

# Agenda 5: Looking Forward

## i. Atmosphere

Daeun Jeong  
APEC Climate Centre

# Precipitation Outlook

# Precipitation Outlook for MJJ to ASO 2022

## WMO LC LRF MME

**2022MJJ:** Dry conditions with more than 80% chances along the western and central equatorial Pacific; Wet conditions for the off-equatorial region (>70% for southern Melanesia)

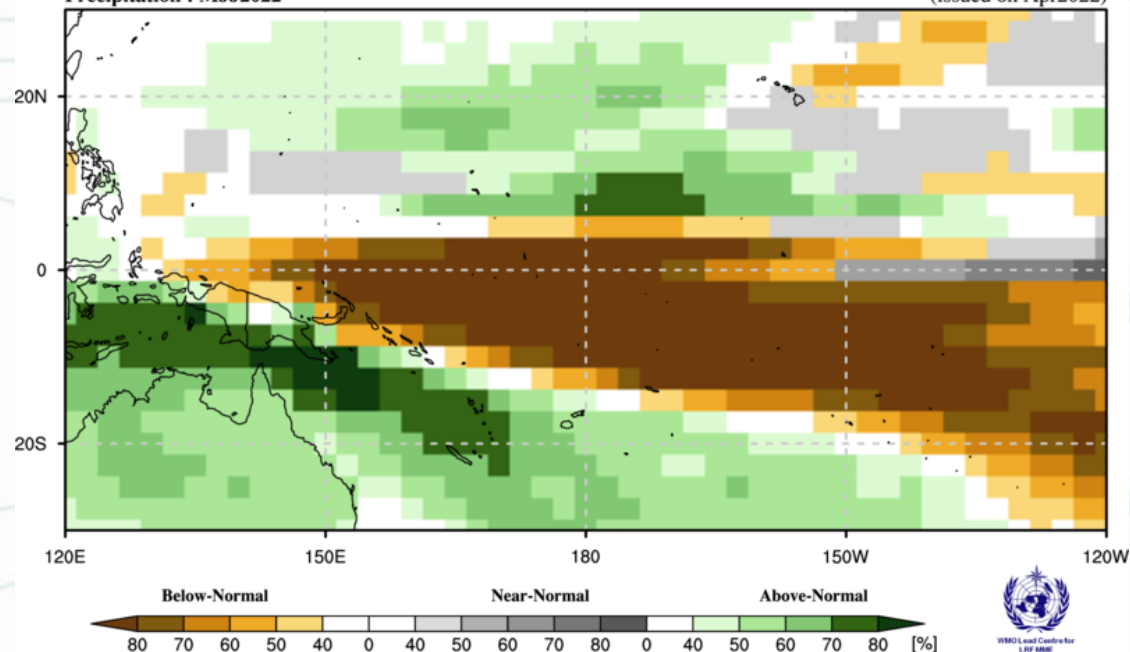
**2022ASO:** Weakening chances for dry and wet conditions; Enhanced probability for near normal precipitation for equatorial Polynesia

### Probabilistic Multi-Model Ensemble Forecast

Beijing, CMCC, CPTEC, ECMWF, Exeter, Melbourne, Montreal, Moscow, Offenbach, Seoul, Tokyo, Toulouse, Washington

#### Precipitation : MJJ2022

(issued on Apr2022)

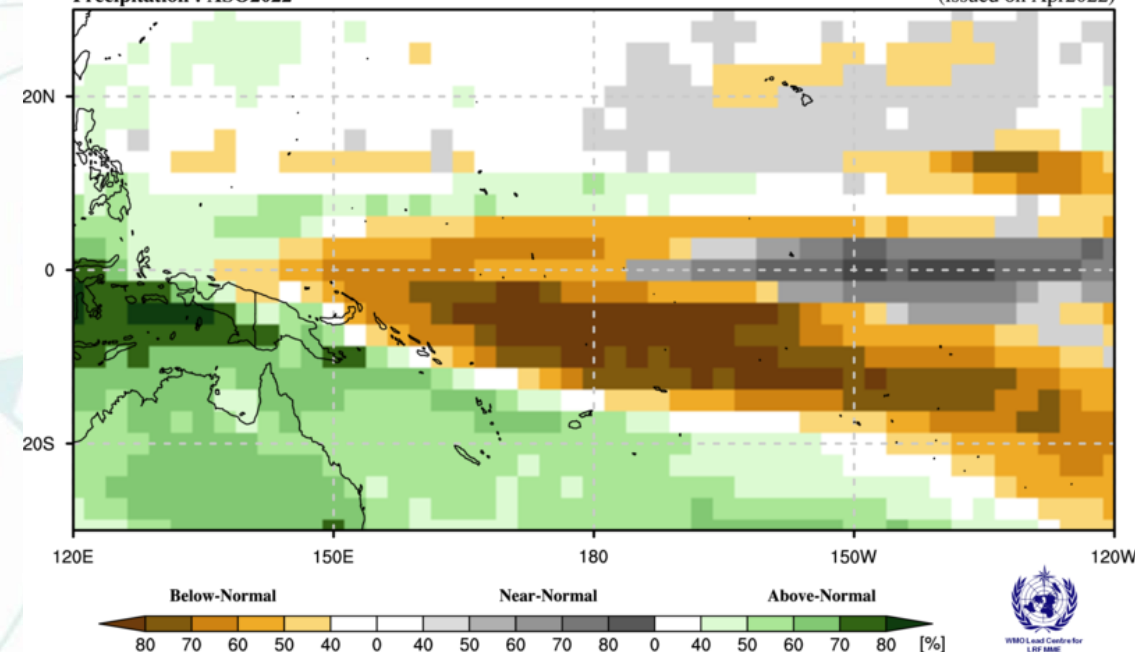


### Probabilistic Multi-Model Ensemble Forecast

Beijing, Montreal, Seoul, Tokyo, Washington

#### Precipitation : ASO2022

(issued on Apr2022)





# Precipitation Outlook for MJJ 2022

**NIWA  
ICU**

**BoM  
ACCESS-S**

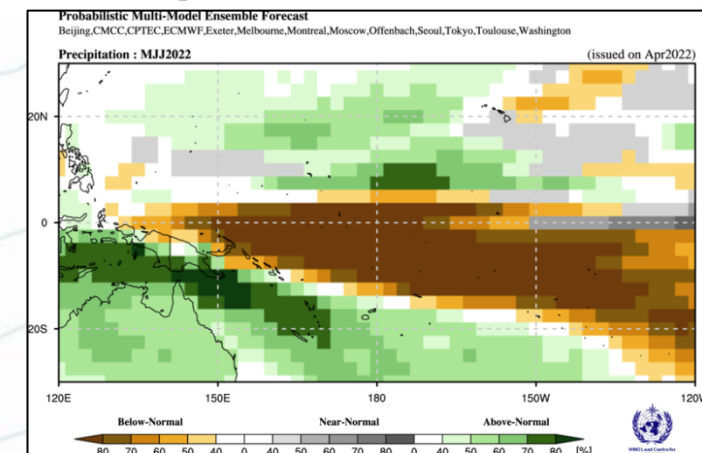
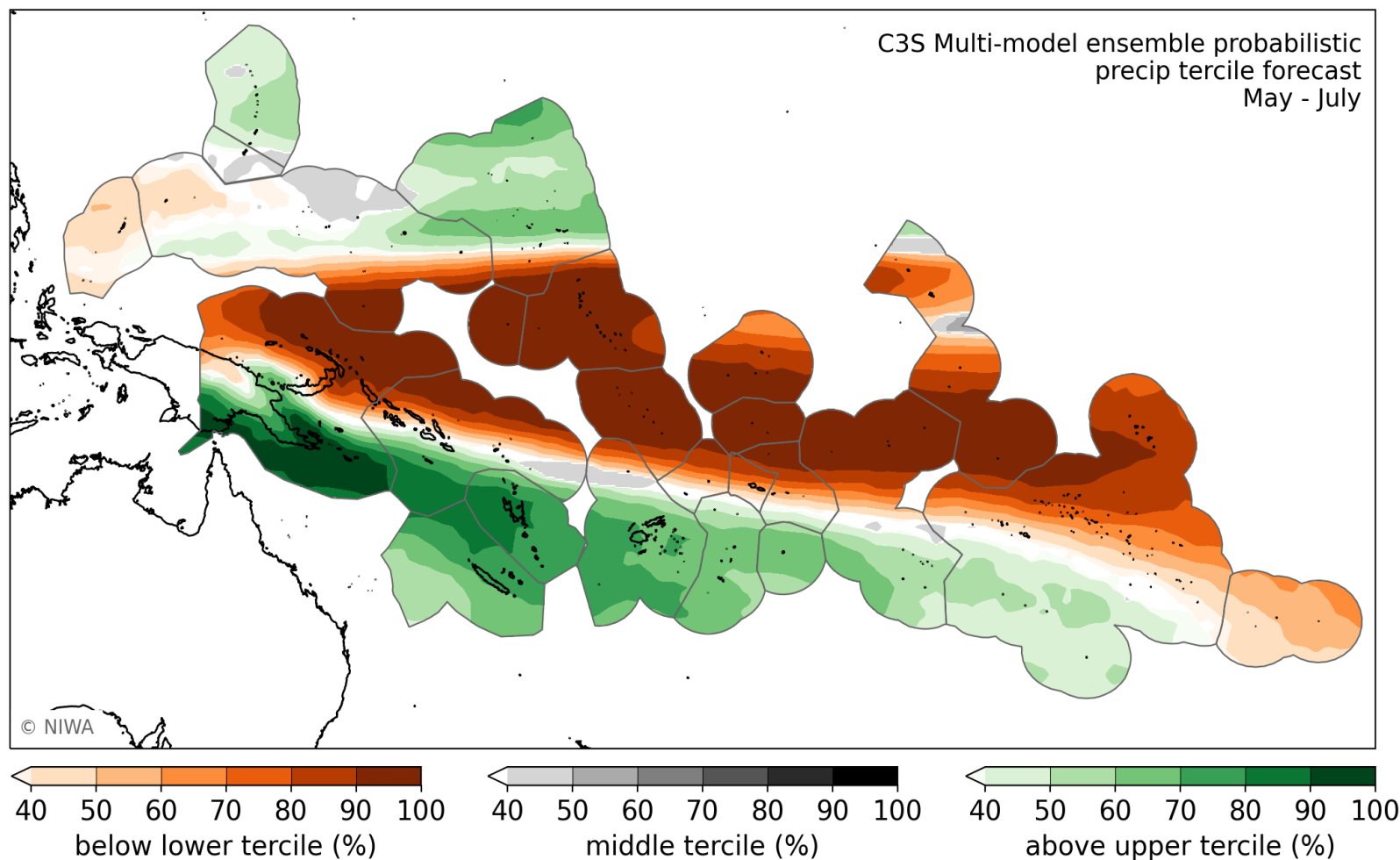
**NOAA  
NMME**

**APCC  
PMME**

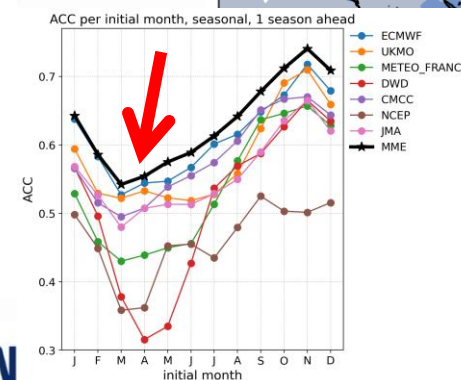
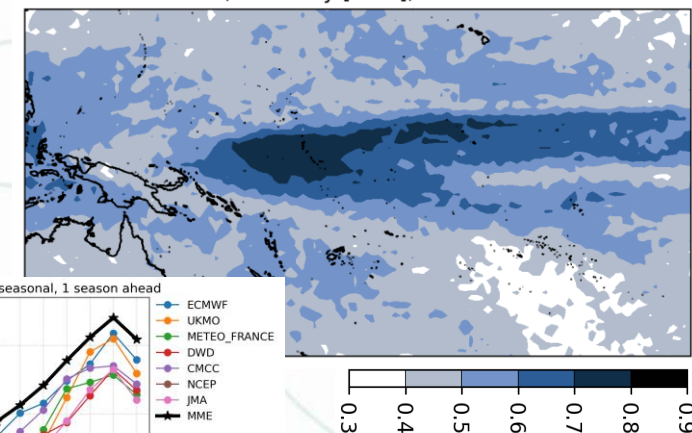
**CLIK-®**

**PICASO**

**SCOPIC**



C3S MME, Accuracy [0 - 1], 1 season ahead



# Precipitation Outlook for MJJ 2022

NIWA  
ICU

BoM  
ACCESS-S

NOAA  
NMME

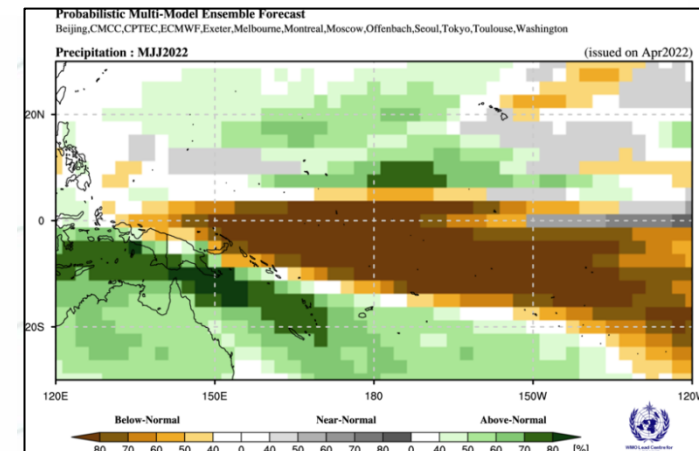
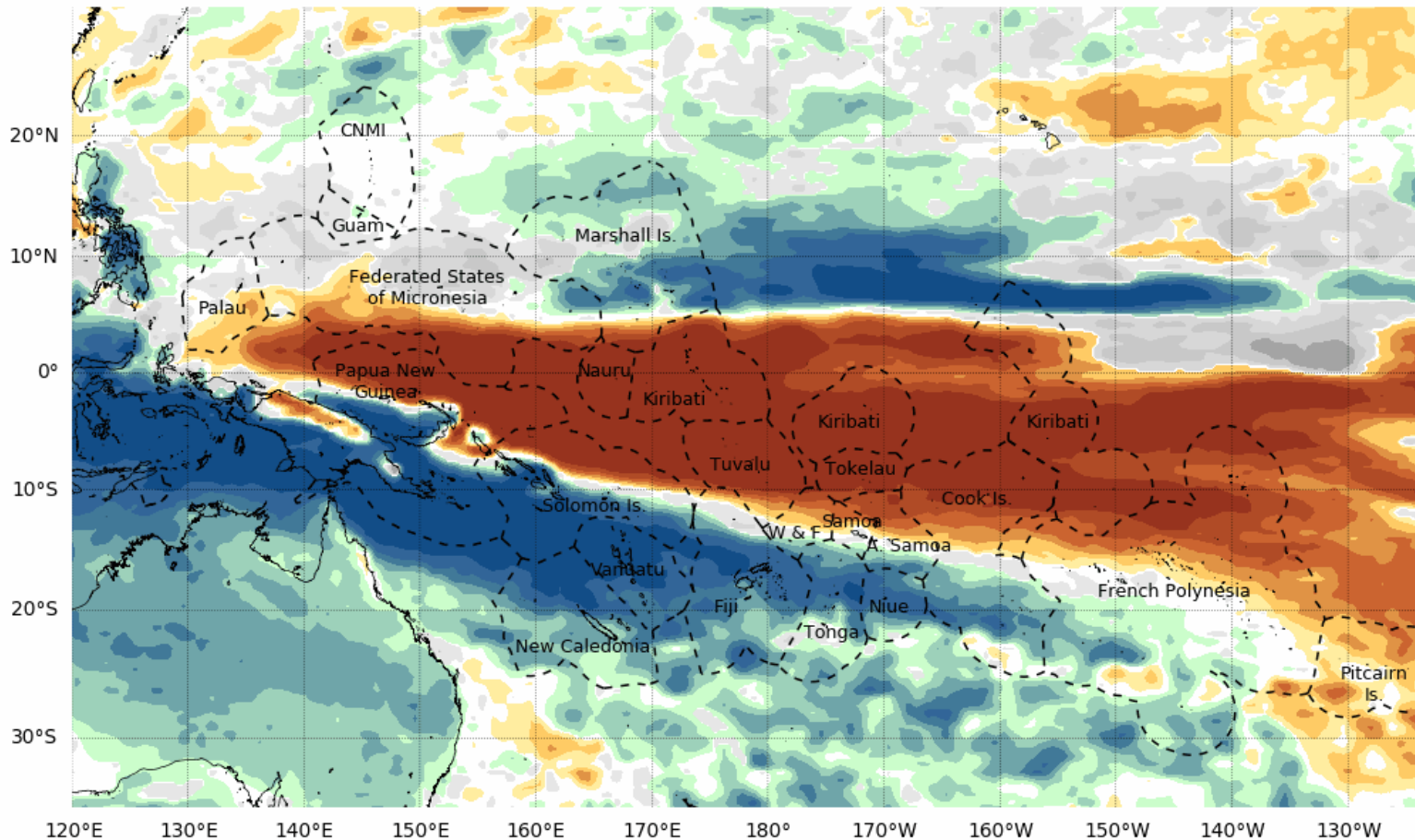
APCC  
PMME

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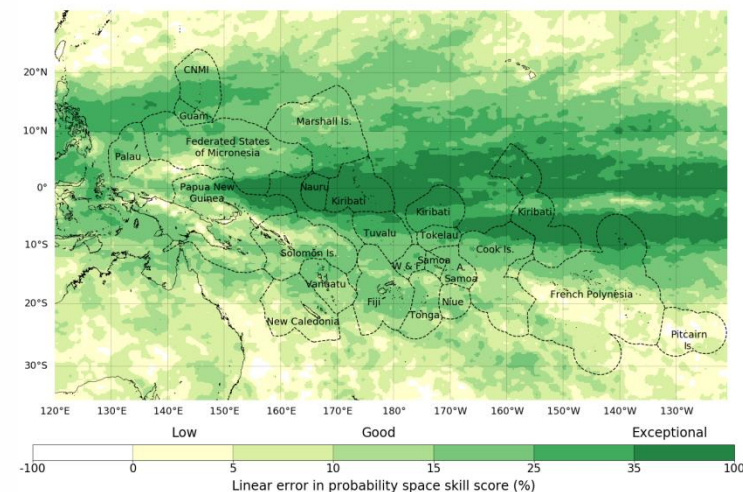
PICASO

SCOPIC

Tercile rainfall probabilities for  
May to July 2022



Tercile seasonal rainfall past accuracy  
for May - July. Lead time: 1 months



Run date: 17th April  
Data source: ACCESS-S2 and ERA5 Climate Reanalysis  
© Commonwealth of Australia 2022, Australian Bureau of Meteorology, Supported by COSPPac  
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.maritimeresources.org/>



# Precipitation Outlook for MJJ 2022

NIWA  
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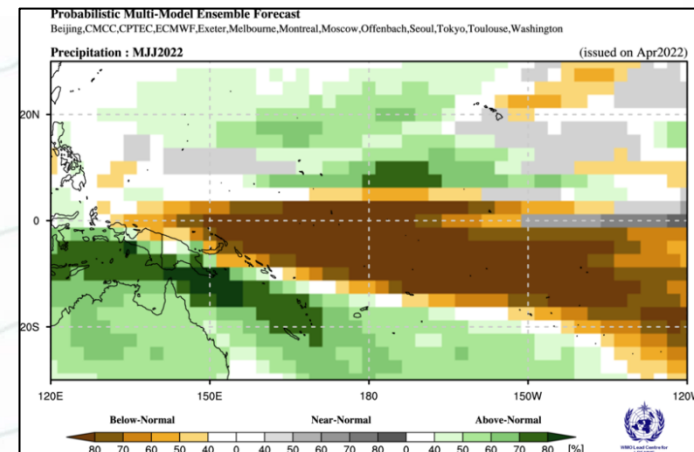
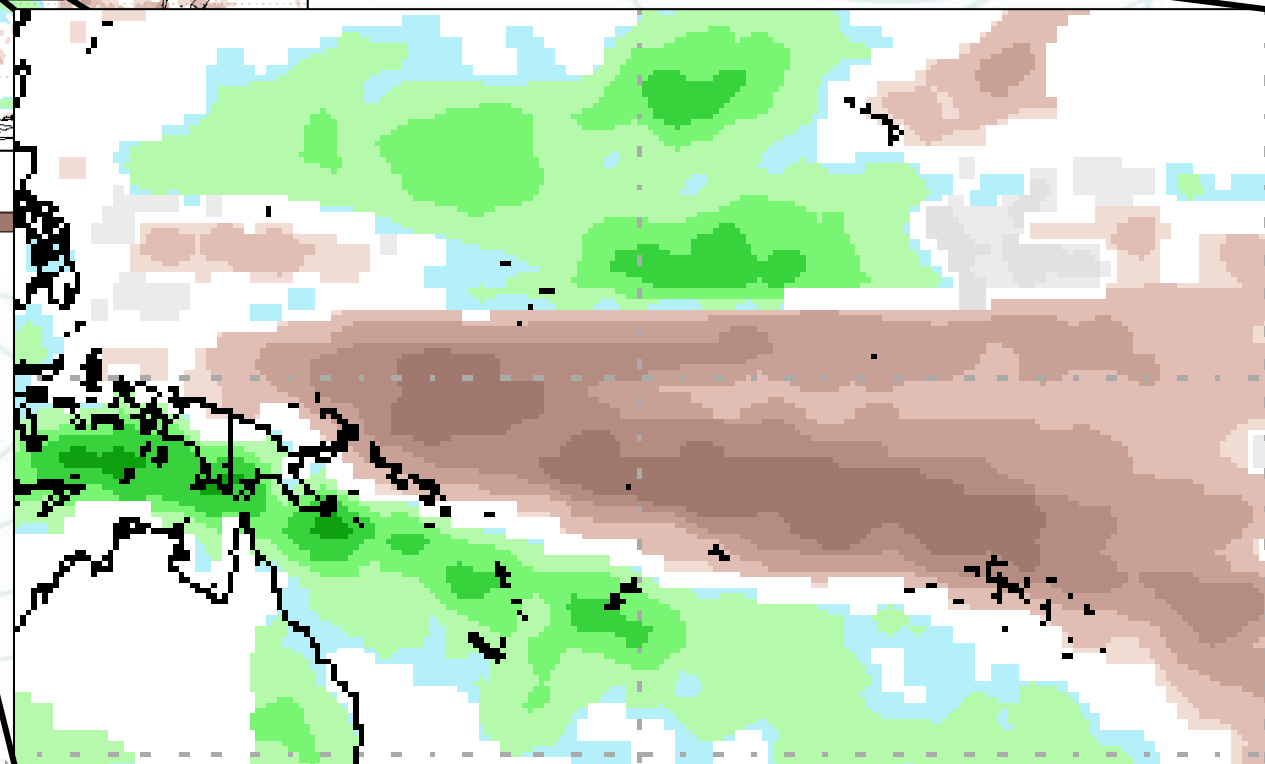
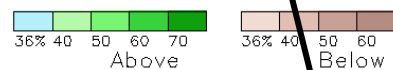
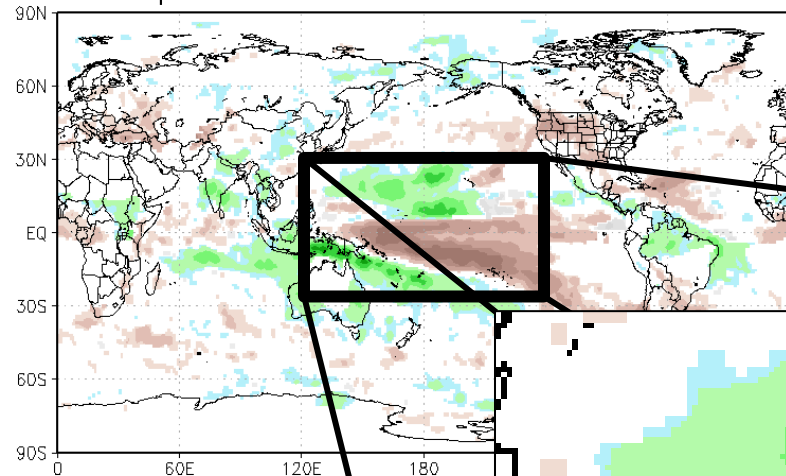
APCC  
PMME

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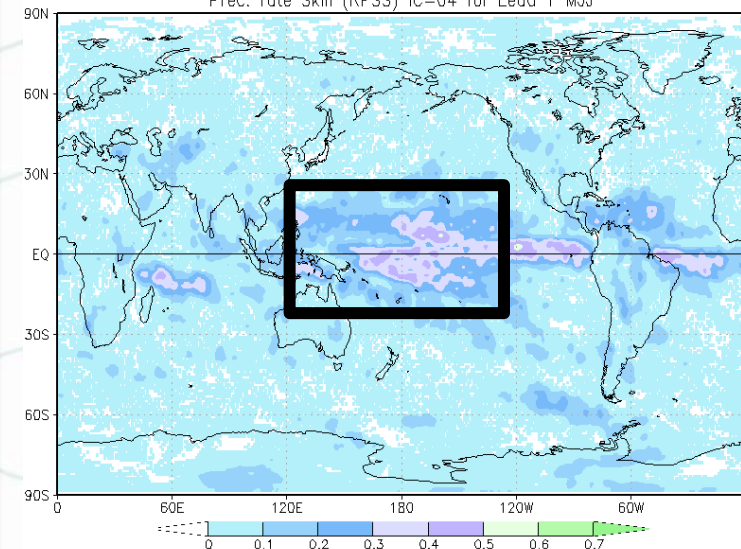
PICASO

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NMME prob fcst Prate IC=202204 for lead 1 2022 MJJ



Prec. rate Skill (RPSS) IC=04 for Lead 1 MJJ



# Precipitation Outlook for MJJ 2022

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NOAA  
NMME

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PMME

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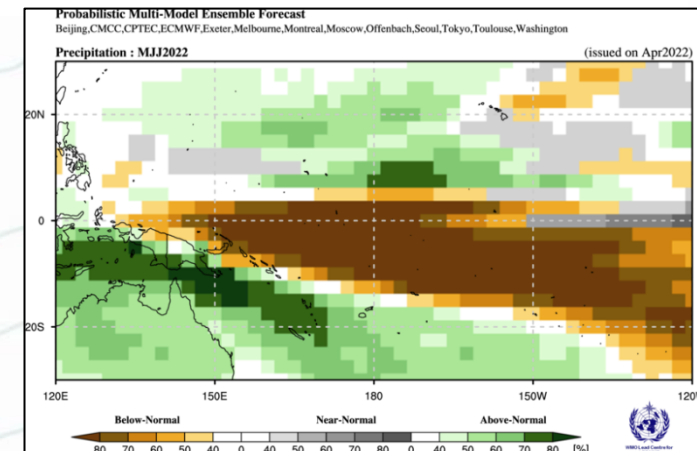
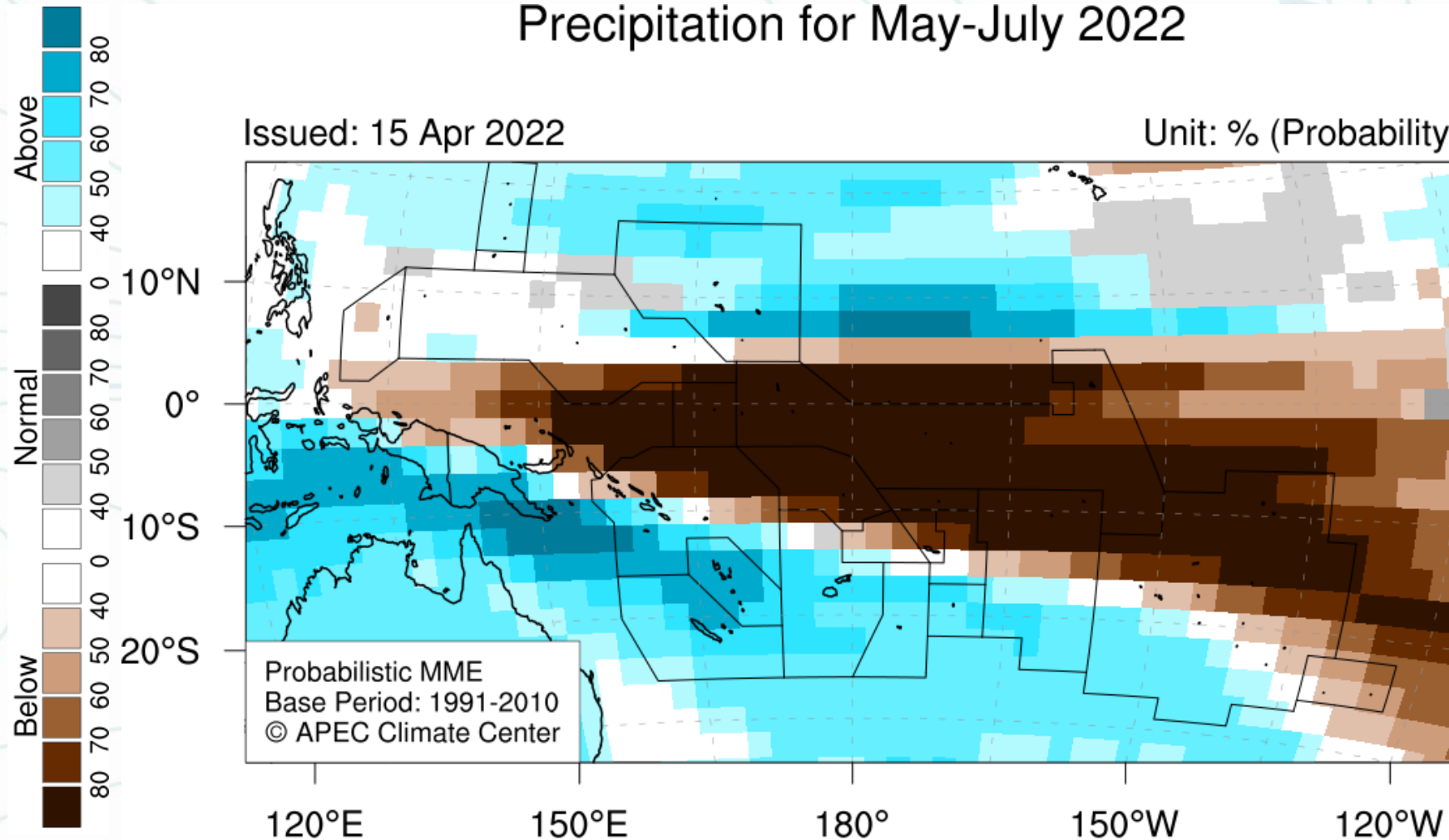
PICASO

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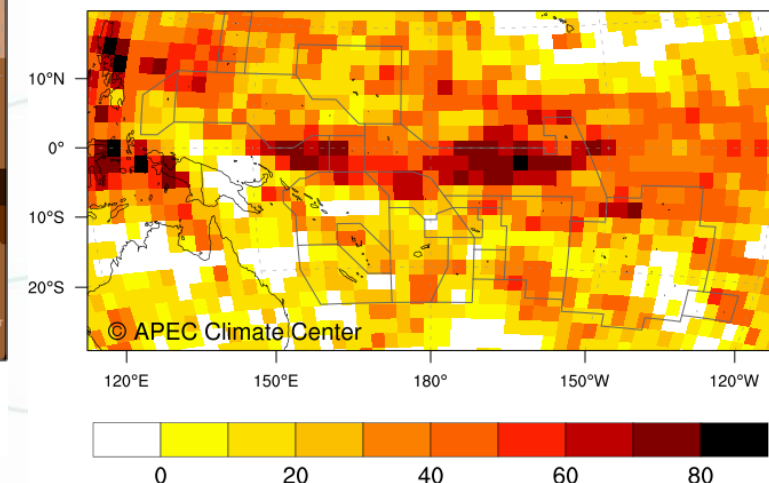
## Precipitation for May-July 2022

Issued: 15 Apr 2022

Unit: % (Probability)



Heidke Skill Score : PREC, MJJ (1991-2010)





# Precipitation Outlook for MJJ 2022

NIWA  
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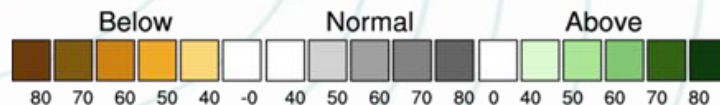
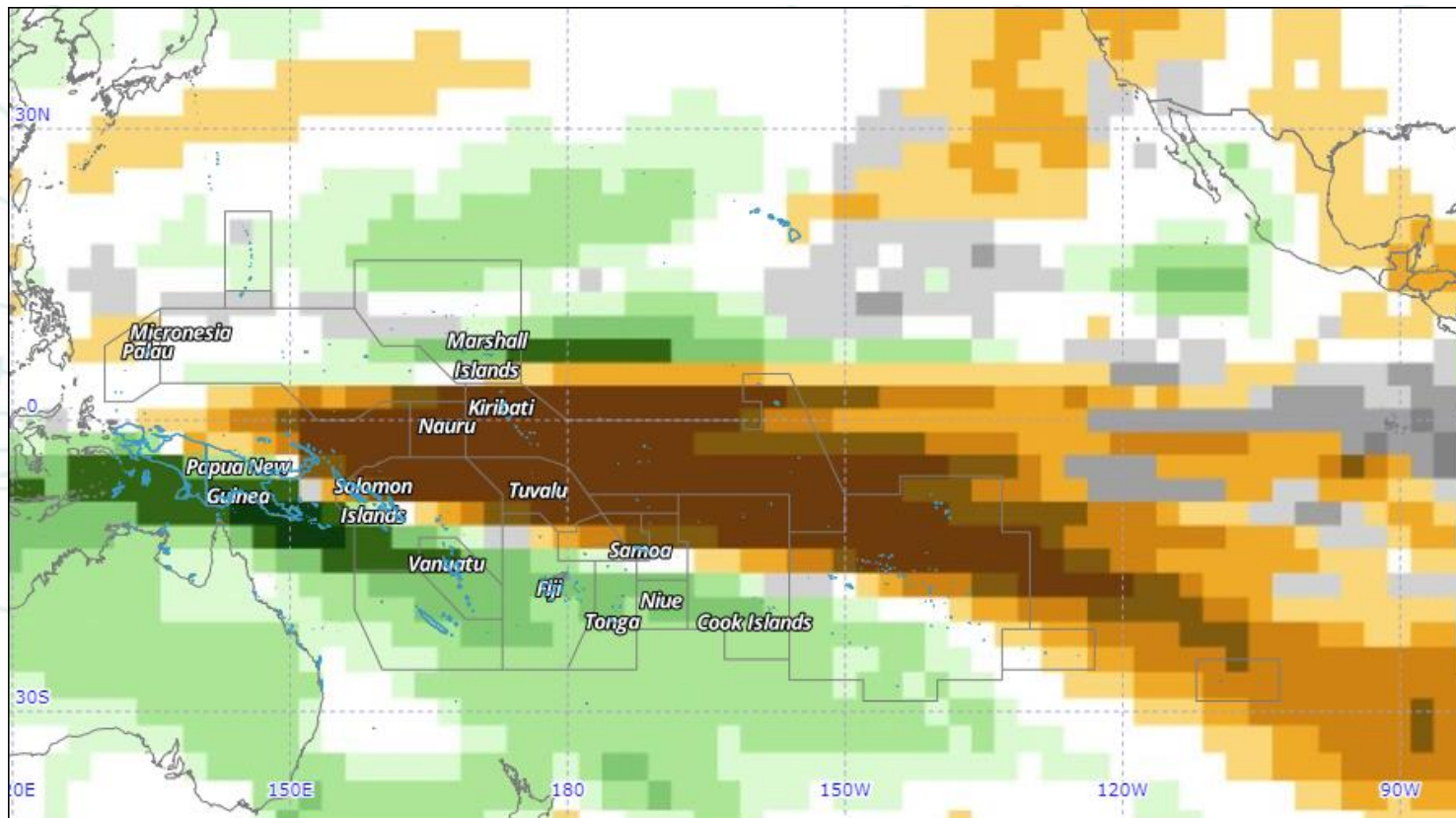
NOAA  
NMME

APCC  
PMME

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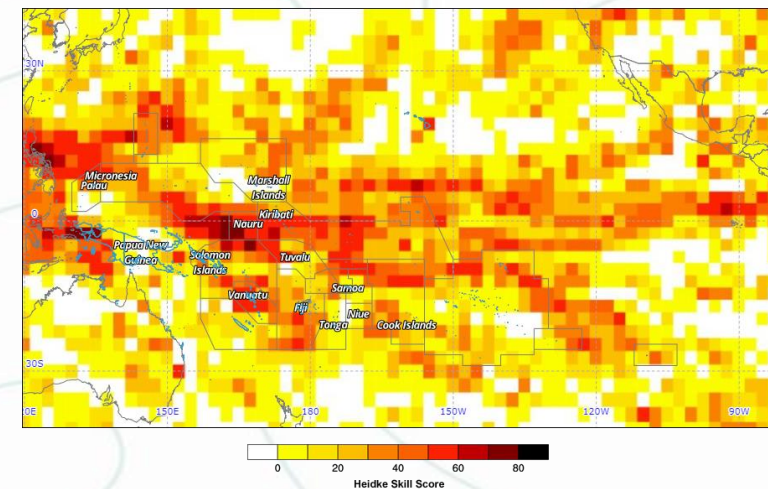
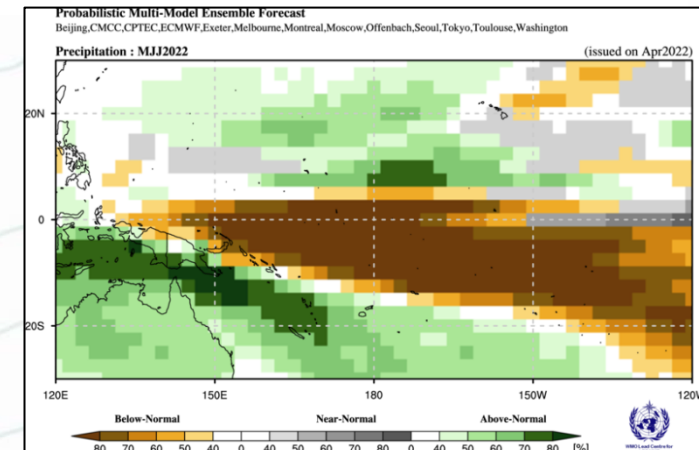


Year: 2022, Season: MJJ, Lead Month: 3, Method: GAUS

Model: APCC, CMCC, CWB, MSC, NCEP, PNU, POAMA

Generated using CLIK<sup>®</sup> (2022-4-21)

© APEC Climate Center



Year: 2022, Season: MJJ, Lead Month: 3, Method: GAUS

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Generated using CLIK<sup>®</sup> (2022-4-21)

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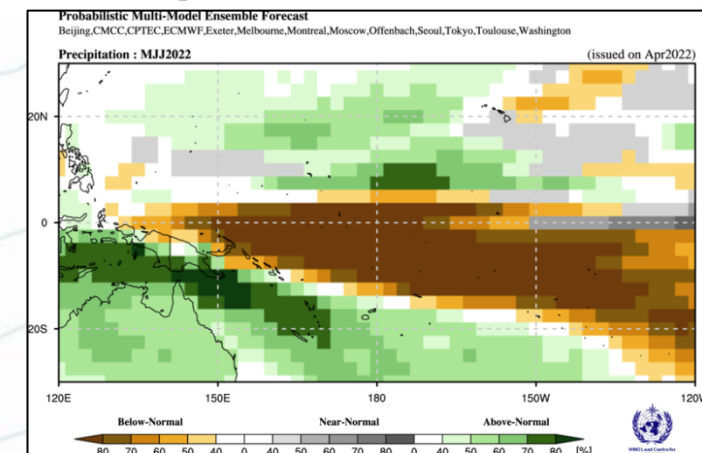
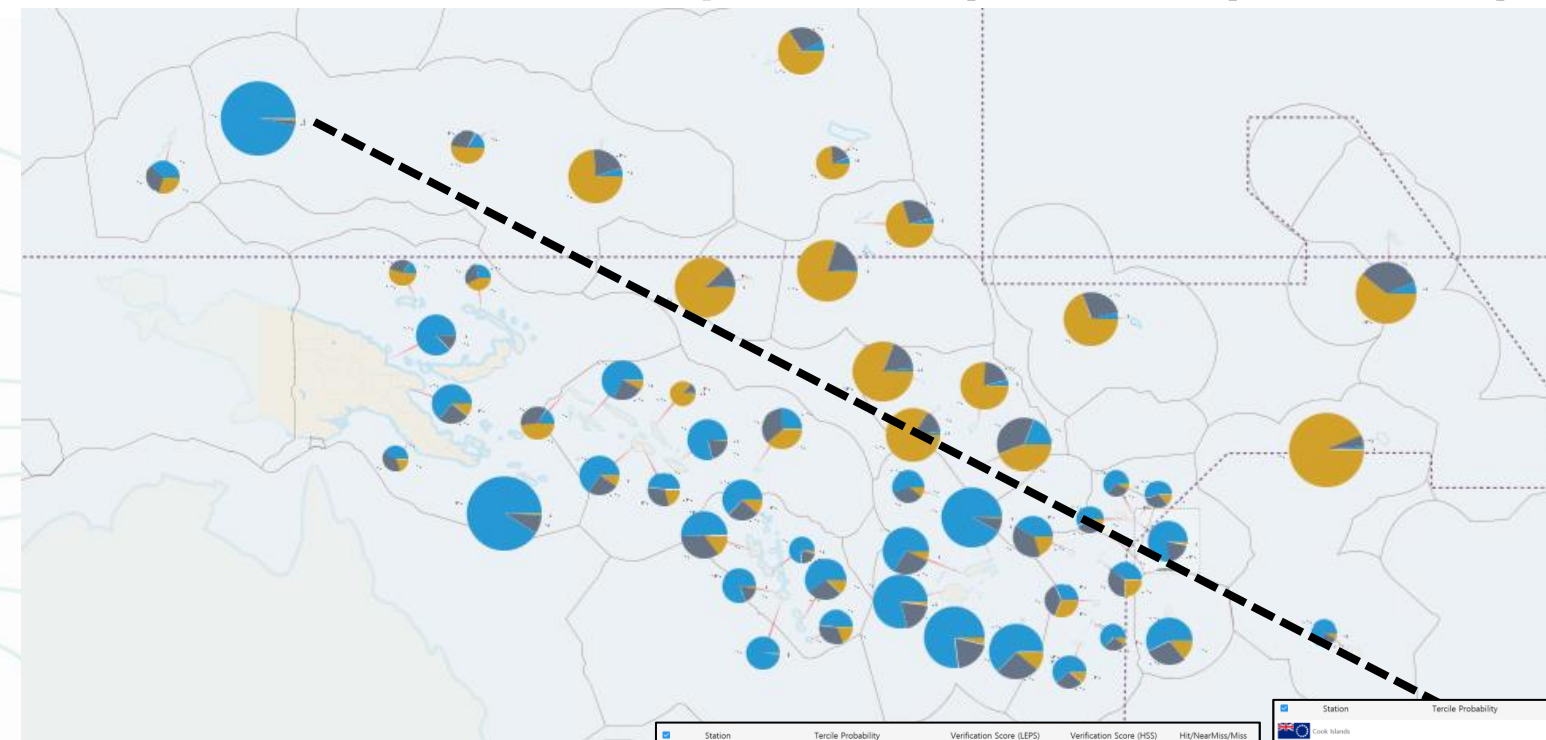
NOAA  
NMME

APCC  
PMME

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PICASO

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Afiomalulu, Samoa 2022 MJJ  
created by PICASO (2022-04-22)

Station	Tercile Probability			Verification Score (LEPS)	Verification Score (HSS)	Hit/NearMiss/Miss
Samoa						
Afiomalulu	81%	17%	26.8	Very High	65.9	7 4 0
Nanumea	84%	14%	24.3	High	31.8	6 5 0
Fuaifua	76%	20%	14.9	Good	10	6 8 1
Nukunono	44%	37%	20.6	High	25	4 6 1
Tonga						
Sola (Vavau Lave)	11%	26%	63%	Moderate	25	5 4 1
Pekoa Airport (Santo)	15%	34%	51%	Good	42.3	8 3 2
Lamap (Makulu)	21%	74%	-2.3	Very Low	7.7	5 6 2
Bauerfield (Efate)	16%	81%	-2.9	Low	-17.9	3 9 2
Port Vila		98%	9.8	Low	7.7	5 5 3
White Grass Airport	12%	28%	60%	Moderate	42.3	8 3 2
Aniwaym	19%	33%	48%	Low	14.3	6 7 1

	Station	Tercile Probability			Verification Score (LEPS)	Verification Score (HSS)	Hit/NearMiss/Miss			
	Micronesia									
	Chuuk WSO AP	<div><div></div><div></div><div></div></div> <div>52%</div>	<div><div></div><div></div><div></div></div> <div>31%</div>	<div><div></div><div></div><div></div></div> <div>17%</div>	<div><div></div><div></div><div></div></div> <div>4.3</div>	<div><div></div><div></div><div></div></div> <div>Low</div>	<div><div></div><div></div><div></div></div> <div>62.5</div>	<div><div></div><div></div><div></div></div> <div>10</div>	<div><div></div><div></div><div></div></div> <div>1</div>	<div><div></div><div></div><div></div></div> <div>3</div>
	Pohnpei	<div><div></div><div></div><div></div></div> <div>74%</div>	<div><div></div><div></div><div></div></div> <div>21%</div>	<div><div></div><div></div><div></div></div> <div>19.9</div>	<div><div></div><div></div><div></div></div> <div>High</div>	<div><div></div><div></div><div></div></div> <div>55</div>	<div><div></div><div></div><div></div></div> <div>10</div>	<div><div></div><div></div><div></div></div> <div>3</div>	<div><div></div><div></div><div></div></div> <div>2</div>	
	Yap Island WSO Airport	<div><div></div><div></div><div></div></div> <div>97%</div>	<div><div></div><div></div><div></div></div> <div></div>	<div><div></div><div></div><div></div></div> <div>63.2</div>	<div><div></div><div></div><div></div></div> <div>Excellent</div>	<div><div></div><div></div><div></div></div> <div>100</div>	<div><div></div><div></div><div></div></div> <div>15</div>	<div><div></div><div></div><div></div></div> <div>0</div>	<div><div></div><div></div><div></div></div> <div>0</div>	
	Norou									
	Norou	<div><div></div><div></div><div></div></div> <div>88%</div>	<div><div></div><div></div><div></div></div> <div>11%</div>	<div><div></div><div></div><div></div></div> <div>27.3</div>	<div><div></div><div></div><div></div></div> <div>Very High</div>	<div><div></div><div></div><div></div></div> <div>34.3</div>	<div><div></div><div></div><div></div></div> <div>3</div>	<div><div></div><div></div><div></div></div> <div>4</div>	<div><div></div><div></div><div></div></div> <div>0</div>	
	Norou									
	Hasan Airport	<div><div></div><div></div><div></div></div> <div>14%</div>	<div><div></div><div></div><div></div></div> <div>29%</div>	<div><div></div><div></div><div></div></div> <div>57%</div>	<div><div></div><div></div><div></div></div> <div>10.7</div>	<div><div></div><div></div><div></div></div> <div>Good</div>	<div><div></div><div></div><div></div></div> <div>40</div>	<div><div></div><div></div><div></div></div> <div>9</div>	<div><div></div><div></div><div></div></div> <div>4</div>	<div><div></div><div></div><div></div></div> <div>2</div>
	Palau									
	Koror	<div><div></div><div></div><div></div></div> <div>30%</div>	<div><div></div><div></div><div></div></div> <div>32%</div>	<div><div></div><div></div><div></div></div> <div>38%</div>	<div><div></div><div></div><div></div></div> <div>1.5</div>	<div><div></div><div></div><div></div></div> <div>Low</div>	<div><div></div><div></div><div></div></div> <div>-10</div>	<div><div></div><div></div><div></div></div> <div>4</div>	<div><div></div><div></div><div></div></div> <div>5</div>	<div><div></div><div></div><div></div></div> <div>6</div>
	Papua New Guinea									
	Madang	<div><div></div><div></div><div></div></div> <div>12%</div>	<div><div></div><div></div><div></div></div> <div>87%</div>	<div><div></div><div></div><div></div></div> <div>5</div>	<div><div></div><div></div><div></div></div> <div>Moderate</div>	<div><div></div><div></div><div></div></div> <div>0</div>	<div><div></div><div></div><div></div></div> <div>5</div>	<div><div></div><div></div><div></div></div> <div>7</div>	<div><div></div><div></div><div></div></div> <div>3</div>	
	Port Moresby	<div><div></div><div></div><div></div></div> <div>19%</div>	<div><div></div><div></div><div></div></div> <div>39%</div>	<div><div></div><div></div><div></div></div> <div>42%</div>	<div><div></div><div></div><div></div></div> <div>-4.2</div>	<div><div></div><div></div><div></div></div> <div>Very Low</div>	<div><div></div><div></div><div></div></div> <div>9</div>	<div><div></div><div></div><div></div></div> <div>5</div>	<div><div></div><div></div><div></div></div> <div>7</div>	<div><div></div><div></div><div></div></div> <div>3</div>
	Monrovia	<div><div></div><div></div><div></div></div> <div>55%</div>	<div><div></div><div></div><div></div></div> <div>29%</div>	<div><div></div><div></div><div></div></div> <div>16%</div>	<div><div></div><div></div><div></div></div> <div>-1.6</div>	<div><div></div><div></div><div></div></div> <div>Very Low</div>	<div><div></div><div></div><div></div></div> <div>20</div>	<div><div></div><div></div><div></div></div> <div>5</div>	<div><div></div><div></div><div></div></div> <div>7</div>	<div><div></div><div></div><div></div></div> <div>3</div>
	Nadabula	<div><div></div><div></div><div></div></div> <div>11%</div>	<div><div></div><div></div><div></div></div> <div>25%</div>	<div><div></div><div></div><div></div></div> <div>64%</div>	<div><div></div><div></div><div></div></div> <div>9.3</div>	<div><div></div><div></div><div></div></div> <div>Moderate</div>	<div><div></div><div></div><div></div></div> <div>30</div>	<div><div></div><div></div><div></div></div> <div>8</div>	<div><div></div><div></div><div></div></div> <div>4</div>	<div><div></div><div></div><div></div></div> <div>3</div>
	Kavieng	<div><div></div><div></div><div></div></div> <div>42%</div>	<div><div></div><div></div><div></div></div> <div>30%</div>	<div><div></div><div></div><div></div></div> <div>28%</div>	<div><div></div><div></div><div></div></div> <div>-1.6</div>	<div><div></div><div></div><div></div></div> <div>Very Low</div>	<div><div></div><div></div><div></div></div> <div>5</div>	<div><div></div><div></div><div></div></div> <div>3</div>	<div><div></div><div></div><div></div></div> <div>6</div>	<div><div></div><div></div><div></div></div> <div>6</div>
	Milne	<div><div></div><div></div><div></div></div> <div>8%</div>	<div><div></div><div></div><div></div></div> <div>91%</div>	<div><div></div><div></div><div></div></div> <div></div>	<div><div></div><div></div><div></div></div> <div>35.3</div>	<div><div></div><div></div><div></div></div> <div>Excellent</div>	<div><div></div><div></div><div></div></div> <div>40</div>	<div><div></div><div></div><div></div></div> <div>9</div>	<div><div></div><div></div><div></div></div> <div>6</div>	<div><div></div><div></div><div></div></div> <div>0</div>

	Station	Tercile Probability			Verification Score (LEPS)	Verification Score (HSS)	Hit/NearMiss/Miss
	Cook Islands						
	Penryn	94%	6	42.9	Excellent	30	8 7 0
	Rarotonga	89 23%	69%	-11.6	Very Low	-20	3 7 7
	Fiji						
	Rotuma	101 34%	56%	2.6	Low	19.6	6 5 3
	Lido Point	71 92%	31.2	4.5	Very High	0	4 7 0
	Nukunono	71 27%	66%	12.1	Good	-9.1	3 6 2
	Nadi Airport	19%	79%	24	High	62.5	10 3 1
	Suva	19%	77%	30.4	Very High	35.7	8 6 0
	Ono I Laila	119 26%	63%	16.2	High	65.4	10 0 3
	Kiribati						
	Kiritimati	61%	33%	6 30.9	Very High	73.2	11 3 0
	Buariki	70%	26%	12.5	Good	3.6	5 9 0
	Tarawa	80%	19%	32.2	Very High	46.4	9 5 0
	Kanton	70%	26%	22.9	High	42.3	8 5 0
	Marshall Islands						
	Kwajalein Buchele Aaf	66%	27%	7 13.9	Good	25	7 5 2
	Majuro	74%	20%	6 2	Low	-17.9	3 9 9

# Precipitation Outlook for MJJ 2022

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ICU

BoM  
ACCESS-S

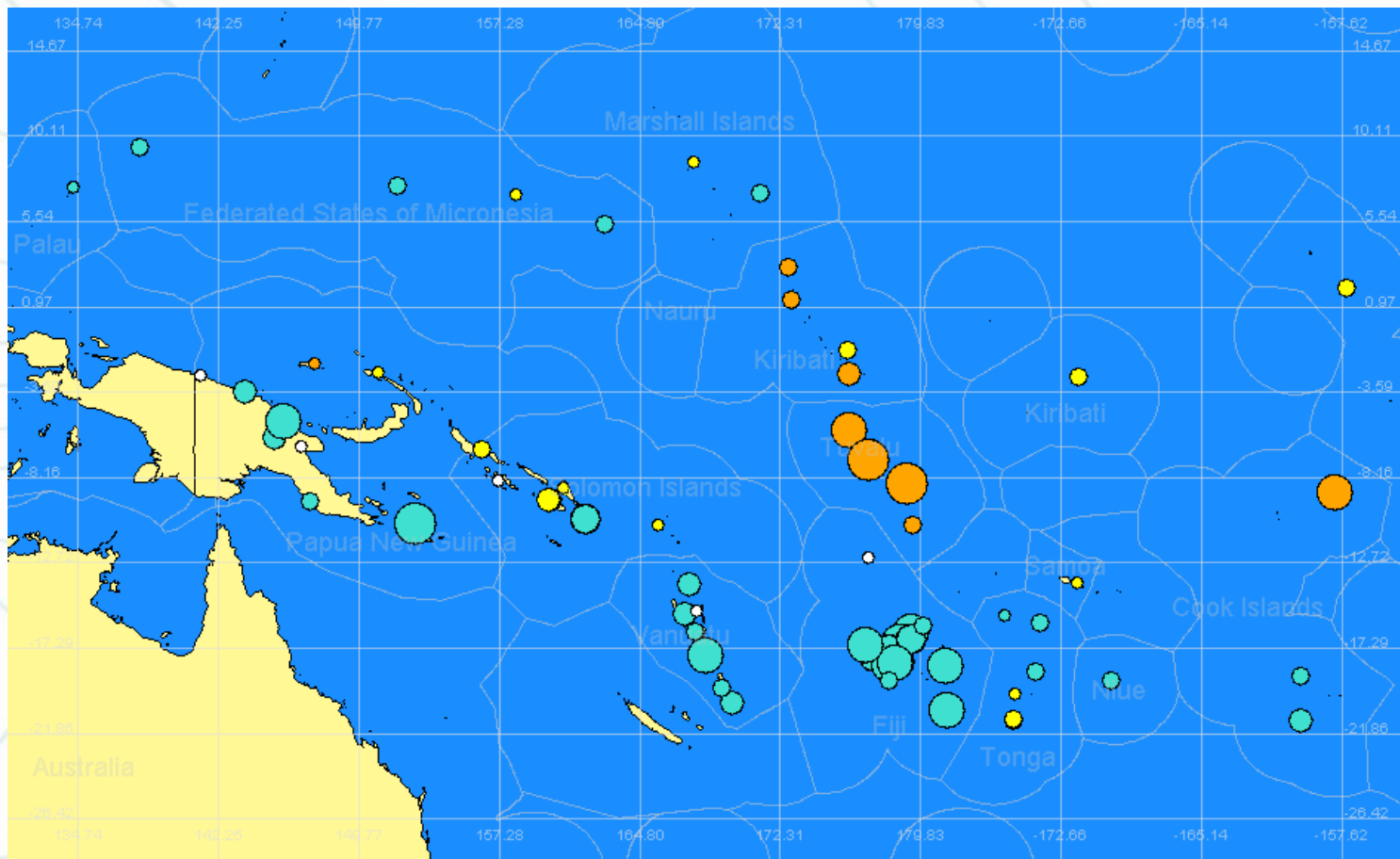
NOAA  
NMME

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Legend

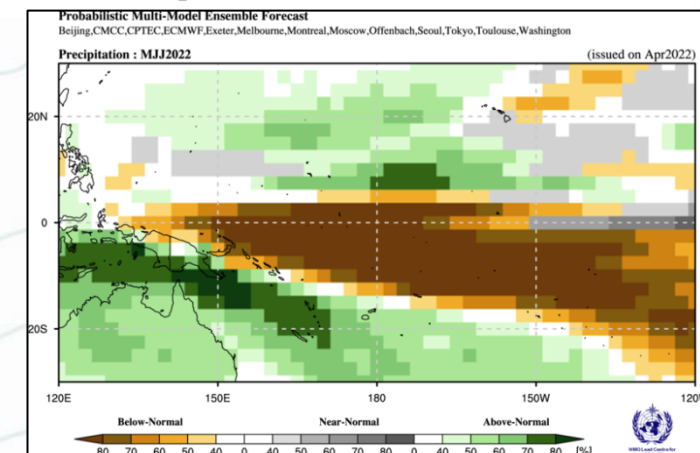
 Bias towards below-normal rainfall

 Bias towards normal rainfall

 Bias towards above-normal rainfall

 No bias in forecast (Climatology)

Larger "bubbles" represent higher forecast skill (based on LEPS scores)



The three months outlook to July 2022 is very likely to be above normal rainfall for **Palau, FSM, PNG, Vanuatu, Fiji, central and northern Tonga, Niue and southern Cook Islands**. Below normal is very likely for **PNG islands, Kiribati, Tuvalu and northern Cook Islands**. Normal rainfall other remaining countries.



# Precipitation Outlook for ASO 2022

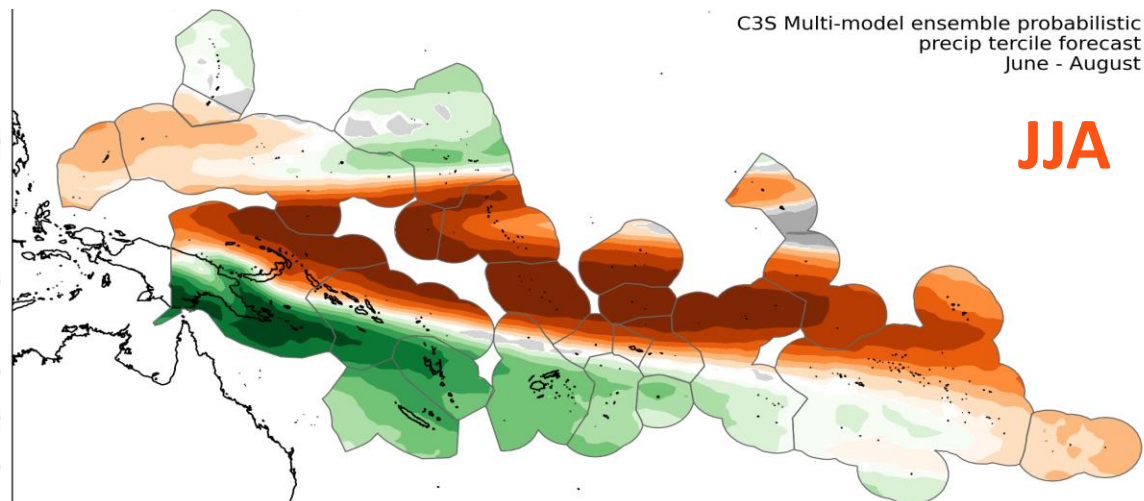
NIWA  
ICU

BoM  
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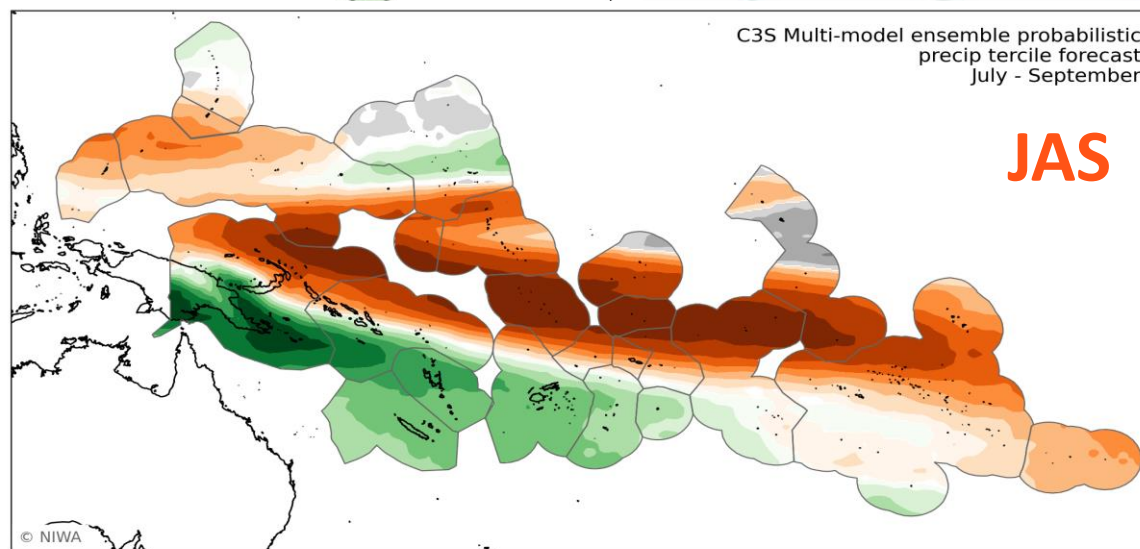
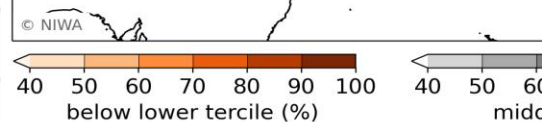
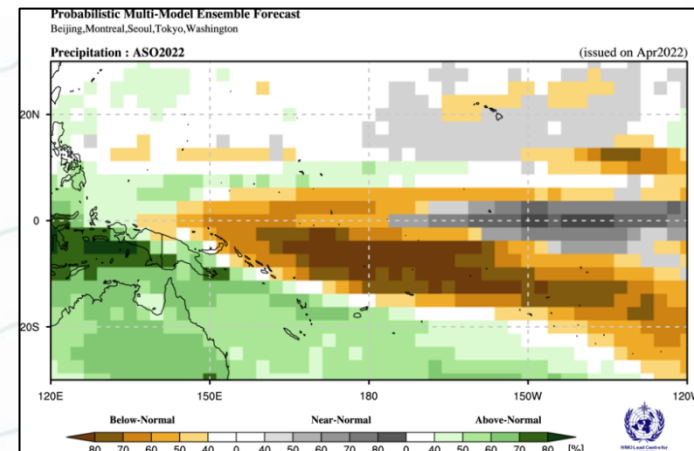
NOAA  
NMME

APCC  
PMME

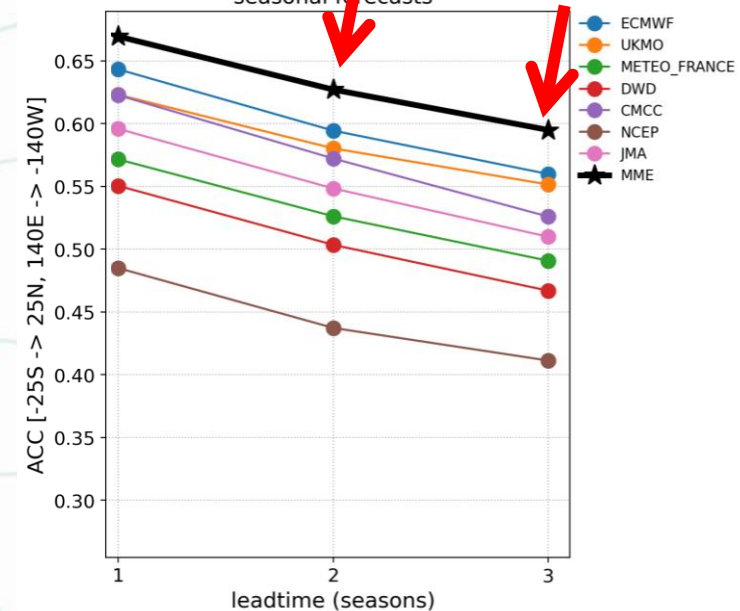
SCOPIC



ASO is not available!



C3S MME ACC, Tropical Pacific seasonal forecasts





# Precipitation Outlook for ASO 2022

NIWA  
ICU

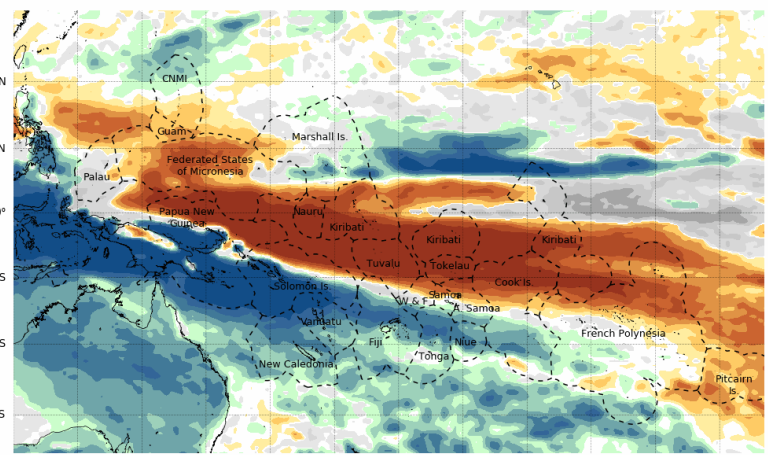
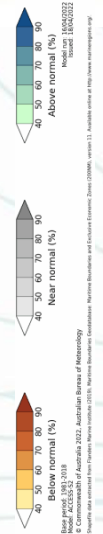
BoM  
ACCESS-S

NOAA  
NMME

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PMME

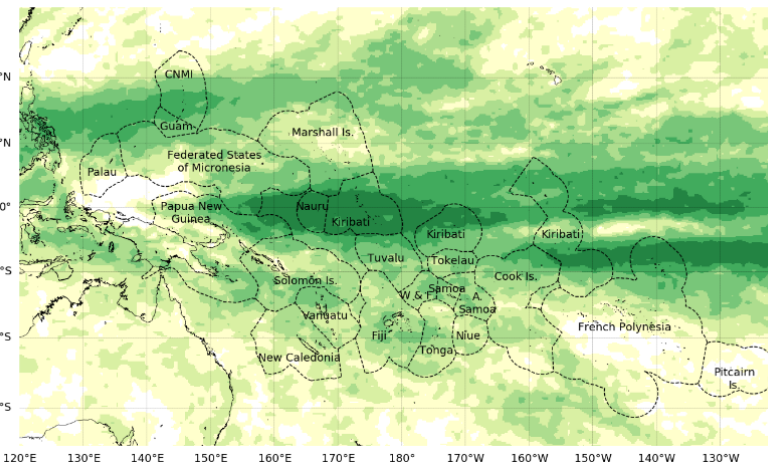
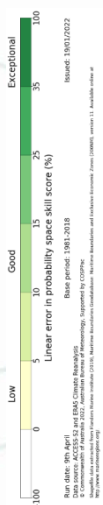
SCOPIC

Tercile rainfall probabilities for June to August 2022

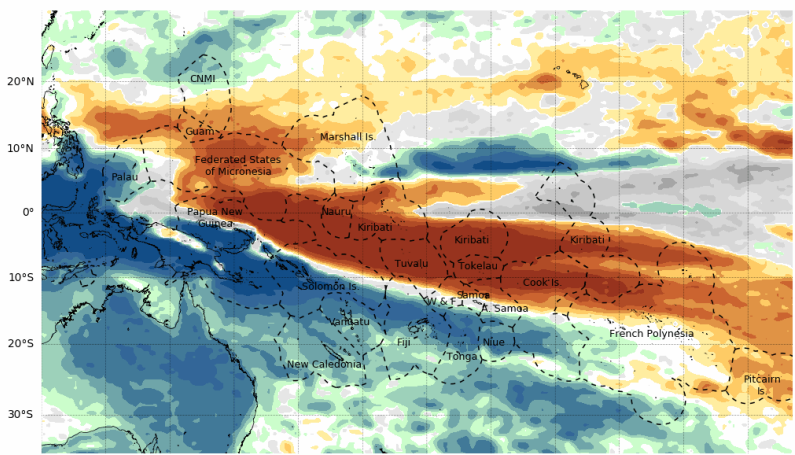


**JJA**

Tercile seasonal rainfall past accuracy for June - August. Lead time: 2 month

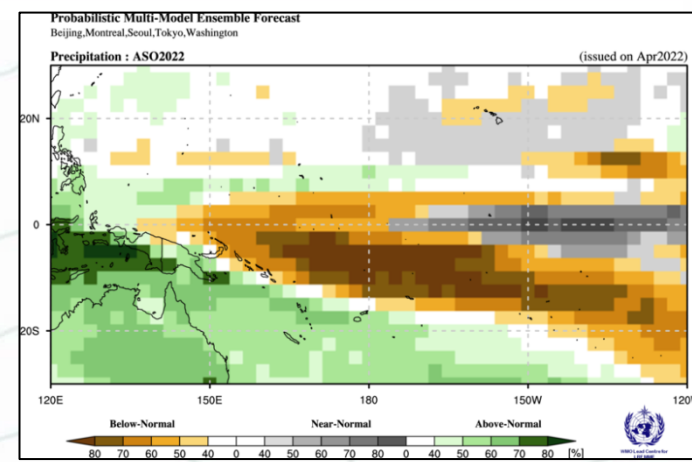


Tercile rainfall probabilities for July to September 2022



**JAS**

Tercile seasonal rainfall past accuracy for July - September. Lead time: 3 months



ASO is not available!



# Precipitation Outlook for ASO 2022

NIWA  
ICU

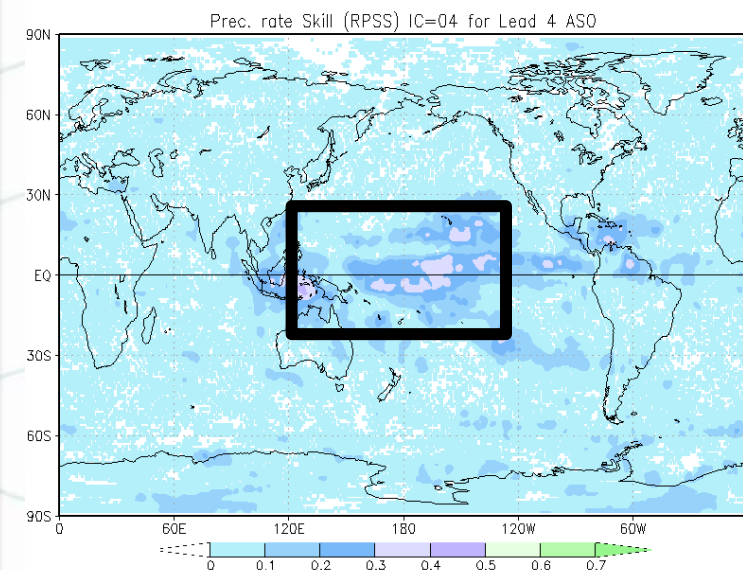
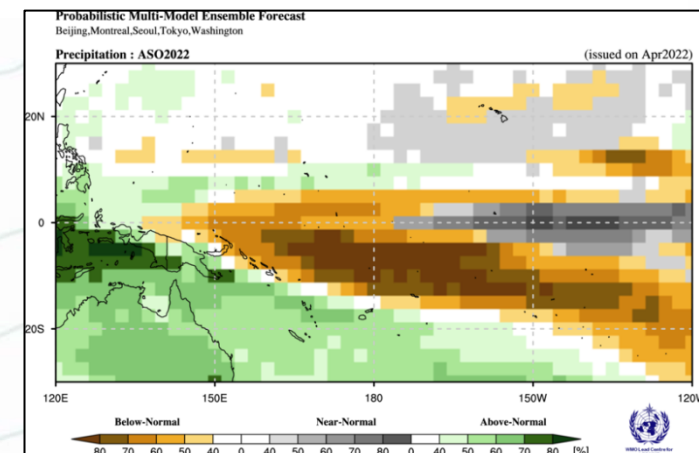
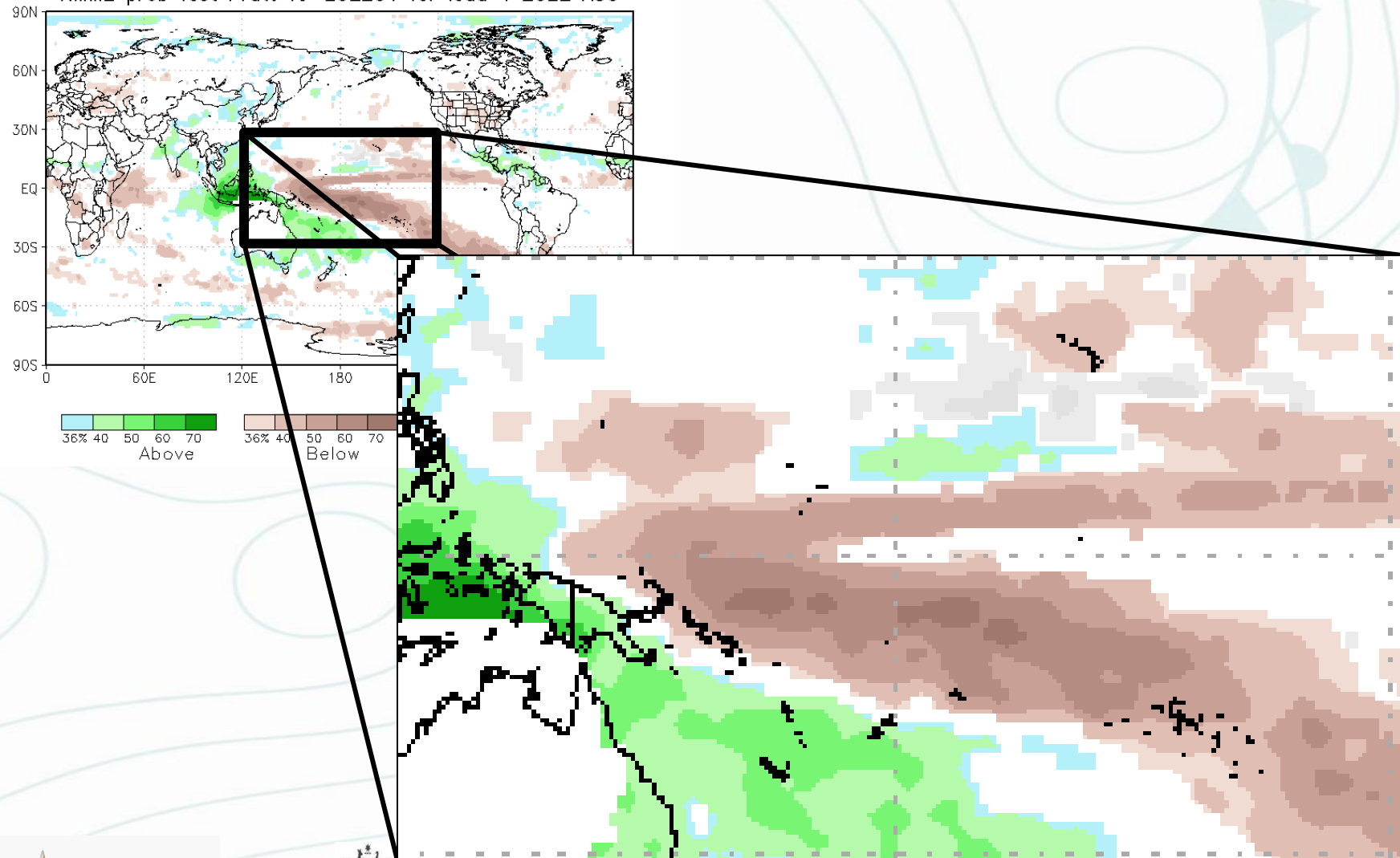
BoM  
ACCESS-S

NOAA  
NMME

APCC  
PMME

SCOPIC

NMME prob fcst Prate IC=202204 for lead 4 2022 ASO



# Precipitation Outlook for ASO 2022

NIWA  
ICU

BoM  
ACCESS-S

NOAA  
NMME

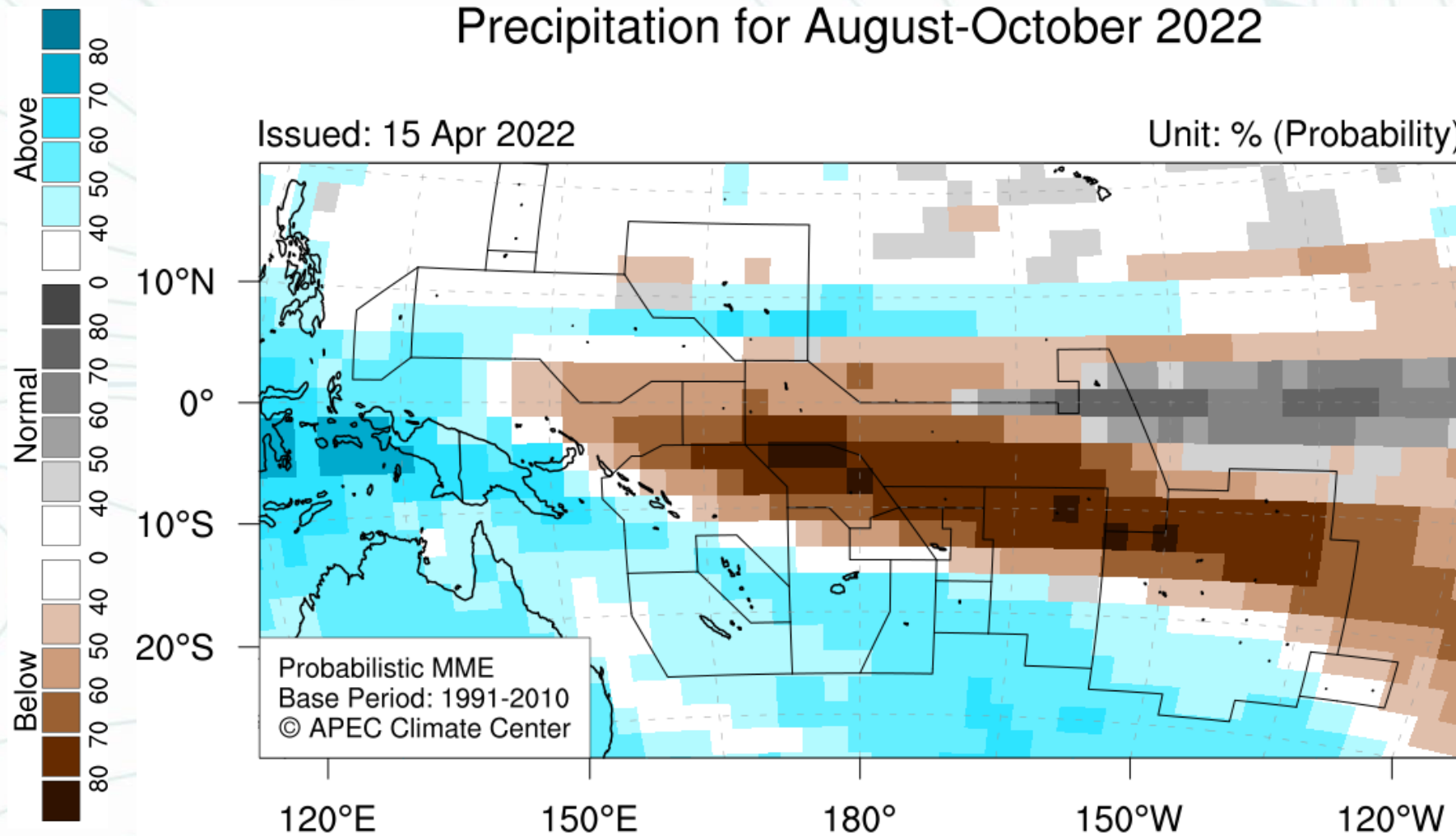
APCC  
PMME

SCOPIC

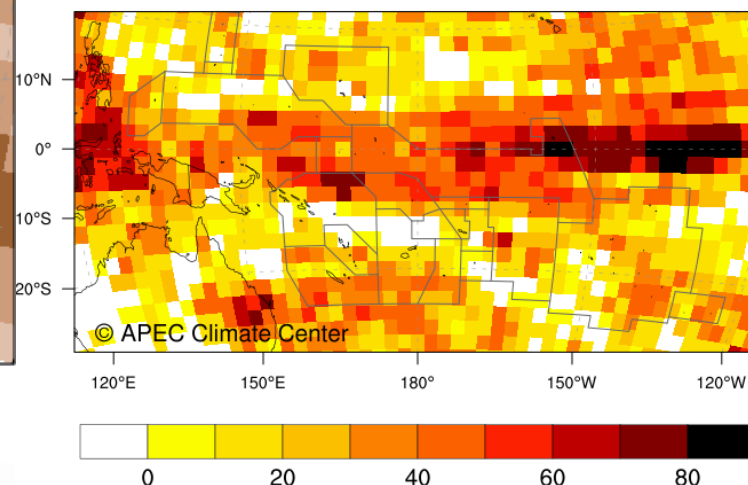
## Precipitation for August-October 2022

Issued: 15 Apr 2022

Unit: % (Probability)



Heidke Skill Score : PREC, ASO (1991-2010)





# Precipitation Outlook for ASO 2022

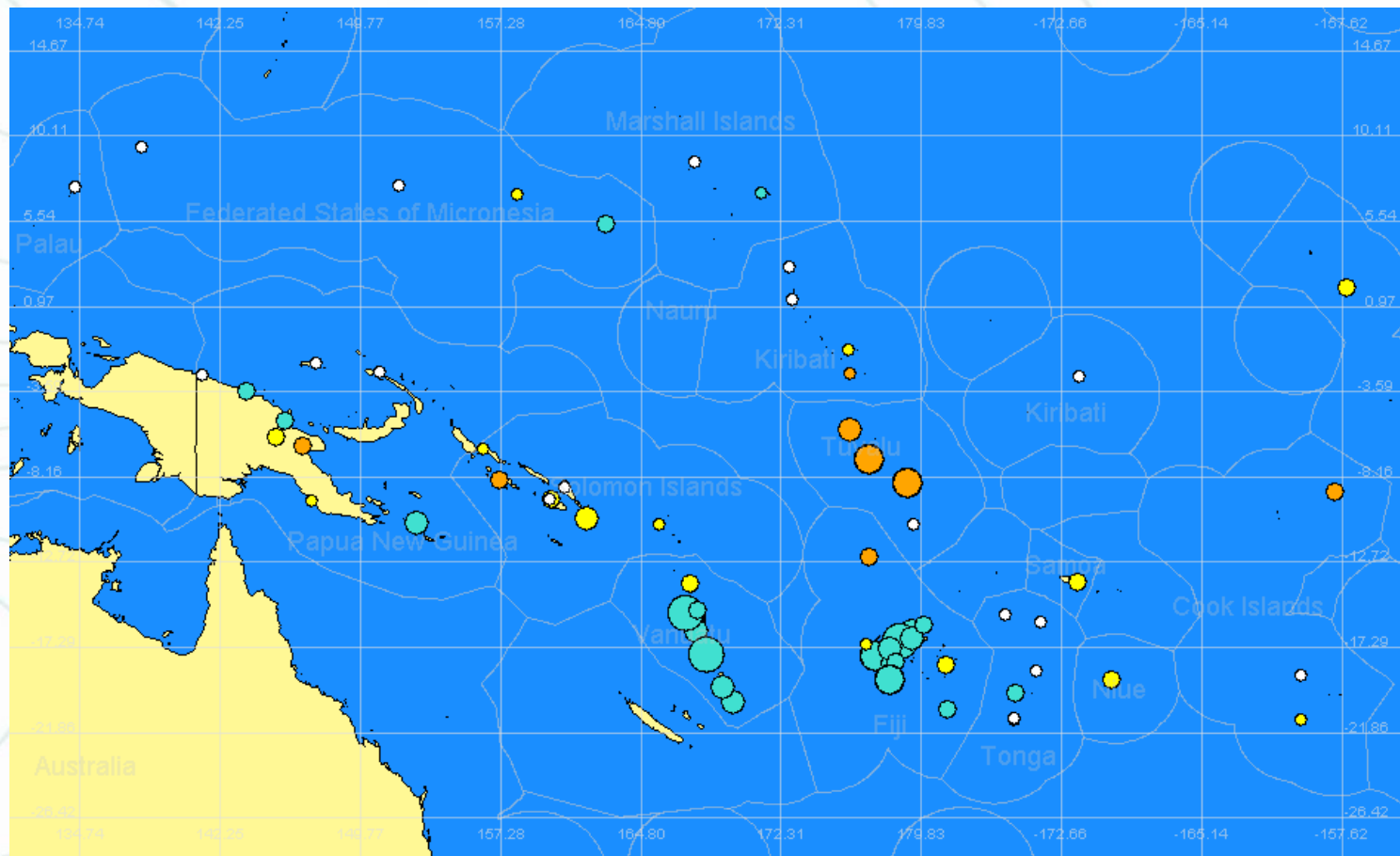
NIWA  
ICU

BoM  
ACCESS-S


NOAA  
NMME


APCC  
PMME


SCOPIC




## Legend

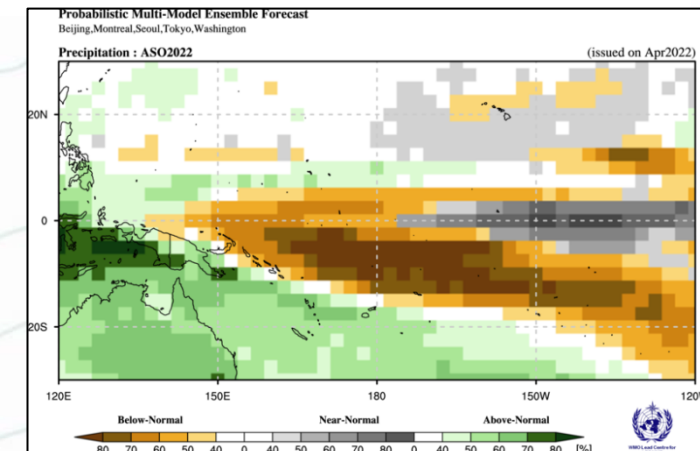
 Bias towards below-normal rainfall

 Bias towards normal rainfall

 Bias towards above-normal rainfall

 No bias in forecast (Climatology)

Larger "bubbles" represent higher forecast skill (based on LEPS scores)



# Temperature Outlook



# Temperature Outlook for MJJ to ASO 2022

## WMO LC LRF MME

**2022MJJ:** Cooler than normal conditions with more than 80% chances along the equator near and east of the Dateline; Warmer than normal conditions for the off-equatorial region

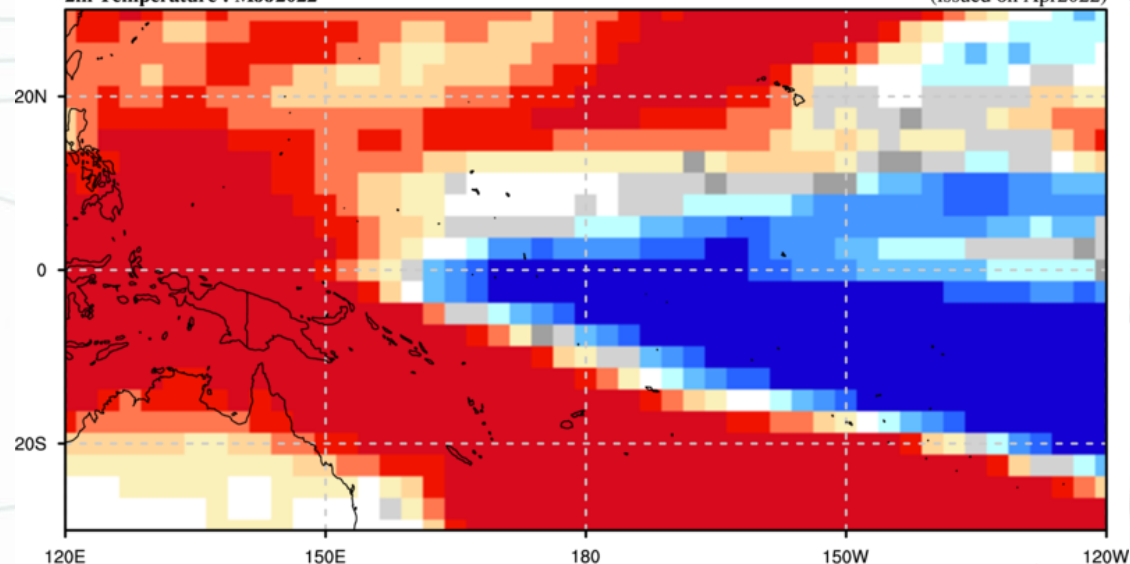
**2022ASO:** Weakening chances for cooler than normal conditions; Persisting probability (>80%) for warmer than normal conditions for Melanesia

### Probabilistic Multi-Model Ensemble Forecast

Beijing,CMCC,CPTEC,ECMWF,Exeter,Melbourne,Montreal,Moscow,Offenbach,Seoul,Tokyo,Toulouse,Washington

#### 2m Temperature : MJJ2022

(issued on Apr2022)

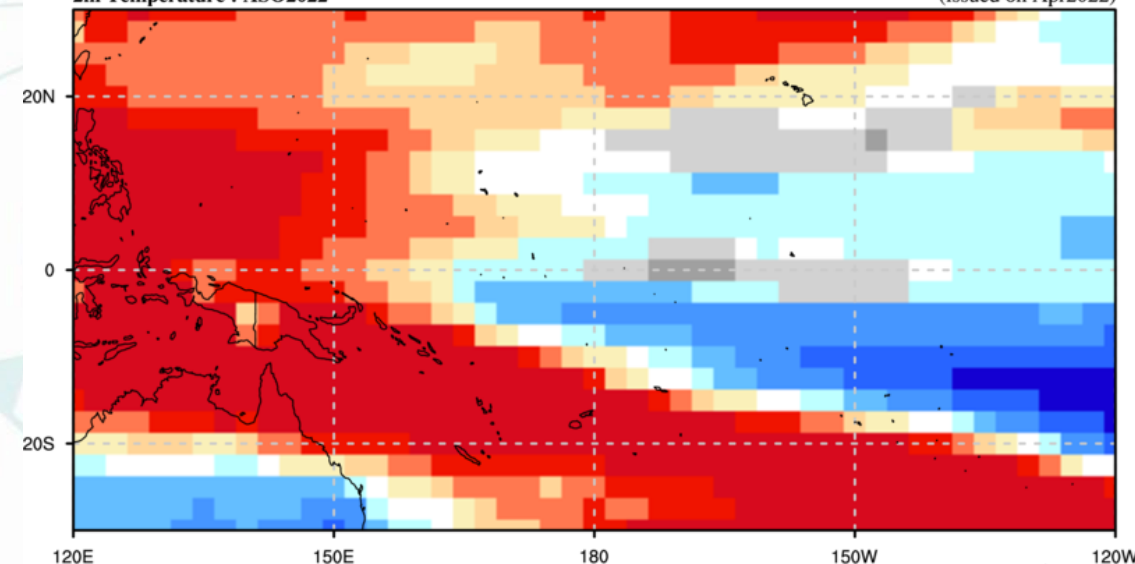


### Probabilistic Multi-Model Ensemble Forecast

Beijing, Montreal, Seoul, Tokyo, Washington

#### 2m Temperature : ASO2022

(issued on Apr2022)



# Temperature Outlook for MJJ 2022

**BoM**  
**ACCESS-S**

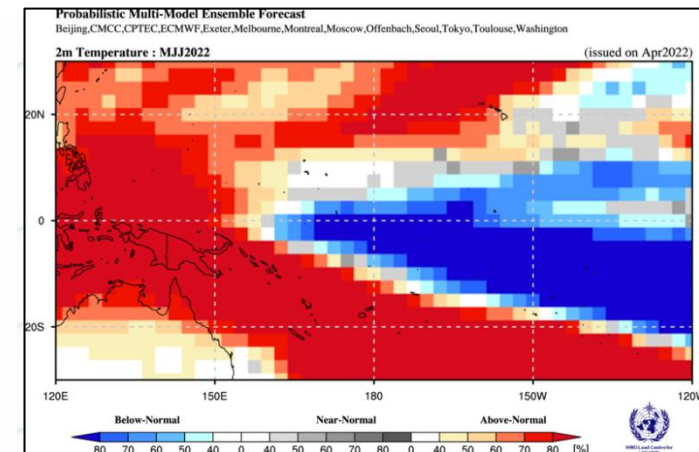
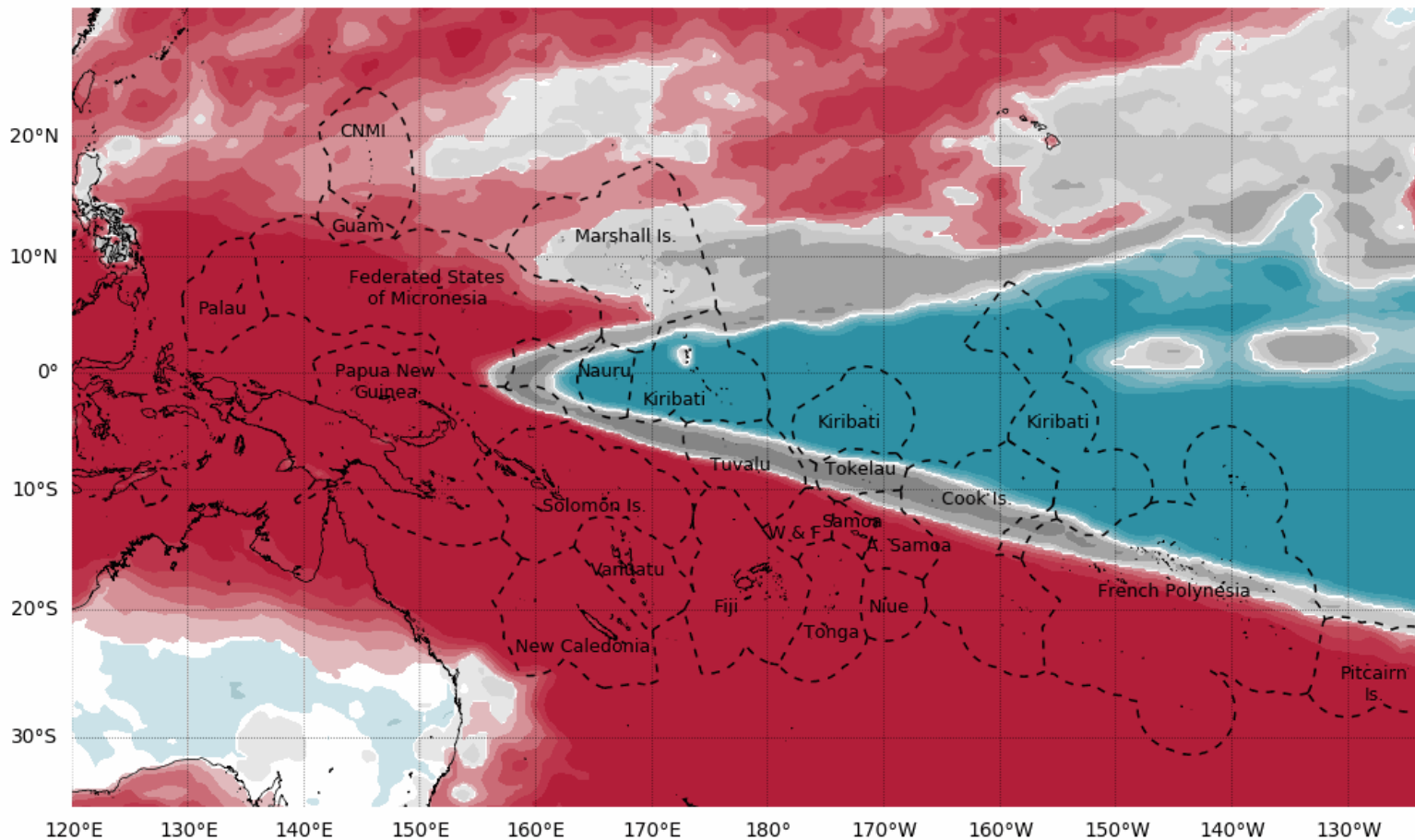
**NOAA**  
**NMME**

**APCC**  
**PMME**

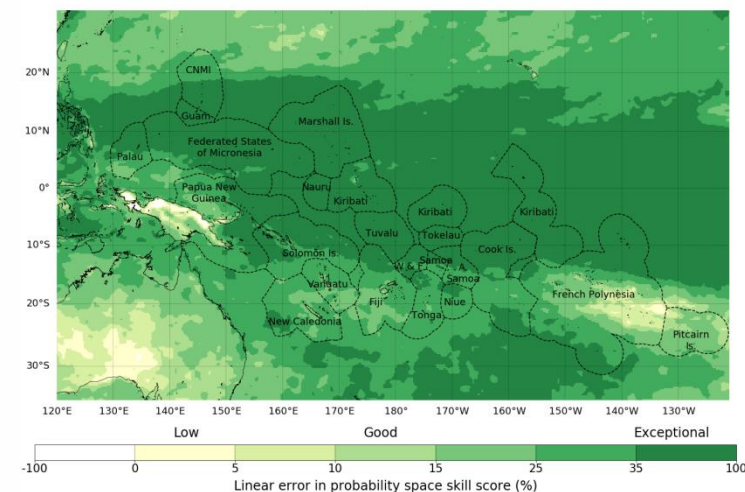
**CLiK-<sup>®</sup>**  
**PMME**

**T max**

Tercile maximum temperature probabilities for May to July 2022



Tercile seasonal maximum temperature past accuracy for May - July. Lead time: 1 months



Run date: 17th April  
Data source: ACCESS-S2 and ERA5 Climate Reanalysis  
© Commonwealth of Australia 2022, Australian Bureau of Meteorology, Supported by COSPAR  
Shapefile data extracted from Flanders Marine Institute (2019), Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at: <http://www.maritimeresources.org/>

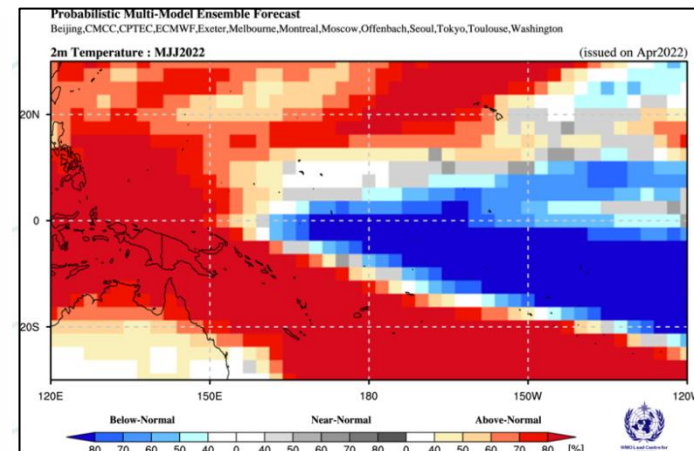
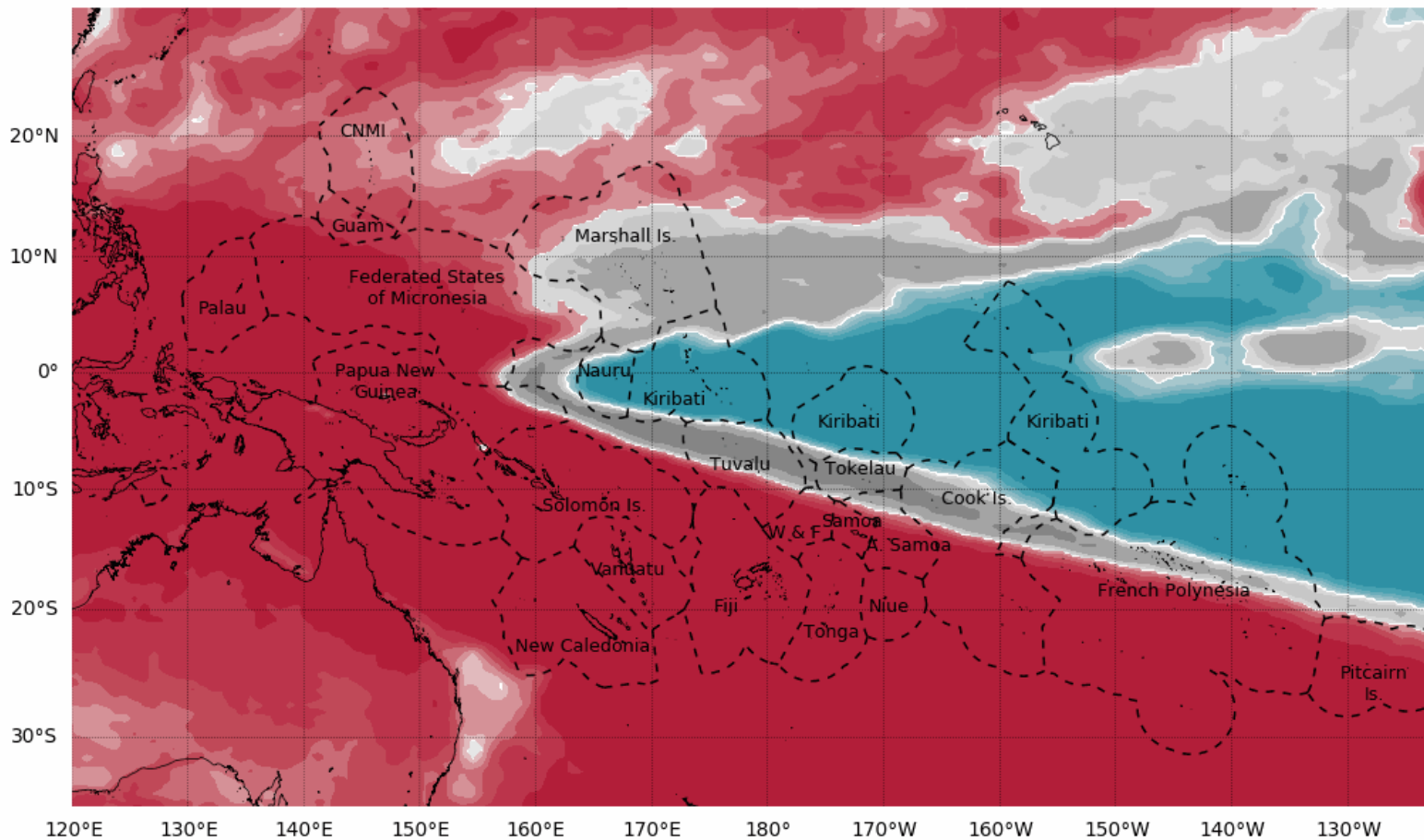


# Temperature Outlook for MJJ 2022

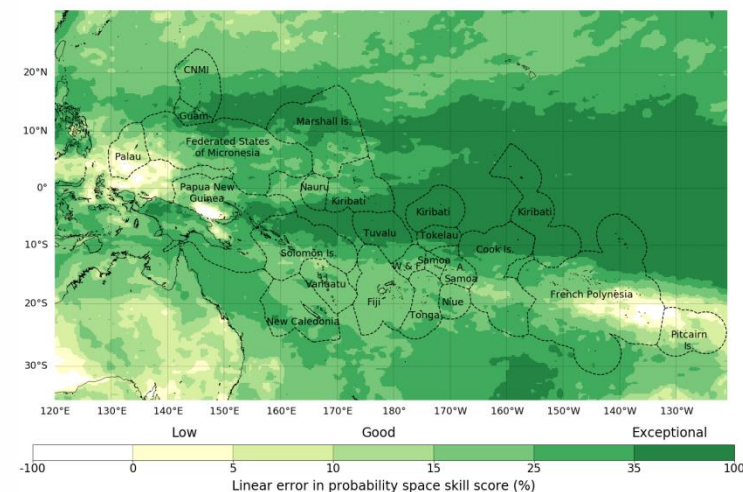
BoM | NOAA | APCC | CLiK-<sup>®</sup>  
ACCESS-S | NMME | PMME | PMME

## T min

Tercile minimum temperature probabilities for May to July 2022



Tercile seasonal minimum temperature past accuracy for May - July. Lead time: 1 months



Run date: 17th April  
Data source: ACCESS-S2 and ERA5 Climate Reanalysis  
© Commonwealth of Australia 2022, Australian Bureau of Meteorology, Supported by COSPAR  
Shapefile data extracted from Flanders Marine Institute (2019), Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at <http://www.maritimeresources.org/>

# Temperature Outlook for MJJ 2022

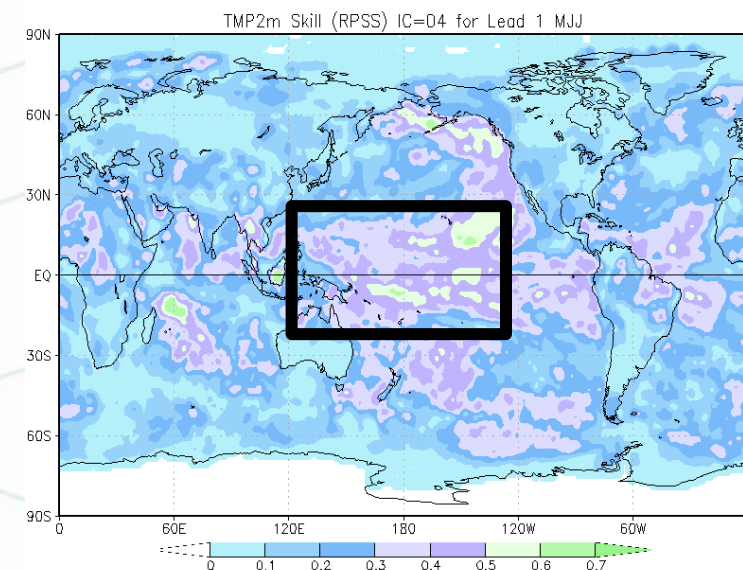
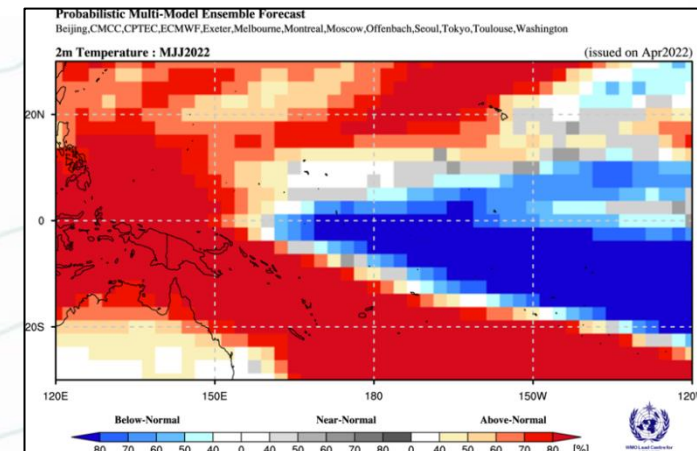
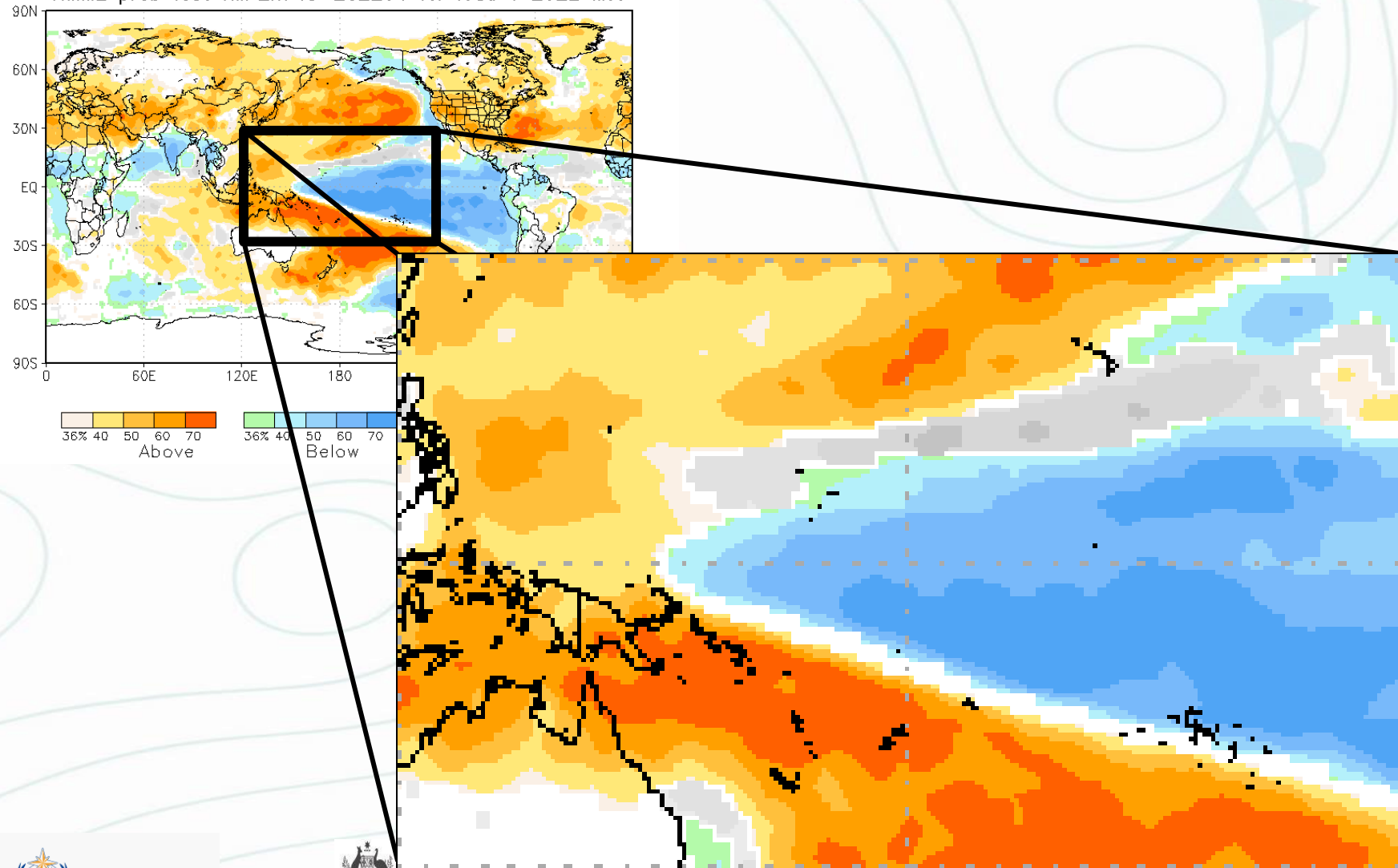
BoM  
ACCESS-S

NOAA  
NMME

APCC  
PMME

CLIK-<sup>®</sup>

NMME prob fcst TMP2m IC=202204 for lead 1 2022 MJJ

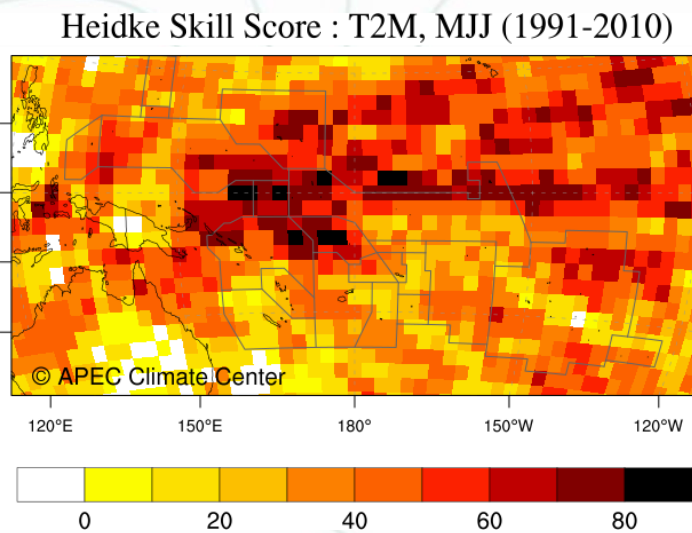
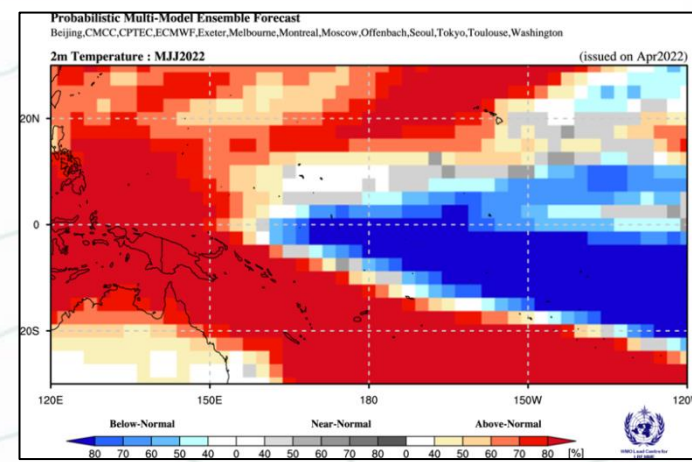
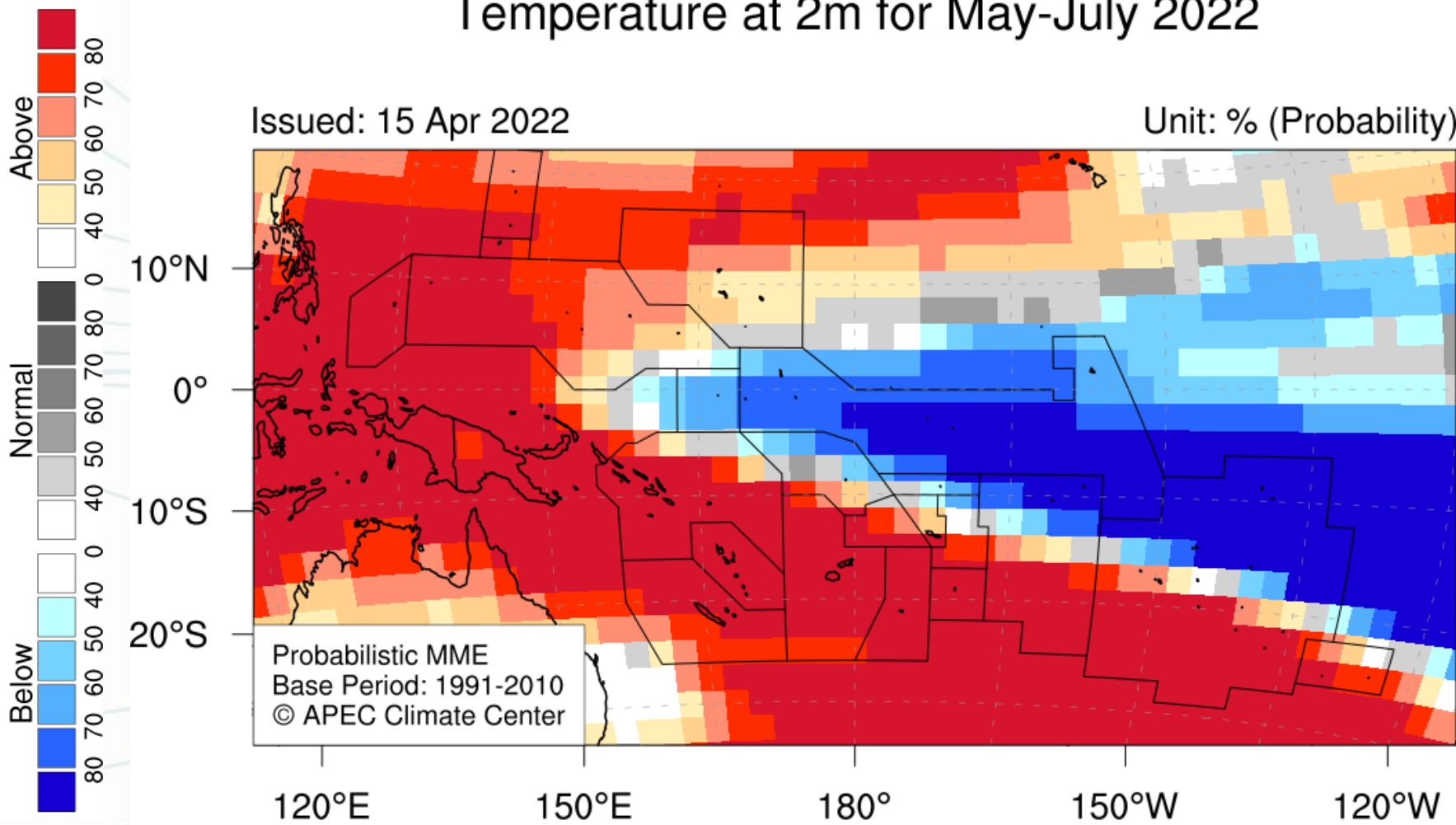




# Temperature Outlook for MJJ 2022

BoM | NOAA | APCC | CLIK-<sup>p</sup>  
ACCESS-S | NMME | PMME

## Temperature at 2m for May-July 2022



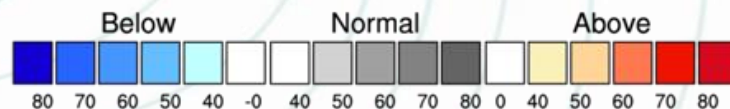
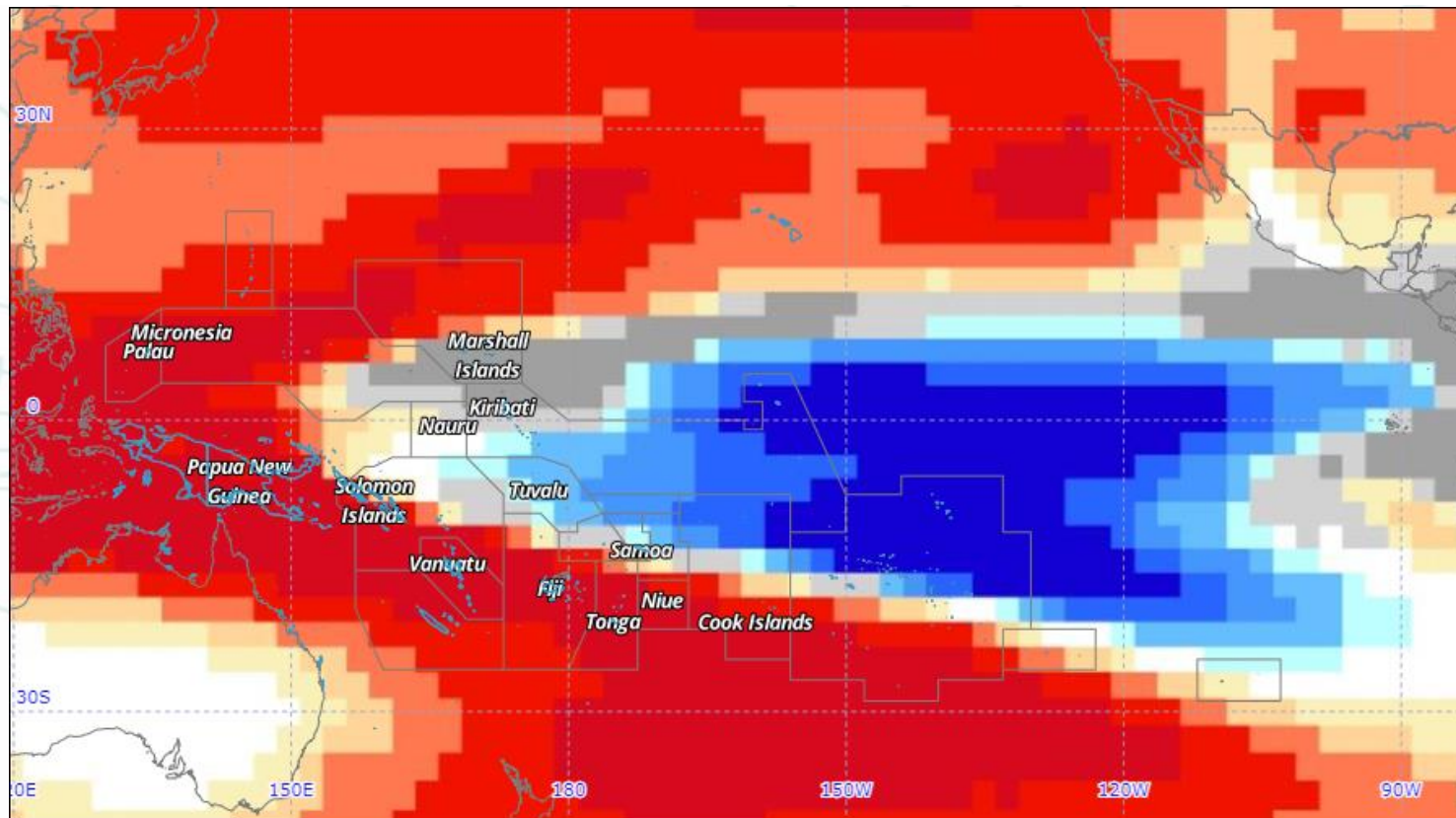
# Temperature Outlook for MJJ 2022

BoM  
ACCESS-S

NOAA  
NMME

APCC  
PMME

CLIK-<sup>®</sup>

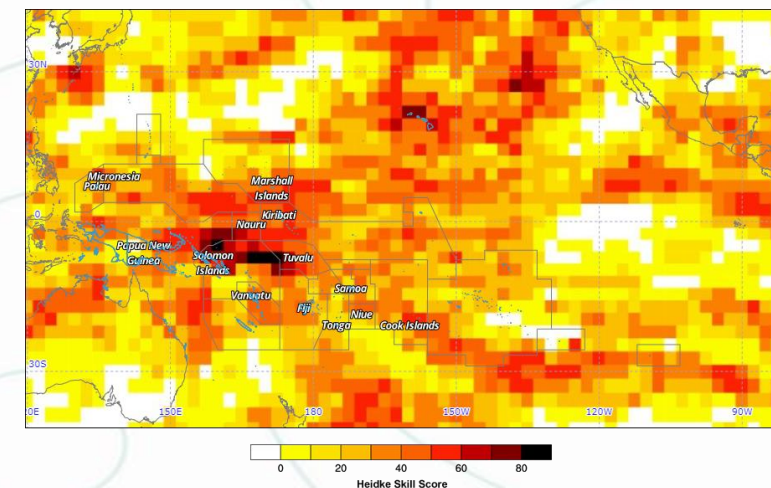
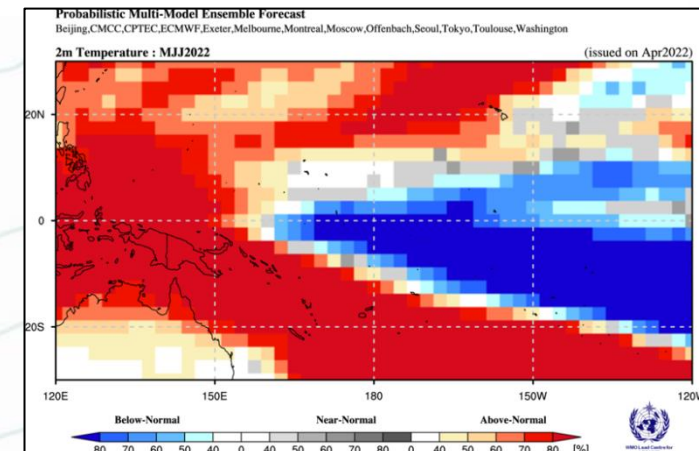


Year: 2022, Season: MJJ, Lead Month: 3, Method: GAUS

Model: APCC, CMCC, CWB, MSC, NCEP, PNU, POAMA

Generated using CLIK<sup>®</sup> (2022-4-21)

© APEC Climate Center



Year: 2022, Season: MJJ, Lead Month: 3, Method: GAUS

Model: APCC, CMCC, CWB, MSC, NCEP, PNU, POAMA

Generated using CLIK<sup>®</sup> (2022-4-21)

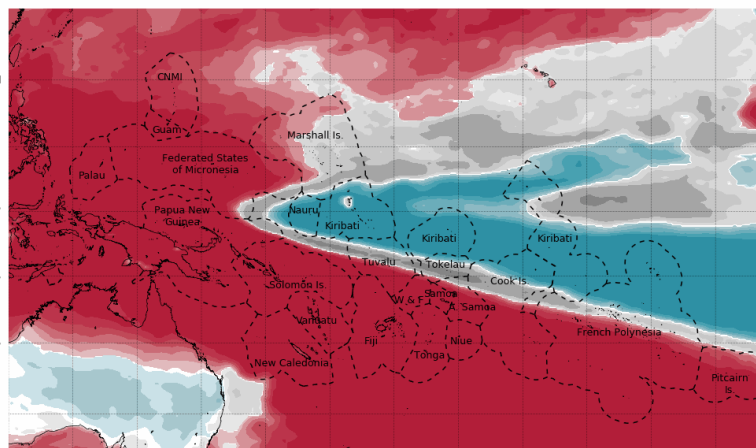
© APEC Climate Center



# Temperature Outlook for ASO 2022

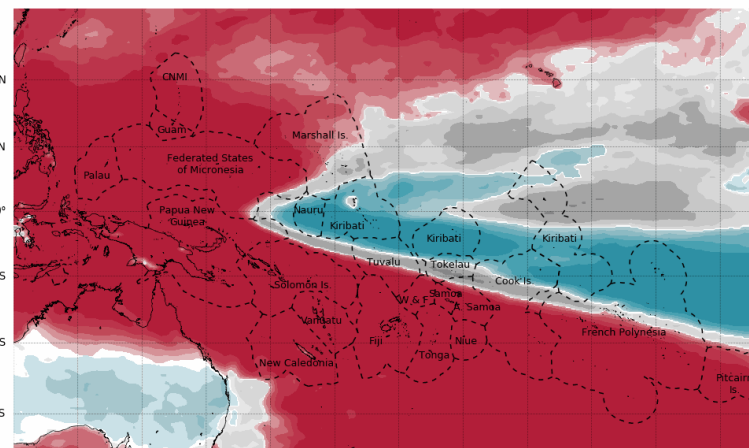
BoM | NOAA | APCC  
ACCESS-S | NMME | PMME

Tercile maximum temperature probabilities for June to August 2022

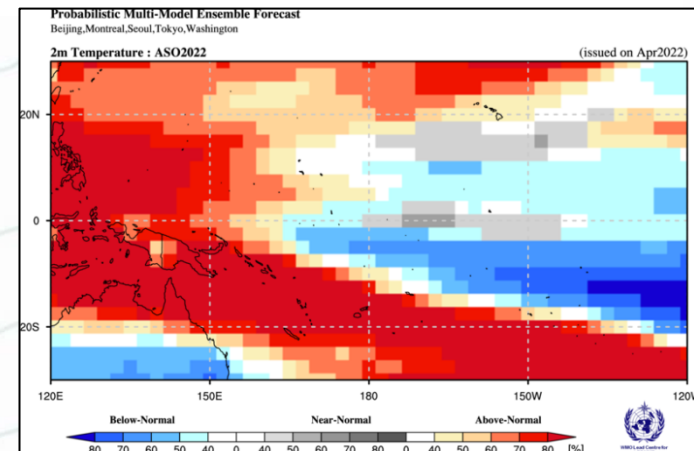


**JJA** Tercile seasonal maximum temperature past accuracy for June - August. Lead time: 2 month

Tercile maximum temperature probabilities for July to September 2022

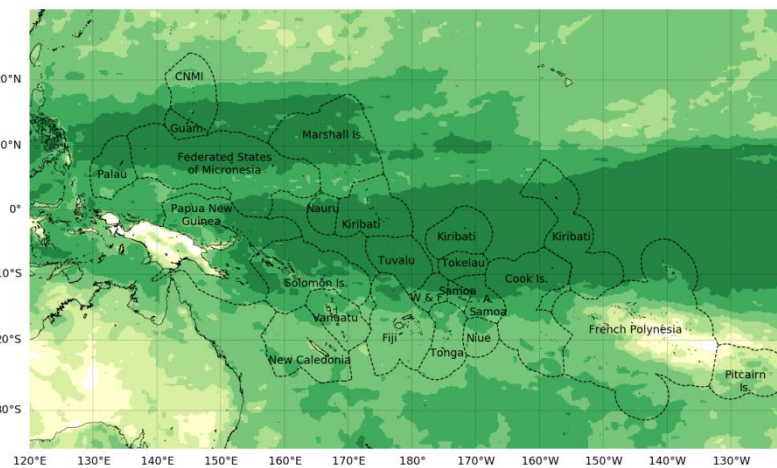
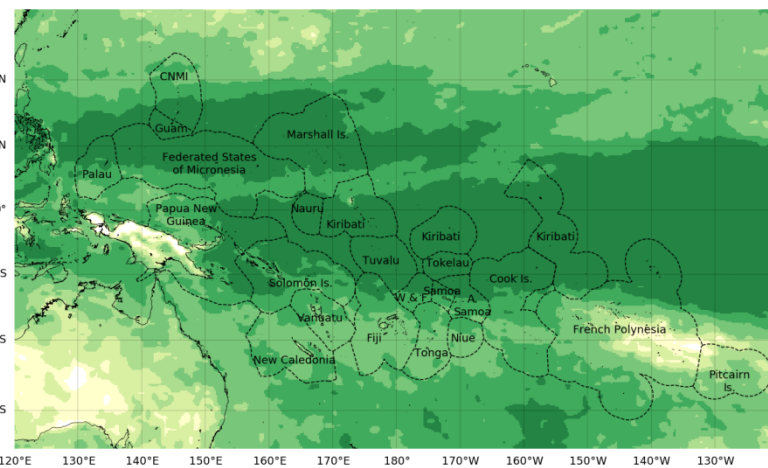


Tercile seasonal maximum temperature past accuracy for July - September. Lead time: 3 months **JAS**



**T max**

ASO is not available!

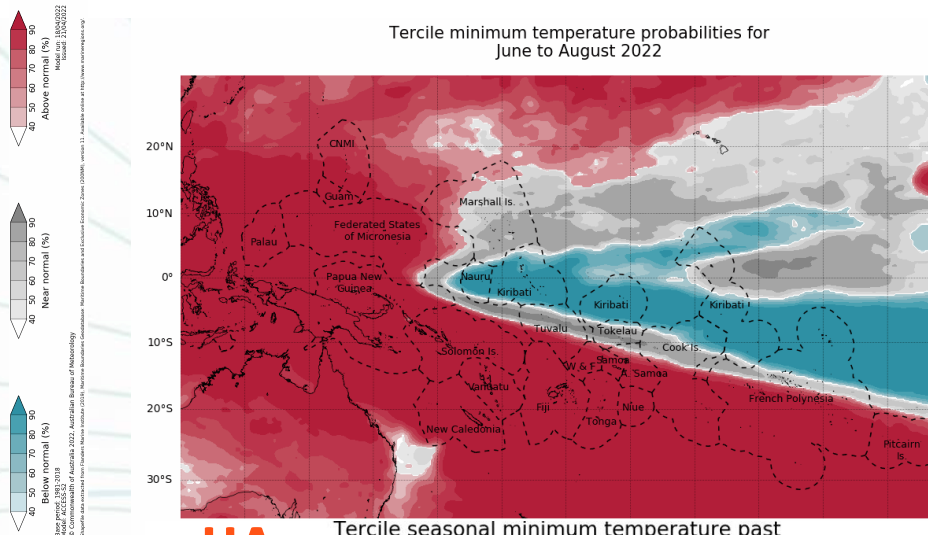




# Temperature Outlook for ASO 2022

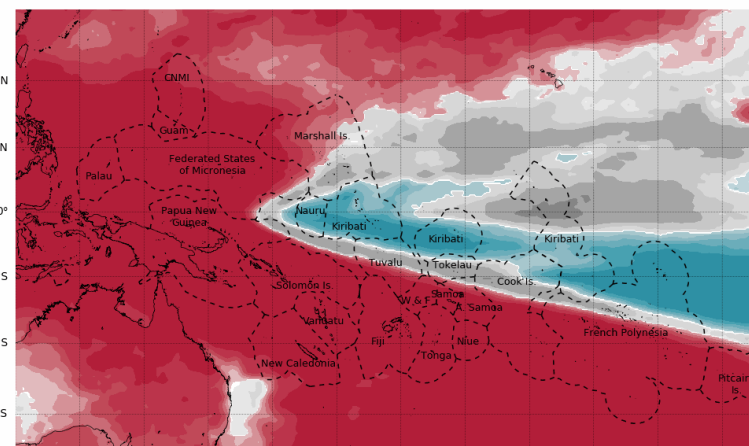
BoM | NOAA | APCC  
ACCESS-S | NMME | PMME

Tercile minimum temperature probabilities for June to August 2022

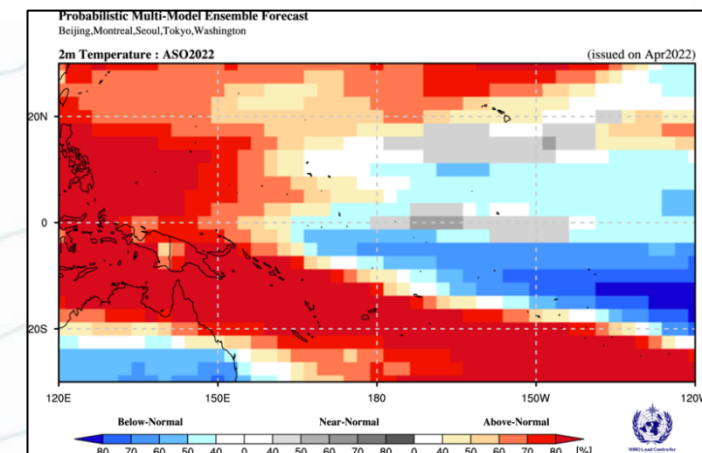


**JJA** Tercile seasonal minimum temperature past accuracy for June - August. Lead time: 2 month

Tercile minimum temperature probabilities for July to September 2022

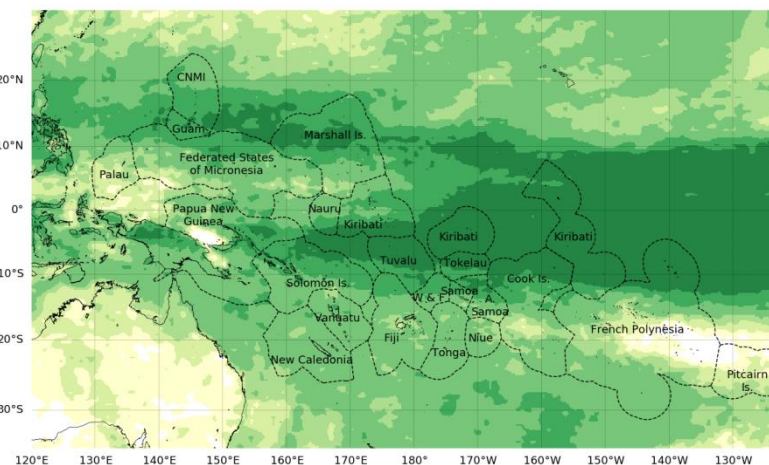
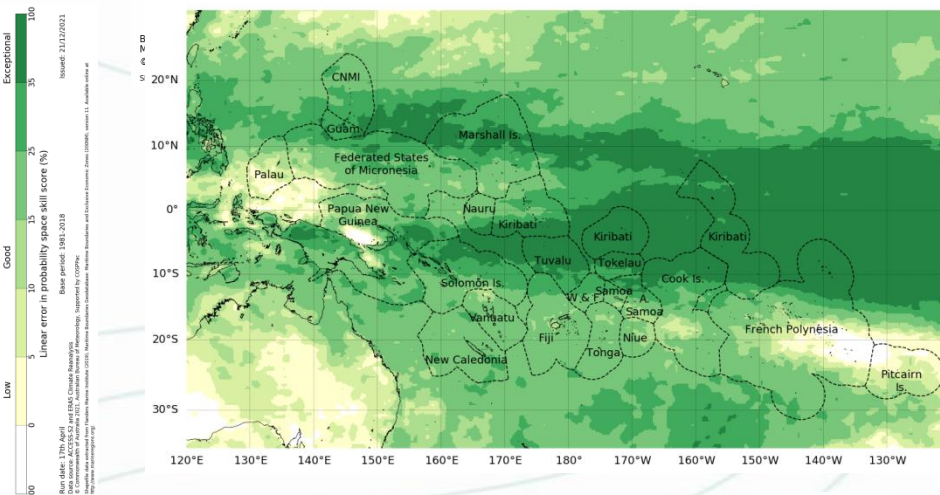


Tercile seasonal minimum temperature past accuracy for July - September. Lead time: 3 months **JAS**



**T min**

ASO is not available!

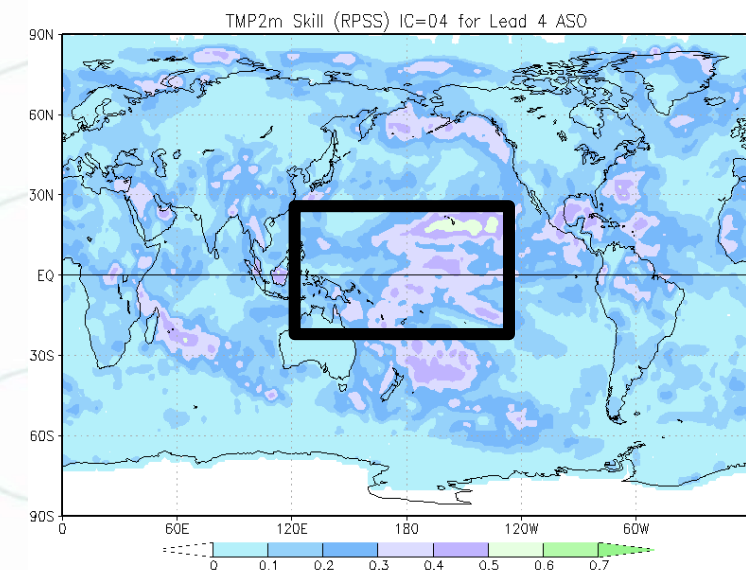
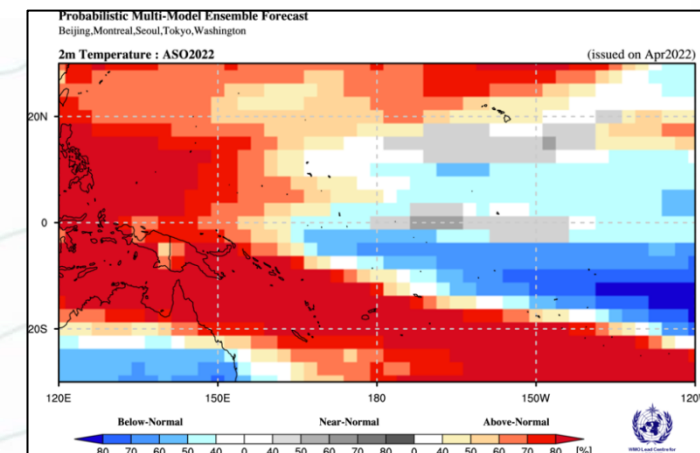
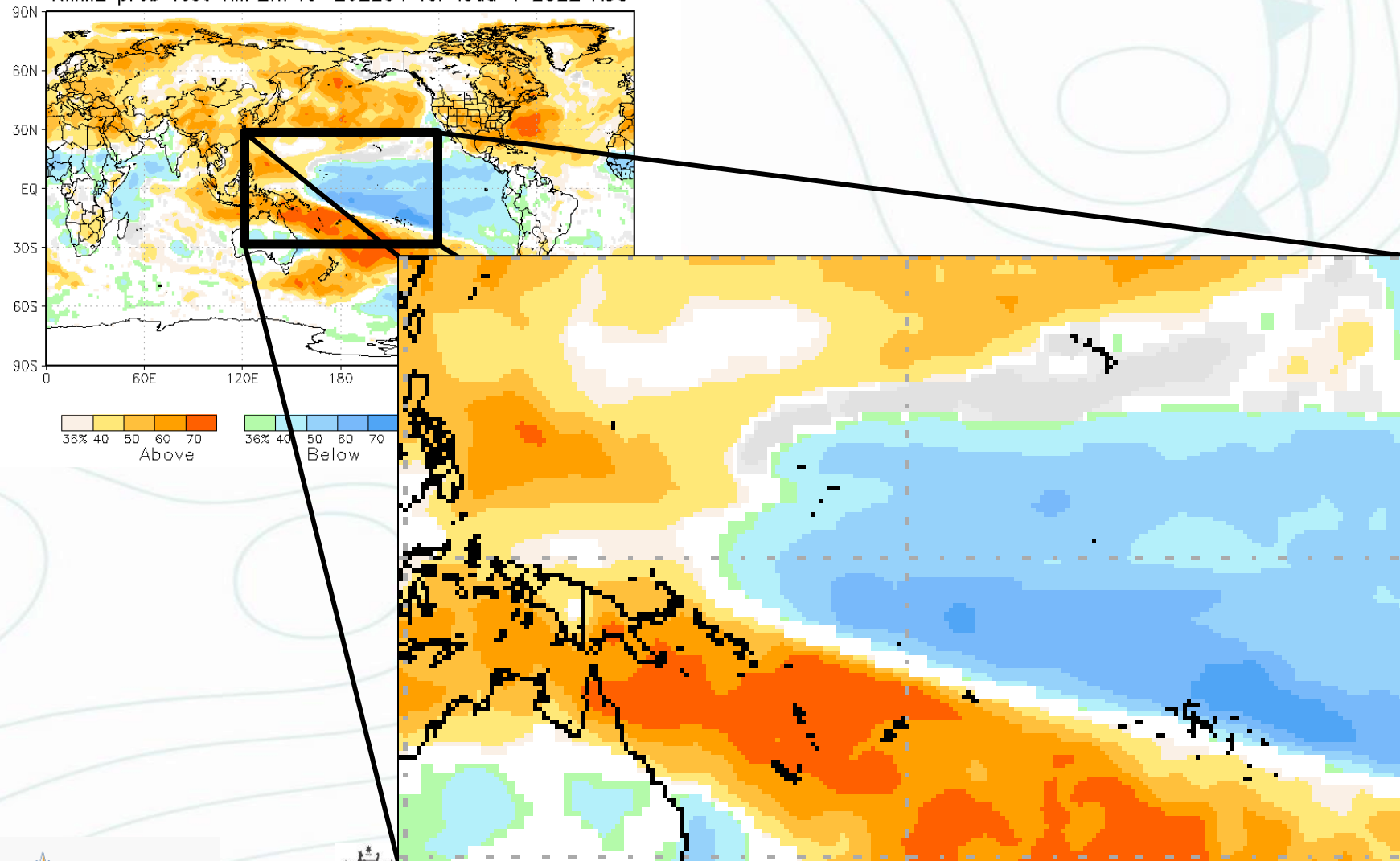




# Temperature Outlook for ASO 2022

BoM | NOAA | APCC  
ACCESS-S | NMME | PMME

NMME prob fcst TMP2m IC=202204 for lead 4 2022 ASO



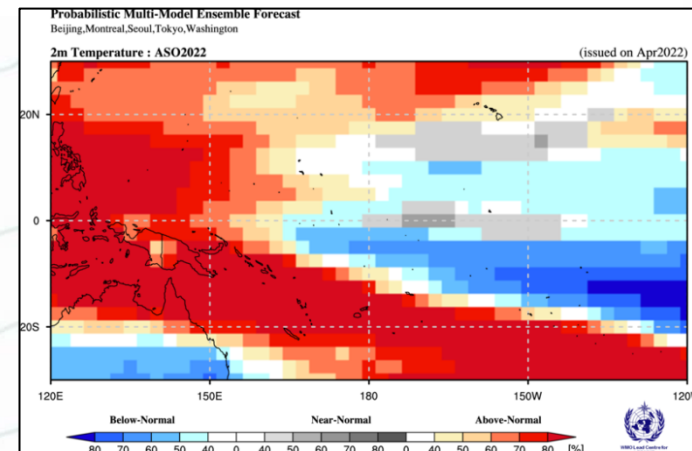
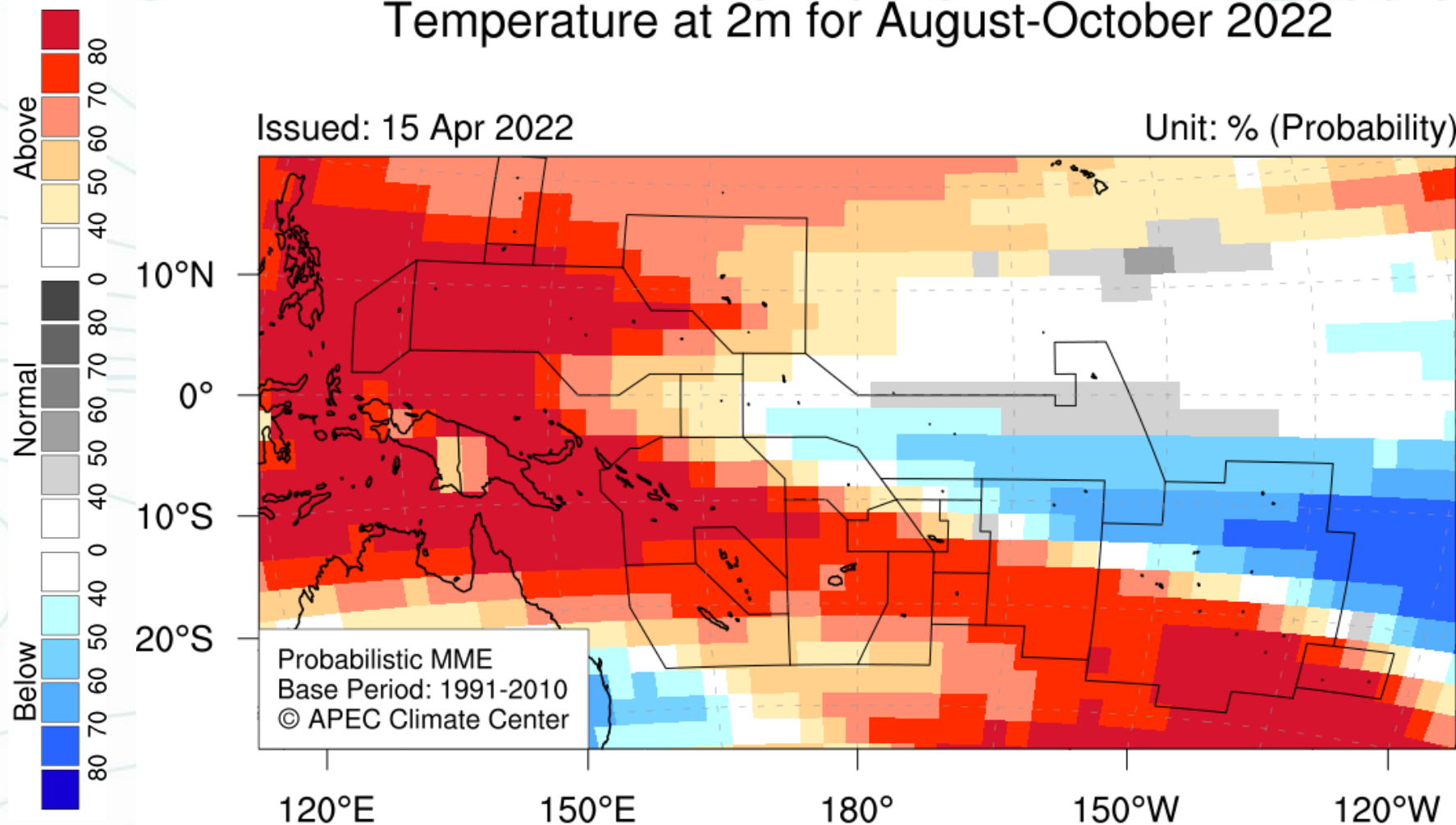
# Temperature Outlook for ASO 2022

BoM | NOAA | APCC  
ACCESS-S | NMME | PMME

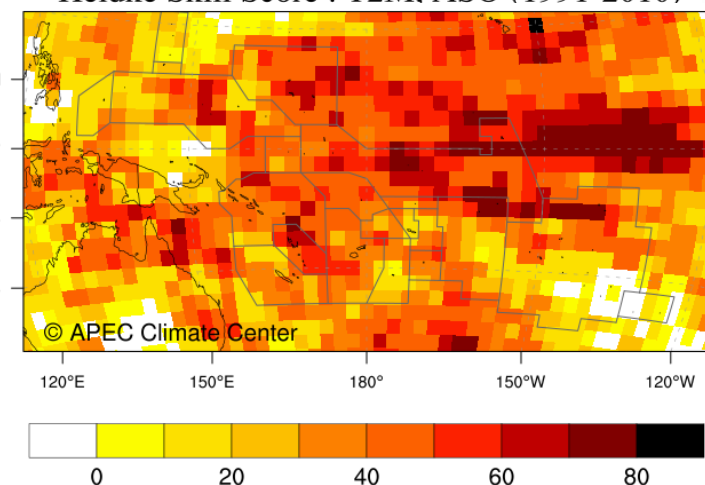
## Temperature at 2m for August-October 2022

Issued: 15 Apr 2022

Unit: % (Probability)



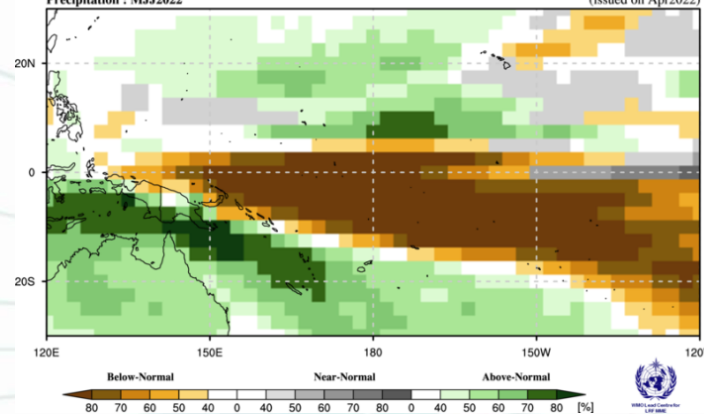
Heidke Skill Score : T2M, ASO (1991-2010)



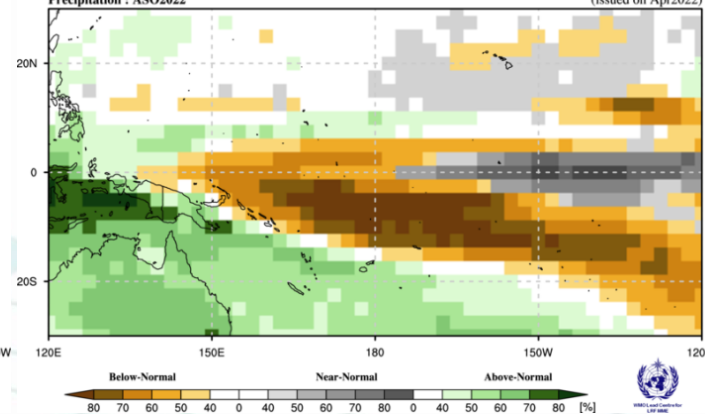


# Summary

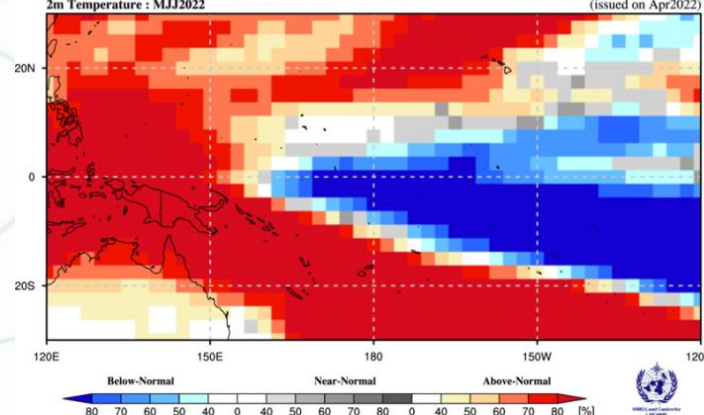
Probabilistic Multi-Model Ensemble Forecast  
Beijing,CMCC,CPTEC,ECMWF,Exeter,Melbourne,Montréal,Moscow,Offenbach,Seoul,Tokyo,Toulouse,Washington  
Precipitation : MJJ2022 (issued on Apr2022)



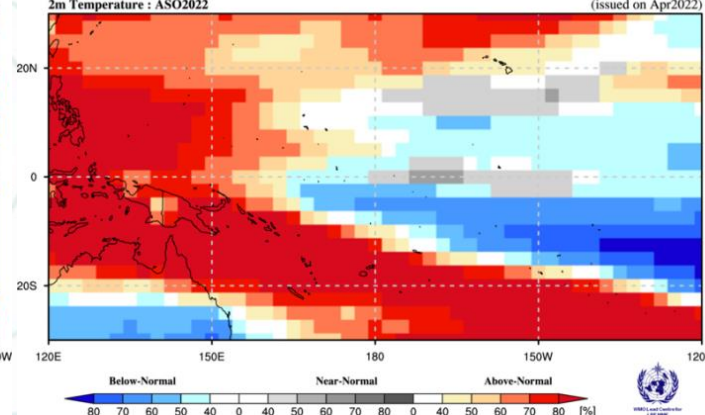
Probabilistic Multi-Model Ensemble Forecast  
Beijing,Montréal,Seoul,Tokyo,Washington  
Precipitation : ASO2022 (issued on Apr2022)



Probabilistic Multi-Model Ensemble Forecast  
Beijing,CMCC,CPTEC,ECMWF,Exeter,Melbourne,Montréal,Moscow,Offenbach,Seoul,Tokyo,Toulouse,Washington  
2m Temperature : MJJ2022 (issued on Apr2022)



Probabilistic Multi-Model Ensemble Forecast  
Beijing,Montréal,Seoul,Tokyo,Washington  
2m Temperature : ASO2022 (issued on Apr2022)



## Precipitation

- During MJJ 2022, dry conditions are expected for the Islands along the equator, and wet conditions for the off-equatorial region (>70% for southern Melanesia).
- During ASO 2022, the both probabilities are expected to weaken, whereas the chances for near normal conditions are expected to be enhanced for equatorial Polynesia.

## Temperature

- During MJJ 2022, cooler than normal conditions are expected along the equator near and east of the Dateline, and warmer than normal conditions for region extending northeast and southeast towards the subtropics (excluding MH and KI).
- During ASO 2022, the probability for below normal temperatures is expected to decrease, whereas the chances (>80%) for above normal conditions are expected to persist.