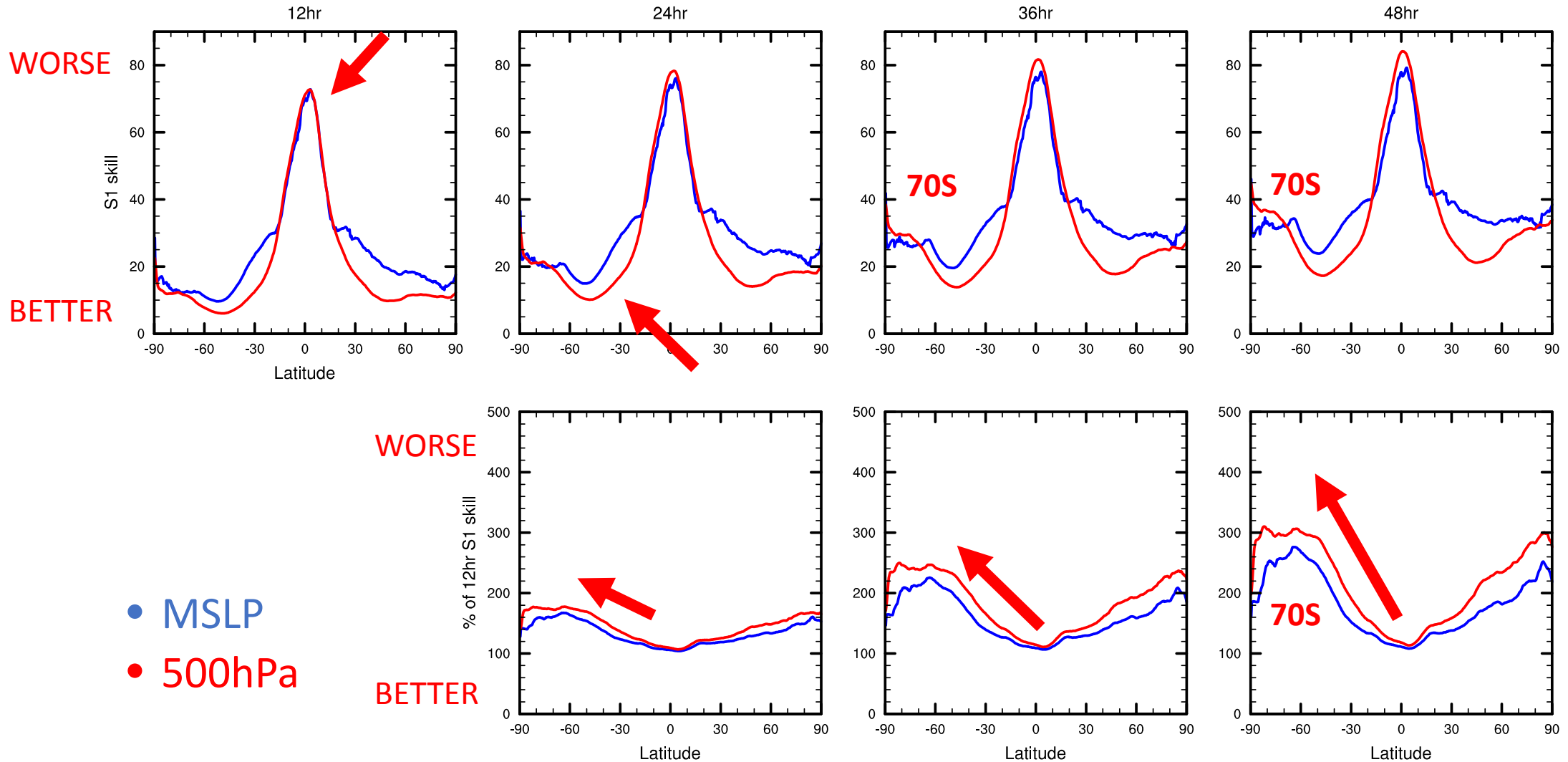
o = observed value (analysis)

ϕ_i = latitude of cell i

S1 skill

- 2015, all model runtimes
- MSLP & 500hPa
- 2.5° & native resolution
- Domains:
  - Antarctic (50S - 90S)
  - Australian (15S - 55S, 100E - 170E)
 - Global

S1 skill by latitude (2015)

S1 skill - Contributing factors

- 87% land cells south of 70S
  - 100% by 80S

- ACCESS MSLP over land
  - Vertically extrapolated from first theta
  - Antarctic elevation up to 4km
  - Artificial, smooth field for Antarctic continent

- S1 skill relies on gradients
  - Sensitive to grid structure (cell distance, curvature)
  - Gradients are smaller over Southern Ocean & Antarctica
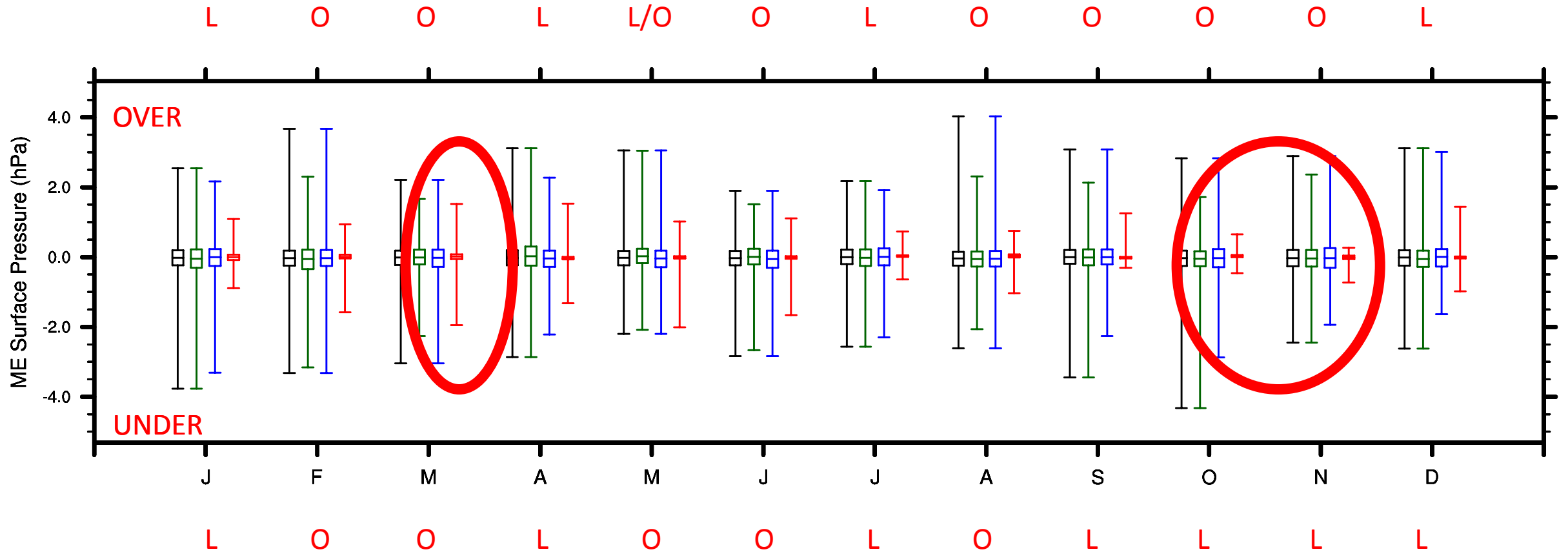 - S1 of MSLP not ideal for study domain
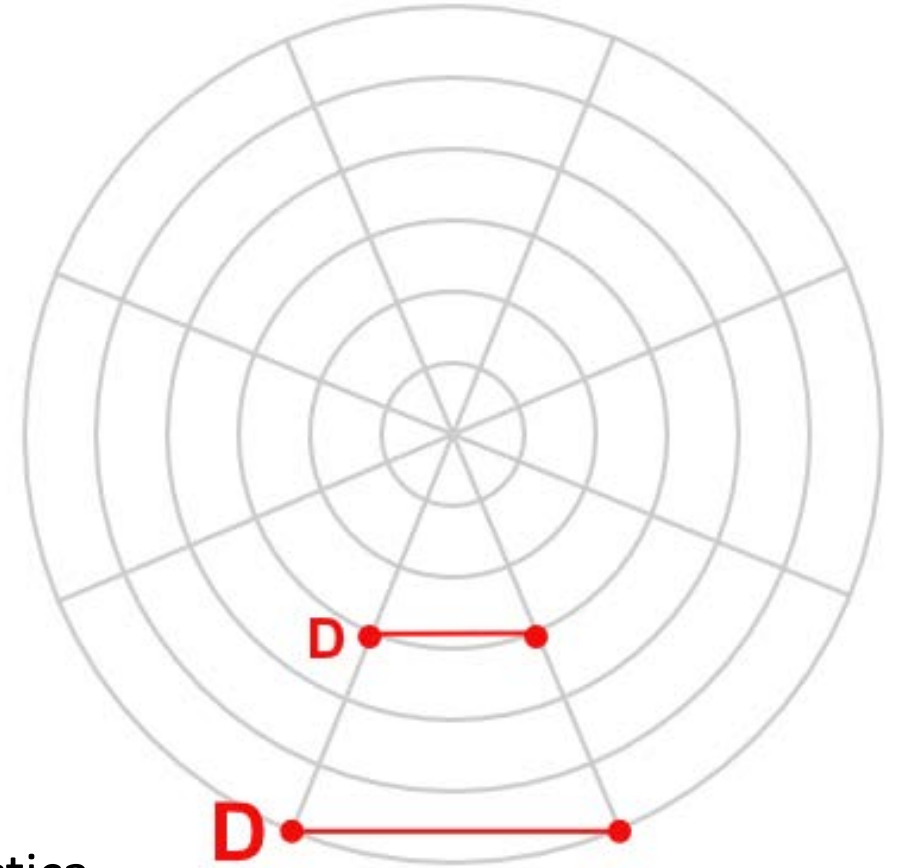
Digging deeper

Decomposing error by cell classification

+12hr forecast surface pressure spatial decomposition
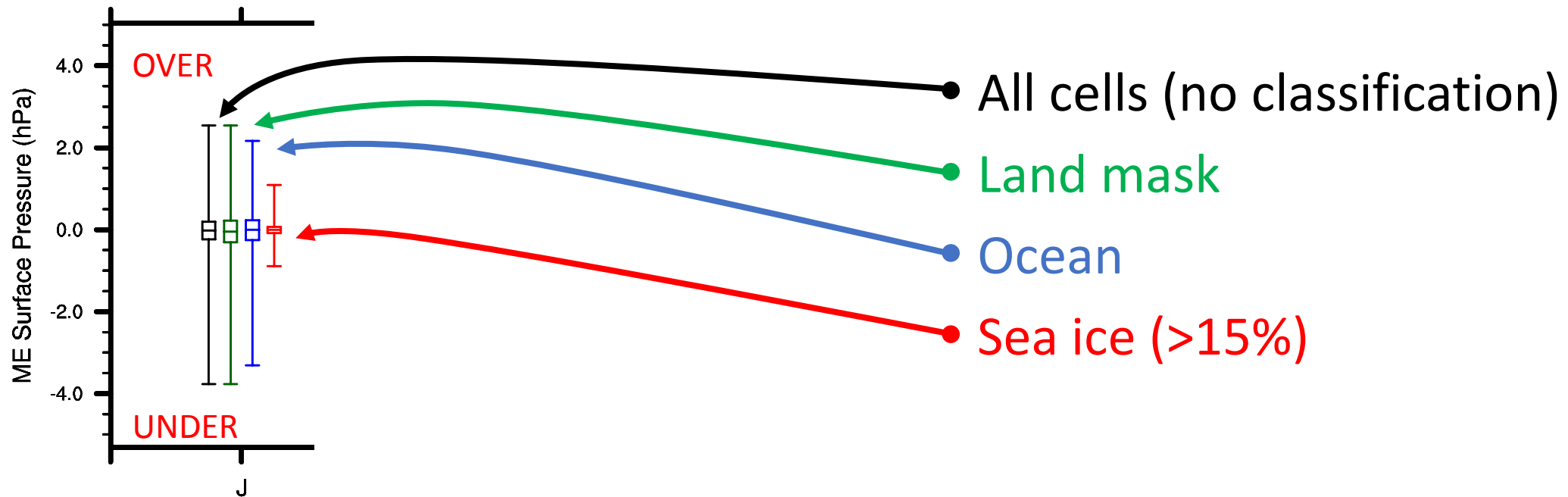
+12hr forecast surface pressure spatial decomposition

Decompositions – what have we learned?

- Mean & interquartile range only loses detail
  - Look at the range of over- and under-forecast values

- Sea ice
  - Has a seasonal signal, which alternates throughout the atmosphere

- Ocean
  - Errors may actually be sea ice
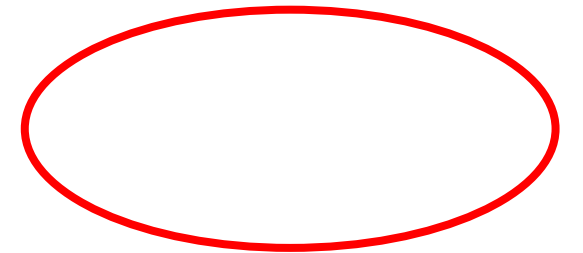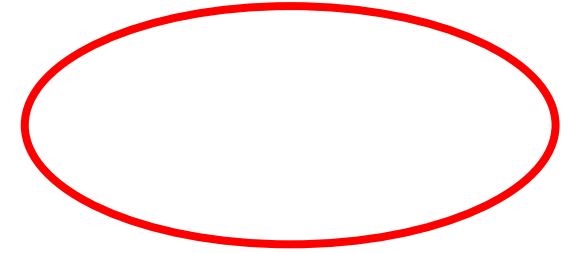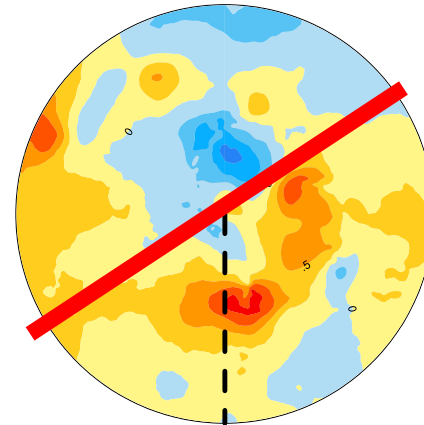
- Naïve approach, needs more study

Spatial analyses

Distribution and scale of model performance

Mean Error (Spatial)

- Sharp discontinuity 120W / 60E
  - Particularly in the East

- Under-forecast ocean 90W - 90E
  - More pronounced at 12Z

- Over-forecast Vic / Oates land

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