Seasonal sea level forecasts for the Australian Coastline

Ryan Holmes, Grant Smith and Claire Spillman (Seasonal and Marine Applications Team, Research)

Email: ryan.holmes@bom.gov.au

1. Objective

Develop seasonal coastal sea level forecast products for coastal hazard early warnings (*Australian Climate Service* WP3). First step: **Seasonal sea level skill assessment for ACCESS-S2**

2. Data

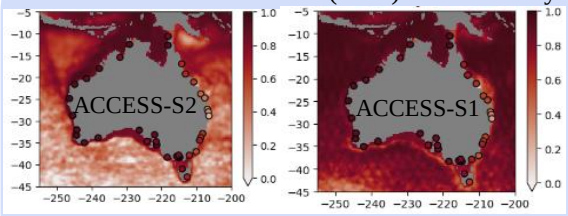
Monthly sea level from **ACCESS-S2 hindcast** (Wedd et al. 2022) at 0-7 month lead. Global mean, climatology and linear trend removed (sea level anomaly, SLA).

Impact of atmospheric sea level pressure on SLA ("**inverse barometer**") included.

Observations: **Altimetry** from Copernicus. **Tide gauges** from ANCHORS (Hague et al. 2023)

3. Reanalysis performance

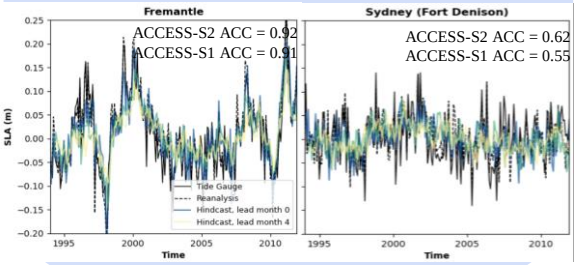
SLA Correlation Coefficient (ACC) with altimetry



1993-2012

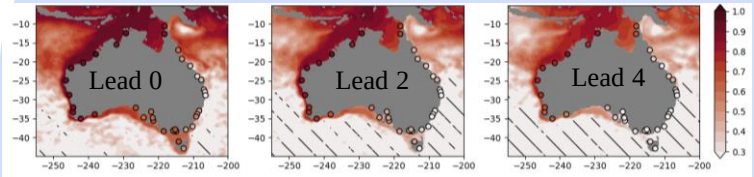
No altimetry assimilation in S2 » initial conditions worse in open ocean, but comparable/better on shelf

Tide gauge SLA time series

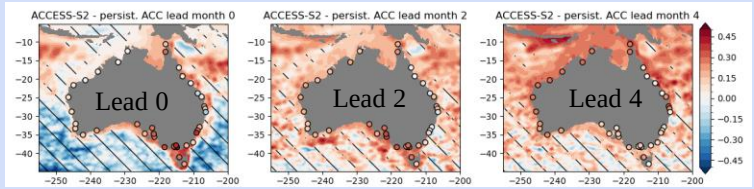


4. Hindcast skill assessment

ACCESS-S2 Correlation Coefficient (ACC) compared to altimetry



ACCESS-S2 ACC minus persistence (observed SLA from lead -1)



1993-2018

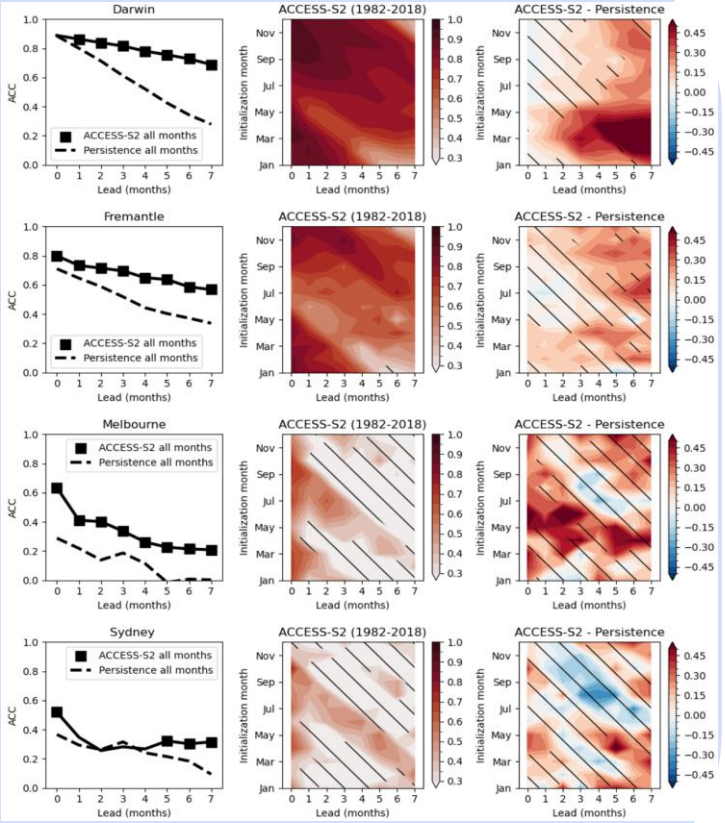
North and West Coasts: High skill (particularly Jul-Dec starts) due to ENSO and coastal trapped waves (CTWs). Large seasonal variability (±10-15cm).

South Coast: Some skill at early lead. CTWs and inverse barometer important. Signals have low persistence.

East Coast: Very little skill. High atmospheric variability, weak CTW connections. Small monthly variability (±5cm).

Skill improved over POAMA (McIntosh et al. 2015) and ACCESS-S1. Skill and dynamics strongly differ on-shelf vs. open ocean.

Comparison with tide gauges



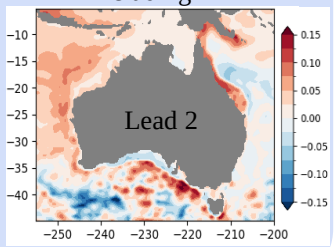
Hatching (/no marker) indicates no statistically significant improvement over persistence

1982-2018

5. Inverse barometer (IB)

ACCESS-S2 ACC improved when including IB (except S coast). Increased signal variance. Better potential to capture extremes.

ACC change when including IB



1993-2018

6. Next steps

- ❖ Does ACCESS-S2 have subseasonal skill?
- ❖ Probabilistic skill assessment
- ❖ Mechanisms (modes of variability, dynamics)
- ❖ Forecasts of still water level: combine with tides and global sea level rise
- ❖ Explore options for coastal downscaling and calibration
- ❖ Product design – what does the end-user want?

References: Wedd et al. 2022, JSHESS, 72, 218-242. DOI: 10.1071/ES22026
Hague et al. 2022, GDJ, 9, 256-272. DOI: 10.1002/gdj3.136
McIntosh et al. 2015, GRL, 42, 6747-6753. DOI: 10.1002/2015GL065091