Seasonal Forecast

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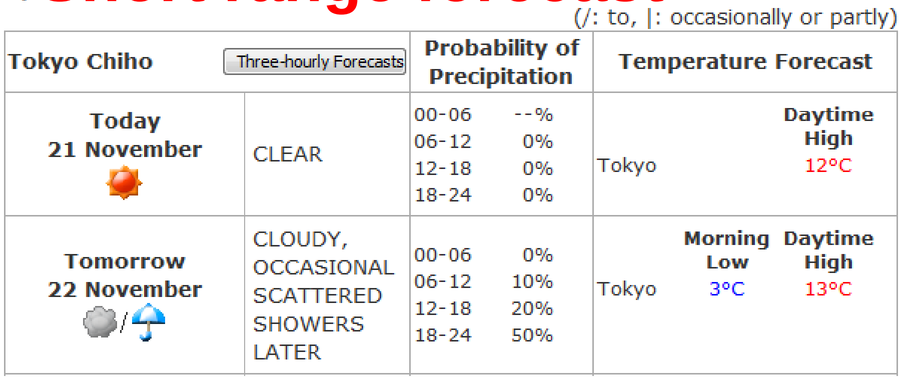
Outline

- Introduction
- Predictability and Ensemble Prediction
- Seasonal Forecast in Japan
- Procedure of Seasonal Forecast

Introduction

Short/Long Range Forecasts

Short range forecast

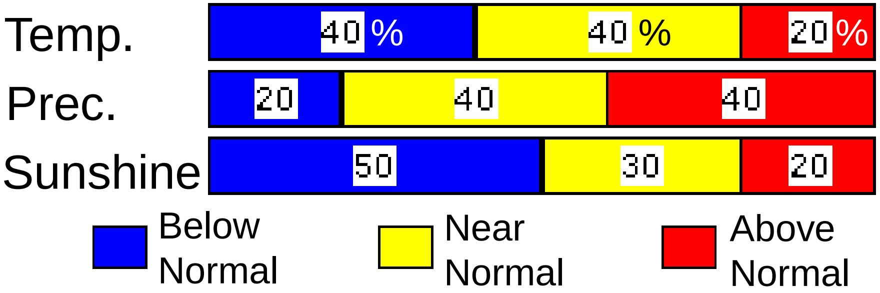


(/: to, |: occasionally or partly)

Tokyo Chiho	Three-hourly Forecasts	Probability of Precipitation	Temperature Forecast
Today **21 November**	CLEAR	00-06 --% 06-12 0% 12-18 0% 18-24 0%	Tokyo **Daytime High** 12°C
Tomorrow **22 November** /	CLOUDY, OCCASIONAL SCATTERED SHOWERS LATER	00-06 0% 06-12 10% 12-18 20% 18-24 50%	Tokyo **Morning Low** 3°C **Daytime High** 13°C

- Forecasting the actual weather parameters (e.g., weater, temp.)
- Deterministic forecast

Seasonal forecast



Above example shows a forecast in 3 categories: **Below**, **Near** and **Above normal**.

Probabilities of both below and near normal temp. are **40%**, and above normal temp. is **20%**.

- Forecasting deviation from the climatological normal in categories (Not actual temp. or precip.)
- Probabilistic forecast (Not forecasting which category will happen, but forecasting probabilities of occurrence for each category)

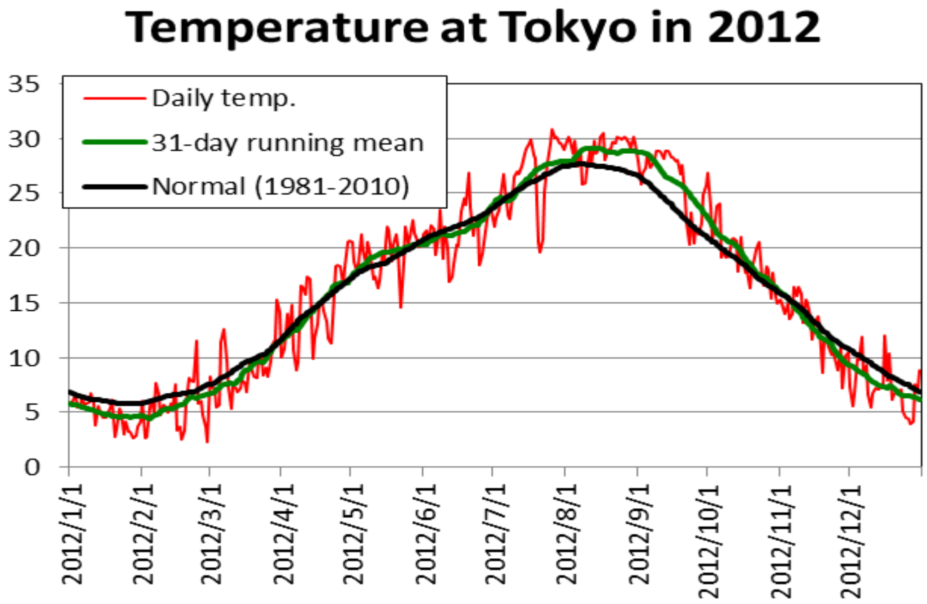
Anomaly in Seasonal Forecast

Normal: Defined as 30-year average for 1981 – 2010

Anomaly: Deviation from the normal

[Anomaly] = [Actual Value] – [Normal]

- Weather condition changes from year to year (interannual variability)
- Anomalous climate may affects the lives of society (e.g., drought, flood, and hot spell)

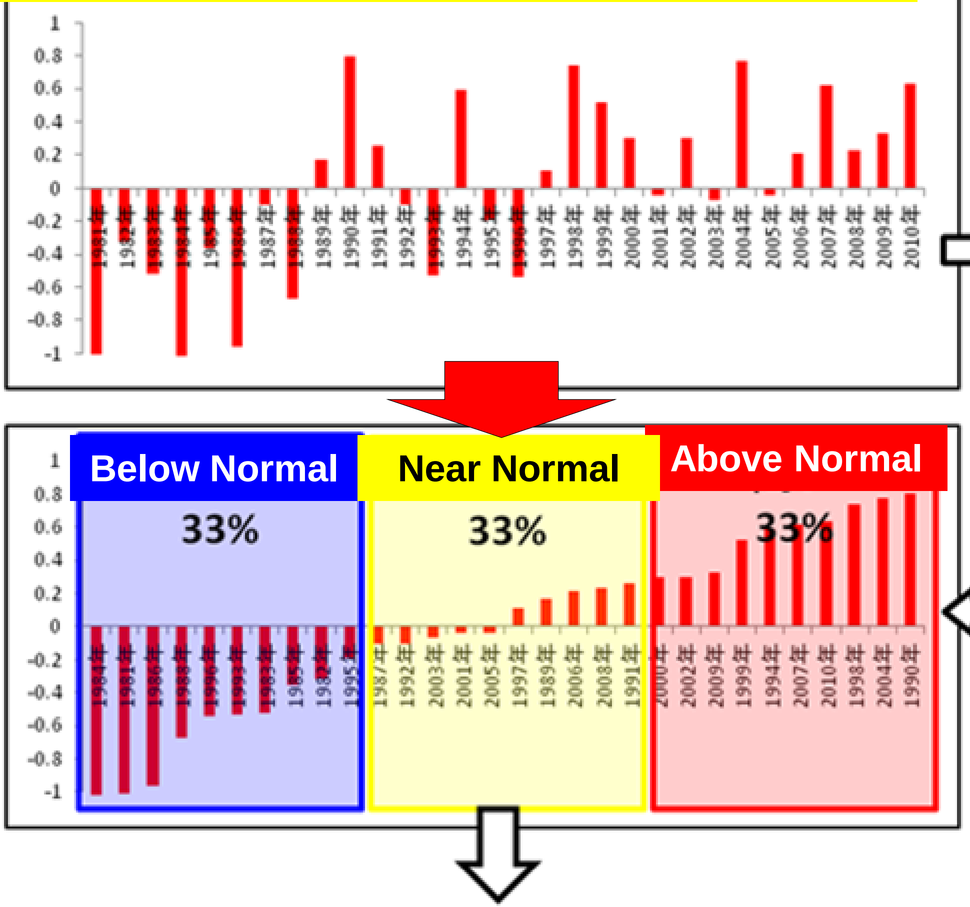

Temperature at Tokyo in 2012

Anomaly is the target of seasonal forecasting.

Forecast Category

- JMA conducts seasonal forecast in **3 categories**: **Above**, **Near**, and **Below Normal**
- Arranging historical data for 30-year (e.g., 1981-2010) in ascending order,
  - 1 - 10th: **Below Normal**
  - 11 - 20th: **Near Normal**
  - 21 - 30th: **Above normal**

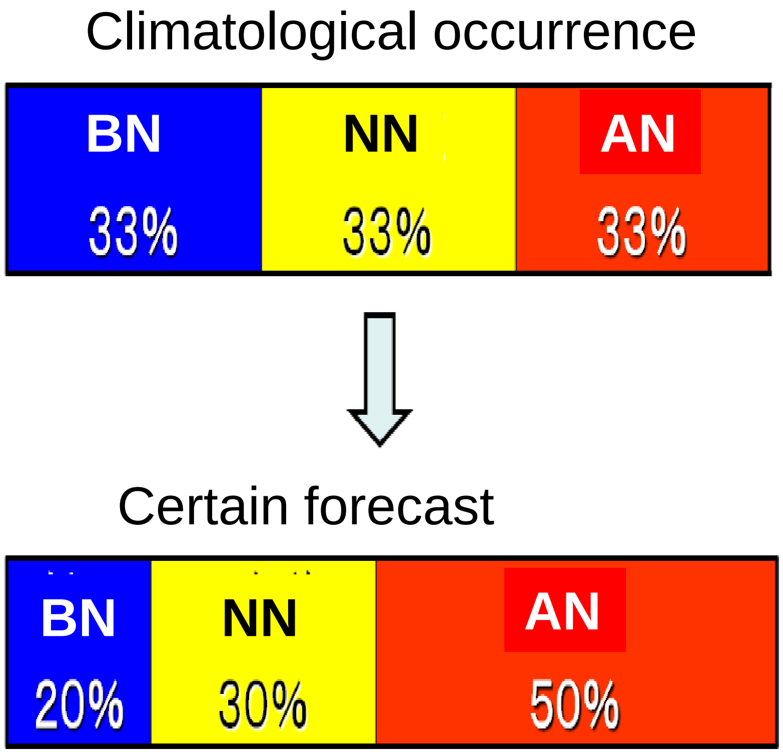
Time series of temp. anomaly (1981-2010)



Range of Near normal: -0.1 to +0.3 ℃

3-category Probabilistic Forecast

- In the seasonal forecast probability for each category is predicted.
- Occurrence rate for each category is expected 33% in climatology.
- In certain forecasting, deviation from the climatological occurrence is important.



Climatological occurrence

BN	NN	AN
33%	33%	33%

Certain forecast

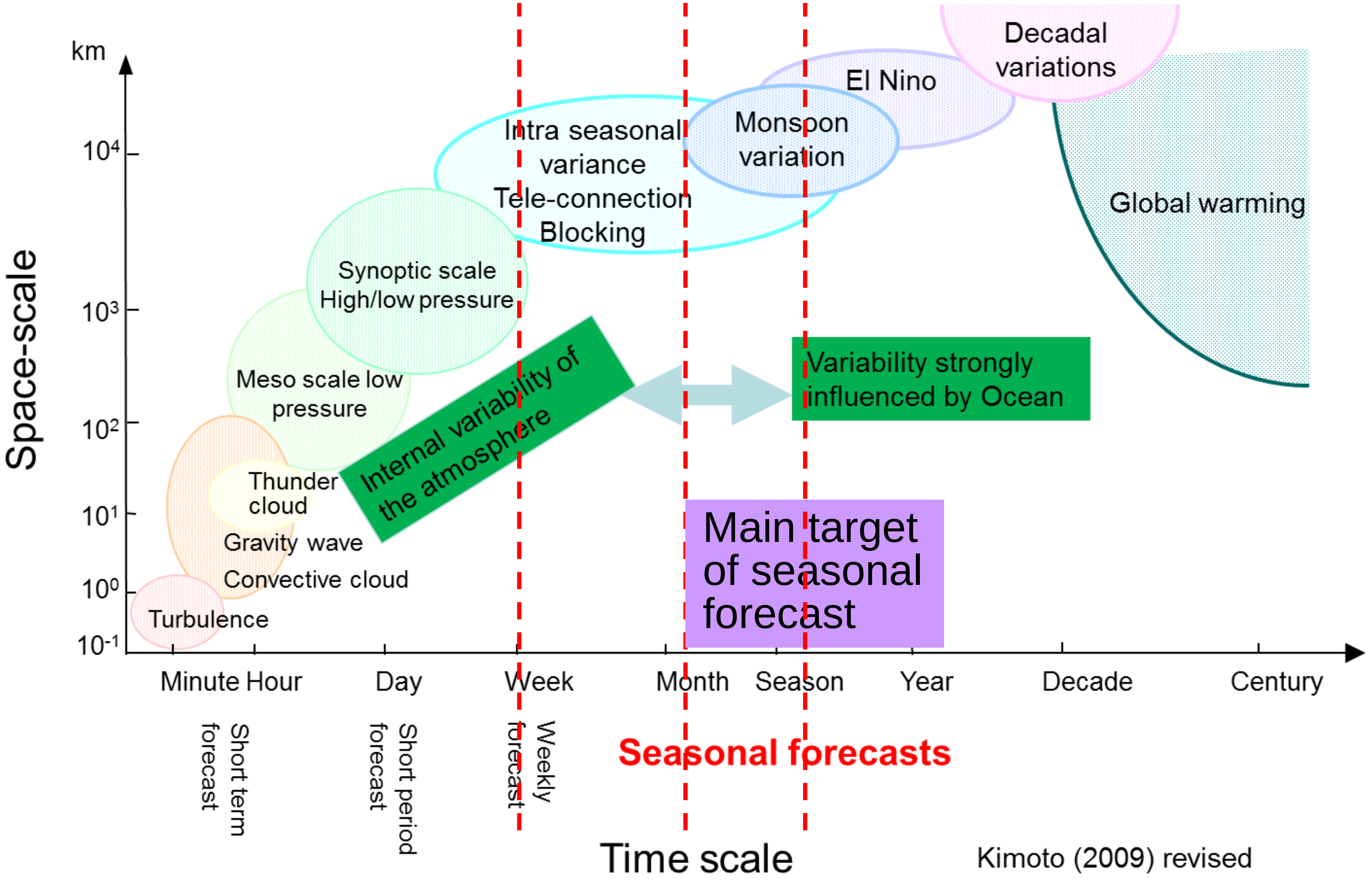
BN	NN	AN
20%	30%	50%

This forecast shows that above normal is ***more likely*** (50%), and below normal is ***less likely*** (20%) to occur than expected in climatology (33%).

Predictability and Ensemble Prediction

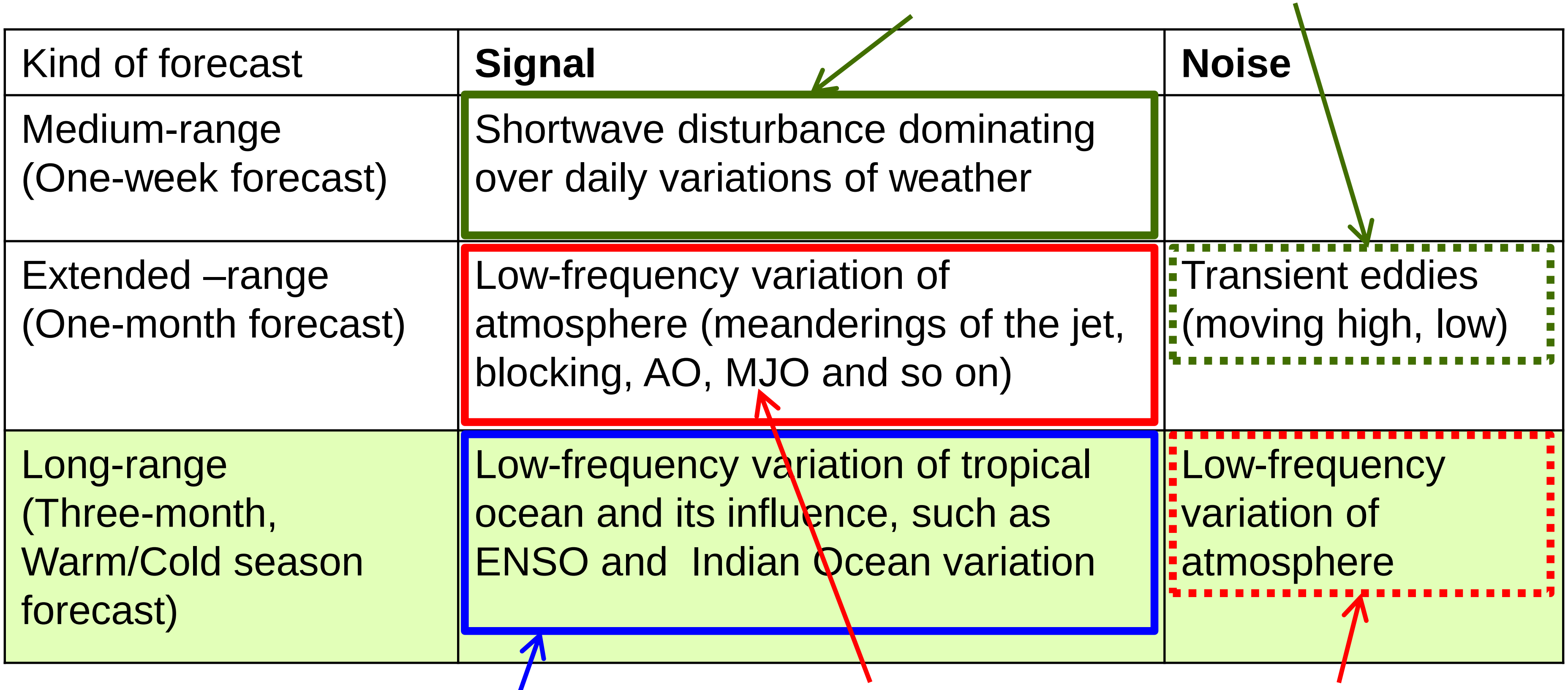
Multiple Structure of Atmospheric Phenomena

- Variations in atmosphere consist various space- and time-scale phenomena.
- Targets for seasonal prediction are phenomena with large time- and space-scale (over about a month).


km
Space-scale
10⁴
10³
10²
10¹
10⁰
10⁻¹
Turbulence
Convective cloud
Gravity wave
Thunder cloud
Meso scale low pressure
Synoptic scale High/low pressure
Intra seasonal variance
Tele-connection
Blocking
Monsoon variation
El Nino
Decadal variations
Global warming
Internal variability of the atmosphere
Variability strongly influenced by Ocean
Main target of seasonal forecast
Minute Hour
Day
Week
Month
Season
Year
Decade
Century
Short term forecast
Short period forecast
Weekly forecast
Seasonal forecasts
Time scale

Kimoto (2009) revised

Signal and Noise for Each Kind of Forecast



Green boxes show signal for short-range forecast and noise for one-month forecast

Kind of forecast	**Signal**	**Noise**
Medium-range (One-week forecast)	Shortwave disturbance dominating over daily variations of weather	
Extended –range (One-month forecast)	Low-frequency variation of atmosphere (meanderings of the jet, blocking, AO, MJO and so on)	Transient eddies (moving high, low)
Long-range (Three-month, Warm/Cold season forecast)	Low-frequency variation of tropical ocean and its influence, such as ENSO and Indian Ocean variation	Low-frequency variation of atmosphere

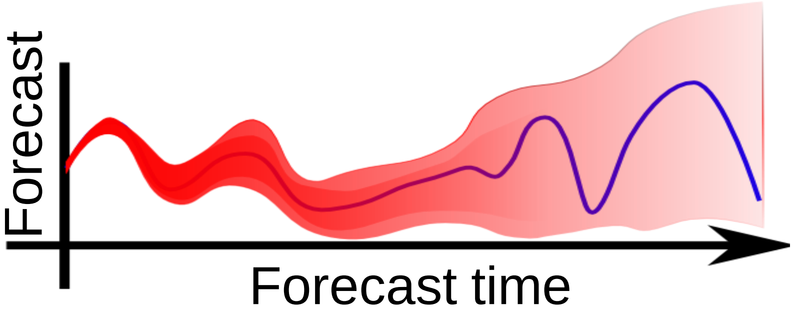
Blue box shows signal for seasonal forecast

Red boxes show signal for one-month forecast and noise for seasonal forecast

Noise can be reduced by time average (e.g., 3-month mean)

Chaos in Atmosphere

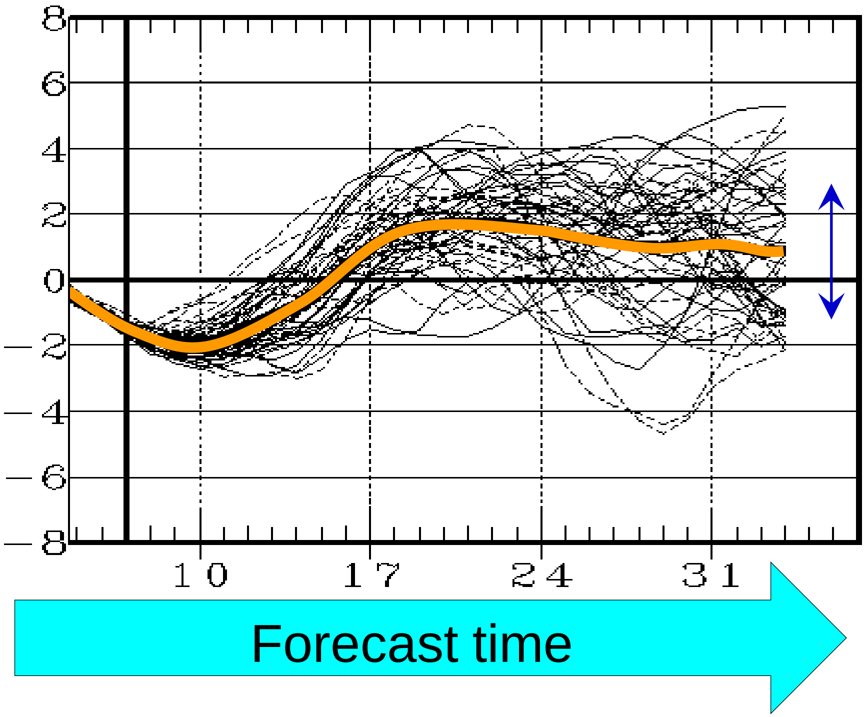
- Due to chaotic behavior of atmosphere, errors rapidly grow during period of prediction.



- To address this issue, ensemble prediction is essential for long-range forecasting.

Ensemble Prediction

In **ensemble prediction**, the model is run many times from very slightly different initial conditions.



Ensemble Member = Individual solutions

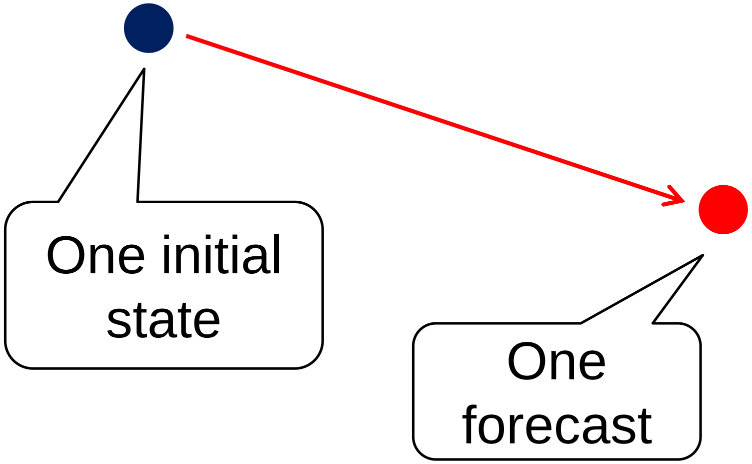
Ensemble spread = Standard dev. among members, suggesting degree of **uncertainty**

Ensemble mean = Average of ensemble members, suggesting degree of **signal**

- Ensemble mean is statistically better than each member.
- The more the number of members is, the better the prediction is.

Deterministic and Probabilistic Forecast

Deterministic forecast

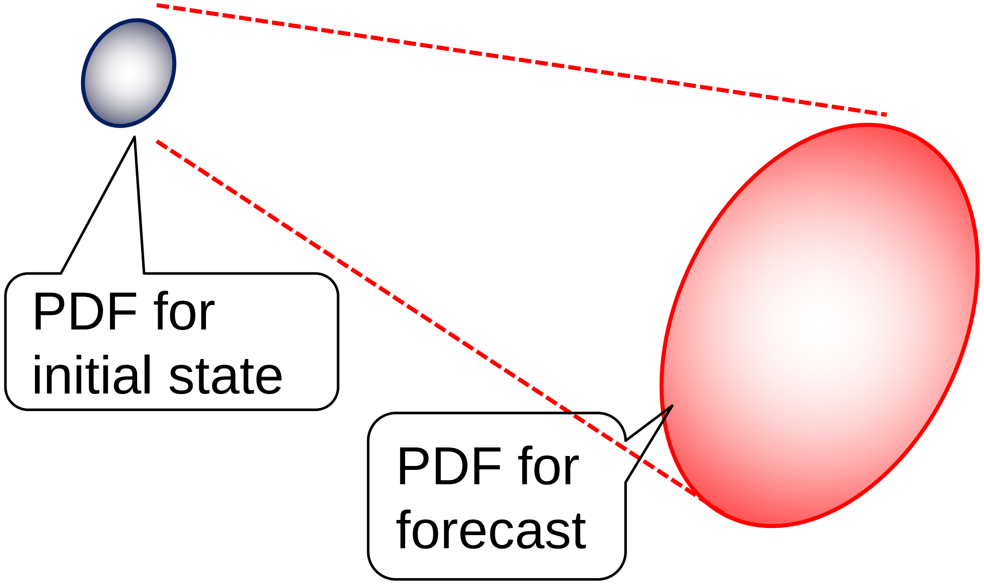


One initial state

One forecast

Calculate one forecast using one initial state

Probabilistic forecast



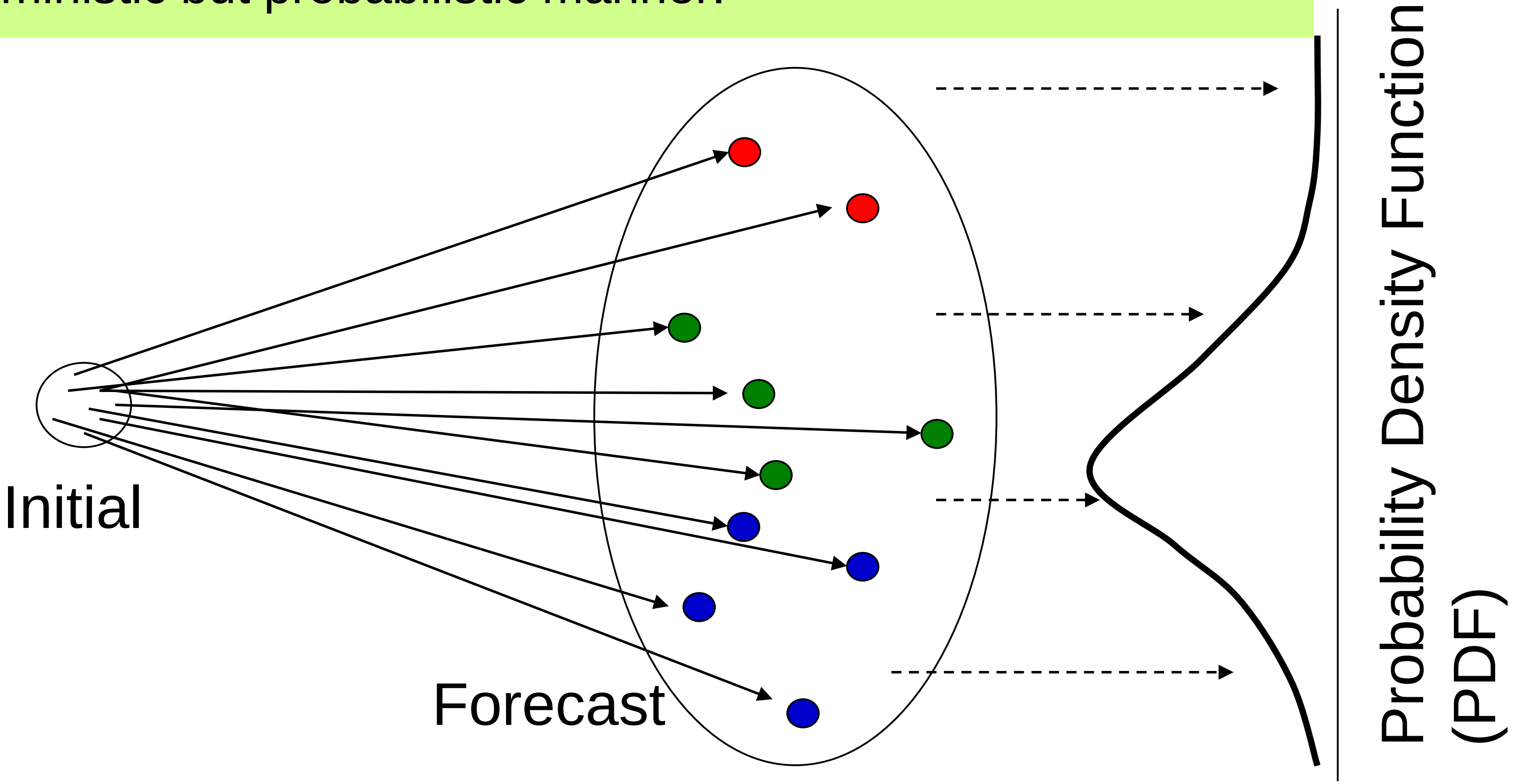
PDF for initial state

PDF for forecast

- EPS derives PDF for forecast.
  - ➢Possible to predict probability of the targeted phenomena, which add degree of reliability to deterministic forecasting.

Probabilistic Forecast

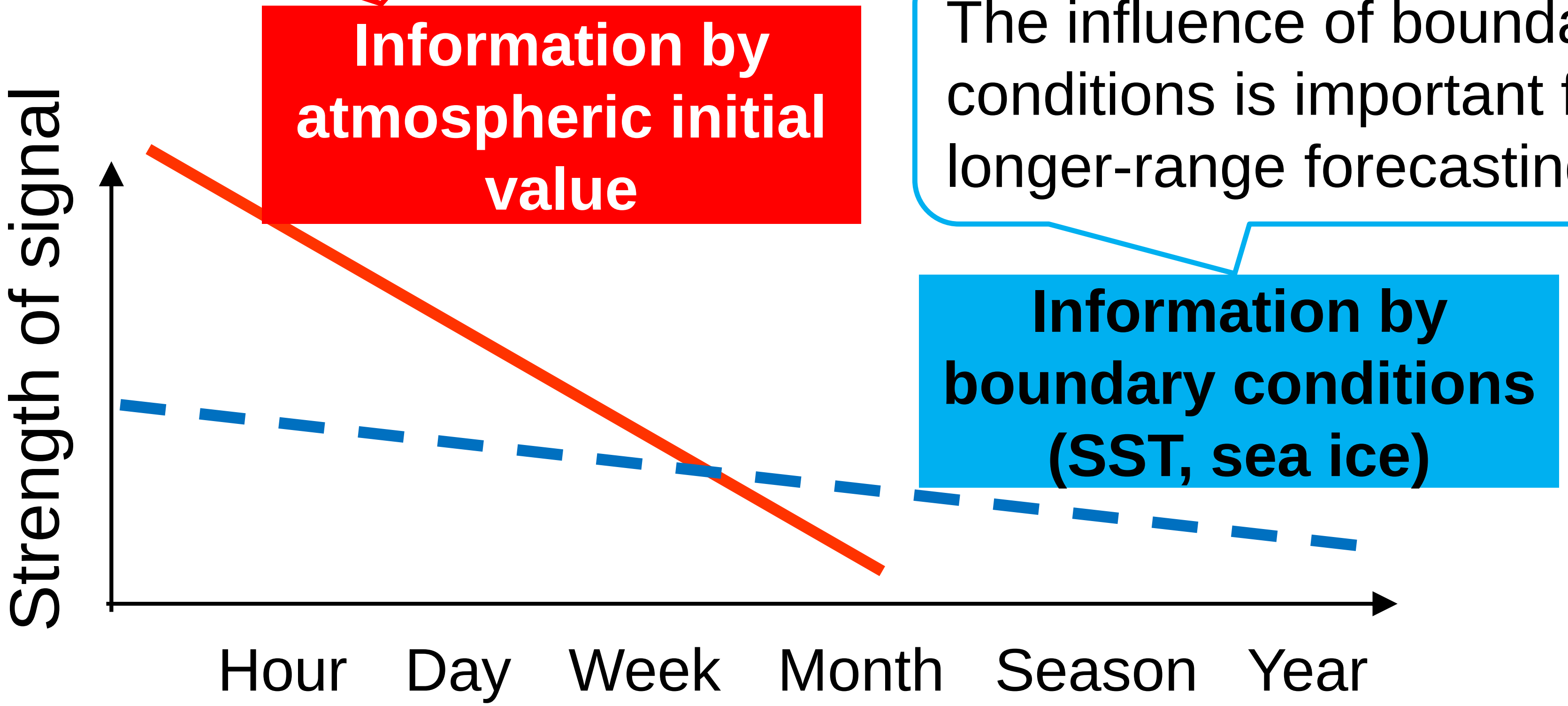
- Ensemble prediction system (EPS) enables to derive PDF from the distribution of individual members.
- This denotes that long-range forecast is possible with not deterministic but probabilistic manner.


Initial
Forecast
Probability Density Function
(PDF)

Initial and Boundary Condition

Due to the chaotic nature of the atmosphere, the limit for deterministic forecasting is about two weeks.

The influence of boundary conditions is important for longer-range forecasting



Information by atmospheric initial value

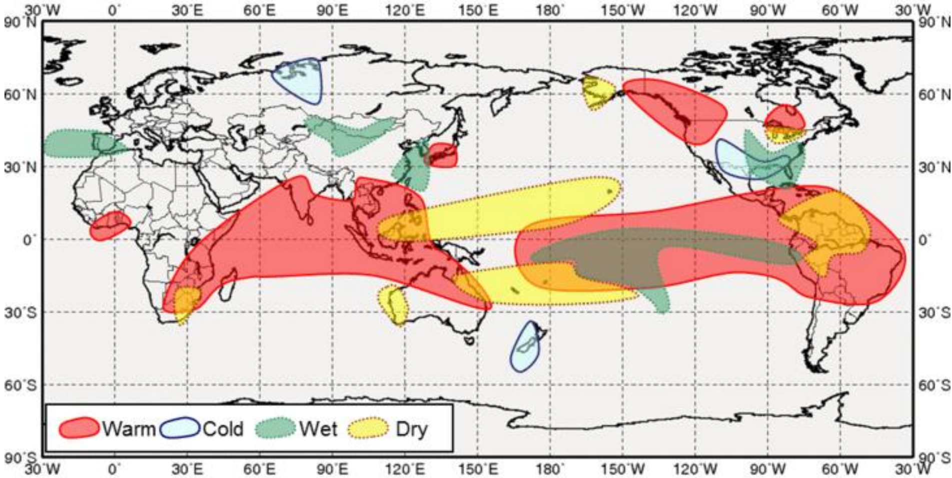
Information by boundary conditions (SST, sea ice)

Boundary Condition – ENSO

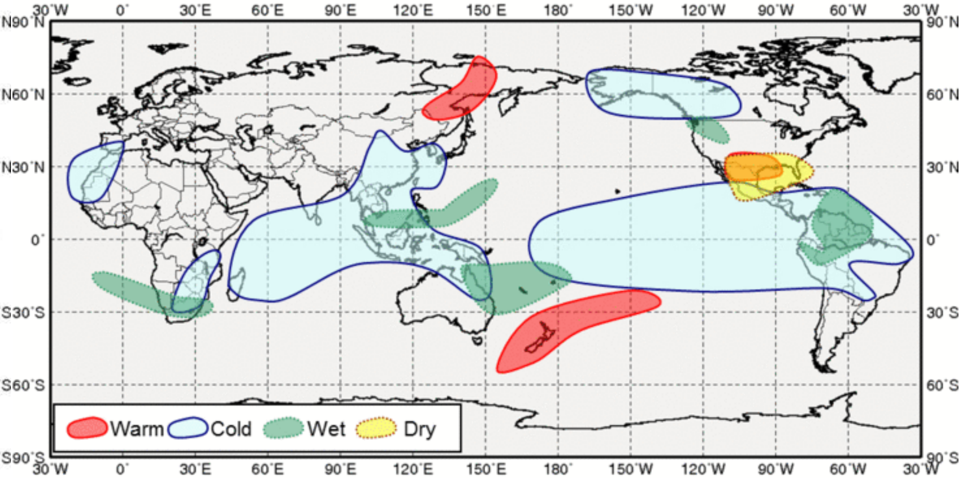
- ENSO brings large impact on the global climate.
- Its evolution is predictable several month ahead.
- Its timescale is several month to a year.

→ ENSO is the most important BC for seasonal forecast.

Typical anomaly patterns during **El Nino** (boreal winter)

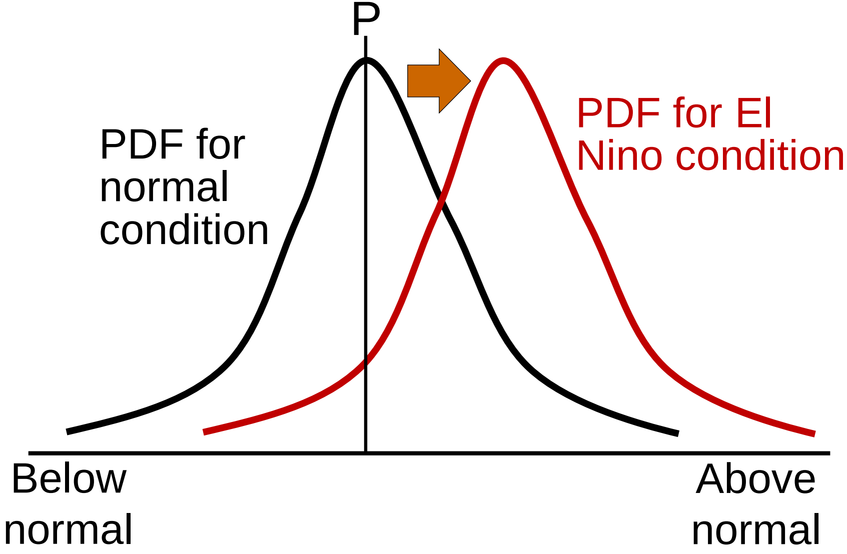

30°W
0°
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
90°N
60°N
30°N
0°
30°S
60°S
90°S
Warm
Cold
Wet
Dry

Typical anomaly patterns during **La Nina** (boreal winter)


30°W
0°
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
90°N
60°N
30°N
0°
30°S
60°S
90°S
Warm
Cold
Wet
Dry

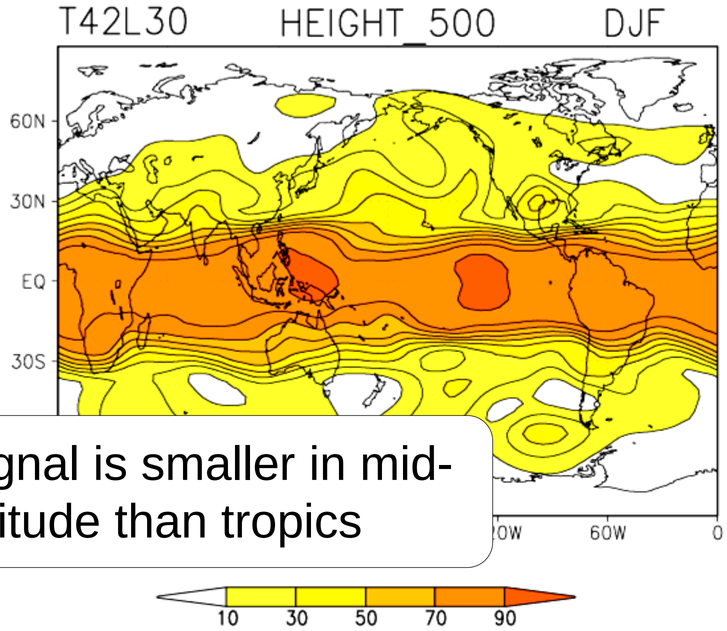
Boundary Condition – ENSO

- Typical anomaly pattern (**signal**) tends to appear during El Nino (or La Nina), but not always due to the internal variability (**noise**).
- Seasonal forecast must be issued with probabilistic forecast because of the uncertainty from the noise.


P
PDF for normal condition
PDF for El Nino condition
Below normal
Above normal

In this case, El Nino brings more (less) probability for above (below) normal category than normal condition

Ratio (signal / (signal + noise))


T42L30
HEIGHT_500
DJF
60N
30N
EQ
30S
0W
60W
0
10
30
50
70
90

Signal is smaller in mid-latitude than tropics

Seasonal Forecasts in Japan

Japan’s seasonal forecast started in 1942 for the purpose to reduce agricultural damages associated with cooler summers.

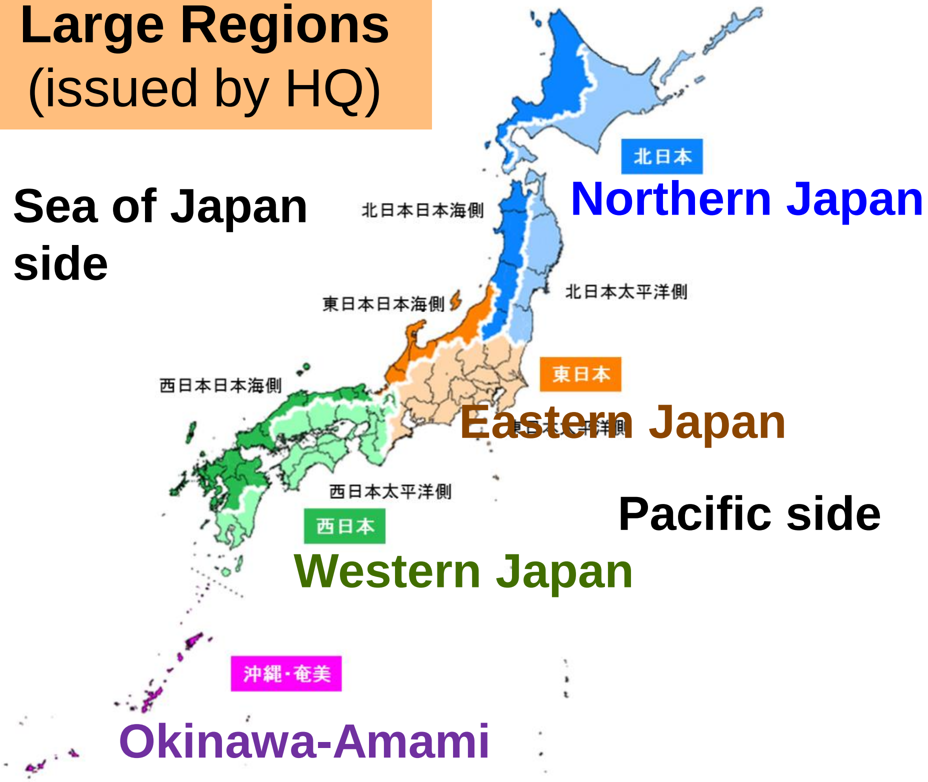
Seasonal Forecast at JMA

	Date of issue	Forecast Period	Forecast Item
1-month Forecast	Every Thursday	1-month mean	Temperature, Precipitation, Sunshine, Snowfall
		Weekly mean (1st, 2nd, 3rd-4th week)	Temperature
3-month Forecast	Around 25th of every month	3-month mean,	Temperature, Precipitation, Snowfall
		Monthly mean (1st, 2nd, 3rd month)	Temperature, Precipitation
Warm Season Forecast	Around 25 Feb.	3-month mean (Jun. – Aug.)	Temperature, Precipitation
		Rainy season (Jun. – Jul.)	Precipitation
Cold Season Forecast	Around 25 Sep.	3-month mean (Dec. – Feb.)	Temperature, Precipitation, Snowfall

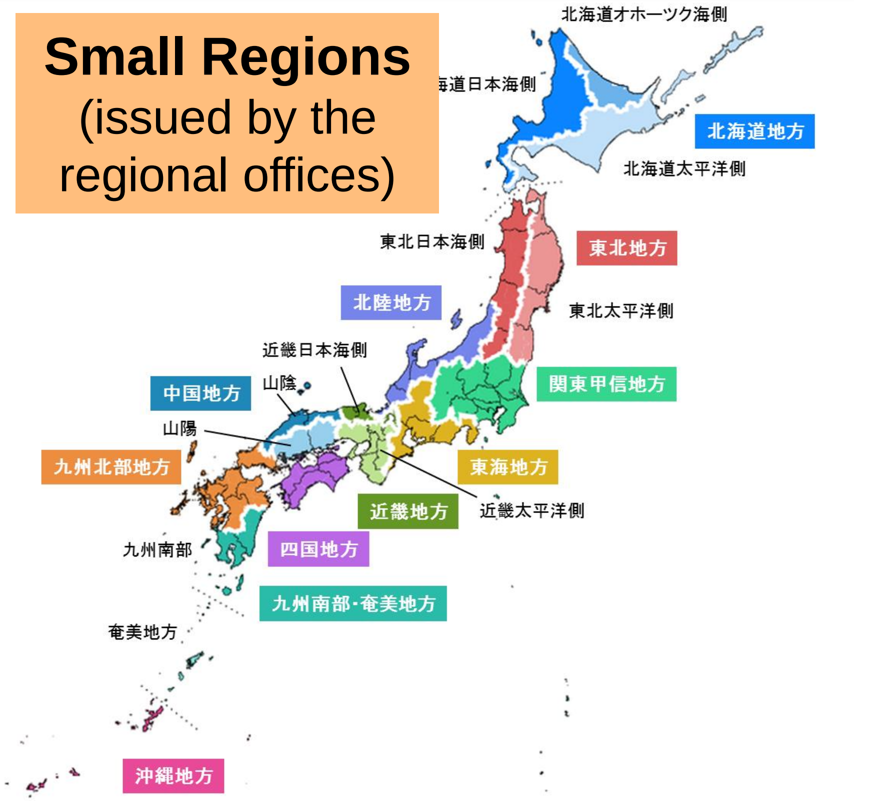
Forecast Region

- Forecast is issued for sub-regions divided based on the climate characteristics.

Large Regions
(issued by HQ)

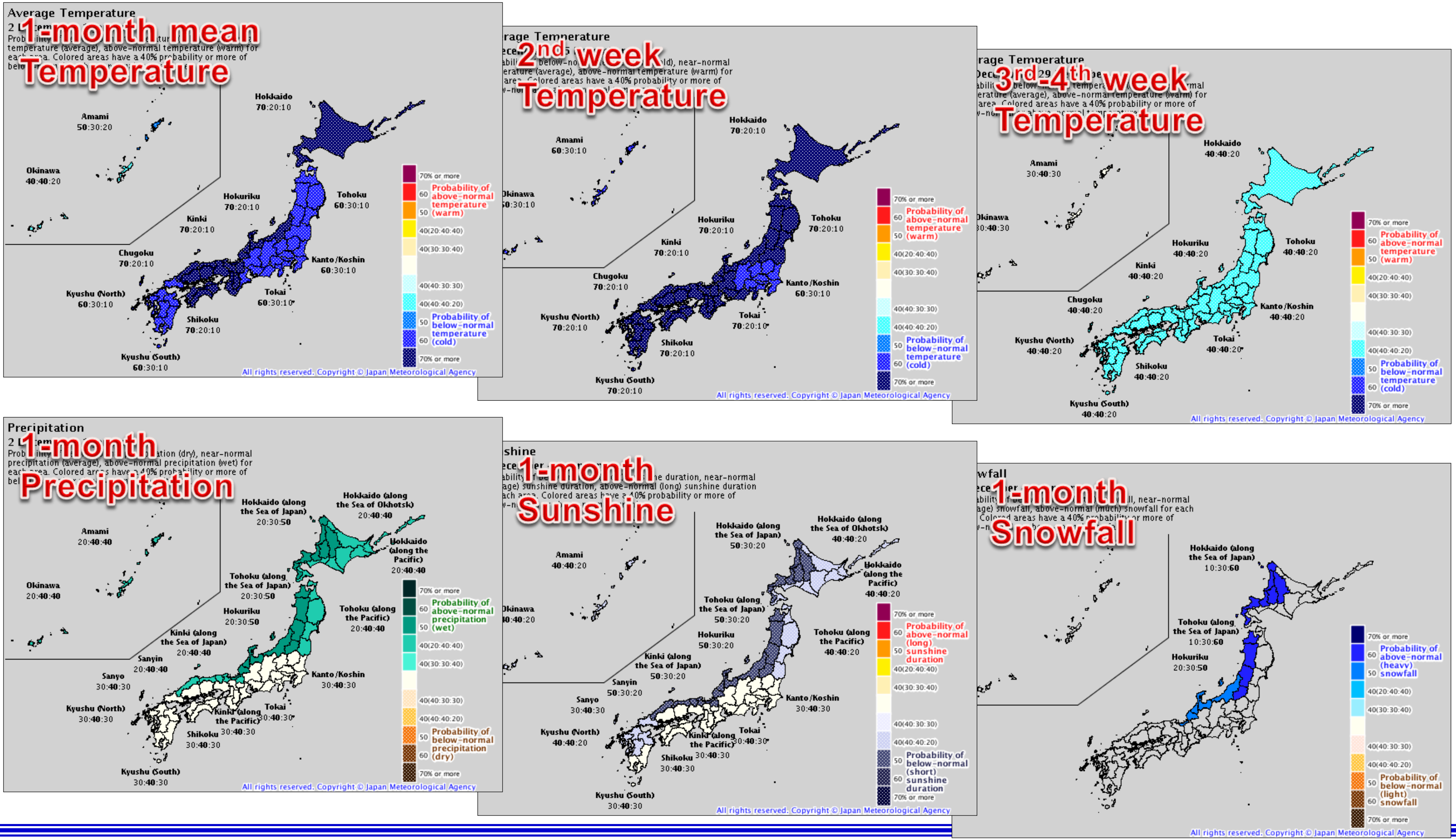

Sea of Japan side
北日本日本海側
北日本
Northern Japan
北日本太平洋側
東日本日本海側
西日本日本海側
東日本
Eastern Japan
東日本太平洋側
西日本太平洋側
西日本
Pacific side
Western Japan
沖縄・奄美
Okinawa-Amami

Small Regions
(issued by the regional offices)


北海道オホーツク海側
海道日本海側
北海道地方
北海道太平洋側
東北日本海側
東北地方
北陸地方
東北太平洋側
近畿日本海側
山陰
中国地方
関東甲信地方
山陽
九州北部地方
東海地方
近畿地方
近畿太平洋側
九州南部
四国地方
九州南部・奄美地方
奄美地方
沖縄地方

One-month Forecast

Example issued on 30 Nov. 2017



1-month mean Temperature
Average Temperature
Hokkaido 70:20:10
Tohoku 60:30:10
Kanto/Koshin 60:30:10
Hokuriku 70:20:10
Tokai 60:30:10
Kinki 70:20:10
Chugoku 70:20:10
Shikoku 70:20:10
Kyushu (North) 60:30:10
Kyushu (South) 60:30:10
Amami 50:30:20
Okinawa 40:40:20
2nd week Temperature
Hokkaido 70:20:10
Tohoku 70:20:10
Kanto/Koshin 60:30:10
Hokuriku 70:20:10
Tokai 70:20:10
Kinki 70:20:10
Chugoku 70:20:10
Shikoku 70:20:10
Kyushu (North) 70:20:10
Kyushu (South) 70:20:10
Amami 60:30:10
3rd-4th week Temperature
Hokkaido 40:40:20
Tohoku 40:40:20
Kanto/Koshin 40:40:20
Hokuriku 40:40:20
Tokai 40:40:20
Kinki 40:40:20
Chugoku 40:40:20
Shikoku 40:40:20
Kyushu (North) 40:40:20
Kyushu (South) 40:40:20
Amami 30:40:30
70% or more
Probability of above-normal temperature (warm)
40(20:40:40)
40(30:30:40)
40(40:30:30)
40(40:40:20)
Probability of below-normal temperature (cold)
1-month Precipitation
Precipitation
Hokkaido (along the Sea of Japan) 20:30:50
Hokkaido (along the Sea of Okhotsk) 20:40:40
Hokkaido (along the Pacific) 20:40:40
Tohoku (along the Sea of Japan) 20:30:50
Tohoku (along the Pacific) 20:40:40
Hokuriku 20:30:50
Kinki (along the Sea of Japan) 20:40:40
Sanyin 20:40:40
Sanyo 30:40:30
Kanto/Koshin 30:40:30
Tokai 30:40:30
Kinki (along the Pacific) 30:40:30
Shikoku 30:40:30
Kyushu (North) 30:40:30
Kyushu (South) 30:40:30
Amami 20:40:40
Okinawa 20:40:40
Probability of above-normal precipitation (wet)
Probability of below-normal precipitation (dry)
1-month Sunshine
Sunshine
Hokkaido (along the Sea of Japan) 50:30:20
Hokkaido (along the Sea of Okhotsk) 40:40:20
Hokkaido (along the Pacific) 40:40:20
Tohoku (along the Sea of Japan) 50:30:20
Tohoku (along the Pacific) 40:40:20
Hokuriku 50:30:20
Kinki (along the Sea of Japan) 50:30:20
Sanyin 50:30:20
Sanyo 30:40:30
Kanto/Koshin 30:40:30
Tokai 30:40:30
Kinki (along the Pacific) 30:40:30
Shikoku 30:40:30
Kyushu (North) 40:40:20
Kyushu (South) 30:40:30
Amami 40:40:20
Okinawa 40:40:20
Probability of above-normal (long) sunshine duration
Probability of below-normal (short) sunshine duration
1-month Snowfall
Snowfall
Hokkaido (along the Sea of Japan) 10:30:60
Tohoku (along the Sea of Japan) 10:30:60
Hokuriku 20:30:50
Probability of above-normal (heavy) snowfall
Probability of below-normal (light) snowfall
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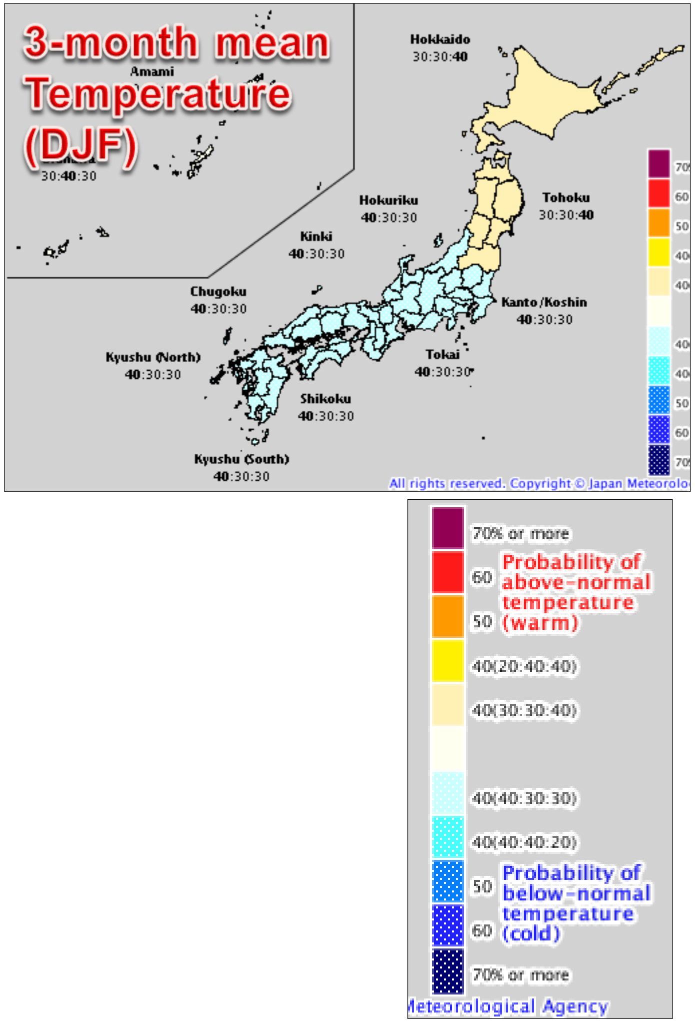
Three-month Forecast

Example issued on 24 Nov. 2017


3-month mean Temperature (DJF)
Hokkaido 30:30:40
Amami
30:40:30
Tohoku 30:30:40
Hokuriku 40:30:30
Kinki 40:30:30
Chugoku 40:30:30
Kanto/Koshin 40:30:30
Kyushu (North) 40:30:30
Tokai 40:30:30
Shikoku 40:30:30
Kyushu (South) 40:30:30
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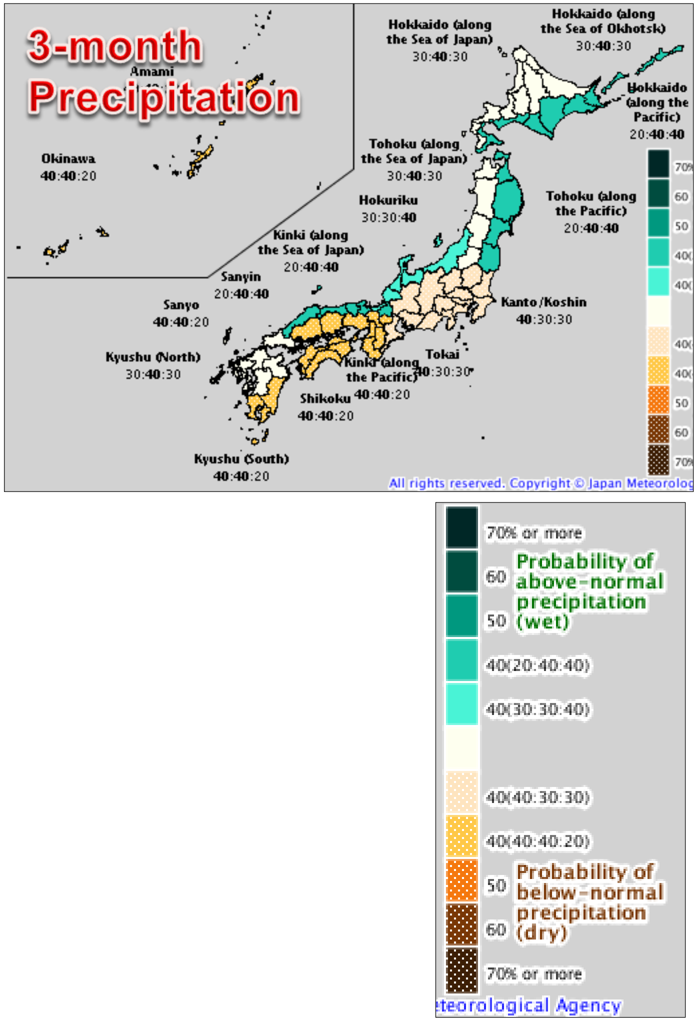
70% or more
Probability of above-normal temperature (warm)
60
50
40(20:40:40)
40(30:30:40)
40(40:30:30)
40(40:40:20)
50
60
Probability of below-normal temperature (cold)
70% or more
Meteorological Agency


3-month Precipitation
Hokkaido (along the Sea of Japan) 30:40:30
Hokkaido (along the Sea of Okhotsk) 30:40:30
Hokkaido (along the Pacific) 20:40:40
Amami
Okinawa 40:40:20
Tohoku (along the Sea of Japan) 30:40:30
Tohoku (along the Pacific) 20:40:40
Hokuriku 30:30:40
Kinki (along the Sea of Japan) 20:40:40
Sanyin 20:40:40
Sanyo 40:40:20
Kanto/Koshin 40:30:30
Kyushu (North) 30:40:30
Tokai 40:30:30
Kinki (along the Pacific) 40:40:20
Shikoku 40:40:20
Kyushu (South) 40:40:20
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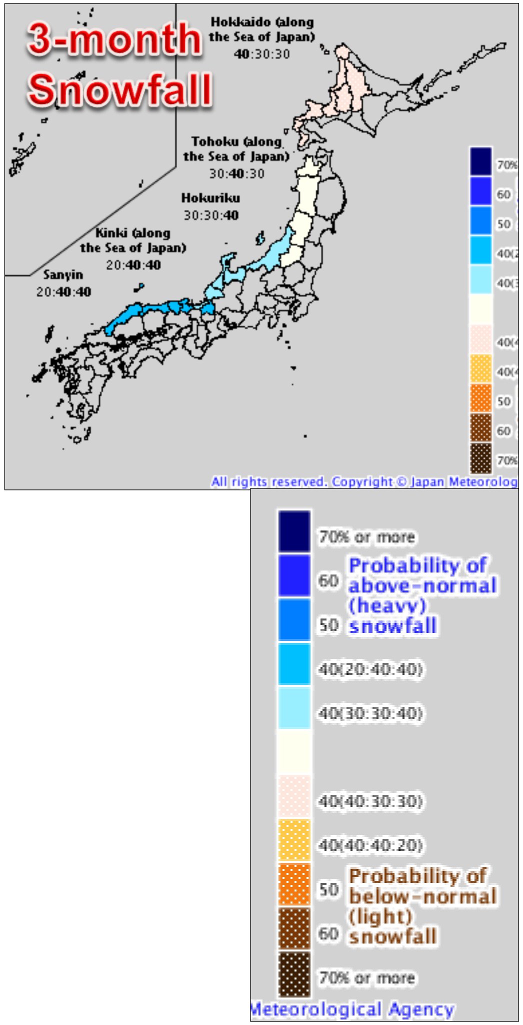
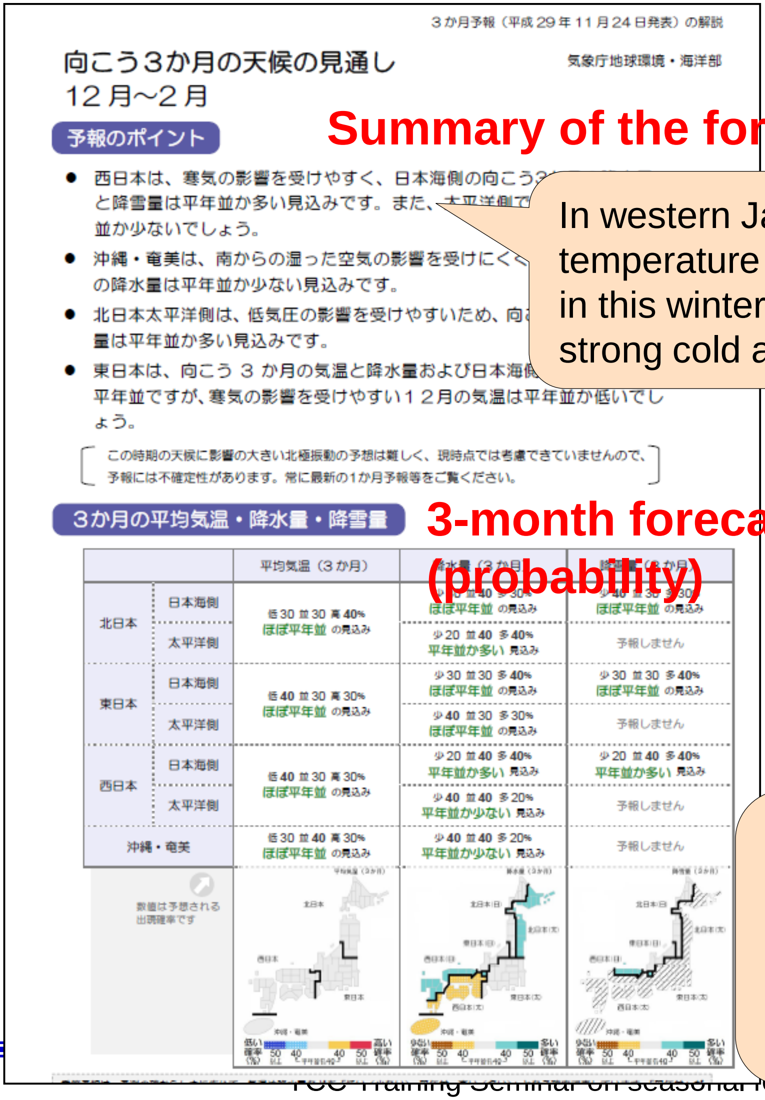
70% or more
Probability of above-normal precipitation (wet)
60
50
40(20:40:40)
40(30:30:40)
40(40:30:30)
40(40:40:20)
50
60
Probability of below-normal precipitation (dry)
70% or more
teorological Agency


3-month Snowfall
Hokkaido (along the Sea of Japan) 40:30:30
Tohoku (along the Sea of Japan) 30:40:30
Hokuriku 30:30:40
Kinki (along the Sea of Japan) 20:40:40
Sanyin 20:40:40
All rights reserved. Copyright © Japan Meteorolog
70% or more
Probability of above-normal (heavy) snowfall
60
50
40(20:40:40)
40(30:30:40)
40(40:30:30)
40(40:40:20)
50
60
Probability of below-normal (light) snowfall
70% or more
Meteorological Agency

Commentary on 3-month Forecast

Commentary material is also provided from JMA HP



３か月予報（平成 29 年 11 月 24 日発表）の解説

向こう３か月の天候の見通し
12 月～2 月

気象庁地球環境・海洋部

予報のポイント

Summary of the forecast

- 西日本は、寒気の影響を受けやすく、日本海側の向こう3
  と降雪量は平年並か多い見込みです。また、太平洋側で
  並か少ないでしょう。
- 沖縄・奄美は、南からの湿った空気の影響を受けにくく
  の降水量は平年並か少ない見込みです。
- 北日本太平洋側は、低気圧の影響を受けやすいため、向こ
  量は平年並か多い見込みです。
- 東日本は、向こう ３ か月の気温と降水量および日本海側
  平年並ですが、寒気の影響を受けやすい１２月の気温は平年並か低いでしょう。

In western Japan, cold temperature is expected in this winter due to strong cold airflow...

〔この時期の天候に影響の大きい北極振動の予想は難しく、現時点では考慮できていませんので、予報には不確定性があります。常に最新の1か月予報等をご覧ください。〕

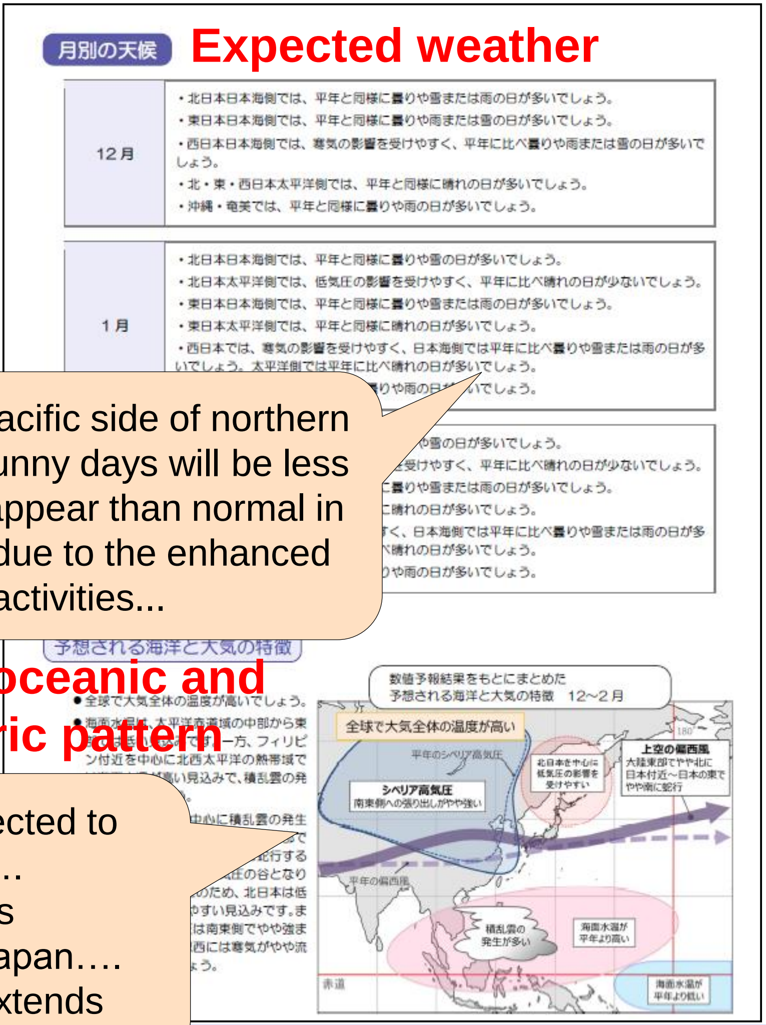
３か月の平均気温・降水量・降雪量

3-month forecast (probability)

		平均気温（3 か月）	降水量（3 か月）	降雪量（3 か月）
北日本	日本海側	低 30 並 30 高 40% ほぼ平年並 の見込み	少 [illegible]0 並 40 多 30% ほぼ平年並 の見込み	少 40 並 30 多 30% ほぼ平年並 の見込み
	太平洋側		少 20 並 40 多 40% 平年並か多い 見込み	予報しません
東日本	日本海側	低 40 並 30 高 30% ほぼ平年並 の見込み	少 30 並 30 多 40% ほぼ平年並 の見込み	少 30 並 30 多 40% ほぼ平年並 の見込み
	太平洋側		少 40 並 30 多 30% ほぼ平年並 の見込み	予報しません
西日本	日本海側	低 40 並 30 高 30% ほぼ平年並 の見込み	少 20 並 40 多 40% 平年並か多い 見込み	少 20 並 40 多 40% 平年並か多い 見込み
	太平洋側		少 40 並 40 多 20% 平年並か少ない 見込み	予報しません
沖縄・奄美		低 30 並 40 高 30% ほぼ平年並 の見込み	少 40 並 40 多 20% 平年並か少ない 見込み	予報しません

数値は予想される出現確率です

平均気温（3か月）
北日本
東日本
西日本
沖縄・奄美
低い確率（%） 50以上 40 平年並40 40 50以上 高い確率（%）
降水量（3か月）
北日本(日)
北日本(太)
東日本(日)
東日本(太)
西日本(日)
西日本(太)
沖縄・奄美
少ない確率（%） 50以上 40 平年並40 40 50以上 多い確率（%）
降雪量（3か月）
北日本(日)
北日本(太)
東日本(日)
東日本(太)
西日本(日)
西日本(太)
沖縄・奄美
少ない確率（%） 50以上 40 平年並40 40 50以上 多い確率（%）



月別の天候

Expected weather

12 月	・北日本日本海側では、平年と同様に曇りや雪または雨の日が多いでしょう。 ・東日本日本海側では、平年と同様に曇りや雨または雪の日が多いでしょう。 ・西日本日本海側では、寒気の影響を受けやすく、平年に比べ曇りや雨または雪の日が多いでしょう。 ・北・東・西日本太平洋側では、平年と同様に晴れの日が多いでしょう。 ・沖縄・奄美では、平年と同様に曇りや雨の日が多いでしょう。
1 月	・北日本日本海側では、平年と同様に曇りや雪の日が多いでしょう。 ・北日本太平洋側では、低気圧の影響を受けやすく、平年に比べ晴れの日が少ないでしょう。 ・東日本日本海側では、平年と同様に曇りや雪または雨の日が多いでしょう。 ・東日本太平洋側では、平年と同様に晴れの日が多いでしょう。 ・西日本では、寒気の影響を受けやすく、日本海側では平年に比べ曇りや雪または雨の日が多いでしょう。太平洋側では平年に比べ晴れの日が多いでしょう。 りや雨の日が[illegible]いでしょう。
	や雪の日が多いでしょう。 を受けやすく、平年に比べ晴れの日が少ないでしょう。 曇りや雪または雨の日が多いでしょう。 晴れの日が多いでしょう。 すく、日本海側では平年に比べ曇りや雪または雨の日が多 べ晴れの日が多いでしょう。 りや雨の日が多いでしょう。

On the Pacific side of northern Japan, sunny days will be less likely to appear than normal in January due to the enhanced cyclonic activities...

予想される海洋と大気の特徴

Expected oceanic and atmospheric pattern

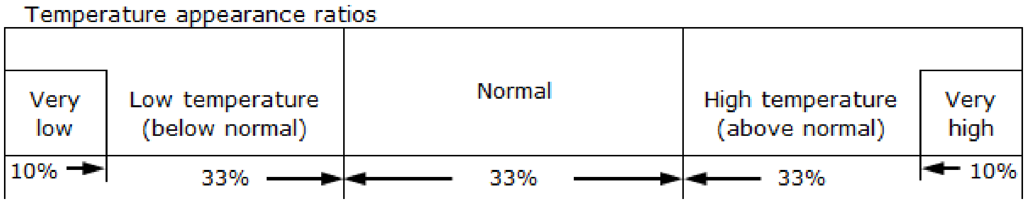
- 全球で大気全体の温度が高いでしょう。
- 海面水温は、太平洋赤道域の中部から東部で
  い見込みです。一方、フィリピン付近を中心に北西太平洋の熱帯域で
  い見込みで、積乱雲の発
  中心に積乱雲の発生
  で
  北行する
  圧の谷となり
  のため、北日本は低
  やすい見込みです。ま
  は南東側でやや強ま
  西には寒気がやや流
  ょう。

数値予報結果をもとにまとめた
予想される海洋と大気の特徴 12～2 月
全球で大気全体の温度が高い
平年のシベリア高気圧
シベリア高気圧
南東側への張り出しがやや強い
北日本を中心に低気圧の影響を受けやすい
上空の偏西風
大陸東部でやや北に
日本付近～日本の東でやや南に蛇行
180°
平年の偏西風
積乱雲の発生が多い
海面水温が平年より高い
海面水温が平年より低い
赤道

Tropical SST is expected to higher than normal….
Jet stream meanders southward around Japan….
The Siberian High extends southward…

Early Warning Information for Extreme Weather

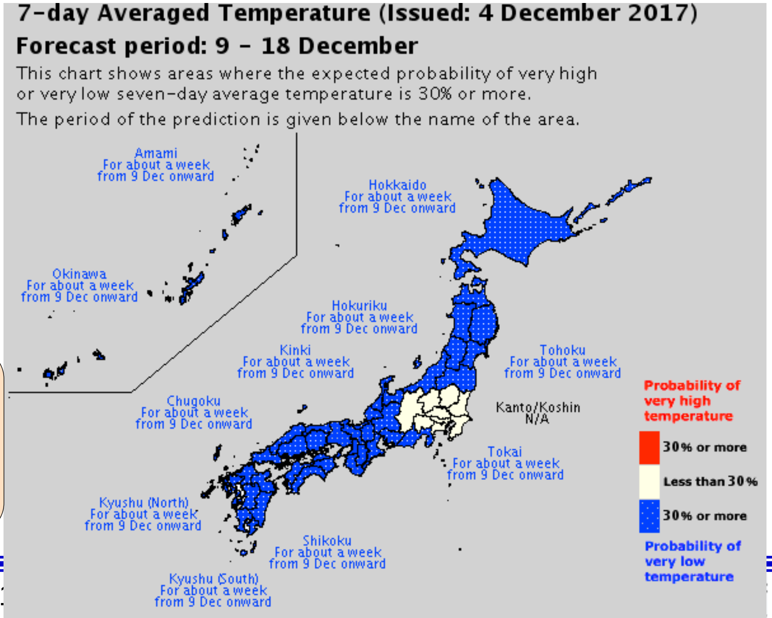
- **Objective**: Mitigation of the adverse impacts from extreme weather events (hot/cold spell, heavy snow) on socio-economic activities such as agriculture and disaster prevention in early stage (1-2-week ahead).
- **Targeted event**: An extreme 7-day averaged temperature or 7-day snowfall amounts event which appears once per decade in climatology (i.e., 10%).
- **Timing of issuing**: When targeted event is expected to happen 5-14-day ahead with the probability of 30% or more (i.e., 3 times more likely to happen than normal).



Temperature appearance ratios

Very low	Low temperature (below normal)	Normal	High temperature (above normal)	Very high
10% →	33% →	← 33% →	← 33%	← 10%

In this example, information for significantly cold weather from 9 Dec. onward was issued on 4 Dec.



7-day Averaged Temperature (Issued: 4 December 2017)

Forecast period: 9 – 18 December

This chart shows areas where the expected probability of very high or very low seven-day average temperature is 30% or more.

The period of the prediction is given below the name of the area.

Amami
For about a week
from 9 Dec onward
Hokkaido
For about a week
from 9 Dec onward
Okinawa
For about a week
from 9 Dec onward
Hokuriku
For about a week
from 9 Dec onward
Kinki
For about a week
from 9 Dec onward
Tohoku
For about a week
from 9 Dec onward
Chugoku
For about a week
from 9 Dec onward
Kanto/Koshin
N/A
Tokai
For about a week
from 9 Dec onward
Kyushu (North)
For about a week
from 9 Dec onward
Shikoku
For about a week
from 9 Dec onward
Kyushu (South)
For about a week
from 9 Dec onward
Probability of very high temperature
30% or more
Less than 30%
30% or more
Probability of very low temperature

Utilization of Seasonal Forecast

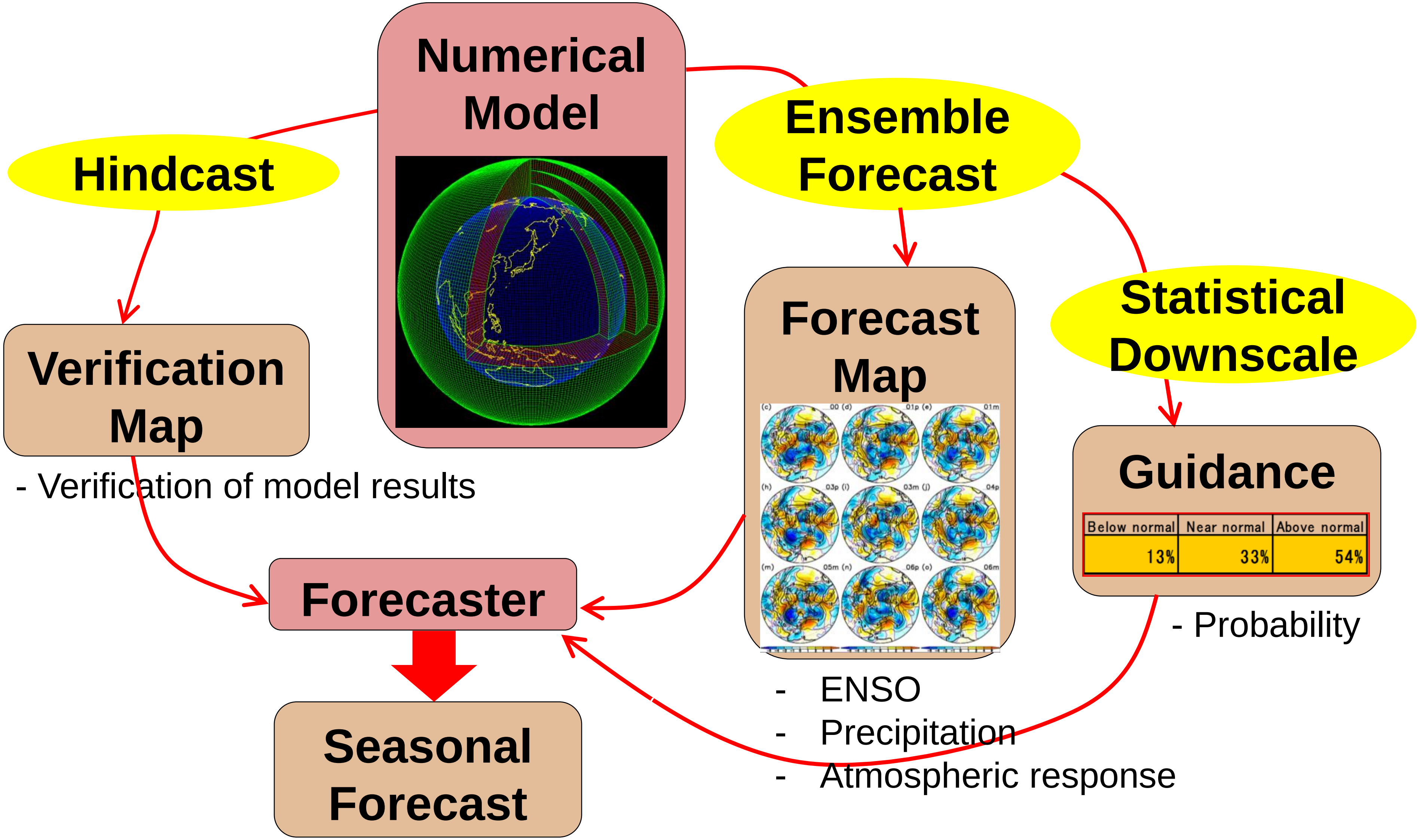
JMA is promoting the utilization of long-range forecast (mainly 2-week/1-month prediction) in various sectors such as agriculture.

Examples

- Prediction data is used at local governments to estimate the adequate timing of rice and fruit harvesting.
- Advisory information is provided by a research organization to reduce damage from significant cold/hot weather on rice farming.

Procedure of Seasonal Forecast

Flow of Making Seasonal Forecast



Numerical Model

Hindcast

Ensemble Forecast

Verification Map

- Verification of model results

Forecast Map

- ENSO
- Precipitation
- Atmospheric response

Statistical Downscale

Guidance

Below normal	Near normal	Above normal
13%	33%	54%

- Probability

Forecaster

Seasonal Forecast

Procedure of Seasonal Forecast (1)

1. Understand the current status of ocean and atmosphere
2. Check the numerical model results
   - SST in the tropics (ENSO, Indian Ocean,…)
   - Convective activity (Precipitation)
   - Atmospheric circulation (response to the convection)
3. Check the prediction skill of the numerical model
   - Which model results should be taken to the forecast?

Exercise on Thursday

These will be introduced during the seminar…

Products for seasonal forecast provided at TCC-HP

Forecast Map

Monthly Discussion

Hindcast Verification Charts

El Nino Outlook

Procedure of Seasonal Forecast (2)

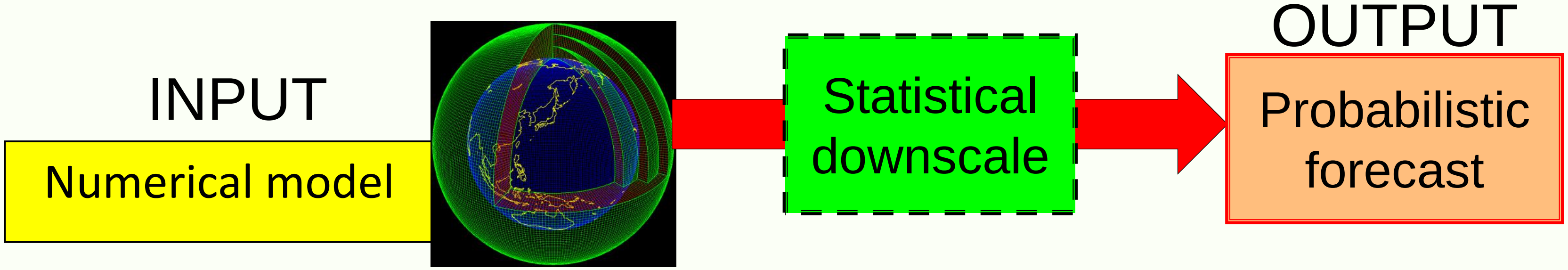
4. Check the **guidance** to estimate probability
5. Decide forecast

Goal of this seminar

   - Modify the guidance based on the prediction skill of the model results and the guidance

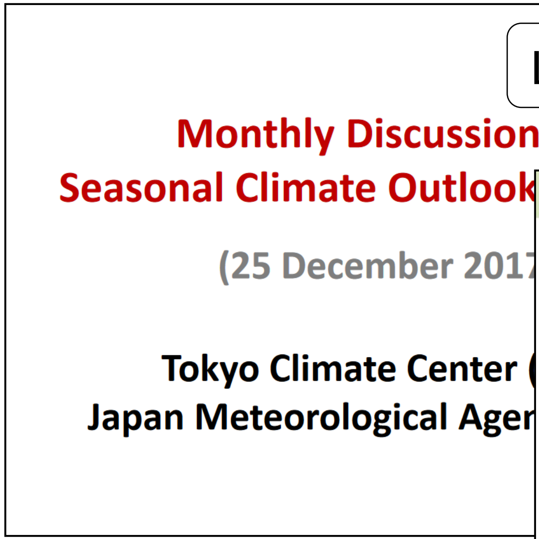
Exercise on Wednesday

Guidance is an application to translate model output values into target of forecasting with statistical relationship between forecast and observation


INPUT
Numerical model
Statistical downscale
OUTPUT
Probabilistic forecast

Monthly Discussion – TCC-HP Product

Material issued every month (around 25th) in order to assist NMHSs in interpreting season prediction products.

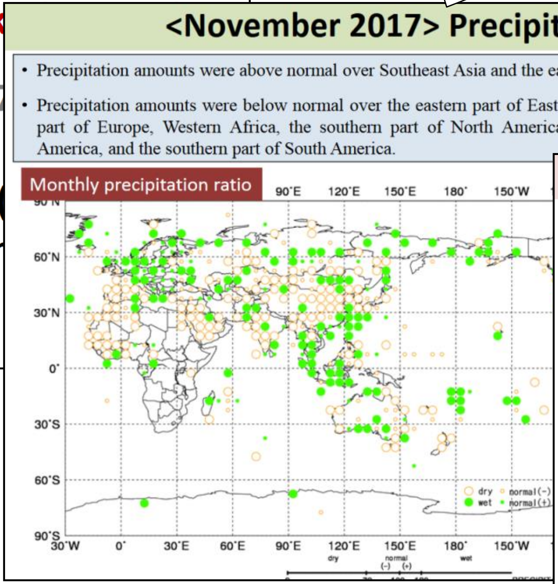


Monthly Discussion on
Seasonal Climate Outlook

(25 December 2017

Tokyo Climate Center (
Japan Meteorological Ager

Latest state of the climate system



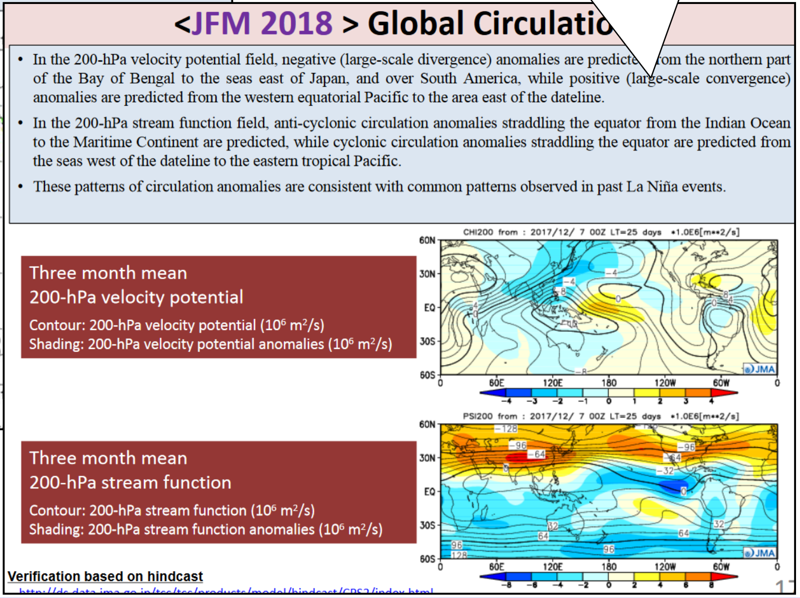
<November 2017> Precipitation

- Precipitation amounts were above normal over Southeast Asia and the eastern part of Europe.
- Precipitation amounts were below normal over the eastern part of East Asia, Middle East, the wester part of Europe, Western Africa, the southern part of North America, the northern part of Centra America, and the southern part of South America.

Monthly precipitation ratio

90°E
120°E
150°E
180°
150°W
60°N
30°N
0°
30°S
60°S
90°S
30°W
0°
30°E
60°E
90°E
120°E
150°E
180°
150°W
dry
wet
normal(-)
normal(+)

Explanatory comments on the latest model's output



<JFM 2018 > Global Circulatio

- In the 200-hPa velocity potential field, negative (large-scale divergence) anomalies are predicte rom the northern part of the Bay of Bengal to the seas east of Japan, and over South America, while positive (large-scale convergence) anomalies are predicted from the western equatorial Pacific to the area east of the dateline.
- In the 200-hPa stream function field, anti-cyclonic circulation anomalies straddling the equator from the Indian Ocean to the Maritime Continent are predicted, while cyclonic circulation anomalies straddling the equator are predicted from the seas west of the dateline to the eastern tropical Pacific.
- These patterns of circulation anomalies are consistent with common patterns observed in past La Niña events.

Three month mean
200-hPa velocity potential
Contour: 200-hPa velocity potential (10^6 m²/s)
Shading: 200-hPa velocity potential anomalies (10^6 m²/s)

Three month mean
200-hPa stream function
Contour: 200-hPa stream function (10^6 m²/s)
Shading: 200-hPa stream function anomalies (10^6 m²/s)

CHI200 from : 2017/12/ 7 00Z LT=25 days *1.0E6[m**2/s]
PSI200 from : 2017/12/ 7 00Z LT=25 days *1.0E6[m**2/s]
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
0
−4 −3 −2 −1 0 1 2 3 4
−8 −6 −4 −2 0 2 4 6 8
JMA

Verification based on hindcast
http://ds.data.jma.go.jp/tcc/tcc/products/model/hindcast/CPS2/index.html

Latest one was issued on 24 Jan., so you can refer to it.

http://ds.data.jma.go.jp/tcc/tcc/products/model/monthly_discussion/latest.pdf