Climate and Oceans Support
Program in the Pacific

ACCESS-S Workshop

MODULE: ACCESS-S Model Skill

Climate and Oceans Support Program in the Pacific

Topics in this module

- Climate driver skill
- SPCZ location in ACCESS
- Tropical cyclone skill

Expected learning outcomes:

- Understanding of how a seasonal climate forecast is verified
- Understanding the methods used to verify ACCESS-S forecasts
- Understanding the datasets used to verify ACCESS-S forecasts

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ACCESS-S Skill: Key Considerations

- Challenging to communicate ensemble verification
- Skill is presented as an average over the hindcasts. Does not show how skill changes over time (windows of forecast opportunity)
- Hindcast ensemble size (11) is considerably smaller than real-time (99)
- The years included in hindcast period will influence the skill
- Observational data available for data assimilation becomes sparser as we go back in time (quality of initial state influences forecast skill)

Challenge: Models are computationally expensive – constraints on hindcast size – Number of years, number of start dates per year and ensemble size

Using LEPS to determine hindcast skill

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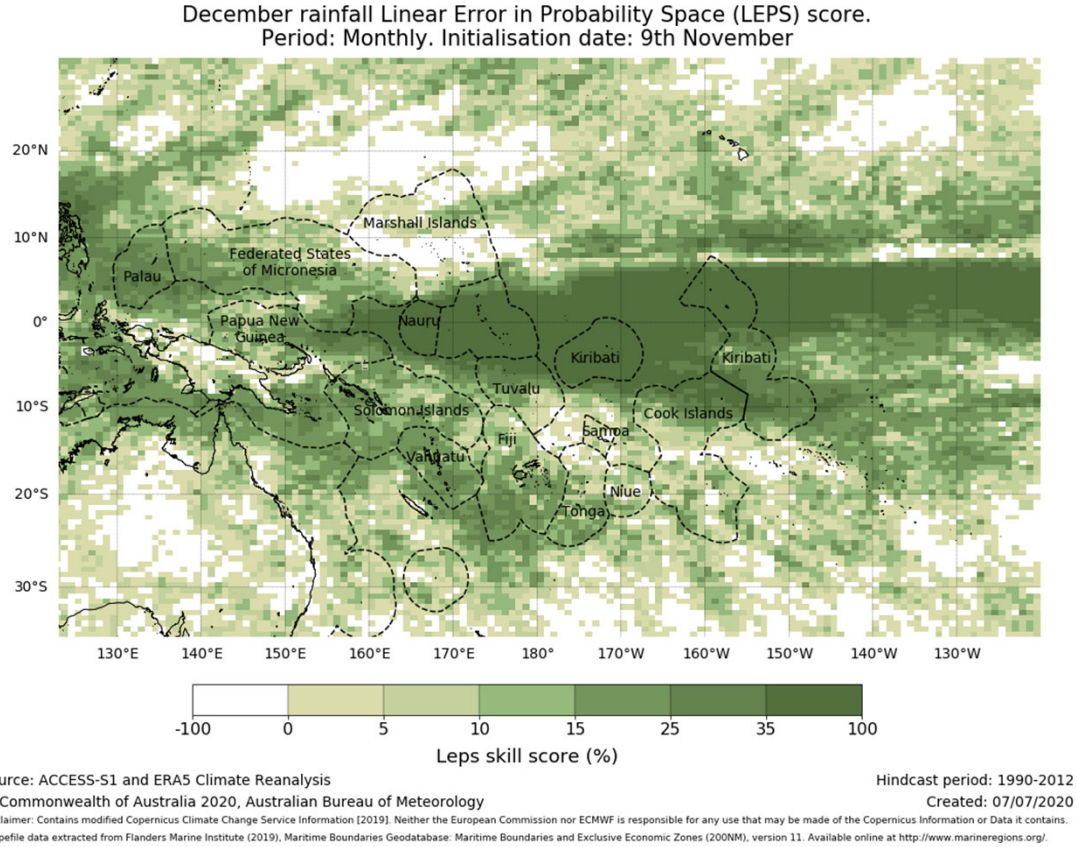
Model skill using LEPS is calculated for **hindcasts** as well as **forecasts**. This is calculated for outlook variables such as temperature and rainfall. Skill can be determined for different regions at different times of year.

Example:

ACCESS-S skill scores for tercile forecasts for December rainfall between 1990 and 2012.

- Darker green regions show the model predicted the correct tercile more often for the Decembers sampled when compared to ERA5 'observations' for that same period.
- This indicates regions where Real-time skill is likely to be highest, however real-time skill should be monitored separately as it may not match hindcast skill exactly.



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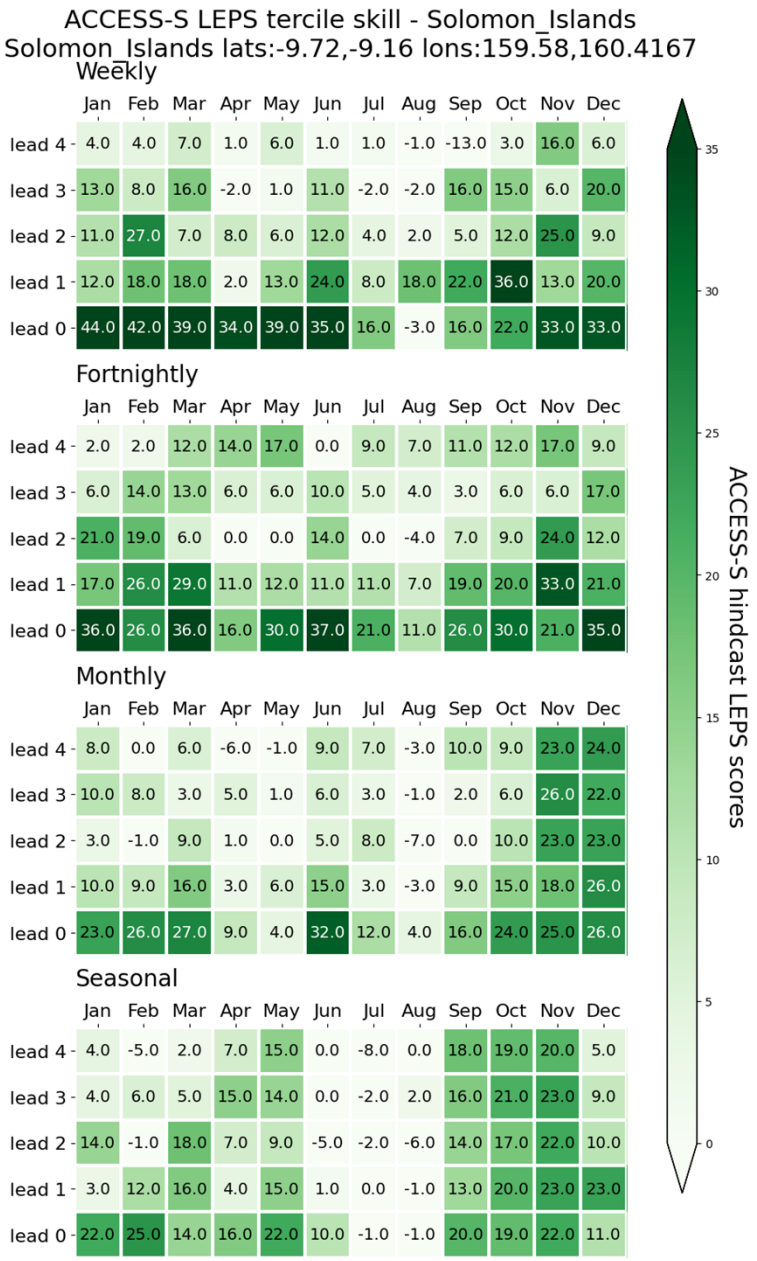
LEPS Skill through the year

- Highest skill usually at shorter model lead times
- The model will perform better at different times of the year
- Different regions will have different skill patterns, even within a country
- Weekly/fortnightly lead 0 skill is the highest, however this overlaps with existing weather forecast and is not provided



LEPS Skill through the year

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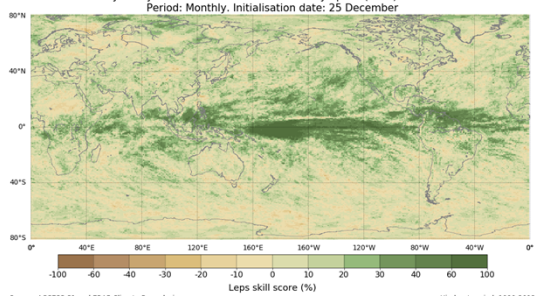
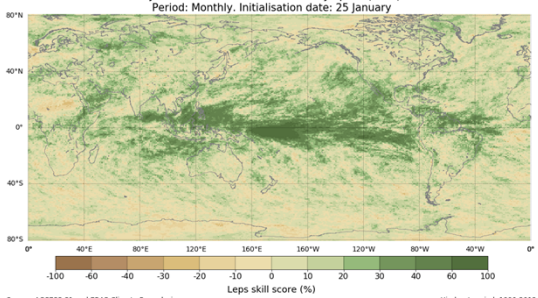
January rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 December



Source: ACCESS-S1 and ERA5 Climate Reanalysis
© Commonwealth of Australia 2020, Australian Bureau of Meteorology
Hindcast period: 1990-2012
Created: 19/02/2020

February rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 January



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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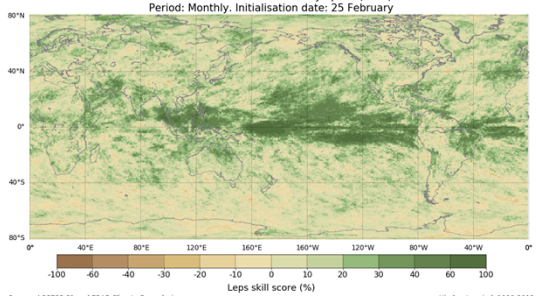
Hindcast period: 1990-2012
Created: 18/02/2020

March rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 February



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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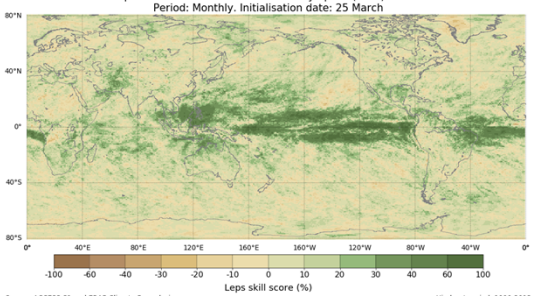
Hindcast period: 1990-2012
Created: 18/02/2020

April rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 March



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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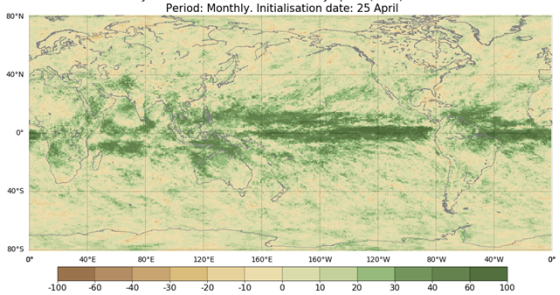
Hindcast period: 1990-2012
Created: 18/02/2020

May rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 April



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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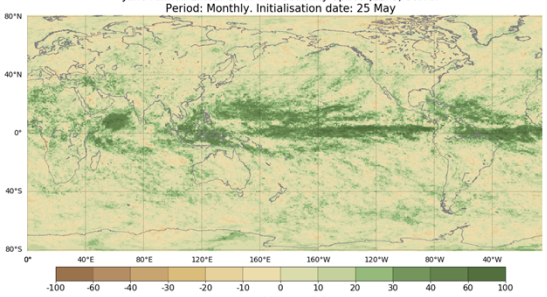
Hindcast period: 1990-2012
Created: 18/02/2020

June rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 May



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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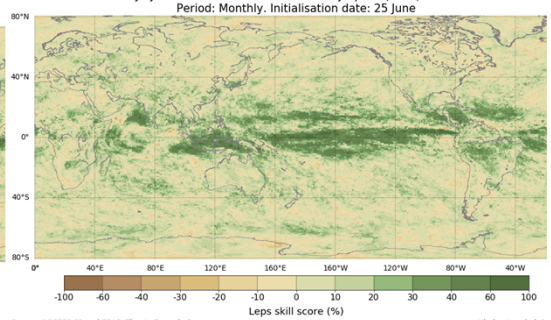
Hindcast period: 1990-2
Created: 18/02/2

July rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 June



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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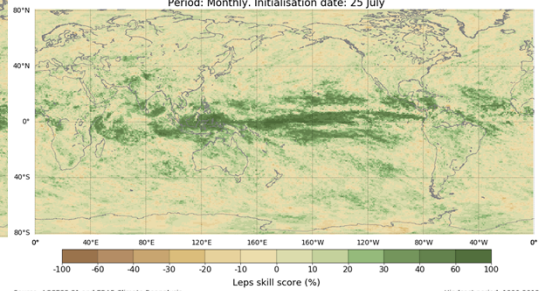
Hindcast period: 1
Created: 18

August rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 July



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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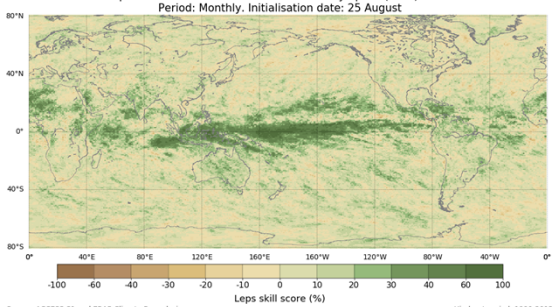
Hindcast period: 1990-2012
Created: 18/02/2020

September rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 August



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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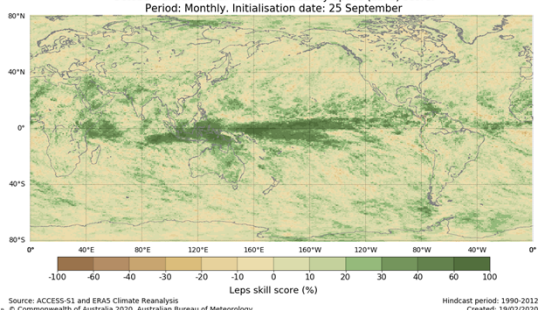
Hindcast period: 1990-2012
Created: 19/02/2020

October rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 September



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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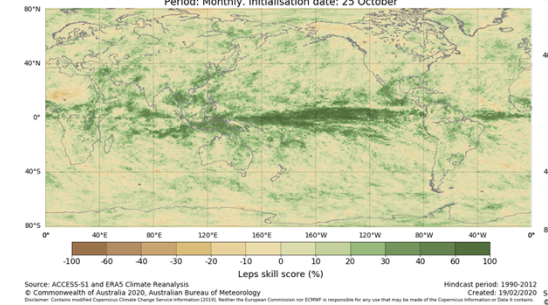
Hindcast period: 1990-2012
Created: 19/02/2020

November rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 October



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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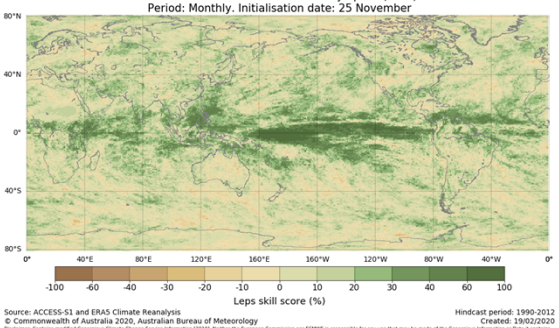
Hindcast period: 1990-2012
Created: 19/02/2020

December rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 November



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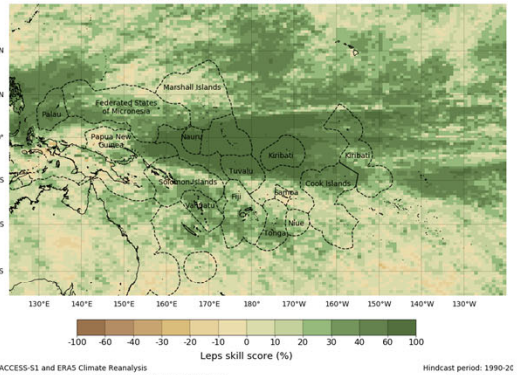
Hindcast period: 1990-2012
Created: 19/02/2020

Meteorology

JFM rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 December



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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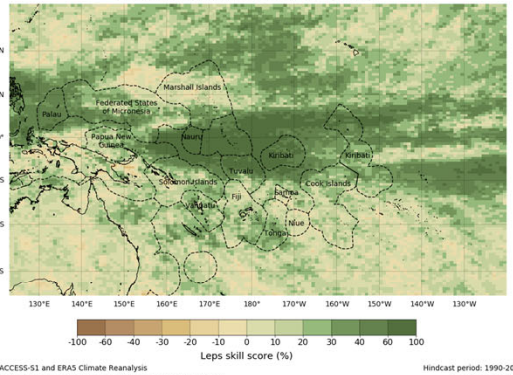
Hindcast period: 1990-2
Created: 19/02/2

FMA rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 January



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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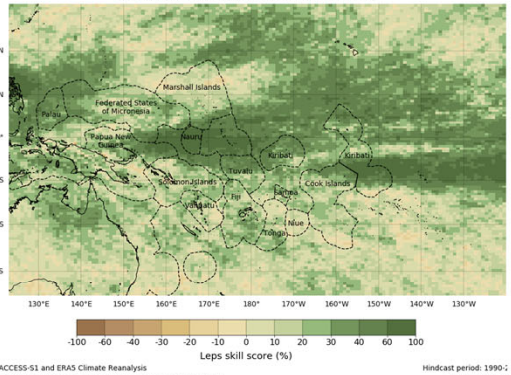
Hindcast period: 1990-2012
Created: 18/02/2020

MAM rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 February



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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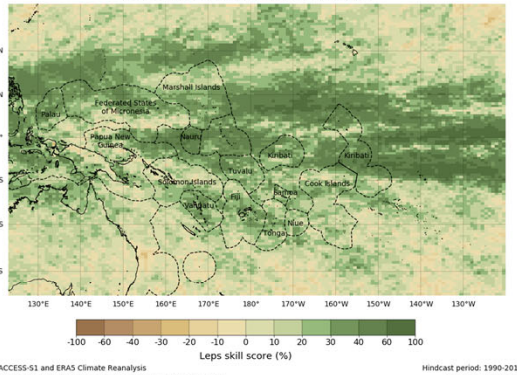
Hindcast period: 1990-2
Created: 18/02/2

AMJ rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 March



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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Hindcast period: 1990-2012
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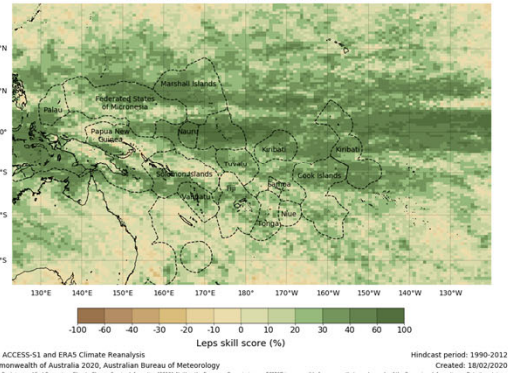
MJJ rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 April



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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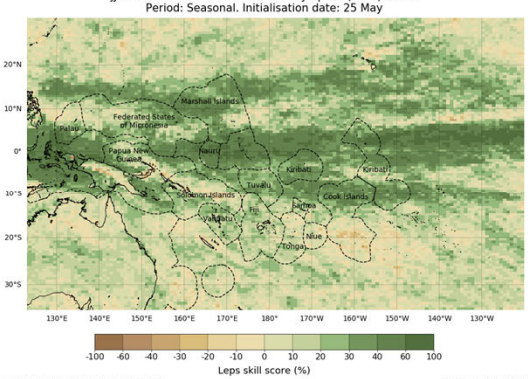
Hindcast period: 1990-2012
Created: 18/02/2020

JJA rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 May



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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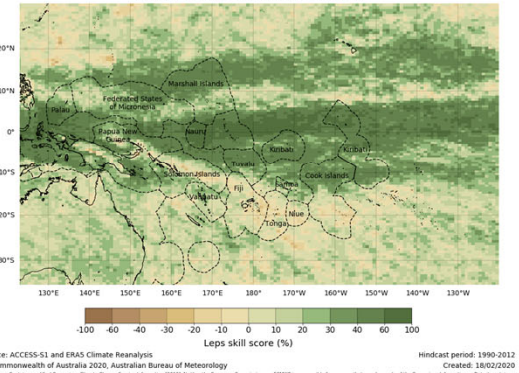
Hindcast period: 1990-2012
Created: 18/02/2020

JAS rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 June



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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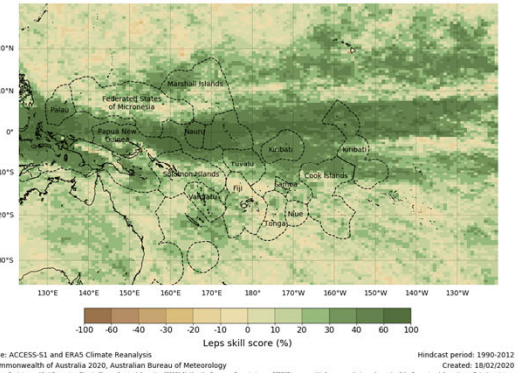
Hindcast period: 1990-2012
Created: 18/02/2020

ASO rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 July



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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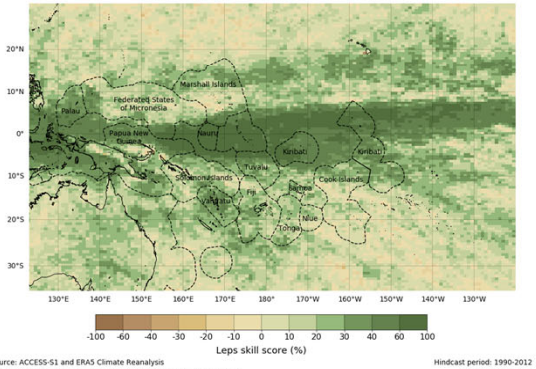
Hindcast period: 1990-2012
Created: 18/02/2020

SON rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 August



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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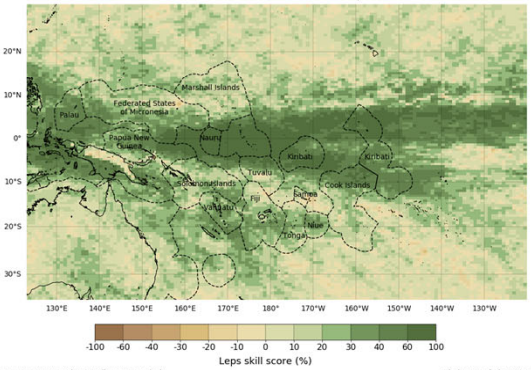
Hindcast period: 1990-2012
Created: 18/02/2020

OND rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 September



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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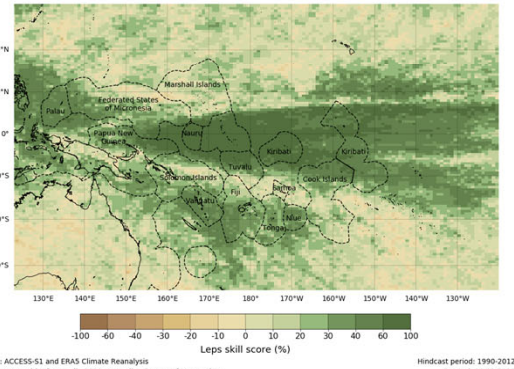
Hindcast period: 1990-201
Created: 18/02/202

NDJ rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 October



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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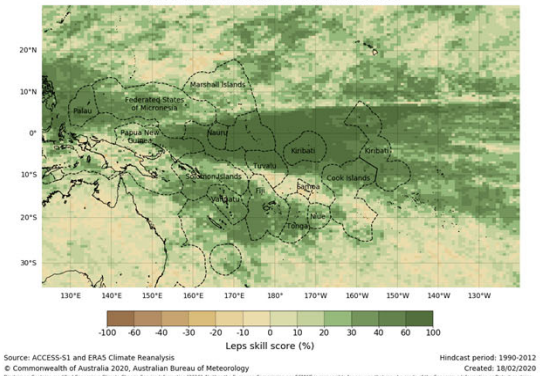
Hindcast period: 1990-2012
Created: 18/02/2020

DJF rainfall Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 November



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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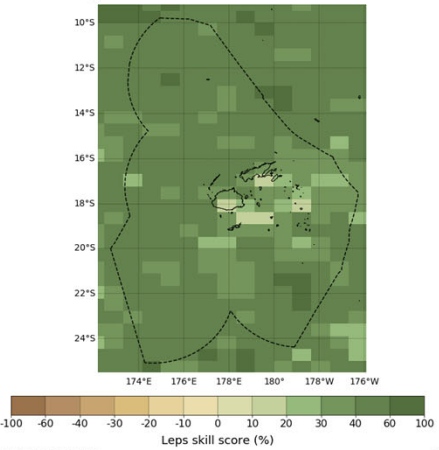
Hindcast period: 1990-2012
Created: 18/02/2020

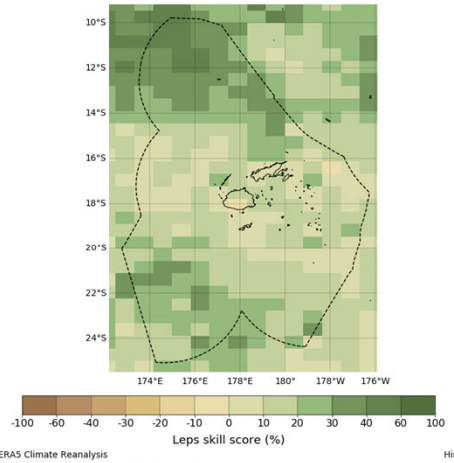
Week of 9 – 15 March

Rainfall Linear Error in Probability Space (LEPS) score.
Period: Weekly. Initialisation date: 9th March. Lead time: 0 weeks



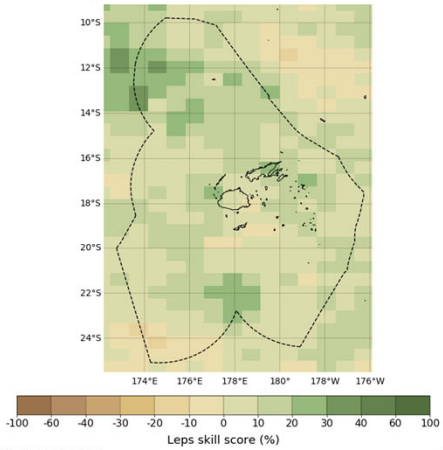
Source: ACCESS-S1 and ERA5 Climate Reanalysis
© Commonwealth of Australia 2019, Australian Bureau of Meteorology
Hindcast period: 1990-2012
Created: 24/12/2019

Rainfall Linear Error in Probability Space (LEPS) score.
Period: Weekly. Initialisation date: 1st March. Lead time: 1 week



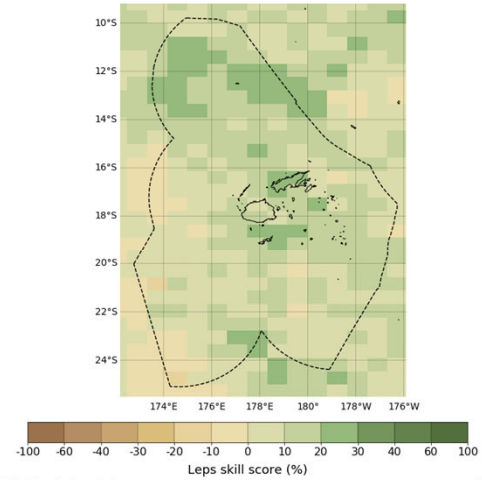
Source: ACCESS-S1 and ERA5 Climate Reanalysis
© Commonwealth of Australia 2019, Australian Bureau of Meteorology
Hindcast period: 1990-2012
Created: 24/12/2019

Rainfall Linear Error in Probability Space (LEPS) score.
Period: Weekly. Initialisation date: 25 February. Lead time: 2 weeks



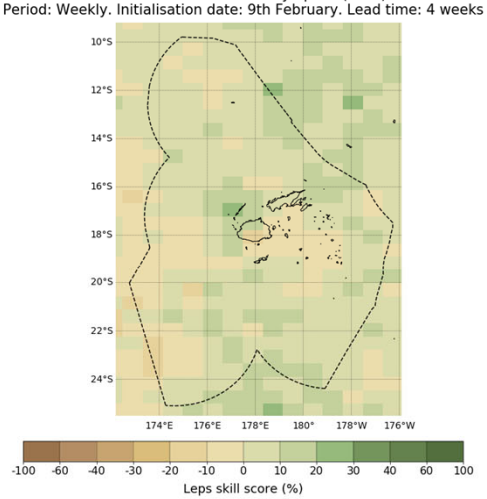
Source: ACCESS-S1 and ERA5 Climate Reanalysis
© Commonwealth of Australia 2019, Australian Bureau of Meteorology
Hindcast period: 1990-2012
Created: 24/12/2019

Rainfall Linear Error in Probability Space (LEPS) score.
Period: Weekly. Initialisation date: 17th February. Lead time: 3 weeks



Source: ACCESS-S1 and ERA5 Climate Reanalysis
© Commonwealth of Australia 2019, Australian Bureau of Meteorology
Hindcast period: 1990-2(
Created: 24/12/2(

Rainfall Linear Error in Probability Space (LEPS) score.
Period: Weekly. Initialisation date: 9th February. Lead time: 4 weeks



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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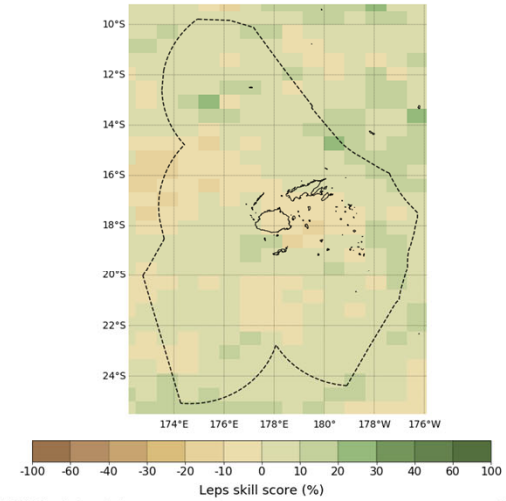
Hindcast period: 1990-2012
Created: 24/12/2019

Rainfall Linear Error in Probability Space (LEPS) score.
Period: Weekly. Initialisation date: 1st February. Lead time: 5 weeks



Source: ACCESS-S1 and ERA5 Climate Reanalysis
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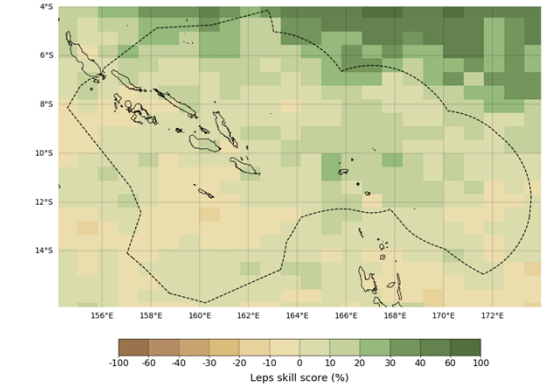
Hindcast period: 1990-2012
Created: 24/12/2019

Climate and Oce
Program in th

March

Rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 December. Lead time: 2 months



Source: ACCESS-S1 and ERA5 Climate Reanalysis
Hindcast period: 1990-2012
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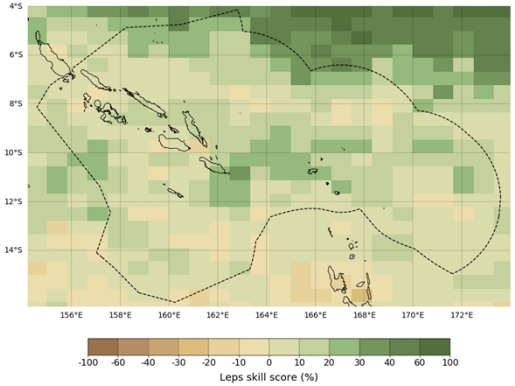
Created: 11/01/2020

Rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 January. Lead time: 1 month



Source: ACCESS-S1 and ERA5 Climate Reanalysis
Hindcast period: 1990-2012
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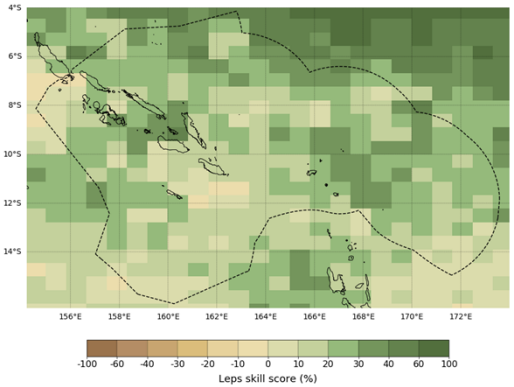
Created: 09/01/2020

Rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 February. Lead time: 0 months



Source: ACCESS-S1 and ERA5 Climate Reanalysis
Hindcast period: 1990-2012
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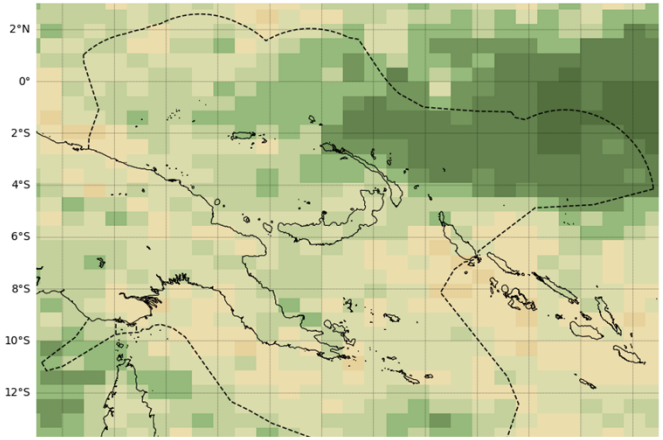
Created: 09/01/2020

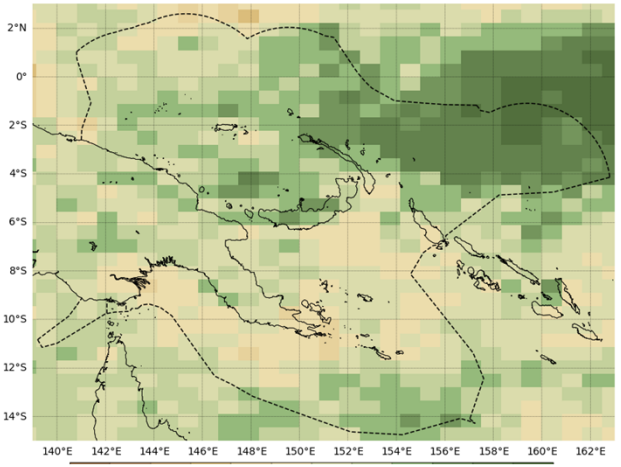
Climate and Ocean Program in the

April

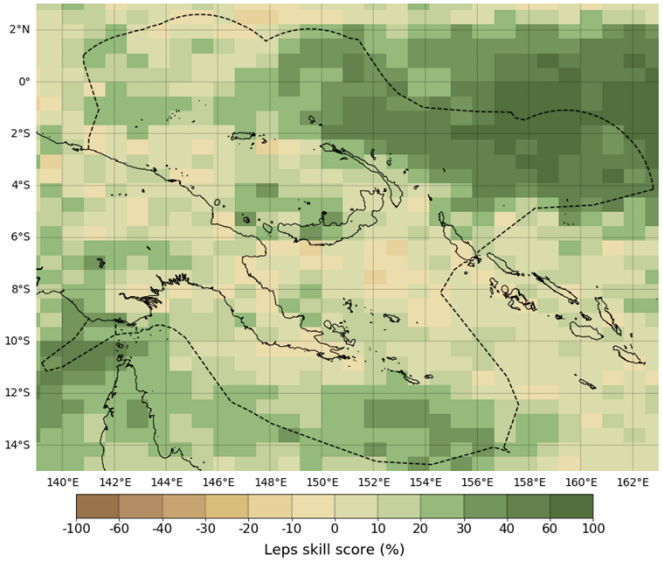
Rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 1st March. Lead time: 1 month



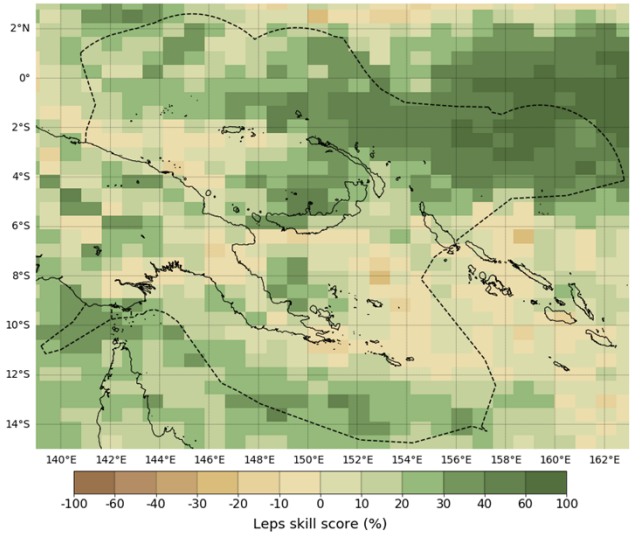
Rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 9th March. Lead time: 0 months



Rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 17th March. Lead time: 0 months



Rainfall Linear Error in Probability Space (LEPS) score.
Period: Monthly. Initialisation date: 25 March. Lead time: 0 months



Source: ACCESS-S1 and ERA5 Climate Reanalysis
Hindcast period: 1990-2012

Created: 09/01/2020

Source: ACCESS-S1 and ERA5 Climate Reanalysis
Hindcast period: 1990-2012
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Created: 09/01/2020
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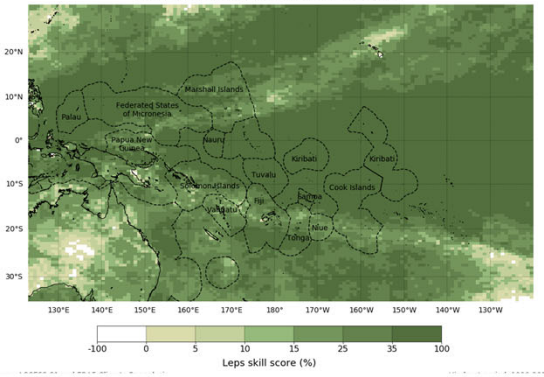
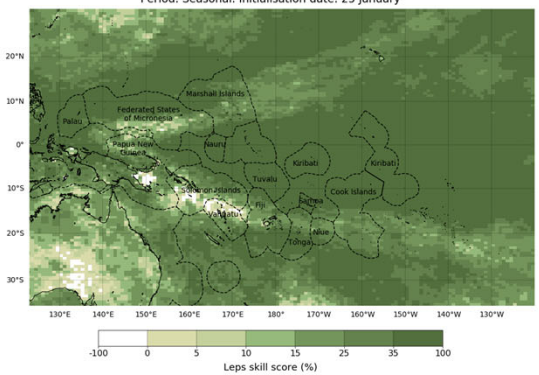
Shapefile data extracted from Flanders Marine Institute (2019), Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at http://www.marineregions.org/.

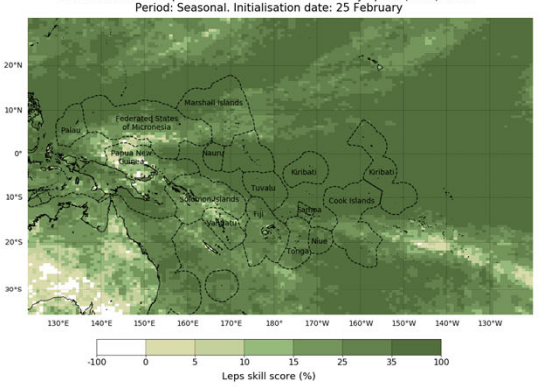
JFM maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 December



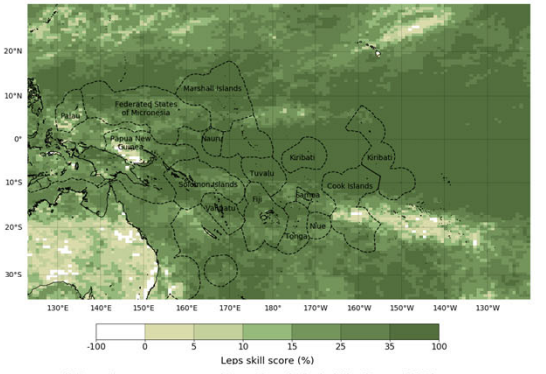
FMA maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 January



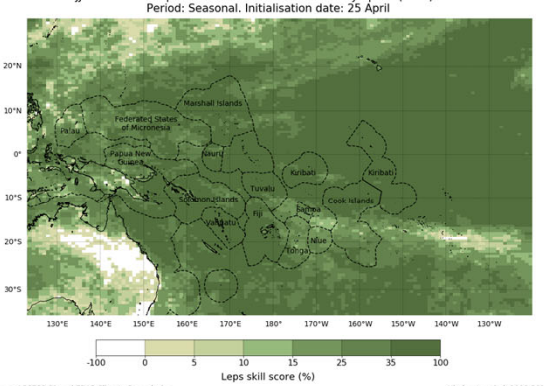
MAM maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 February



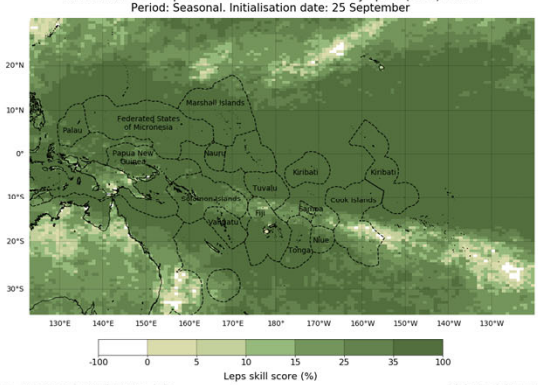
AMJ maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 March



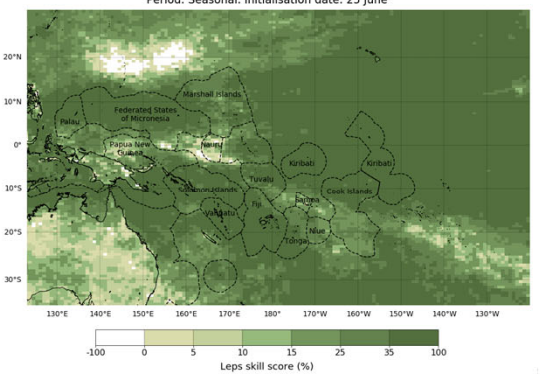
MJJ maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 April



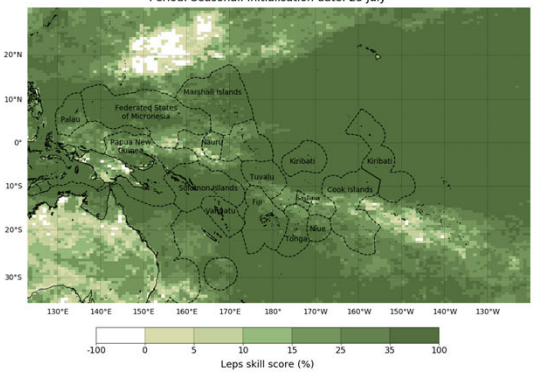
OND maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 September



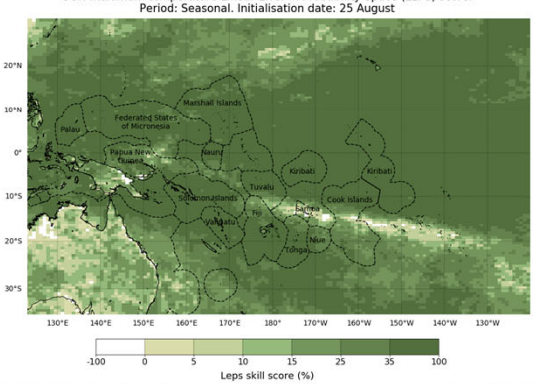
JAS maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 June



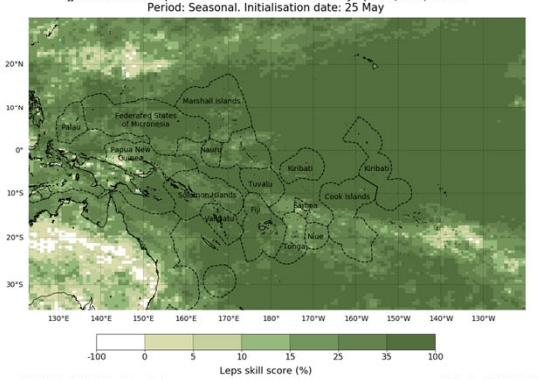
ASO maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 July



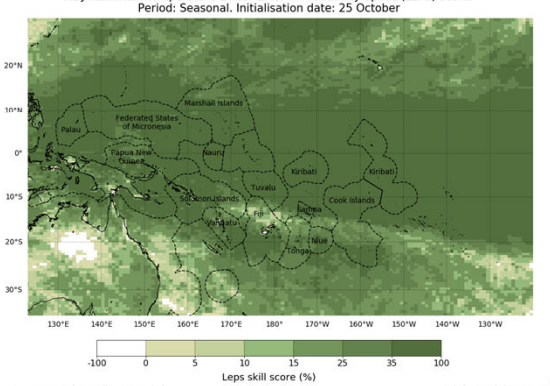
SON maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 August



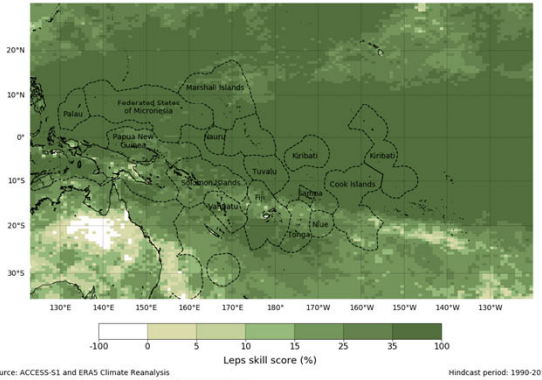
JJA maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 May



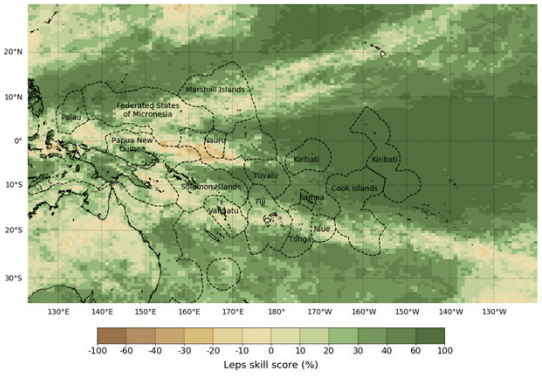
NDJ maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 October



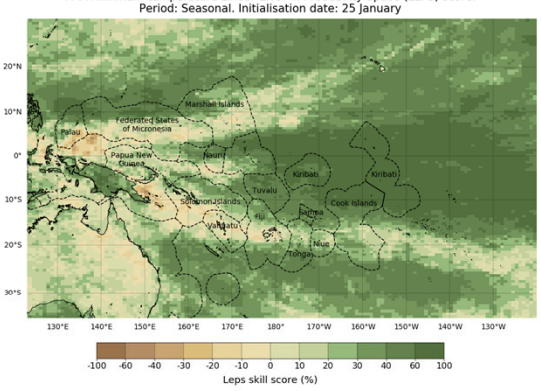
DJF maximum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 November



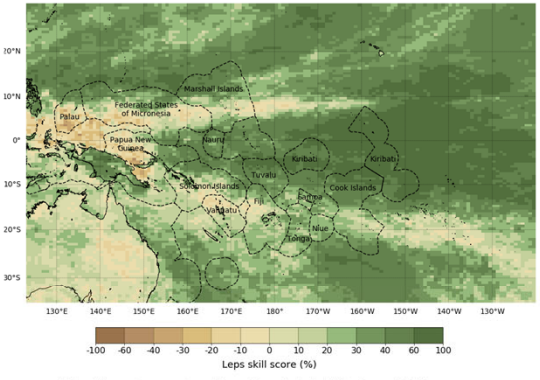
JFM minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 December



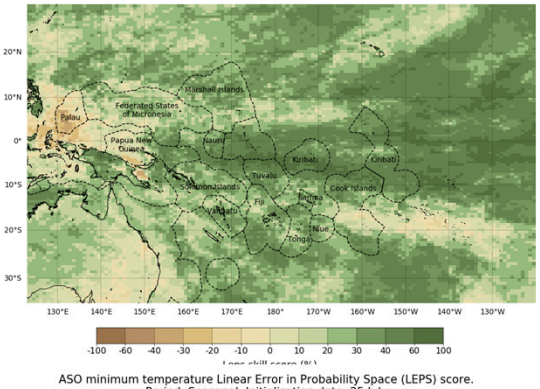
FMA minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 January



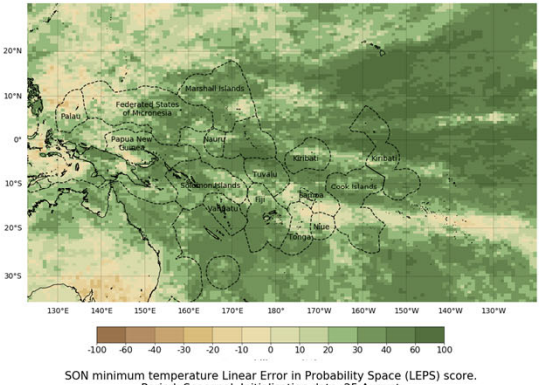
MAM minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 February



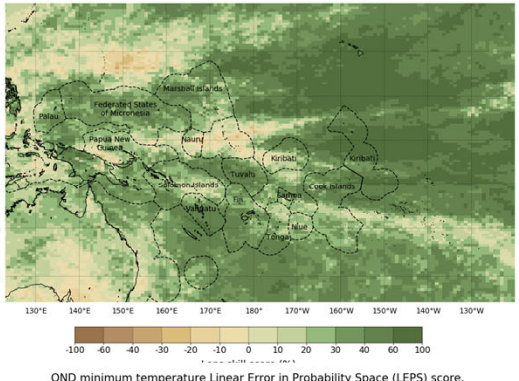
AMJ minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 March



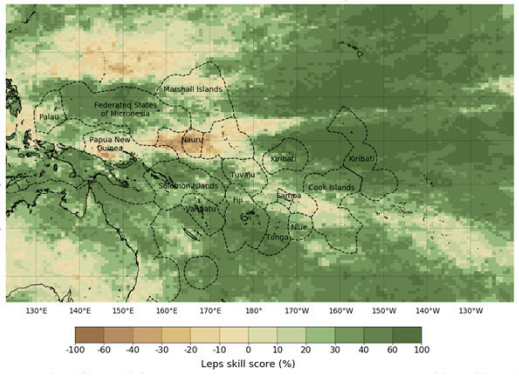
MJJ minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 April



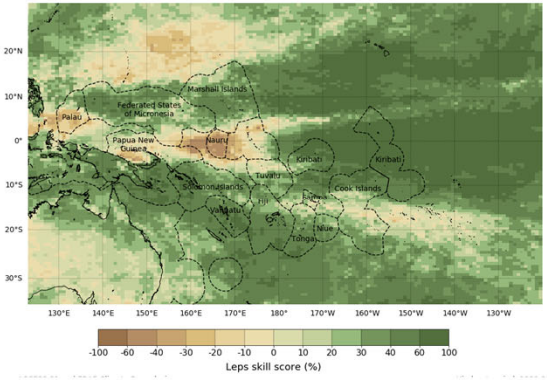
JJA minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 May



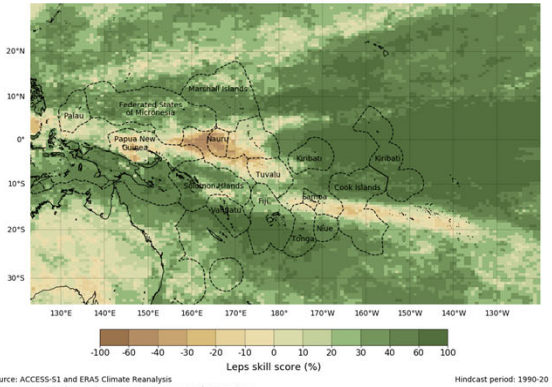
JAS minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 June



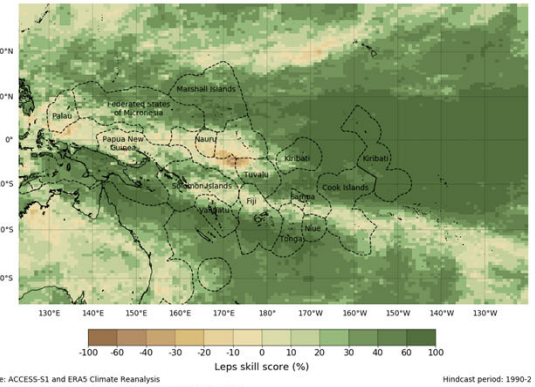
ASO minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 July



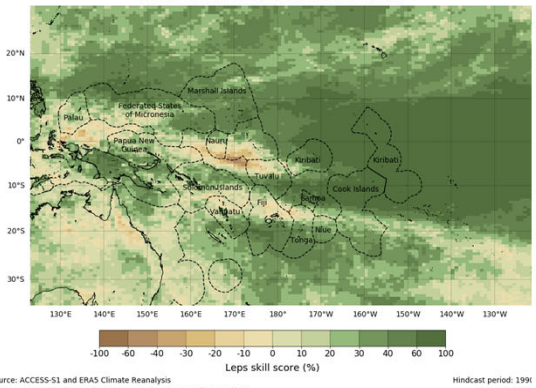
SON minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 August



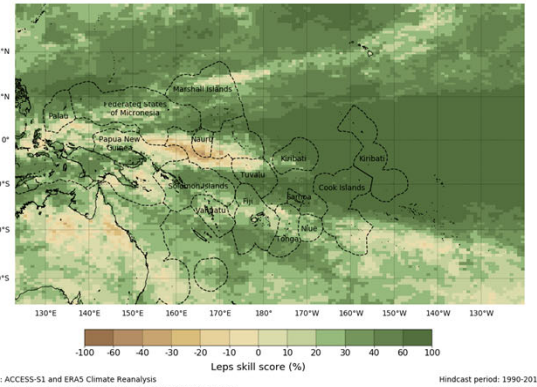
OND minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 September



NDJ minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 October



DJF minimum temperature Linear Error in Probability Space (LEPS) score.
Period: Seasonal. Initialisation date: 25 November



Hindcast period: 1990-20
Created: 18/02/20

Source: ACCESS-S1 and ERA5 Climate Reanalysis
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Shapefile data extracted from Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at http://www.marineregions.org/
Hindcast period: 1990-2
Created: 18/02/2

Source: ACCESS-S1 and ERA5 Climate Reanalysis
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Shapefile data extracted from Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at http://www.marineregions.org/
Hindcast period: 199
Created: 18/0

Source: ACCESS-S1 and ERA5 Climate Reanalysis
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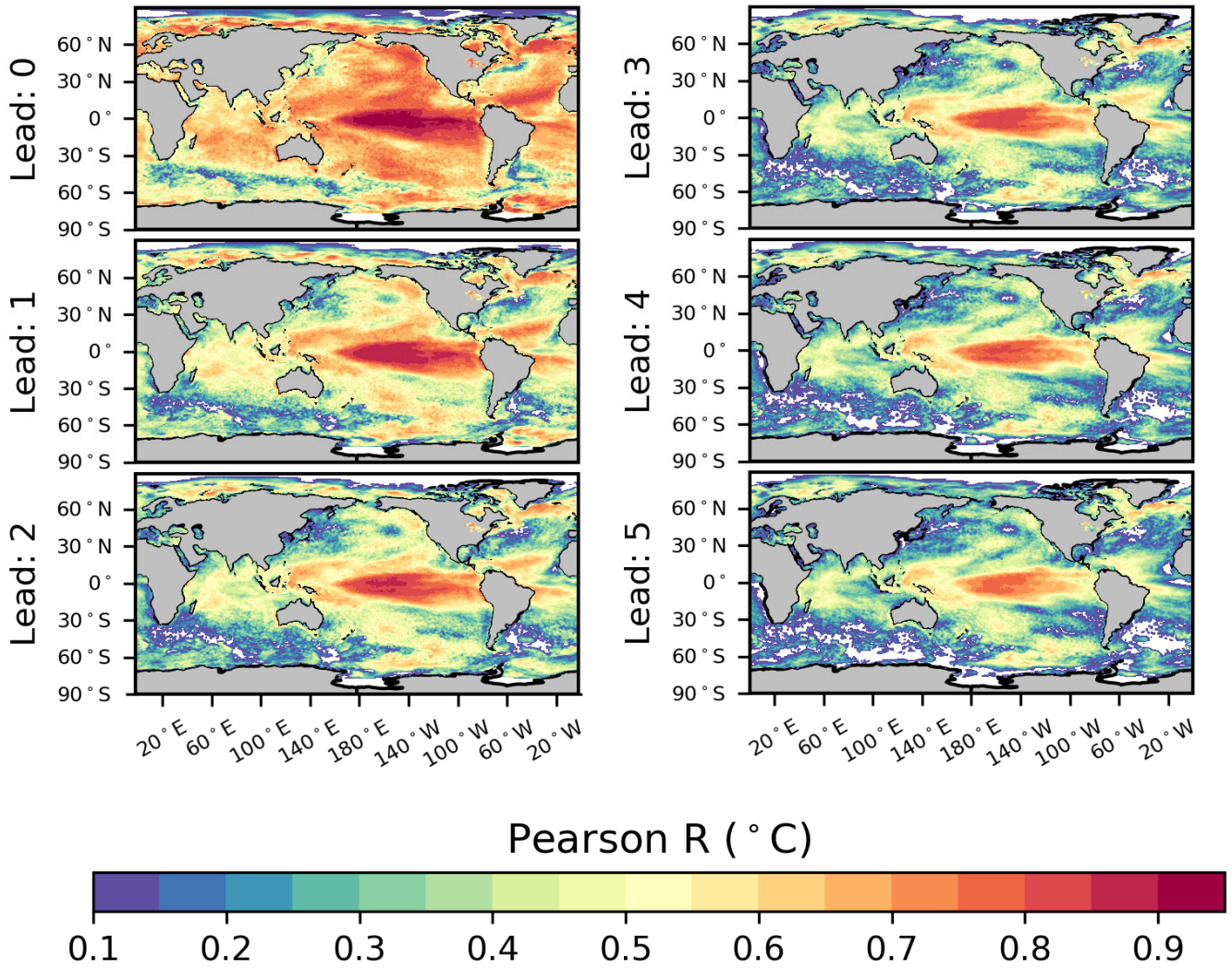
Shapefile data extracted from Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at http://www.marineregions.org/
Hindcast period: 1990-2012
Created: 18/02/2020

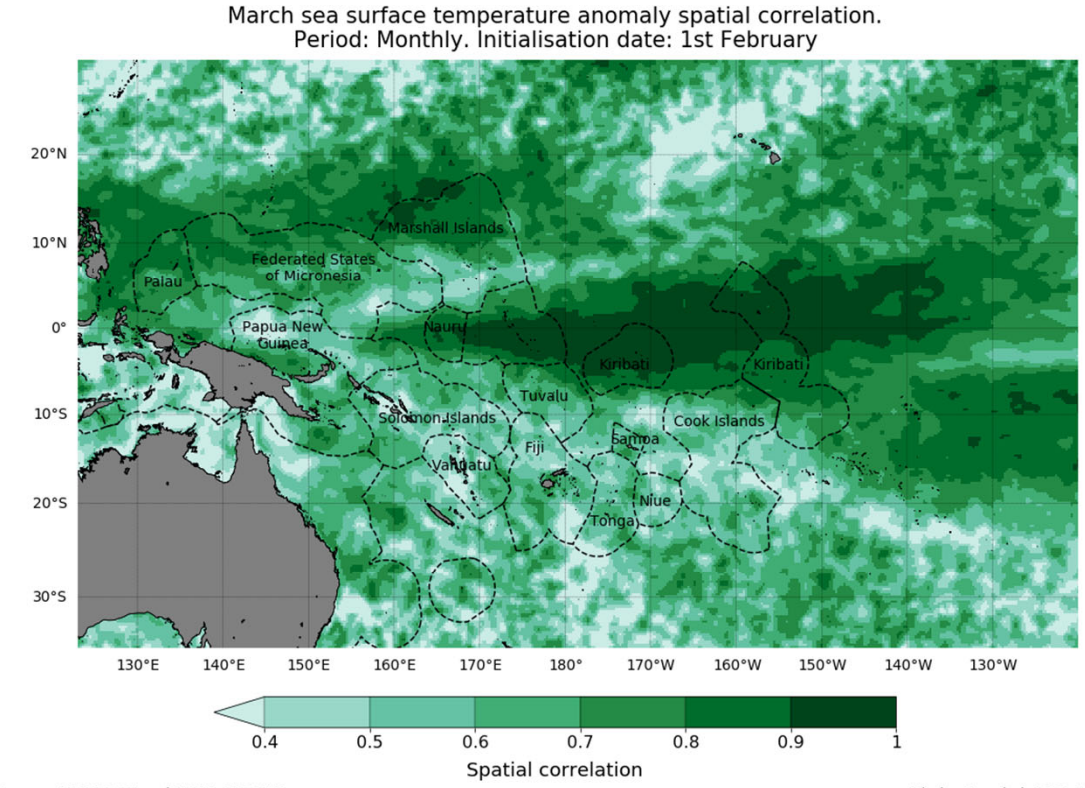
Climate and Oceans Support Program in the Pacific

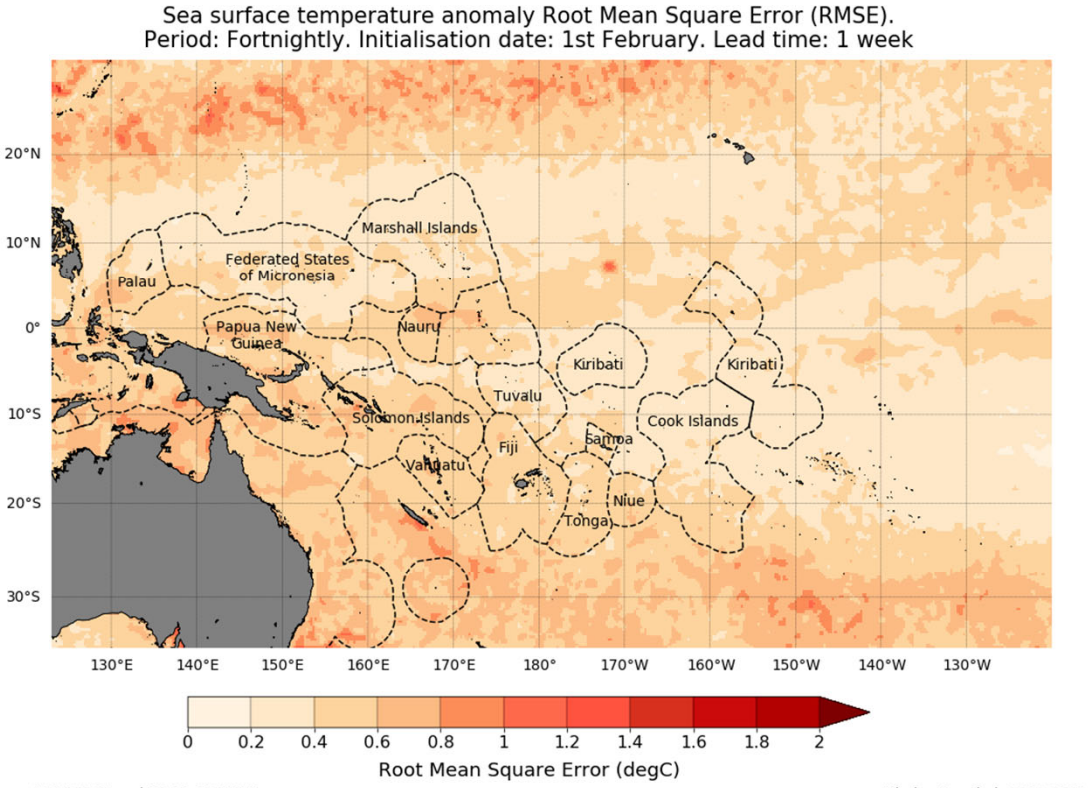
SST Skill: A summary



Climate and Oceans Support Program in the Pacific

Ocean skill on the website





Climate and Oceans Support Program in the Pacific

SST Skill: A detailed summary

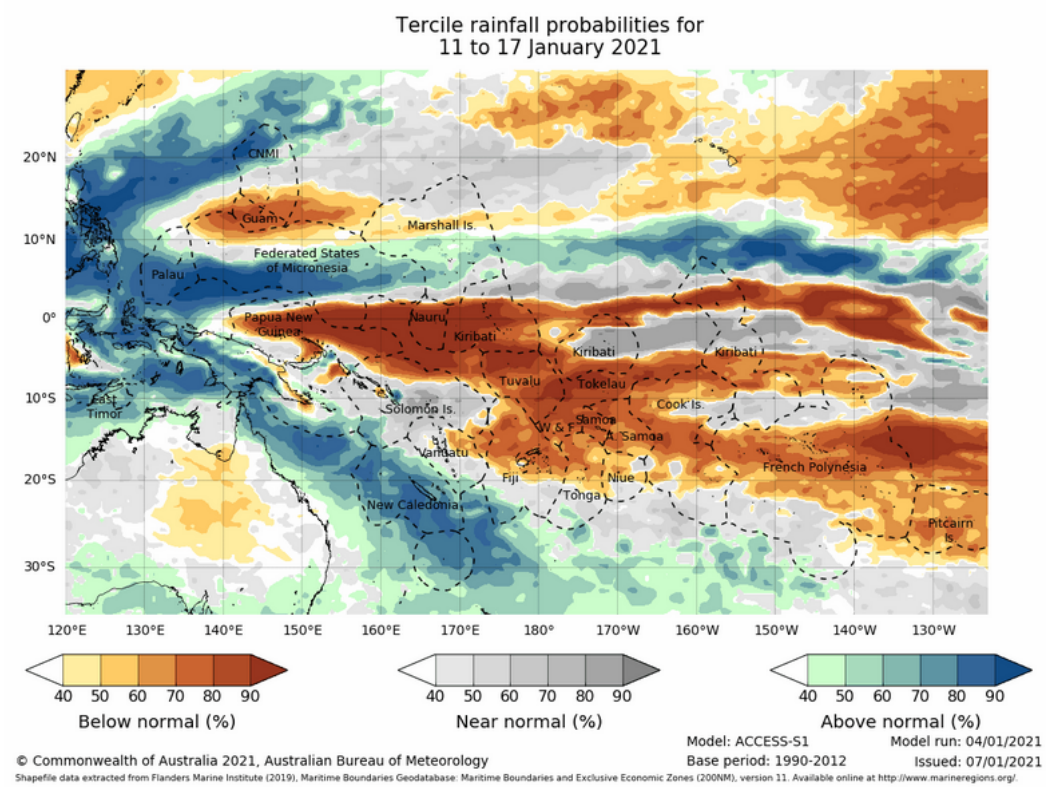
	January				February				March				April				May				June				July				August				September				October				November				December			
	1	9	17	25	1	9	17	25	1	9	17	25	1	9	17	25	1	9	17	25	1	9	17	25	1	9	17	25	1	9	17	25	1	9	17	25	1	9	17	25	1	9	17	25	1	9	17	25
Cook Islands	5	4	6	1	5	3	5	5	2	4	5	4	4	3	4	4	4	3	3	4	3	6	3	2	2	1	1	1	2	1	5	1	2	1	4	1	4	3	3	3	1	2	2	2	2	1	1	1
Samoa	6	6	6	6	6	5	5	6	5	4	5	4	4	3	3	3	4	3	4	4	2	2	4	4	4	2	2	3	2	1	1	0	1	0	1	1	1	0	0	0	1	2	6	6	6	1	6	6
Tonga	6	4	4	3	4	3	3	3	3	1	2	2	2	1	2	2	2	1	2	2	2	2	4	2	2	3	3	3	3	2	2	2	2	1	1	1	1	0	1	2	1	1	1	1	1	1	1	1
Niue	6	0	0	4	4	3	3	3	2	2	2	2	2	1	1	1	1	1	1	3	2	2	4	2	2	1	1	3	2	1	1	1	2	3	3	1	1	0	3	2	2	1	1	1	1	1	1	1
Vanuatu	1	0	0	0	1	0	4	4	3	2	6	3	2	6	3	6	3	2	6	1	2	1	1	1	1	6	6	6	5	5	4	4	4	3	4	4	4	3	3	3	3	2	2	2	2	1	1	1
Solomon Islands	1	0	0	0	0	1	6	1	6	0	6	6	6	6	6	6	6	6	6	6	6	4	5	5	5	5	6	6	6	5	5	3	5	4	4	4	4	3	3	3	1	0	0	2	2	1	1	1
Marshall Islands	5	2	2	2	2	1	3	2	4	3	3	3	3	2	2	2	3	2	2	2	2	1	2	1	1	1	1	2	2	1	5	5	5	4	4	5	4	3	0	3	5	6	6	6	6	3	3	3
Micronesia	3	2	2	2	2	1	1	1	2	0	3	1	3	2	2	2	2	1	1	1	1	0	4	4	5	4	6	6	6	6	6	6	6	5	6	6	6	5	4	5	5	4	6	4	4	3	3	3
Palau	4	3	3	3	3	2	2	2	2	6	1	6	2	0	6	6	6	6	6	6	6	6	6	4	6	6	6	6	6	2	6	6	6	1	6	6	6	0	6	6	6	5	6	5	5	6	4	4
Tuvalu	6	6	6	6	2	6	6	6	6	6	6	6	6	6	5	6	6	5	4	5	4	3	4	4	4	3	3	3	3	2	2	2	2	6	2	6	1	6	6	6	6	6	6	6	6	6	6	6
Fiji	1	2	6	0	2	4	4	5	4	4	3	3	2	3	6	6	6	2	5	5	4	3	4	4	5	4	3	4	3	5	3	2	2	1	2	2	2	3	3	1	1	2	1	2	1	1	1	1
Papua New Guinea	1	0	6	6	6	5	2	2	6	1	6	1	6	6	6	6	6	5	6	5	5	5	4	5	5	4	6	4	4	5	5	3	3	2	2	2	2	1	1	1	1	0	0	2	2	1	1	1
Nauru	5	5	5	5	5	4	4	4	4	3	6	3	6	6	6	6	6	5	6	6	6	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5
Phoenix Group	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Line Group	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Gilbert Islands	5	4	6	4	6	3	4	6	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5

Most outlook skill is online (http://access-s.clide.cloud/index.html)

Climate and Oceans Support Program in the Pacific

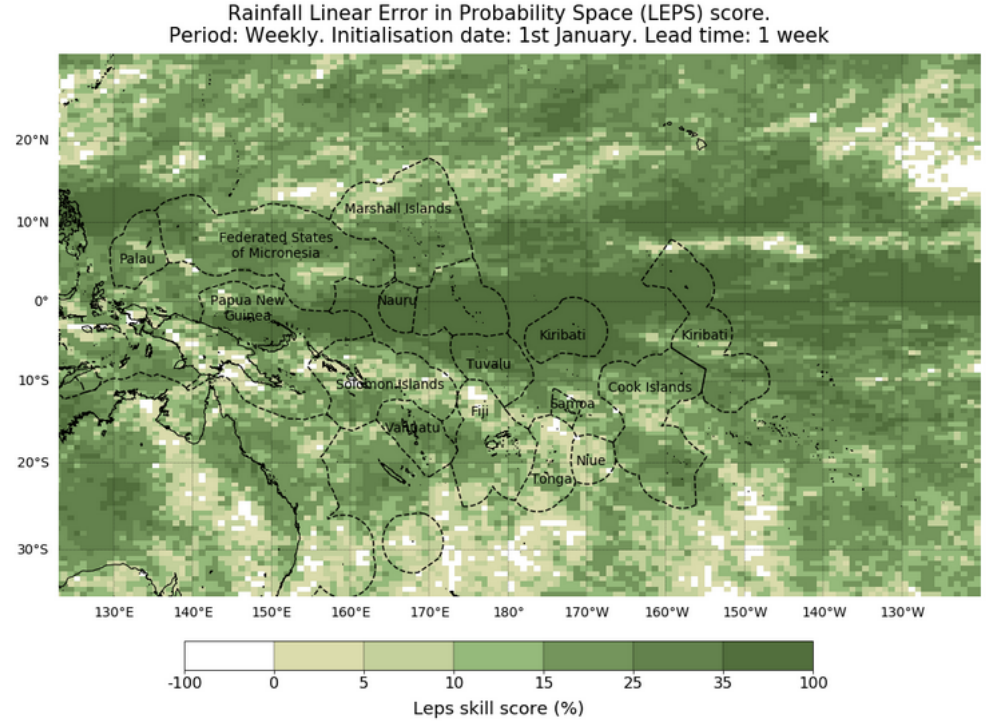
ACCESS-S and Pacific climate monitoring charts

Category	Domain	Time period	Variable
ACCESS-S outlooks	Pacific	Week	Rain
Regional	Forecast	2	Terciles



ACCESS-S and Pacific climate monitoring charts

Category	Domain	Time period	Variable
ACCESS-S outlooks	Pacific	Week	Rain
Regional	LEPS Skill	2	Terciles



Outlooks and skill in the archive - example

Index of /files/archive/20210109/global/monthly/forecast

Name	Last modified	Size	Description
Parent Directory		-	
sst.forecast.anom.glb.month1.png	2021-01-11 10:46	154K	
sst.forecast.anom.glb.month2.png	2021-01-11 10:46	145K	
sst.forecast.anom.glb.month3.png	2021-01-11 10:46	139K	

Index of /files/archive/20210109/global/monthly/skill

Name	Last modified	Size	Description
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sst.skill.CORR.median.glb.month2.png	2021-01-11 10:46	246K	
sst.skill.CORR.median.glb.month3.png	2021-01-11 10:46	238K	
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sst.skill.RMSE.median.glb.month2.png	2021-01-11 10:46	219K	
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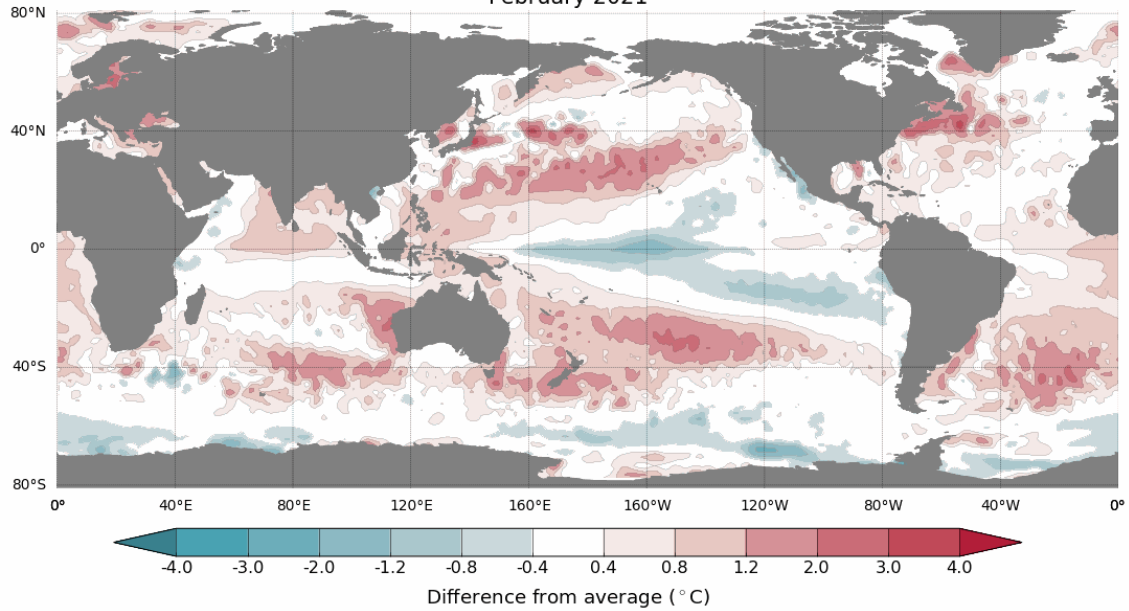
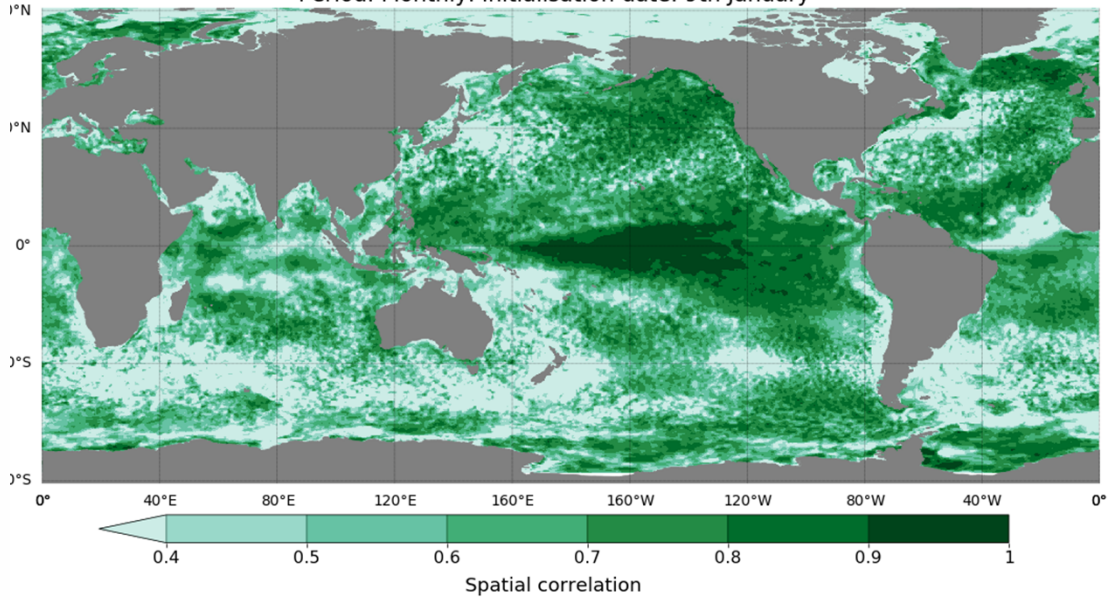
Difference from average sea surface temperature forecast for February 2021



February sea surface temperature anomaly spatial correlation.
Period: Monthly. Initialisation date: 9th January



www.bom.gov.au/climate

Model: ACCESS-S1
Base period: 1990-2012

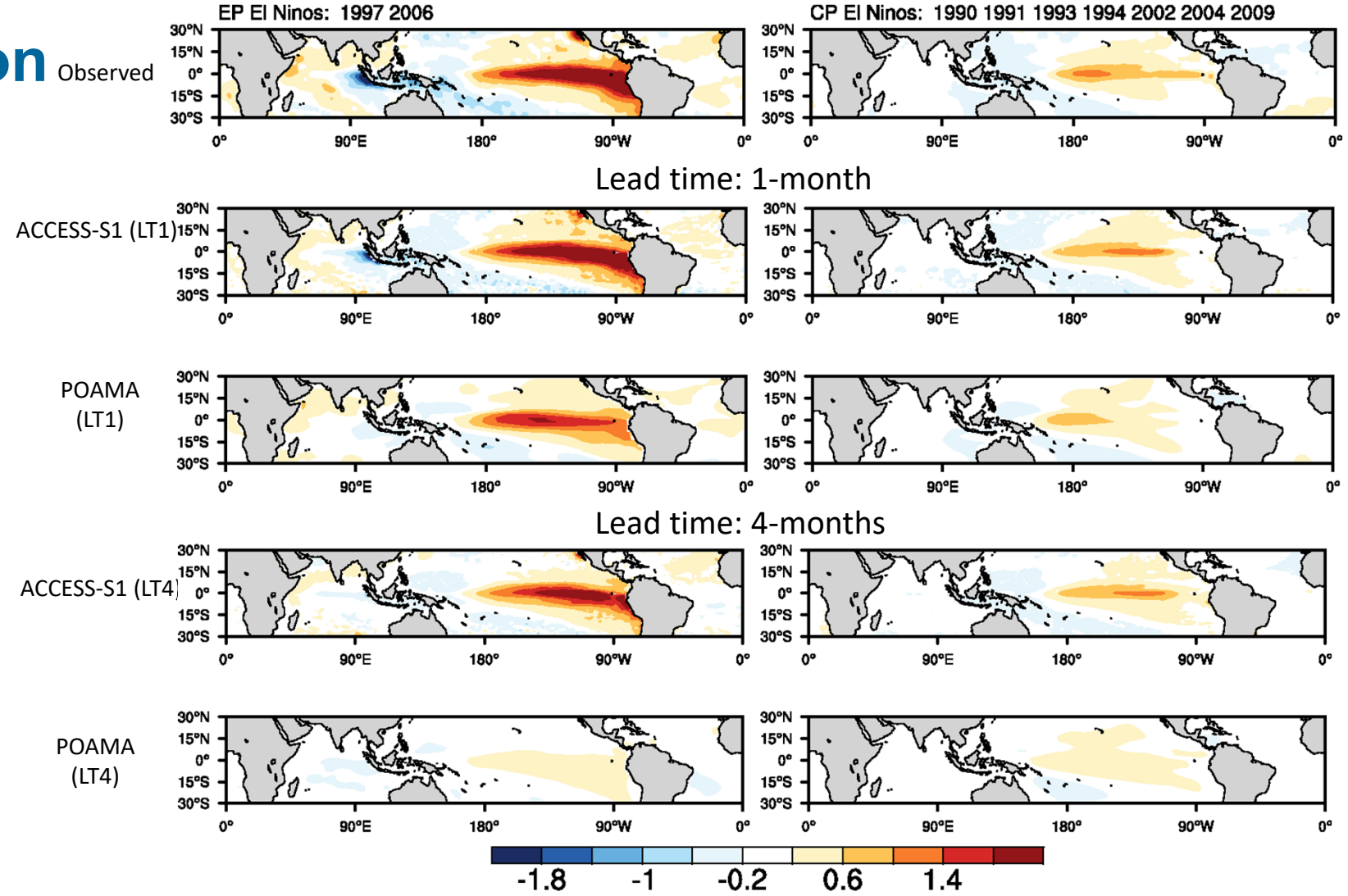
Model run: 09/01/2021
Issued: Map not issued

ource: ACCESS-S1 and NOAA OISST V2
Commonwealth of Australia 2020, Australian Bureau of Meteorology

Hindcast period: 1990-2012
Created: 17/02/2020

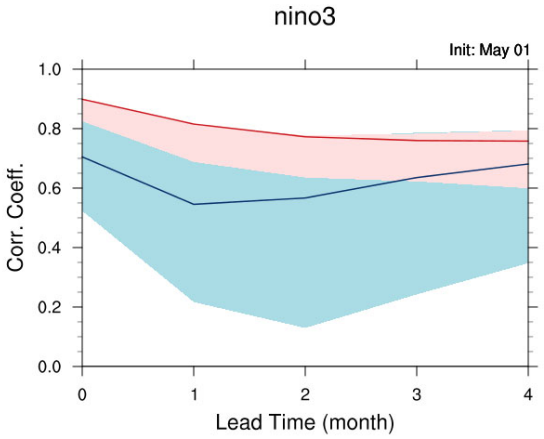
Climate and Oceans Support Program in the Pacific

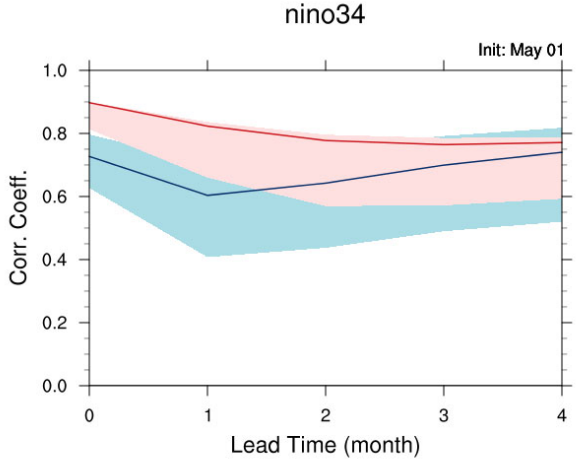
Prediction of ENSO

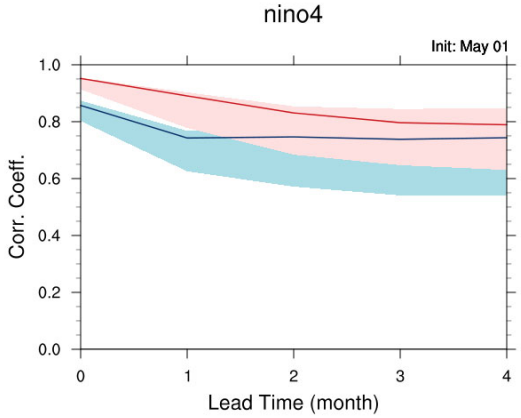


SST anomaly (degC) composites for two eastern Pacific (EP) El Niño events (left) and 7 central Pacific (CP) El Nino events (right) during spring (SON). Observations (top row) and ensemble-mean forecasts (based on 22-member ensembles) at 1-month (initialised on 1st August) and at 4-month (initialised on 1st May) lead times from ACCESS-S1 and POAMA are shown.

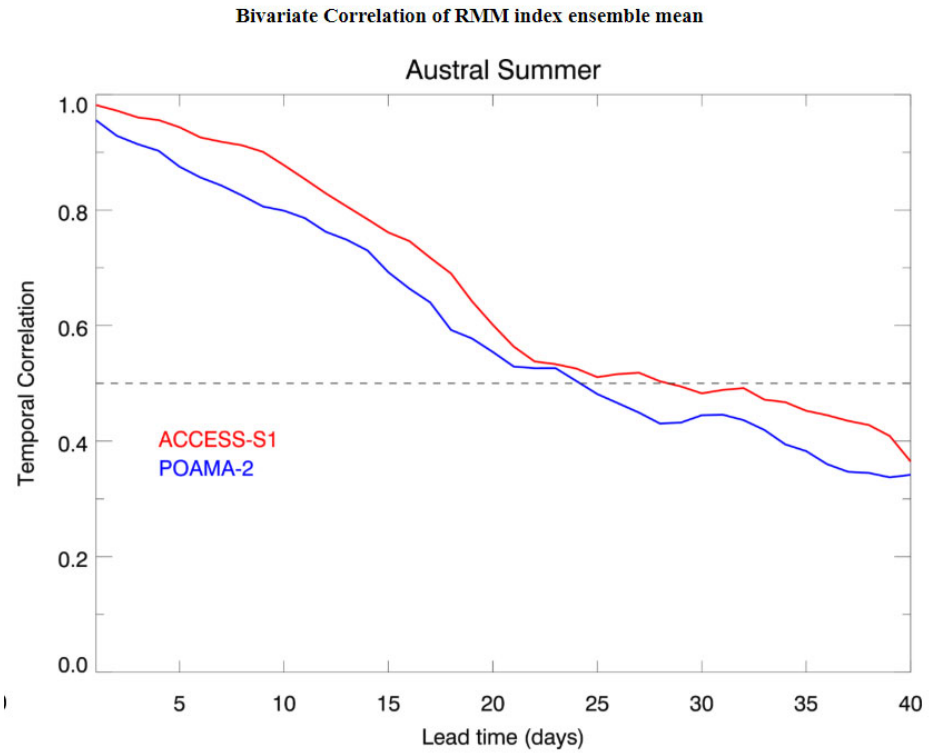
Climate Driver Skill







MJO

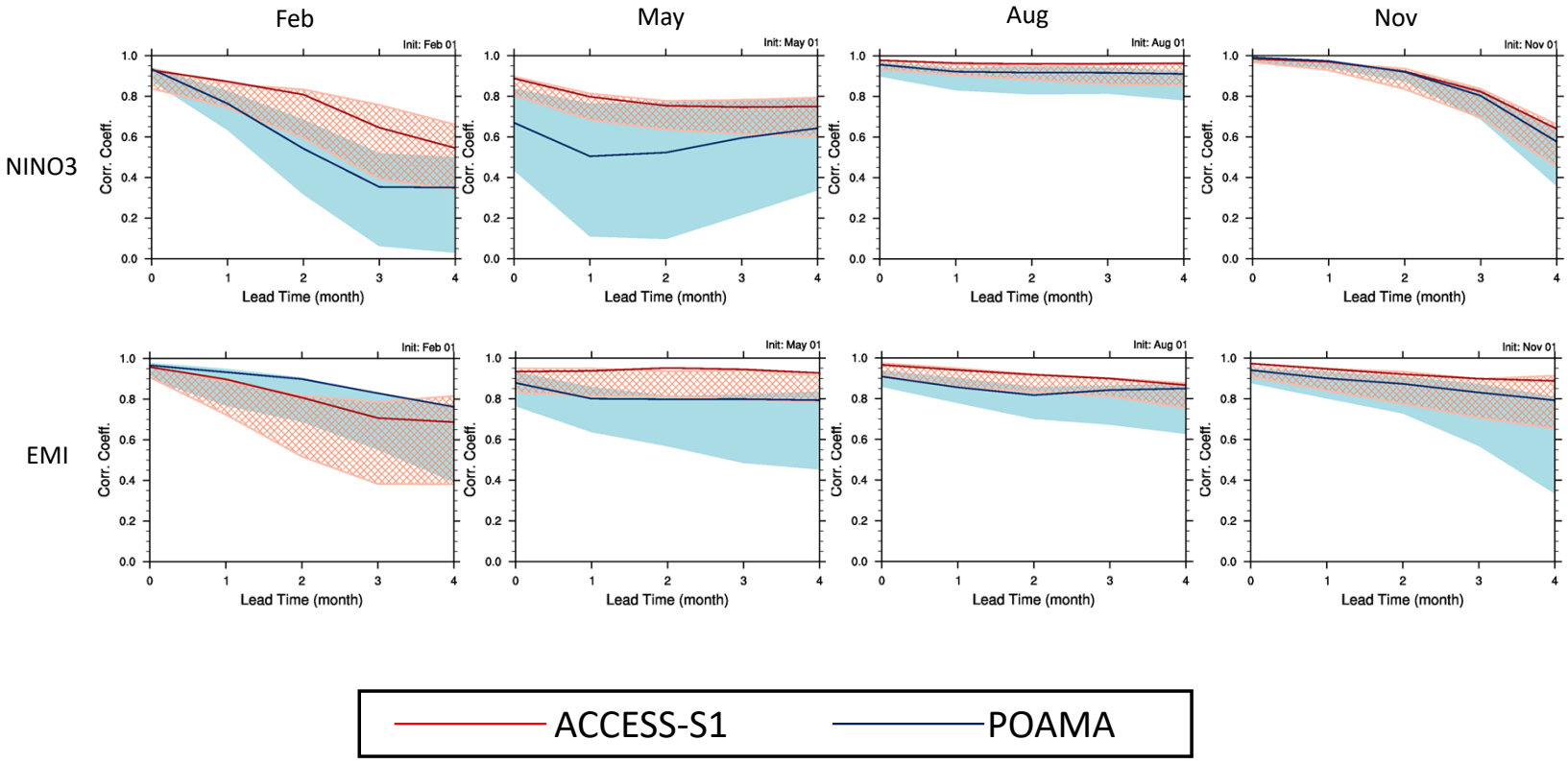


ACCESS-S1 POAMA

Climate and Oceans Support Program in the Pacific

Prediction of ENSO

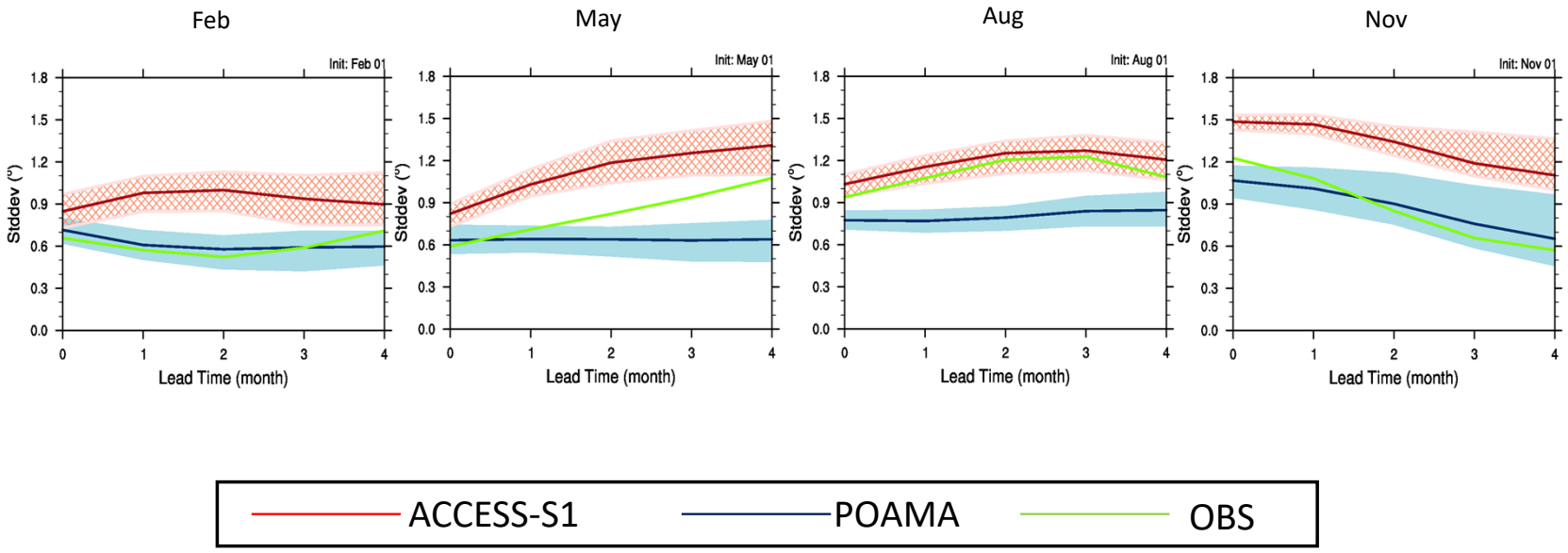
Correlation skill of forecasts of SSTA for NINO3 and El Nino Modoki indices



Climate and Oceans Support Program in the Pacific

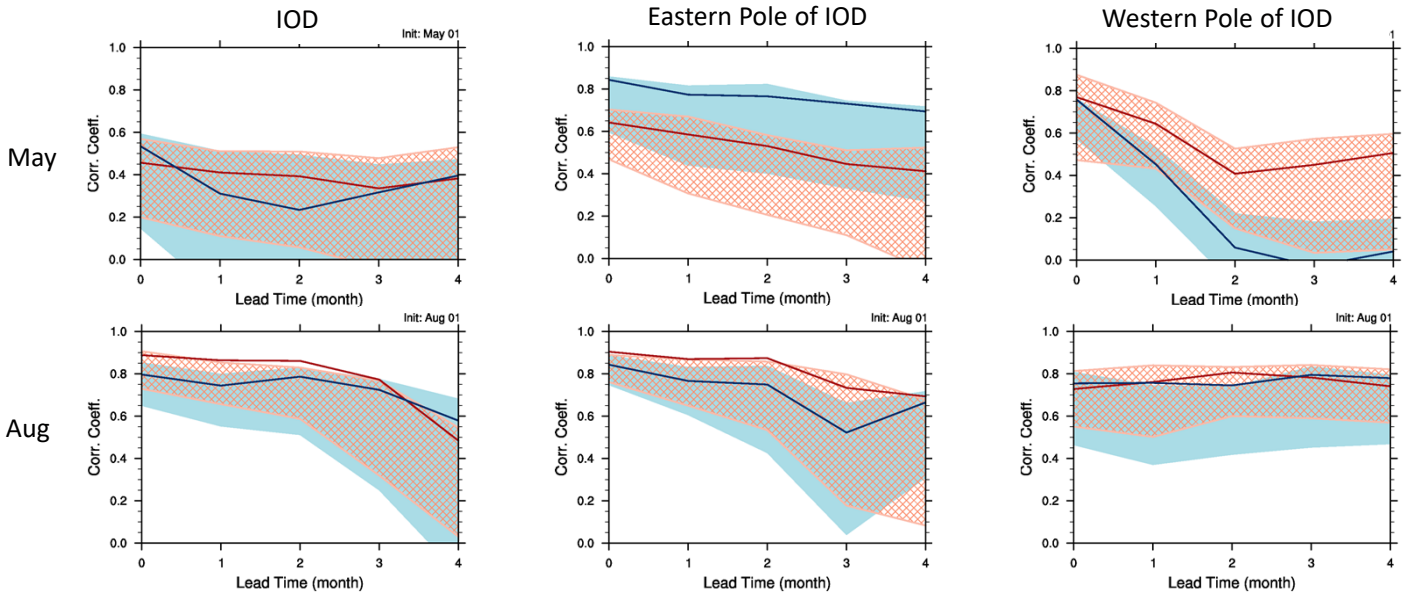
Standard deviation of predicted NINO3

Standard deviation of the magnitude of NINO3 index



Climate and Oceans Support Program in the Pacific

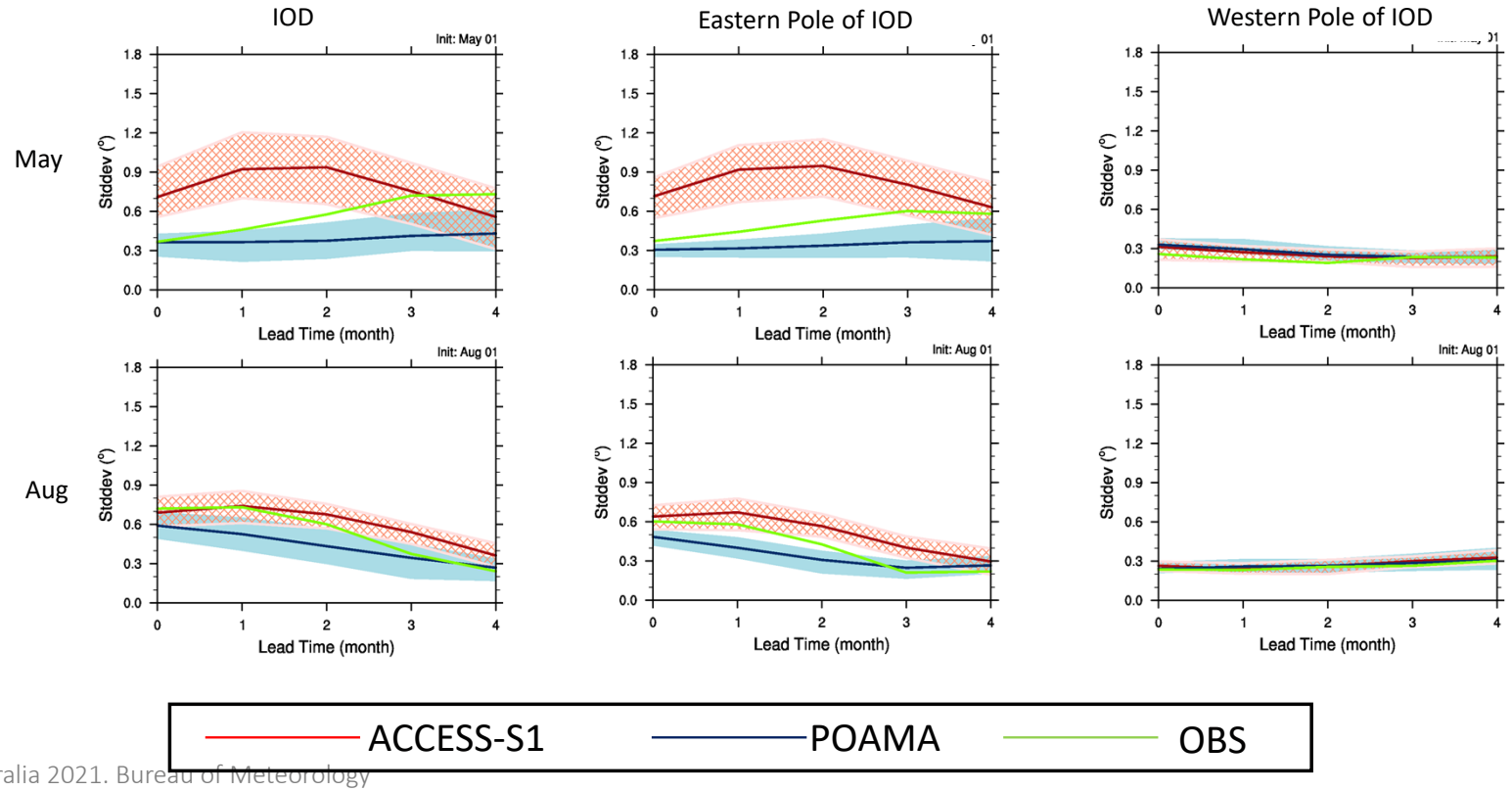
Prediction of IOD



Climate and Oceans Support Program in the Pacific

Standard deviation of predicted IOD

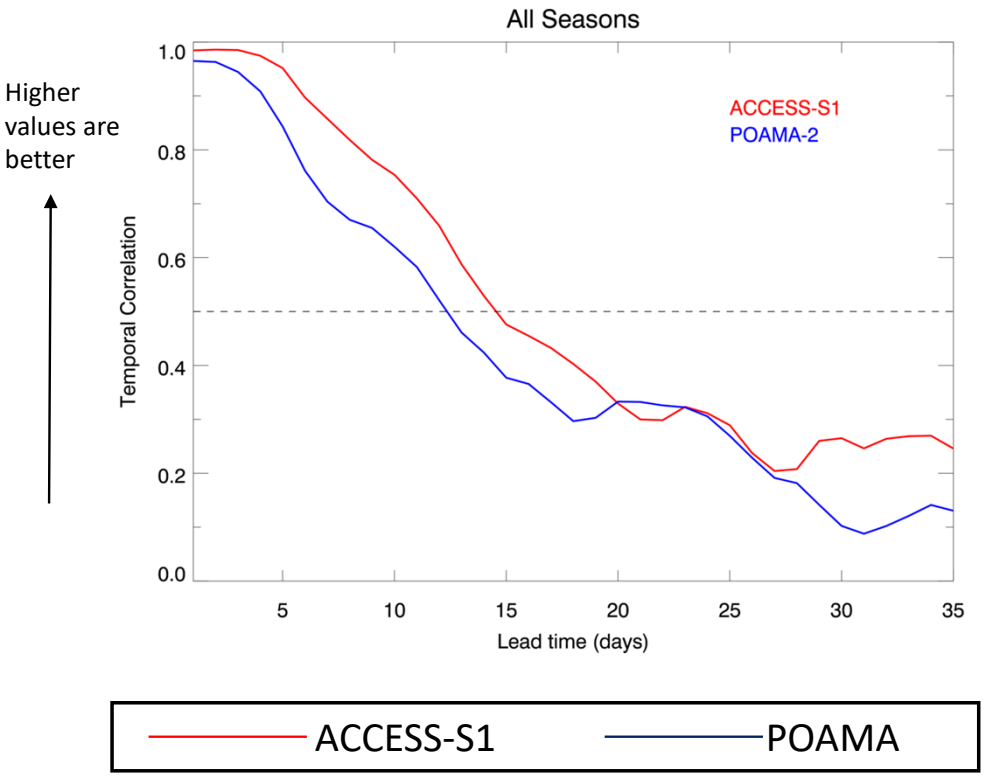
Standard deviation of the magnitude of IOD index



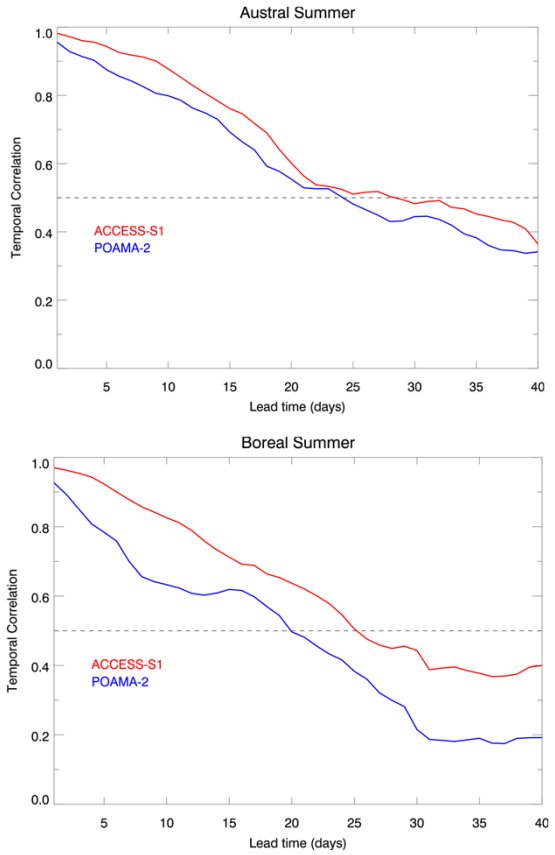
Prediction of SAM and MJO

Climate and Oceans Support Program in the Pacific

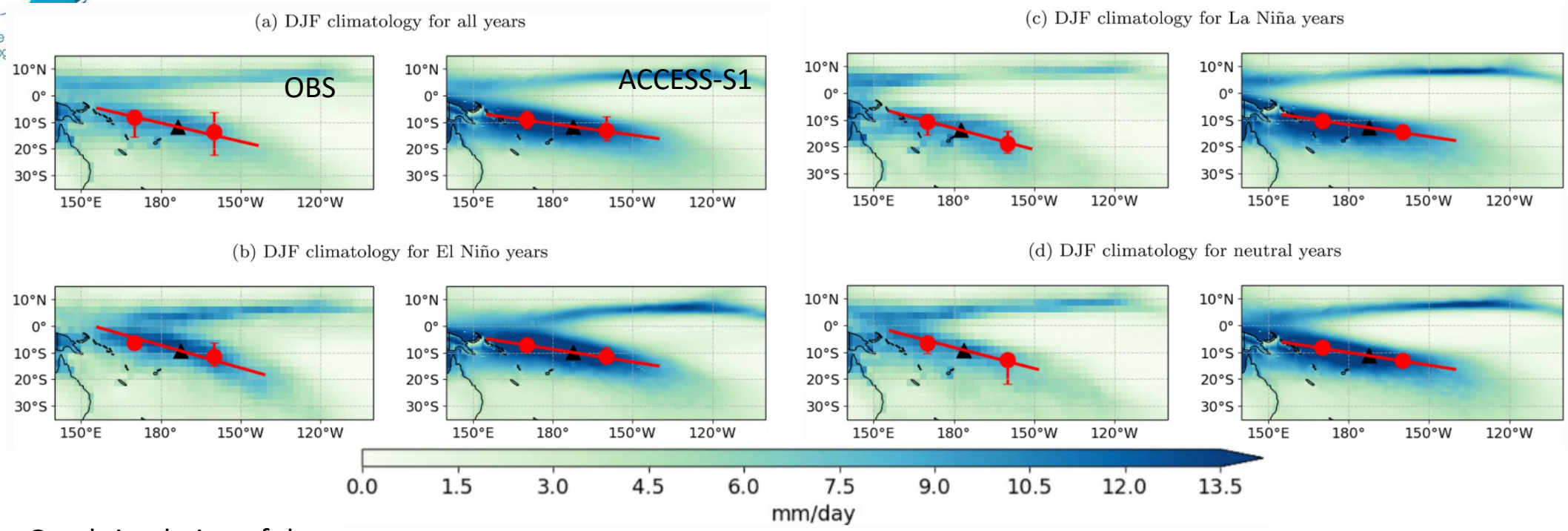
Southern Annular Mode



Madden Julian Oscillation



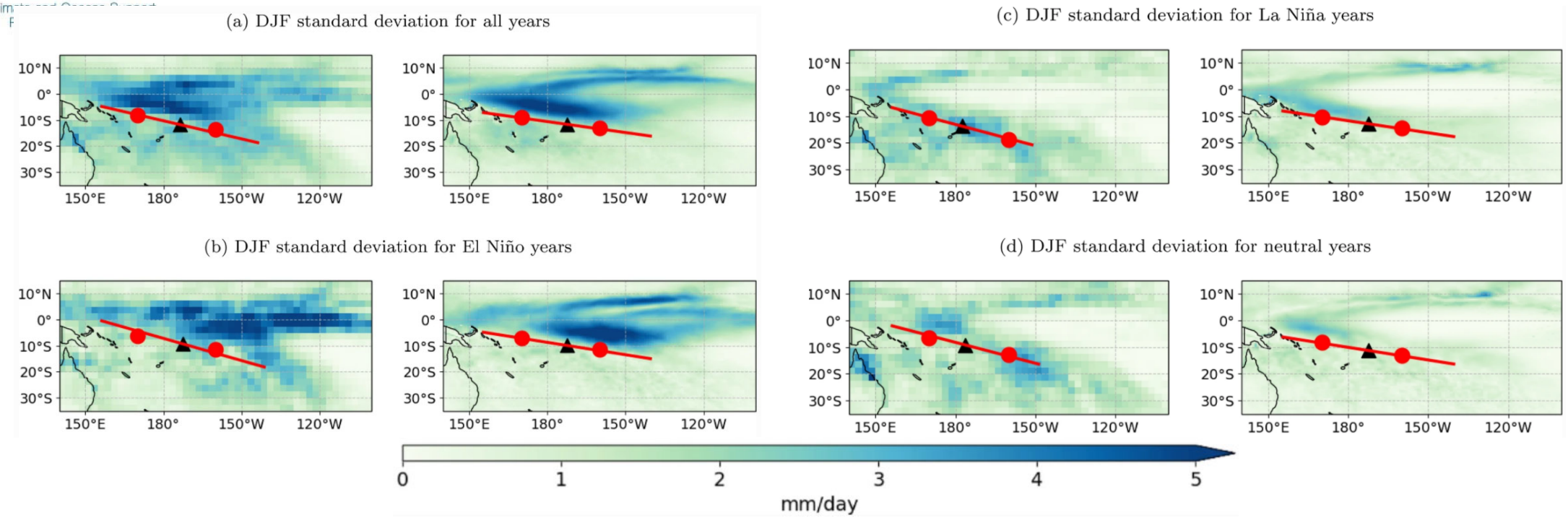
ACCESS-S SPCZ simulation



- Good simulation of the mean position of the SPCZ
- Model is too wet, particularly over the Solomon Islands, Samoa, and French Polynesia, with an over-prediction of rainfall
- Interannual variability of the SPCZ is shown by the vertical arms in the left hand plots, it shows very little movement in the SPCZ to the west through the hindcast period, but there is substantial movement in the eastern arm of the SPCZ. ACCESS-S underestimates the amplitude of this variability in movement

Fig. 2: GPCP observed (left) and ACCESS-S1 (right) precipitation DJF climatologies for 1990-2012 (a) all seasons, (b) El Niño, (c) La Niña and (d) neutral years. The black triangle represents the mean SPCZ latitude, and the two red circles are the latE and latW indices. The red line is fitted using least squares of the latitudes of maximum precipitation (for rainfall greater than 6 mm/day) from 0°S to 30°S for longitudes of 155°E to 140°W [18] [12] [85]. Error bars show the range of latE and latW values obtained in the 23 seasons.

ACCESS-S SPCZ simulation



- The interannual variability of rainfall along the SPCZ is smaller than the surrounding regions (plot A). This area is not as affected by ENSO events as much as those around it.

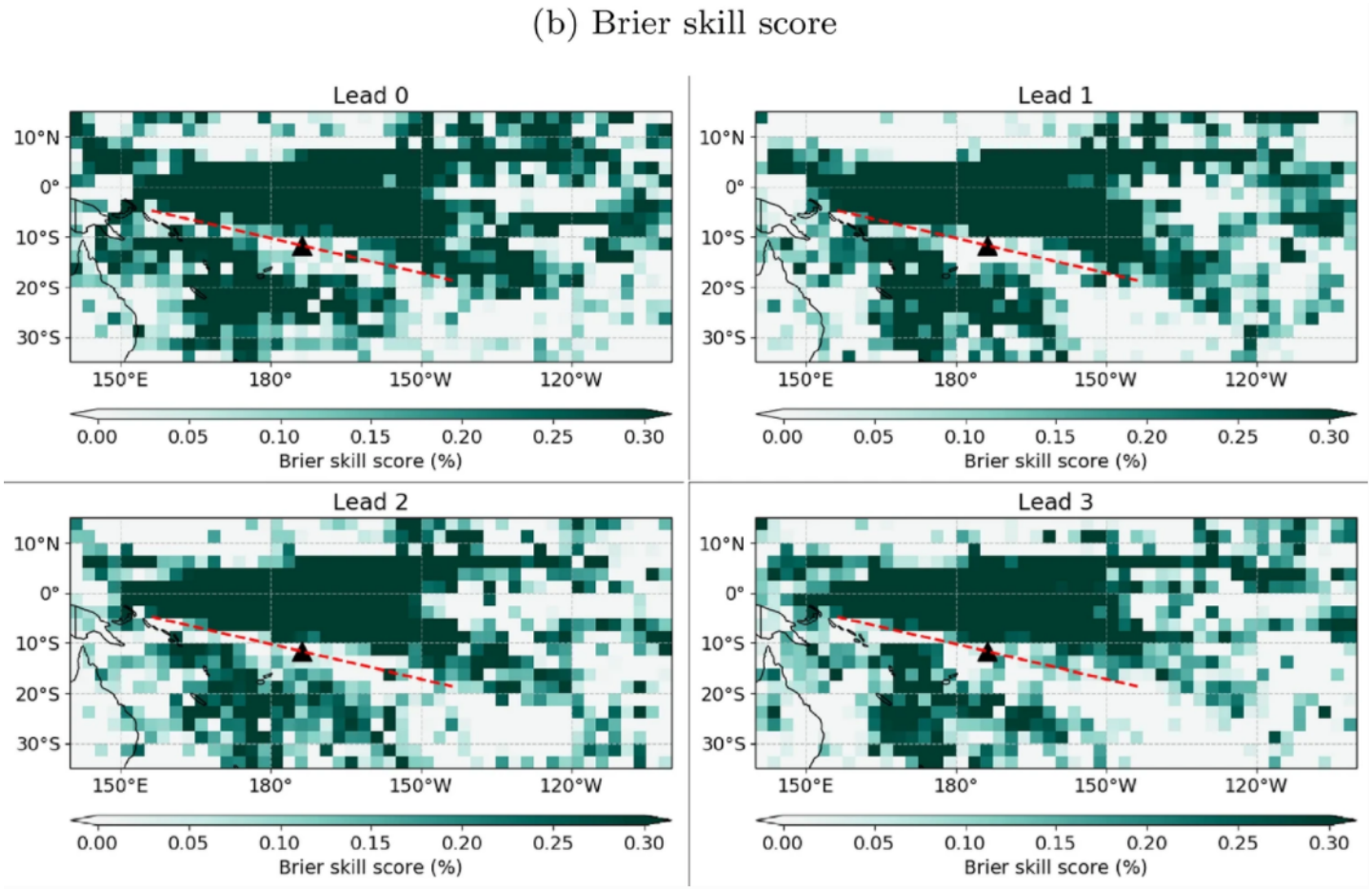
- The standard deviation of DJF total precipitation is generally under-represented in the model, particularly in the southern SPCZ region with respect to all states of ENSO

Fig. 6: GPCP observed (left) and ACCESS-S1 (right) precipitation DJF standard deviation, using the ensemble mean, for 1990-2012 (a) all seasons, (b) El Niño, (c) La Niña and (d) neutral years. The black triangle represents the mean SPCZ latitude, and the two red circles are the latE and latW indices. SPCZ lines, mean latitude, latE and latW indices are found using GPCP (left) and ACCESS-S1 (right) data.

Climate and Oceans Support Program in the Pacific

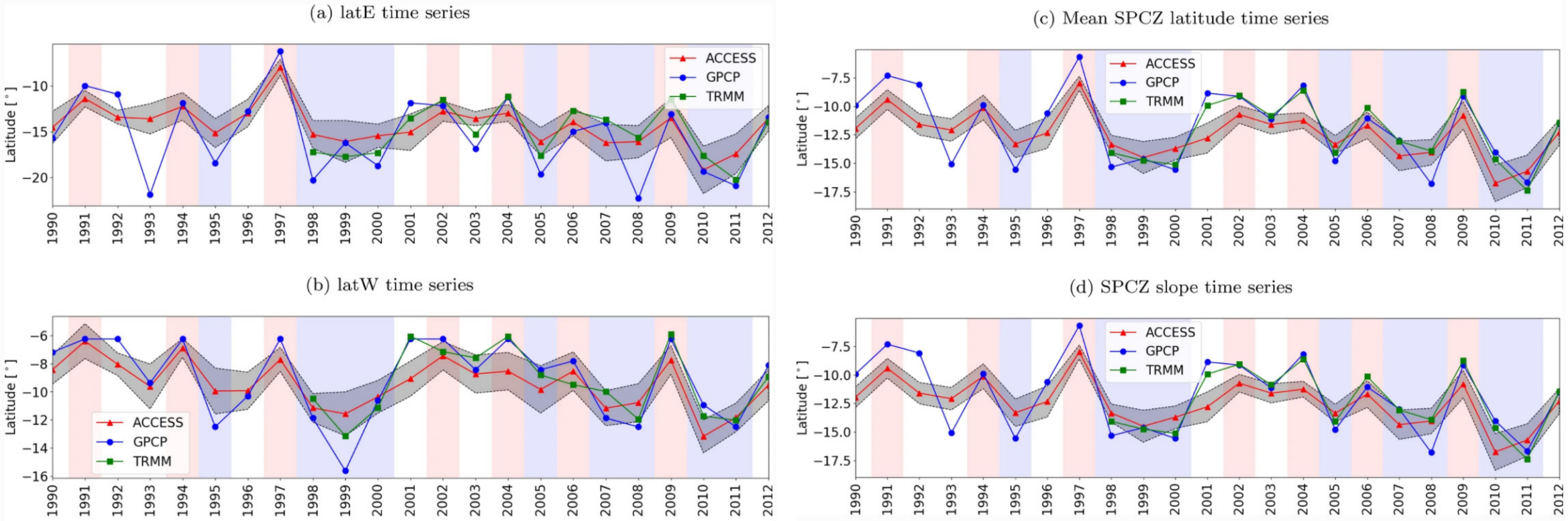
ACCESS-S SPCZ simulation

- There is a region along the SPCZ with little skill as shown by this Brier Skill Score metric plot.
- This region of low skill persists even at short forecast lead times.
- The region along the equator has the highest skill, in areas with high interannual variability in SSTs and rainfall.



ACCESS-S1 precipitation verification skill scores for **a** weighted percent correct (WPC) and **b** Brier skill score for DJF months with 0–3 month lead times over the 1990–2012 hindcast period using GPCP as the observations dataset. The SPCZ and mean latitude is shown by the dotted red line and black triangle respectively, using GPCP data

ACCESS-S SPCZ simulation



- Model consistently predicts a less-sloping SPCZ
- Eastern arm of the SPCZ shows little year-to-year movement compared with the observations (Fig.)

Fig. Time series of **a** eastern component of SPCZ (latE), **b** western component of SPCZ (latW), **c** mean SPCZ latitude and **d** slope of SPCZ for the ACCESS-S1 compared to observations from GPCP and TRMM across DJF months from 1990 – 2012. ACCESS-S1 data is the mean metric value for the 11 ensembles initialised on November 1, and dotted lines are one standard deviation from the mean. El Niño and La Niña years are shown by the pink and purple shaded years, respectively.

ACCESS-S Tropical Cyclone real-time skill: Southern Hemisphere

- ACCESS-S tropical cyclone skill is calculated with the **Brier Skill Score**.
- Verifies accuracy of a probability forecast, but only for binary outcomes.

- The Brier Skill Score measures:
  - Reliability
  - Resolution
  - Uncertainty

- ACCESS-S produces **raw** and **calibrated** outputs

- Calibrated has **greater forecast** and **hindcast skill**

- See documentation for additional details

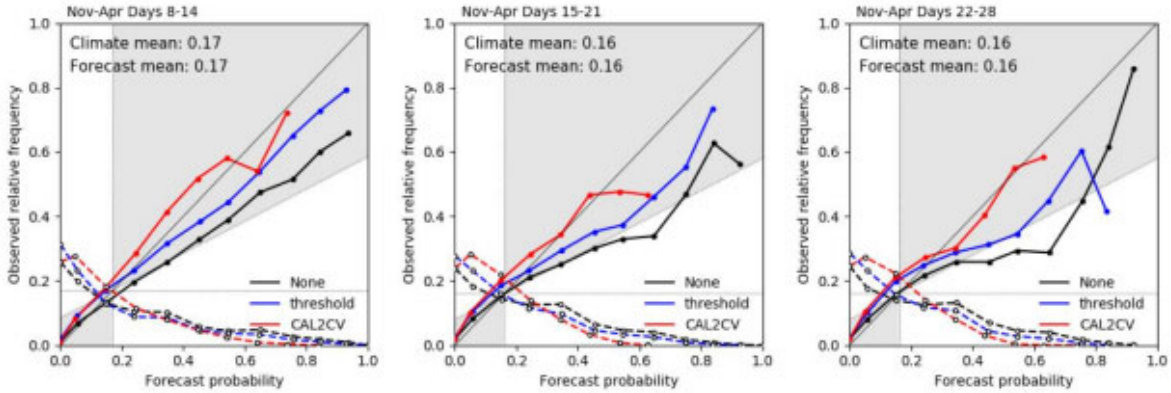


Figure 9. Realtime forecast reliability for all tracks (black), tracks with the windspeed threshold applied (blue) and calibration probabilities (red). From left to right: Days 8-14, Days 15-21, Days 22-28.

Southern Hemisphere (Realtime)	Week 2 (Days 8-14)	Week 3 (Days 15-21)	Week 4 (Days 22-28)
Raw	0.193	0.093	0.075
Calibrated	0.187	0.100	0.081

Table 2. Brier Skill Scores for real-time Southern Hemisphere forecasts during the 2017-18 and 2018-19 seasons.

Climate and Oceans Support Program in the Pacific

Skill summary

- ACCESS-S performs better at predicting climate drivers than POAMA
- Low Skill can be caused for many reasons
- ACCESS-S SPCZ simulation can cause low skill