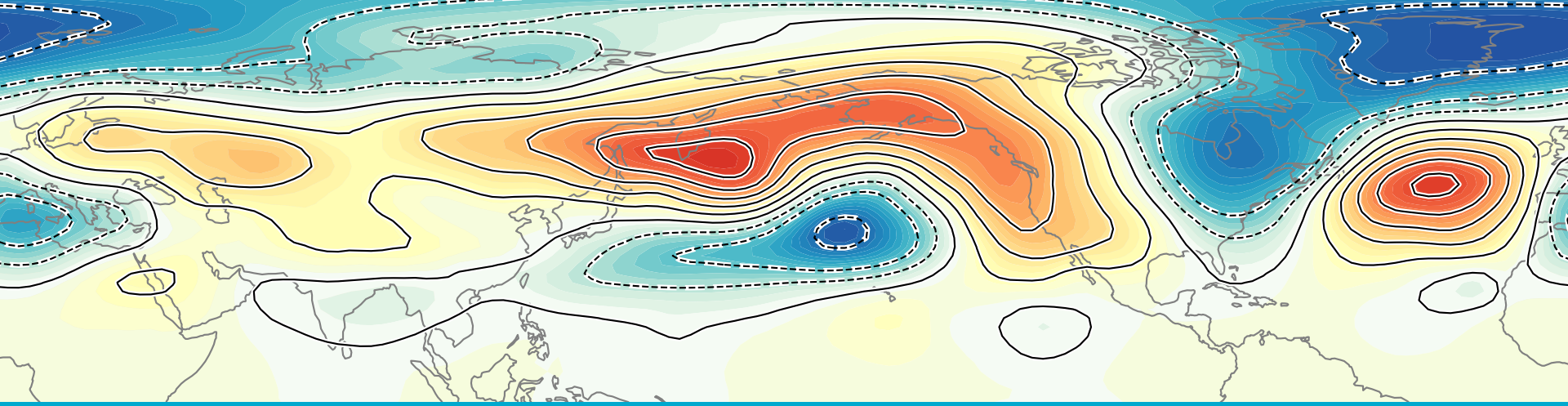

Skill assessment of the CSIRO multi-year Climate Analysis Forecast Ensemble (CAFE) system

CSIRO decadal climate forecasting project

Dougie Squire, James Risbey, Carly Tozer, Thomas Moore, James Munroe

CSIRO

The CSIRO CLIMATE ANALYSIS FORECAST ENSEMBLE system

- New project to understand and improve predictability on multi-year time scales
- Use a variant of the GFDL CM2.1 ocean (MOM5) - atmosphere (AM2) - land (LM2) - sea ice (SIS) model
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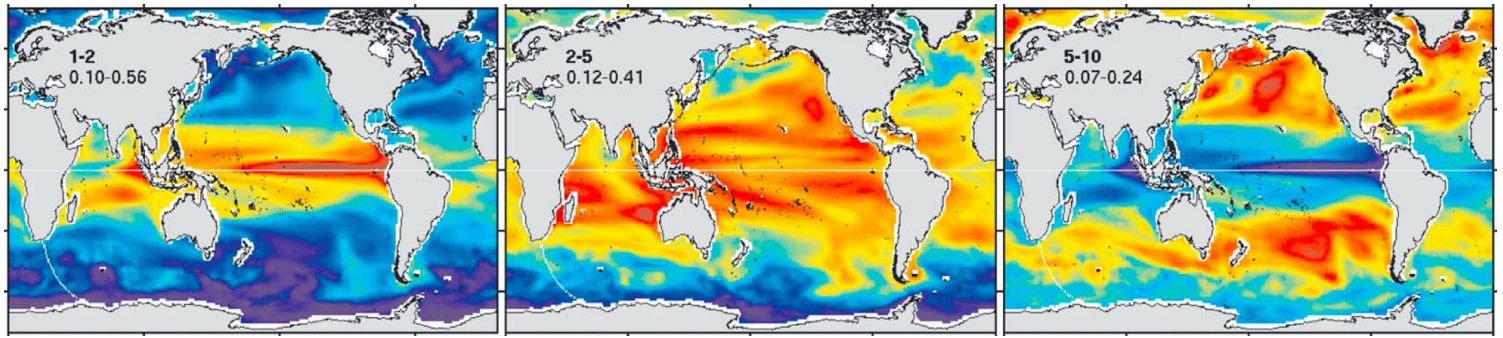

Fractional in-band variances of SLA

Monselesan et al. 2015 GRL

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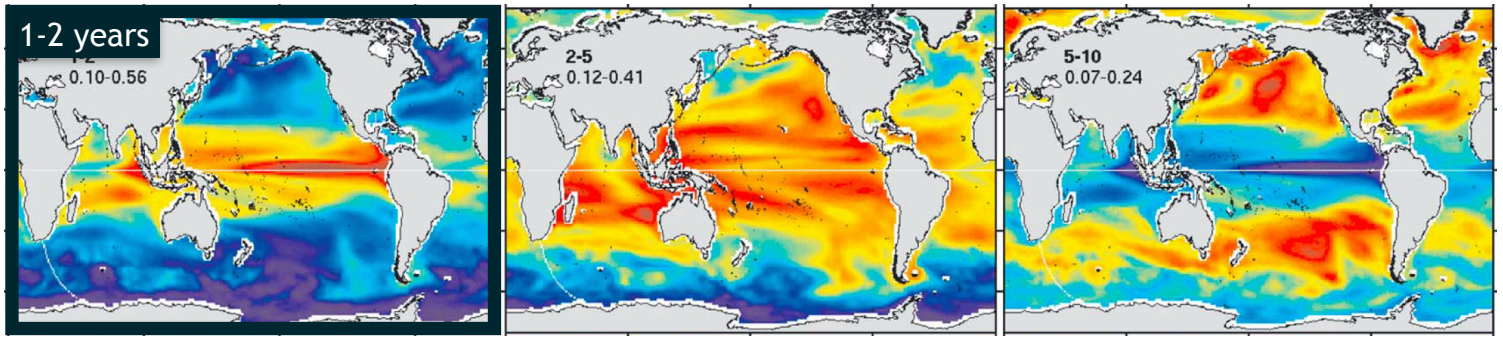

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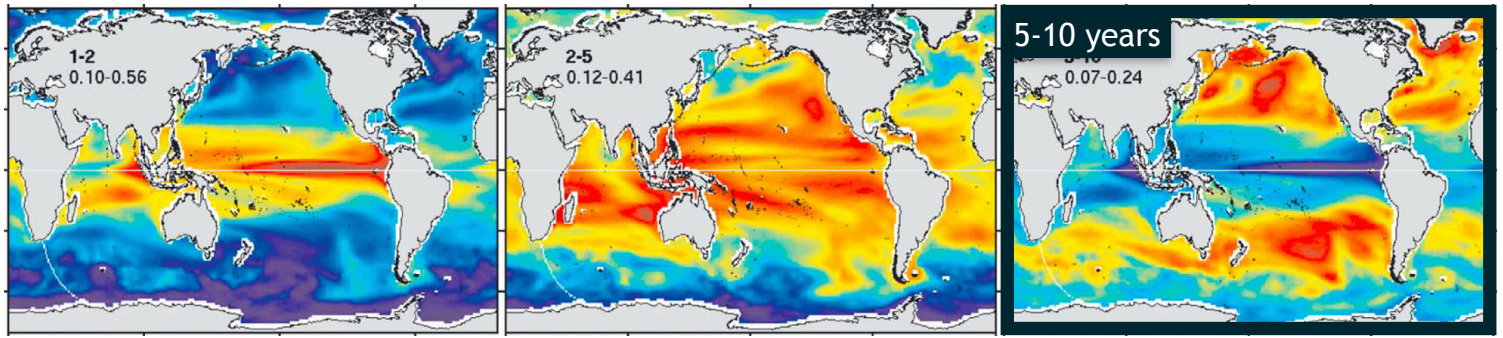

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doppyo diagnostics/verification software

- Leverage emerging efforts towards best practices in big data and reproducibility
  PANGEO + James Munroe
- Towards a community effort
- Dataset/filetype agnostic

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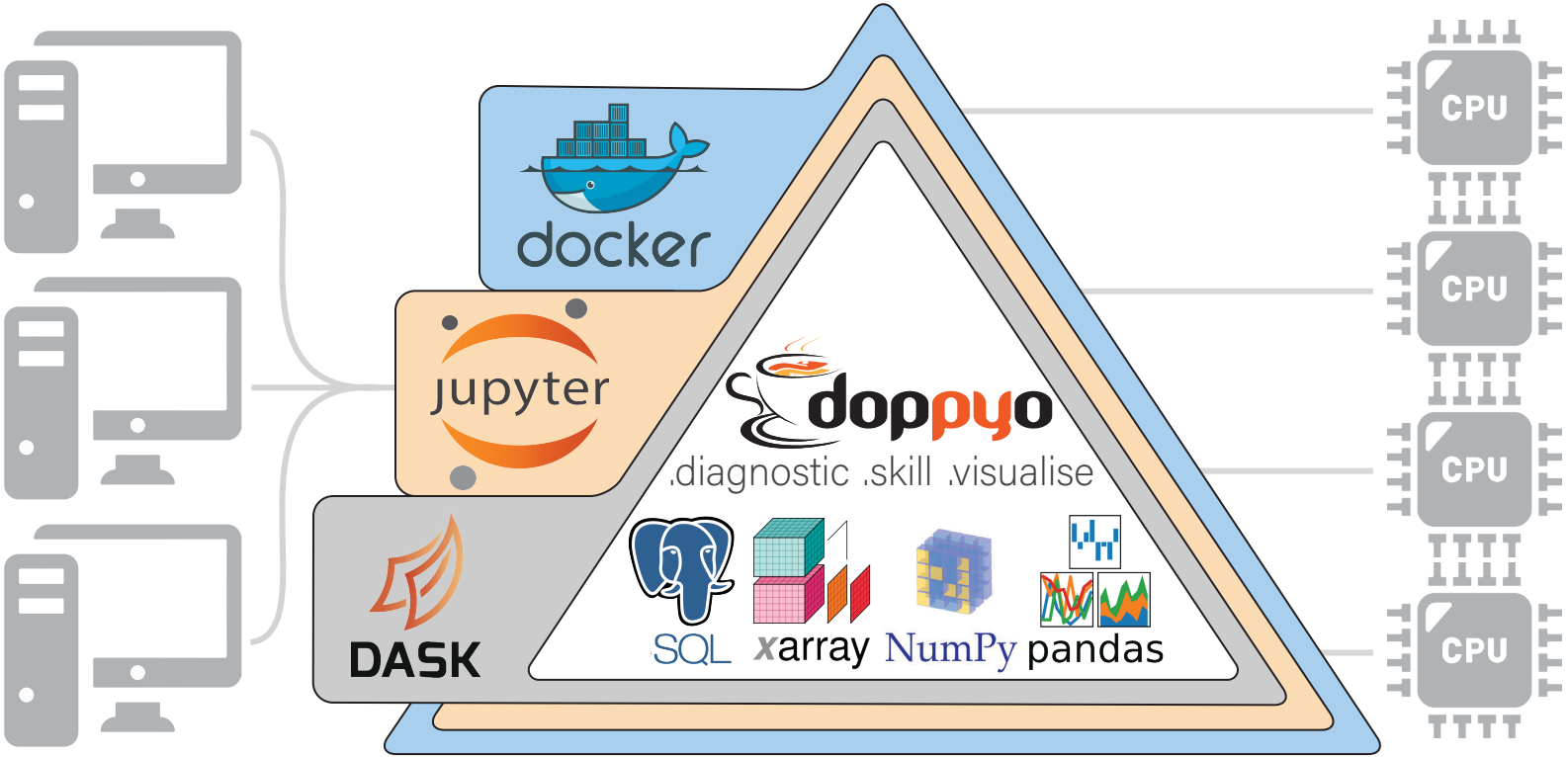

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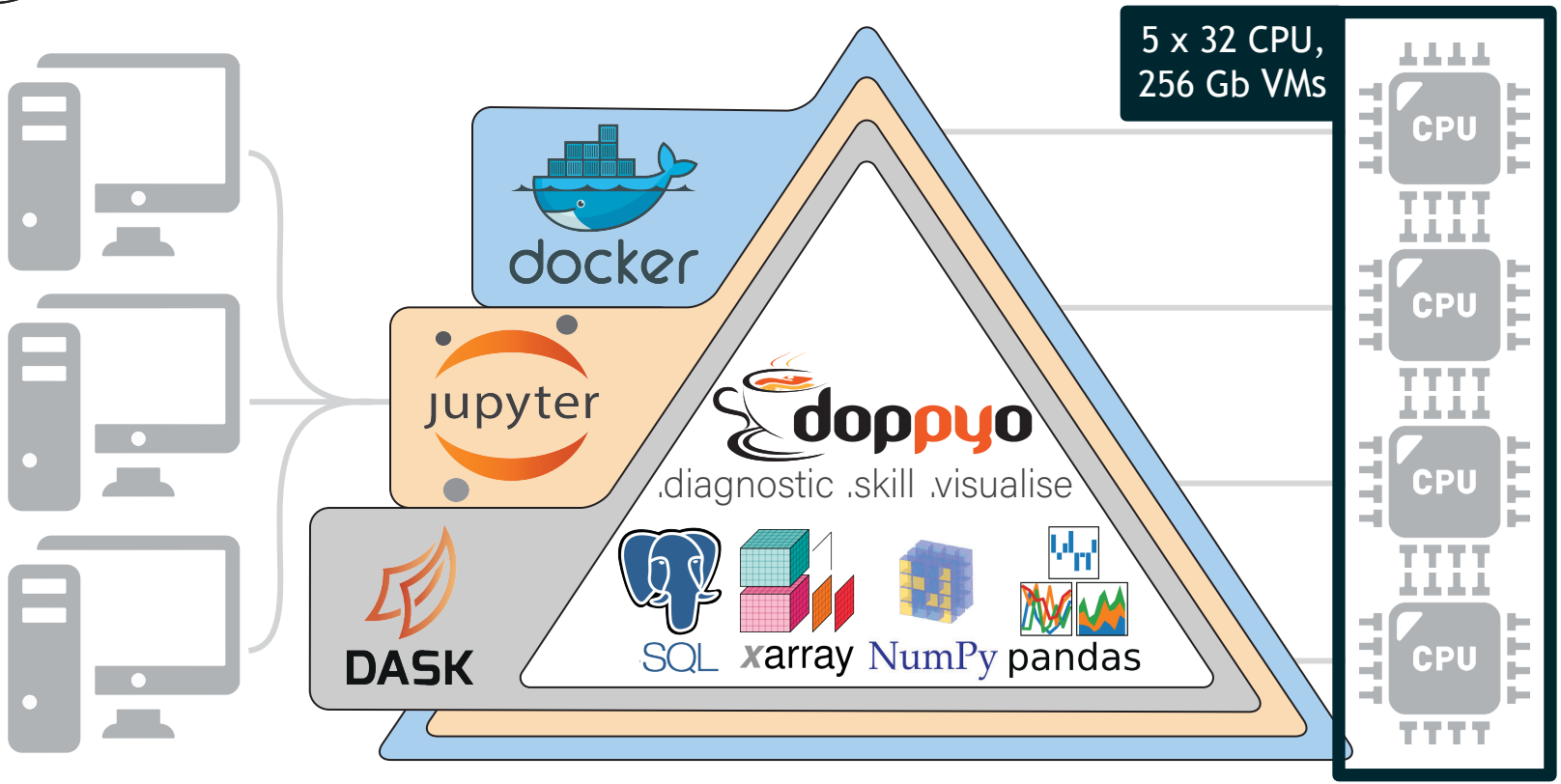

CSIRO

oa-32-cdc.it.csiro.au

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Files Running Commands Cell Tools Tabs

Markdown Python [default]

Import required packages

In [ ]:
```
import doppyo
import dask
import distributed
import xarray as xr
import numpy as np
```

Initialise dask client

In [ ]:
```
client = distributed.Client('tcp://oa-32-cdc.nexus.csiro.au:8786')
client
```

Query database for JRA55 files and load them lazily

In [ ]:
```
%%time
gh, temp, u, v, omega = doppyo.utils.load_ncfiles(dataset='jra55', variables=['gh','temp','u','v','w'])
```

Lazily compute the total eddy available potential energy

In [ ]:
```
%%time
energetics = doppyo.diagnostic.compute_atmos_energy_cycle(temp, u, v, omega, gh, terms='Pe')
```

Compute seasonal means of total eddy available potential energy

In [ ]:
```
%%time
```

Search or enter website name

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Dask: Status

CAFE-f1 hindcasts (today's data)

- 2-year, 11-member hindcasts started monthly over 2002-2016
- Only ocean observations assimilated
- Bred-vector-initialised on sub-surface ocean temperature isosurface corresponding to high in-band variance on 1-2 month time scales
- Mean bias corrected (Stockdale 1997 MWR)

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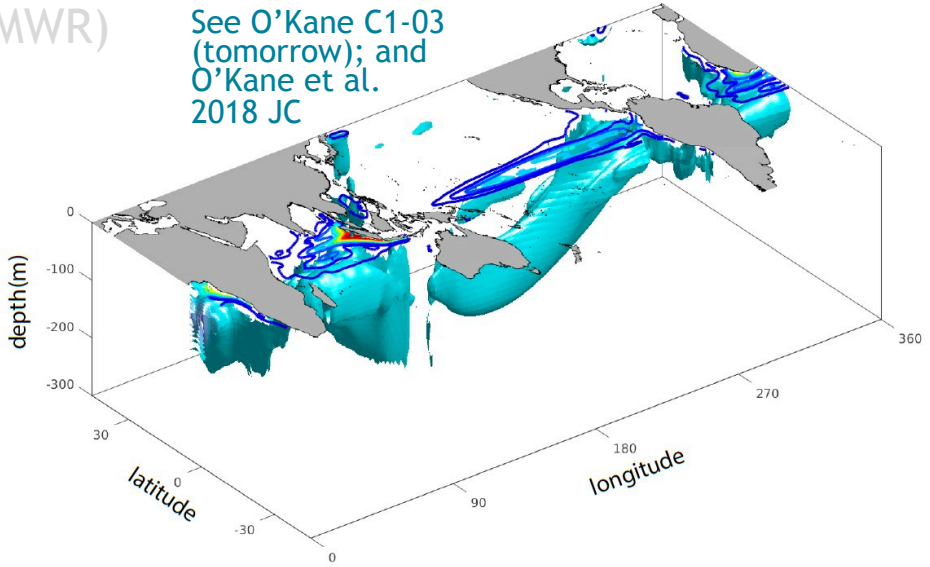

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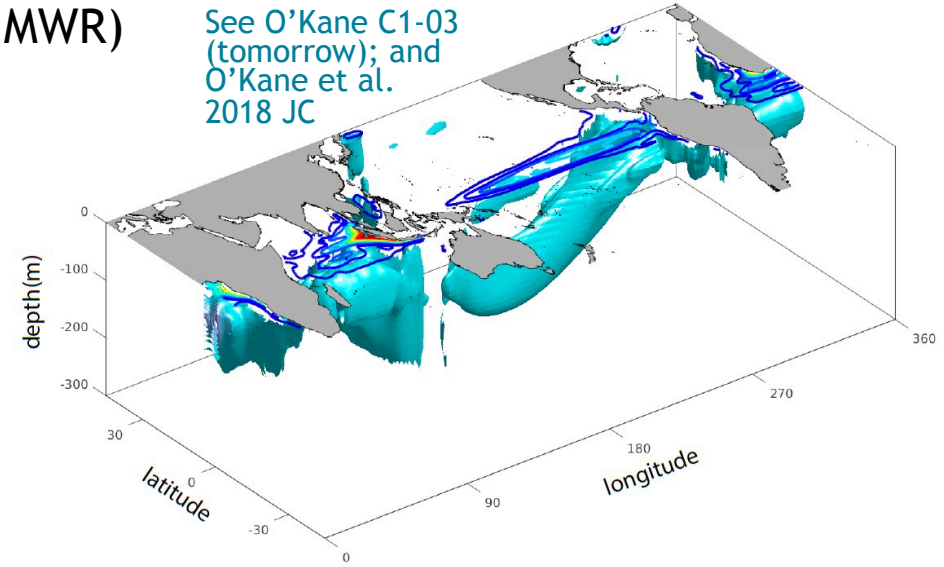
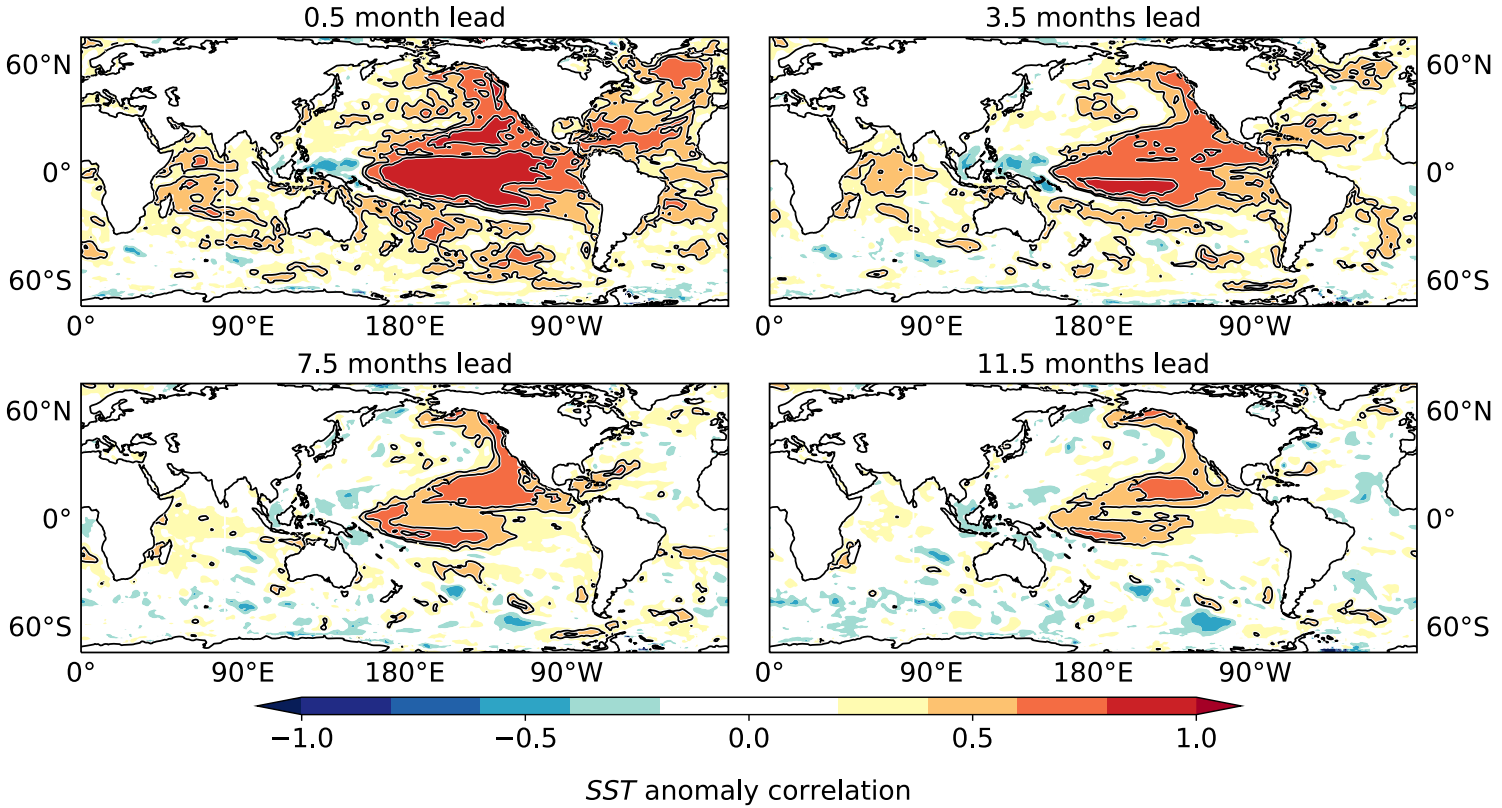
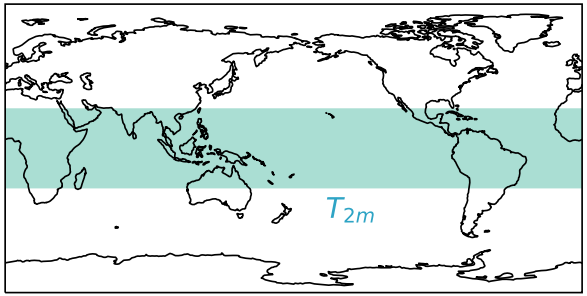
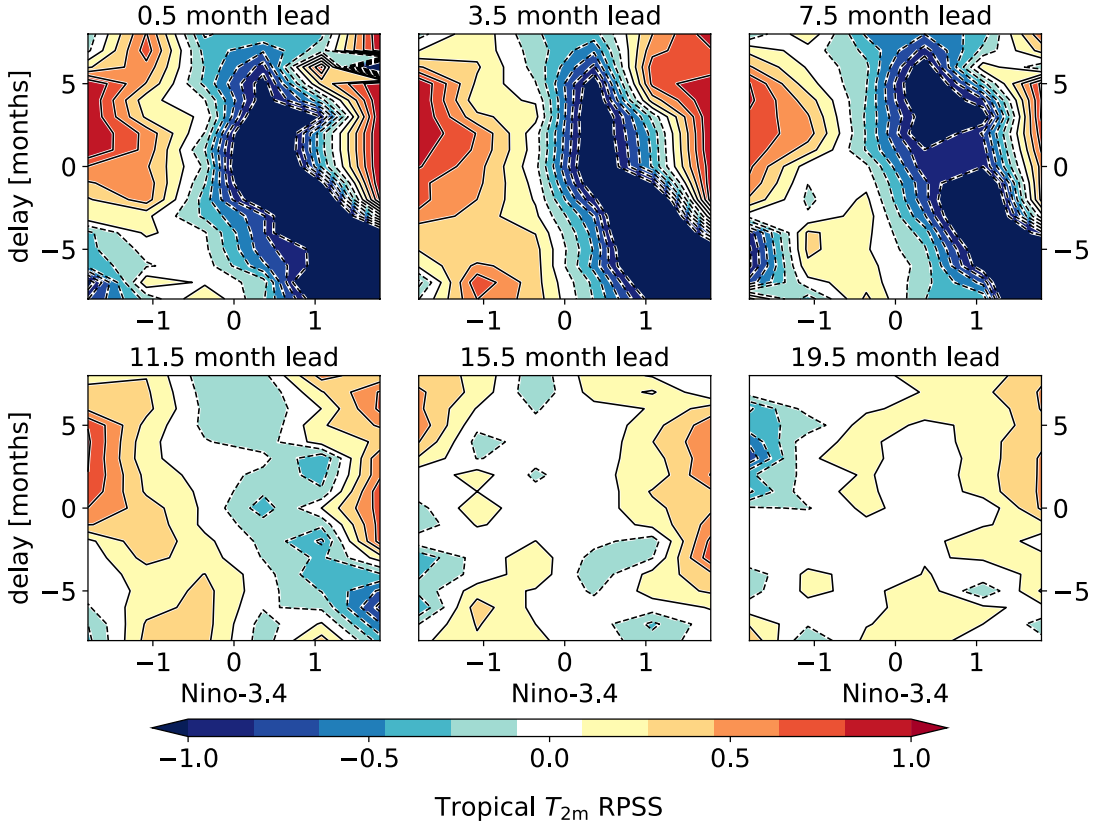


Temporal anomaly correlations of monthly *SST*



Ranked probability skill score of tropical T_{2m}





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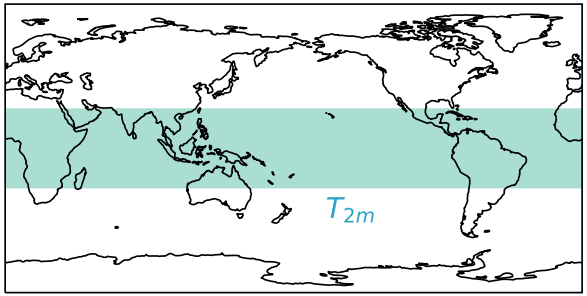
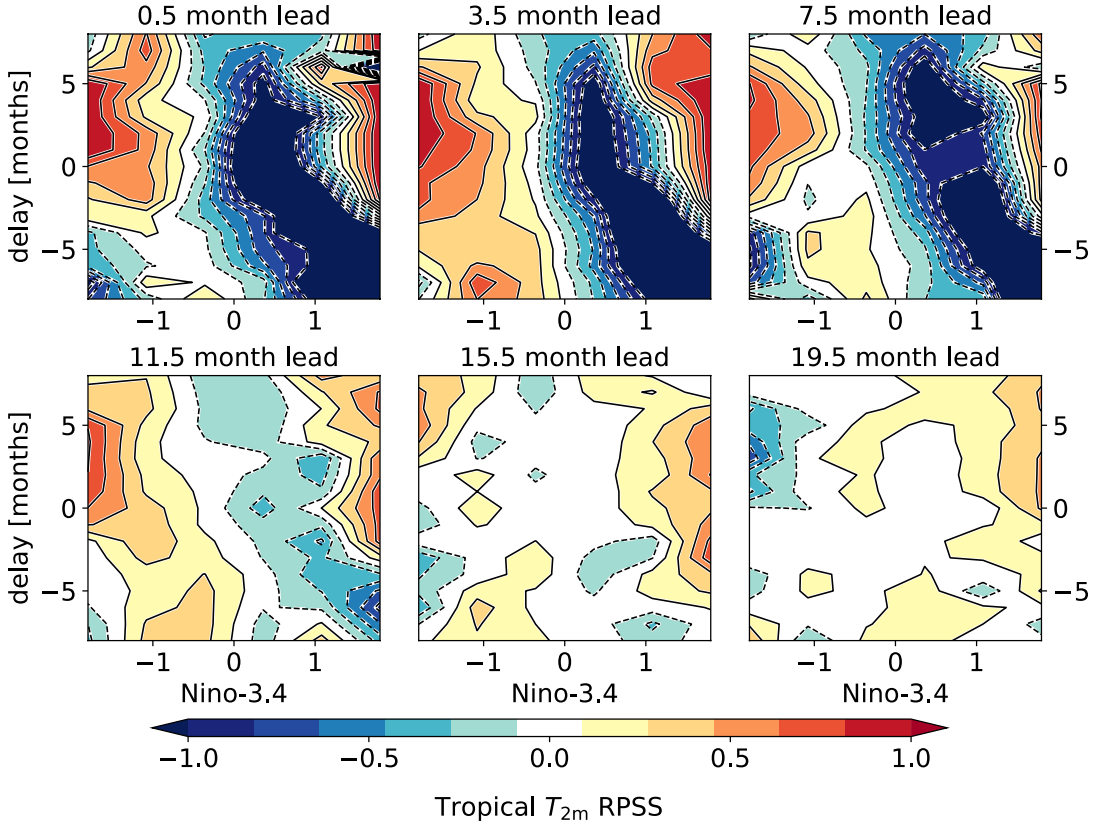
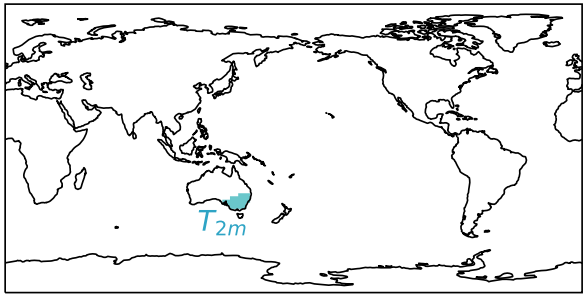
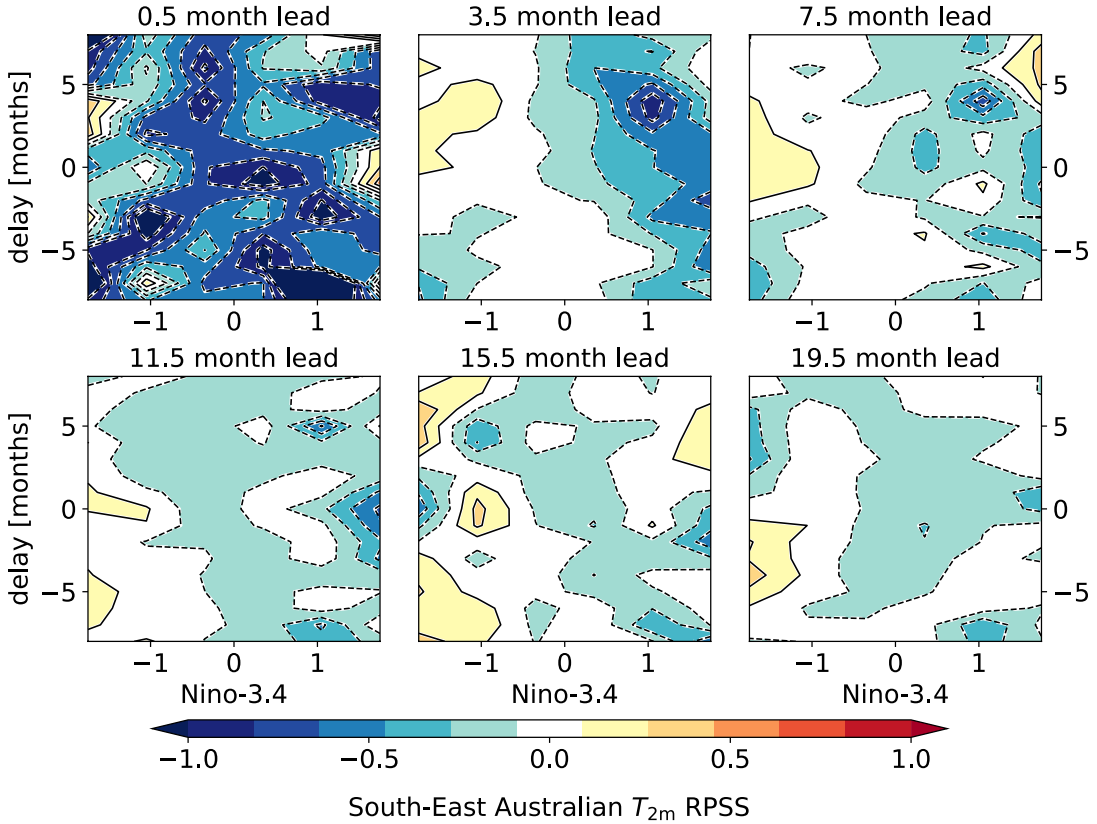


- Forecast skill is strongly related to ENSO variability



Ranked probability skill score of SE Australian T_{2m}





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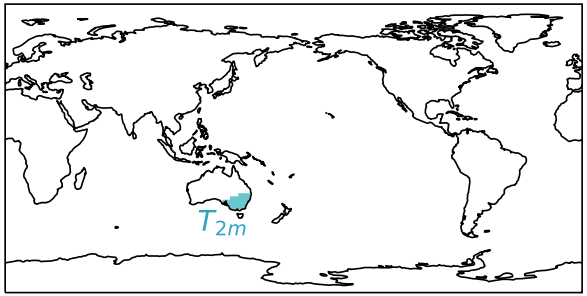
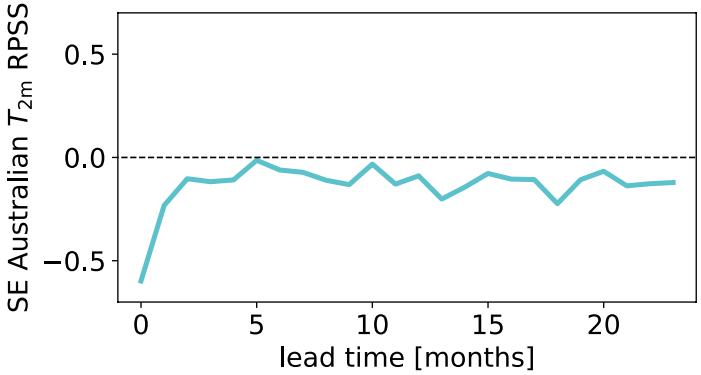
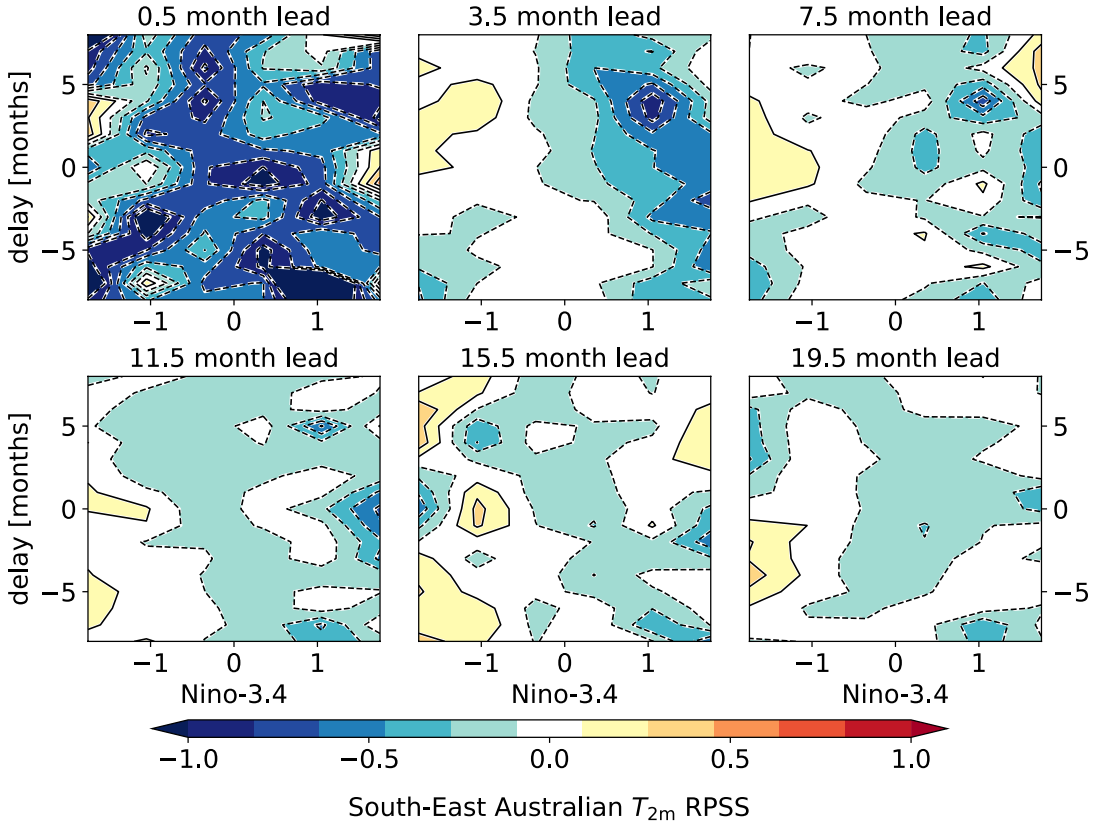
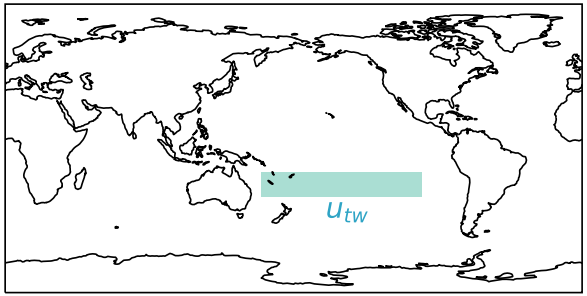
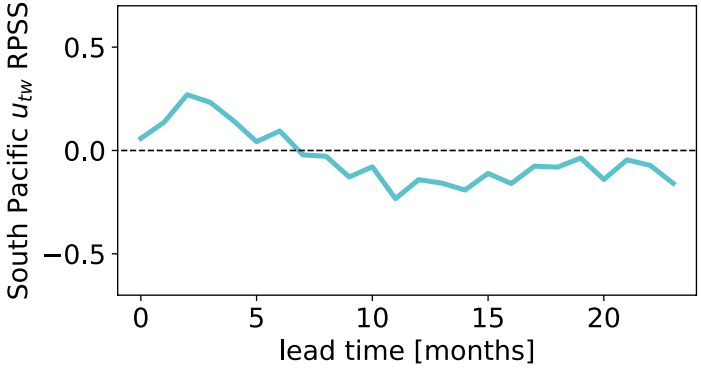


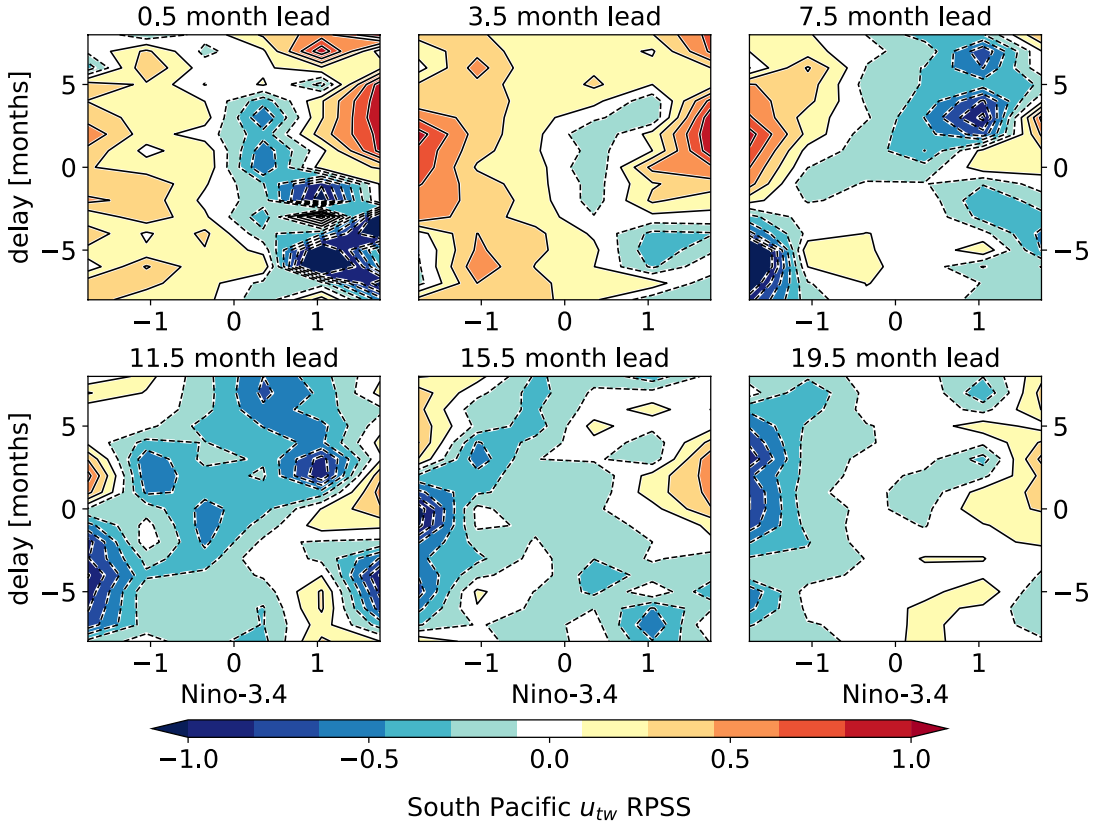




Ranked probability skill score of thermal wind







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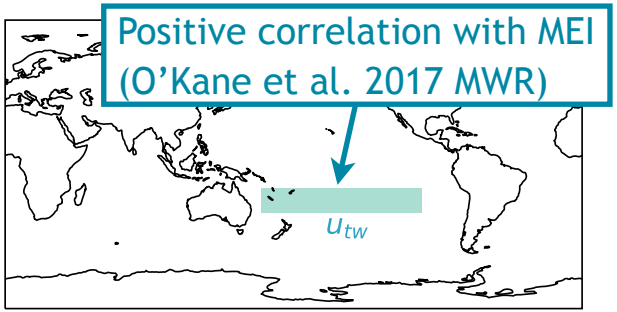
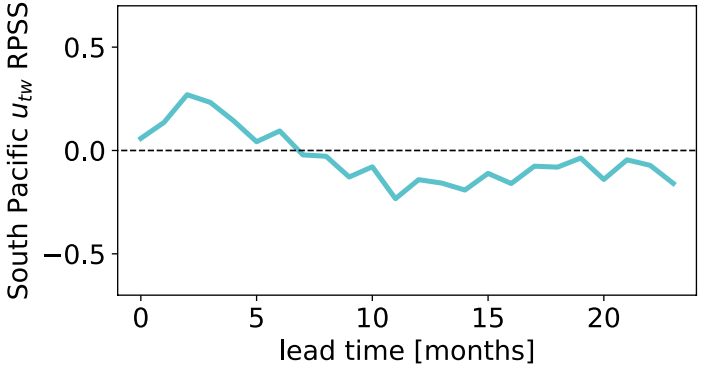
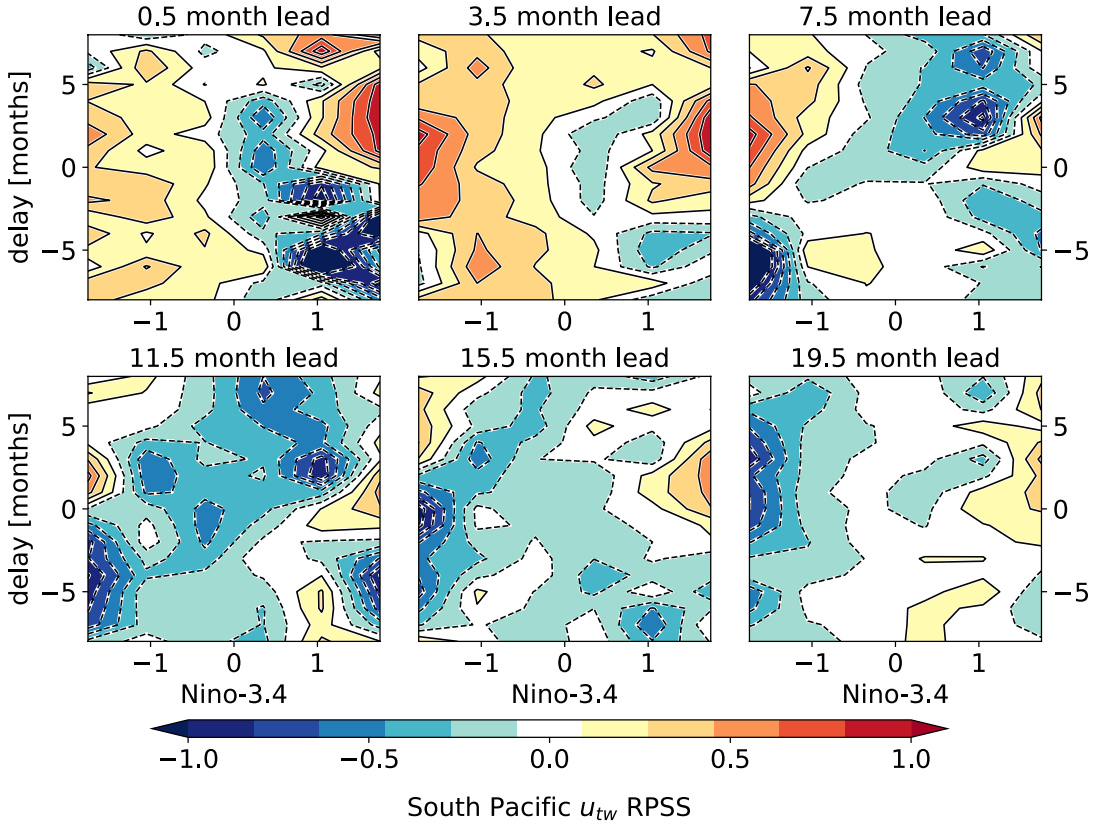






Conclusions

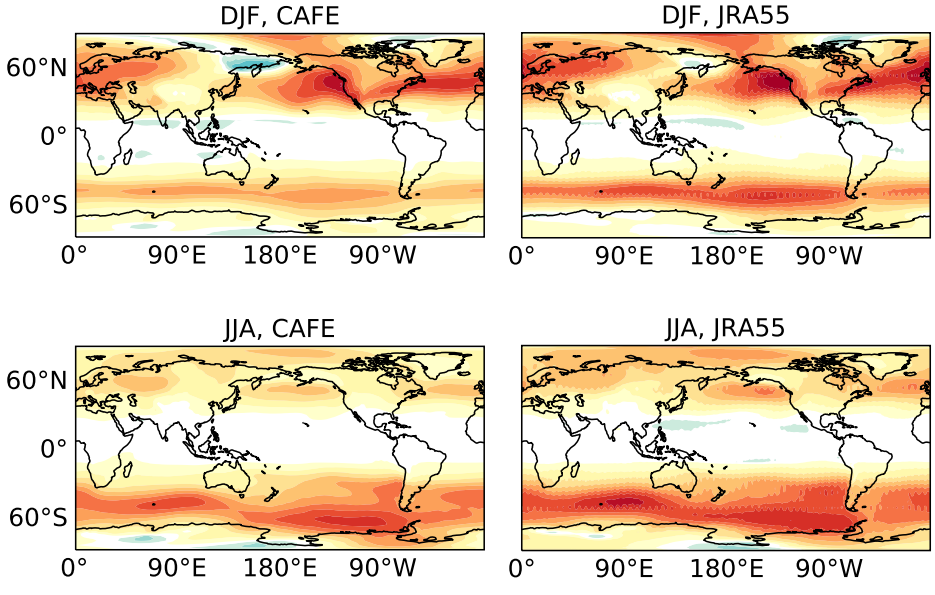
- 

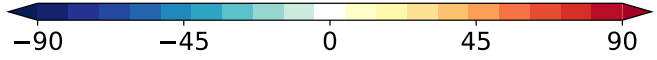
is a diagnostics/verification software package that we are building
- Early CAFE system hindcasts indicate comparable skill to other systems
- Prediction skill in Australia is strongly tied to the tropical ocean (ENSO) and to the CAFE system's ability to simulate relevant teleconnection processes

Contact: Dougie.Squire@csiro.au

Free-running model diagnostics

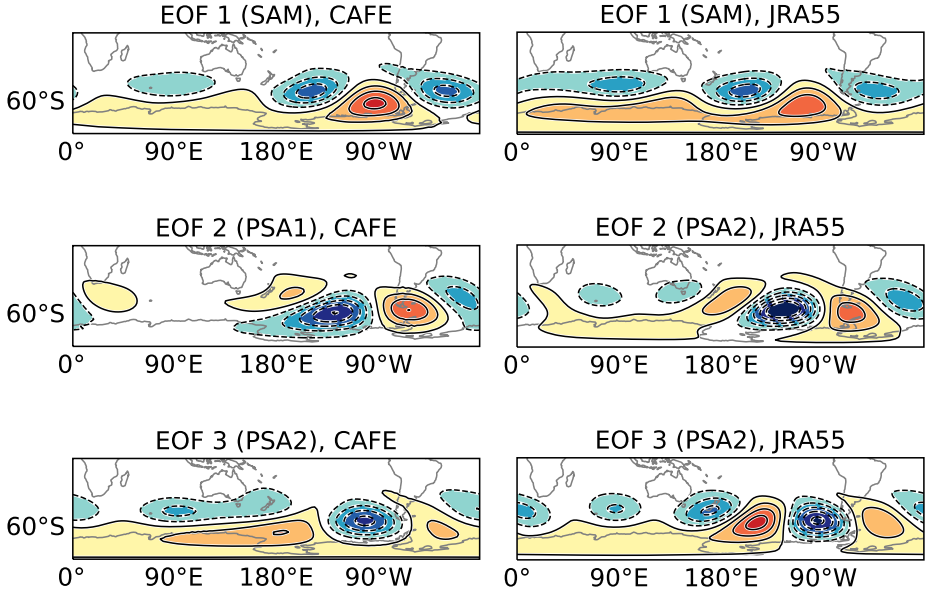
Longitudinal wave activity flux at 500hPa

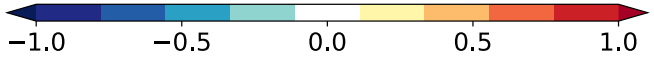




Longitudinal wave activity flux [m^2 / s^2]

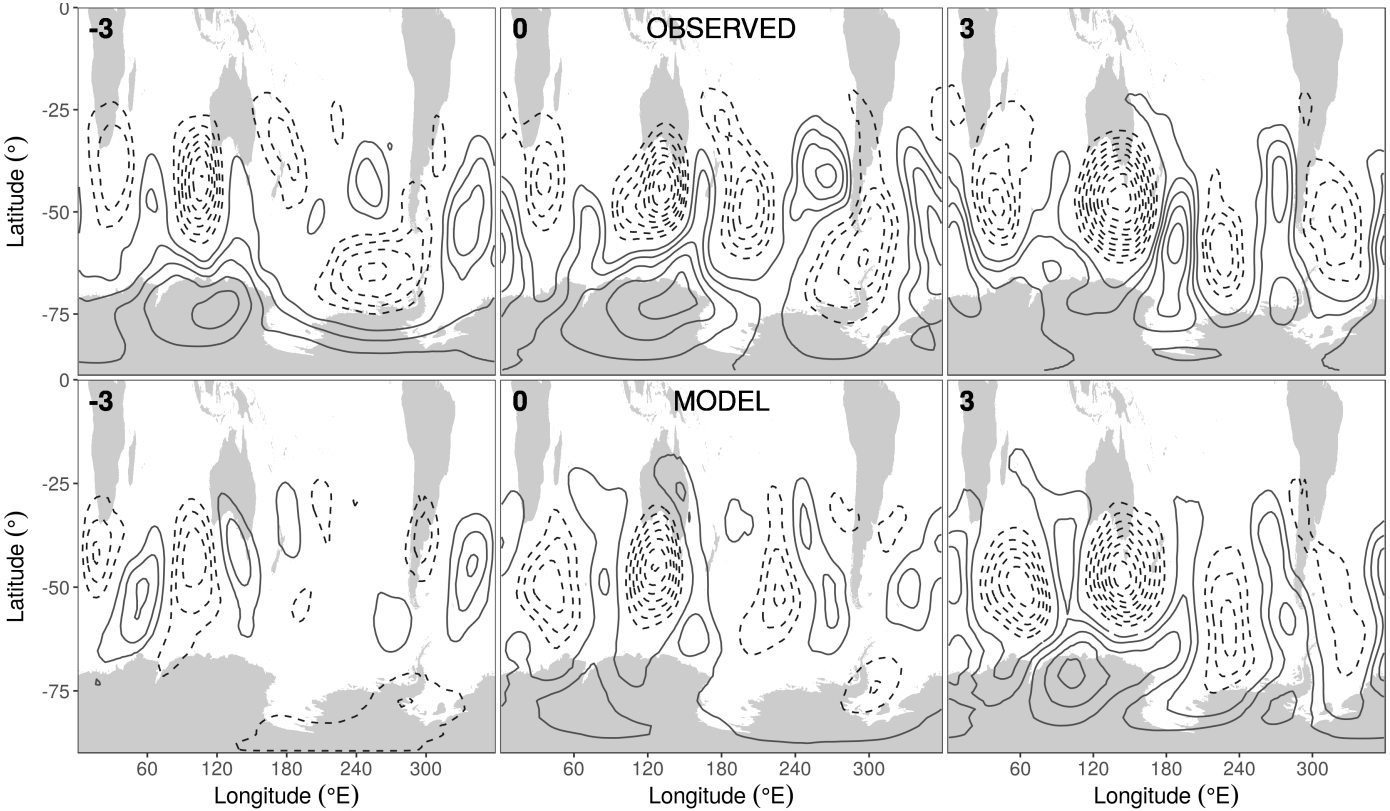
H500 EOFs





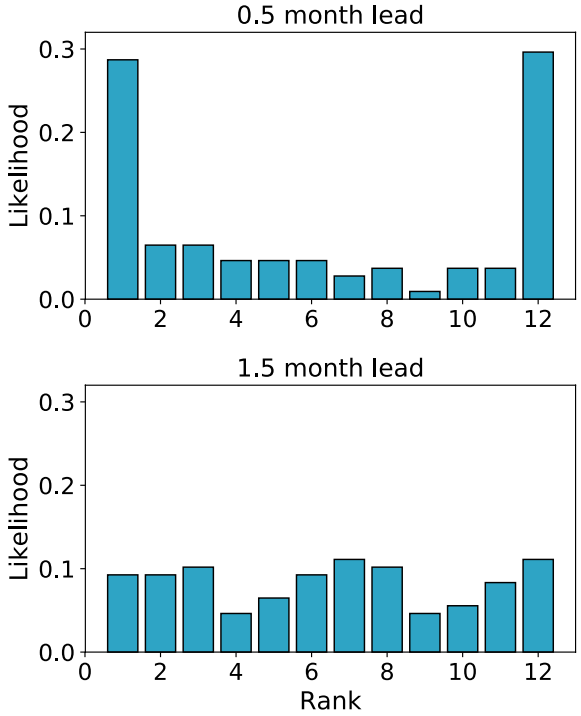
EOFs of 500 hPa height anomalies

h500 anomaly composites for heavy Tasmanian rainfall

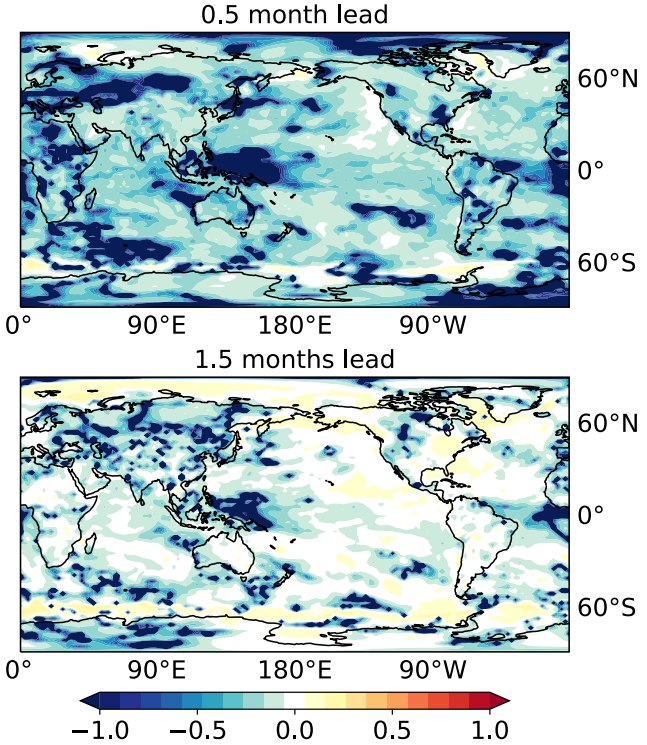


Ensemble spread metrics

Talagrand of SE Australian T_{2m}



Goddard et al. ensemble spread metric, T_{2m}



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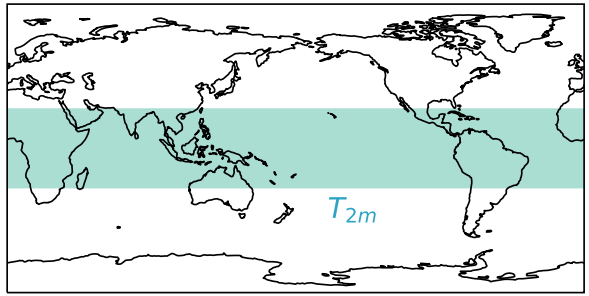

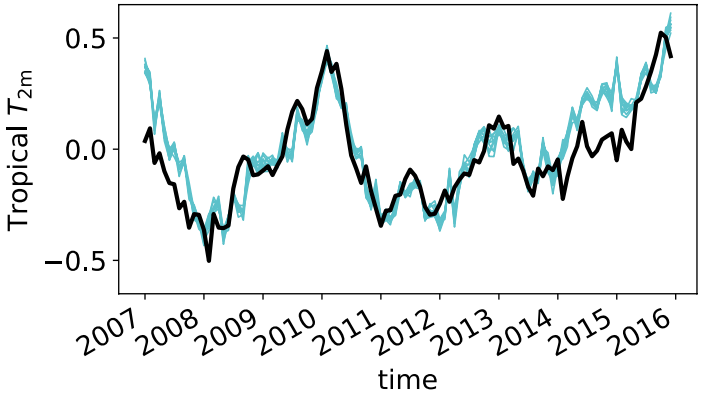

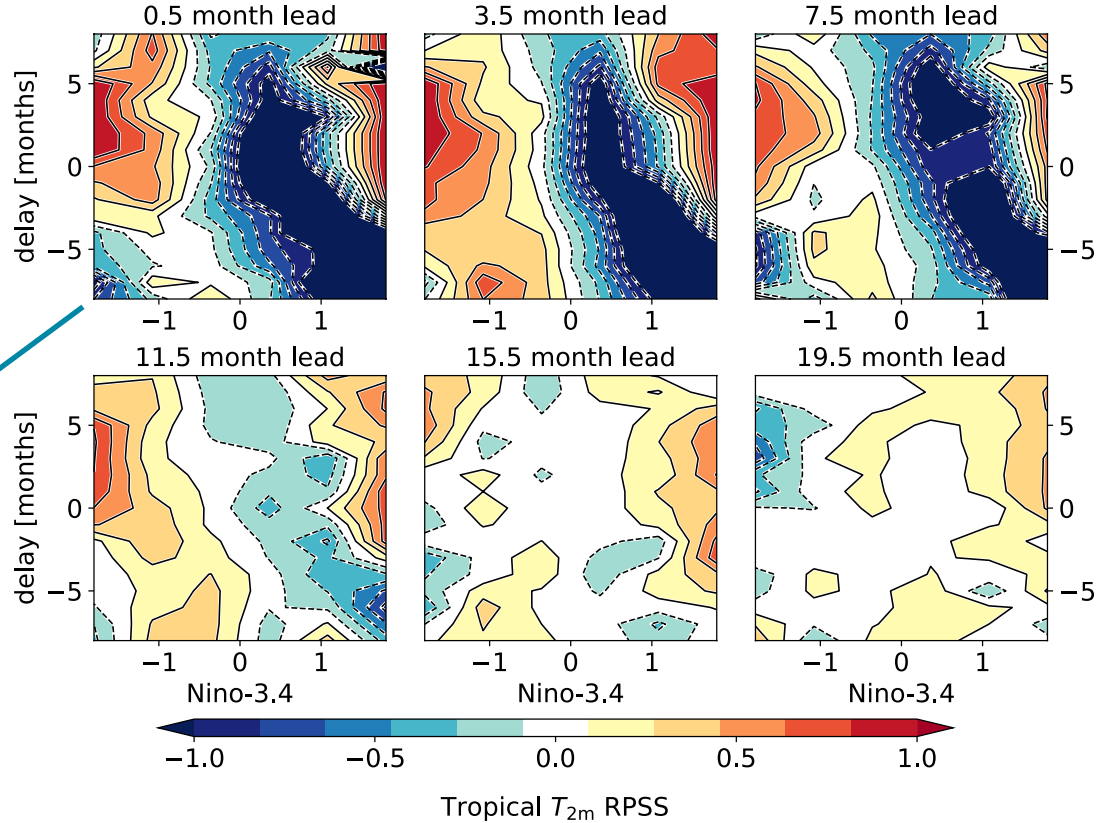

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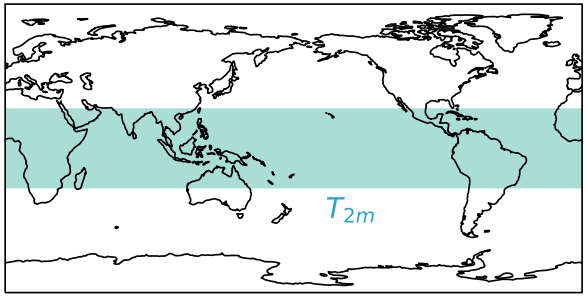
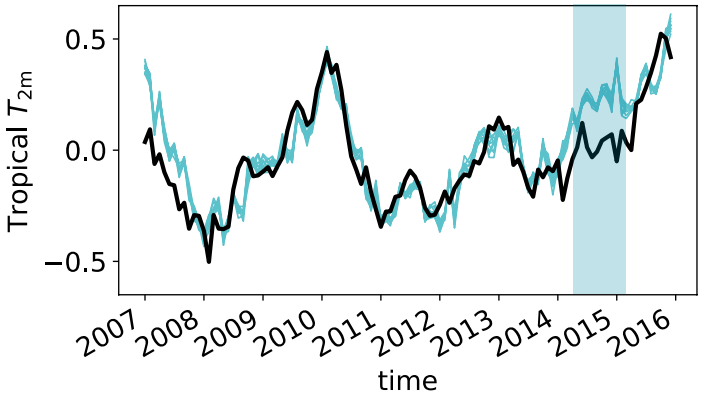
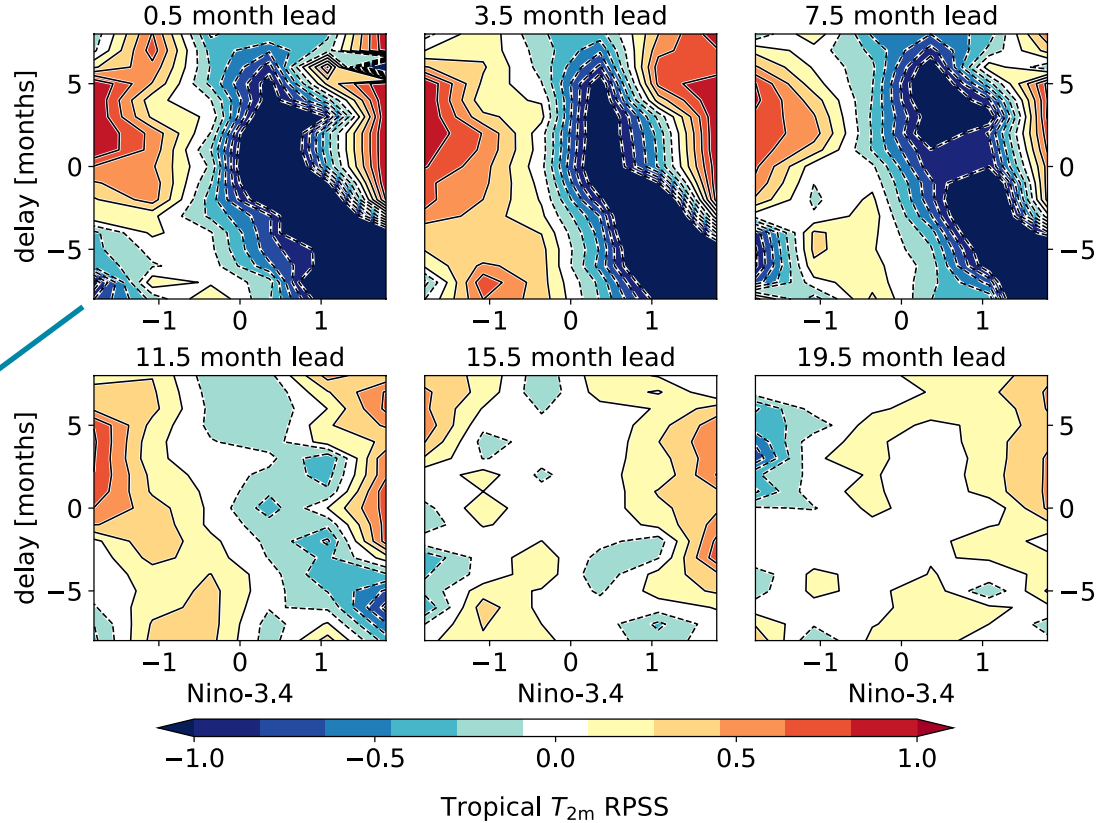
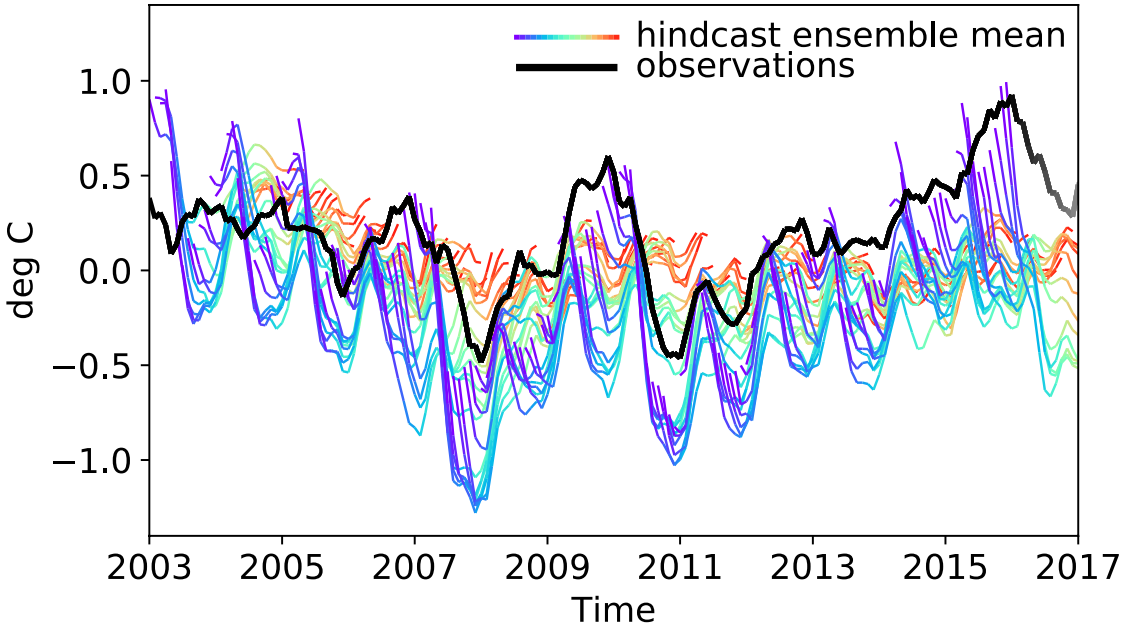






Uncorrected tropical Pacific SST



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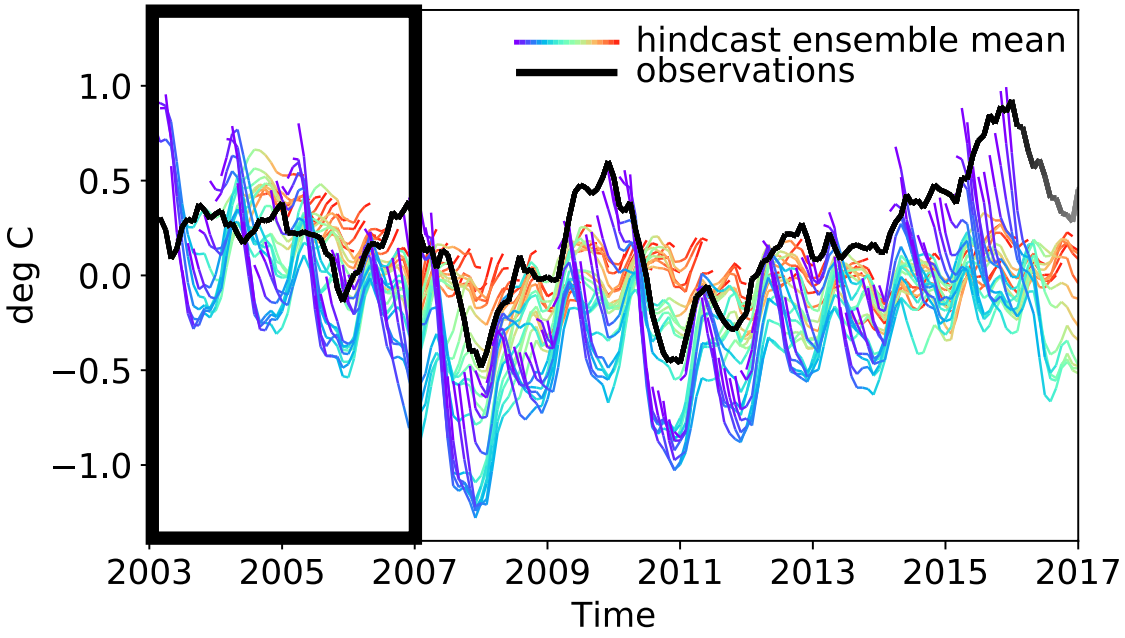

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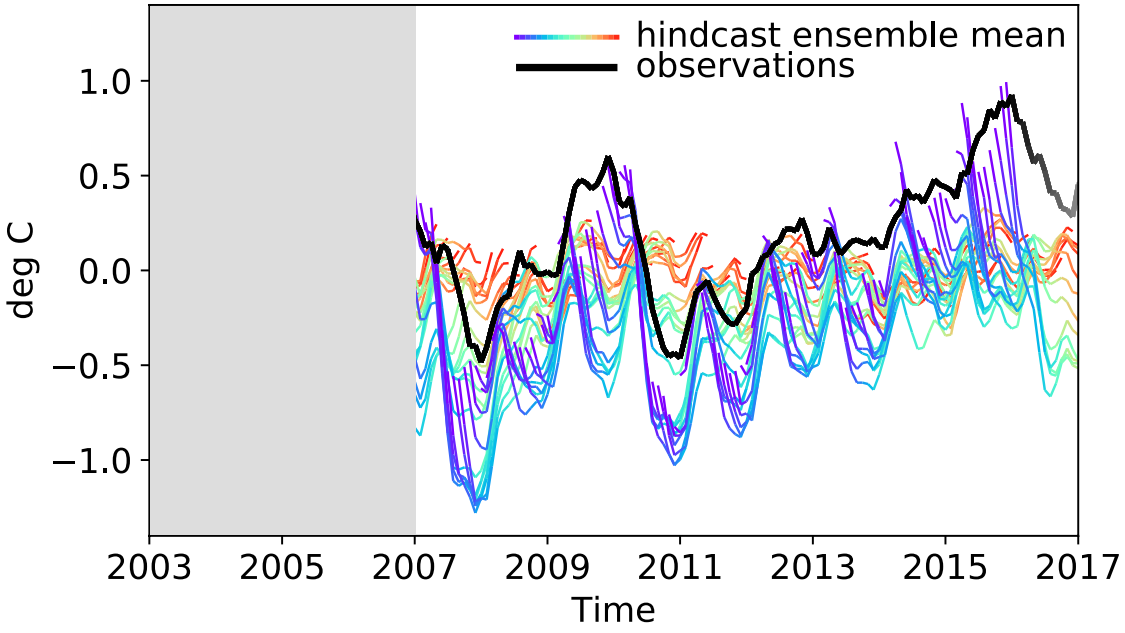

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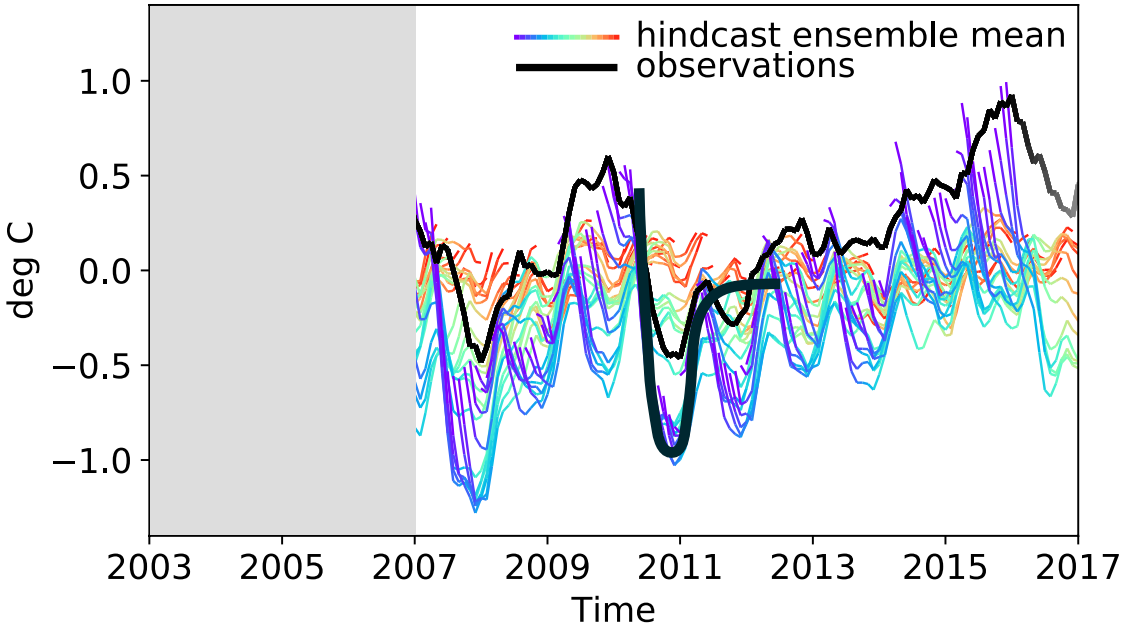

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