

**The seasonal outlook for East Asian winter
2018-2019 from dynamical models,
APCC MME, WMO LC LRFMME**

APEC Climate Center

Yoojin Kim

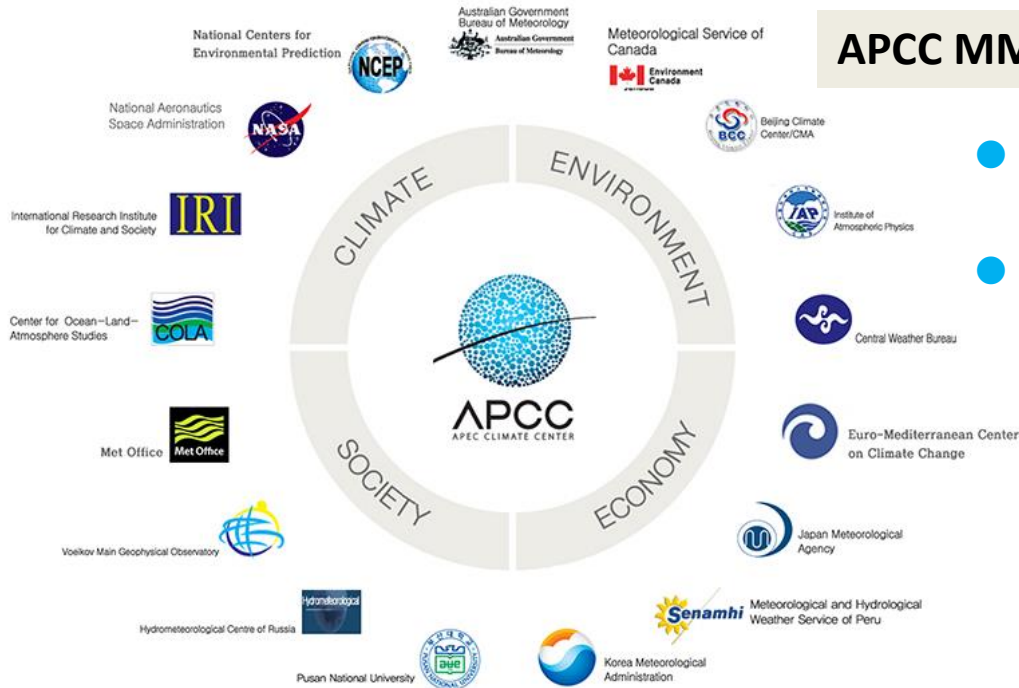


APEC Climate Center Multi Model Ensemble (APCC MME)

- 3M-lead seasonal-rolling forecast since 2005
- 3M-lead monthly-rolling forecast since 2008
- 6M-lead monthly-rolling forecast since September, 2013
- At present, **17** leading climate forecasting centers and institutes in **11** countries are participating.

APCC MME Participation Agencies

- Data collection from the 17 centers and institutes in the world
- Producing seasonal forecast & verification data by MME



APCC MME

- APCC webpage : <http://apcc21.org>

The screenshot shows the APCC MME website interface. At the top, the APCC logo and navigation links (LOGIN, CONTACT US, SITE MAP, 한국어) are visible. The main navigation menu includes Research, Climate Information Services (highlighted with an orange box), International Cooperation, Media, Notices, and About us. Below the navigation, the 'Climate Information Service' section is displayed, featuring a sidebar with a menu of options: Seasonal Forecast (with sub-items Outlook, ENSO, Verification, Forecast, Hindcast), BSISO Forecasts, Current Climate Conditions, CLIK (highlighted with an orange box), CLIPs, and ADSS (highlighted with an orange box). The main content area shows the 'Outlook' page for November 2016 to April 2017, with a search bar and a table of forecast types (Outlook, Deterministic MME Forecast, Probabilistic MME Forecast, Deterministic Forecast). The text on the page indicates a synthesis of model forecasts for November 2016 to April 2017 (NDJFMA) at the APCC, located in Busan, Korea, indicating a neutral ENSO state and positive temperature anomalies.

- ✓ **CLIK: Climate Information Tool Kit**
 - ✓ **ADSS: APEC Climate Center Data Service System**
- Download APCC MME, individual models, etc.



Lead Centre for Long Range Forecast Multi-Model Ensemble

- Data collection from the GPC's in the world
- Producing seasonal forecast & verification data by MME

WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble

Home About us News Data & Plot Related Sites WMO Lead Centre for SVSLRF

Introduction | Deterministic MME | Probabilistic MME | References

Latest Forecast data

World map showing GPC locations: Moscow, Exeter, Toulouse, Beijing, Seoul, Tokyo, Pretoria, Melbourne, Montreal, Washington, CPTC.

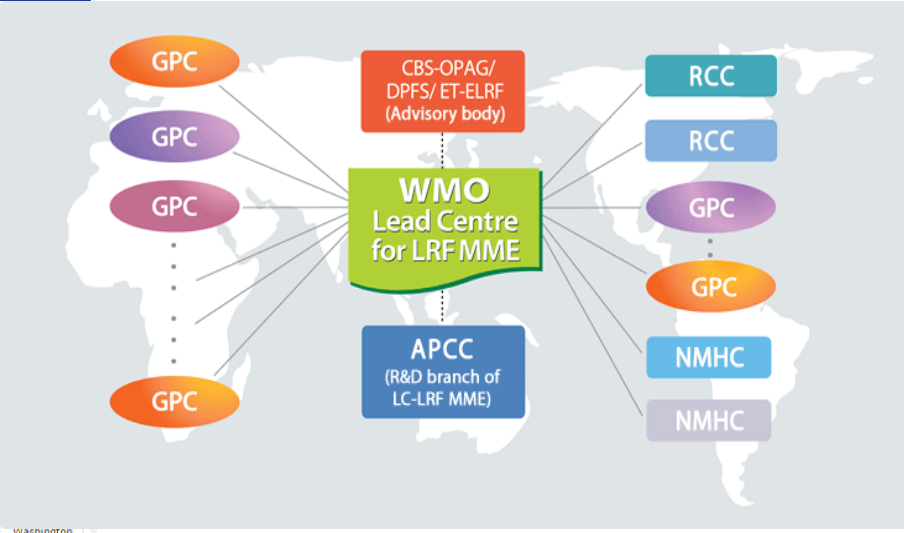
Latest PMME plot | Latest Individual Forecast plot

Notice / News

- Check! System Requirements
- All GPCs(12) for FMA 2016 are uploaded 2016.01.25
- All GPCs(12) for JFM 2016 are uploaded 2015.12.22
- All GPCs(12) for DJF 2015 are uploaded 2015.12.01
- All GPCs(12) for NDJ 2015 are uploaded 2015.10.22
- All GPCs(12) for OND 2015 are uploaded 2015.09.30

WMO Global Producing Centres

Canada	Montreal	BCC	Beijing	ECMWF	INTERNATIONAL CENTRE OF CLIMATE PREDICTION
	Seoul		Tokyo	Toulouse	Washington
	Exeter	PCAWA	Melbourne	Pretoria	CPTC





WMO Global Producing Centres (13 GPCs)



- Beijing: China Meteorological Administration (CMA)/ Beijing Climate Center (BCC)
- CPTEC: Center for Weather Forecasting and Climate Research/
National Institute for Space Research (INPE)
- ECMWF: European Centre for Medium-Range Weather Forecasts
- Exeter: Met Office, United Kingdom
- Melbourne: Bureau of Meteorology (BoM), Australia
- Montreal: Meteorological Service of Canada (MSC)
- Offenbach: Deutscher Wetterdienst

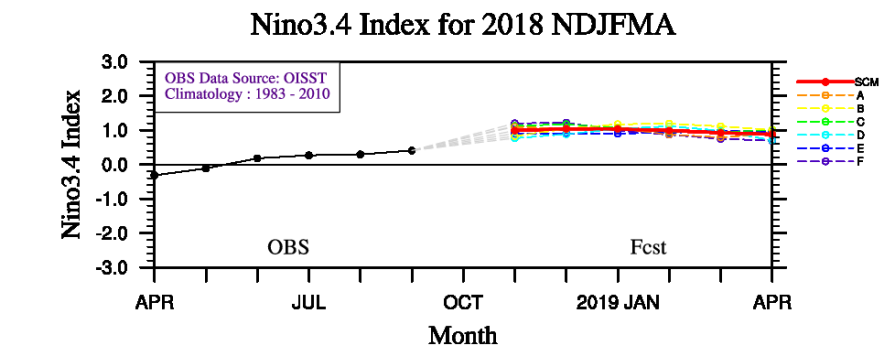
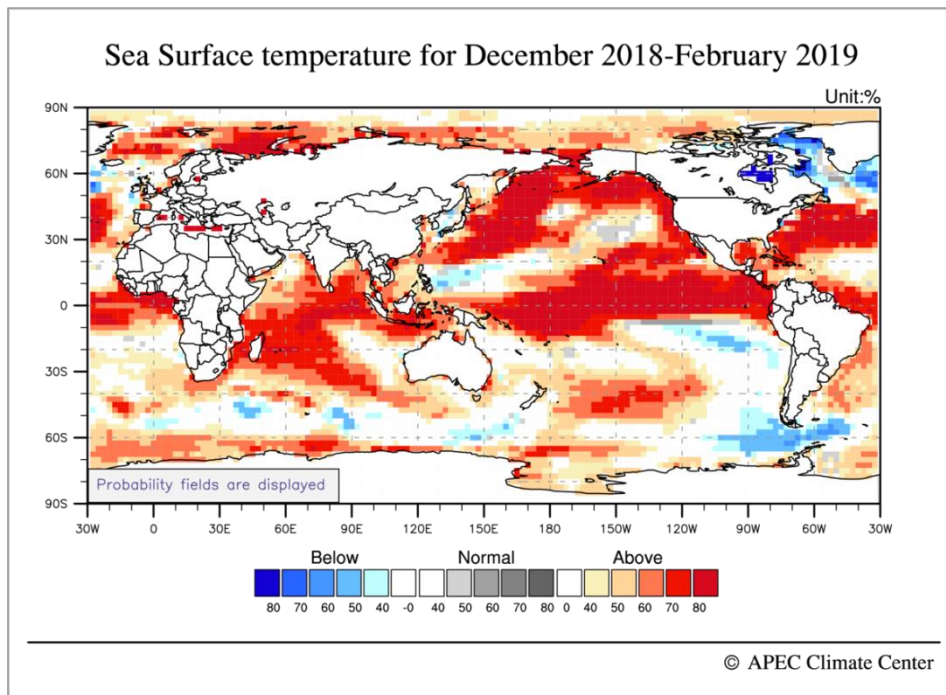
- Moscow: Hydrometeorological Centre of Russia
- Pretoria: South African Weather Services (SAWS)
- Seoul: Korea Meteorological Administration (KMA)
- Tokyo: Japan Meteorological Agency (JMA)/ Tokyo Climate Center (TCC)
- Toulouse: Météo-France
- Washington: Climate Prediction Center (CPC), National Oceanic and Atmospheric Administration, United States of America

➤ A benefit: diversity of model set, an important condition to improve the MME's forecast skill

ENSO Prediction

ENSO Prediction

- East tropical Pacific SST warming
- Around $+1^{\circ}\text{C}$ SSTA predicted for upcoming 6 months in NINO 3.4 region

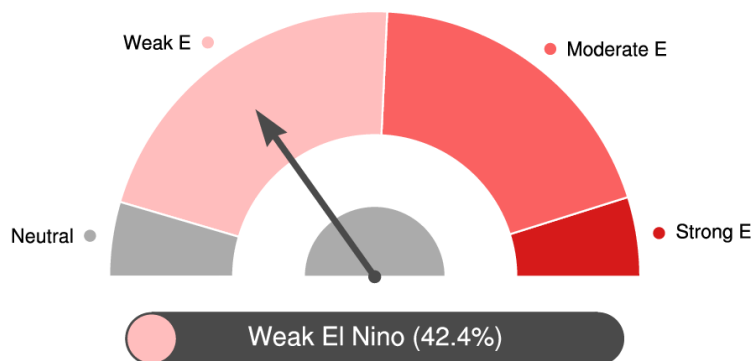


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ENSO Prediction

- Probabilistic ENSO prediction (APCC MME)
- DJF Weak El Nino

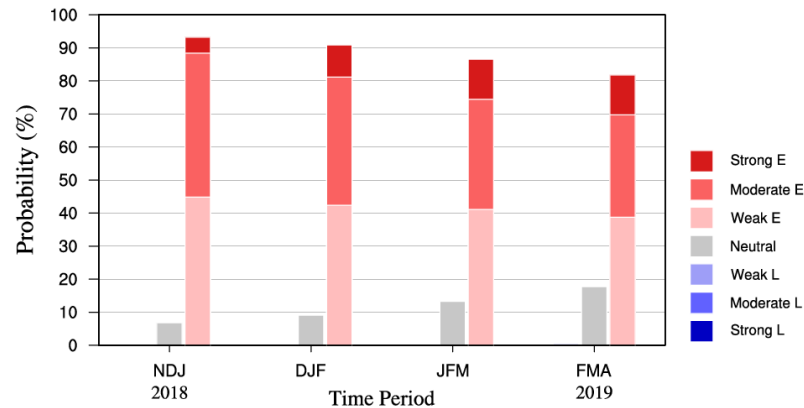
Probabilistic ENSO Forecast for DJF 2018



* ENSO Intensity based on 3M Mean Nino3.4 SST Anomaly (Category Boundries: +/-1.5, 1.0, 0.5°C)

© APEC Climate Center

Probabilistic ENSO Forecast for 2018 NDJFMA



* ENSO Intensity based on 3M Mean Nino3.4 SST Anomaly (Category Boundries: +/-1.5, 1.0, 0.5°C)

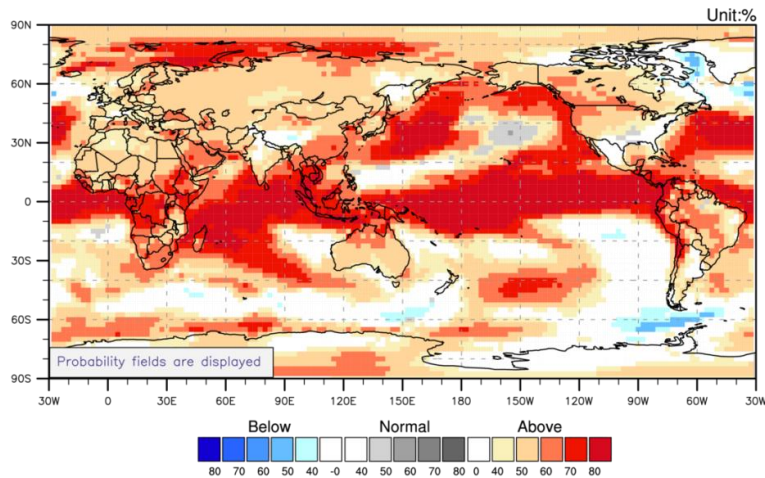
© APEC Climate Center

Global Winter Prediction

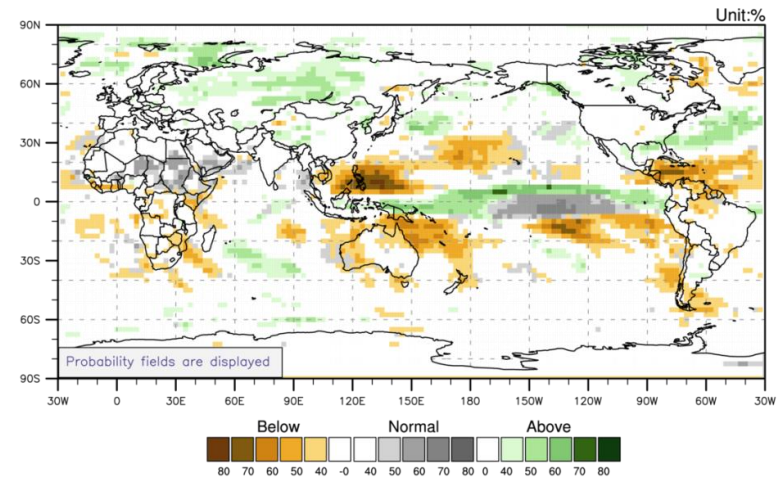


APCC MME DJF MEAN Probabilistic Prediction

Temperature at 2m for December 2018-February 2019



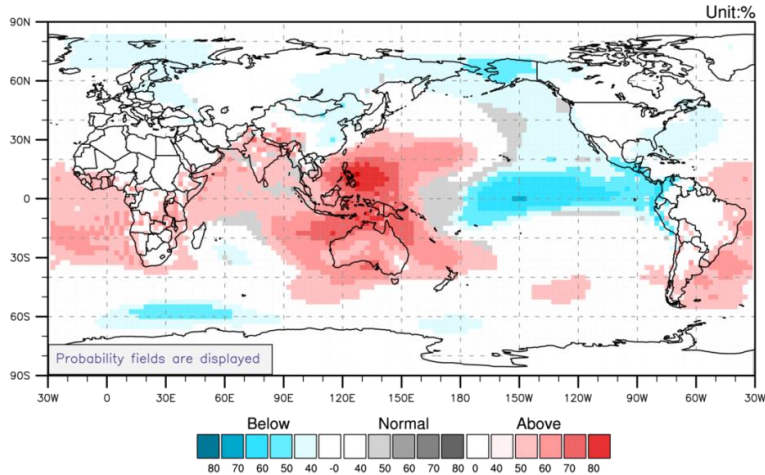
Precipitation for December 2018-February 2019



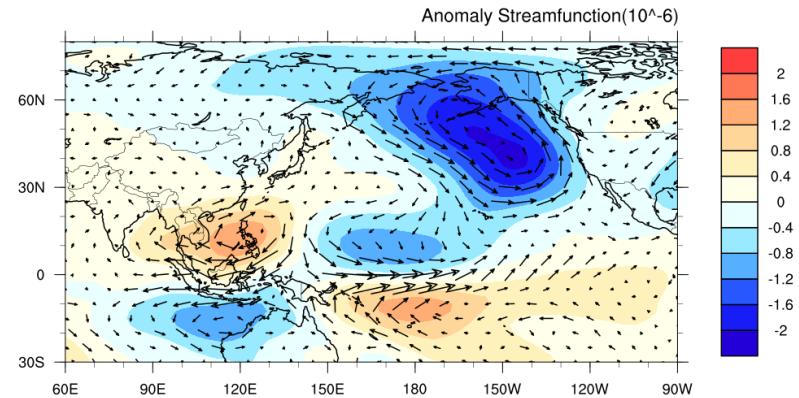
- Northern Hemisphere T2m warming, East Asia
- El Nino response warming in East Asia
- El Nino-like precipitation pattern, but not strong
- Dry western Pacific, wet-neutral eastern Pacific
- Arctic warming, circulation brings cold waves from high-latitudes

APCC MME DJF MEAN Prediction

Sea Level Pressure for December 2018-February 2019

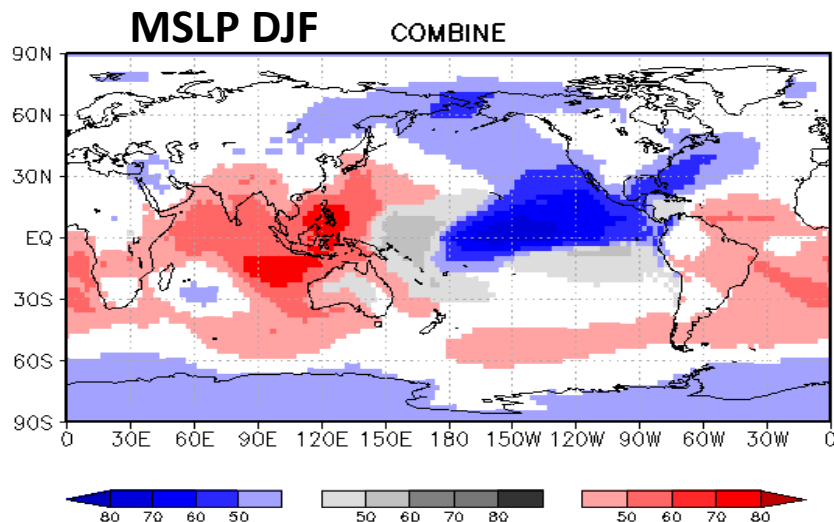
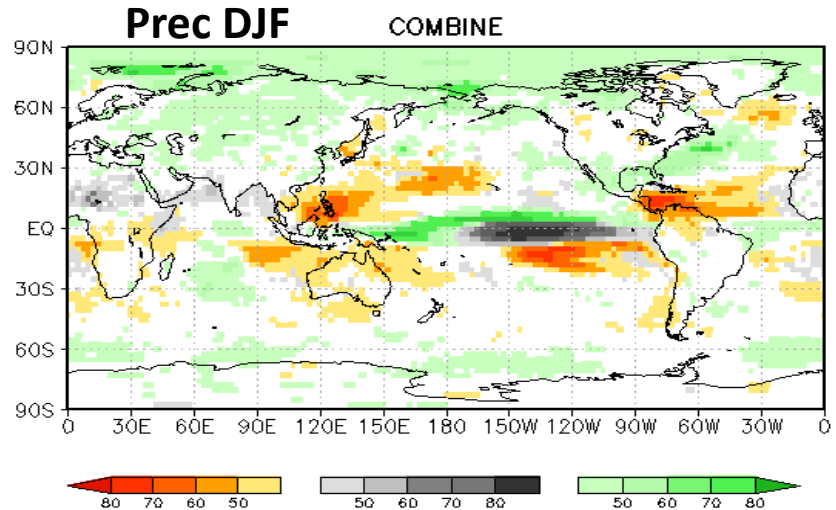
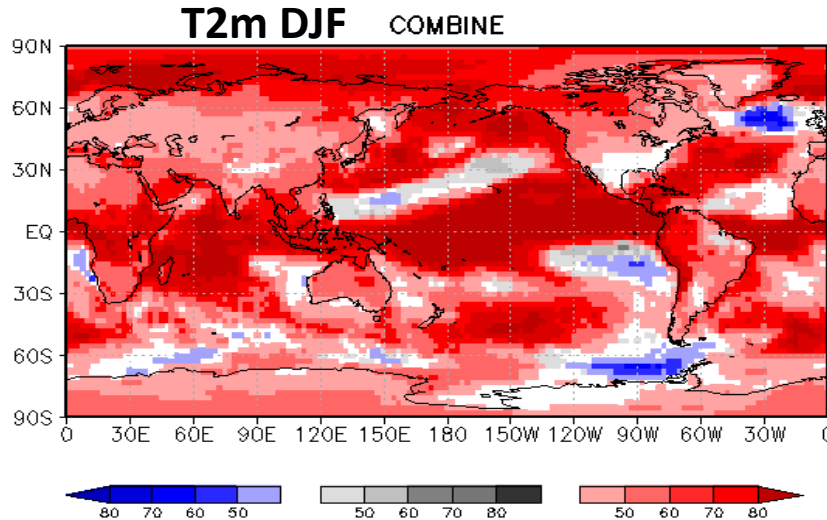


APCC MME 850 WIND DJF 2018



- El Nino like SLP pattern
- Tropical western Pacific High, eastern Pacific Low
- Anti-cyclonic circulation over western Pacific (weak El Nino response)

WMO LC LRFMME DJF MEAN Probabilistic Prediction



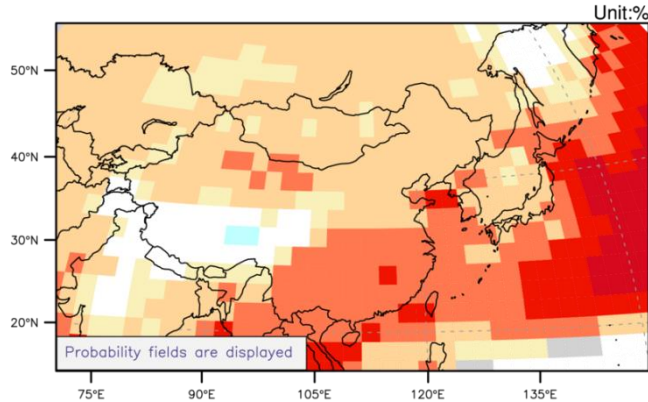
- Northern Hemisphere warming
- Sub-tropical western Pacific cooling
- Weak El Nino like precipitation, SLP pattern
- Sub-tropical western Pacific dry, High pressure
- Similar with APCC MME, generally

East Asia Winter Prediction & Verification



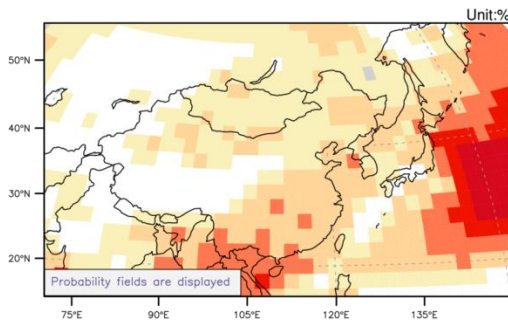
APCC MME 2m temperature

Temperature at 2m for December 2018-February 2019

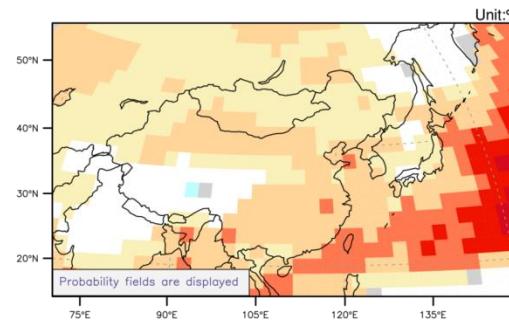


- Warming over East Asia (more than 40% models)
- Mongolia, eastern China, Korea, Japan warming, except the west southern part of China
- Warmer FEB, roughly

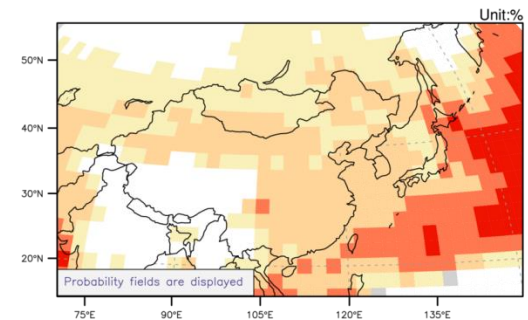
Temperature at 2m for DEC 2018



Temperature at 2m for JAN 2019



Temperature at 2m for FEB 2019



Heidke Skill Score (HSS)

- $Skill = (score\ value - score\ for\ the\ standard\ forecast) / (perfect\ score - score\ for\ the\ standard\ forecast)$
- For the HSS, the "score" is the number correct or the proportion correct. The "standard forecast" is usually the number correct by chance or the proportion correct by chance. Thus using the proportion correct,

$$HSS = \{(a+d)/n - [(a+b)(a+c) + (b+d)(c+d)]/n^2\} / \{1 - [(a+b)(a+c) + (b+d)(c+d)]/n^2\}$$

- This can be simplified into,

$$HSS = \frac{ad - bc}{((a+c) \cdot (c+d) + (a+b) \cdot (b+d)) / 2}$$

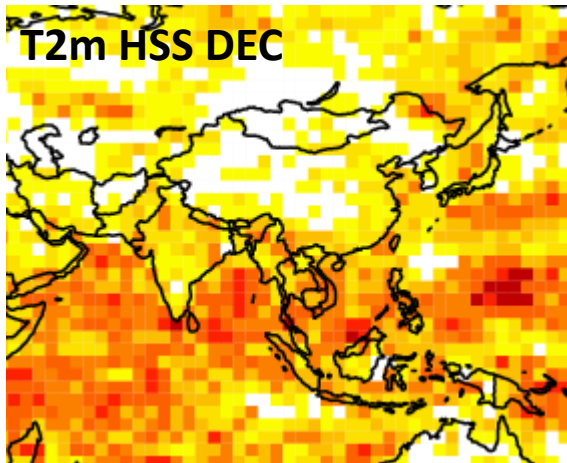
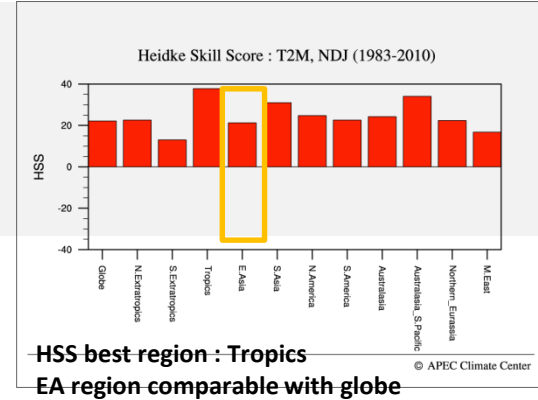
$$-\infty < HSS \leq 1, \quad HSS \leq 0 \text{ no skill}$$

$$HSS > 0 \text{ skillfull}$$

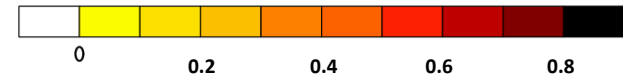
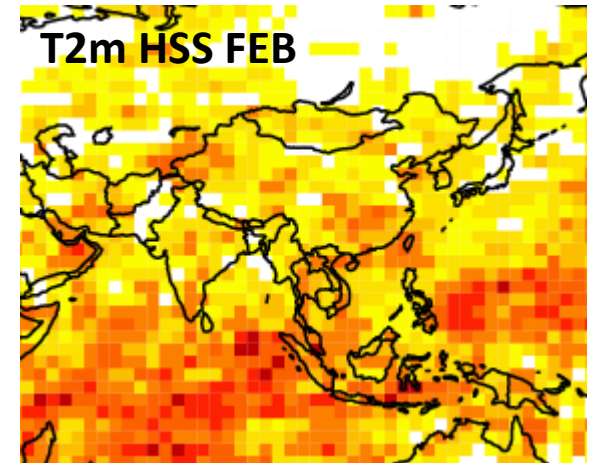
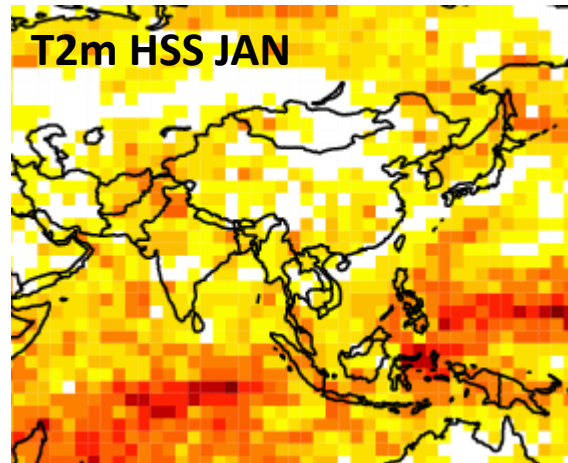
		Observation		
		yes	no	
Forecast	yes	<i>a</i> : hits	<i>b</i> : false alarms	<i>a+b</i> : yes fcsts
	no	<i>c</i> : misses	<i>d</i> : correct rejection	<i>c+d</i> : no fcsts
		<i>a+c</i> : yes obsvd	<i>b+d</i> : no obsvd	<i>N</i> : Total forecasts
		Marginal of Obs		Marginal of Fcst

APCC MME 2m temperature

● Forecast skill (HSS)

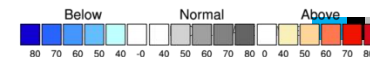
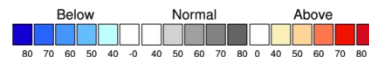
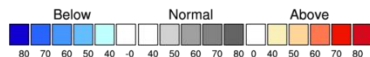
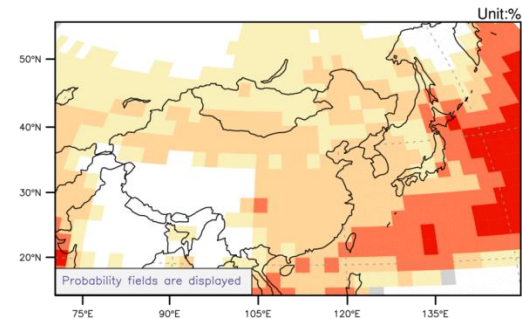
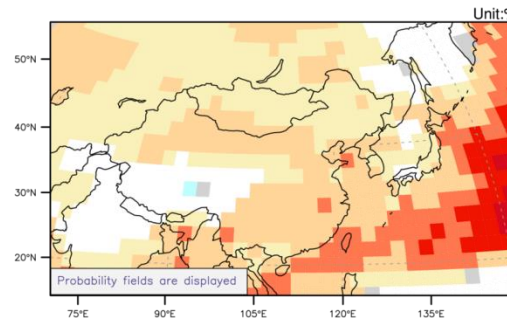
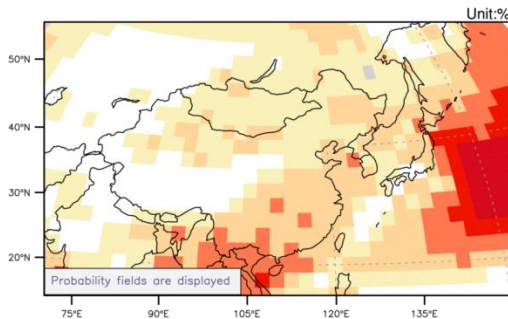


Best skill Tropics, Ocean
No skill China land in DEC, but skilfull in FEB
DEC Arctic contribution to EA is not predictable
Temperature at 2m for DEC 2018



Temperature at 2m for JAN 2019

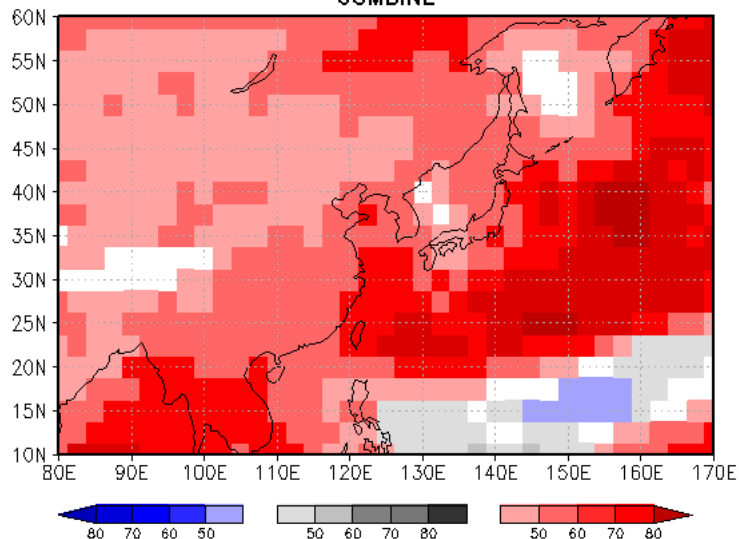
Temperature at 2m for FEB 2019



WMO LC 2m temperature

DJF T2m

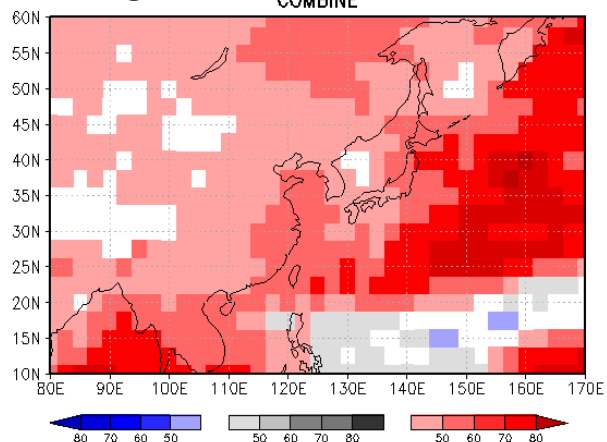
beijing/cpctec/ecmwf/exeter/melbourne/m
COMBINE



- Similar with those from APCC MME
- Warm East Asia
- Cold sub-tropical western Pacific
- Warmer FEB, roughly

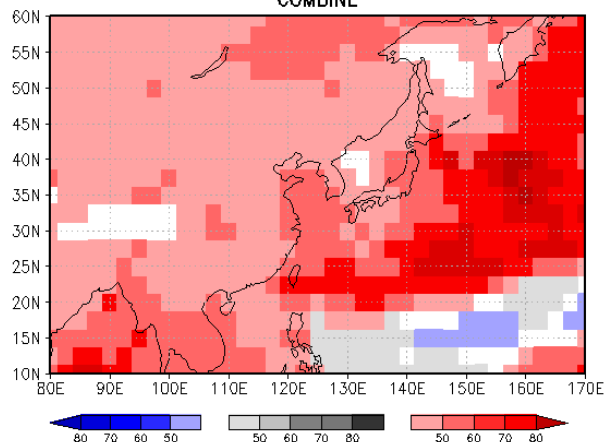
DEC T2m

beijing/cpctec/ecmwf/exeter/melbour
COMBINE



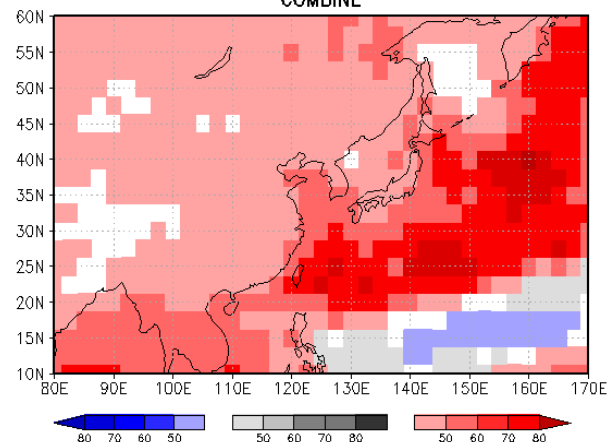
JAN T2m

beijing/cpctec/ecmwf/exeter/melbour
COMBINE



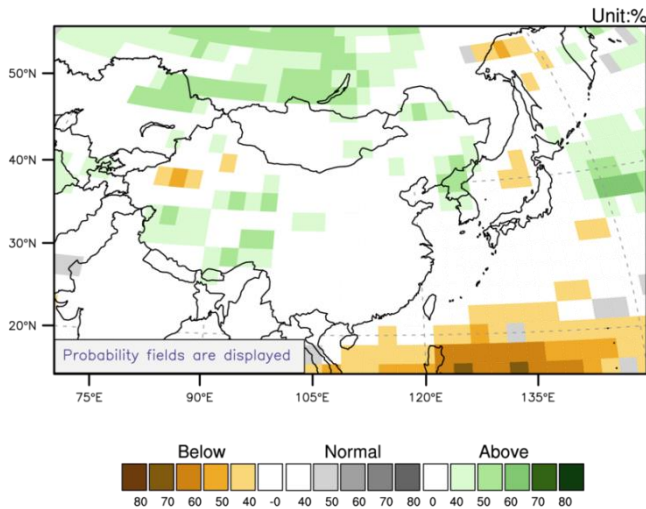
FEB T2m

beijing/cpctec/ecmwf/exeter/melbourne/m
COMBINE



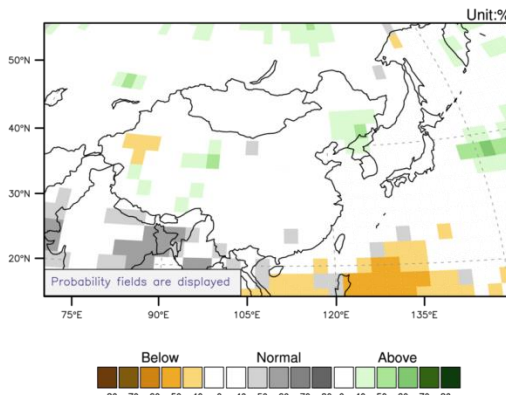
APCC MME Precipitation

Precipitation for December 2018-February 2019

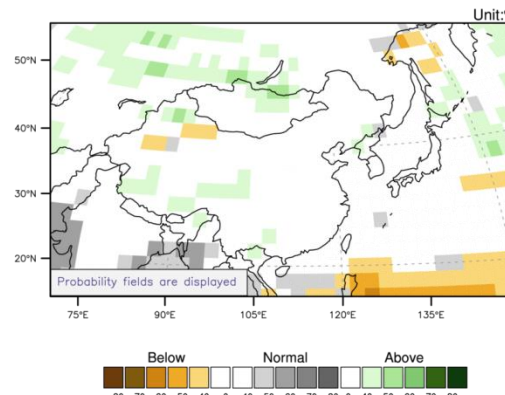


- Dry over sub-tropical western Pacific
- Anti-cyclonic circulation in western Pacific, El Nino
- Wet in some part of western China, North Korea, north eastern China
- Wetter Dec, Drier Feb

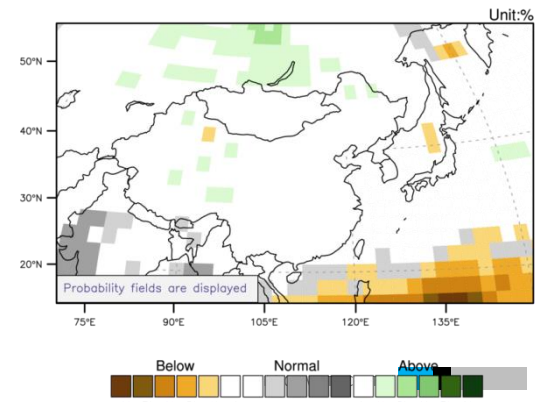
Precipitation for DEC 2018



Precipitation for JAN 2019

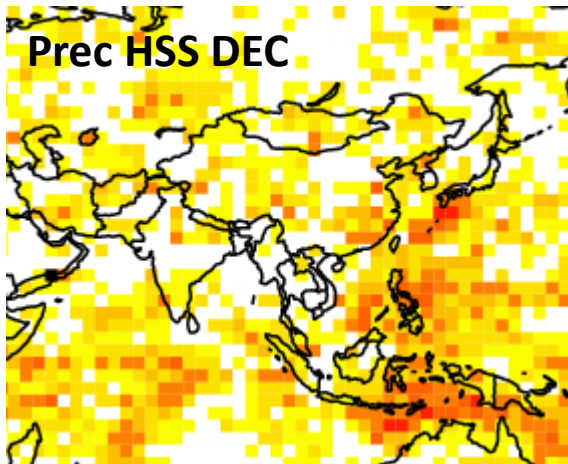
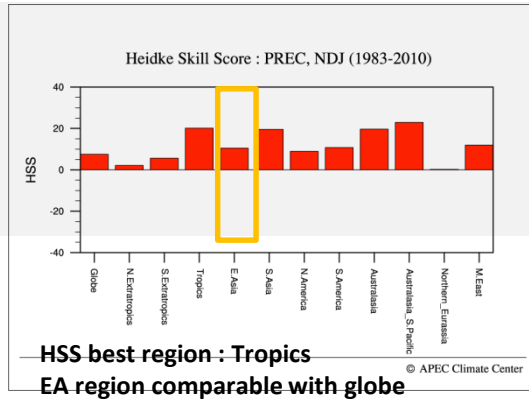


Precipitation for FEB 2019

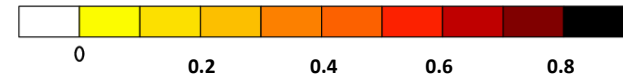
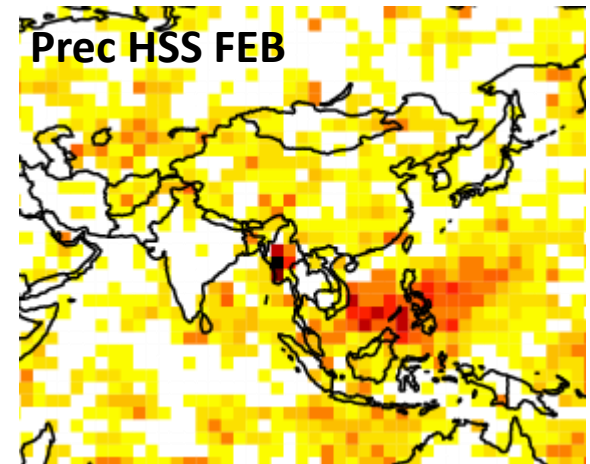
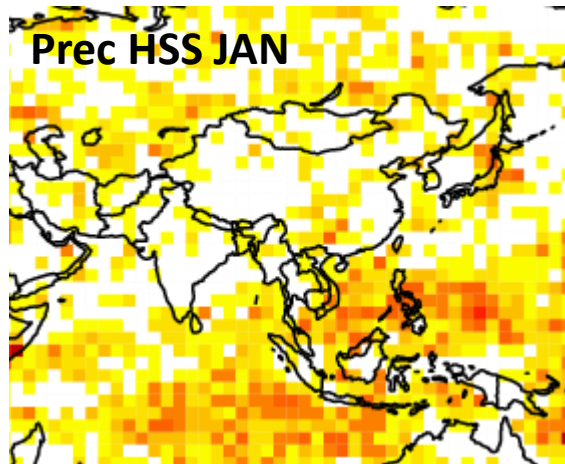


APCC MME Precipitation

Forecast skill (HSS)

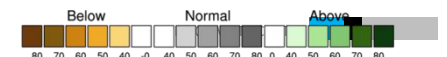
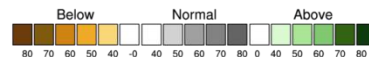
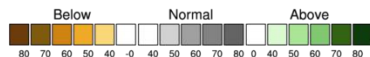
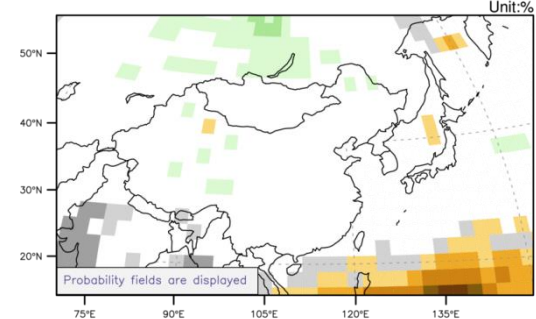
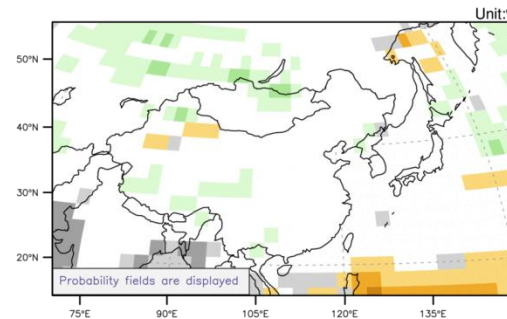
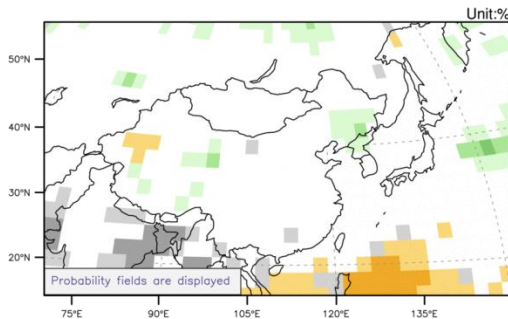


Poor than temperature
Best skill Tropics/Sub-tropics, Ocean
No skill China land in JAN but good in DEC, FEB
Precipitation for DEC 2018



Precipitation for JAN 2019

Precipitation for FEB 2019

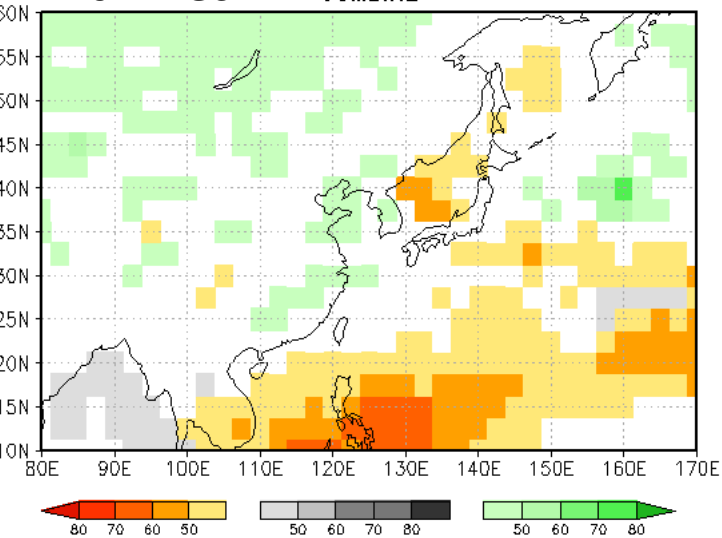


WMO LC Precipitation

- Similar with those from APCC MME
- Dry over sub-tropical western Pacific
- El Nino like circulation pattern in western Pacific
- Wet in some part of western China, Korea, eastern China
- DEC wetter, FEB drier

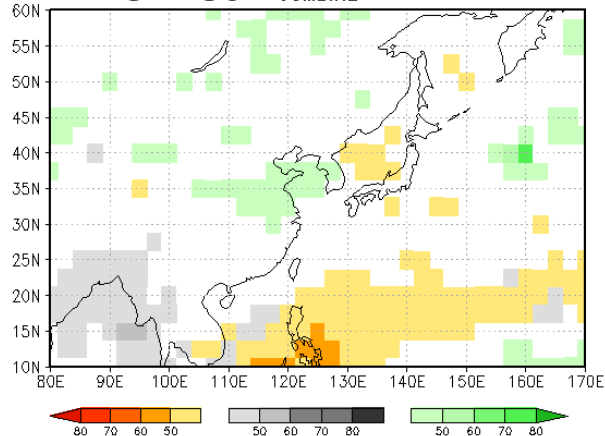
DJF Prec

beijing/cptec/ecmwf/exeter/melbourne/r



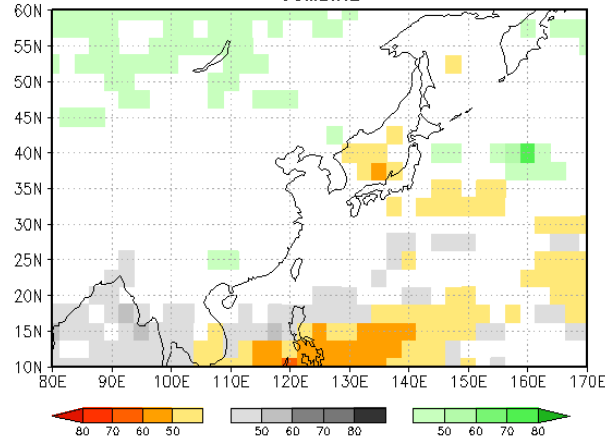
DEC Prec

beijing/cptec/ecmwf/exeter/melbourne/r



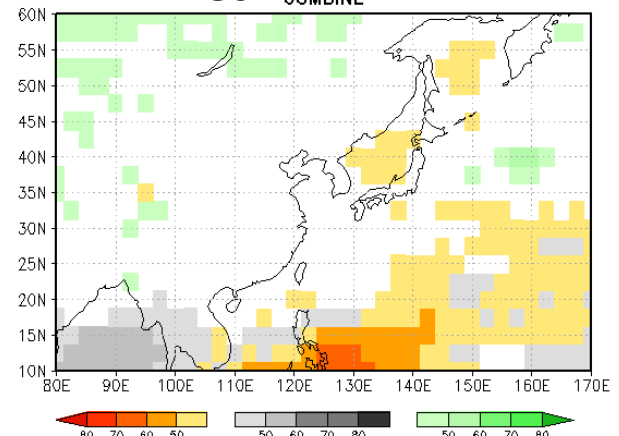
JAN Prec

beijing/cptec/ecmwf/exeter/melbourne/r



FEB Prec

beijing/cptec/ecmwf/exeter/melbourne/r



Summary

- **ENSO**
 - DJF weak El Nino
 - Dry sub-tropical western Pacific, Neutral-wet tropical eastern Pacific
- **T2m**
 - East Asia warming (Mongolia, China except west southern part, Korea, Japan)
 - El Nino response
 - Consistent warming DJF, slight warmer February
 - Be careful the Arctic warming
- **Precipitation**
 - Dry sub-tropical western Pacific, Wet some part of western China, North Korea, north eastern China
 - El Nino response
 - Consistent dry in sub-tropical western Pacific; slight drier FEB

Thank You

