Seasonal Prediction for DJF 2019

Simulated with 2-way nesting ICON model

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Model configurations: ICON to GME comparison

| GME	ICON
Hydrostatic, Arakawa A	**Non-hydrostatic**, Arakawa C
Pressure-based vertical grid, TOA 35km	Hybrid z-based, TOA ca. 75km
Flat-MPI parallelization	Hybrid MPI-OpenMP

- **Computing resources**: CRAY XC40

- **Compiler**: CCE v8.3.7

- **Horizontal resolution**:

    i) Medium-range = R2B7 (20 km)

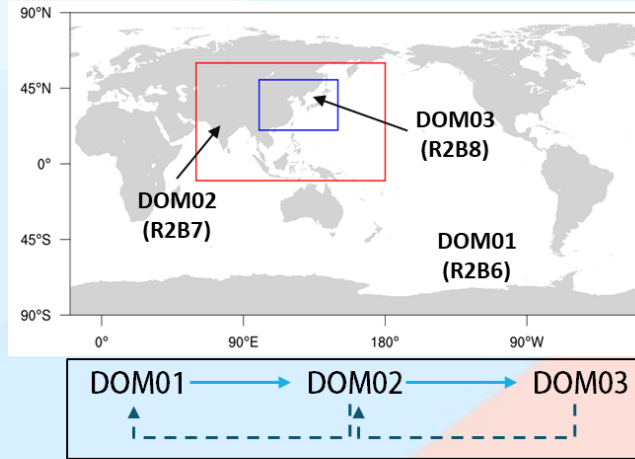   ii) Seasonal prediction = R2B6 (40 km)
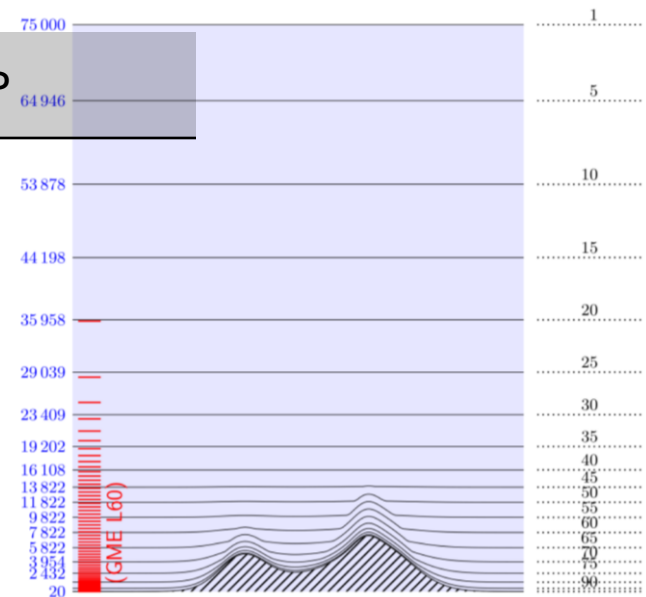
Vertical grid in ICON and GME

Grid Nesting Structure
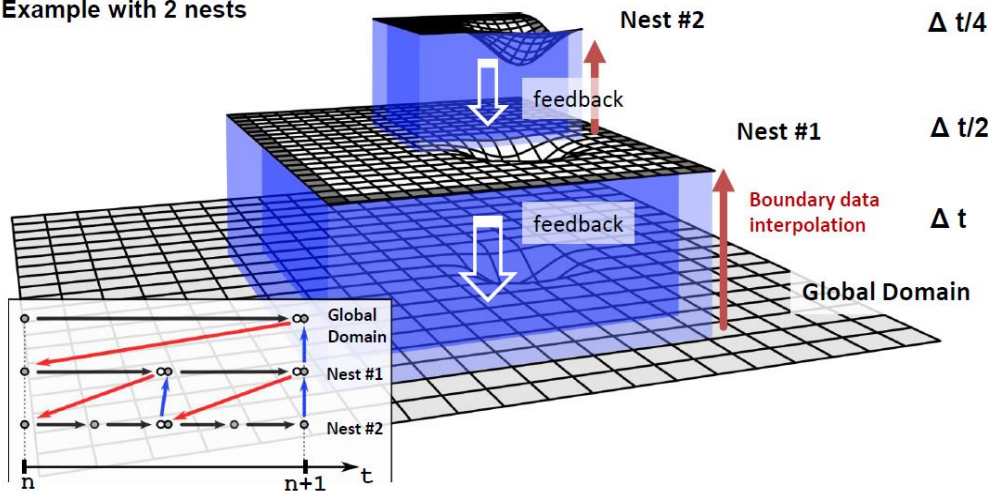
- Globe 40 km - Asia 20 km - East Asia 10 km
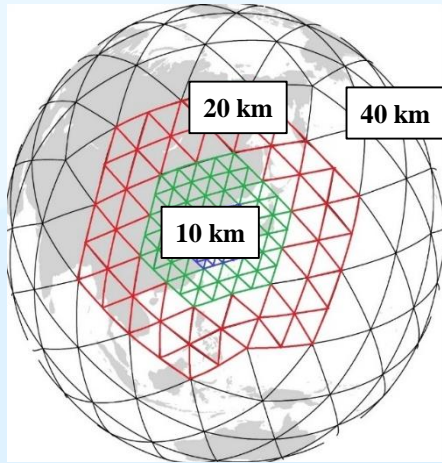
▲ An example of grid nesting structure

▲ Domain composition for seasonal prediction

Horizontal resolution spec.
R2B6 : 40km / **R2B7** : 20km / **R2B8** : 10km

- **Model domains** with various resolutions are **processed sequentially with boundary interpolation and feedback**,

- **Latter overwriting** what has already been computed in the coarse domain.

2-way Nesting Prediction designs

Medium-range (≤ 10-days) 20-10-5-2.5 km

IFS analysis

SST and sea ice fraction are read from the analysis and kept constant.

10-day forecasts

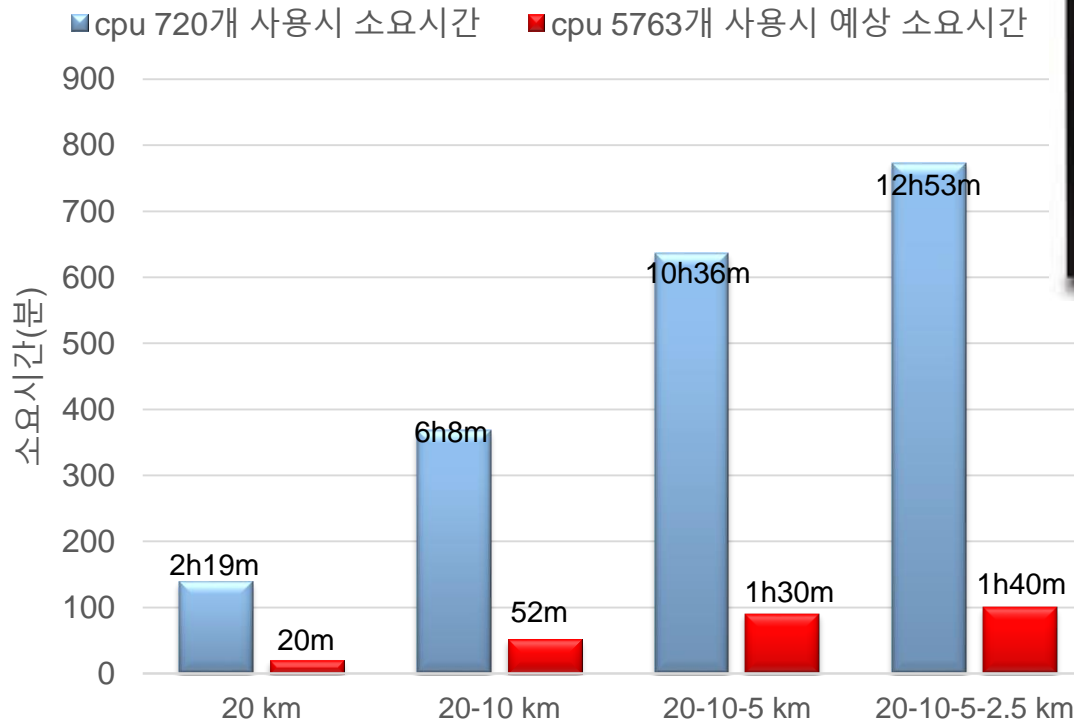**Long-term (≥ 3-months) 40-20-10 km**

IFS analysis

SST and sea ice fraction are updated daily, based on **actual monthly means**

Seasonal prediction & AMIP simulation

# Required Computing Resources for the 2-way nesting ICON model

**Required Computing Resources by domain
with the KMA's URI system**

Legend: ■ cpu 720개 사용시 소요시간   ■ cpu 5763개 사용시 예상 소요시간

Y-axis: 소요시간(분)

Chart values:
- 20 km: 2h19m (blue), 20m (red)
- 20-10 km: 6h8m (blue), 52m (red)
- 20-10-5 km: 10h36m (blue), 1h30m (red)
- 20-10-5-2.5 km: 12h53m (blue), 1h40m (red)

Output Size

Domain Field	20 km domain	10 km domain	5 km domain	2.5 km domain
Surface	28GB	15GB	11GB	3GB
Pressure (7levels)	37GB	19GB	14GB	4GB
Total size of each domain	65GB	34GB	25GB	7GB
TOTAL	131GB			

Typhoon Chaba (2016)

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CHABA
994hPa

2016-09-28 03h
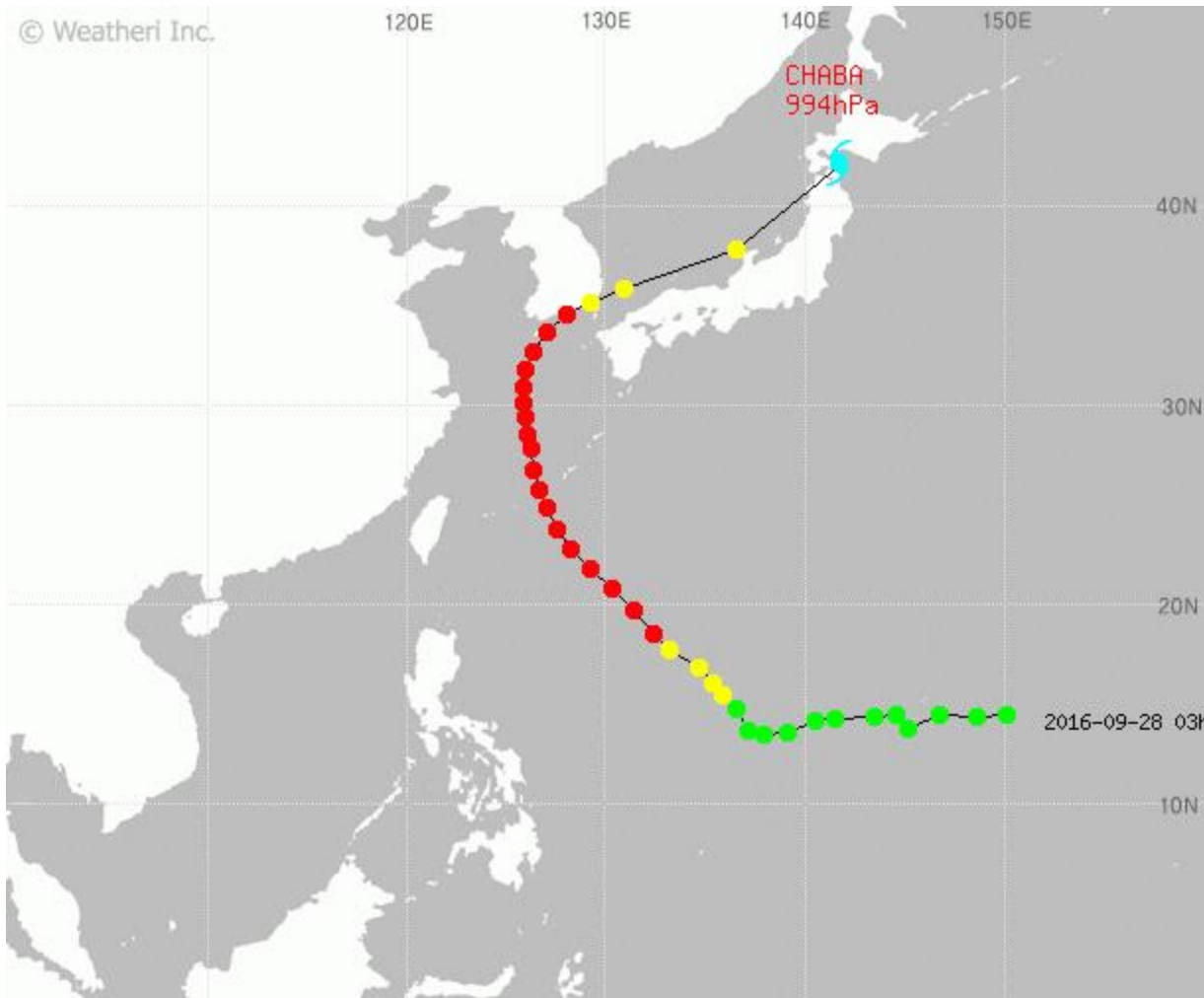
Typhoon Chaba (Igme)

Typhoon (JMA scale)

Category 5 super typhoon (SSHWS)

Typhoon Chaba at peak intensity on October 3, observed from the International Space Station

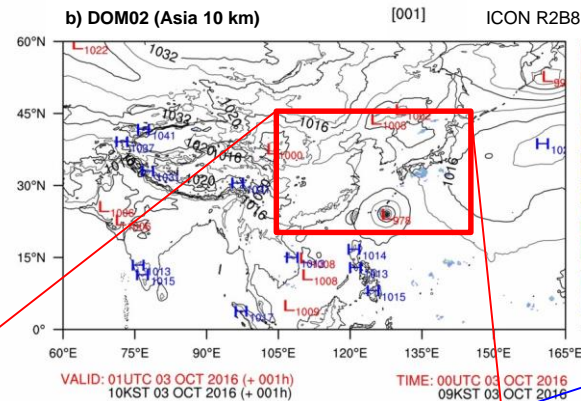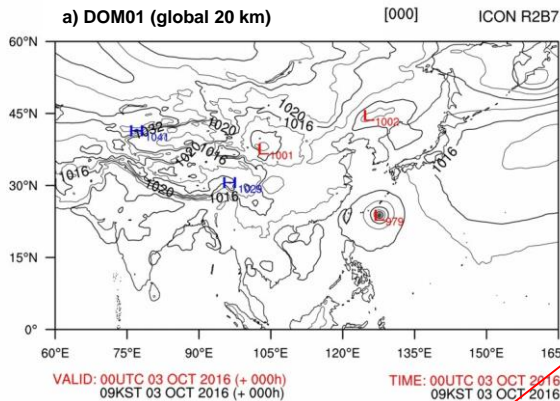|	
Formed	September 24, 2016
Dissipated	October 7, 2016
	(Extratropical after October 5)
Highest winds	*10-minute sustained:*
	215 km/h (130 mph)
	1-minute sustained:
	280 km/h (175 mph)
Lowest pressure	905 hPa (mbar); 26.72 inHg
Fatalities	10 total
Damage	$18.3 million (2016 USD)
Areas affected	Mariana Islands, South Korea, Japan, Russian Far East
Part of the 2016 Pacific typhoon season	

Typhoon Chaba (2016. 10)

18호 태풍 '차바' 진로도

Typhoon Chaba (2016. 10)

MSLP [hPa] and Total Precipitation [mm/3h]

a) DOM01 (global 20 km) — ICON R2B7
VALID: 00UTC 03 OCT 2016 (+ 000h)
09KST 03 OCT 2016 (+ 000h)
TIME: 00UTC 03 OCT 2016
09KST 03 OCT 2016

b) DOM02 (Asia 10 km) — ICON R2B8
VALID: 01UTC 03 OCT 2016 (+ 001h)
10KST 03 OCT 2016 (+ 001h)
TIME: 00UTC 03 OCT 2016
09KST 03 OCT 2016

b) DOM03 (Korea 5 km) — ICON R2B9
VALID: 01UTC 03 OCT 2016 (+ 001h)
10KST 03 OCT 2016 (+ 001h)
TIME: 00UTC 03 OCT 2016
09KST 03 OCT 2016

d) DOM04 (Korea 2.5 km) — ICON R2B10
VALID: 01UTC 03 OCT 2016 (+ 001h)
10KST 03 OCT 2016 (+ 001h)
TIME: 00UTC 03 OCT 2016
09KST 03 OCT 2016

Domain	Maximum value of precipitation [mm/h]
DOM01	73.8
DOM02	84.8
DOM03	121.96
DOM04	**156.9**
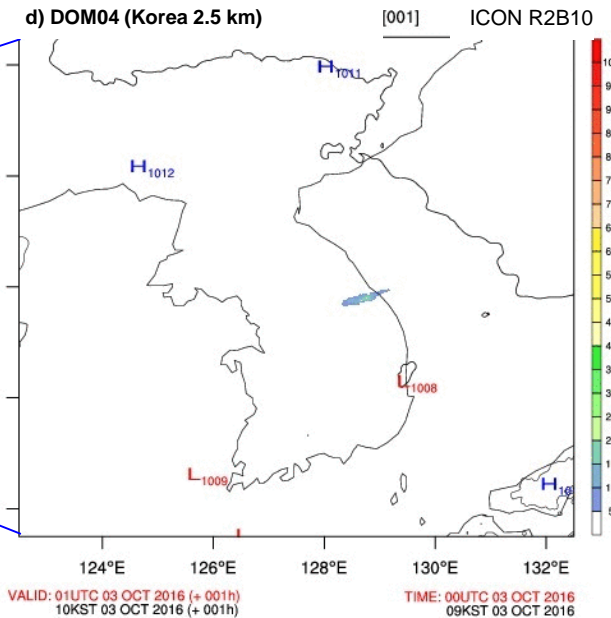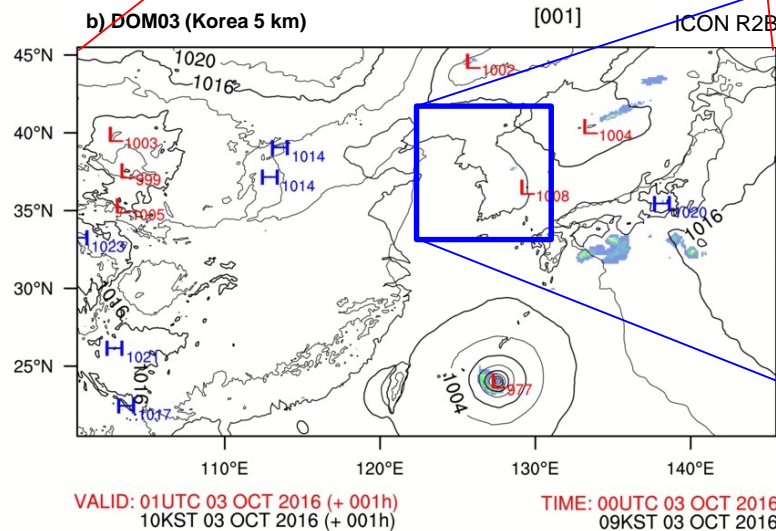
Preparation of Seasonal Prediction for Winter, 2019

- Initial Condition   ECMWF Operational Analysis data (2018.10.11.~10.20.)

- Boundary Condition   NOAA OI Monthly Global SST data (2018.10.05.~10.11.)
  ECMWF Operational Analysis data for Sea ice (2018.10.03.)

- Model   ICOsahedral Non-hydrostatic (ICON) MODEL

- Vertical & Horizontal   2-way nesting :
  Resolution   Globe 40 km – Asia 20 km – Korea 10 km /90 layers

- Integration period   From 2018.10.11 to 2019.02.28

- Method for Seasonal   Time-lag Method
  Prediction   - Prediction run with daily SST forcing (10 Ensemble members)

  AMIP-type Present-day run
       - Climatology run during 1979~2008 (30years)

- Presented Variables   850hPa Temperature, Precipitation

Boundary Condition

SST Anomaly of DJF, 2019 [Present SST – Climatology SST]
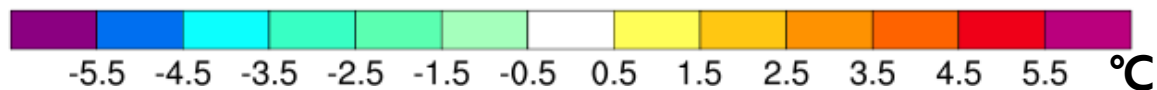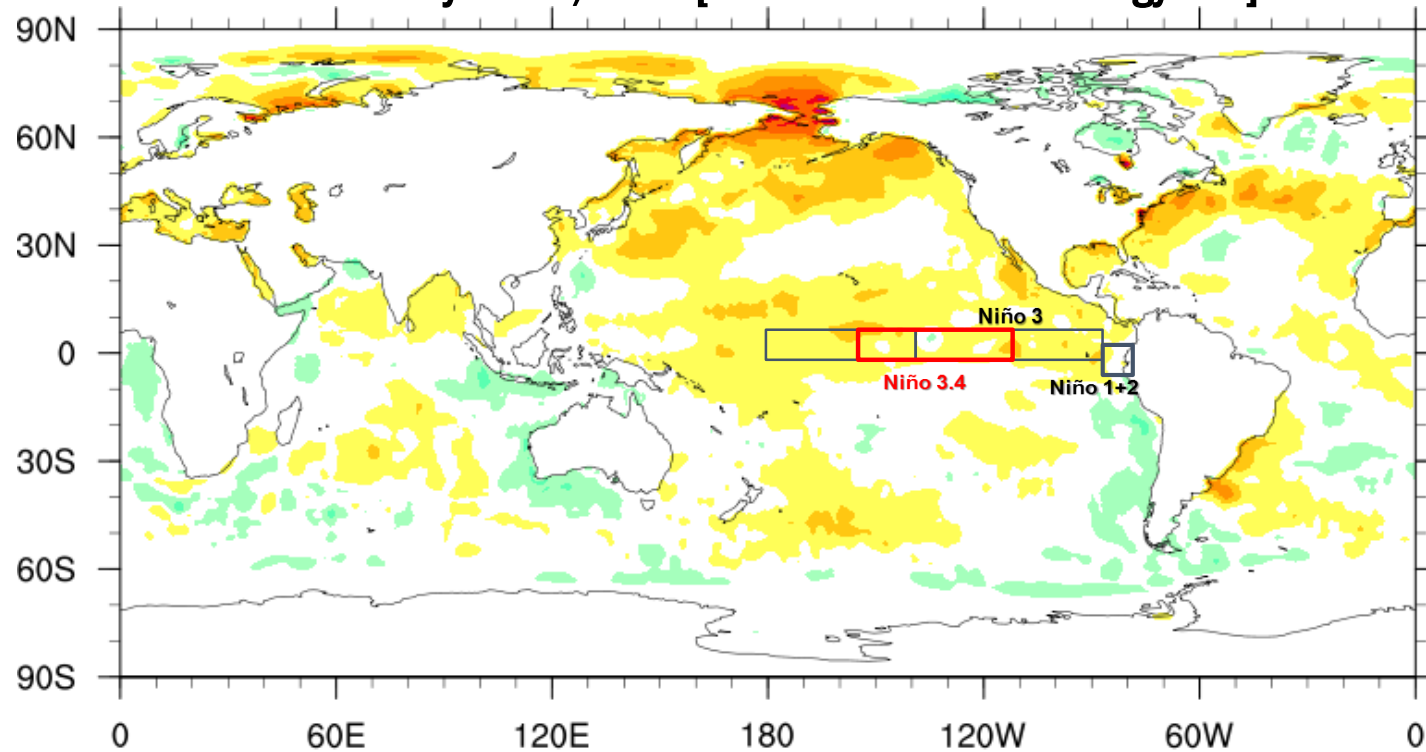
- Present SST : NOAA OI Weekly SST centered on Wednesday (SEP. 30 ~ OCT. 6, 2018)
- Climatology SST : NOAA OI Average year SST (1971~2000)

Boundary Condition

Sea-ice Anomaly of DJF, 2019 [Present SIC – Climatology SIC]

— climatology

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
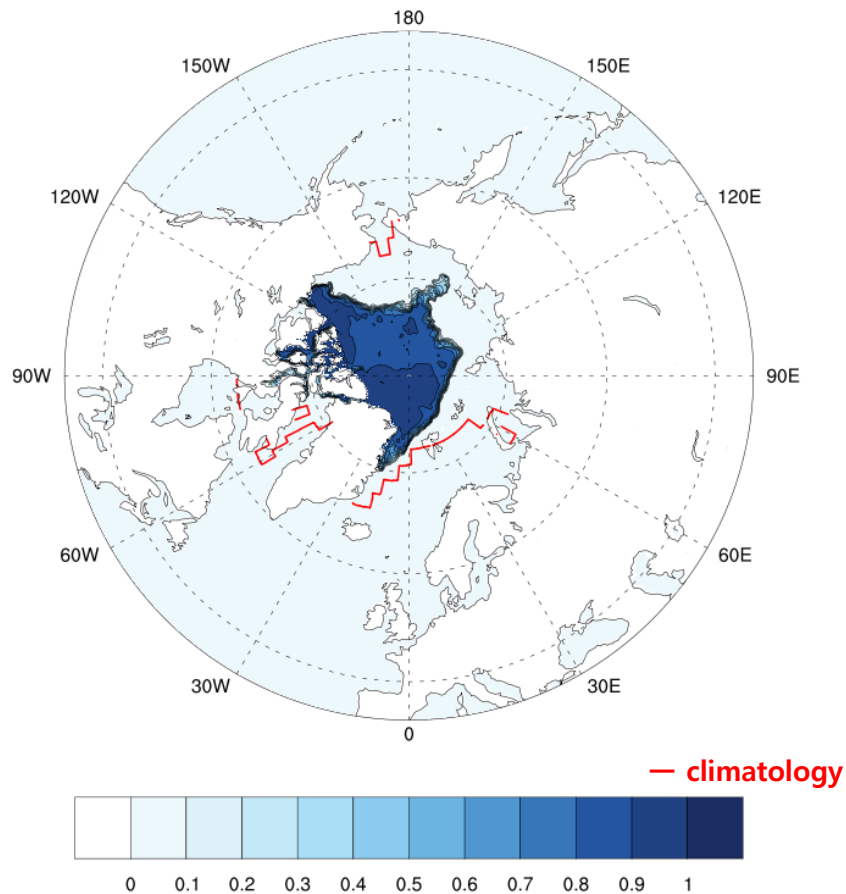
- Present Sea Ice : ECMWF Sea Ice (OCT. 03, 2018)
- Climatology Sea Ice : ERA-40 Average year Sea Ice (1971~2000)

DJF 2019 outlook – MSLP/500hPa GPH Anomaly
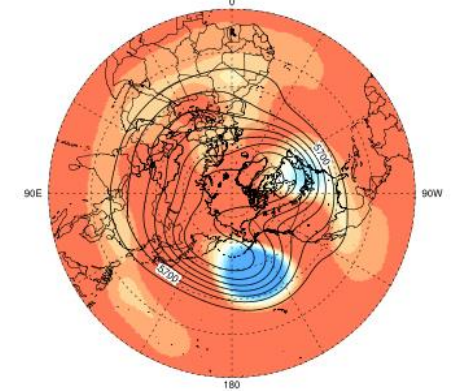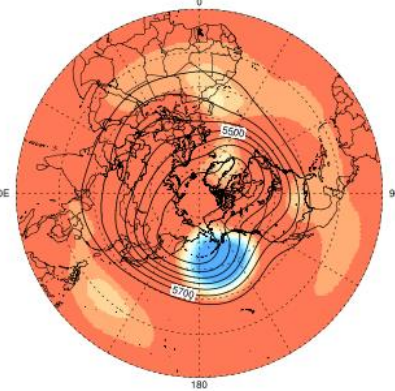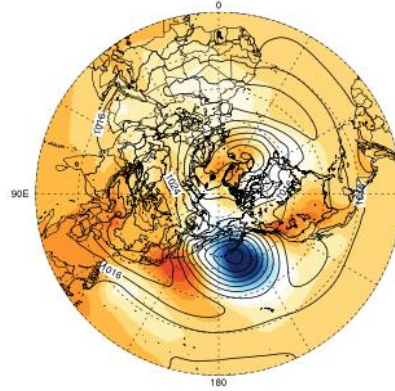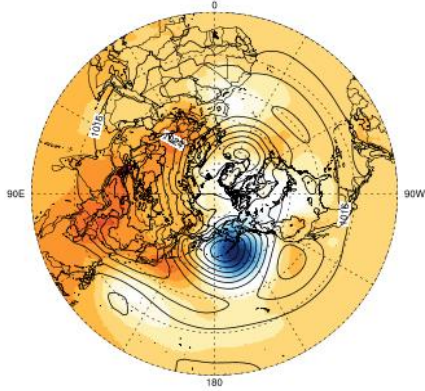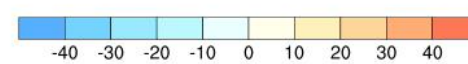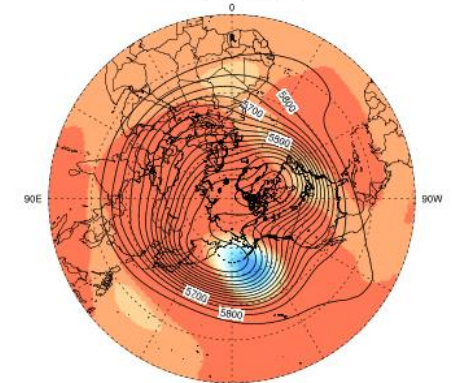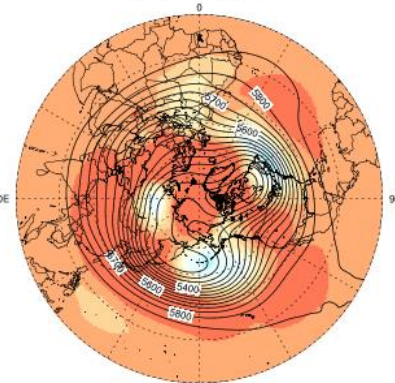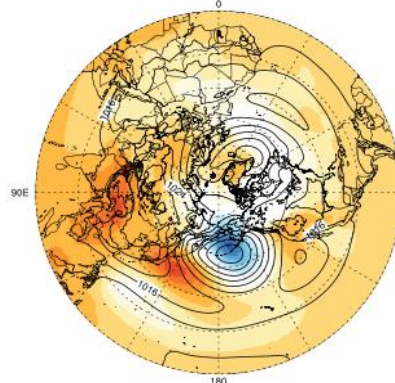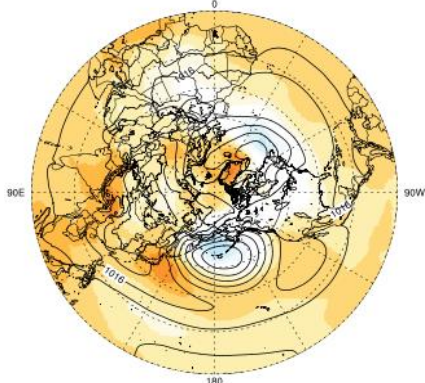
DJF 2019 outlook – Arctic Oscillation (AO) prediction
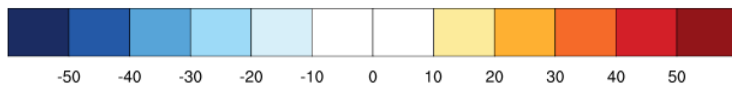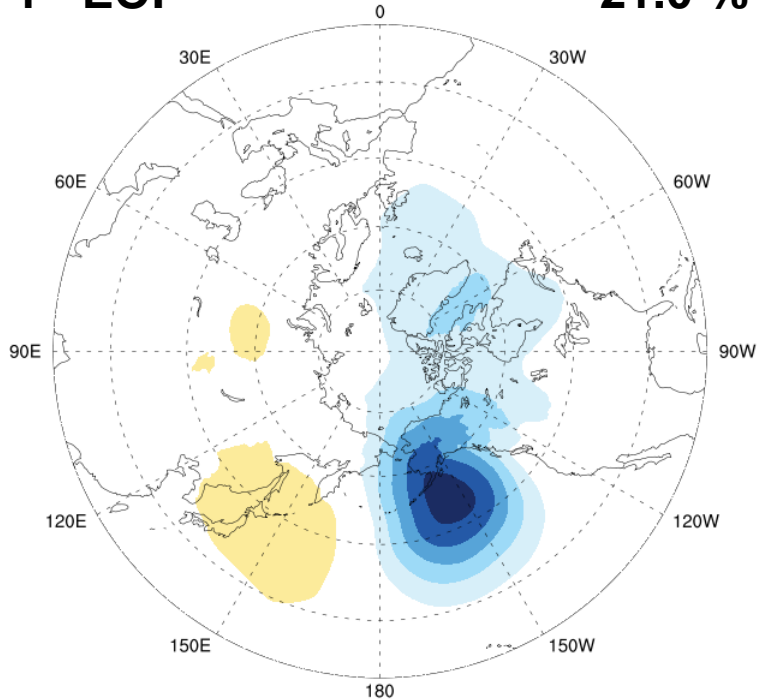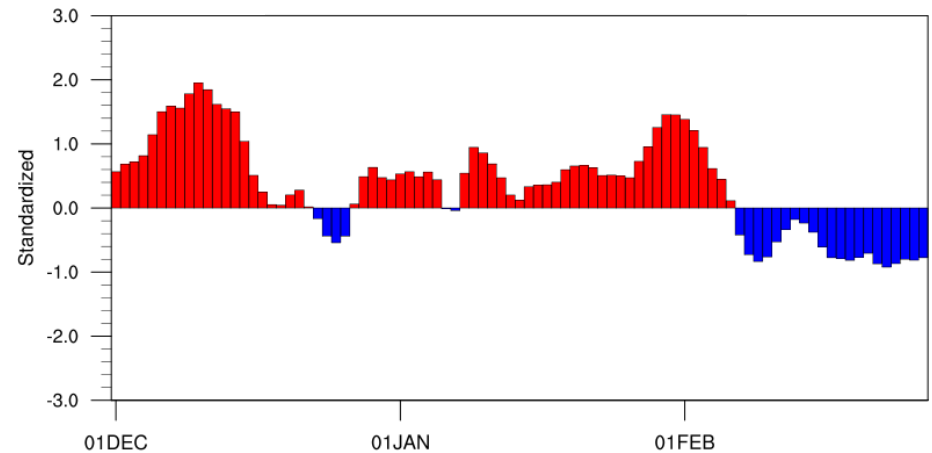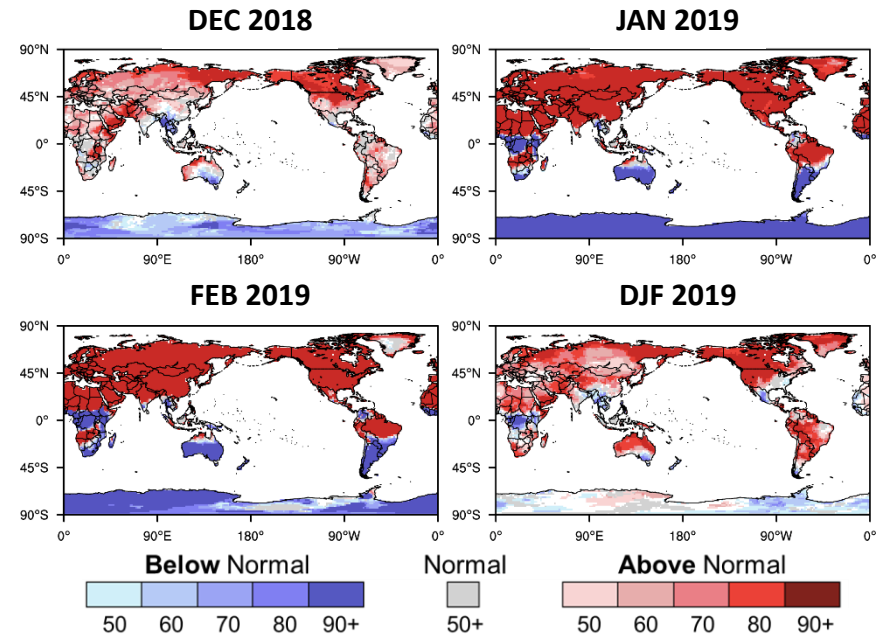

> ➢ Empirical Orthogonal Function (EOF) analysis for the Northern Hemisphere. The loading pattern of AO is defined as the first mode from the EOF analysis of daily mean geopotential height (1000hPa) anomalies for 120 days.

DJF 2019 outlook for the globe (850hPa Temp.)
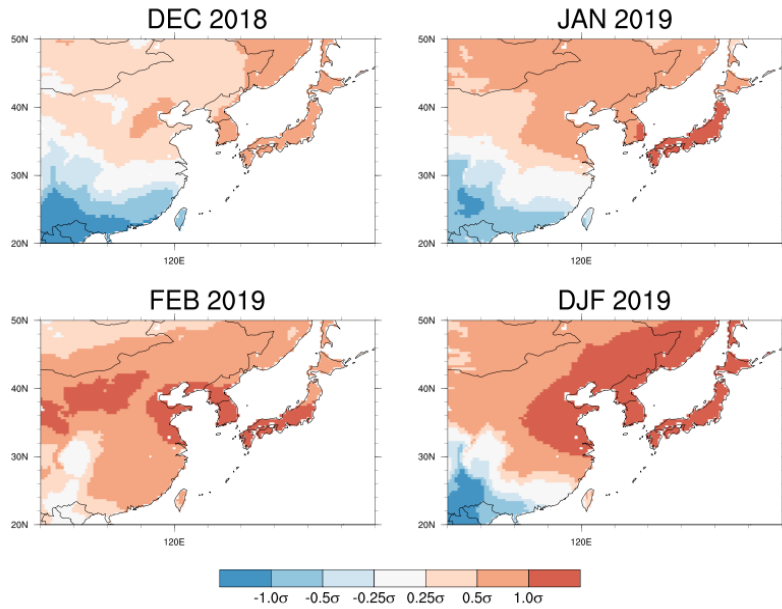
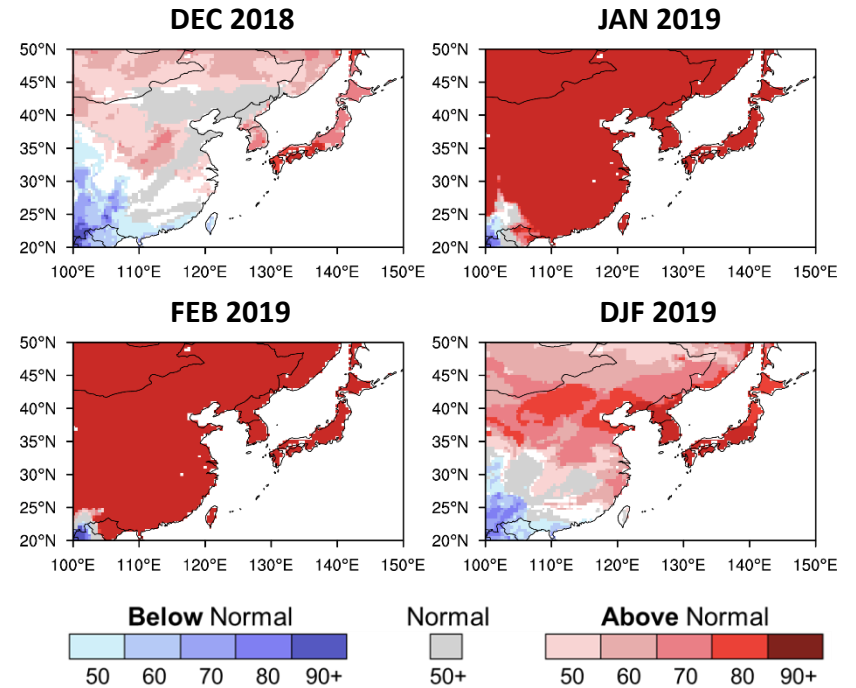## Anomaly Prediction (σ)
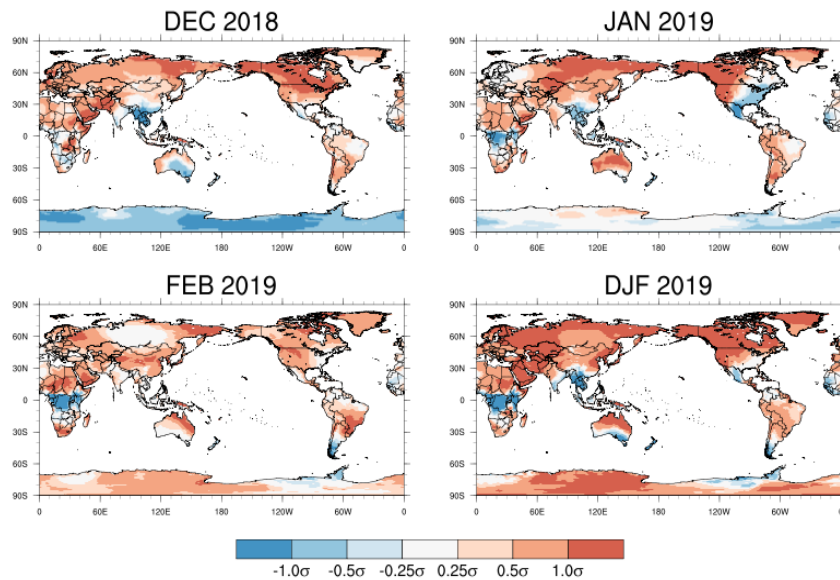
Probability Prediction (%)

DJF 2019 outlook for East Asia(850hPa Temp.)

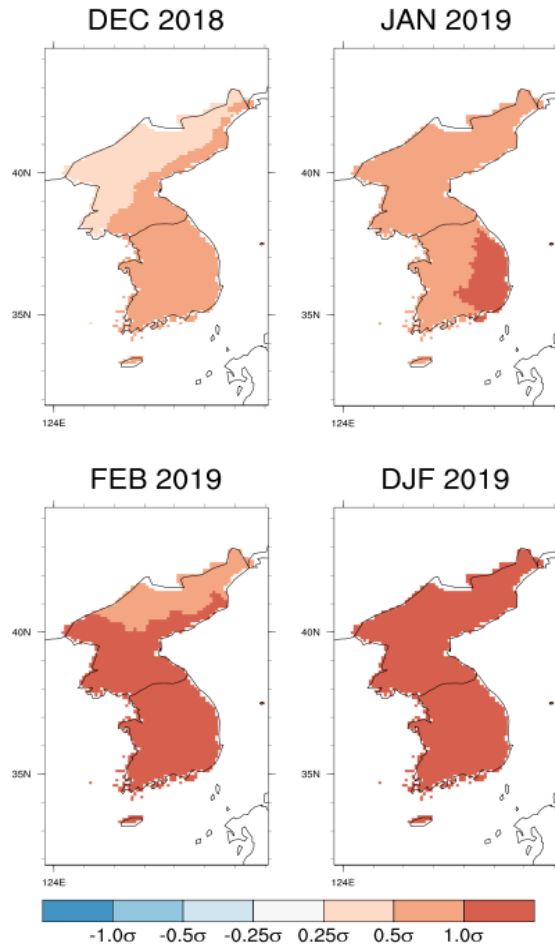# DJF 2019 outlook for Korean peninsular(850hPa Temp.)

Anomaly Prediction (σ)

DEC 2018 · JAN 2019 · FEB 2019 · DJF 2019

-1.0σ -0.5σ -0.25σ 0.25σ 0.5σ 1.0σ

Probability Prediction (%)

DEC 2018 · JAN 2019 · FEB 2019 · DJF 2019

Below Normal — Normal — **Above** Normal

50 60 70 80 90+   50+   50 60 70 80 90+
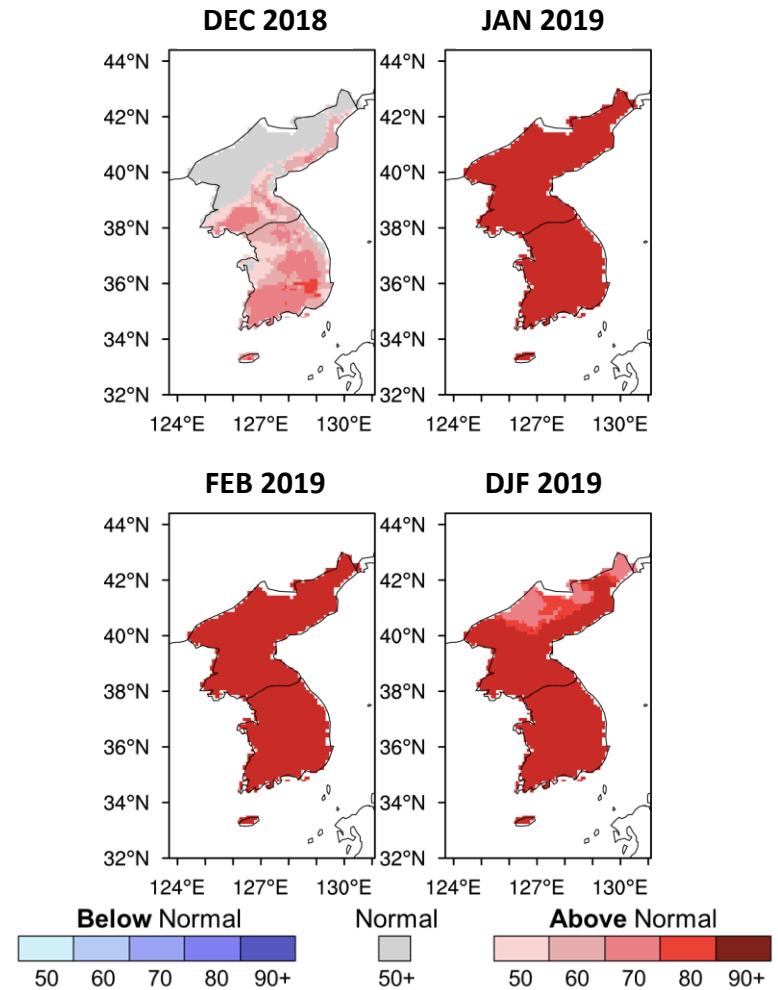
DJF 2019 outlook for the globe (Precipitation)

Anomaly Prediction (σ)

Probability Prediction (%)

DJF 2019 outlook for East Asia (Precipitation)

Anomaly Prediction (σ)

Probability Prediction (%)

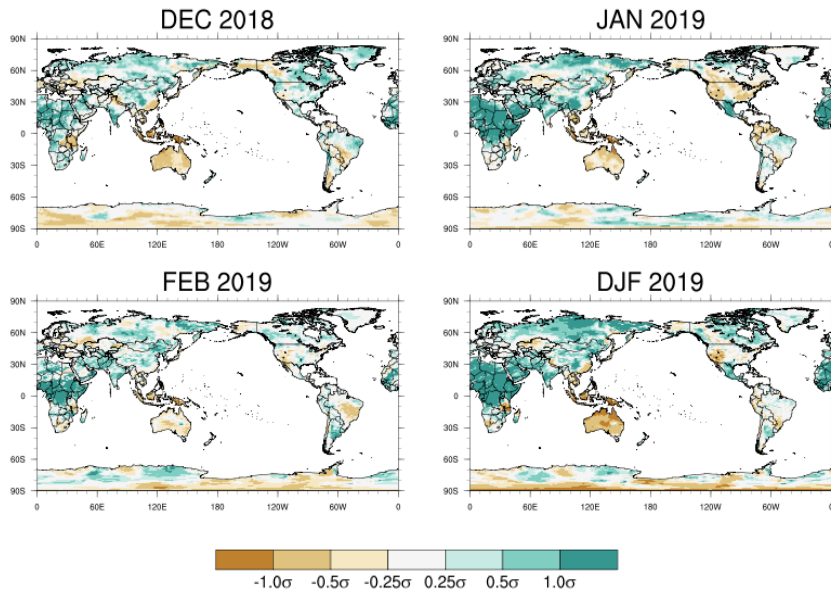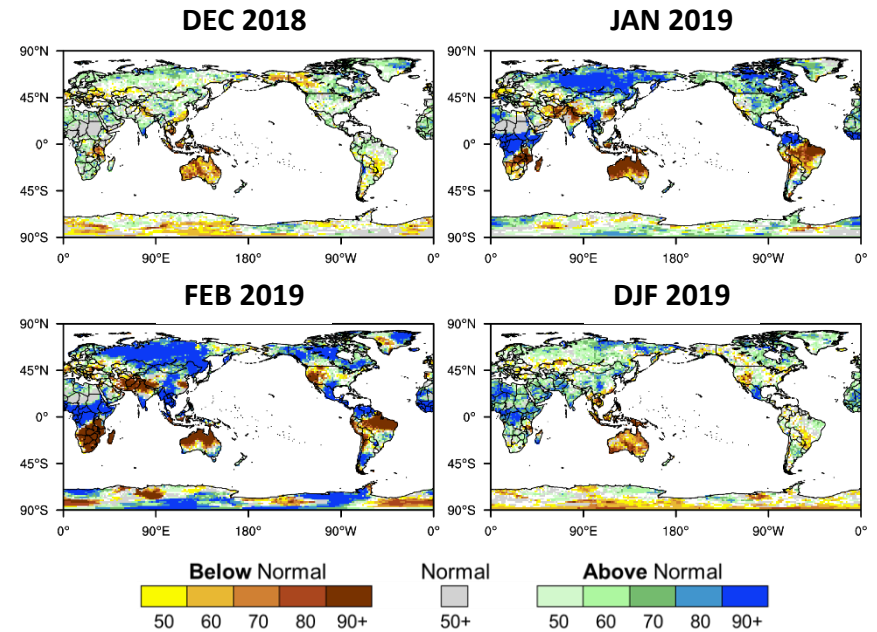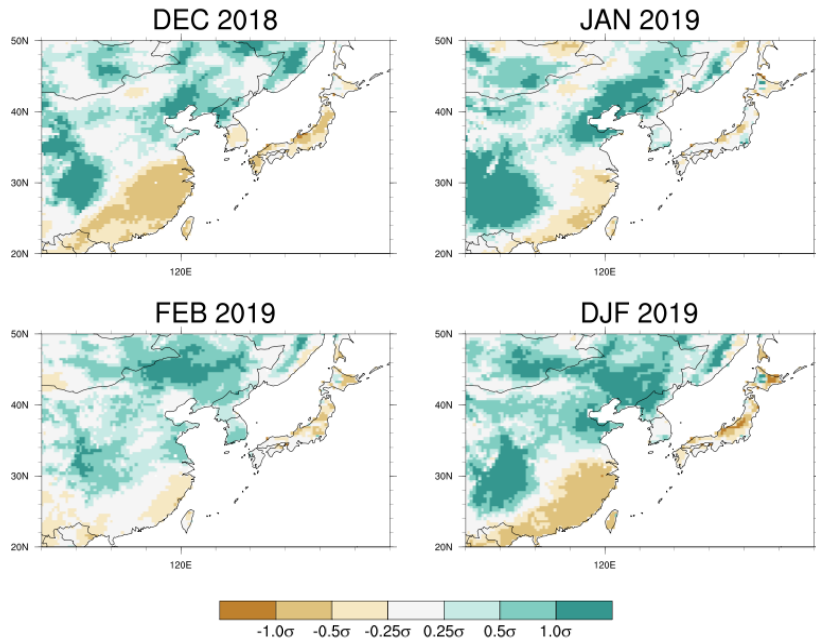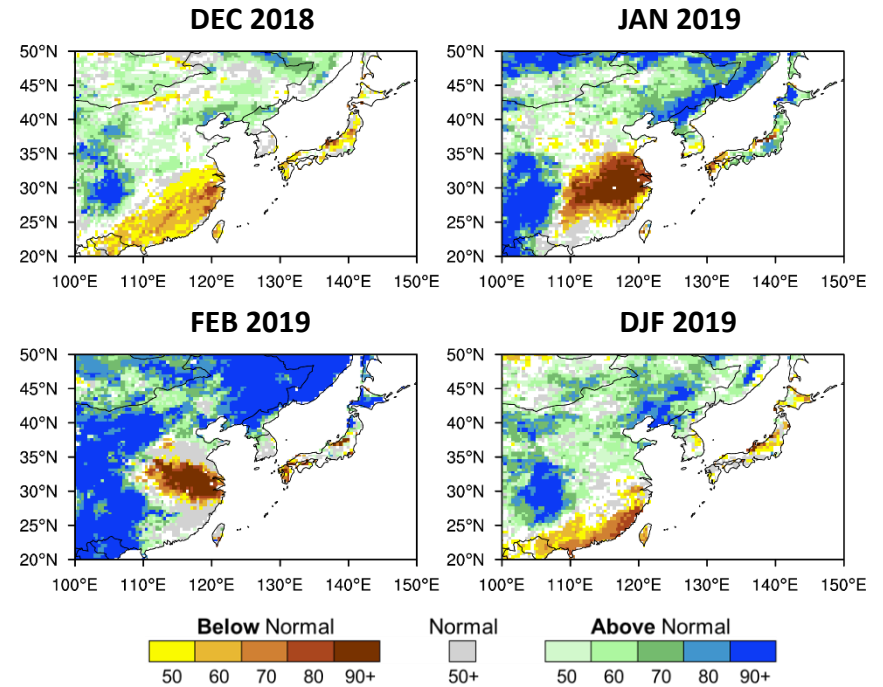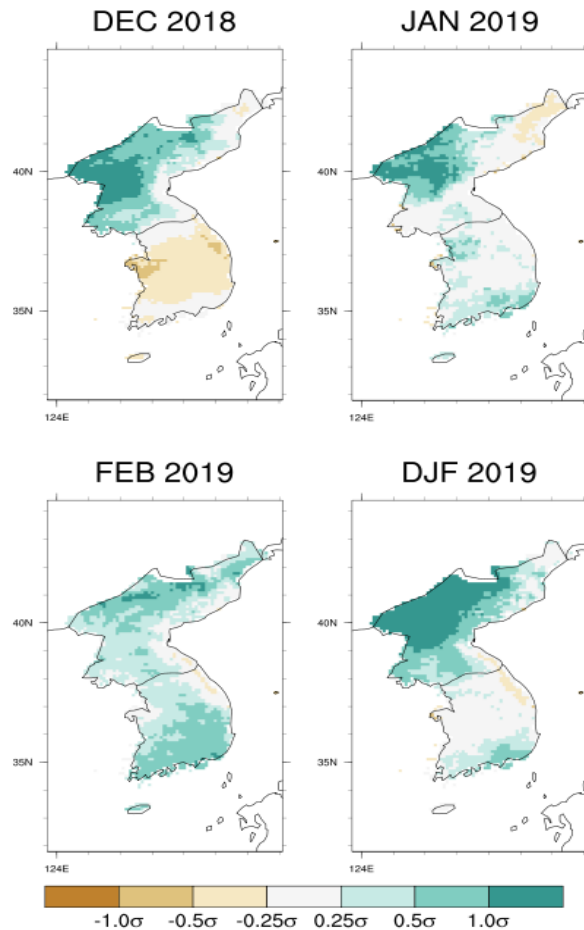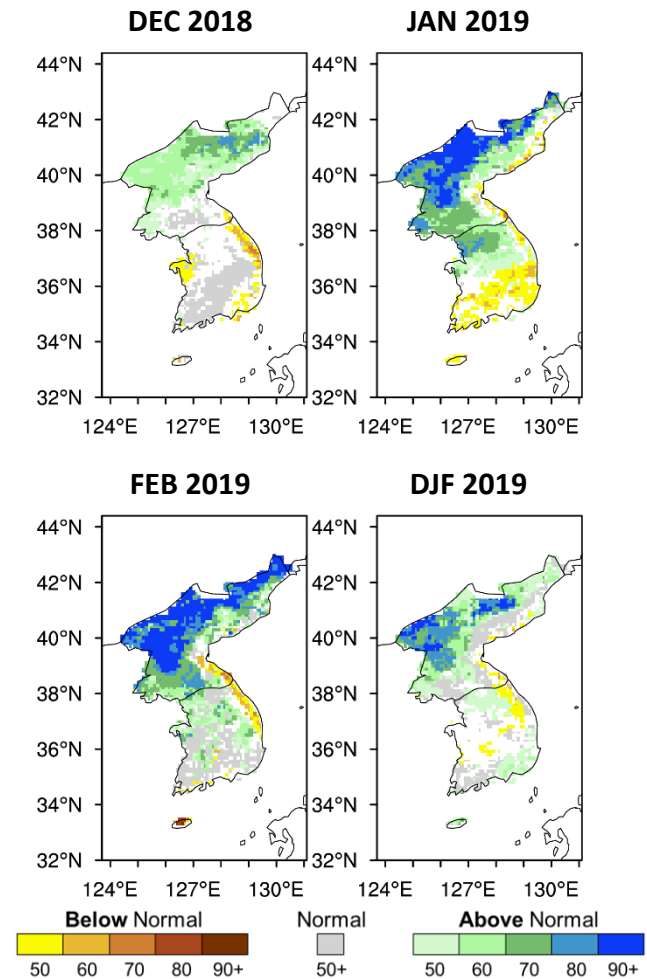# DJF 2019 outlook for Korean peninsular(Precipitation)

Anomaly Prediction (σ)
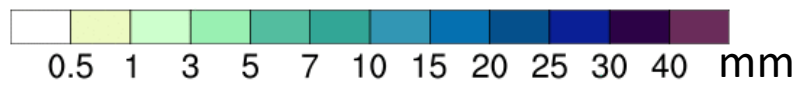

Probability Prediction (%)
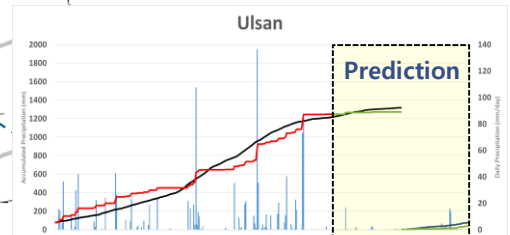
Daily 2m Temperature

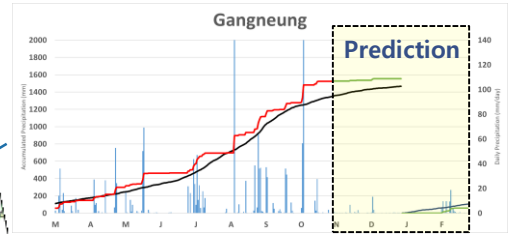
T_2M & FI500   20181201

Daily & Accumulated Precipitation

DJF 2019 outlook – Summary (Korea)

Intensity		DEC	JAN	FEB	DJF
	Temp.	Warm	Warm	Warm	Warm
	Prec.	Normal/Dry	Normal/Wet	Normal/Wet	Normal/Wet

Probability

Temp.

DEC	JAN	FEB	DJF
Above 60% Normal 30% Below 10%	Above 80% Normal 10% Below 10%	Above 80% Normal 10% Below 10%	Above 80% Normal 10% Below 10%

Prec.

DEC	JAN	FEB	DJF
Above 20% Normal 70% Below 10%	Above 60% Normal 10% Below 30%	Above 30% Normal 60% Below 10%	Above 10% Normal 80% Below 10%
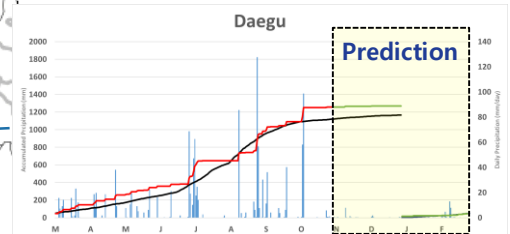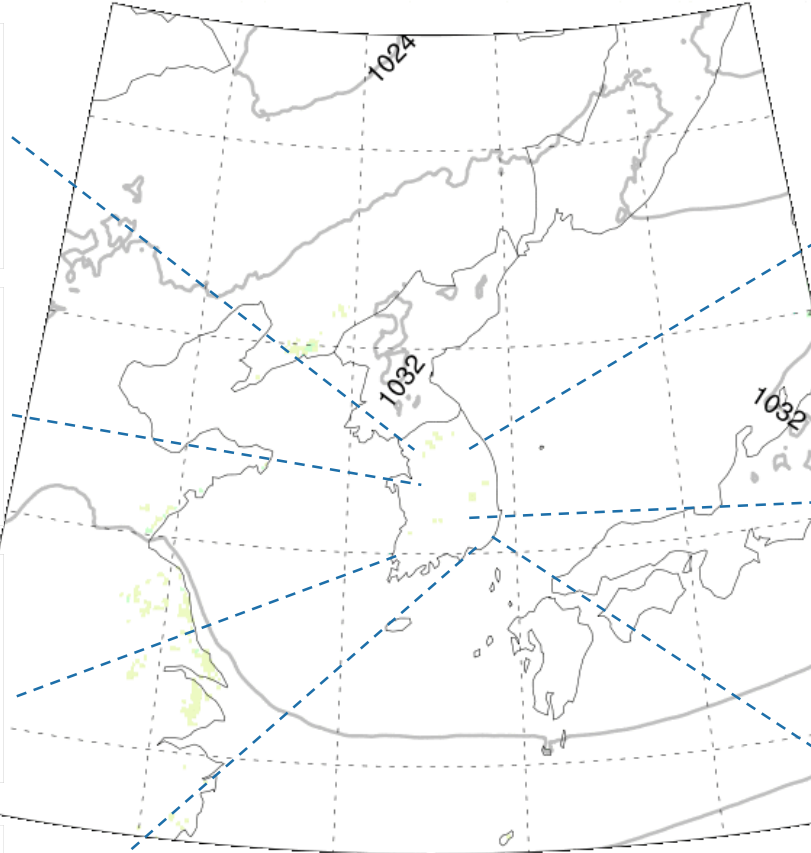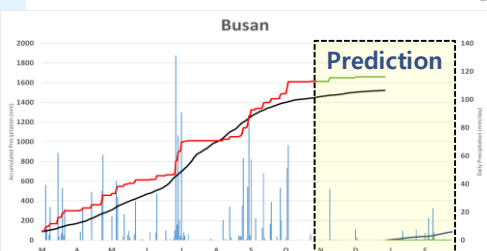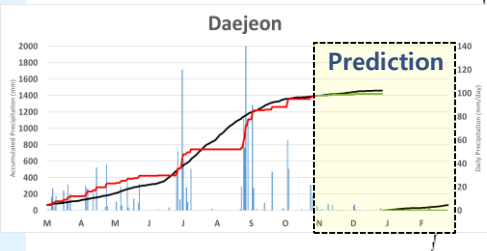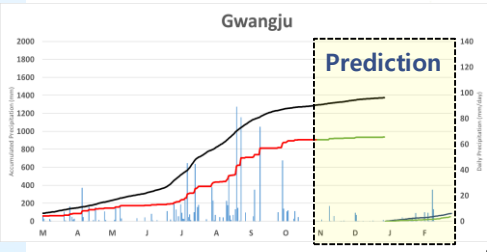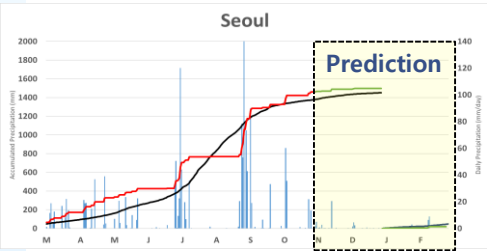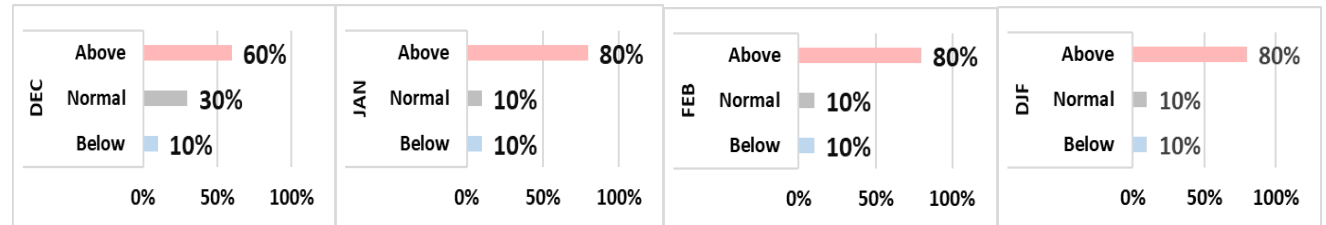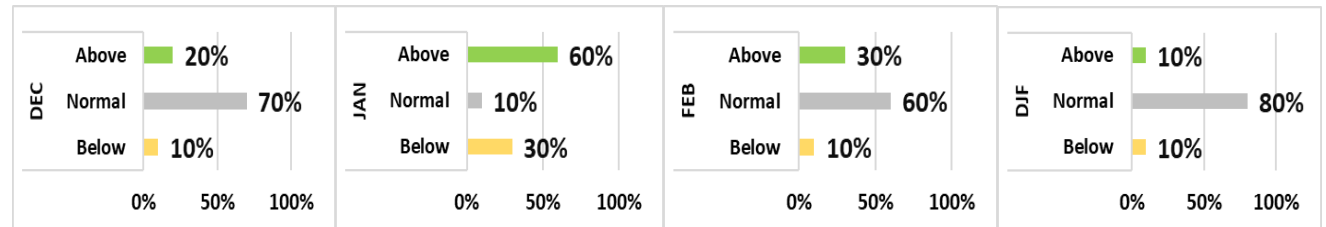
DJF 2019 outlook – Summary (North Korea)

		DEC	JAN	FEB	DJF
Intensity	**Temp.**	Normal/Warm	Warm	Warm	Warm
	Prec.	Wet	Normal/Wet	Wet	Wet

Probability

Temp.

DEC	JAN	FEB	DJF
Above 60% Normal 30% Below 10%	Above 80% Normal 10% Below 10%	Above 80% Normal 10% Below 10%	Above 80% Normal 10% Below 10%

Prec.

DEC	JAN	FEB	DJF
Above 20% Normal 70% Below 10%	Above 60% Normal 10% Below 30%	Above 30% Normal 60% Below 10%	Above 10% Normal 80% Below 10%
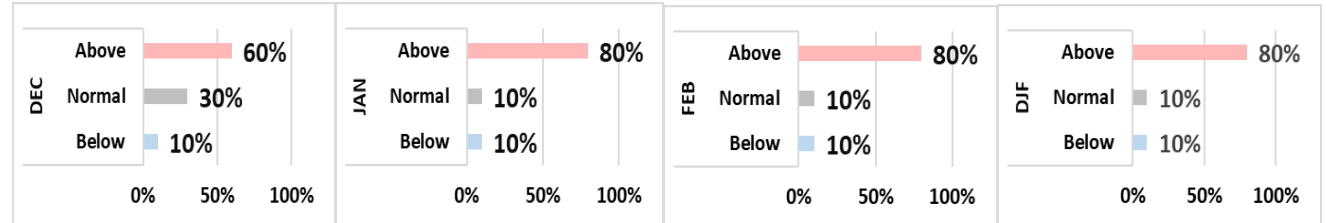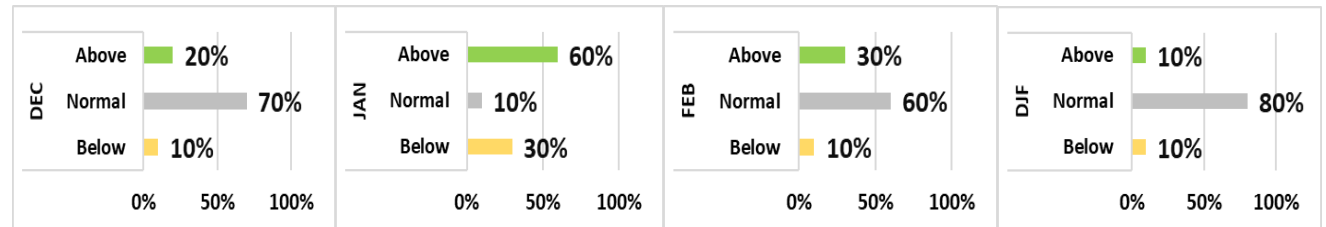
DJF 2019 outlook – Summary (Korea)

➢ According to the "anomaly prediction" employing 2-way nesting ICON model, during Winter 2019,
the temperature is likely to be warmer than average throughout South Korea.

➢ Precipitation is likely to be slight dryer than average level during November, but there might be a slight wetter condition over South Korea for the month of January to February 2019.

➢ According to the "probability prediction", spatial distribution of temperature is likely to be above throughout whole season (60~80%).

➢ Normal condition are likely to prevail for the month of December and February 2019 (60~70%). And it is likely to be above for the month of January (60%).

DJF 2019 outlook – Summary (North Korea)

➢ According to the "anomaly prediction" employing 2-way nesting ICON model, during Winter 2019,
the temperature is likely to be warmer than average throughout North Korea.

➢ Precipitation is likely to be wetter than average level throughout whole season.

➢ According to the "probability prediction", the spatial distribution of temperature is expected to be above (60~80%) for the month of December to February 2019.

➢ Spatial distribution of precipitation during December and February 2019 is likely to be normal (60~70%). And it is likely to be above for the month of January 2019 (60%).

Thank you.