Meeting material at BMKG

18 June 2019, 09:30 to 12:00

Project of Capacity Development for the Implementation of Agricultural Insurance in the Republic of Indonesia

A plan for Key activity 2:

Develop weather information and strengthen abilities for producing products for agriculture.

JMA Seasonal Forecasts_ Evaluation of the probability forecast

- Introduction to JMA seasonal forecast
- Evaluation of the probability forecast

JICA expert (JMBSC)

Koichi Kurihara

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JMA Seasonal Forecasts

Kind and contents of forecasts

- **One-month forecast** : issued at 14:30 JST every Thursday.
  - Mean temperature (Monthly, first week/second week/3-4week mean)
  - Precipitation (Monthly total)
  - Sunshine duration (Monthly total)
  - (Snowfall amount in winter)
- **Three-month forecast**: issued at 14:00 JST around the 25th of each month .
  - Mean temperature (Monthly, three-month mean)
  - Precipitation (Monthly , three-month total)
  - Sunshine duration (Monthly , three-month total)
- **Warm/cold-season outlook**: issued in February/September
  - Mean temperature (June to August mean)
  - Precipitation (June to August total)
  - Precipitation (Rainy season total)

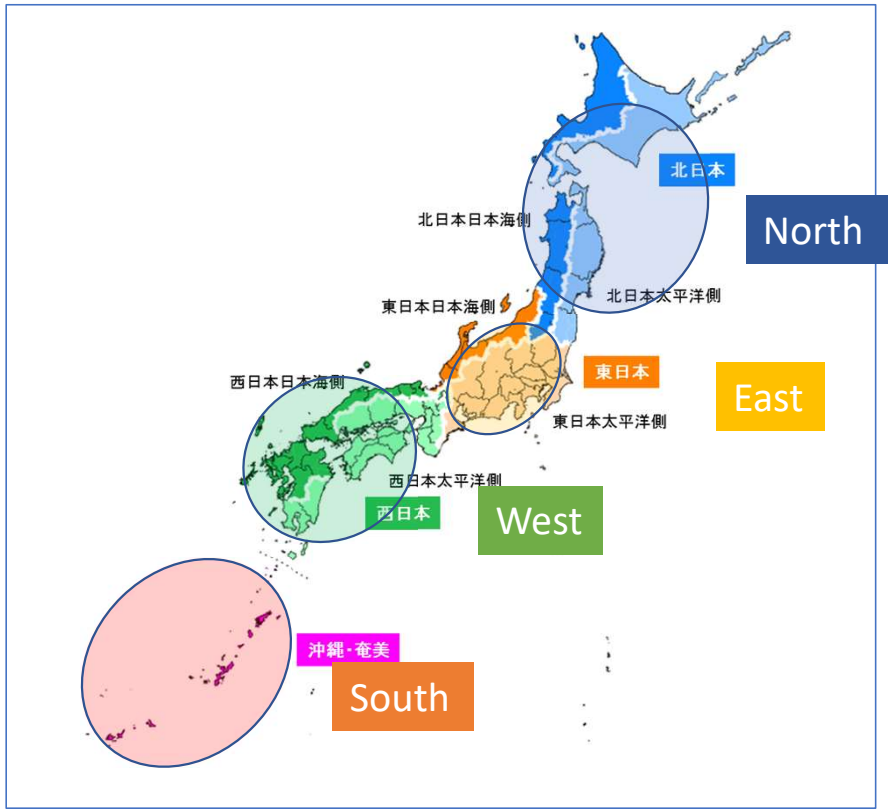
Expression of forecasts (Probability forecasts)

- Forecasts are expressed in Probabilities of the forecast categories (Below, Normal, Above)
- Climatological probability for each category is 33.3%, calculated using 30 years data, presently for the period from 1981 to 2010.

Forecast offices and regions(zones)

- JMA-HQ is in charge of “Nation-wide forecasts” and 10 regional offices (District observatories) are engaged in “Regional forecasts” .
- See next slides for forecast regions

Forecast regions (Nation- wide forecasts)

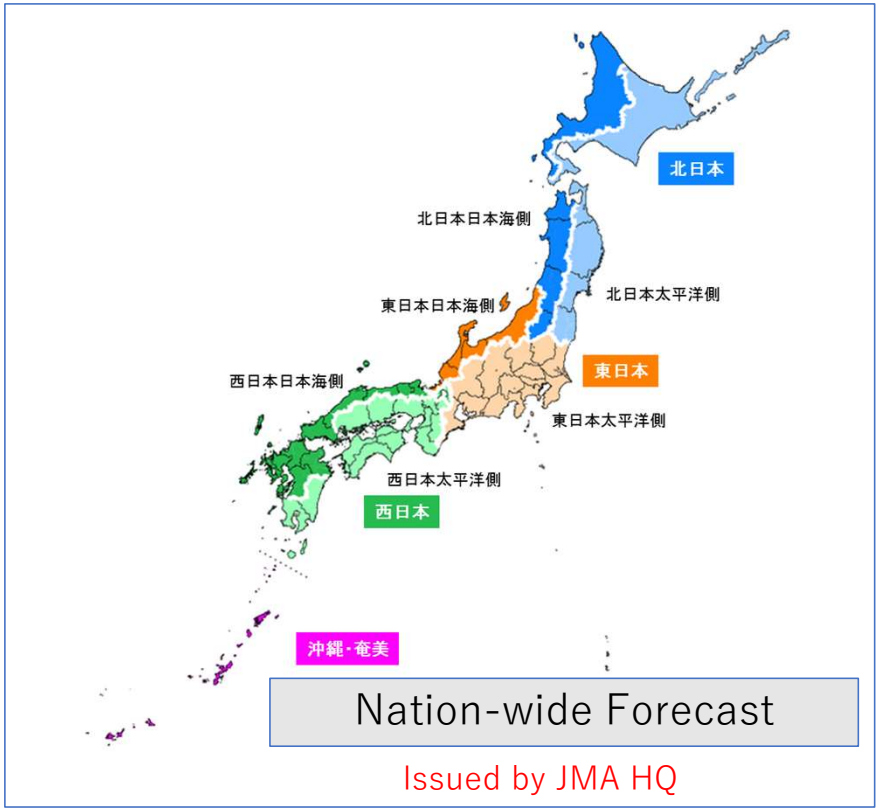


- Nation-wide forecasts are issued by JMA-HQ
- Forecast regions for mean temperature are 4 (North, East, West, South)
- Forecast regions for Precipitation and sunshine duration are 7.

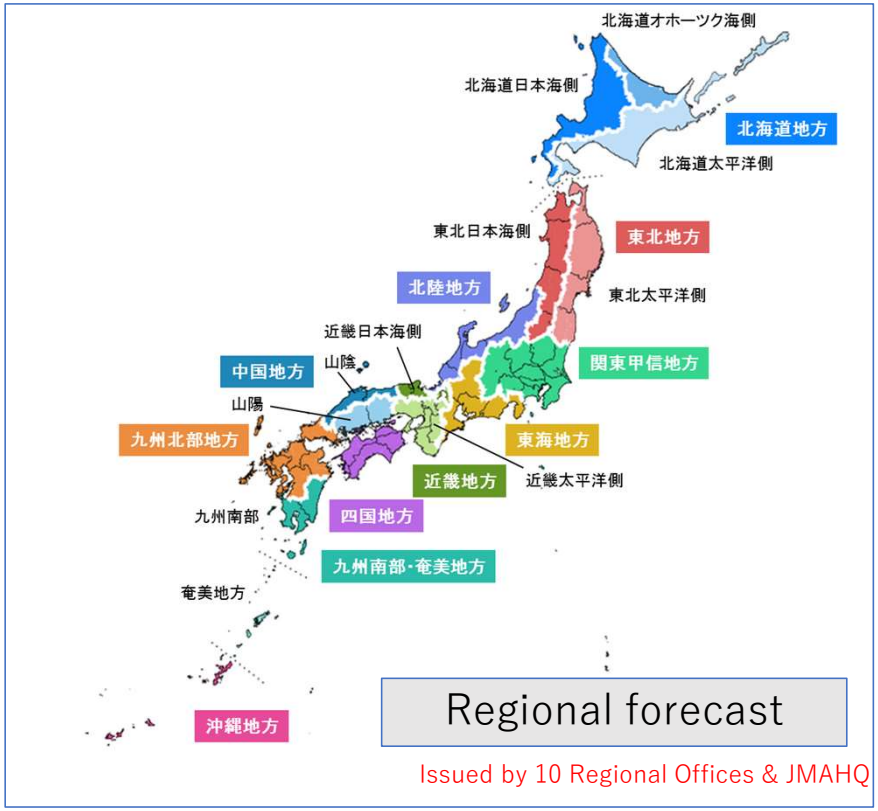
Forecast regions (Regional forecasts)

- Reginal forecasts are issued by 10 regional offices and JMA HQ .
- Forecast regions for mean temperature are 11.
- Forecast regions for Precipitation and sunshine duration are 17.

Forecast regions

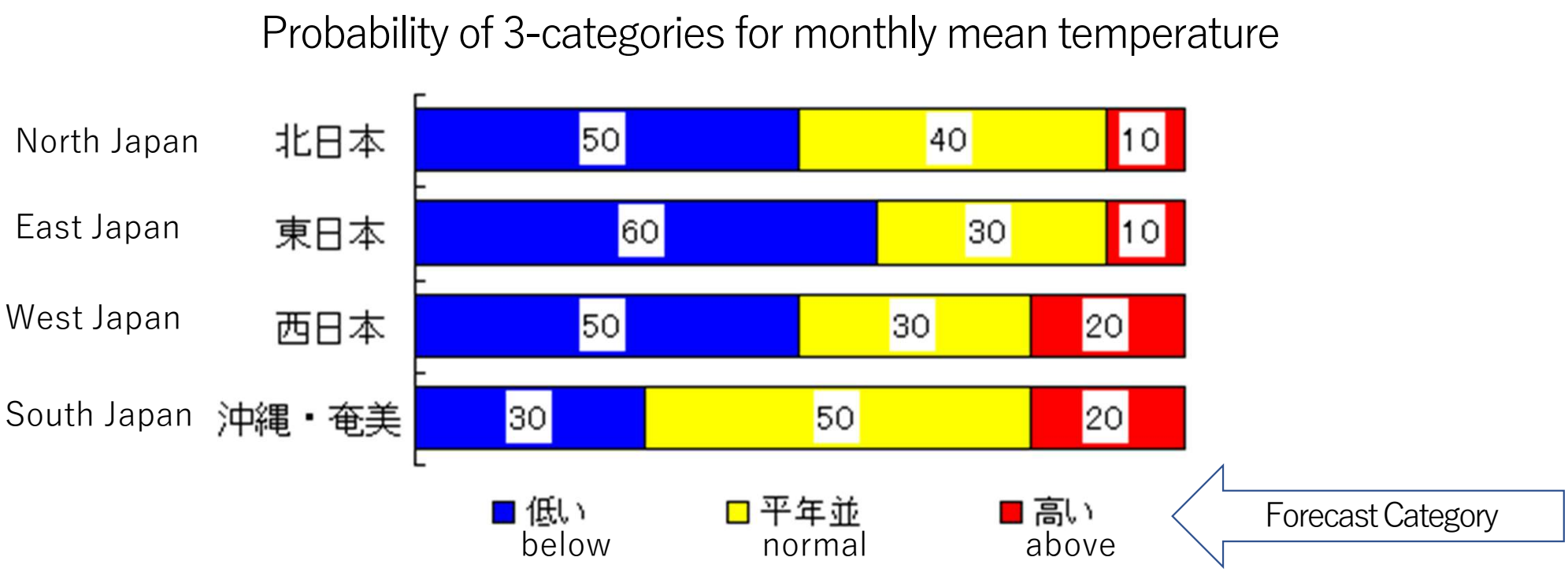


4-regions for mean temperature
7-regions for precip. and sunshine



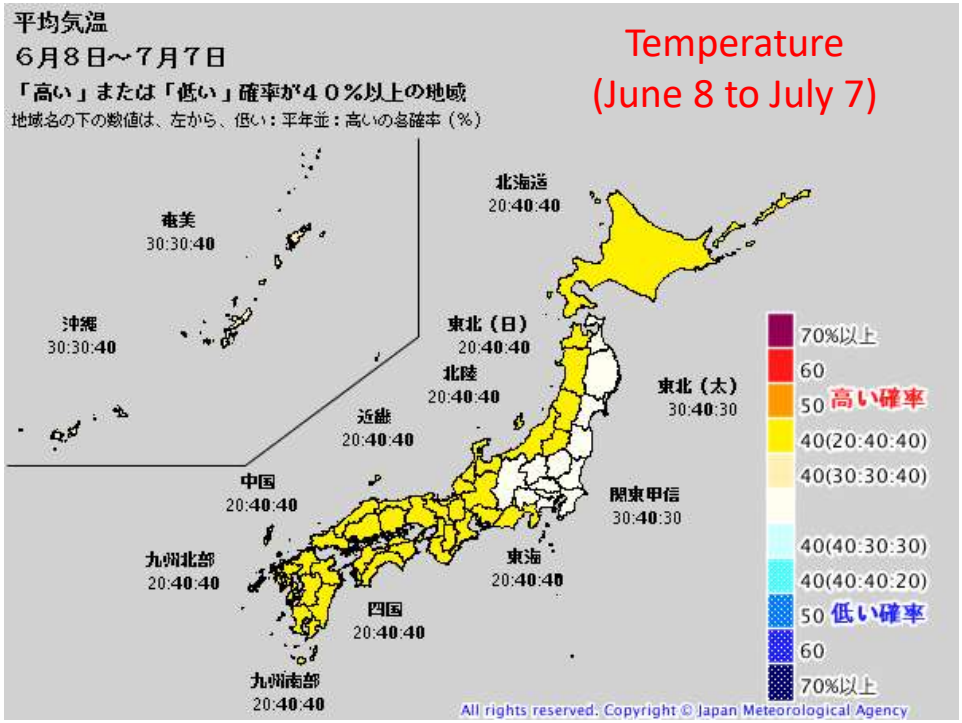
11-regions for mean temperature
17-regions for precip. and sunshine

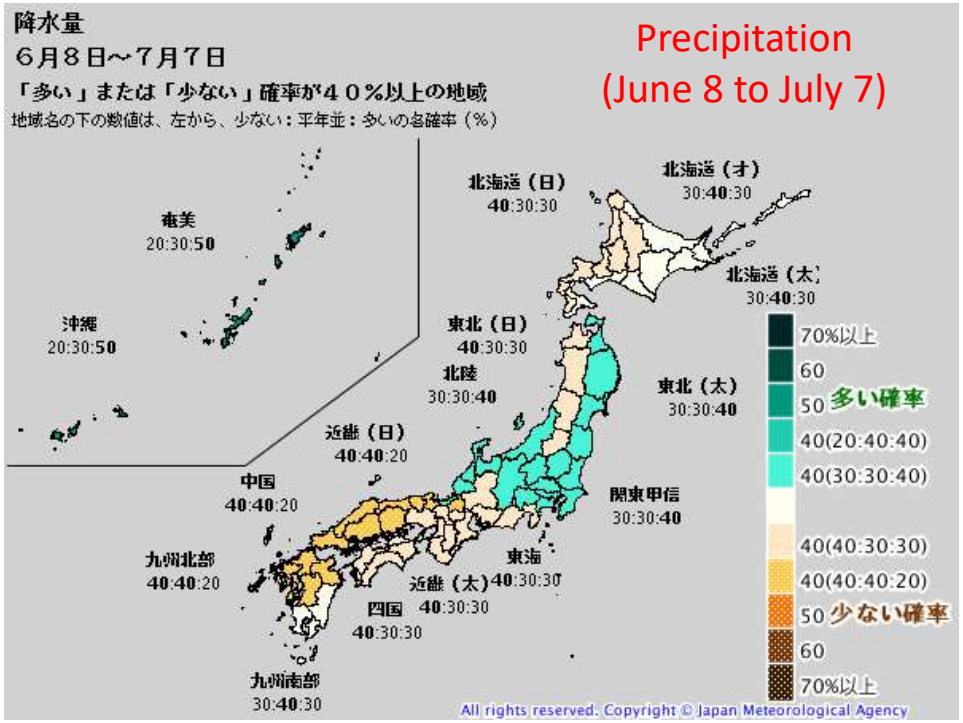
How to express probability forecasts



Example :Nation-wide forecast for monthly mean temperature

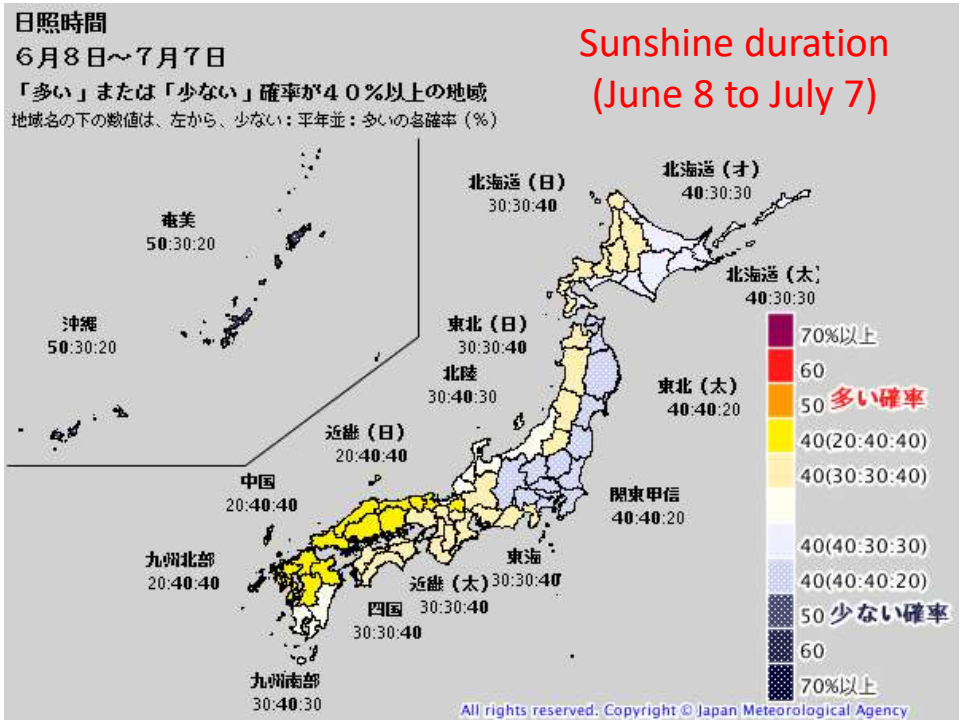
JMA Seasonal Forecasts _Example(1-month)





1-month forecast issued on 6th June 2019

JMA Seasonal Forecasts _Example(1-month)

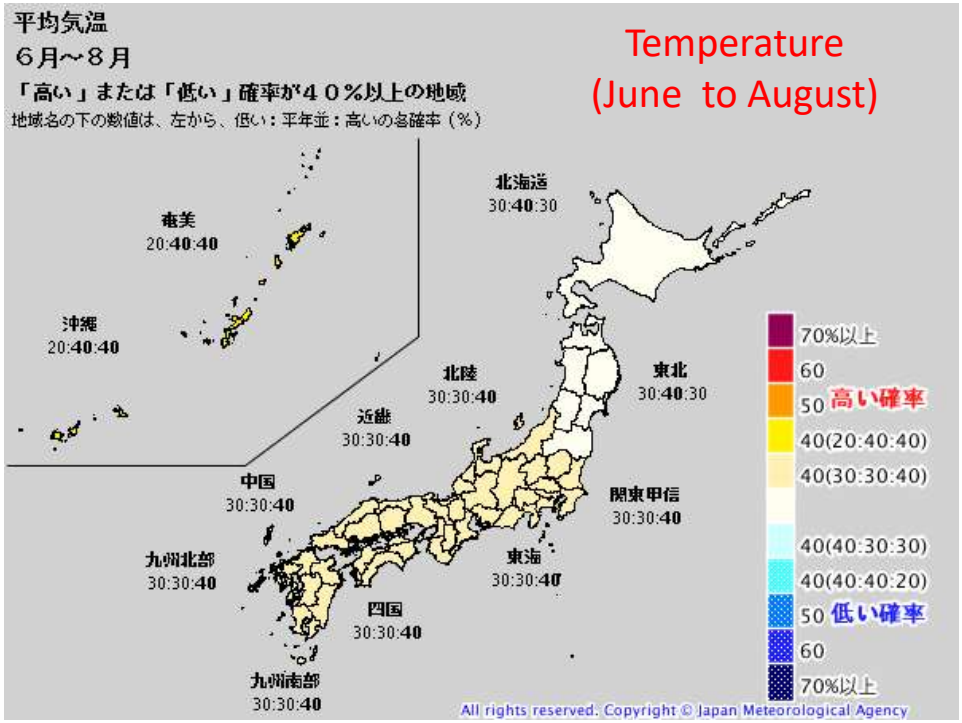


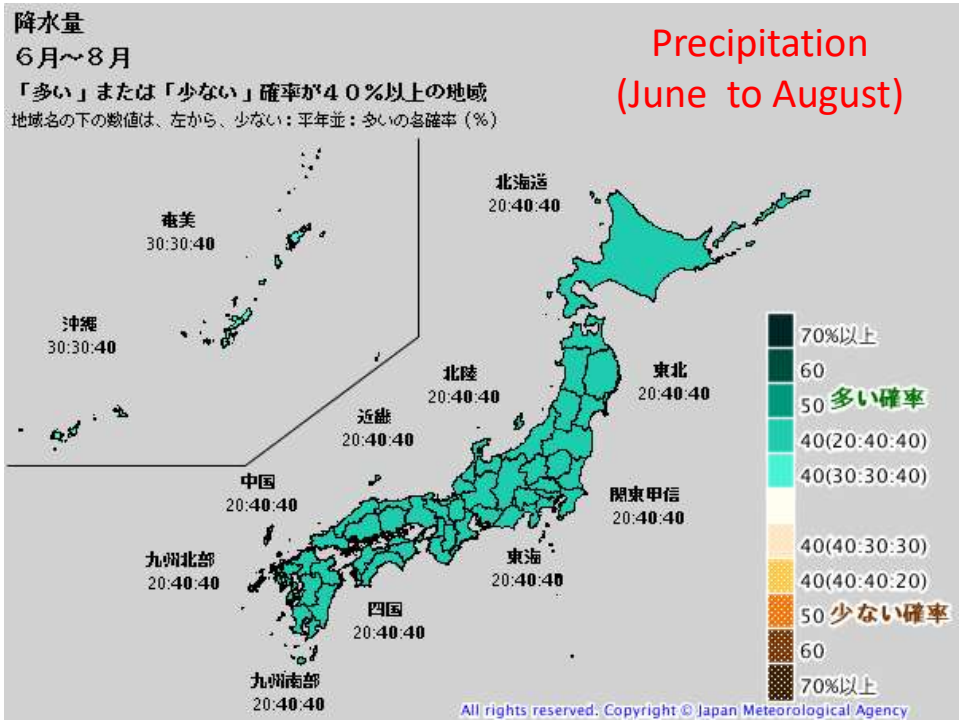
See JMA homepage for the latest one-month forecast:

- https://www.jma.go.jp/jp/longfcst/000_0_00.html

1-month forecast issued on 6th June 2019

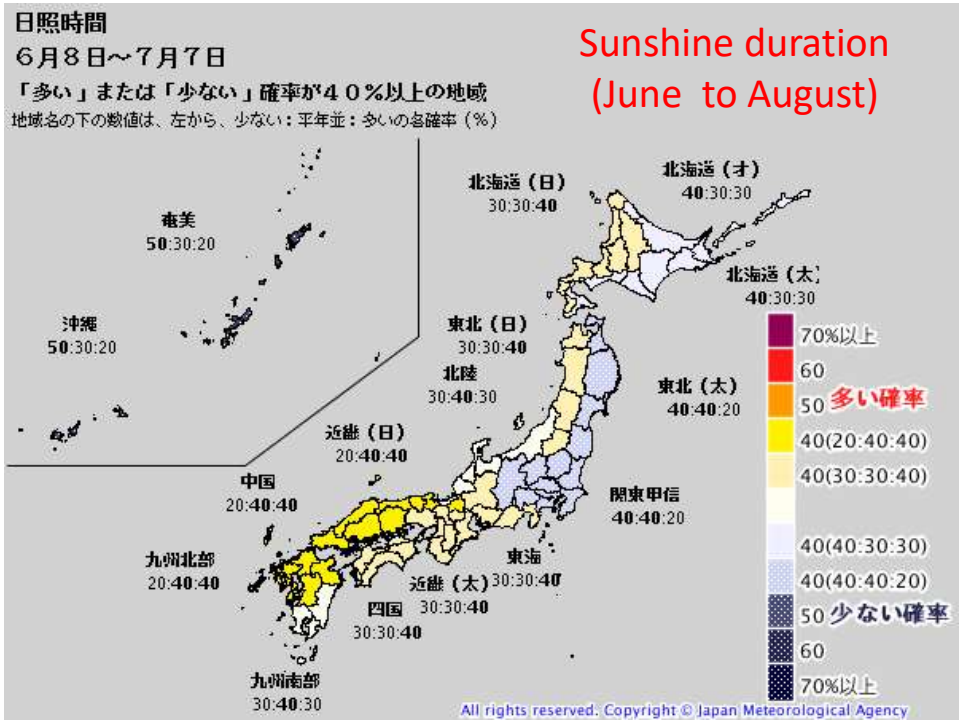
JMA's Seasonal Forecasts _Example(3-month)





3-month forecast issued on 24th June 2019

JMA's Seasonal Forecasts _Example(3-month)



3-month forecast issued on 24th June 2019

See JMA homepage for the latest 3-month forecast

- https://www.jma.go.jp/jp/longfcst/000_0_10.html

Note:

Explanatory documents for the forecast are provided to mass media (including press conference) as well as to the public every time.

Important issues(Challenges to overcome) for probability forecast?

Evaluation of seasonal forecast Example(1-month forecast)

Table One-month forecast evaluation(forecasts issued on 2017/09/01 to 2018/08/31)

Forecast region	Period Predictand	Monthly mean/total T	No	R	No	S	No	Snow	No	1st week T	No	2nd week T	No	3-4 week T	No
北海道地方	Hit rate	0.48	52	0.38	52	0.40	52	0.38	16	0.70	52	0.52	52	0.42	52
	Improved	0.43	0)	0.14	0)	0.21	0)	0.13	0)	1.11	0)	0.56	0)	0.27	0)
	BSS	0.12		0.02		0.03		-0.12		0.31		0.13		0.05	
東北地方	Hit rate	0.74	52	0.45	52	0.31	52	0.16	16	0.70	52	0.58	52	0.43	52
	Improved	1.22	0)	0.34	0)	-0.06	0)	-0.53	0)	1.11	0)	0.73	0)	0.30	0)
	BSS	0.30		0.04		-0.02		-0.08		0.37		0.18		0.07	
関東甲信地方	Hit rate	0.70	52	0.42	52	0.38	52	---	0	0.74	52	0.60	52	0.59	52
	Improved	1.11	0)	0.27	0)	0.13	0)	---	0)	1.22	0)	0.79	0)	0.76	0)
	BSS	0.35		0.05		-0.02		---		0.43		0.19		0.14	
北陸地方	Hit rate	0.68	52	0.44	52	0.39	52	0.56	16	0.67	52	0.62	52	0.46	52
	Improved	1.05	0)	0.33	0)	0.18	0)	0.69	0)	1.02	0)	0.85	0)	0.38	0)
	BSS	0.34		0.07		0.01		0.17		0.36		0.23		0.10	
東海地方	Hit rate	0.66	52	0.48	52	0.37	52	---	0	0.67	52	0.63	52	0.49	52
	Improved	0.99	0)	0.44	0)	0.10	0)	---	0)	1.02	0)	0.90	0)	0.47	0)
	BSS	0.34		0.06		-0.01		---		0.41		0.23		0.09	
近畿地方	Hit rate	0.63	52	0.44	52	0.36	52	0.15	10	0.72	52	0.64	52	0.46	52
	Improved	0.90	0)	0.31	0)	0.07	0)	-0.55	0)	1.16	0)	0.93	0)	0.38	0)
	BSS	0.27		0.03		0.00		-0.16		0.44		0.24		0.07	
中国地方	Hit rate	0.69	52	0.35	52	0.44	52	0.5	10	0.74	52	0.65	52	0.49	52
	Improved	1.08	0)	0.04	0)	0.31	0)	0.5	0)	1.22	0)	0.96	0)	0.47	0)
	BSS	0.32		0.00		0.06		0.2		0.46		0.25		0.09	
四国地方	Hit rate	0.63	52	0.45	52	0.49	52	---	0	0.67	52	0.56	52	0.49	52
	Improved	0.90	0)	0.36	0)	0.47	0)	---	0)	1.02	0)	0.67	0)	0.47	0)
	BSS	0.27		0.06		0.07		---		0.38		0.18		0.09	
九州北部地方	Hit rate	0.77	52	0.31	52	0.40	52	---	0	0.78	52	0.67	52	0.55	52
	Improved	1.31	0)	-0.08	0)	0.21	0)	---	0)	1.34	0)	1.02	0)	0.64	0)
	BSS	0.36		-0.03		0.06		---		0.46		0.26		0.13	
九州南部地方	Hit rate	0.64	52	0.43	52	0.42	52	---	0	0.71	52	0.47	52	0.54	52
	Improved	0.93	0)	0.28	0)	0.27	0)	---	0)	1.12	0)	0.41	0)	0.63	0)
	BSS	0.27		0.06		0.07		---		0.36		0.11		0.11	
沖縄地方	Hit rate	0.58	52	0.52	52	0.45	52	---	0	0.60	52	0.49	52	0.49	52
	Improved	0.73	0)	0.56	0)	0.36	0)	---	0)	0.79	0)	0.47	0)	0.47	0)
	BSS	0.22		0.12		0.12		---		0.29		0.08		0.06	
全国平均	Hit rate	0.66	572	0.42	572	0.40	572	0.35	68	0.70	572	0.58	572	0.49	572
	Improved	0.97	0)	0.27	0)	0.20	0)	0.06	0)	1.10	0)	0.75	0)	0.48	0)
	BSS	0.29		0.04		0.03		0.0		0.39		0.19		0.09	

- "Hit rate"=No. of good forecast/No. of forecast
  Note: In order to translate "Probability forecast" into "Categorical forecast", categories with the largest probability are considered as forecast categories.
- "Improved"=("Hit rate" – Hit rate of climatology forecast)/ Hit rate of climatology forecast
- "BSS"= Brier Skill Score (See next slides)

“Hit rate” and “improved” ratio

3X3 Contingency tabel

(Forecast)

(Observed) Obs.＼Fcst	Below	Normal	Above	Total
Below	n_{11}	n_{12}	n_{13}	n_{1X}
Normal	n_{21}	n_{22}	n_{23}	n_{2X}
Above	n_{31}	n_{32}	n_{33}	n_{3X}
Total	n_{X1}	n_{X2}	n_{X3}	N

Hit rate(S)

$S=(n11+n22+n33)/N$

n11,n22,n33 No. of “good forecast”

N No. of total forecst

$0=<S=<1$

Improved (Si: Improved ratio against climatological forecast)

$Si=(S-Sc)/Sc$

Sc=1/3(Climatology forecast)

$Si<0$ Forecast skill lower than climatology forecast

$Si=0$ Forecast skill equal to climatology forecast

$Si>0$ Forecast skill higher than climatology forecast

Brier Score (BS)

- Brier score is mean squared error of the probability forecasts.

$$BS = \frac{1}{2N} \sum_{i=1}^{N} \sum_{m=1}^{3} (p_i^m - o_i^m)^2$$

p_i^m : forecast probability

o_i^m : observed occurrence (0 or 1)

N : forecast frequency

m : category

Range: 0 to 1

Smaller score indicates better forecast (Perfect score: 0)

Forecast (Below, Near, Above): (0.1, 0.3, 0.6)

Observation: Above normal (0, 0, 1)

BS: $\{(0.1-0)^2+(0.3-0)^2+(0.6-1)^2\}/2 = 0.13$ (N=1, for example)

Brier Skill Score (BSS)

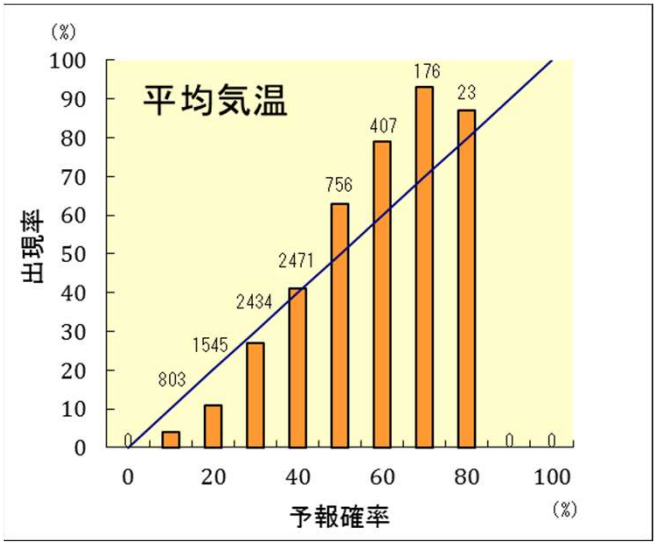
- Brier skill score is ***skill*** relative to a reference forecast (usually climatology).

$$BSS = 1 - \frac{BS}{BS_{reference}}$$

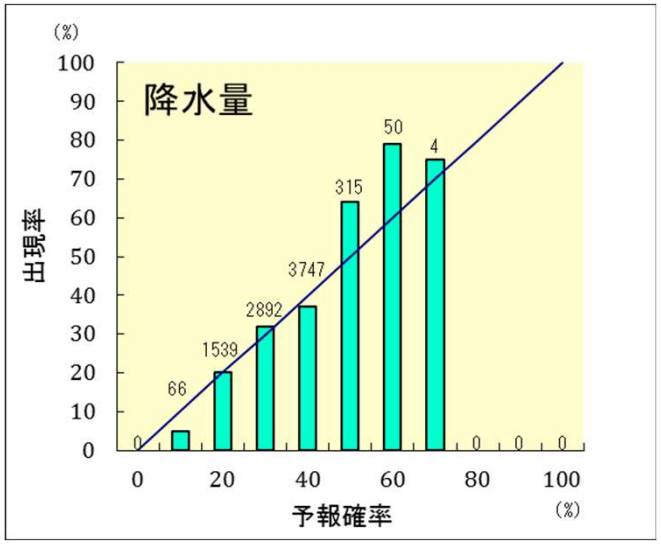
$$BSr = \frac{1}{3}$$

- Perfect score: 1
- BSS>0 : better than the climatological forecast.
- BSS<0 : worse than the climatological forecast.

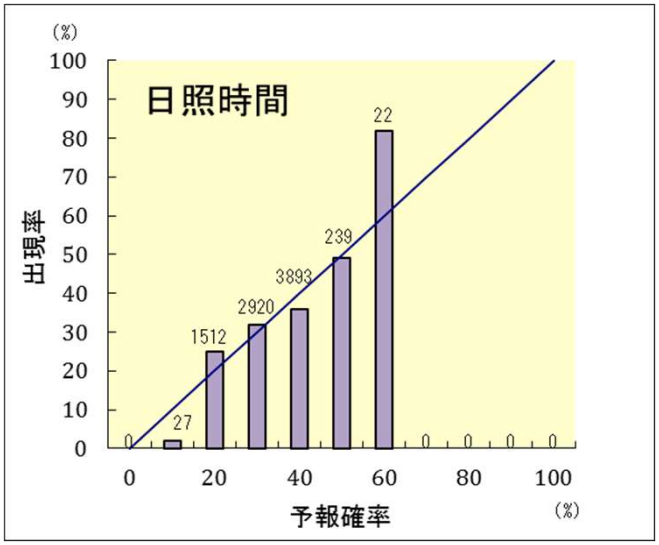
Evaluation of 1-month forecast (2013to2017)



Monthly mean temperature



Monthly total precipitation(mm)



Monthly total sunshine(hours)

Figures from JMA_Home Page

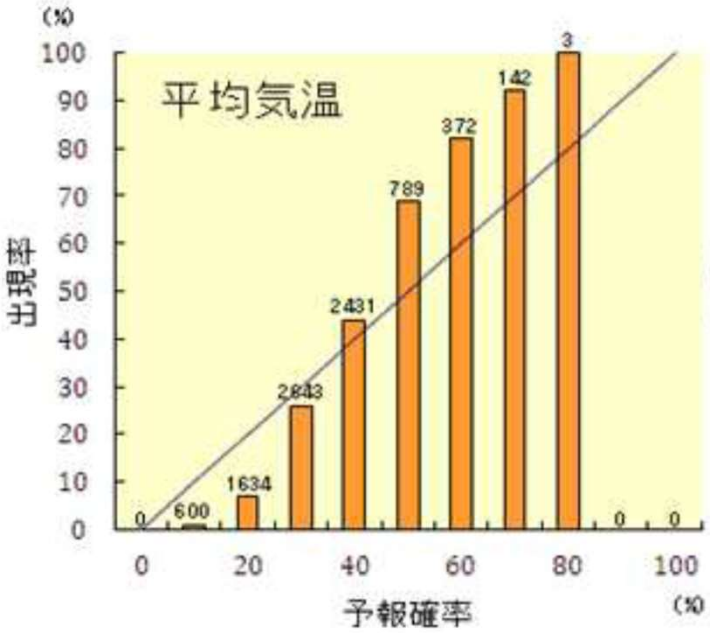
Data period: 2013 to 2017 (5years)

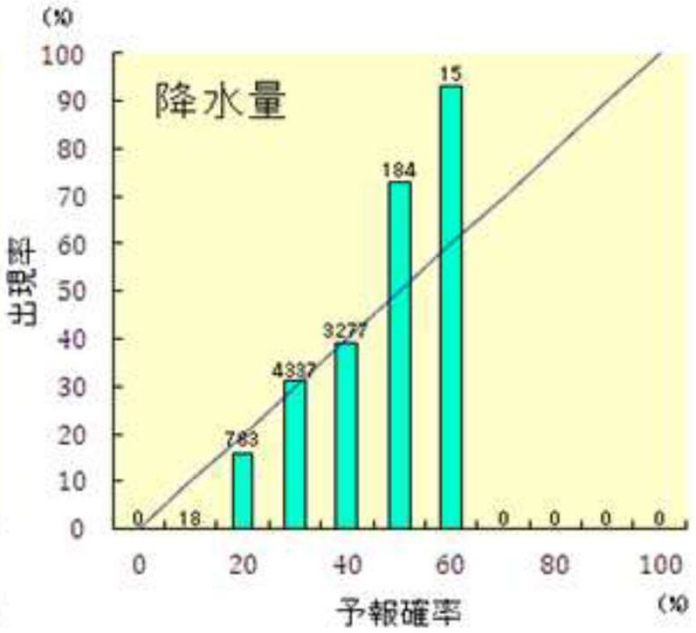
Forecast object: Temperature, Precipitation, Sunshine duration

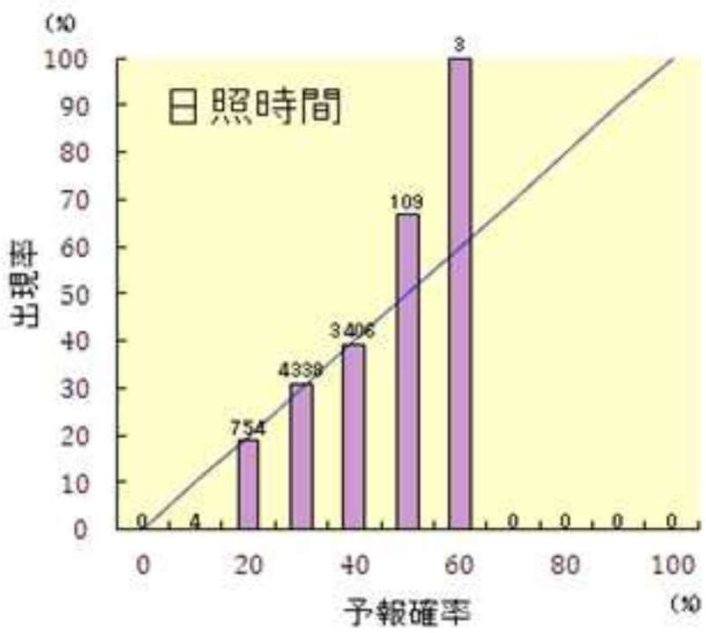
Forecast category: below normal, near normal, above normal

Forecast region: 11 regional areas in Japan

Evaluation of 1-month forecast(2007to2011)







Data period: 2007 to 2011 (5years)

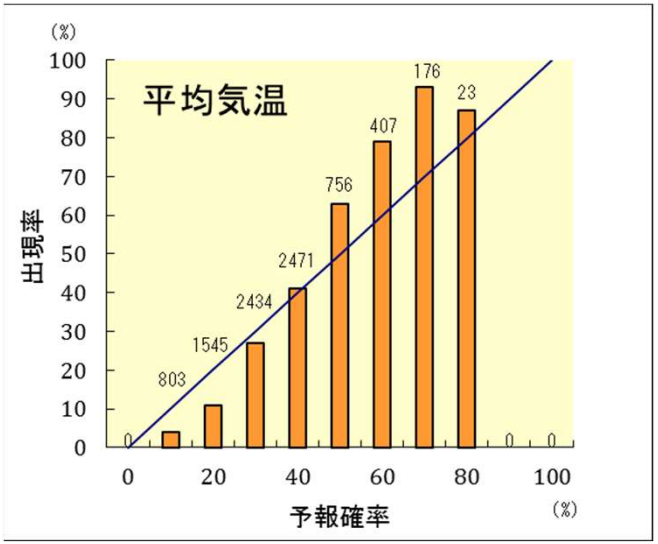
Forecast object: Temperature, Precipitation, Sunshine duration

Forecast category: below normal, near normal, above normal

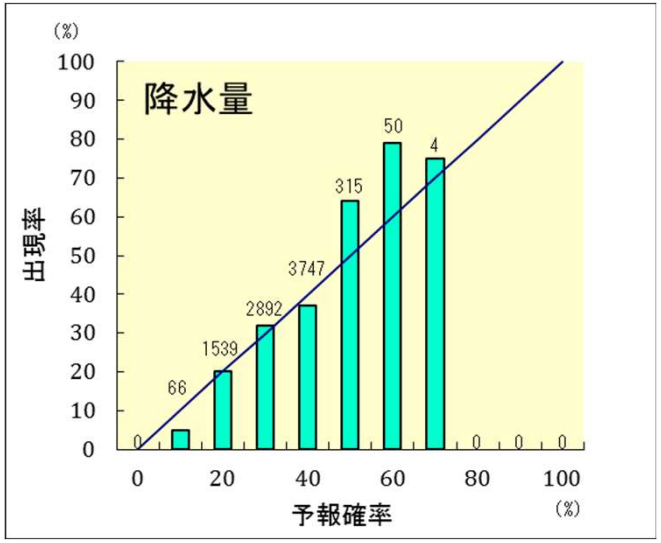
Forecast region: 11 regional areas in Japan

Figures from “Seasonal forecast training text(FY2012)”

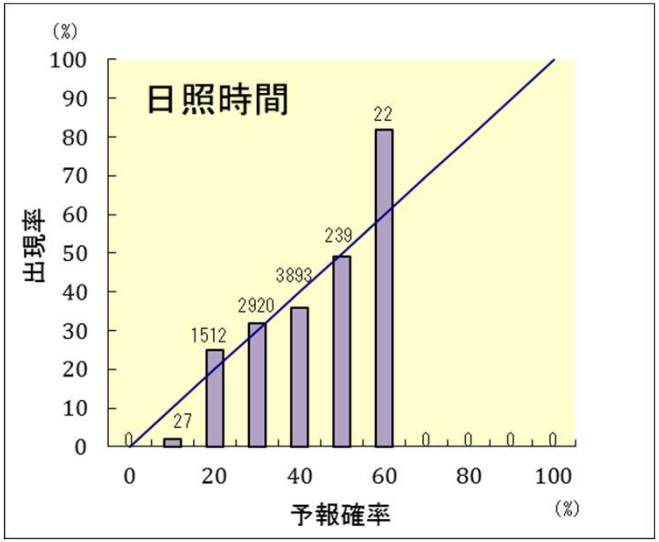
Evaluation of 3-month forecast (2013to2017)



3-month mean temperature



3-month total precipitation(mm)



3-month total sunshine(hours)

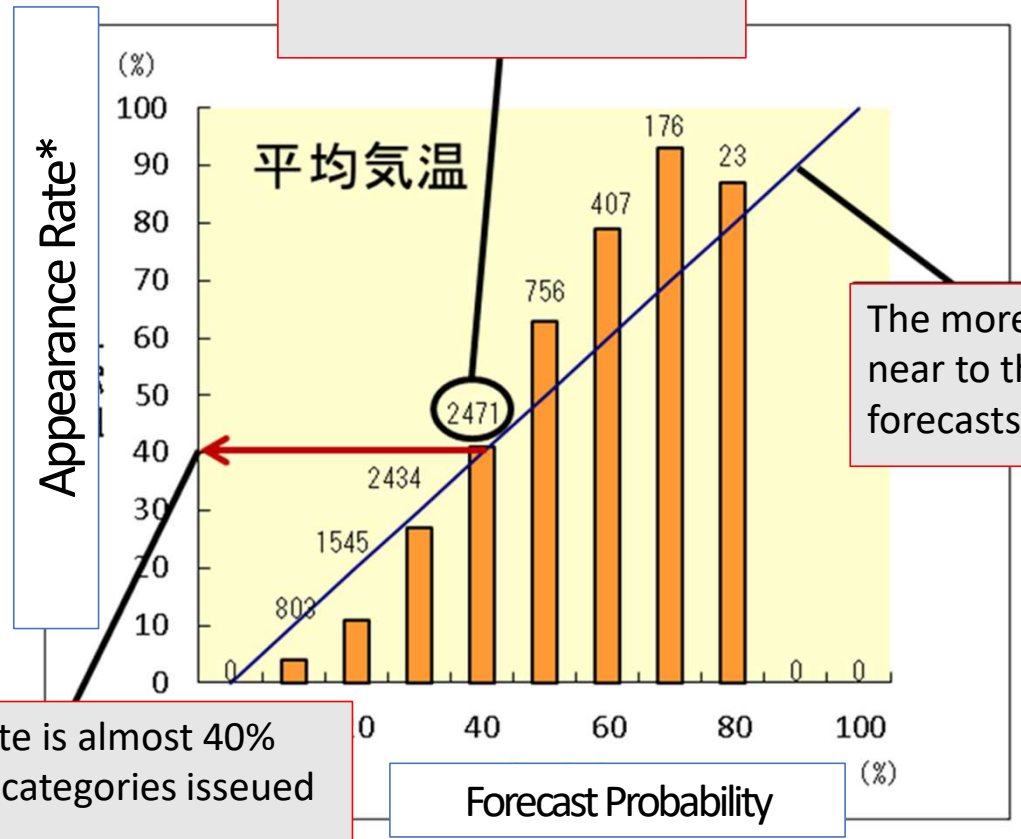
Data period: 2013 to 2017 (5years)

Forecast object: Temperature, Precipitation, Sunshine duration

Forecast category: below normal(33.3%), near normal(33.3), above normal(33.3%)

Forecast region: 11 regional areas in Japan

Forecast probability evaluation chart



*Appearance Rate=

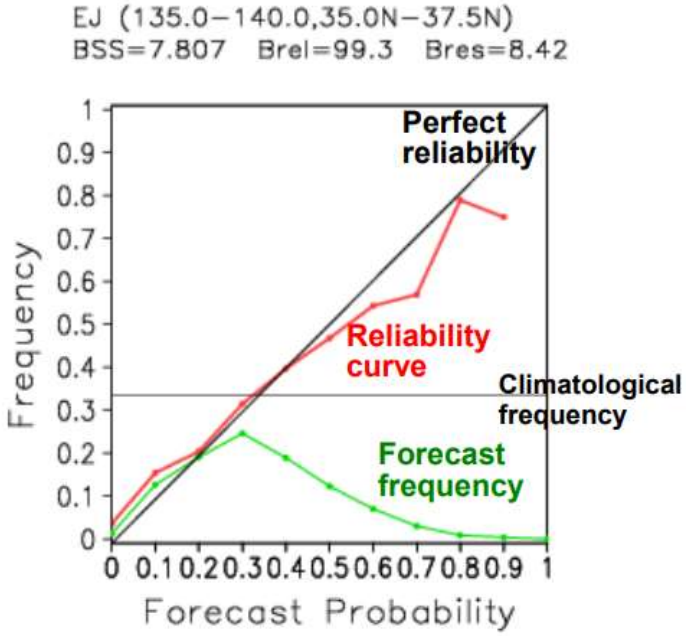
No. of observed category / No. of forecast category

Reliability Diagram

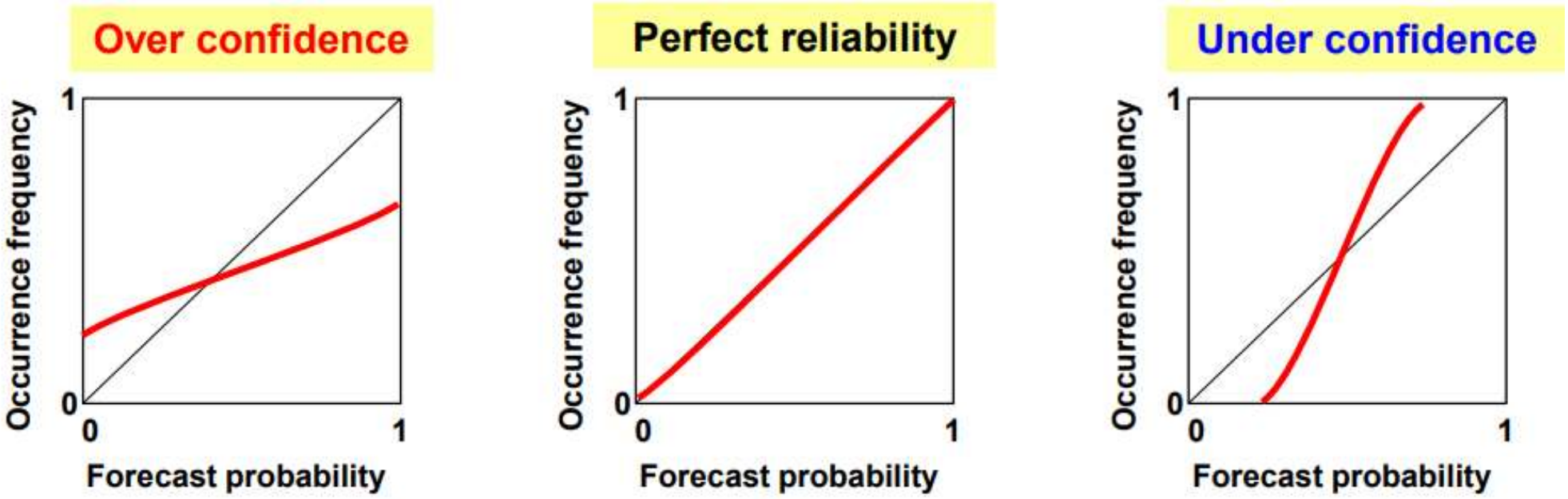
- Red line (reliability curve);
  plotted the observed frequency(Y-axis) against the forecast probability(X-axis)

Probabilistic forecast becomes better the more the reliability curve fit to 45° line (perfect reliability).

- Green line denotes forecast frequency (sharpness diagram);
  - If most of the forecast probabilities are near the climatological frequency = unsharp
  - If probabilities near 0 and 1 (100%) are often used = sharp

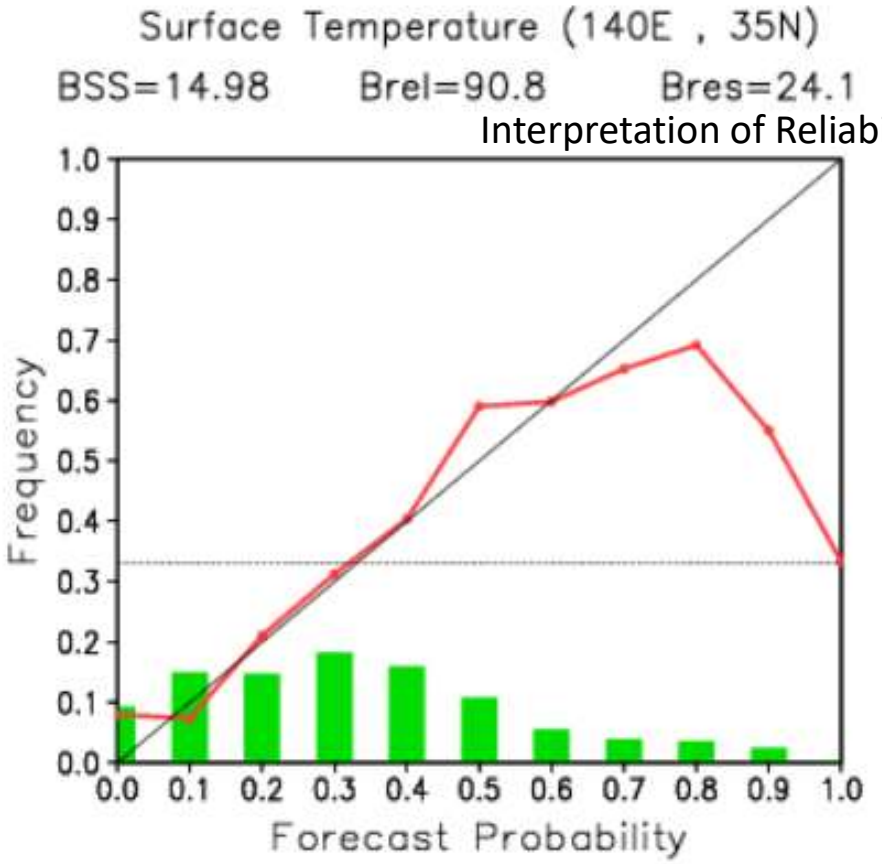


Reliability Diagram



- ✓ Predicted probabilities are overestimated as compared with actual
- ✓ Predicted probabilities are underestimated as compared with actual

Reliability Diagram



Interpretation of Reliability Diagram

- The forecast is generally reliable for below 60%, while over-confident over 70%.

✓ Maximum probability should be suppressed under 60%

Meeting material at BMKG

24 June 2019, 09:30 to 11:30

Project of Capacity Development for the Implementation of Agricultural Insurance in the Republic of Indonesia

A plan for Key activity 2:

Develop weather information and strengthen abilities for producing products for agriculture.

Case study on monsoon onset/retreat variability

- Introduction_Key2 activity, Purpose of the study,Data&method,Analysis
- Example analysis for Japan and East Jawa
- Working plan for June/July/August 2019
- Discussion

JICA expert (JMBSC)

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Introduction_Target tasks for Key activity 2

1. Improvement of Seasonal forecast, especially onset forecast
   - ✓ Evaluation of operational forecasts (BMKG forecasts and JMA guidance)
   - ✓ Case study on monsoon onset/retreat variability

Topic today

2. Improvement of ENSO monitoring and forecast
   - ✓ Task prepared by SUPARI_san and Rida_san, and to be discussed later.
3. Other important topics

   To be discussed later.

Case study on monsoon onset/retreat variability

Purpose of Study

- To understand
  1. features of monsoon onset(start)/retreat(end) variabilities
  2. Features of atmospheric circulations as well as boundary conditions associated with the monsoon variabilities,
- To identify atmospheric as well as boundary conditions which influence year to year variations of monsoon (rainy season) activities.
- To provide study results to strengthen abilities for producing products for agriculture.

Case study on monsoon onset/retreat variability

- Data and method
  - ✓ Two forecast zones are chosen from the Pilot study areas; **"ZOM152"** in East Jawa and **"ZOM298"** in South Sulawesi,
  - ✓ Histrical data(observation and forecasted) for Onset(start) and retreat(endo) for two zones for the last 40 years from 1981 to 2019 are being prepared.
  - ✓ Decad(10day) and monthly total rainfall data for the same period are to be available in the pilot study areas.

    Note: BMKG station data as well as rainpost data are to be available.
  - ✓ Atmospheric circulation and boundary condition data are available from several data sources such as from iTacs.
  - ✓ Several software for drawing maps are available .

Case study on monsoon onset/retreat variability

- Analysis
  - ✓Basic statistics for monsoon(rainy season); climatology, variability, trend, latest onset/retreat as well as earliest onset/retreat, etc.
  - ✓Analysis of atmospheric features as well as boundary conditions in case of early/late onset years (composite analysis for example)
  - ✓Analysis of monsoon variabilities during certain boundary conditions such as El Nino/La Nina, different phases of Indian Ocean Dipole, and so on. (composite analysis for example)

Basic statistics and analysis of variability features
(example)

- Climatology(1981 to 2010)
  - Onset:
  - Retreat:
  - Duration(days,No.of dekad):
  - Total rainfall:
- Variability
  - Onset
    - Earliest:
    - Latest:
  - Retreat
    - Earliest:
    - Latest:

. . . . .

. . . . .

- Significantly early onset/retreat years
  - Onset Early (Select several years) *
    Late (Same as above) *
  - Retreat Early (Same as above) *
    Late (Same as above) *

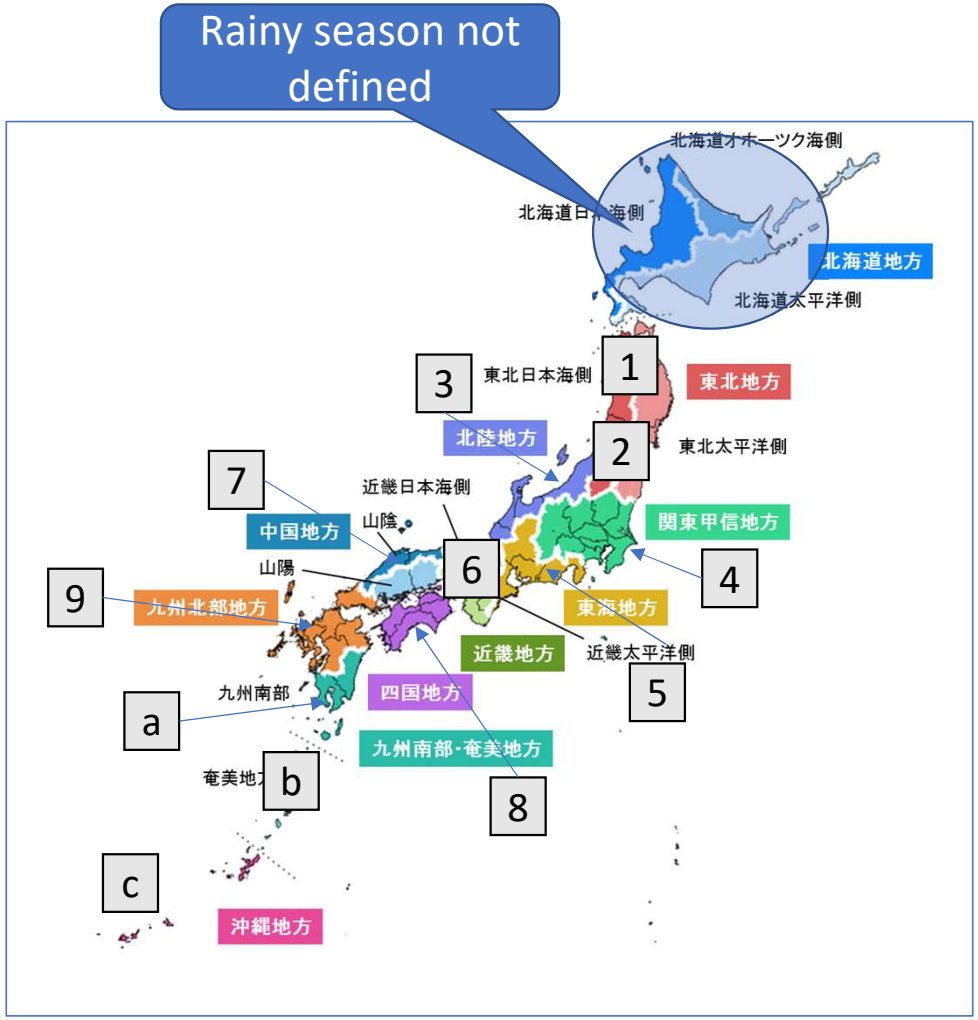
*Use selected years to produce composites of atmospheric circulation and boundary conditions to identify their significant features.

- Evaluation of BMKG onset/retreat forecast
  - 3X3 contingency table for onset/retreat
  - Hit rate

Example of rainy season statistics (Japan)

Name of Zones :	KANTO		Onset/Retreat/Duration/Precipitation of Rainy season										
	Onset (Start)					Retreat(End)					Duration (No. of days)		total precipitation (%)
	forecast		observed			forecast		observed			forecast	observed	observed
year	Month	Date	Month	Date	No. of days from May 1st	Month	Date	Month	Date	No. of days from May 1st	-		
climatology	-	-	6	8	39	-	-	7	21	82	-	43	-
1951	-	-	6	15	46	-	-	7	18	79	-	33	141
1952	-	-	6	14	45	-	-	7	16	77	-	32	140
1953	-	-	6	1	32	-	-	7	24	85	-	53	136
1954	-	-	6	6	37	-	-	7	25	86	-	49	110
1955	-	-	6	13	44	-	-	7	9	70	-	26	104
1956	-	-	6	9	40	-	-	7	26	87	-	47	158
1957	-	-	6	6	37	-	-	7	28	89	-	52	198
1958	-	-	6	11	42	-	-	7	13	74	-	32	86
Period from 1959 to 2009 not shown here													
2010	-	-	6	13	44	-	-	7	17	78	-	34	95
2011	-	-	5	27	27	-	-	7	9	70	-	43	138
2012	-	-	6	9	40	-	-	7	25	86	-	46	115
2013	-	-	6	10	41	-	-	7	6	67	-	26	93
2014	-	-	6	5	36	-	-	7	21	82	-	46	126
2015	-	-	6	3	34	-	-	7	10	71	-	37	73
2016	-	-	6	5	36	-	-	7	29	90	-	54	84
2017	-	-	6	7	38	-	-	7	6	67	-	29	105
2018	-	-	6	6	37	-	-	6	29	60	-	23	71
2019	-	-			-9999	-	-			-9999	-	-9999	
2020	-	-			-9999	-	-			-9999	-	-9999	

Zones defined for Rainy season(Baiu,梅雨)



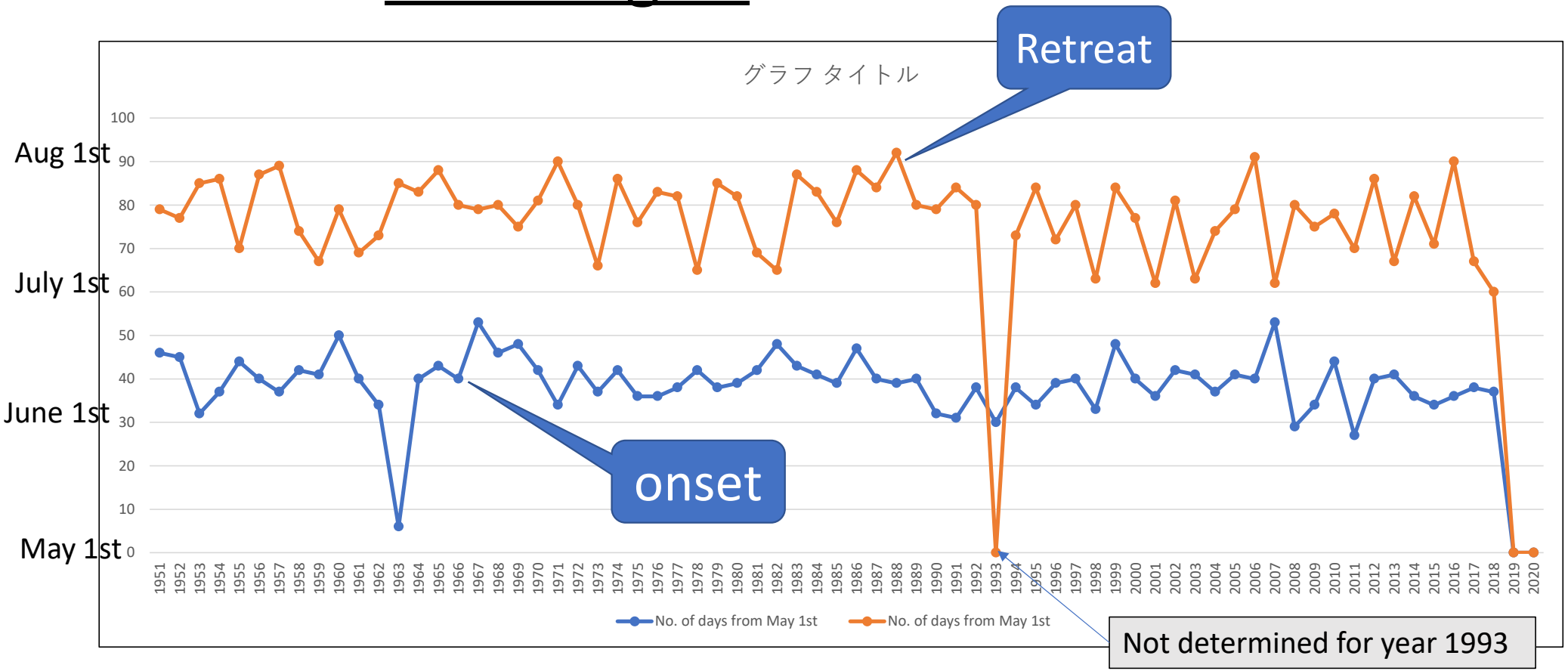
1. Tohoku_North
2. Tohoku_South
3. Hokuriku
4. Kanto
5. Tokai
6. Kinki
7. Tyuugoku
8. Sikoku
9. Kyuusuu_North

a Kyuusyuu_South

b Amami

c Okinawa

Year to year variations of onset/retreat of Rainy season for Kanto region



Example of rainy season statistics (East Jawa)

Dry Season					Wet Season				
Year	Normal Onset (1981-2010)	Onset	Retreat	Cumulative Rainfall (mm/year)	Year	Normal Onset (1981-2010)	Onset	Retreat (in the next year)	Cumulative Rainfall (mm/year)
1981	APR III	MAY II	OCT III	539.25	1981/1982	NOV I	NOV I	APR I	2134.25
1982	APR III	APR II	NOV III	200	1982/1983	NOV I	DEC I	MAY III	2076.5
1983	APR III	JUN I	OCT II	69	1983/1984	NOV I	OCT III	APR II	2008.25
1984	APR III	APR III	NOV II	586.25	1984/1985	NOV I	NOV III	APR III	2065
1985	APR III	MAY I	NOV I	264.25	1985/1986	NOV I	NOV II	APR II	2213
1986	APR III	APR III	NOV I	406	1986/1987	NOV I	NOV II	MAR III	1750.5
1987	APR III	APR I	NOV II	167	1987/1988	NOV I	NOV III	MAY II	1823
1988	APR III	MAY III	NOV I	336.5	1988/1989	NOV I	NOV II	JUN II	2671
1989	APR III	JUN III	OCT II	179.5	1989/1990	NOV I	OCT III	APR III	2016.5
1990	APR III	MAY I	NOV II	338.75	1990/1991	NOV I	NOV III	APR III	2120.75
1991	APR III	MAY I	NOV I	70	1991/1992	NOV I	NOV II	APR III	1999.25
1992	APR III	MAY I	NOV I	433	1992/1993	NOV I	NOV II	APR II	2018.25

Period from 1993 to 2009 not shown here

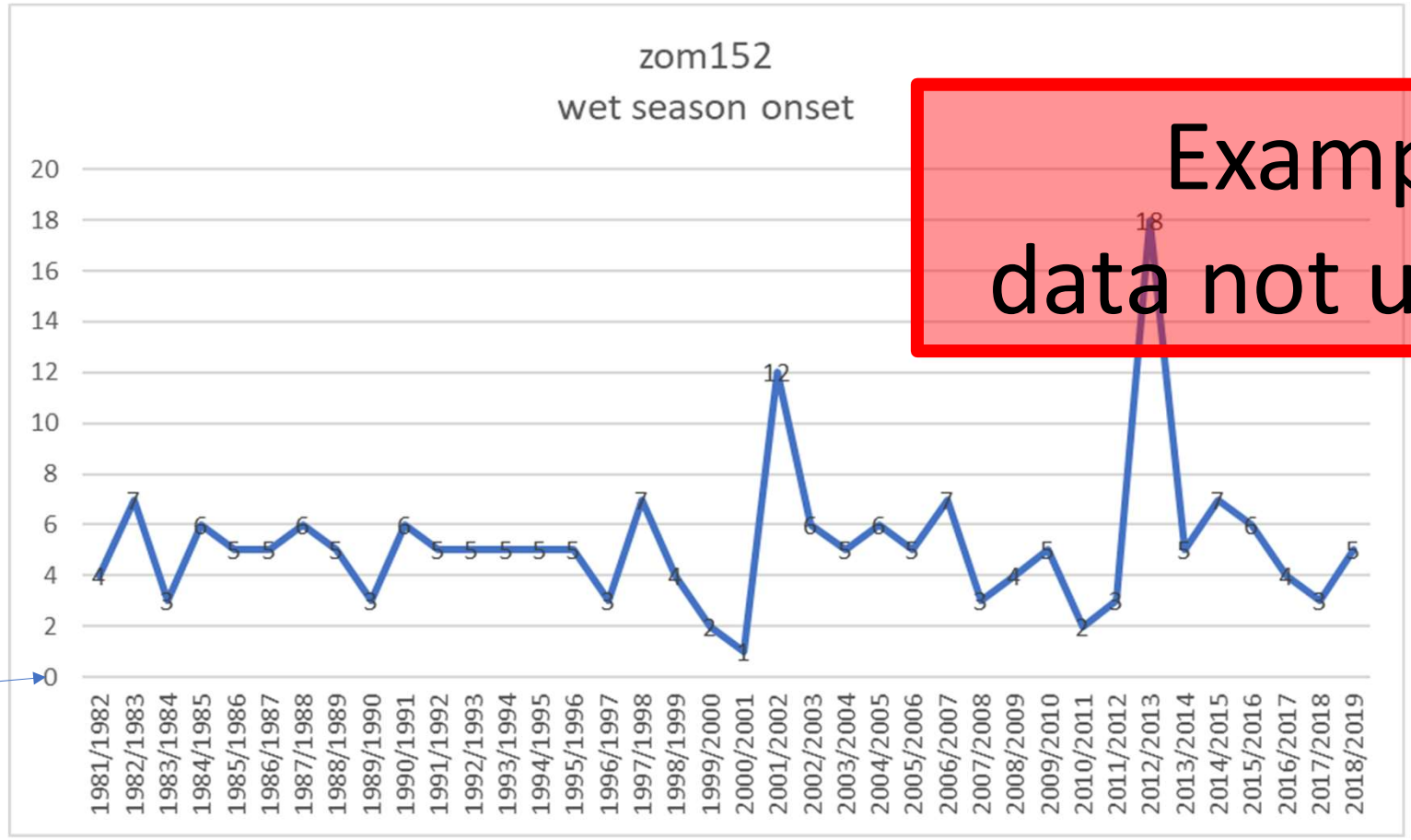
2010	APR III	JUN III	OCT I	361.25	2010/2011	NOV I	OCT II	MAY II	1967.75
2011	APR III	MAY III	OCT II	52.75	2011/2012	NOV I	OCT III	APR I	1298.5
2012	APR III	APR II	DEC I	315.25	2012/2013	NOV I	DEC II	APR II	1415
2013	APR III	APR III	NOV I	398.25	2013/2014	NOV I	NOV II	APR III	1533
2014	APR III	MAY I	NOV III	170.25	2014/2015	NOV I	DEC I	APR III	1474.675
2015	APR III	MAY I	NOV II	127.75	2015/2016	NOV I	NOV III	APR II	1274.525
2016	APR III	APR III	OCT III	620.75	2016/2017	NOV I	NOV I	APR I	1547.075
2017	APR III	APR II	OCT II	288.5	2017/2018	NOV I	OCT III	MAR II	1491.25
2018	APR III	MAR III	NOV I	241.25	2018/2019	NOV I	NOV II		

Intro | Information | ZOM152

Note:

- Official forecast for onset/retreat to be added to the sheet

Year to year variations of onset~~/retreat~~ of Rainy season for ZOM152



Example
data not updated

Draft working plan for June/July/August

1. Improvement of Seasonal forecast, especially onset forecast
   - ✓ Evaluation of operational forecasts (BMKG forecasts and JMA guidance) by Adi-san, Damiana-san, Rosi-san
   - ✓ Case study on monsoon onset/retreat variability by Adi-san, Dmiana-san, Rosi-san,(Kuri-san).
2. Improvement of ENSO monitoring and forecast
   - ✓ Task prepared by Supari_san and Rida_san (and to be discussed later in detail)
3. Other important topics

   To be planed in the latter half period (To be discussed later.)

Note: Details of the plan to be prepared by next Monday (July 1st)

Discussion

- Nomination of person for each task
- Data available, and data management person in charge_Agus team and noveta, Ganesa, and Adli-team
- Software/Application available and/or to be provided:

  Note: iTacs ID and Password to be applied to TCC .
- Evaluation of monsoon forecast for the last 5 years!
- Others

気象庁
Japan Meteorological Agency

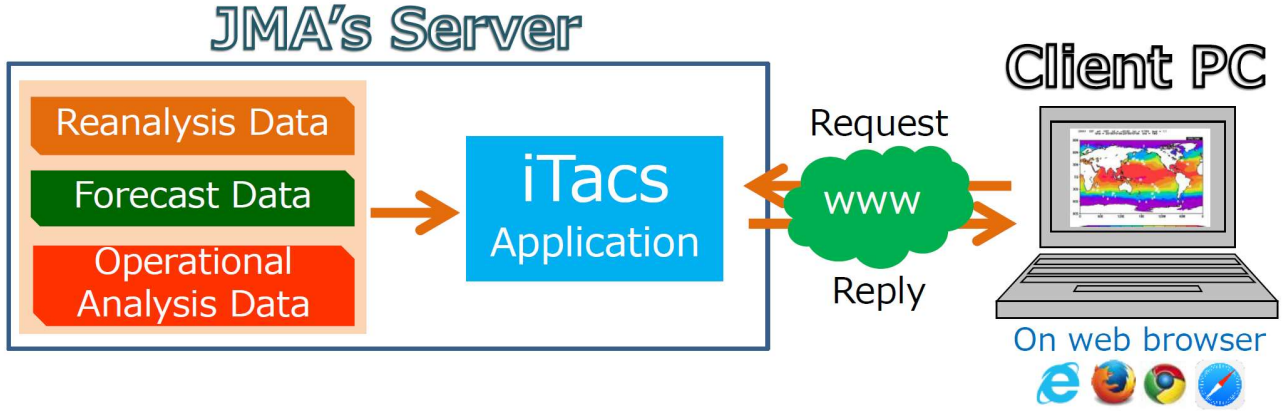
TCC seminar,
16:15–18:00, 12 November 2018,
Tokyo, Japan

Introduction and operation of iTacs

- Interactive Tool for Analysis of the Climate System -

What's iTacs?

- iTacs stands for "Interactive Tool for Analysis of the Climate System".
- Available on web browsers through Graphical User Interface (GUI) with personal IDs.
- Only NMHS staff can use iTacs.
- No additional software or plug-ins are required in user's client PCs.



Available dataset and period

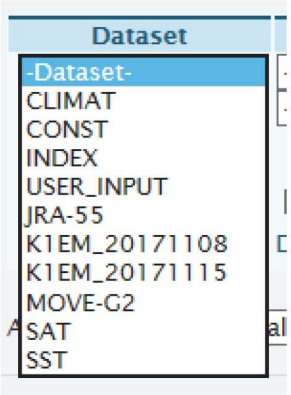
Atmospheric analysis dataset		
JRA-55	1958～	The Japanese 55-year Reanalysis
SAT	1979*～	NOAA's outgoing longwave radiation (OLR)

*full available period. Actually data is available from 1974 but is missing between 1978/3/17-12/31.

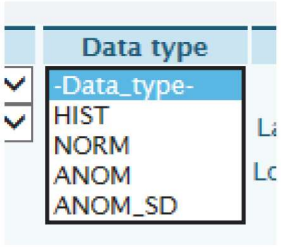
Oceanographic analysis dataset		
SST	1891～	Sea surface temperature (COBE-SST)
MOVE-G2	1958～	Data assimilation by MOVE/MRI.COM-G2

Forecast dataset
JMA's one-month prediction model output

Other dataset	
INDEX	ENSO index (NINO.3 etc.)
CLIMAT	Monthly CLIMAT reports
USER-INPUT	Text data input by user

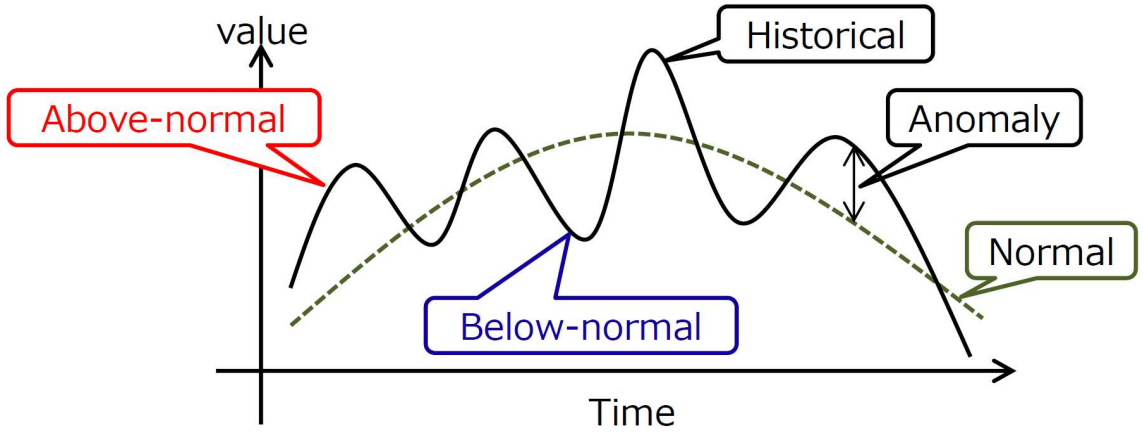


Available data type



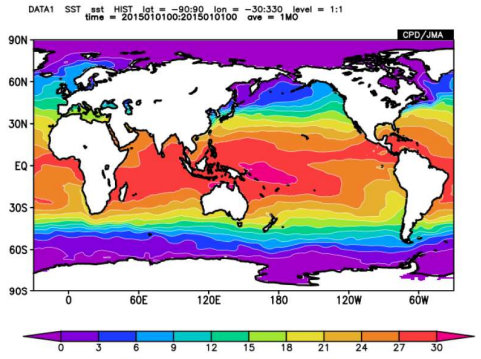
- Various data types are available to perform climate diagnosis.

HIST	Historical actual analysis or observation data
NORM	Climatological normal data (averaged from 1981 to 2010)
ANOM	Anomaly data (difference from the climatological normal)

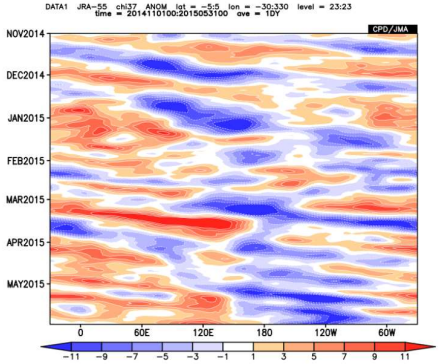


Samples of charts

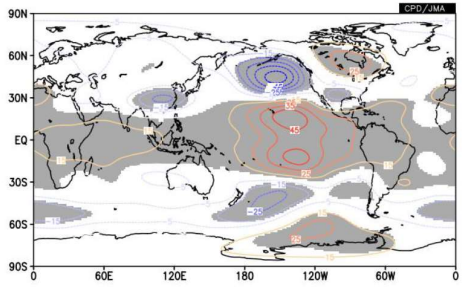
- Various types of charts and statistical analyses are available on iTacs.



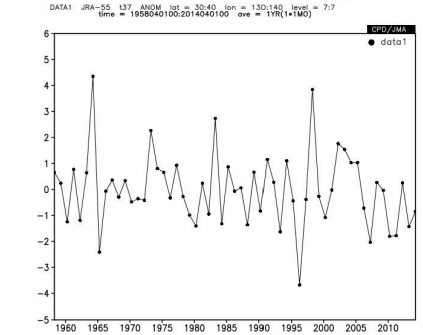
2-dimensional map



Cross section diagram



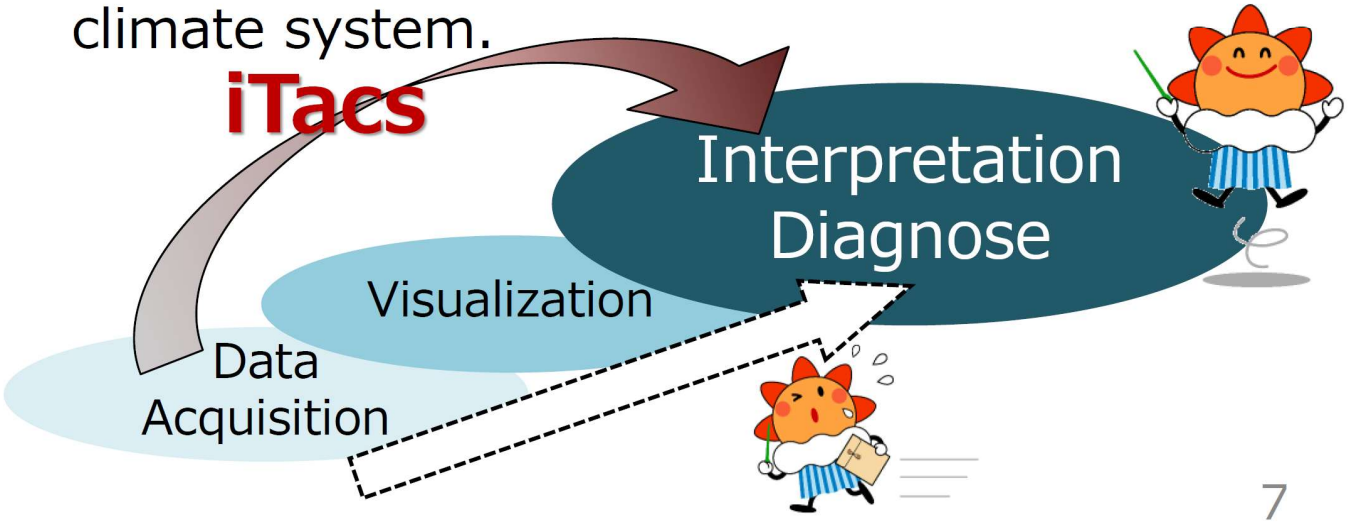
Regression/Correlation and significance-test



Time series graph

Advantages of iTacs

- iTacs is one of the most useful tools developed by JMA to perform climate analysis and will strongly help you in climate monitoring.
- Use of iTacs costs *less time to visualize the data, more time to make interpretation* of the climate system.



Improving Seasonal Forecast for Climate and Agriculture Insurance

Koichi Kurihara

JICA Expert for Project of Capacity Development
for the Implementation of Agricultural Insurance

Dry Season Forecast Meeting 2020
Date & Time: Thursday, 27 Feb 2020 at 11:30AM

Location: Ballroom III, 5th Floor
YELLO Hotel Harmoni

My personal history

- 1976 Start working JMA(Japan Meteorological Agency)
- 1989 Forecaster for Long-range Weather Forecast at JMA HQ
- 1990 Forecaster for Short-range Weather Forecast at JMA HQ
- 1993 Forecaster for Long-range Weather Forecast at JMA HQ
- 2000 Chief forecaster for LRF at Climate Prediction Division, JMA
- 2005 Director, Climate Prediction Division, JMA
- 2007 to 2009 Director at regional meteorological Observatories
- 2011 Director General, Tokyo District Observatory (2013 retired)
- 2014 Disaster Prevention Adviser, Maebashi Municipal government for 5years
- 2019 JICA expert
  (Part time Staff, Japan Meteorological Business Support Center(JMBSC), Tokyo, Japan

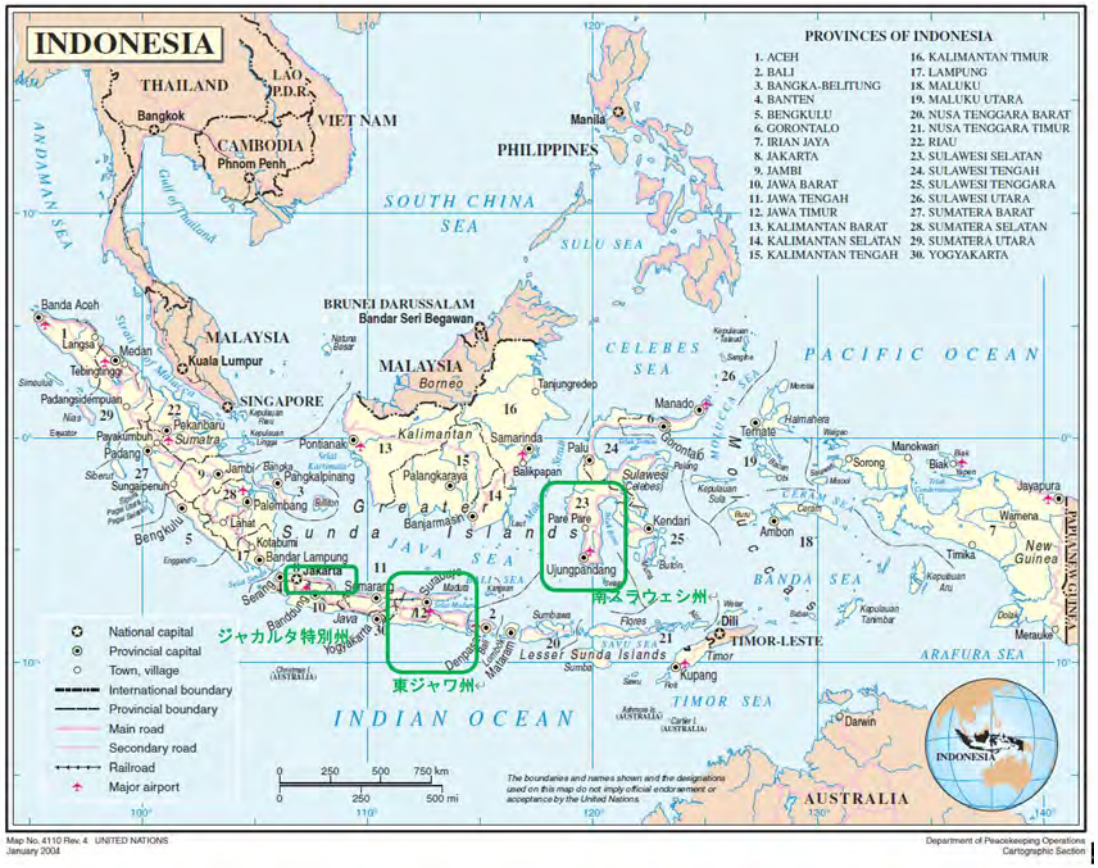
My personal history

- Worked for JMA(Japan meteorological Agency) for 37 years.
- During my carrier in JMA I was engaged in long-range weather forecasting for about 30 years.
- After the year 2000, I worked as Chief forecaster like Adi-san, and then worked as director of Climate prediction Division JMA, which is responsible for Seasonal forecasting in Japan.
- 7 years ago I retired from JMA and then worked for the municipal government as ‘Disaster prevention advisor’ for 5 years.
- Last year I started working at the Japan Meteorological Business Support Center (JMBSC) and participated in the JICA project.

Contents

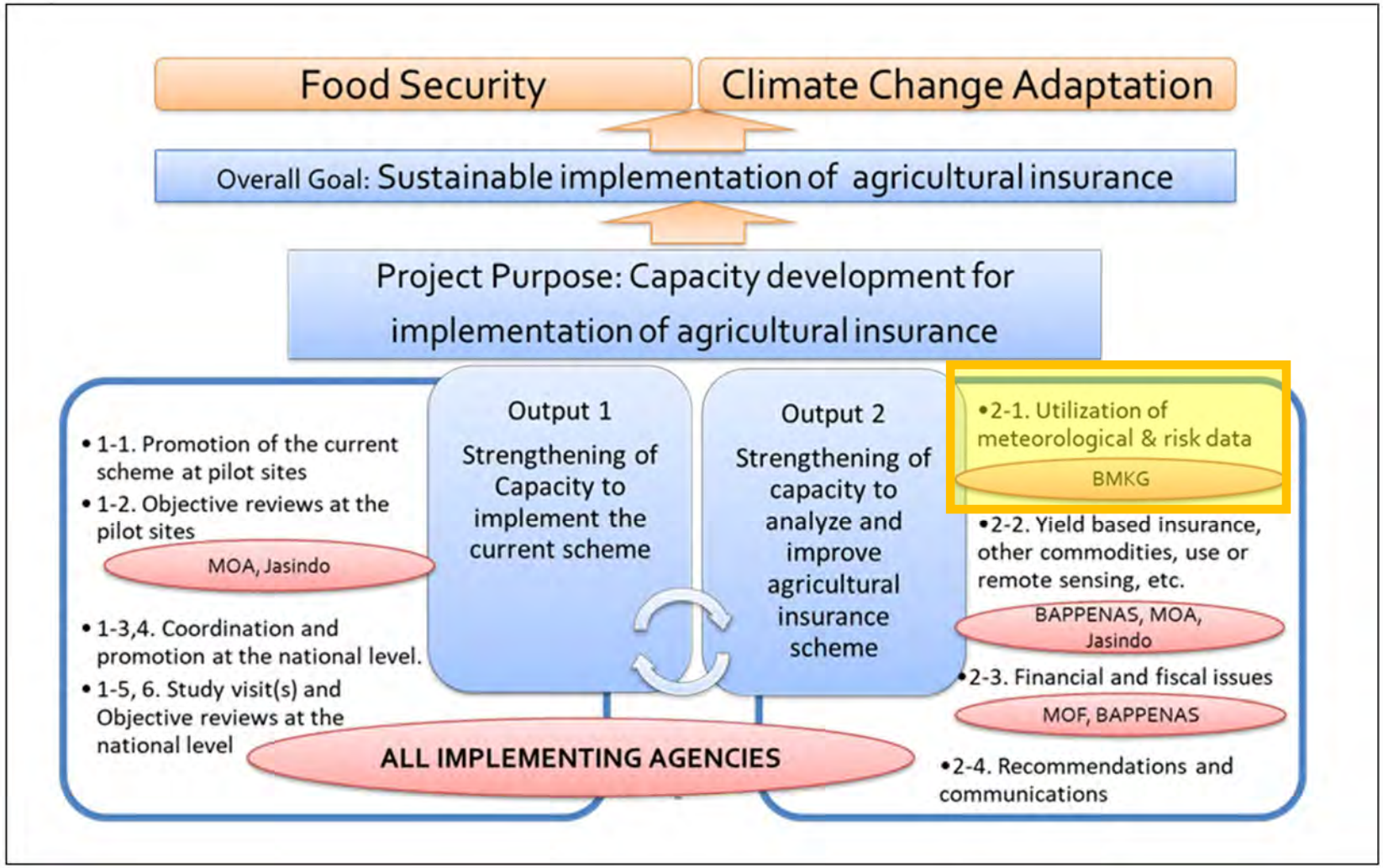
- Introduction
- Outline of the BMKG-JICA Project
- Recent efforts of JMA seasonal forecasting
- Concluding remarks

Project of Capacity Development for the Implementation of Agricultural Insurance



Period	**October 2017 – September 2022 (5 years)**
Sites	➢ **Jakarta DKI;** ➢ **East Java Province;** ➢ **South Sulawesi Province**

Framework of project implementation



Outline of the project

Goal	**Agricultural insurance is continuously implemented in Indonesia**
Project Purpose	Capacity of the key ministries/institutions, the concerned local governments, and other relevant organizations to enhance the implementation of agricultural insurance is strengthened.
Outputs	1.Capacity to implement the current scheme of agricultural insurance for paddy is strengthened.
	2.Capacity to analyze and improve agricultural insurance scheme is strengthened.
Sites	Jakarta DKI; East Java Province; South Sulawesi Province

Outline of the project(continued)_Activities

1-1. Promote the implementation of the current scheme of agricultural insurance at the pilot sites.
1-2. Conduct objective reviews at the pilot sites, and communicate their results and recommendations.
1-3. Coordinate and promote the implementation of the current scheme at the national level.
1-4. Conduct information dissemination and training at the national level.
1-5. Organize study visit(s).
1-6. Conduct objective reviews at the national level, and communicate their results and recommendations.
2-1. Conduct assessment of meteorological observation and climate/disaster risk data, communicate the results and recommendations for capacity development, as well as relevant training for capacity building in order for such data to be utilized for insurance implementation/development incl. weather-index based insurance.
2-2. Prioritize and conduct desk-top/field studies concerning yield based insurance, other commodities to be insured, use of remote sensing, etc., and relevant training as necessary.
2-3. Prioritize and conduct policy studies concerning financial and fiscal issues relating to agricultural insurance.
2-4. Develop and communicate recommendations, based on the results of the activities 2-

Implementation of Activity 2-1

For enhancing ability of BMKG for agricultural isurances, the project supports following 3 key activities:

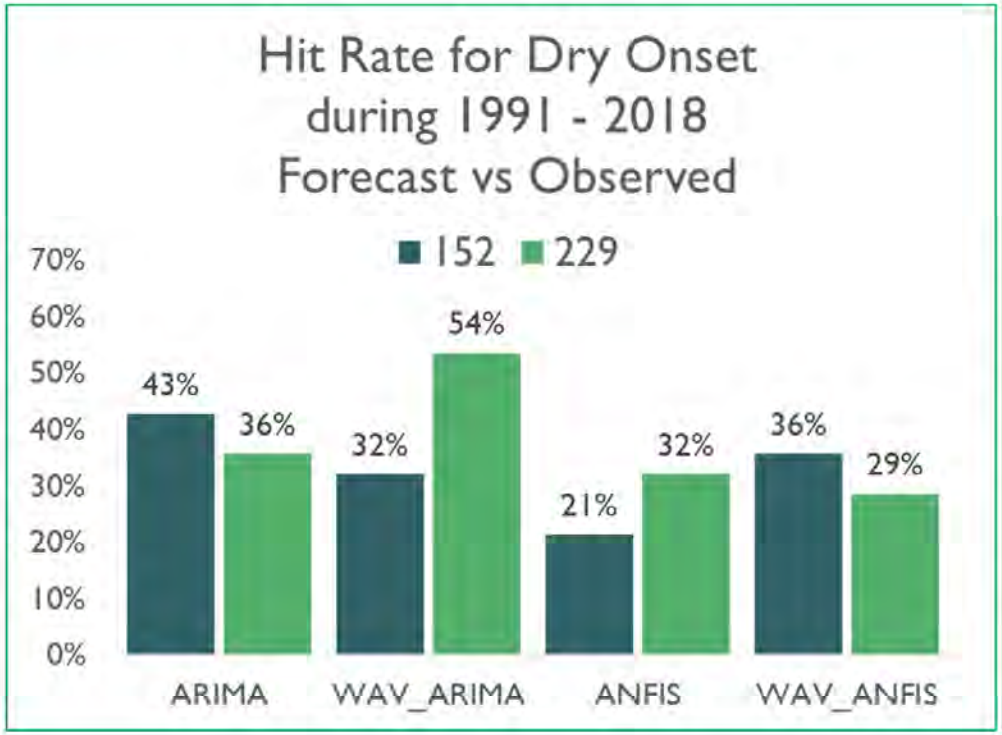
1. Provide/prepare reliable meteorological data for agricultural insurance.
2. Develop weather information and strengthen abilities for producing products for agriculture.
3. Enhance analysis abilities of risk analysis for climate change data-set.

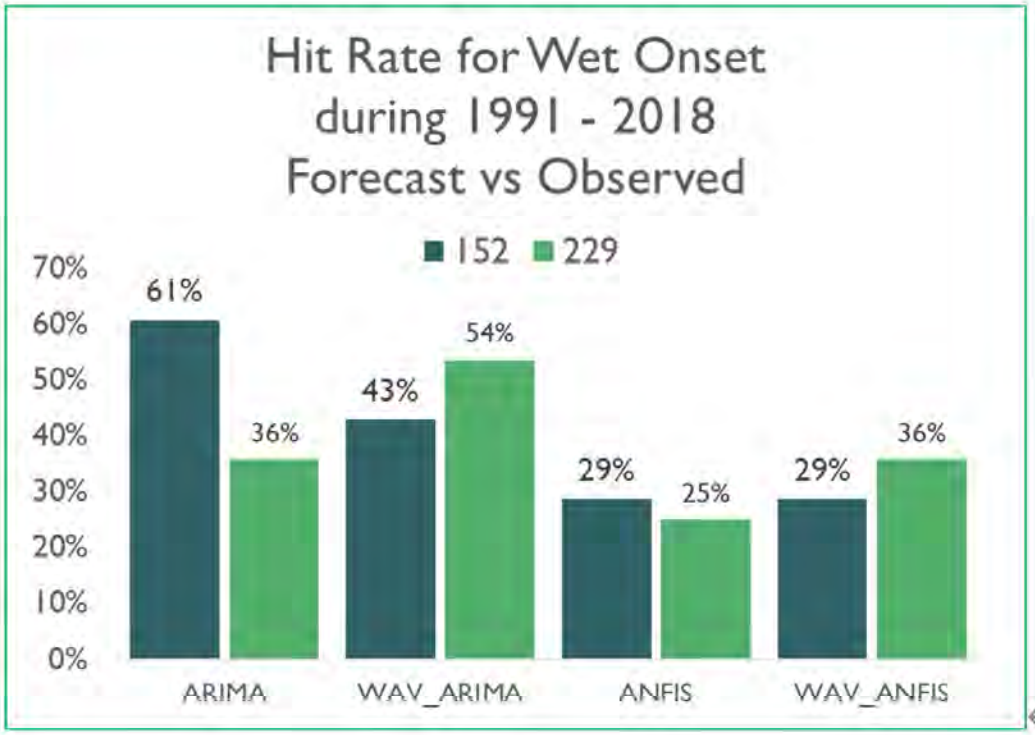
va

l as data collection


PLN

Comparison of forecast methods for Dry onset(left) and Wet onset(right)

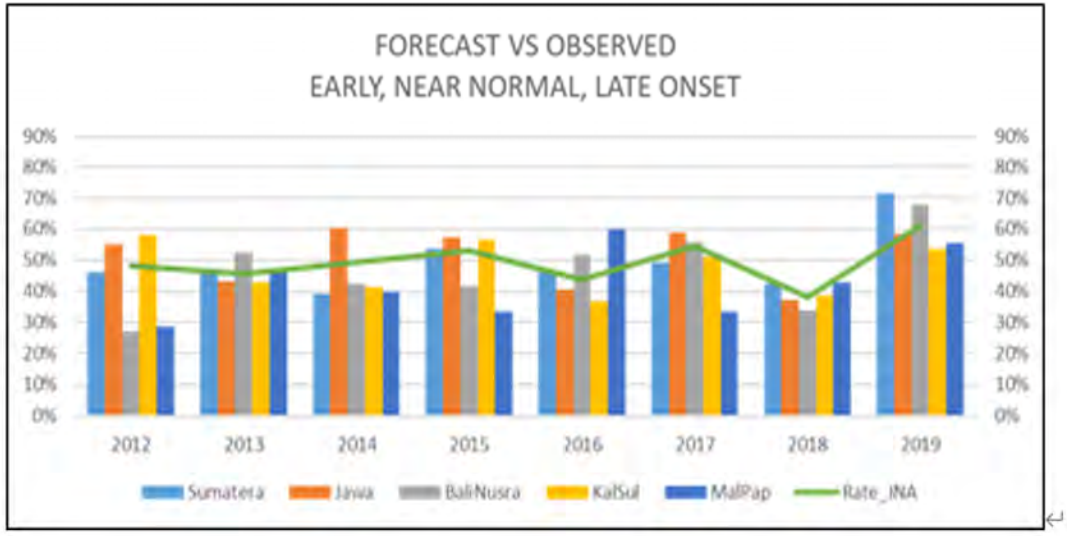




Graph 5. Comparison of Hit Rate Estimates for Early Dry and Wet Season in ZOM 152 and ZOM 299

(prepared by Adi team)

Evaluation of Dry season Onset for 5 Major Islands in Indonesia



Hit Rate Comparison of Issued Dry Season's Onset among 5 Major Islands in Indonesia

Skill	2012	2013	2014	2015	2016	2017	2018	2019
Skill_INA	0.07	0.08	0.00	0.17	0.15	0.09	-0.05	0.95
Sumatera	0.32	-0.04	0.05	0.32	0.00	0.09	0.10	0.36
Jawa	0.03	-0.11	0.03	0.06	0.72	0.12	-0.15	0.00
BaliNusra	-0.45	0.29	-0.07	0.29	-0.19	0.00	0.11	0.03
KalSul	0.64	0.69	-0.13	0.30	0.05	0.15	-0.04	0.16
MalPap	1.00	0.40	0.50	0.25	0.13	-0.20	0.00	0.00

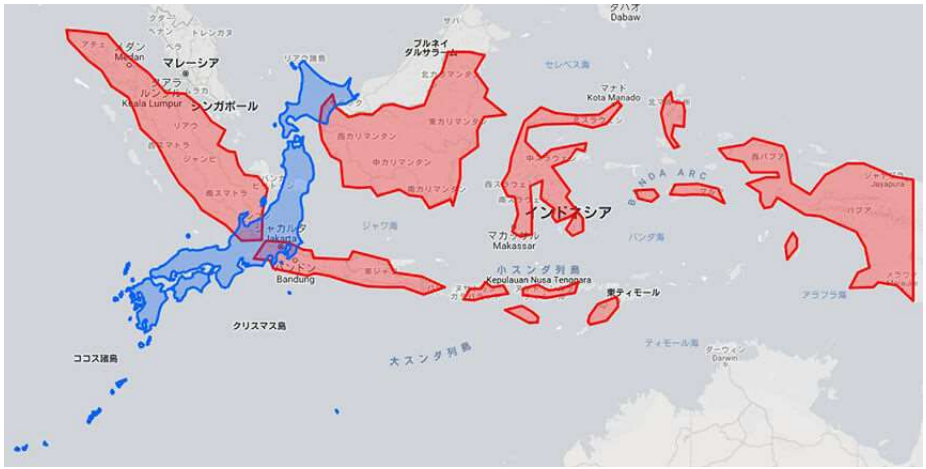
Skill Score of Issued Dry Season's Onset Forecast Over Indonesia

(prepared by Adi team)

Introduction to JMA seasonal forecasting

- Introduction(Comparison of Japan and Indonesia)
  - location/size/climate, etc
  - Typical weather patterns in Hot/Cool summer in Japan
  - Impacts of ENSO to Japan
- JMA Seasonal Forecasts
  - Kind and contents of forecasts
  - Expression of forecasts (Probability forecasts)
  - Forecast offices and regions(zones)
  - Examples of 1-month, 3-month, and 6-month forecast
  - TCC information

Japan and Indonesia



Some features of Japan

- Location: NH midlatitudes
- Distance:Tokyo to Jakarta 6000km
- Land size: 380,000km² Vs 1,905,000 km² (Indonesia about 5 times as large as Japan)
- Weather/climate features : Temperate zone characterized by 4-seaons
- Meteorological factors which have impacts on climate of Japan : Westerlies, Blocking highs, Subtropical highs, Tropical convective activities, Asian monsoons, MJO, SSTs in the tropical Pacific ocean, ENSO, and so on
- **Seasonal Forecast zone**: 11(Japan) Vs 342(Indonesia)

Typical atmospheric features of Hot/ Cool summer

Very hot summer (1984)

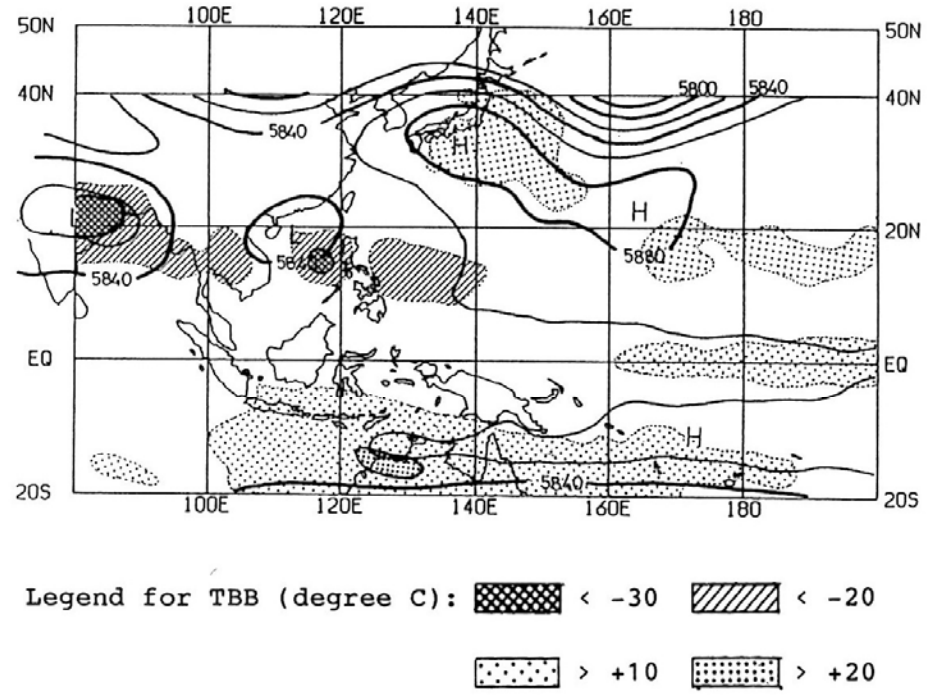
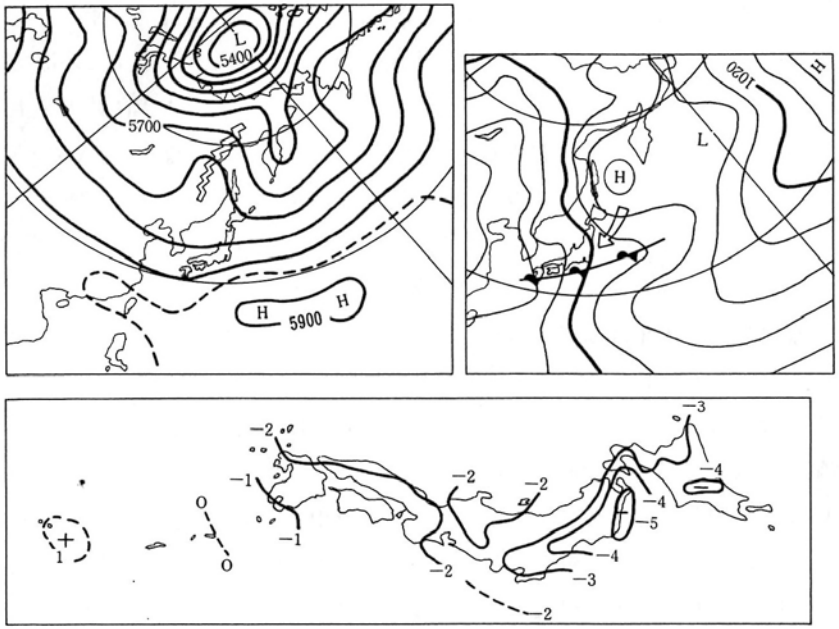


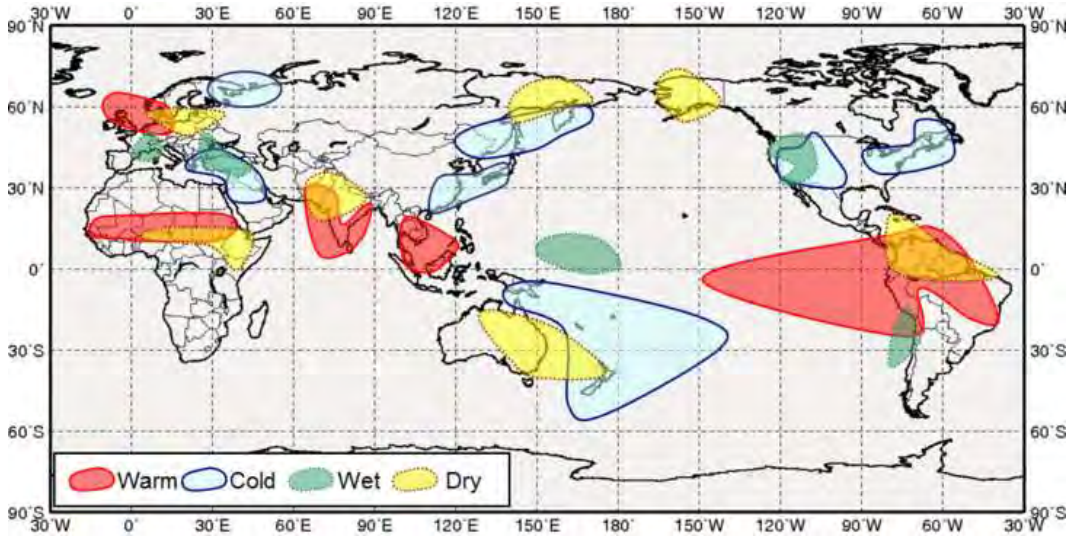
Fig. 20. Monthly mean 500mb height and equivalent black-body temperature(T_{BB}) over East Asia in August 1984.

Cool summer (1993)

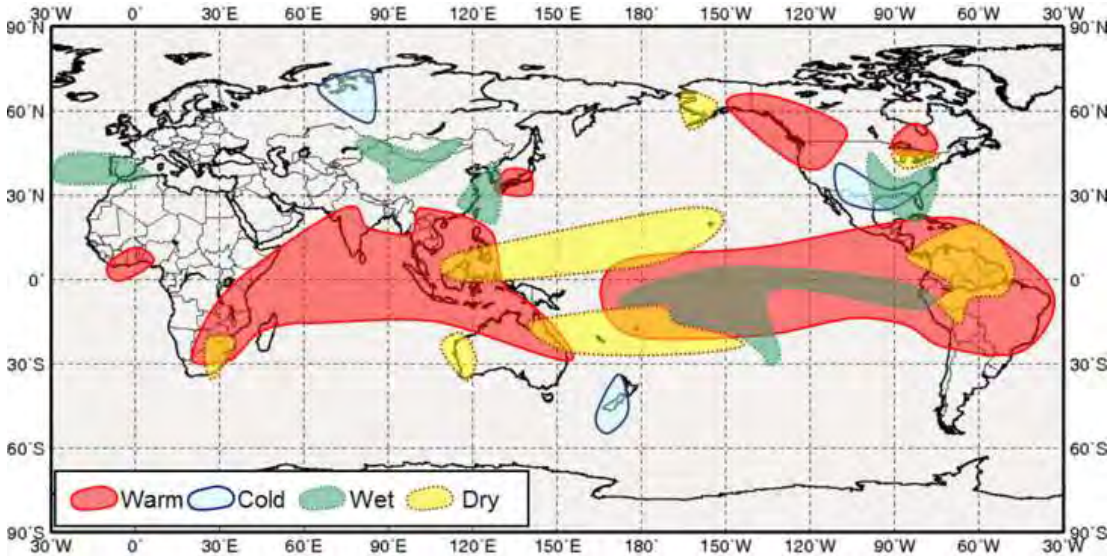


Above left 500 hPa height(m)
Above right Sea surface pressure (hPa)
Below: Surface temperature anomaly (deg. C)

Temperature and precipitation anomalies in previous El Niño events



Boreal summer (June through August)



Boreal winter (December through February)

(JMA_TCC Homepage)

JMA Seasonal Forecasts

Kind and contents of forecasts

- **One-month forecast** : issued at 14:30 JST every Thursday.
  - Mean temperature (Monthly, first week/second week/3-4week mean)
  - Precipitation (Monthly total)
  - Sunshine duration (Monthly total)
  - (Snowfall amount in winter)
- **Three-month forecast**: issued at 14:00 JST around the 25th of each month .
  - Mean temperature (Monthly, three-month mean)
  - Precipitation (Monthly , three-month total)
  - Sunshine duration (Monthly , three-month total)
- **Warm/cold-season outlook**: issued in February/September
  - Mean temperature (June to August mean)
  - Precipitation (June to August total)
  - Precipitation (Rainy season total)

Expression of forecasts (Probability forecasts)

- Forecasts are expressed in Probabilities of the forecast categories (Below, Normal, Above)
- Climatological probability for each category is 33.3%, calculated using 30 years data, presently for the period from 1981 to 2010.

Forecast offices and regions(zones)

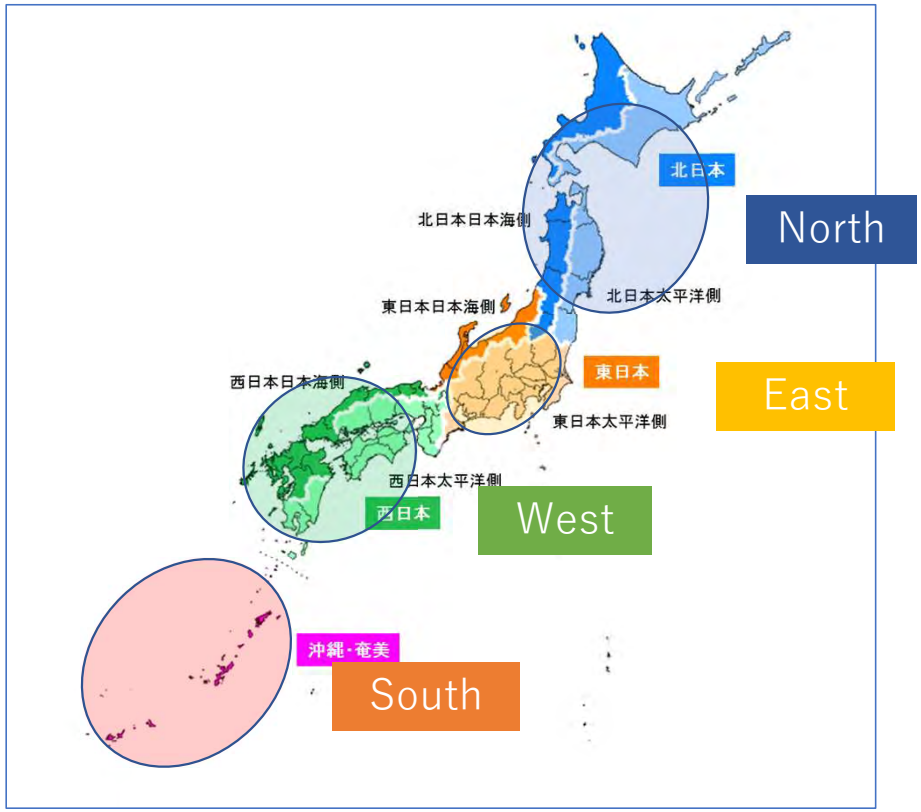
- JMA-HQ is in charge of “Nation-wide forecasts” and 10 regional offices (District observatories) are engaged in “Regional forecasts” .
- See next slides for forecast regions

Forecast methods

Forecasts are prepared based on :

- Climate System Monitoring and Diagnostics
- EPS(Ensemble Prediction System) for 3-month and 6-month forecast

Forecast regions (Nation- wide forecasts)

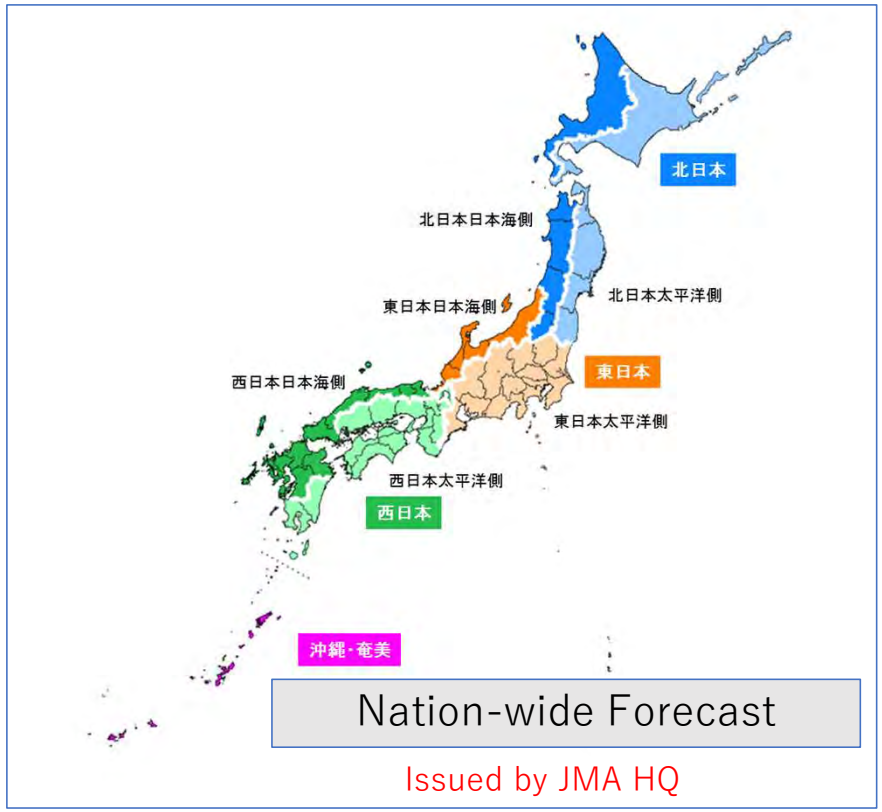


- Nation-wide forecasts are issued by JMA-HQ
- Forecast regions for mean temperature are 4 (North, East, West, South)
- Forecast regions for Precipitation and sunshine duration are 7.

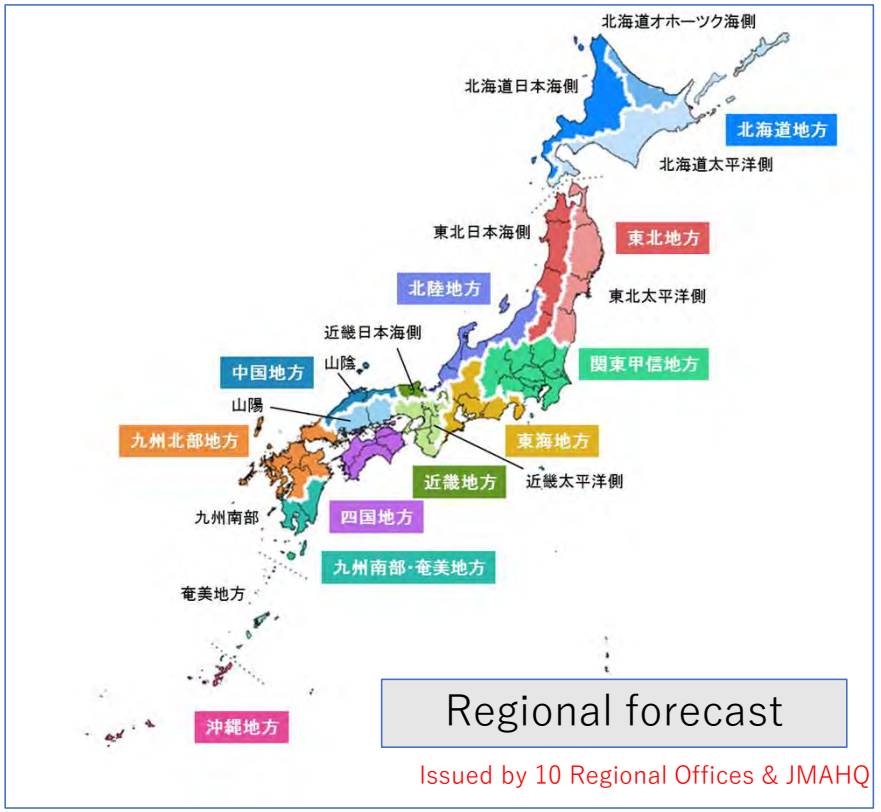
Forecast regions (Regional forecasts)

- Reginal forecasts are issued by 10 regional offices and JMA HQ .
- Forecast regions for mean temperature are 11.
- Forecast regions for Precipitation and sunshine duration are 17.

Forecast regions

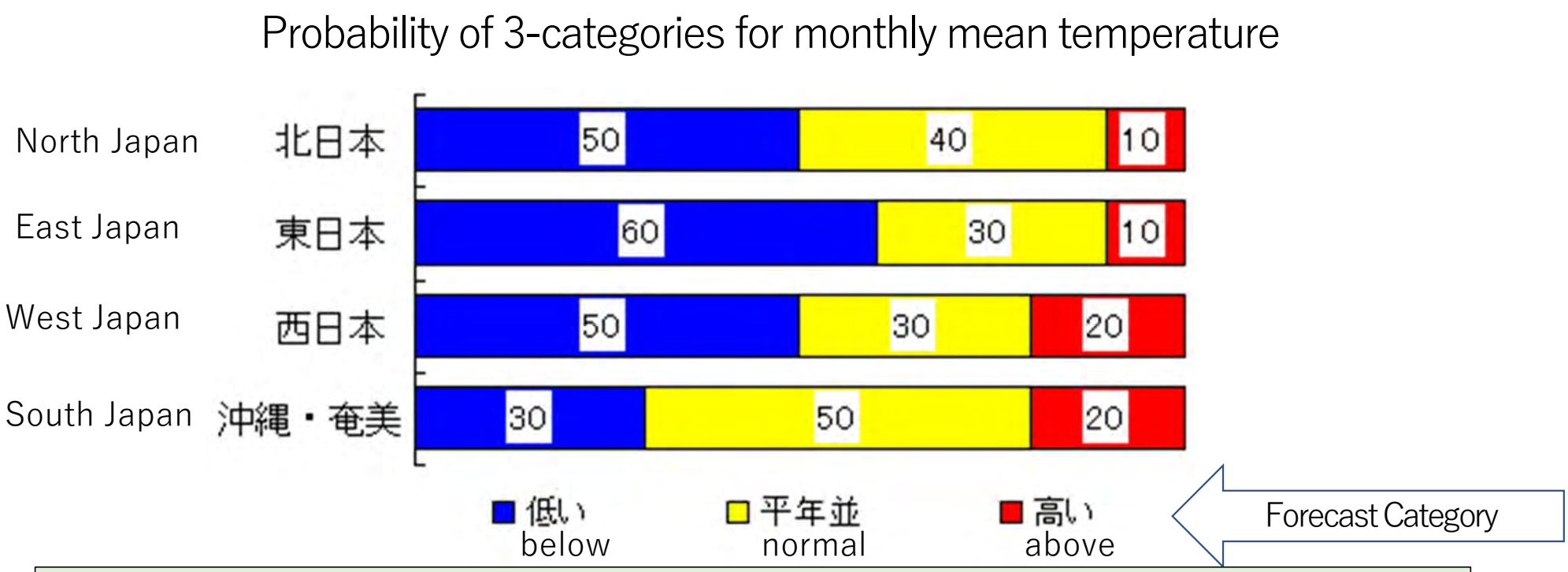


4-regions for mean temperature
7-regions for precip. and sunshine



11-regions for mean temperature
17-regions for precip. and sunshine

How to express probability forecasts

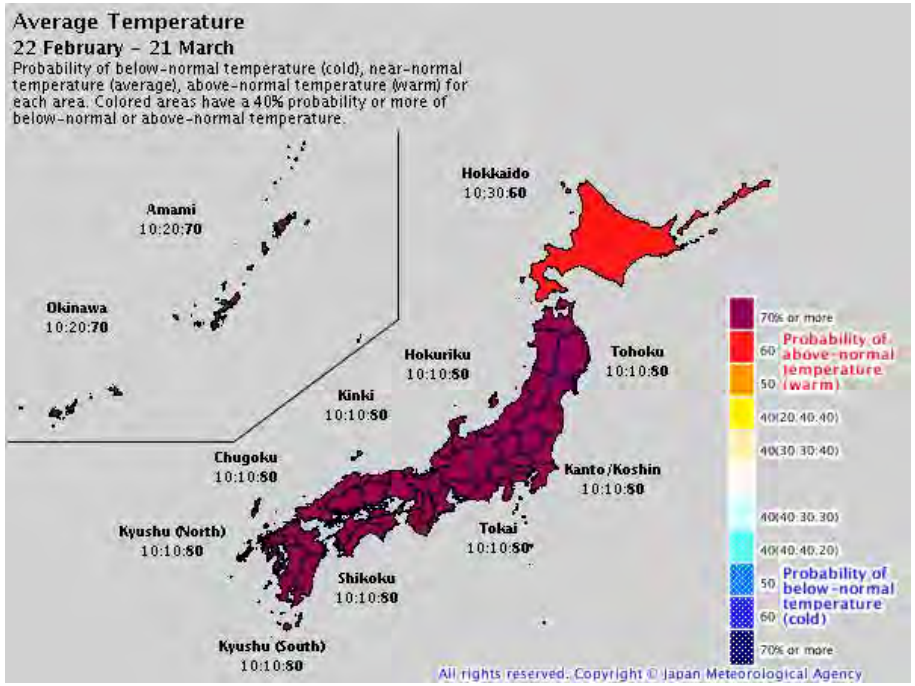


Climatological appearance rate for three categories(Below, Normal, Above) are 33%.

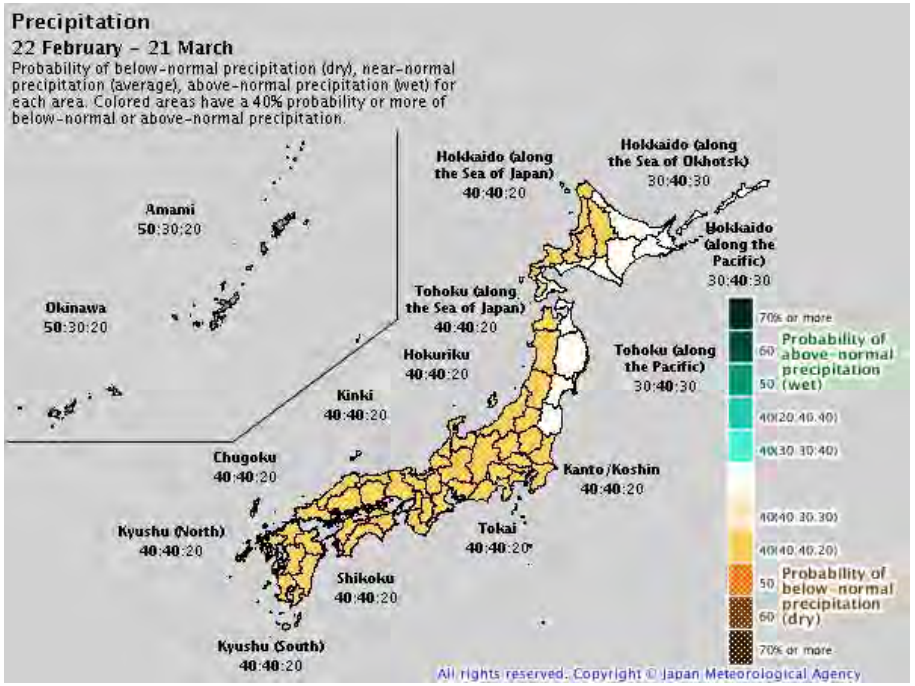
Example :Nation-wide forecast for monthly mean temperature

JMA Seasonal Forecasts _Example(1-month)

1-month mean temperature

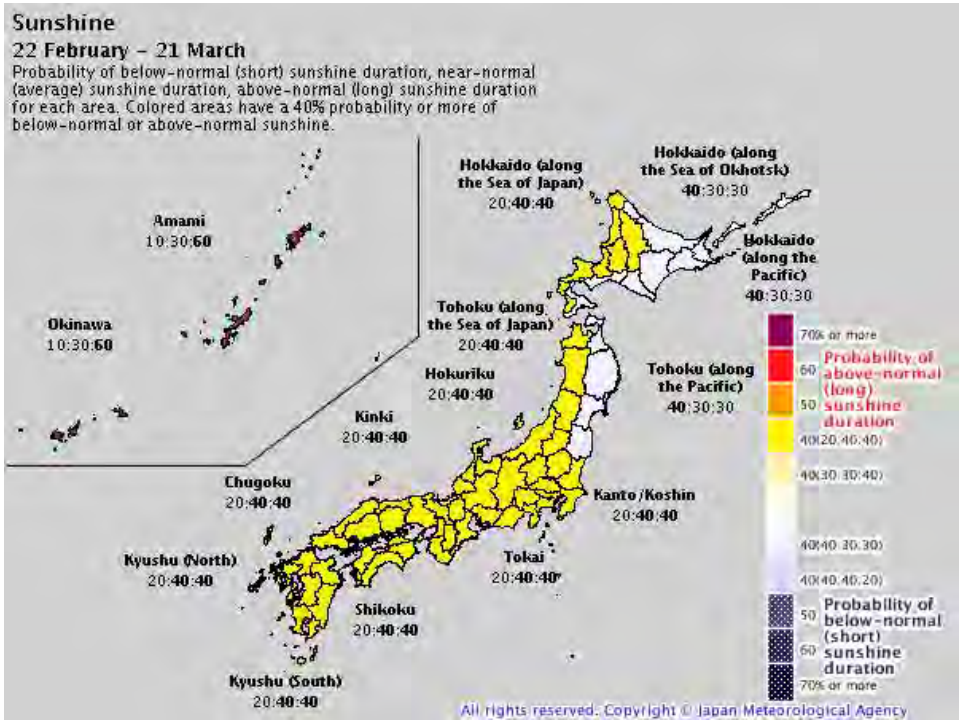


1-month total precipitation



1-month forecast issued on 21th Feb. 2020

JMA Seasonal Forecasts _Example(1-month)



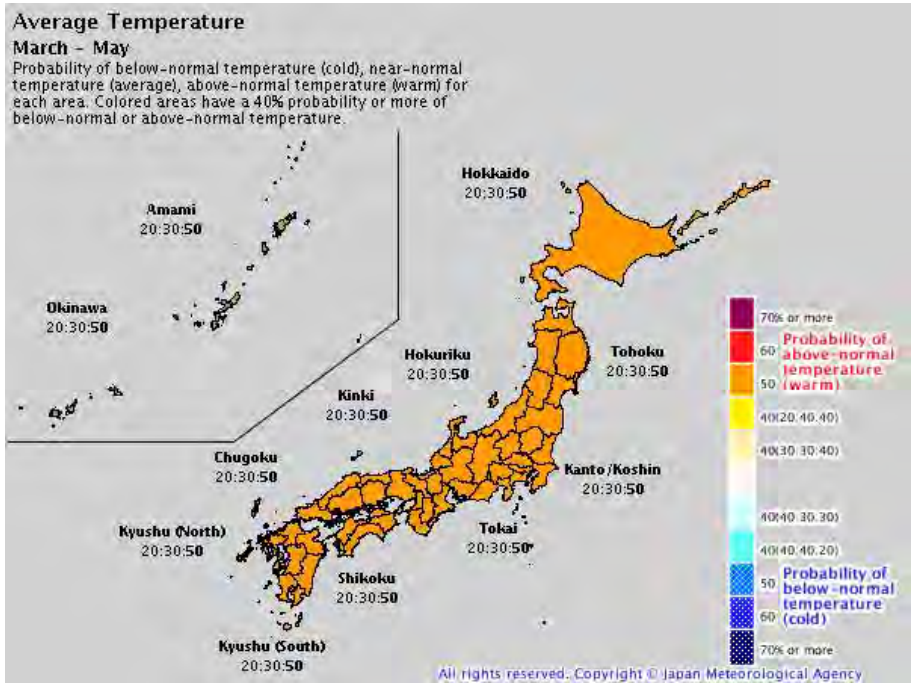
See JMA homepage for the latest one-month forecast:

- https://www.jma.go.jp/jp/longfcst/000_0_00.html

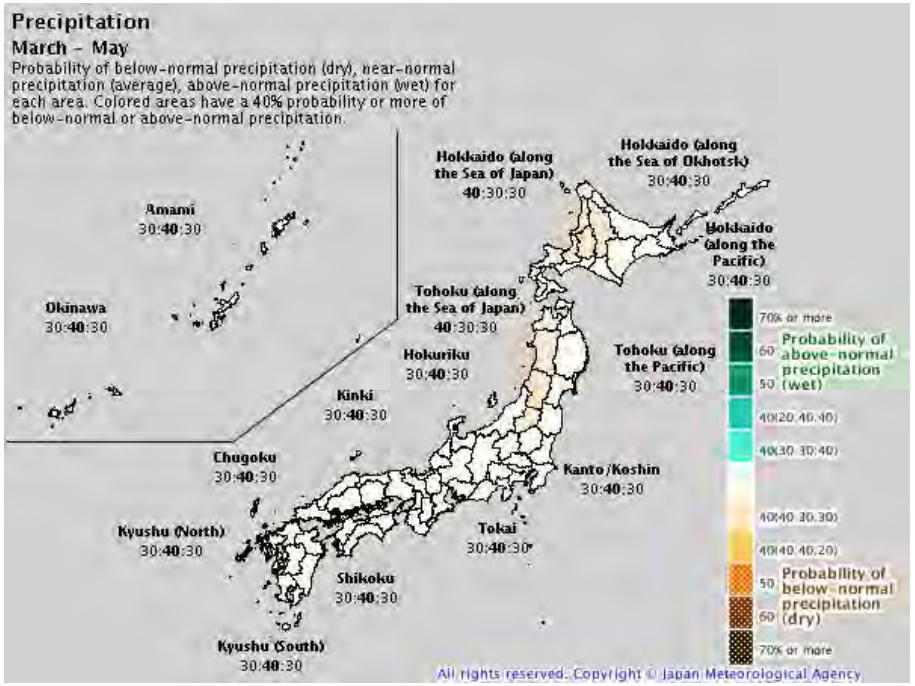
1-month forecast issued on 21th Feb. 2020

JMA's Seasonal Forecasts _Example(3-month)

Spring mean temperature 2020



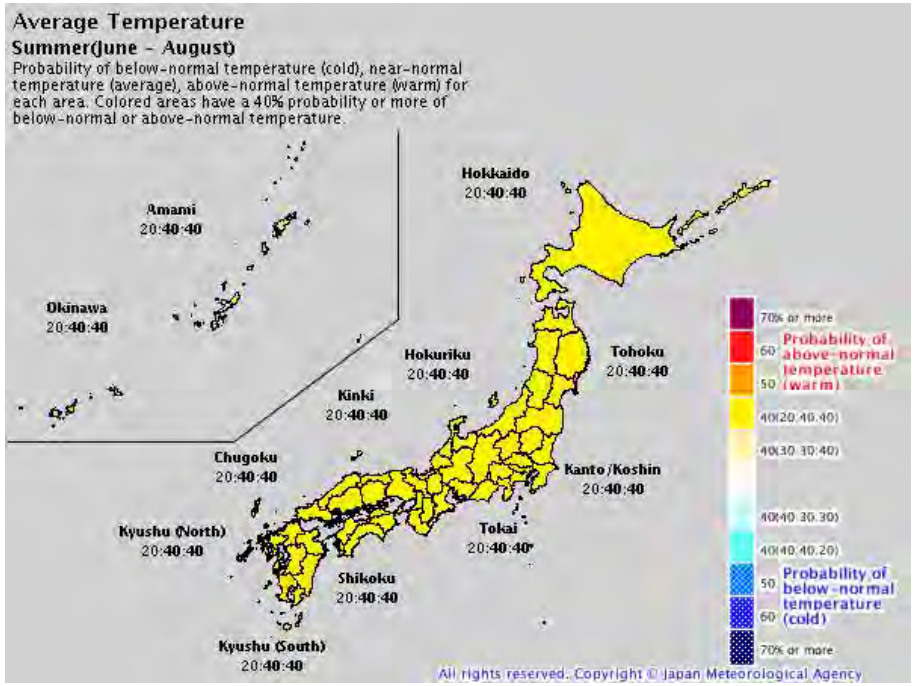
Spring total precipitation 2020



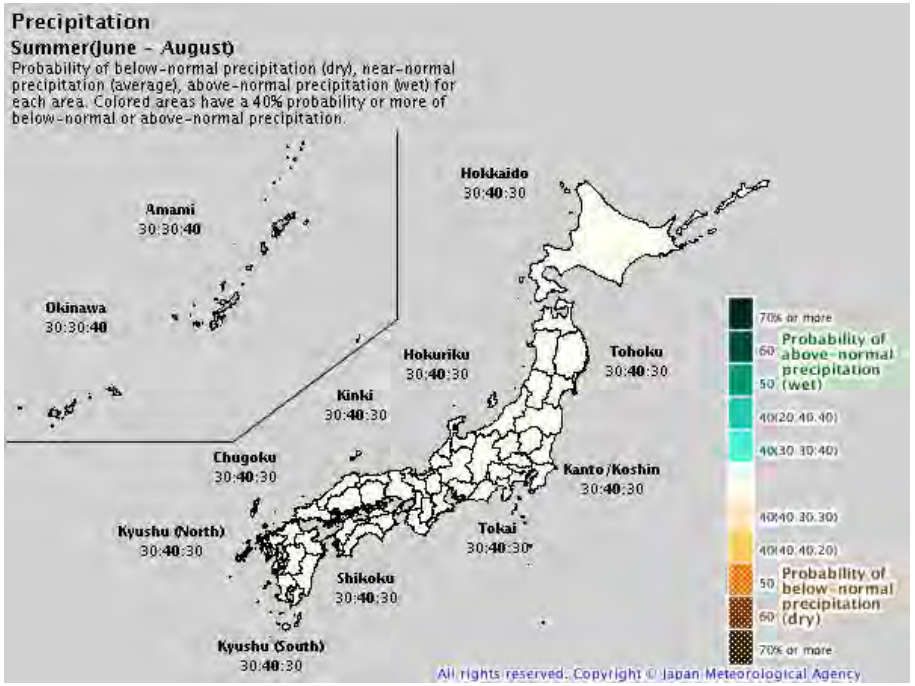
3-month forecast issued on 25th Feb. 2020

6-month forecast for summer(June,July,Aug.)

Temperature in summer 2020



Precipitation in summer 2020



3-month forecast issued on 25th Feb. 2020

Monthly Discussion on Seasonal Climate Outlooks (No. 72)

(25 February 2020)

Tokyo Climate Center (TCC)
Japan Meteorological Agency (JMA)

1. Summary and Discussion

ENSO

- ENSO-neutral conditions persisted.
- ENSO-neutral conditions are likely (60%) to continue until boreal summer.

Prediction for March-April-May 2020 (MAM 2020)

- In the upper troposphere, large-scale divergence anomalies are predicted over the western tropical Indian Ocean and from Micronesia to northern Polynesia, and large-scale convergence anomalies are predicted in and around the Caribbean Sea.
- A high probability of above-normal precipitation is predicted in and around the southwestern tropical Indian Ocean. A high probability of below-normal precipitation is predicted from the northeastern tropical Indian Ocean to the Philippines.
- A high probability of above-normal temperatures is predicted over the southern part of the Middle East, Southeast Asia, and the northern and eastern part of East Asia.

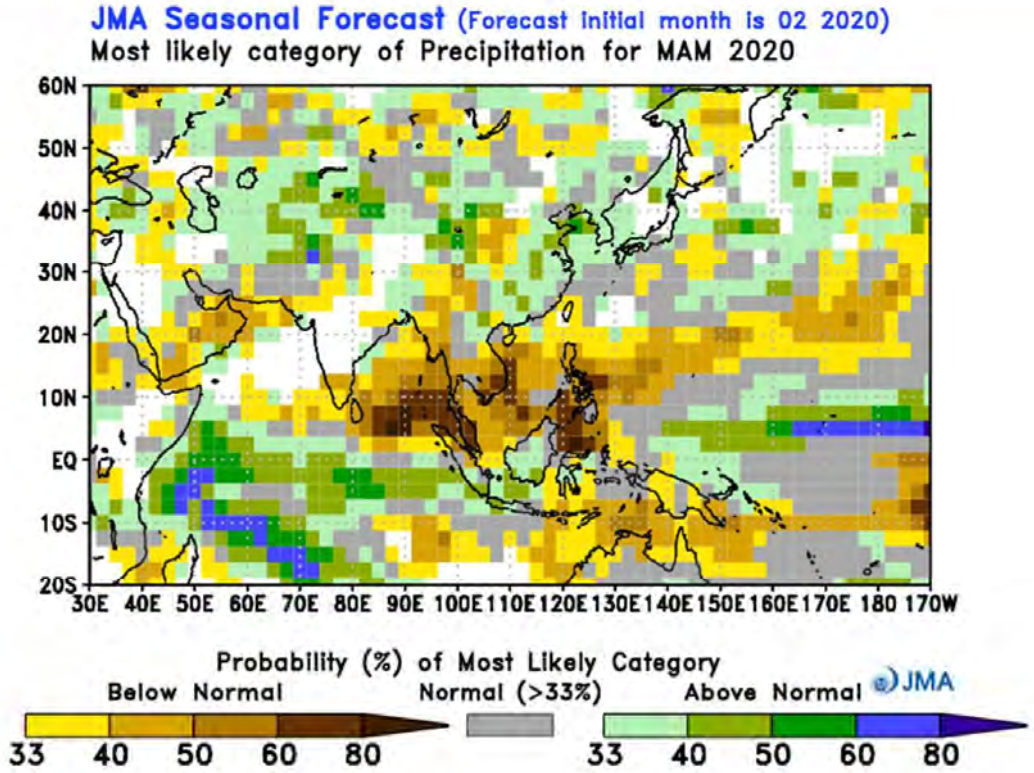
1. Summary and Discussion

Prediction for June-July-August 2020 (JJA 2020)

- In the upper troposphere, large-scale divergence anomalies are predicted over the western tropical Indian Ocean, large-scale convergence anomalies are predicted over the western tropical Pacific.
- A high probability of above-normal precipitation is predicted over the southern part of Southeast Asia.
- A high probability of above-normal temperatures is predicted over the southern part of the Middle East, Southeast Asia, and part of East Asia.

<MAM 2020> Probability Forecasts (precipitation)

- A high probability of above-normal precipitation is predicted in and around the southwestern tropical Indian Ocean.
- A high probability of below-normal precipitation is predicted from the northeastern tropical Indian Ocean to the Philippines.



Verification based on hindcast

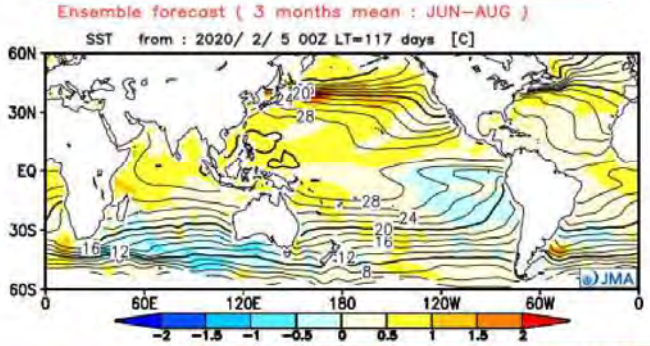
https://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/3-mon/hind/html/skill_reg_3-mon.html
https://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/3-mon/hind/html/skill_2d_3-mon.html

<JJA 2020> Sea Surface Temperature (SST)

- ENSO-neutral conditions are likely (60%) to continue until boreal summer.
- The NINO.WEST SST is likely to be below or near normal until boreal spring and near or above normal in boreal summer.
- The IOBW SST is likely to be above or near normal until boreal summer.

Three month mean Sea surface temperature (SST)

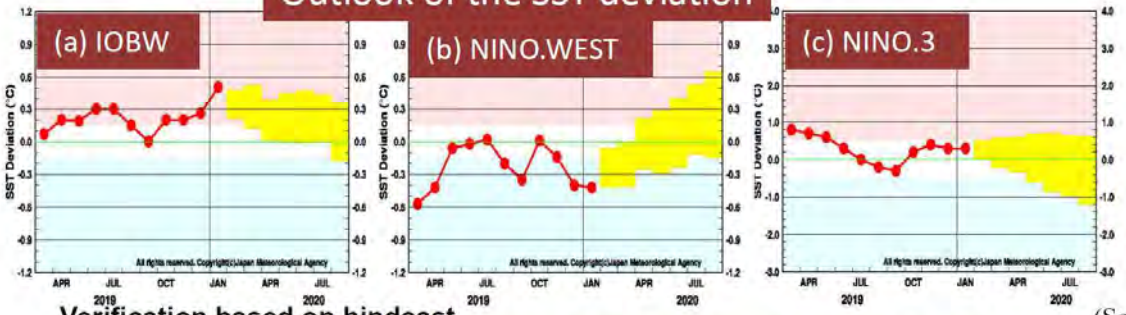
Contour: SST (°C); Shading: SST anomalies.

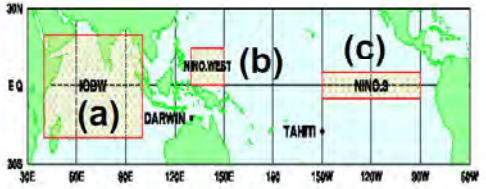


ENSO forecast probabilities

YEAR	MONTH	mean period	El Niño	ENSO neutral	La Niña
2019	DEC	OCT2019–FEB2020		100	
2020	JAN	NOV2019–MAR2020		100	
	FEB	DEC2019–APR2020	10	90	
	MAR	JAN2020–MAY2020	10	80	10
	APR	FEB2020–JUN2020	20	70	10
	MAY	MAR2020–JUL2020	20	60	20
	JUN	APR2020–AUG2020	20	60	20

Outlook of the SST deviation





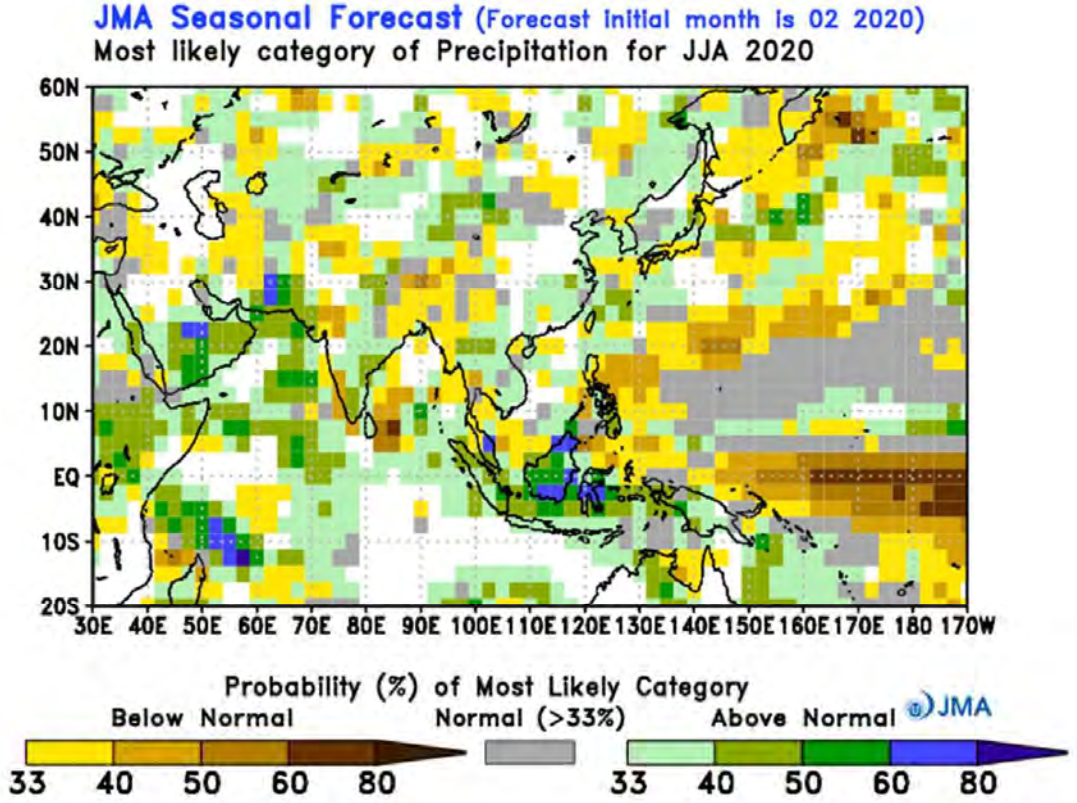
Verification based on hindcast

https://ds.data.jma.go.jp/tcc/tcc/products/model/hindcast/CPS2/index.html
https://ds.data.jma.go.jp/tcc/tcc/products/model/hindcast/CPS2/shisu/shisu.html

(See "Explanatory Notes (2)" for the definition of the SST indices.)

<JJA 2020> Probability Forecasts (precipitation)

- A high probability of above-normal precipitation is predicted over the southern part of Southeast Asia.



Verification based on hindcast

https://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/warm_cold_season/hind/html/skill_reg_warm_cold_season.html
https://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/warm_cold_season/hind/html/skill_2d_warm_cold_season.html

TCC website

気象庁 Japan Meteorological Agency

Tokyo Climate Center
WMO Regional Climate Center in RA II (Asia)

WMO

TCC home | About TCC | Site Map | Contact us

Home | World Climate | Climate System Monitoring | El Niño Monitoring | NWP Model Prediction | Global Warming | Climate in Japan | Training Module | Press release | Links

HOME

What are WMO RCCs

WMO RCCs are centres of excellence...

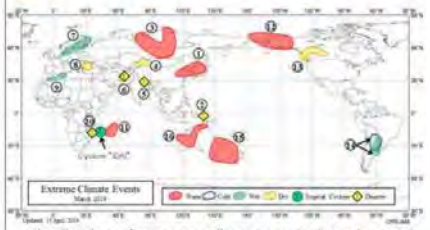
RCC Functions

- **Operational Activities for Long-range Forecasting (LRF)**
- **Operational Activities for Climate Monitoring**
- **Operational Data Services, to support operational LRF and climate monitoring**
- **Training in the use of operational RCC products and services**

Latest Updates

World Climate Updated: 15 April 2019

The latest monthly report is issued on 15 April 2019.



Distribution of Extreme Climate Event (March 2019)

Climate System Monitoring	Updated 15 April 2019
El Niño Monitoring	Updated: 10 April 2019
Monthly Discussion	Updated: 25 March 2019
Global Warming	Updated: 15 April 2019
Climate in Japan	Updated: 10 April 2019
STRATALERT TOKYO	

Main Products

iTacs

iTacs, Interactive Tool for Analysis of the Climate System, is a web-based application to assist NMHSs to analyses extreme climate events and to monitor climate status.

WMC Tokyo

Products of long-range forecast from World Meteorological Centre (WMC) Tokyo are available. These products are based on JMA's ensemble prediction system.

Monthly Discussion on Seasonal Climate Outlook

This is intended to assist NMHSs in the Asia-Pacific region in interpreting WMC Tokyo's three-month prediction and warm/cold season prediction products.

El Niño Monitoring

"El Niño Outlook" consists of a diagnosis of current condition and prediction of El Niño/Southern Oscillation. This is issued every month around 10th.

ClimatView

The ClimatView tool enables viewing and downloading of monthly world climate data, including monthly temperature/precipitation statistics and 30-year climate normals.

TCC News

TCC News, a quarterly newsletter from Tokyo Climate Center, acquaints with significant climate disasters and events, forecaster's commentaries on seasonal outlooks, besides topics on the renewal and the usage of TCC products.

What's New

RSS

19 March 2019

- Announcement: Incorpotation of Standardized Precipitation Index (SPI) into the ClimatView tool.

14 March 2019

- Announcement: New JMA's One-month Guidance Tool (password required) is launched. Please refer to the commentary for details.

1 March 2019

- TCC News No. 55 (Winter 2019: PDF)
  - Global surface temperature for 2018 the fourth highest since 1891
  - Highlights of the Global Climate in 2018
  - Summary of Japan's Climatic Characteristics for 2018
  - TCC Activity Report for 2018
  - TCC contribution to WMO International Workshop on RCC Operations

21 December 2018

- Press release: Global temperature for 2018 to be the 4th highest since 1891 (Preliminary)

» Previous news

» Press release

Links

Regional Climate Centers

- RA II Regional Climate Center (RCC) Network Homepage
- Beijing Climate Center
- National Climate Centre, Pune
- North Eurasian Climate Center (NEACC)
- WMO RA VI RCC-Network

Regional Climate Outlook Forum (RCOF)

- Forum on Regional Climate Monitoring-Assessment-Prediction for Asia (FOCRAII)
- East Asia winter Climate Outlook Forum (EASCOF)
- South Asian Climate Outlook Forum (SASCOF)
- ASEAN Climate Outlook Forum (ASEANCOF)

WMO RA II Climate Services

https://ds.data.jma.go.jp/tcc/tcc/index.html

Concluding remarks

- To continue contributing to BMKG-JICA Project
- Toward strengthening seasonal forecast and climate information
  - Update of seasonal forecast numerical models (Products to be provided to MHSs in asia-pacific region through TCC Home page)

Thank you for your kind attention

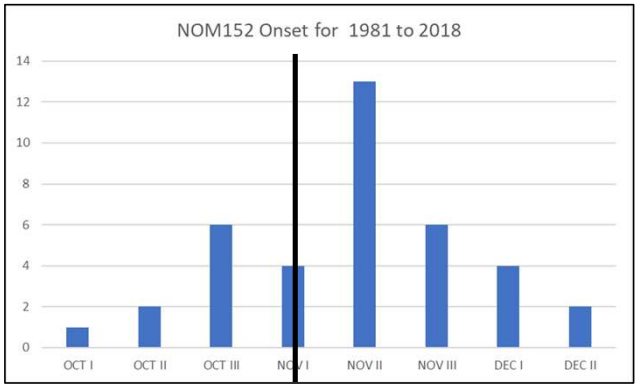
Terima kasih

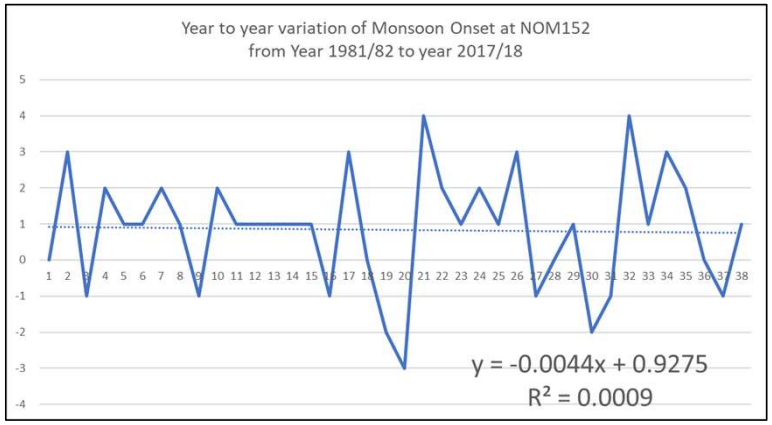
ご清聴ありがとうございました

Case study of monsoon variability
—Wet season onset at NOM152—
Data:1981 to 2018 (to add 2019data)

- Normal: NOV I
- Onset : a large bias?
  - Earlier than normal: 9
  - Later than normal:25
- Significantly early onset :
  1999、2000、2010
- Significantly late onset :
  2001、2012
- To study:
  - Atmospheric and boundary condition features associated with early/late onsets
  - Impacts of the present normal “bias” on the monsoon forecasts

Wet season Onset :		
Normal(1981-2010)	0.77	
Standard deviation	1.6	
Onset dasarian		
OCT I	1	9
OCT II	2	
OCT III	6	
NOV I	4	Normal at present
NOV II	13	25
NOV III	6	
DEC I	4	
DEC II	2	
No. of data	38	





Long-term trend for onset not found so far!

Case study of monsoon variability
—Wet season total precipitation at NOM152—
Data:1981 to 2018 (to add 2019data)

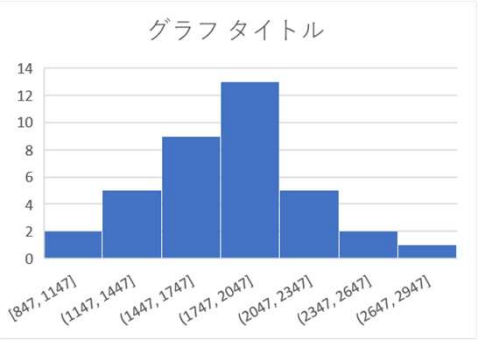
- Normal: 1836.5mm
- Precipitation amount:
  - Significantly small:2001、2002、2006、2015
  - Significantly large:1985、1988、1997、2009

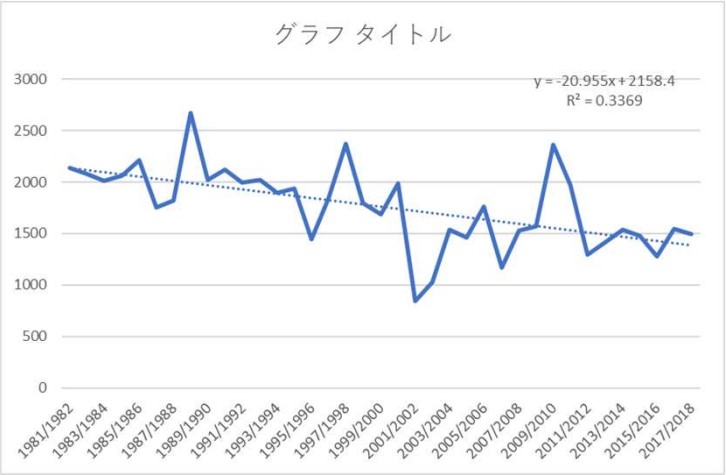
Long-term trend of precipitation:

- A declining trend!?

- To study:
  - Atmospheric and boundary condition features associated with small/large amount of precipitation
  - Relationship between early/late onset and monsoon total precipitation
  - “declining trend” of monsoon precipitation(Is it general or not?)

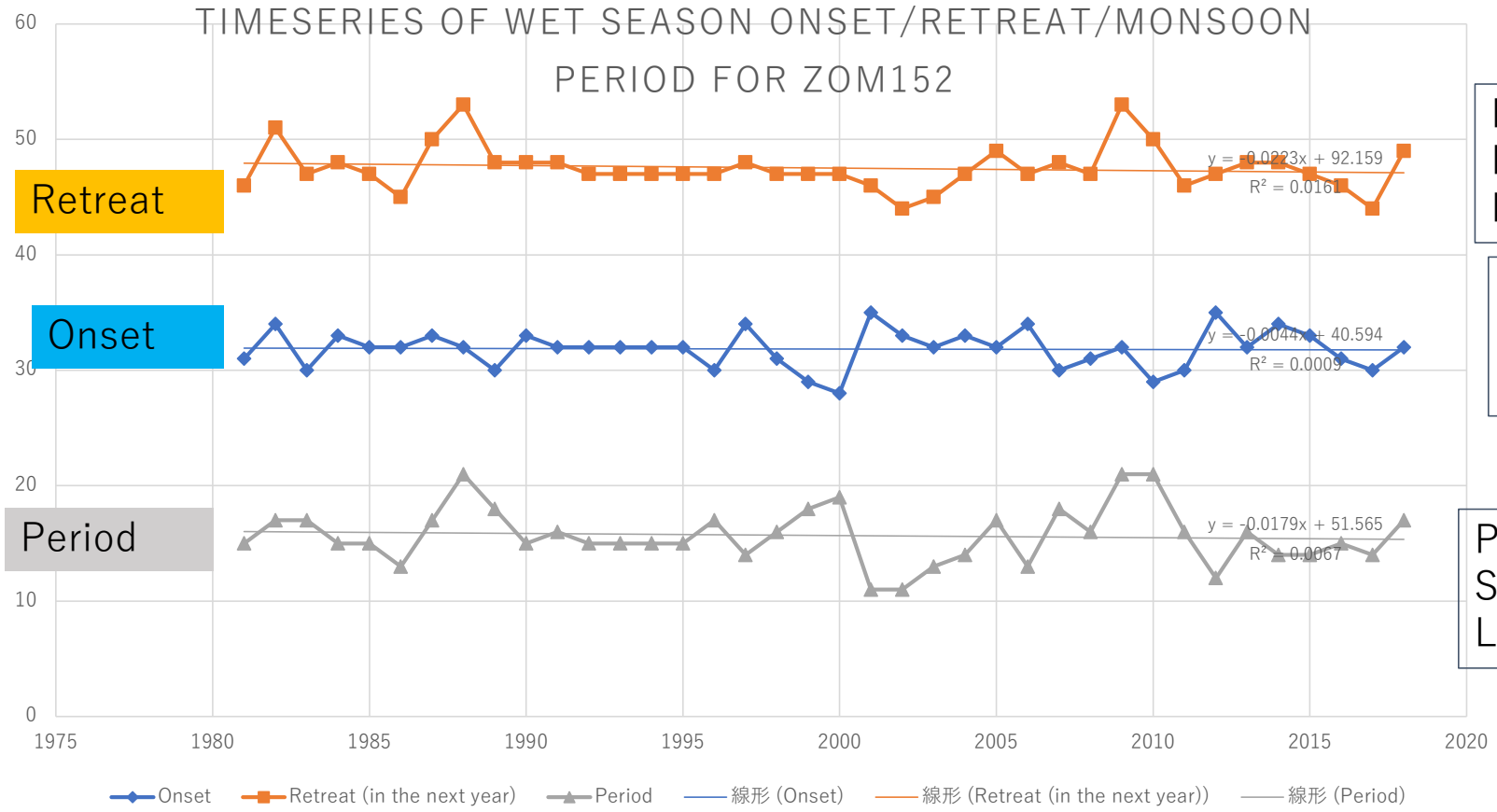
Wet season precipitation(mm) :	
Normal(198-2010)	1836.5
Standard variation	387.4
Coefficient of Variation）	0.211





Monsoon precipitation shows a declining trend.

Wet season Onset/Retreat/Monsoon period for **ZOM152**



Retreat

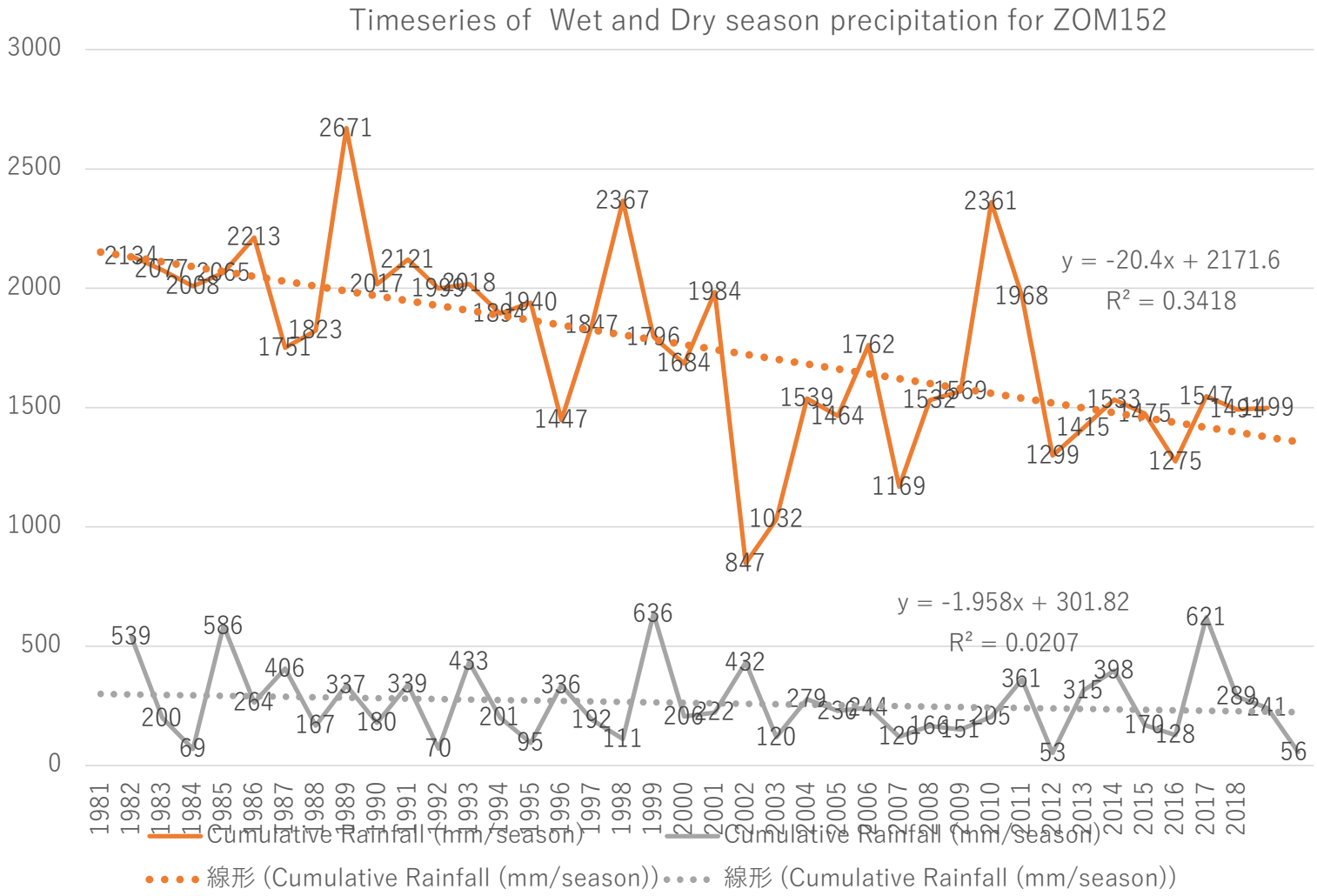
Onset

Period

Retreat
Early:2002, 2017, 1986, 2003
Late:　2009,　1988、1982

Onset
Early：2000、1999、2010
Late：2012,　2001

Period:
Short: 2002,2001,2012
Long:, 2010,1988,2009,2000



Wet monsoon precipitation
Small: 2001、2002、2006、2015
Large: 1988,1997,2009,1985

Dry monsoon precipitation
Small: 2011,1983,1991,1994
Large: 1998,2016,1984,1981

What to do (Example: case for E.ast Java(ZOM152)

➢Tasks:

- To study variability of Wet/Dry season onset/retreat, Wet/Dry season rainfall amount
  - ◆**Basic statistic**: Climatology, Average&Standard variation, trend,,,,
  - ◆**What are the most important factors** among ENSO, IOD, SSTs around Indonesia regions, Monsoon activities, MJO, some other local factors, etc(Decadal change?)
  - ◆**Predictability** of those factors; Can we predict those factors? If so, with how much of 'lead time' for each factor?
  - ◆**Representativeness** of ZOM152 in East Java: To what extent ZOM152 represent monsoon variability in East Java

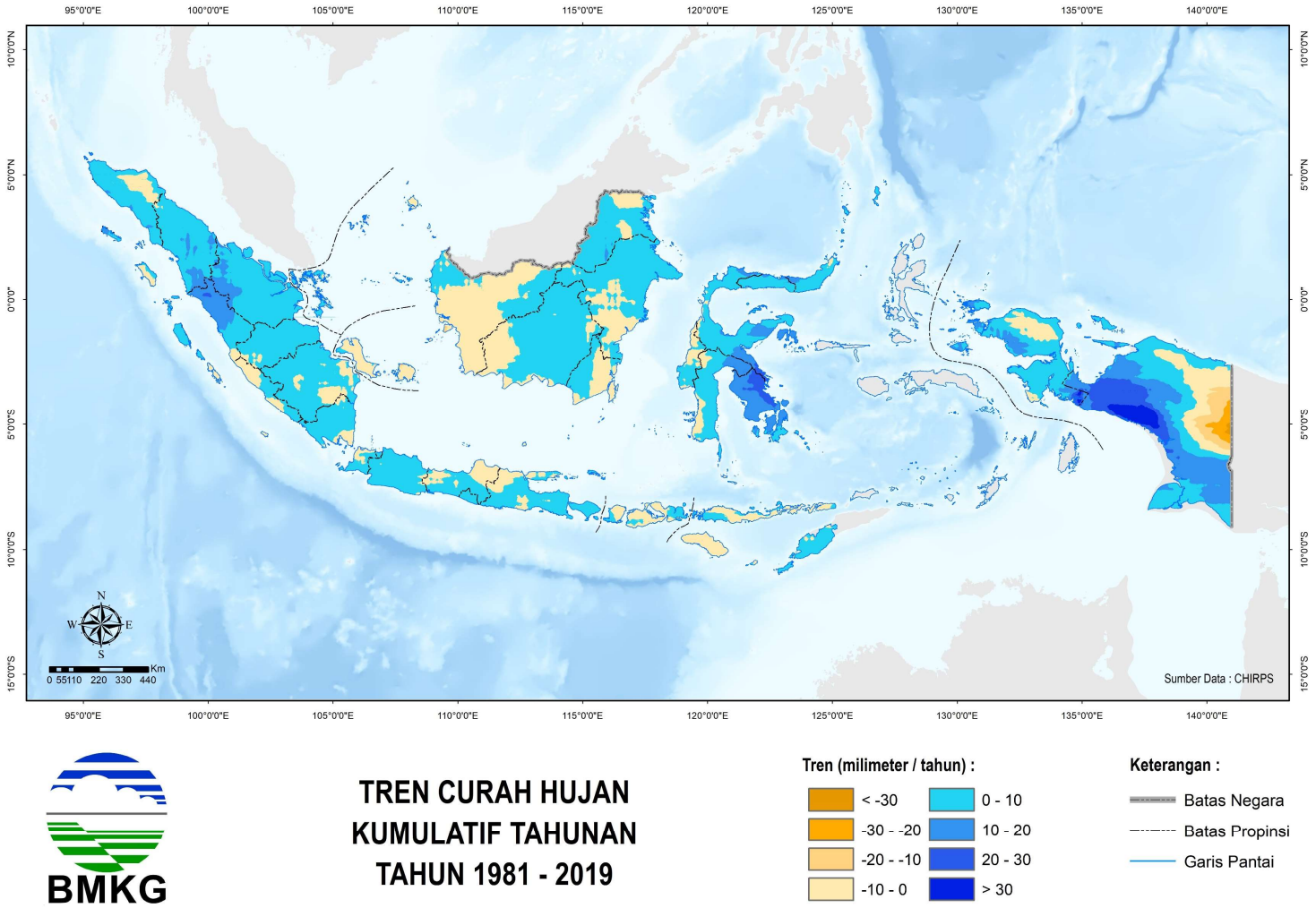
➢How to study: (See PPTs above for example)

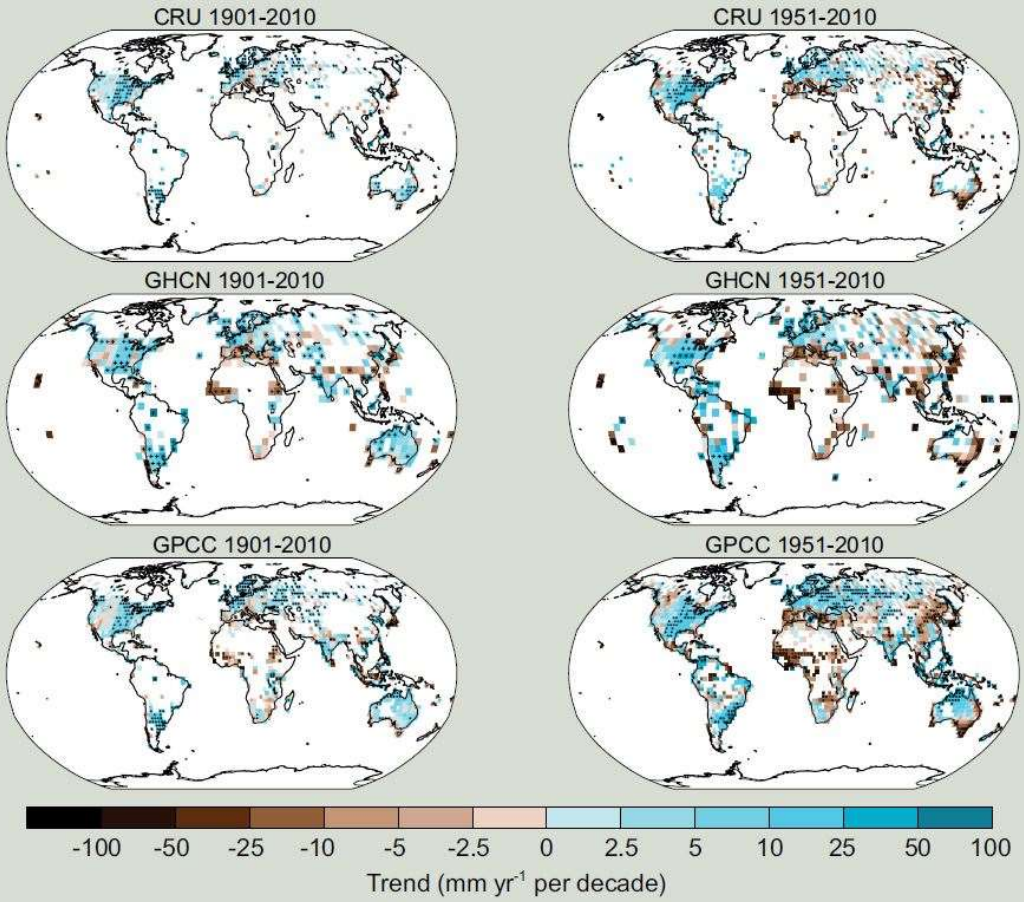
Information

- JMA' s new One-month/6-month forecast being prepared to provide to NHMs from TCC (as of 10 March 2020)
  - TCC will start providing new one-month forecast from 26 March 2020, and announcement for this are presently being prepared by TCC.
  - As for 6-month forecast re-forecast for evaluation is being done by Numerical group of TCC. So far schedule for provision not decided yet.

- Torrential rain in end/start of the year 2019/20 in Jakarta may be caused by a kind of 'cyclone' but relation with MJO not found (information from a researcher of LAPAN)

Trend of annual rainfall in Indonesia__Figures to be provided by Ganesha





TFE.1, Figure 2 | Maps of observed precipitation change over land from 1901 to 2010 (left-hand panels) and 1951 to 2010 (right-hand panels) from the Climatic Research Unit (CRU), Global Historical Climatology Network (GHCN) and Global Precipitation Climatology Centre (GPCC) data sets. Trends in annual accumulation have been calculated only for those grid boxes with greater than 70% complete records and more than 20% data availability in first and last decile of the period. White areas indicate incomplete or missing data. Black plus signs (+) indicate grid boxes where trends are significant (i.e., a trend of zero lies outside the 90% confidence interval). Further detail regarding the related Figure SPM.2 is given in the TS Supplementary Material. {Figure 2.29; 2.5.1}

2020/6/16

10:00～11:00(Jakarta local time)

Project of Capacity Development for the Implementation of Agricultural Insurance in the Republic of Indonesia

=Progressive report and activities proposal for remained project period=

for Key Activity 2

JICA expert (JMBSC)
Koichi KURIHARA

Key activities and PIC

Key Activities

21st of December 2018

- 1: Provide/prepare reliable meteorological data for agricultural insurance.
- 2: Develop weather information and strengthen abilities for producing products for agriculture. (Agricultural information)
- 3: Enhance analysis abilities of risk analysis for climate change data-set.

PIC for key activities

- 1. provide/prepare reliable meteorological data for agricultural insurance: Noveta Chandra
- 2. develop weather information and strengthen abilities for producing products for agriculture:
- 3. enhance analysis abilities of risk analysis for climate change data set: Ganesha Tri Chandraja

Key Activity 2:
agricultural information

Target tasks for Key activity 2

A) Improvement of Seasonal forecast, especially onset forecast

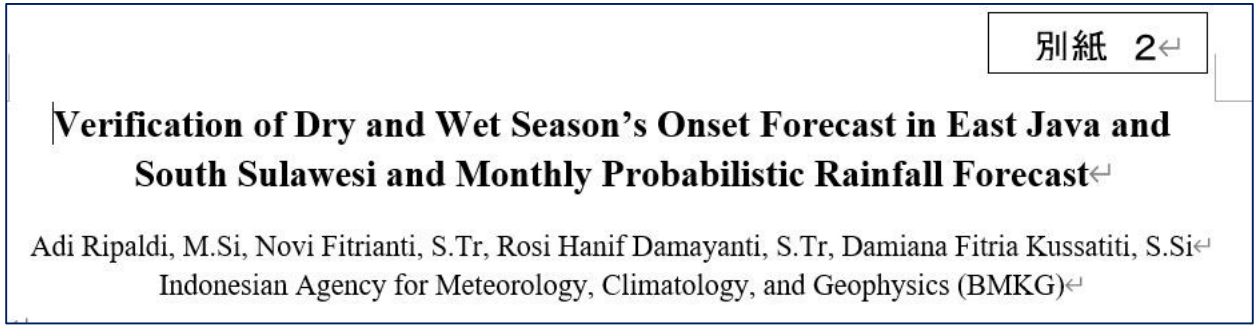
1. <A-1> Evaluation of operational forecasts
2. <A-2> Case study on monsoon onset/retreat variability

B) Improvement of ENSO monitoring and forecast

<A-1> Evaluation of operational forecasts

Key Activity 2: agricultural information <Evaluation of operational forecast>

Topics 1. to 7. shown bellow were studied, and results(1. to 6.) were included in the progressive report.

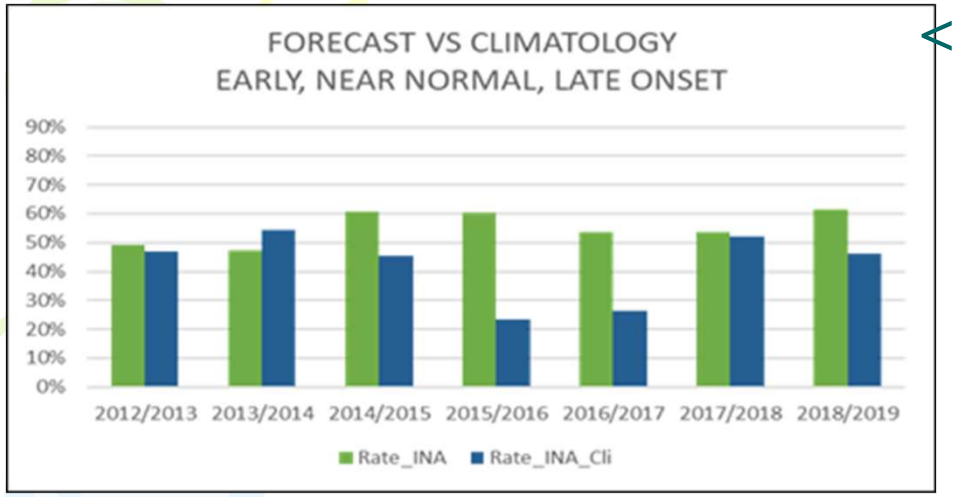


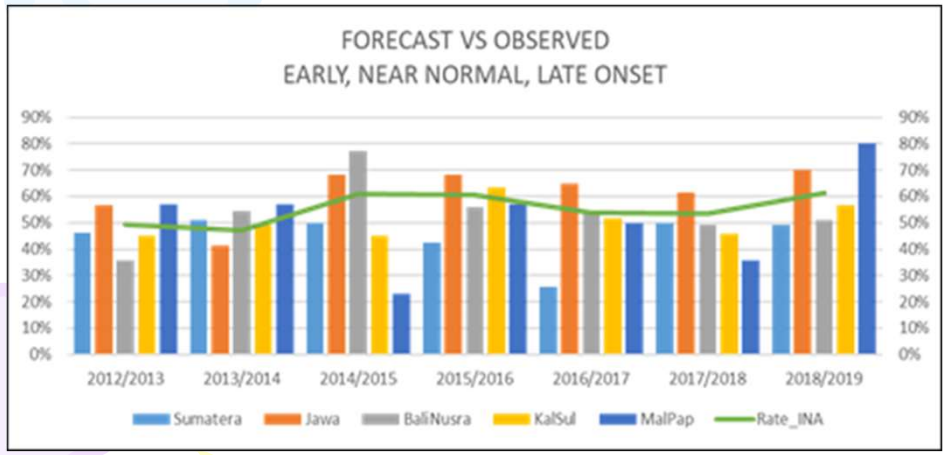
別紙 2

Verification of Dry and Wet Season's Onset Forecast in East Java and South Sulawesi and Monthly Probabilistic Rainfall Forecast

Adi Ripaldi, M.Si, Novi Fitrianti, S.Tr, Rosi Hanif Damayanti, S.Tr, Damiana Fitria Kussatiti, S.Si
Indonesian Agency for Meteorology, Climatology, and Geophysics (BMKG)

1. Hit Rate Comparison between Dry Season's Onset Forecast issued by BMKG and Climatological Forecast in Indonesia
2. Hit Rate Comparison of Issued Dry Season's Onset among 5 Major Islands in Indonesia
3. Hit Rate Comparison between Wet Season's Onset Forecast issued by BMKG and Climatological Forecast in Indonesia
4. Hit Rate Comparison of Issued Wet Season's Onset among 5 Major Islands in Indonesia
5. Comparison of Hit Rate Estimates for Early Dry and Wet Season in ZOM 152 and ZOM 299
6. Hit Rate Probabilistic Forecast for Monthly Rainfall in 2018
7. Evaluation of JMA One-month forecast for 2018





<A-1> Verification of onset/offset forecast issued by BMKG

- Generally dry and wet season's onset forecast for 342 Seasonal Zones in Indonesia issued by BMKG since 2012 is better than the climatological forecast, except 2018 for dry season and 2013/2014 for wet season. Generally wet season's onset forecast has higher hit rate and skill than dry season's onset forecast so we can say that wet season's onset forecast is better than dry season's onset forecast.
- Among 4 statistical methods (ARIMA, WAVELET ARIMA, ANFIS, and WAVELET ANFIS) that is used to forecast dry and wet season's onset during 1991-2018 in ZOM 152 (East Java) and ZOM 299 (South Sulawesi) shows that dry and wet season's onset forecast in ZOM 152 is best using ARIMA while ZOM 299 is best using WAVELET ARIMA.
- Verification on probabilistic forecast for monthly rainfall during 2018 shows that generally there is no significant difference among the lag-6 until lag-0 forecasts. Probabilistic for categories less than 100mm/month, less than 150 mm/month, and more than 200 mm/month tend to be relatively good. Hit rate of the probabilistic forecast during 2018 for less than 100 mm/month and less than 150 mm/month tend to decrease a lot around June – August 2018 (the target month) while more than 200 mm/month is at its peak.

Topic1-6

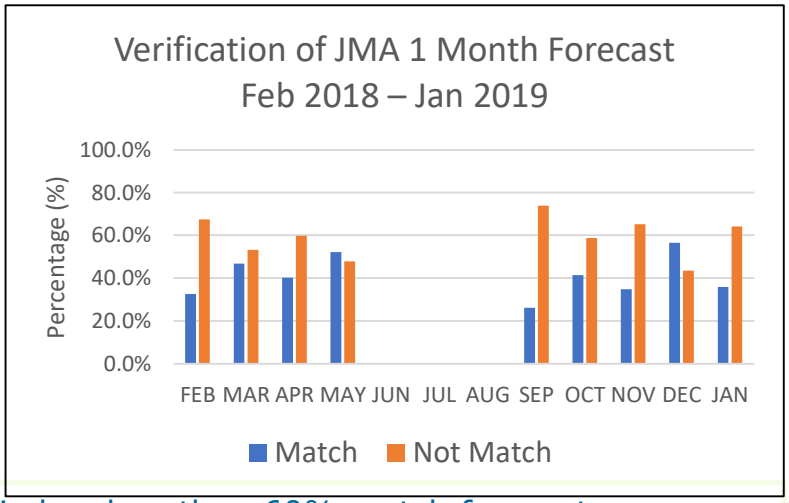
Key Activity 2: agricultural information
<Evaluation of operational forecast>

<A-1> Verification of JMA Forecast Conclusion

Topic 7

VERIF	COUNT SCORE											
	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN
Match	30	43	37	48				24	38	32	52	33
Not Match	62	49	55	44				68	54	60	40	59
Total	92	92	92	92				92	92	92	92	92

VERIF	PERCENTAGE											
	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN
Match	32.6%	46.7%	40.2%	52.2%				26.1%	41.3%	34.8%	56.5%	35.9%
Not Match	67.4%	53.3%	59.8%	47.8%				73.9%	58.7%	65.2%	43.5%	64.1%
Total	100%	100%	100%	100%				100%	100%	100%	100%	100%



- Overall, JMA 1 month forecast in western part Indonesia has less than 60% match forecast.
- Highest % of match forecast : December 2018
- Lowest % of match forecast : September 2018
- During forecast for Feb 2018 until Jan 2019, generally match forecast occur in middle part of Sumatra and west part of Kalimantan while other regions only for particular months.

Key Activity 2: agricultural information
<Evaluation of operational forecast>

Activities almost finished.
(1) Reporting of the project.
(2) Add evaluation of latest forecast (2019)?

<A-2> Case study on monsoon onset/retreat variability

Following works/studies done:

1. ZOM152 in East Java and ZOM299 in South Sulawesi selected for the study.
2. Collection of the historical 10day(dasarian) rainfall data for the period from 1981 to present for these ZOMs, and onset/offset of Dry/Wet season identified for each year.
3. Basic statistics concerning climatic features in the ZOMs.
   - Climate normal (average of 30 years;1981 to 2010) for 10day/Monthly/Dry season/Wet season rainfall.
   - Climate normal for onset/offset of Dry/Wet season as well as period of Dry/West season.
   - Years with certain significant features were selected such as:
     - Years that have significantly early/late onset/offset of Dry/Wet season
     - Years that have significantly small/large rainfall amount during Wet season

Note that some results(climatic features for these years) are shown in the next slides for example.

<A-2> Case study of monsoon variability —Wet season total precipitation at ZOM152— Data:1981 to 2018 (to add 2019data)

Last Meeting
24 Feb, 2020

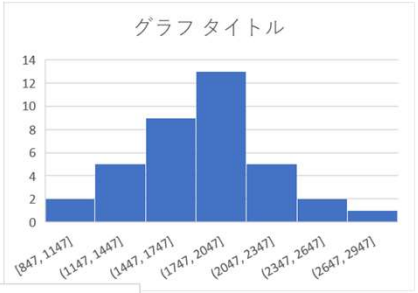
- Normal: 1836.5mm
- Precipitation amount:
  - Significantly small:2001、2002、2006、2015
  - Significantly large:1985、1988、1997、2009

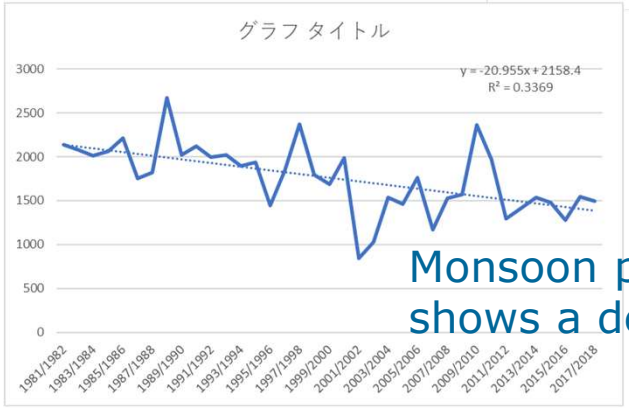
Long-term trend of precipitation:

- A declining trend!?

- To study:
  - Atmospheric and boundary condition features associated with small/large amount of precipitation
  - Relationship between early/late onset and monsoon total precipitation
  - "declining trend" of monsoon precipitation(Is it general or not?)

Wet season precipitation(mm) :	
Normal(198-2010)	1836.5
Standard variation	387.4
Coefficient of Variation)	0.211





Monsoon precipitation shows a declining trend.

Key Activity 2: agricultural information
<Case study for monsoon onset/offset>

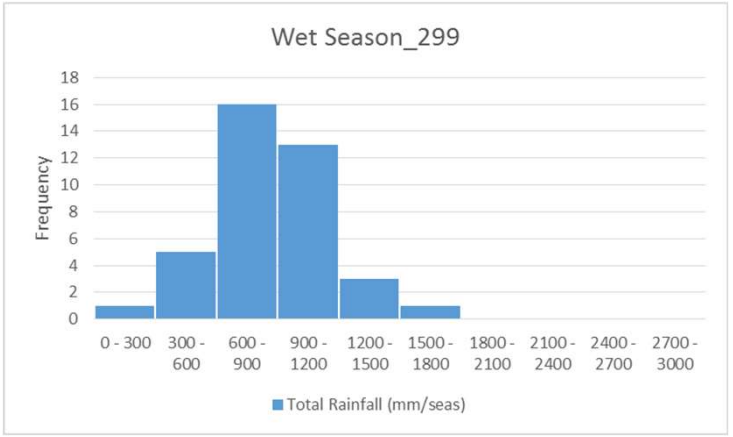
Key Activity 2: agricultural information
<Case study for monsoon onset/offset>

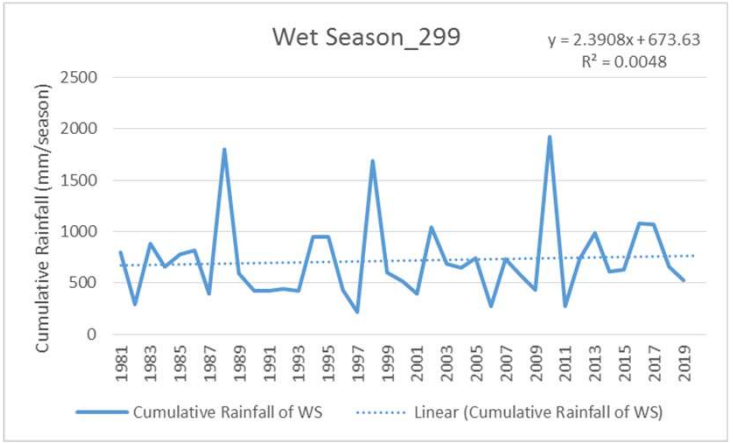
<A-2> ZOM 299 – South Sulawesi WET SEASON Precipitation

- Normal: 719 mm
- Precipitation amount:
  - Significantly small: 1982, 1997, 2006, 2011
  - Significantly large: 1988、1988、2010
- There is slight increasing trend on Wet Season's Cumulative Rainfall

	Wet_Season	Dry_Season
Normal (1981-2010)	719	909
Standard of Variation	391.64	313.91
Coefficient of Variation	0.54	0.36

Total Rainfall (mm/seas)	Wet Season	Dry Season
0 - 300	4	1
300 - 600	12	5
600 - 900	14	16
900 - 1200	6	13
1200 - 1500	0	3
1500 - 1800	2	1
1800 - 2100	1	0
2100 - 2400	0	0
2400 - 2700	0	0
2700 - 3000	0	0

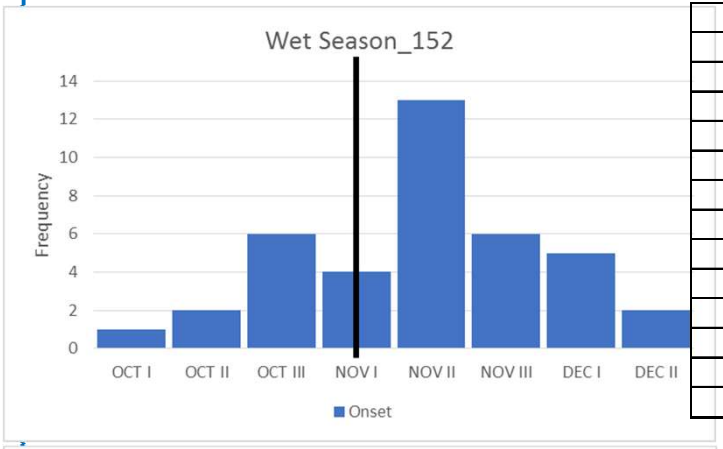


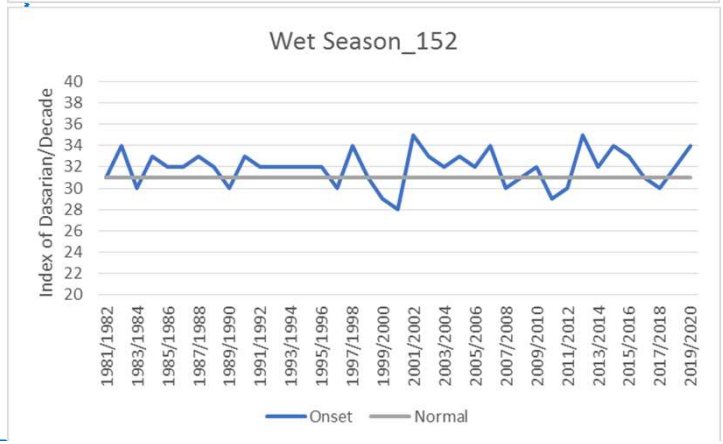


<A-2> ZOM 152 – East Java WET SEASON

Key Activity 2: agricultural information
<Case study for monsoon onset/offset>

- Normal: NOV I
- Frequency of onset
  - Mode of Onset (13) is 1 dasarian later than Normal (4) at Nov II
  - Earlier than normal: 9
  - Later than normal: 26
- Significantly early onset：2000/2001
- Significantly late onset ：2001/2002, 2012/2013





Wet Season		
Normal (1981-2010)	1837	
Standard Deviation	1.67	
No. of Data	38	
Onset (Dasarian)		
OCT I	1	9
OCT II	2	
OCT III	6	
NOV I	4	**Normal**
NOV II	13	26
NOV III	6	
DEC I	5	
DEC II	2	

<A-2> Case study on monsoon onset/retreat variability

Tasks: To prepare reports and add some studies

- To summarize present results as a short report.
- To add some studies if we have enough time and data available:
  - To study features of atmospheric circulation and boundary conditions for the years selected by the present study, based on composite analysis (use of iTacs for example). This is intended to find factors which have major influence on the monsoon variability in the pilot regions.
  - (Note that seasonal predictability of factors associated with Dry/Wet season variability is not studied here but expected to be done in the coming project（'PhaseII'）.)
  - (New important topic) DKI observed severe weather events in the new year days of 2019/2020. Case study for this event will be done including S2S forecast study using ECMWF and JMA numerical forecast data.

Key Activity 2: agricultural information
<Case study for monsoon onset/offset>

<B> Improvement of ENSO monitoring and forecast

Evaluation of ENSO forecast by BMKG and JMA was done:

- BMKG ENSO forecast for 2013 to 2018 shows correlation between forecast and observation is generally high for one to 3month time-lag, and its skill score larger for one to 4month time-lag compared to climate forecast.
- JMA ENSO forecast for 2015 to 2020 shows correlation between forecast and observation for one to 3month time-lag is larger than that for BMKG forecast, and its skill score seems better than that for BMKG's.
- JMA ENSO forecast shows forecast results for May and June (and some case up to August) are not so good compared to those for other months(This may be related to so-called 'Spring ~~briar~~ barrier' and need to improve).

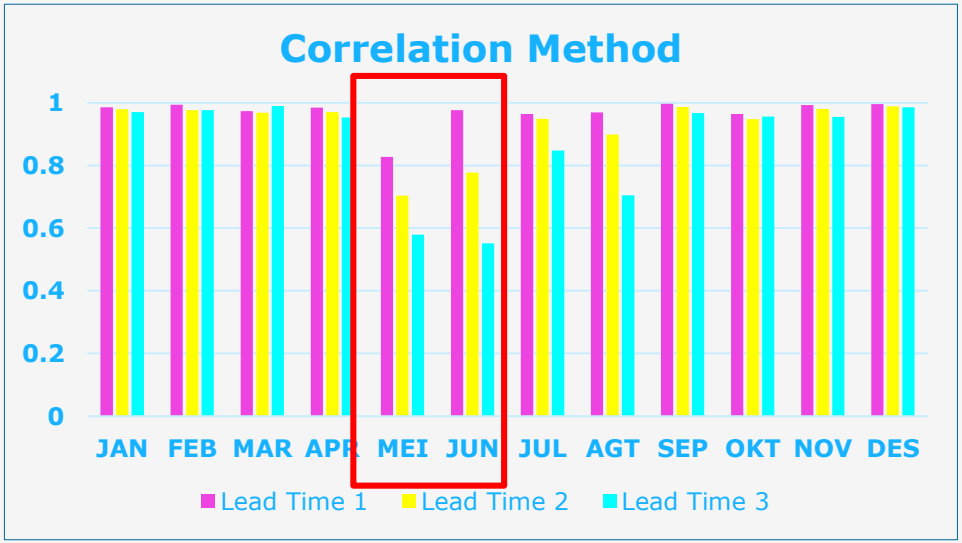
Tasks:

- To summarize present results as a short report.
- Evaluation of other forecast materials such as JAMSTEC forecast (if data available).
- To develop and/or evaluate forecast methods for other boundary conditions such as IOD (when we have enough time and data available).

Key Activity 2: agricultural information
<Improve ENSO monitoring/forecast>

<B> PERFORMANCE OF ENSO PREDICTIONS METHOD ISSUED BY JMA

- Verification of Nino 3.4 using ***Person Correlation*** method
- Model ***is generally strongly correlated*** with observation
- Model is ***weakly correlated*** during ***Mei*** and ***June***



Lead Time	JAN	FEB	MAR	APR	MEI	JUN	JUL	AGT	SEP	OKT	NOV	DES
Lead Time 1	0.986	0.994	0.973	0.984	0.827	0.976	0.964	0.969	0.997	0.964	0.993	0.996
Lead Time 2	0.979	0.976	0.968	0.97	0.704	0.777	0.949	0.899	0.987	0.948	0.98	0.989
Lead Time 3	0.97	0.976	0.99	0.953	0.579	0.551	0.848	0.705	0.967	0.956	0.955	0.985

Key Activity 2: agricultural information
<Improve ENSO monitoring/forecast>

Work schedule (draft)

- Web meeting :
  - On Tuesday 10:00 for 1 hour in **every two weeks** until July 28.
    (June 30, July 14, July 28)
- Preparing the reports for the present studies by the end of July
- Some additional studies and preparing reports by the end of August
- A draft of 'completion report' by the end of August 2020.

Note:
Some of studies planed but not done would be included in the study topics of the next project.

2020/7/14

10:00～11:00（Jakarta local time)

Comments on the case study on monsoon variability

Features of rainfall fluctuations associated with WS onset variability, WS total rainfall variability, and WS length at ZOM152

Koichi Kurihara JICA expert

Introduction

Data and method:

- Monthly(10day) rainfall data for the period from 1981 to 2019 at ZOM152.
- Selection of significantly (1) early/late WS onset, (2) WS small/large rainfall amount, and (3) WS short/long period.

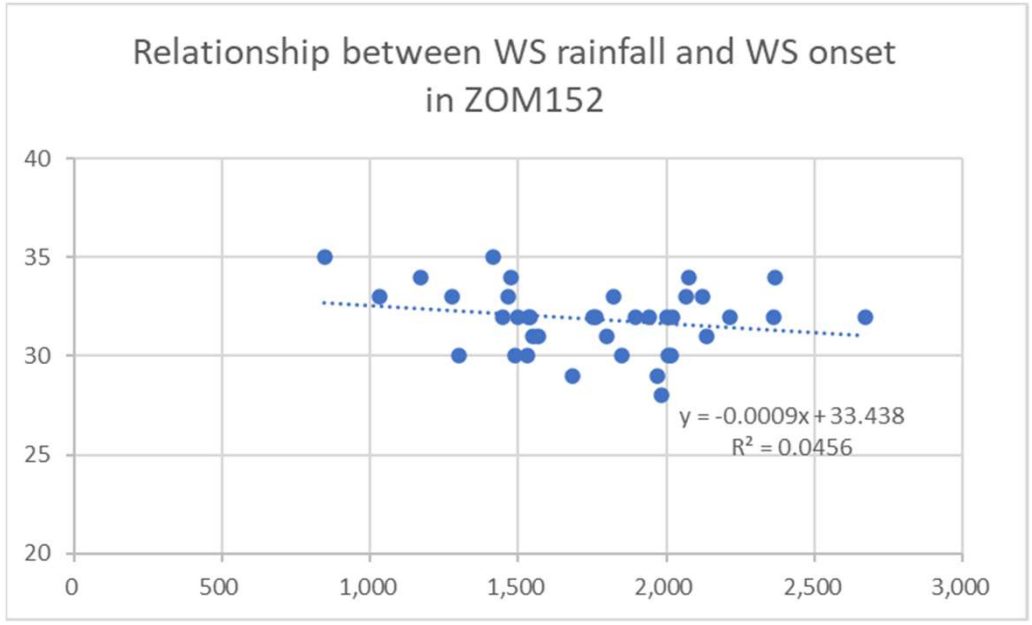
Analysis:

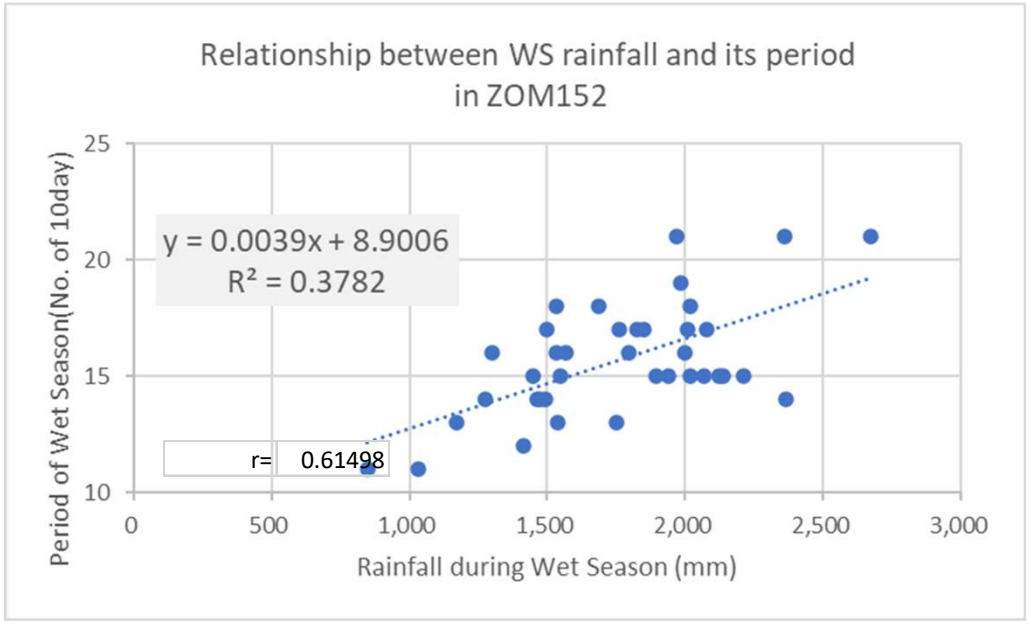
- Features of rainfall variability are studied based on composite analysis using above-mentioned data.
- Rainfall variability and ENSO is also studied.

Results

0. Relation between WS rainfall and WS onset time/WS length
1. Features of monthly(10day) rainfall variations in WS early onset and late onset
2. Features of monthly(10day) rainfall variations in WS small rainfall and WS large rainfall
3. Features of 10day rainfall variations in the short WS and the long WS
4. Relation between WS monsoon rainfall and ENSO

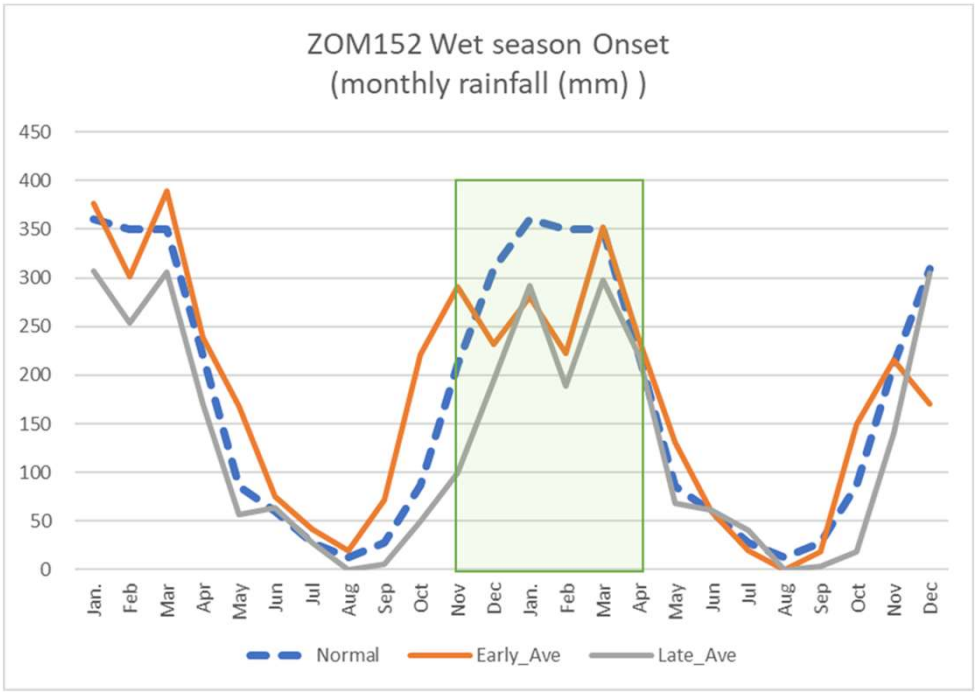
0. Relation between WS rainfall and WS onset time(left)/WS period(right)

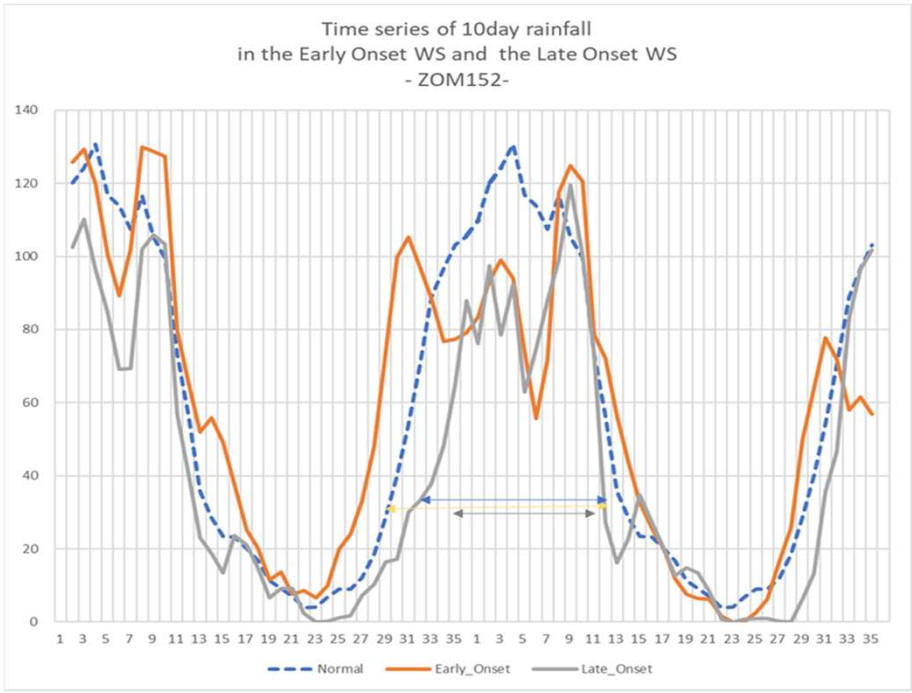




- No significant relation between WS total rainfall and WS onset variability(Left figure)
- Statistically significant correlation between WS total rainfall and WS length(Right figure, 95% level)

1. Features of monthly/10day rainfall variations in WS early onset and WS late onset

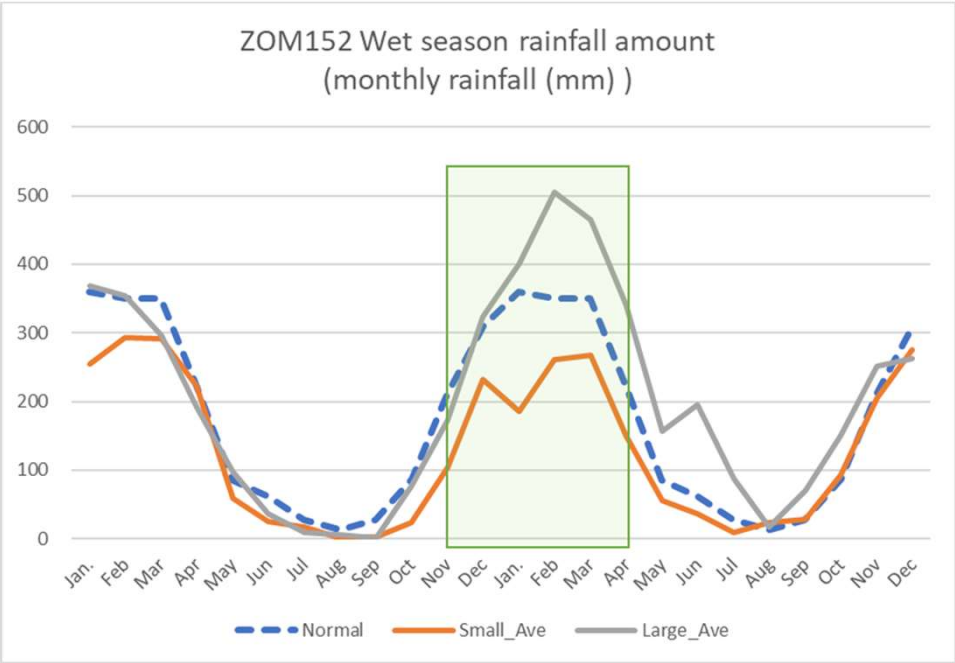


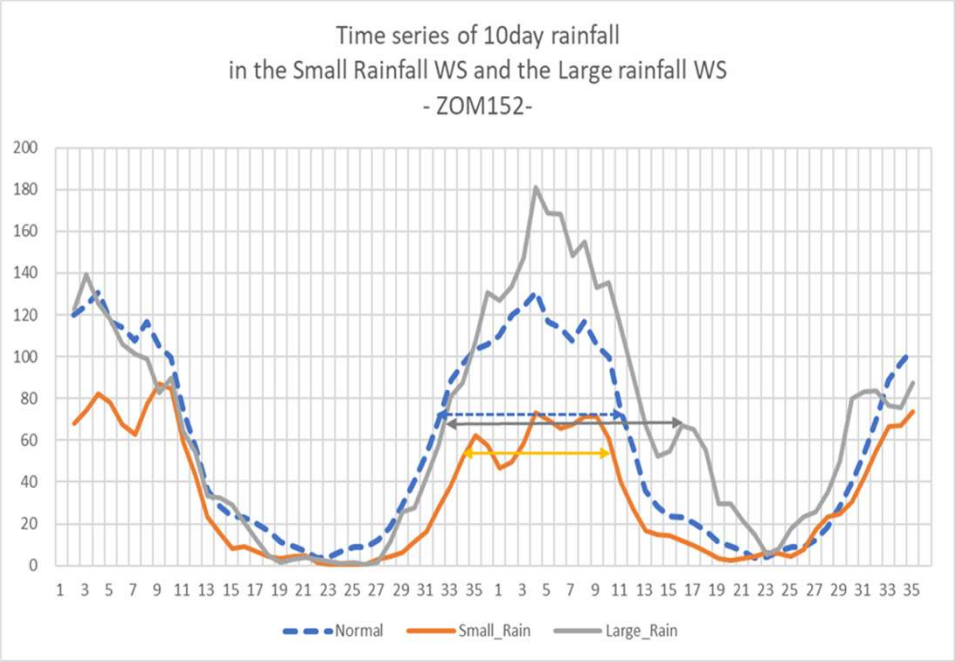


	onset		retreat(next yr)		WS period	Rainfall(mm)
Normal	32	NovII	12	AprIII	15	1,837
Early	29	OctII	12	AprIII	19	1,878
Late	35	DecII	11	AprII	12	1,131

- In early onset years rainfall tends to be above normal from Sep. to Nov. and followed by below normal rainfall until around March next year.
- In late onset years rainfall tends to below normal from Sep. to March next year.

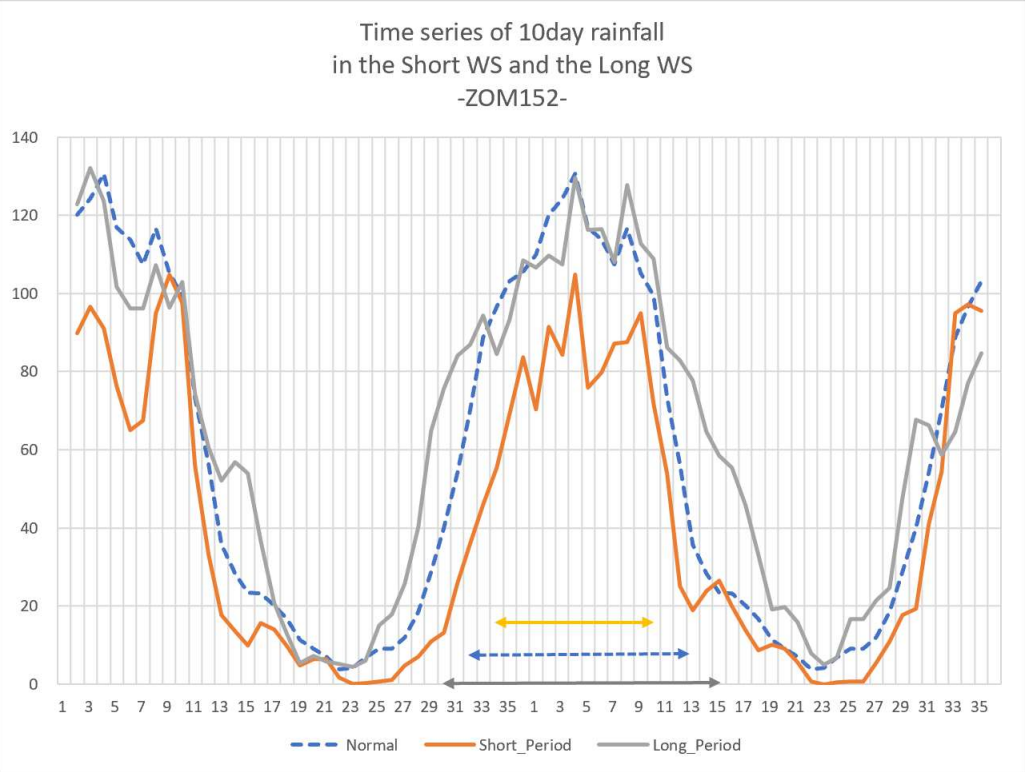
2. Features of monthly(10day) rainfall variations in WS small rainfall and WS large rainfall





- In years when WS rainfall is significantly above normal rainfall is almost normal for the period from WS onset to the middle of the season. Then rainfall tends to be above normal around July next year.
- In years when WS rainfall is significantly below normal rainfall tends to be blow normal from around Oct. to June next year.

3. Features of 10day rainfall variations in the short WS and the long WS

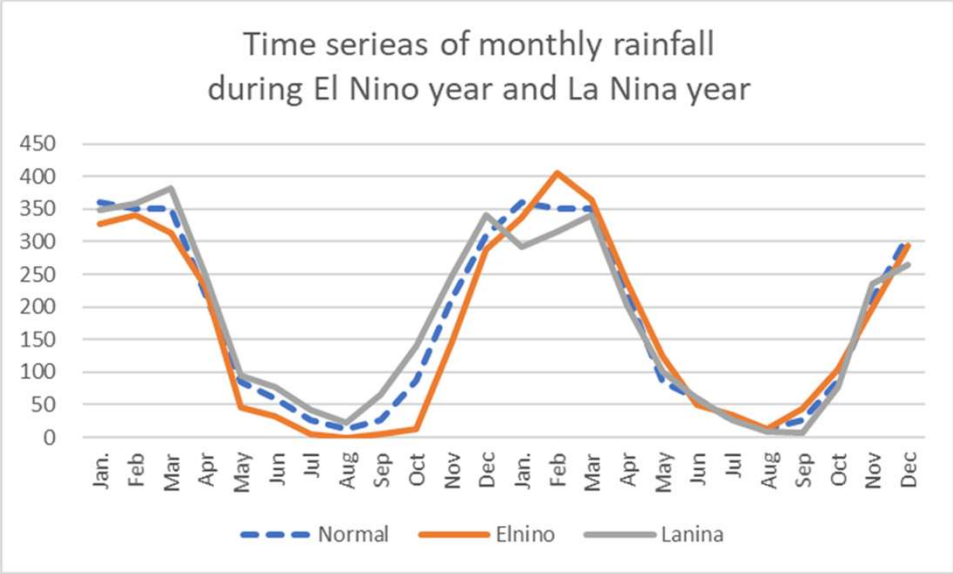


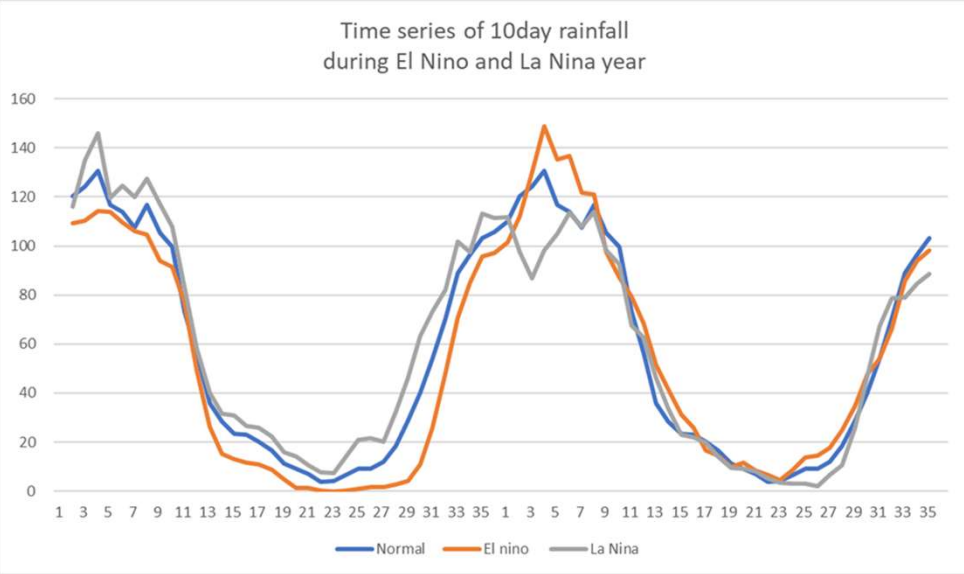
- When WS is significantly shorter than formal, rainfall tends to be below normal from Aug. to Apr. next year.
- When WS is significantly longer than normal, rainfall tends to be above normal from Sep. to Nov. and then it tends to be near normal until around March. It tends to be above normal from April to around July.

Onset/retreat time, WS period, and WS rainfall in the Short and the Long WS

WS rainfall	onset		retreat(next yr)		WS period	Rainfall(mm)
Normal	32	NovII	12	AprIII	15	1,837
Short WS	34	DecI	10	AprI	11	1,098
Long WS	30	OctIII	15	MayIII	21	2,246

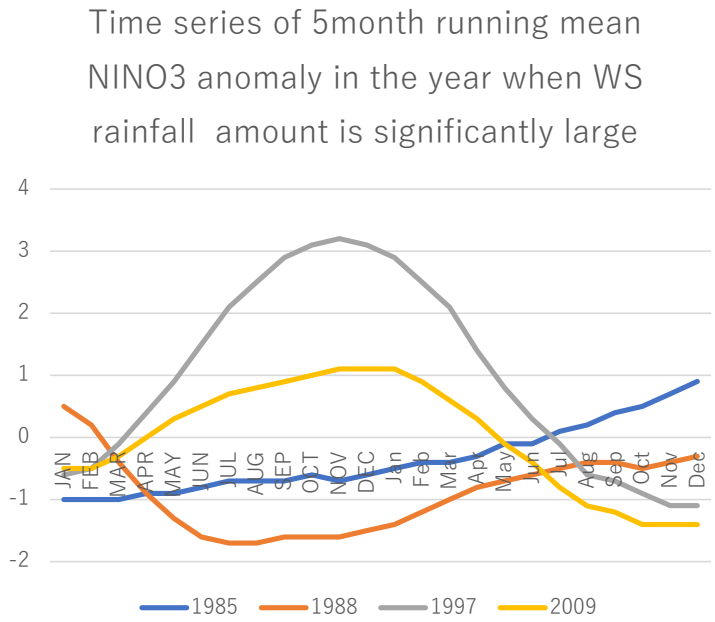
4. 1 Features of monthly(10day) rainfall variations in El Nino and La Nina years

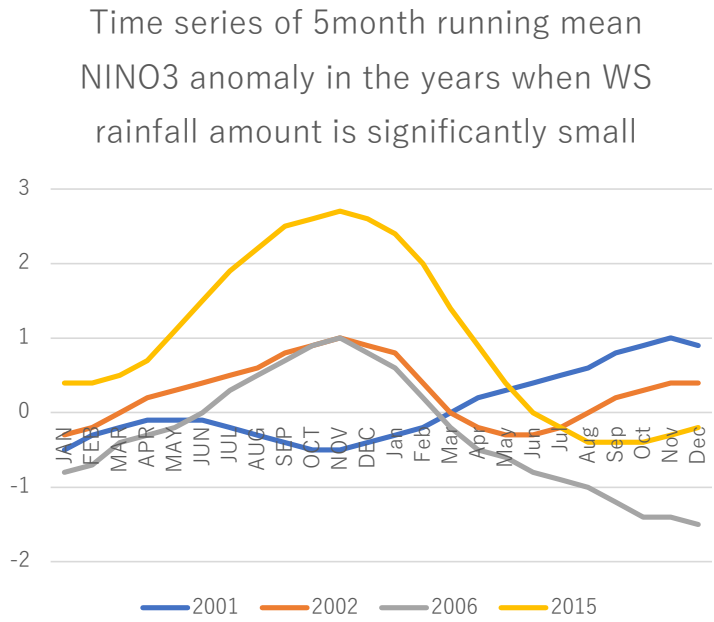




- Influence of ENSO on rainfall seems to appear around May to Dec. but is not evident during latter half of WS period.
- In El Nino years rainfall tends to be below normal from around May to Dec. . On the other hand in La Nina years it tends to be above normal during the period.
- In latter half of the WS period rainfall tends to be near normal in El Nino as well as in La Nina years.

4.2 Relationship between WS rainfall and ENSO





- The impacts of ENSO on WS rainfall amount: how do we understand these facts?
  - In the years when WS rainfall is significantly large 2years(1997, 2009) are El Nino onset years and one(1988) La Nina year.
  - In the years when WS rainfall is significantly small 3years(2002, 2006, 2015) are El Nino onset years.
  - Thus further studies are needed to understand the influence of ENSO on monsoon rainfall variability.

5. For further study

- Atmospheric futures associated with monsoon variability.
- Influence of SSTs(ENSO, IOD, and local SSTs) to monsoon rainfall variability including monsoon onset, length, and rainfall amount variability.
- Study of other regions.

-Evaluation on Normal Season Onset-

Presented by:
Dr. Koichi Kurihara
Rosi Hanif Damayanti, S.Tr

NATIONAL MEETING ON THE
2020/2021 RAINY SEASON FORECAST

Wednesday
August 5, 2020

INTRODUCTION
MAJOR CLIMATE DRIVERS IN INDONESIA

Introduction

- JICA Project
- Climate of Indonesia
- Case Study Sites' Profile

Evaluation on Season Onset in ZOM 152 and 299

- Data and Method
- Analysis
- Summary

Evaluation on Season Onset in Indonesia

- Data and Method
- Analysis
- Summary

INTRODUCTION
JICA-BMKG PROJECT

Project of Capacity Development
for the Implementation of Agricultural Insurance
in the Republic of Indonesia

Pilot Project takes place in → East Java & South Sulawesi

Consist of →

Key Activities

1. Provide/prepare reliable meteorological data for agricultural insurance.
2. Develop weather information and strengthen abilities for producing products for agriculture.
3. Enhance analysis abilities of risk analysis for climate change data-set.

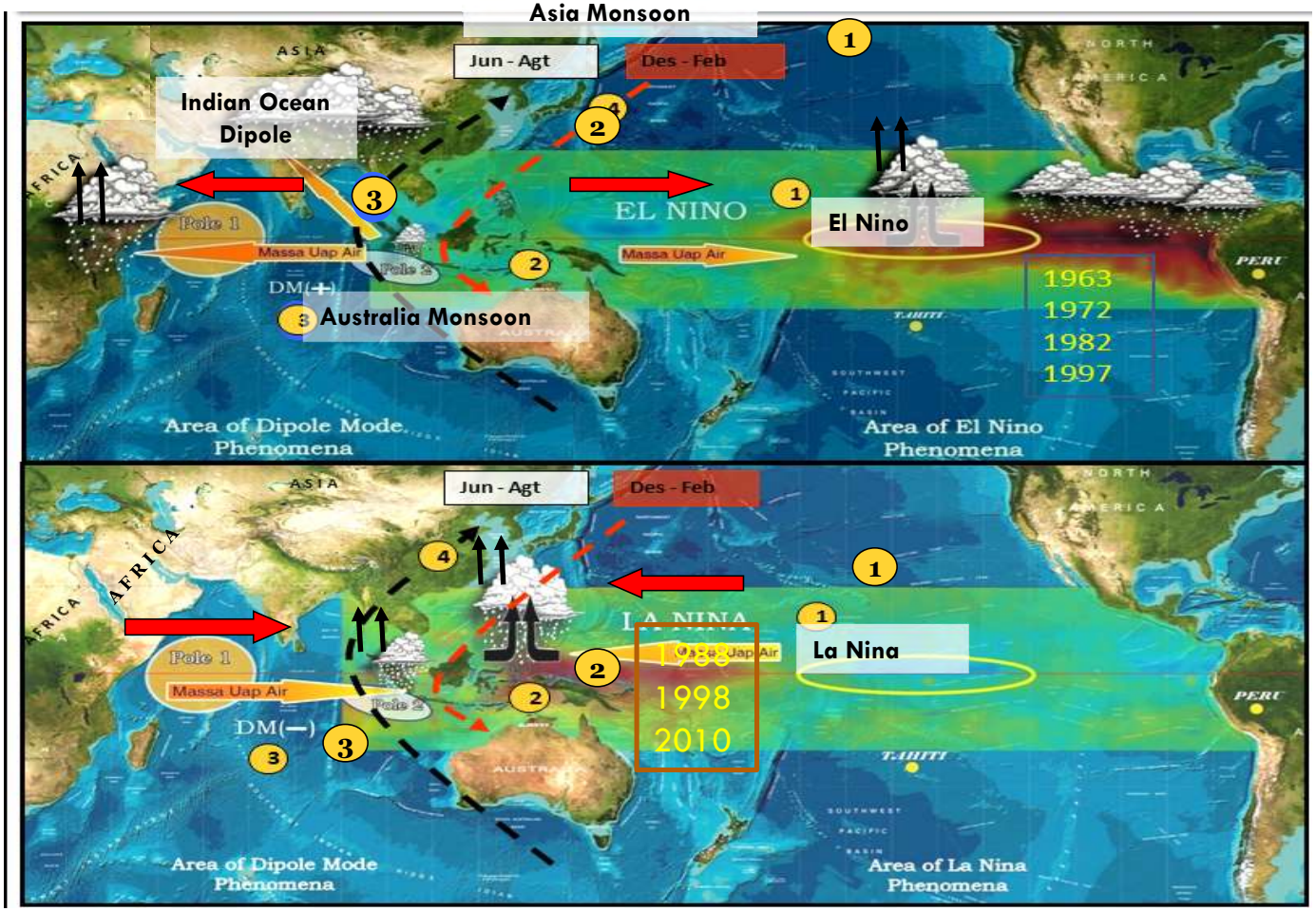
Key Activity 2

JICA : Koichi Kurihara
BMKG : Division for Climate Variability Analysis
- Adi Ripaldi, Damiana, Novi, Rosi
- Supari, Amsari, Ridha

Doing several topics of research activities/technical development related to the project and operational

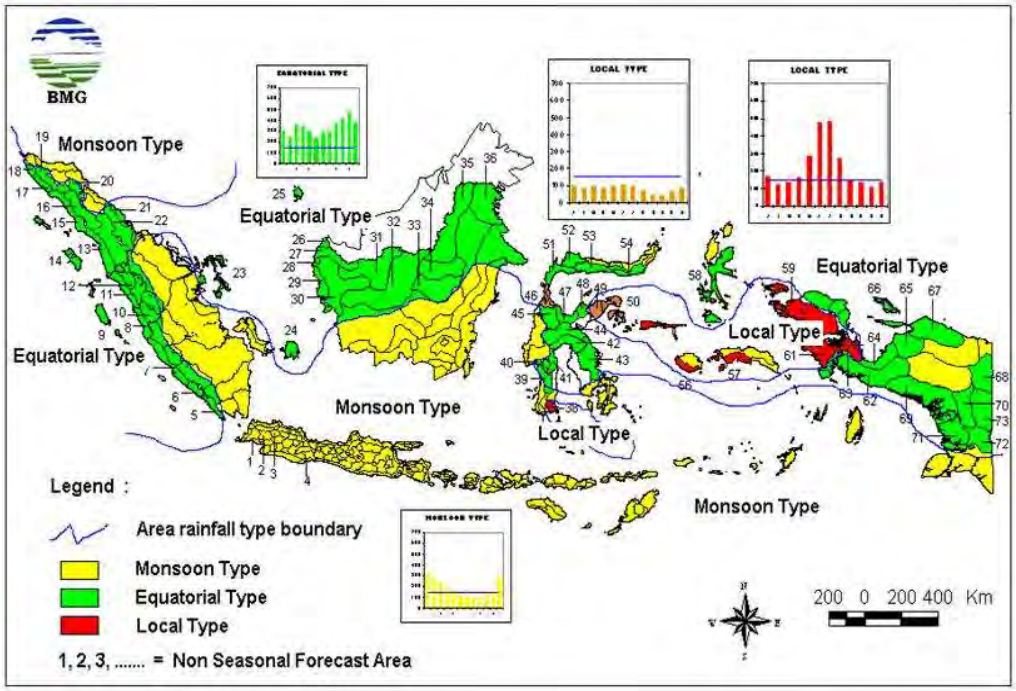
INTRODUCTION

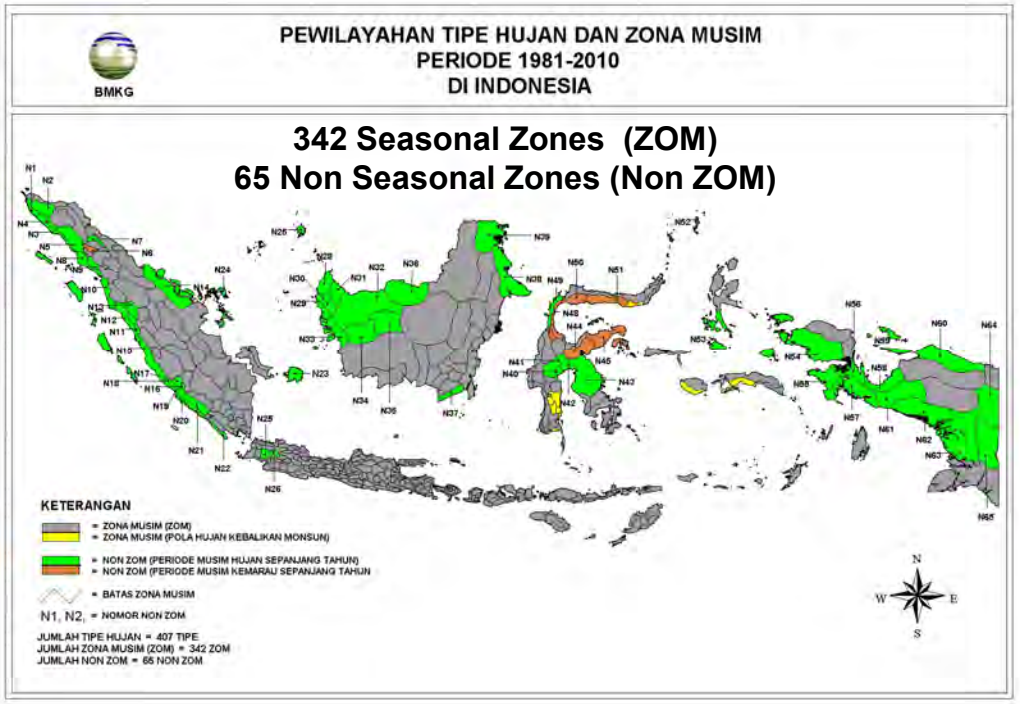
MAJOR CLIMATE DRIVERS IN INDONESIA



INTRODUCTION

RAINFALL TYPES IN INDONESIA





Three Major Rainfall Type in Indonesia

❖**Monsoonal :**

Dry : Apr – Sep

Wet : Oct – Mar

❖**Equatorial**

Dry: Jan-Feb/Jun-Jul

Wet: Mar-May/Aug-Dec

❖**Local/Anti-Monsoon**

Dry : Sep – Apr

Wet : May - Aug

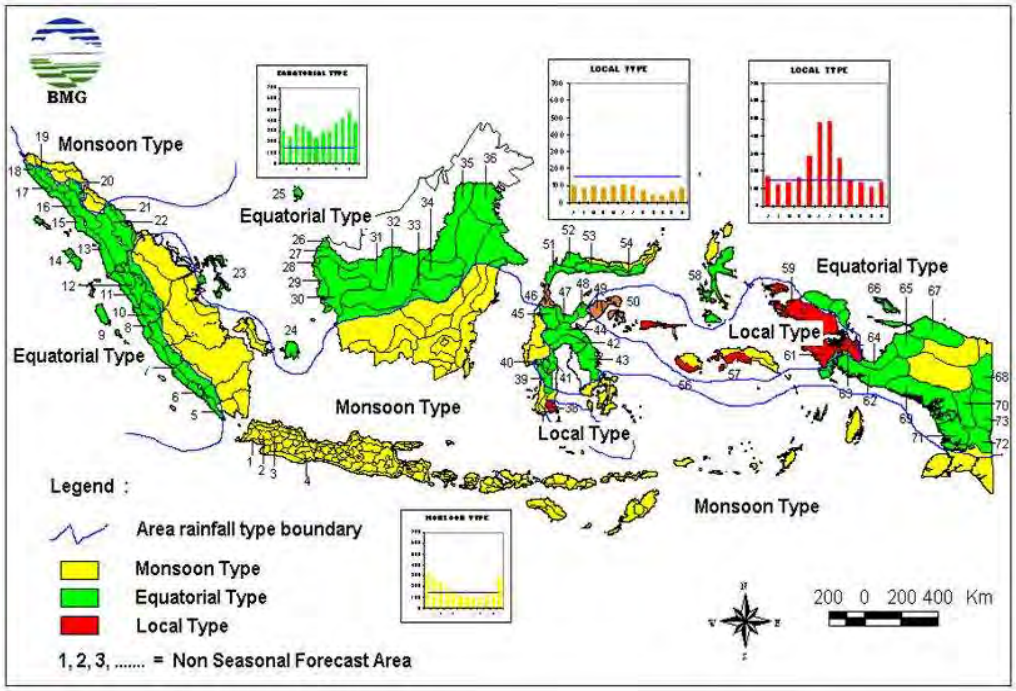
Clustered more specifically into :

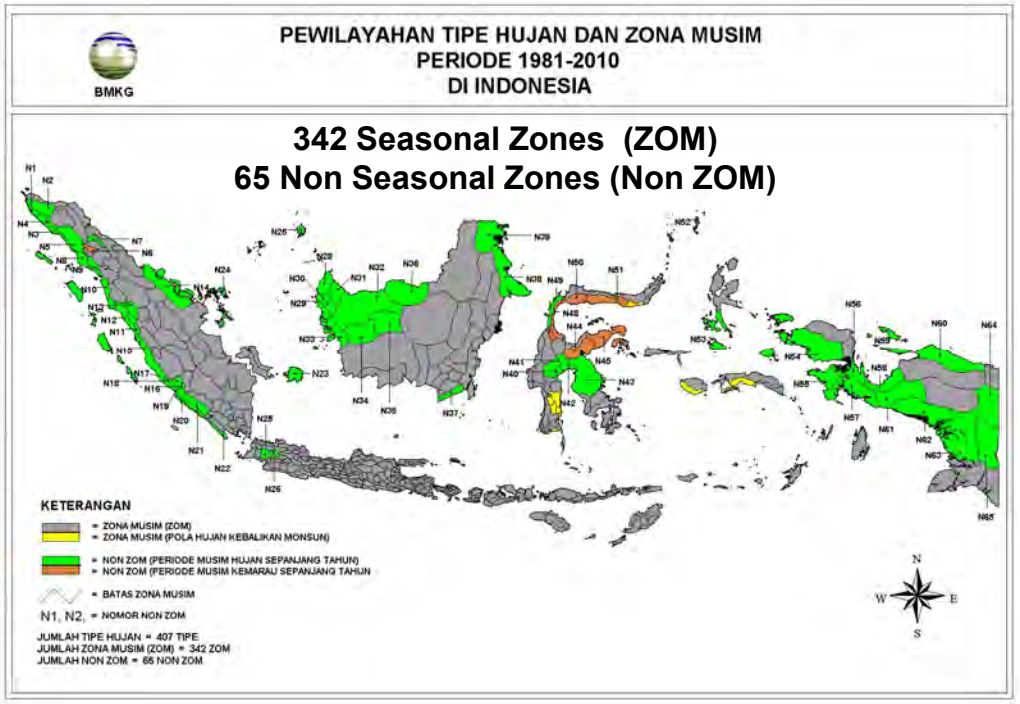
342 Seasonal Zones (ZOM)

65 Non Seasonal Zones (Non ZOM

INTRODUCTION

RAINFALL TYPES IN INDONESIA





Three Major Rainfall Type in Indonesia

❖**Monsoonal :**

Dry : Apr – Sep

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❖**Local/Anti-Monsoon**

Dry : Sep – Apr

Wet : May - Aug

Clustered more specifically into :

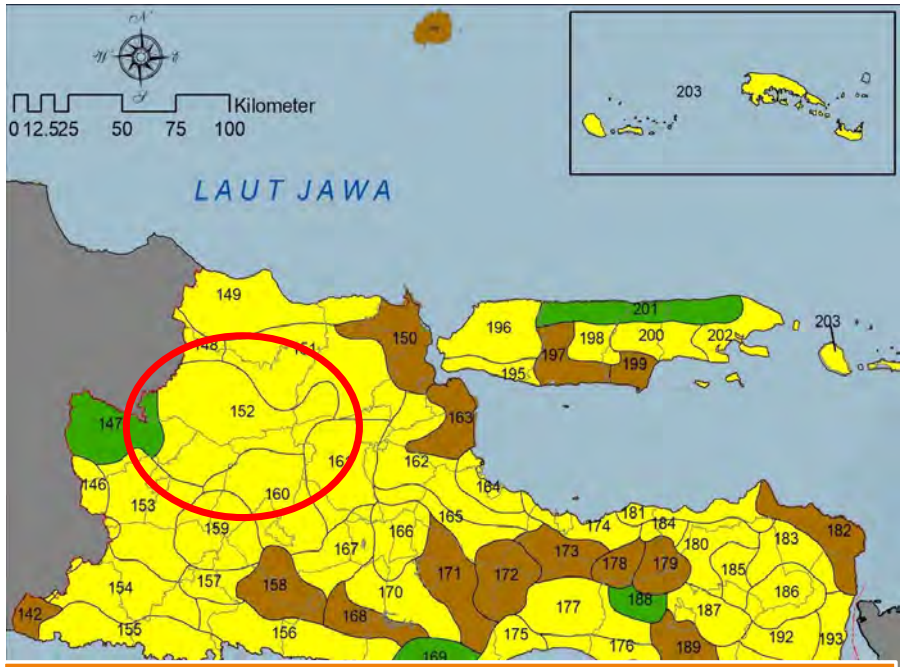
342 Seasonal Zones (ZOM)

65 Non Seasonal Zones (Non ZOM

INTRODUCTION

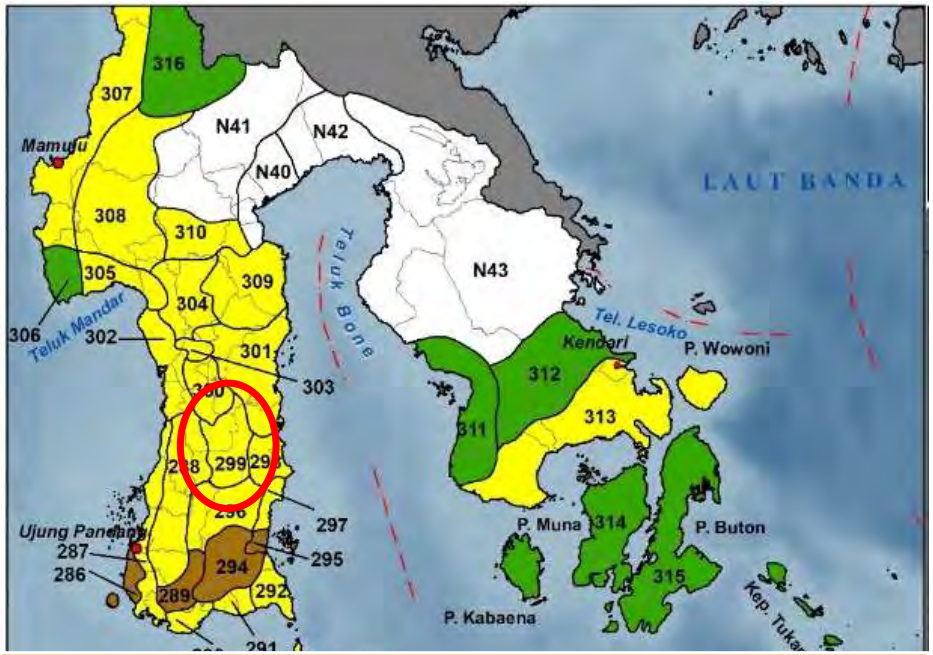
SITES' PROFILE

ZONE 152



- Located in south of Bojonegoro
- Consist of 4 main rainfall observation that have complete data since 1981

ZONE 299

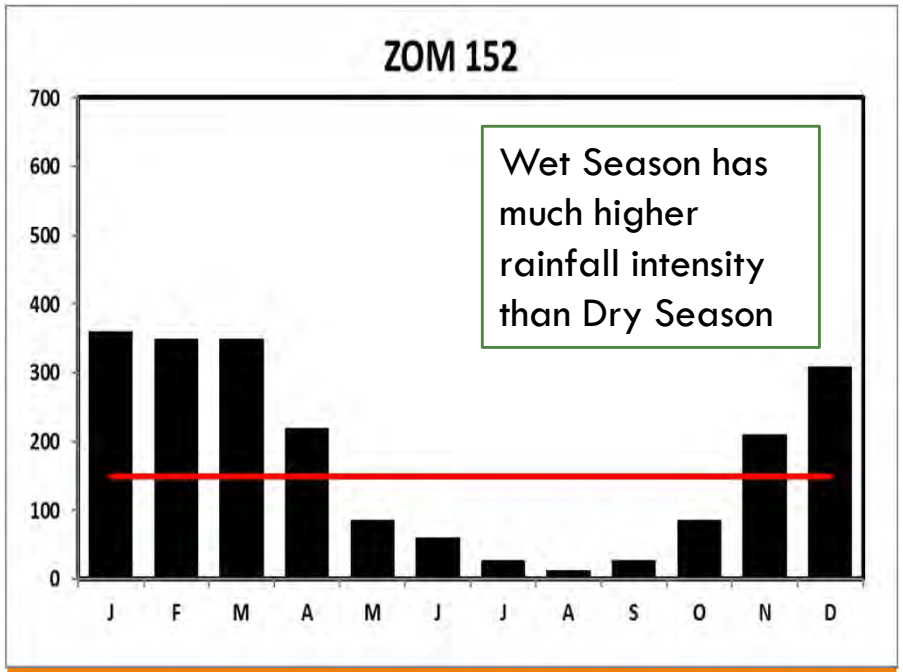


- Located in southern Soppeng, Central Bone
- Consist of 6 main rainfall observations, 2 of them have complete data since 1981.

INTRODUCTION

SITES' PROFILE

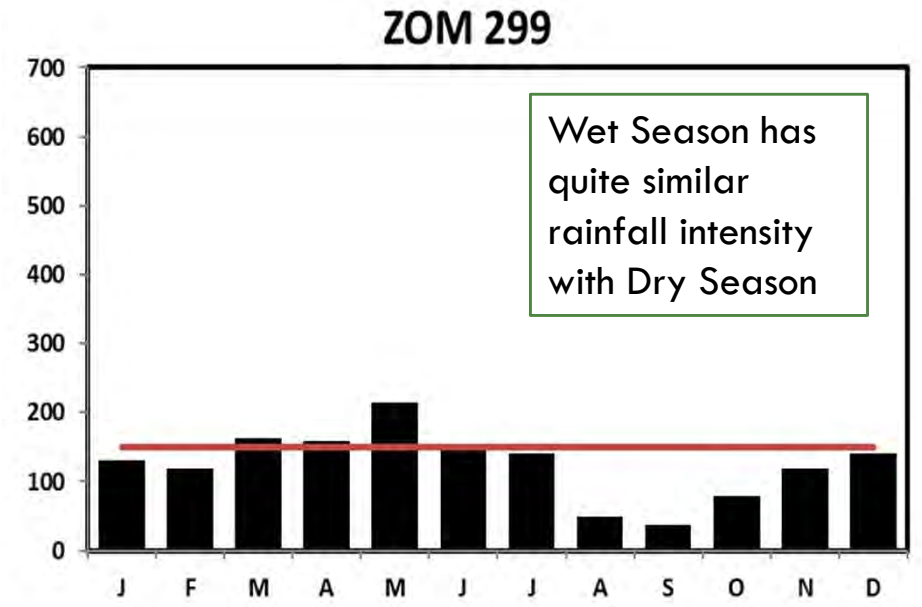
ZONE 152



Normal Rainfall 1981-2010

Monsoonal Type

ZONE 299



Normal Rainfall 1981-2010

Anti-Monsoonal Type

ZONE 152

ZONE 299

Normal Rainfall 1981-2010

Dry Onset

Dry Onset

Annual Rainfall

No.Zom	JAN			FEB			MAR			APR			MEI			JUN			JUL			AGT			SEP			OKT			NOV			DES			JUMLAH
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	
152	115	106	139	128	125	97	119	106	125	85	89	46	34	27	24	19	27	15	8	11	8	2	1	9	10	8	9	19	27	40	53	70	89	108	93	108	2099
299	46	35	50	47	43	28	42	57	64	56	50	53	102	55	57	62	45	38	55	46	39	15	13	22	12	13	12	21	26	32	36	34	48	46	45	50	1495

Wet Onset

Wet Onset

Wet Season

Dry Season

152

Duration between Dry and Wet Season is quite similar

Rainfall intensity in dry season and wet season has large gap.

Cumulative rainfall in Dry Season is lower than in Wet Season

299

- Duration of Dry Season is much longer than Wet Season
- Rainfall intensity in dry and wet season has little gap.
- Cumulative rainfall in Dry Season may be higher due to longer duration and little gap of rainfall intensity than Wet Season

DATA AND METHOD

DATA

Hist Rainfall Data 1981-2019
(rainfall observation data)

METHOD

Mode = The value in the data set that occurs most frequently

$$\sigma = \sqrt{\frac{\sum (x - \text{mean})^2}{n}}$$

x is a set of numbers

mean is the average of the set of numbers

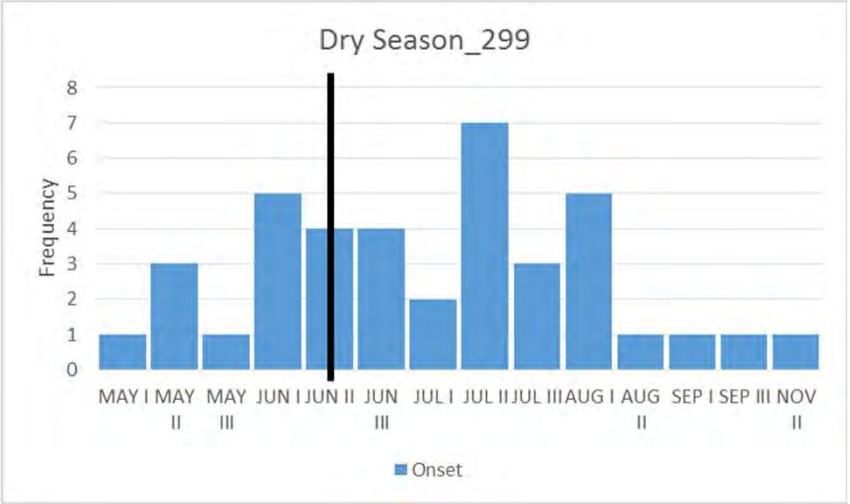
n is the size of the set

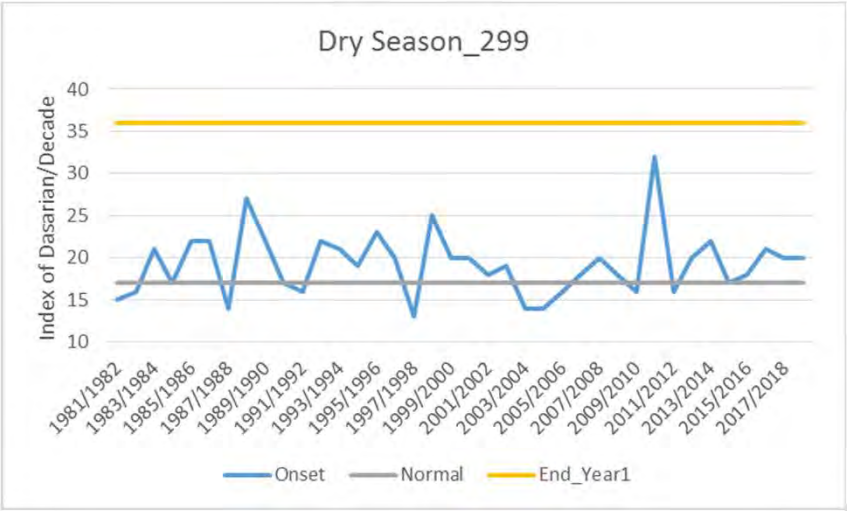
σ is the standard deviation

ANALYSIS
ZOM 299 – SOUTH SULAWESI
DRY SEASON

- Normal: JUN II
- Onset has large variation
- Frequency of onset
  - Mode of Onset (7) is 1 month later than Normal (4) at Jul III
  - Earlier than normal: 10
  - Later than normal: 25
- Early onset : 1997/1998
- Late onset : 1988/1989, 1998/1999, 2010/2011

Dry Season		
Normal (1981-2010)	909	
Standard Deviation	3.77	
No. of Data	39	
Onset (Dasarian)		
MAY I	1	10
MAY II	3	
MAY III	1	
JUN I	5	
JUN II	4	**Normal**
JUN III	4	25
JUL I	2	
JUL II	7	
JUL III	3	
AUG I	5	
AUG II	1	
SEP I	1	
SEP III	1	
NOV II	1	

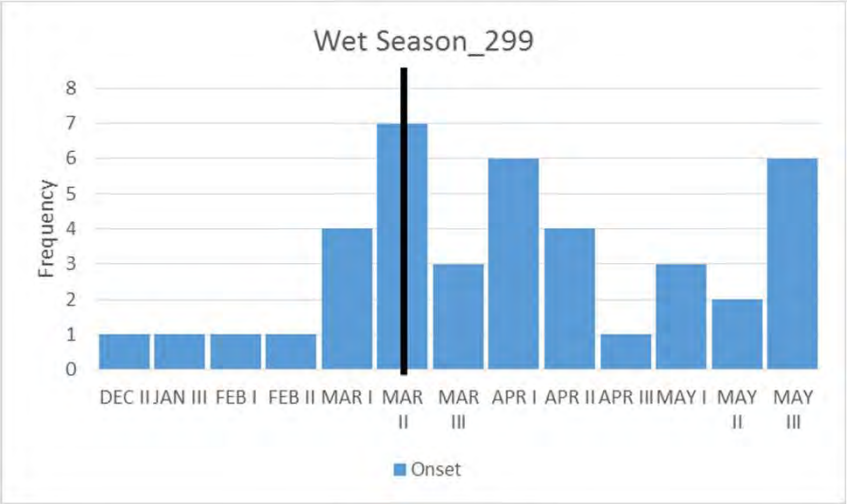


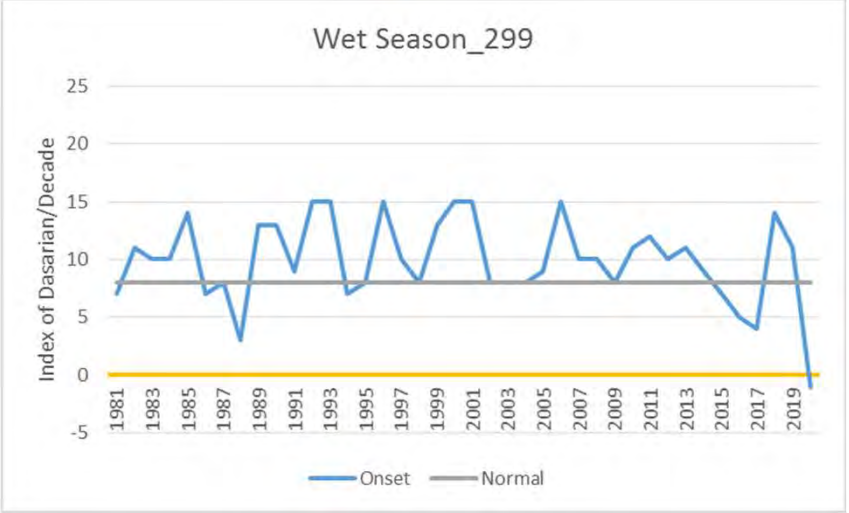


ANALYSIS
ZOM 299 – SOUTH SULAWESI
WET SEASON

- Normal: MAR II
- Onset has large variation
- Frequenncy of onset
  - ➢ Normal is the same as mode of onset : 7
  - ➢ Earlier than normal: 8
  - ➢ Later than normal: 25
- early onset : 1988, 2020
- late onset : 1992, 1993, 1996, 2000, 2001, 2006

Wet Season		
Normal (1981-2010)	719	
Standard Deviation	3.63	
No. of Data	40	
Onset (Dasarian)		
DEC II	1	
JAN III	1	
FEB I	1	8
FEB II	1	
MAR I	4	
MAR II	7	**Normal**
MAR III	3	
APR I	6	
APR II	4	
APR III	1	25
MAY I	3	
MAY II	2	
MAY III	6	

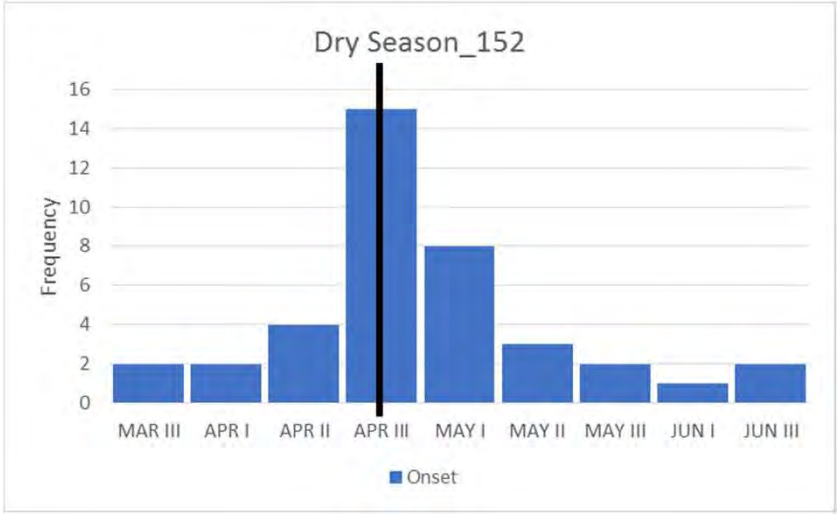


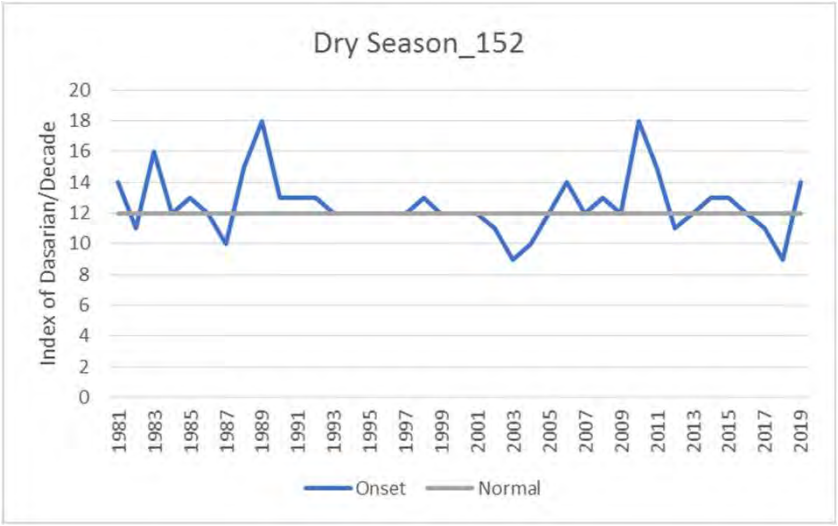


ANALYSIS
ZOM 152 – EAST JAVA
DRY SEASON

- Normal: APR III
- Onset variation is not too large and the mode of onset is same as its normal.
- Frequenncy of onset
  - Normal is the same as mode of onset : 15
  - Earlier than normal: 8
  - Later than normal: 16
- early onset : 2003, 2018
- late onset : 1983, 1989, 2010

Dry Season		
Normal (1981-2010)	263	
Standard Deviation	1.94	
No. of Data	39	
Onset (Dasarian)		
MAR III	2	
APR I	2	8
APR II	4	
APR III	15	**Normal**
MAY I	8	
MAY II	3	
MAY III	2	16
JUN I	1	
JUN III	2	

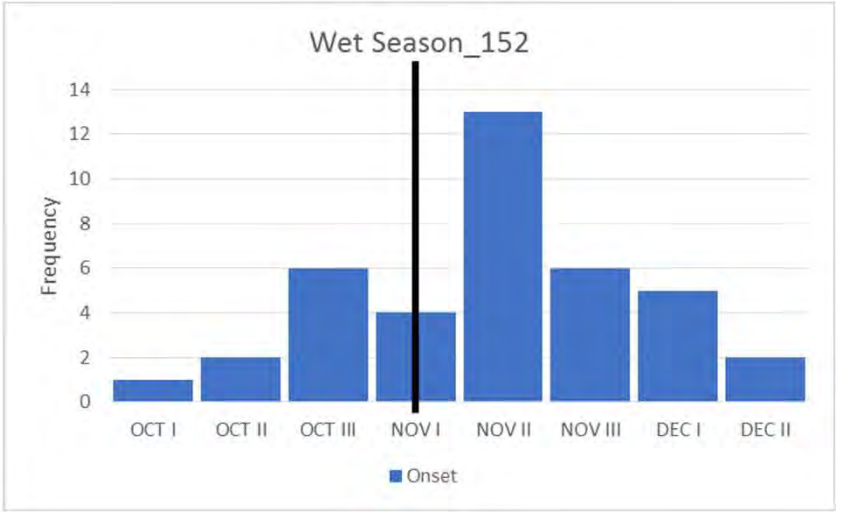


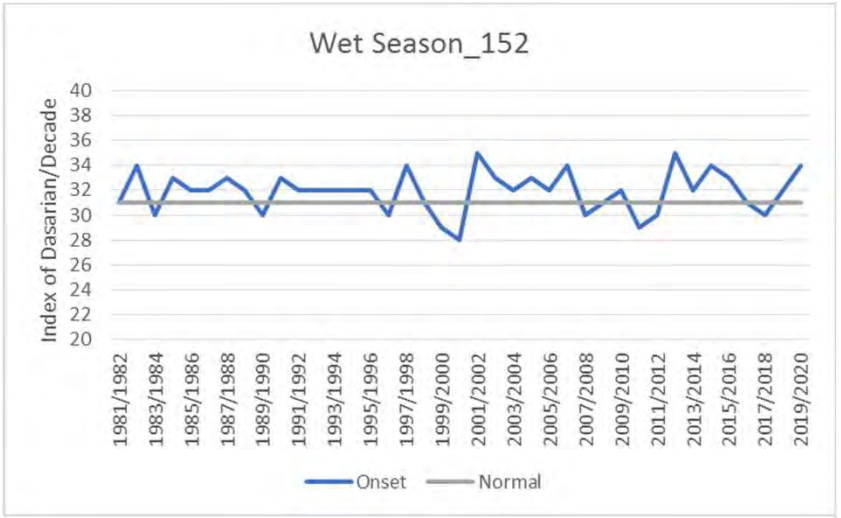


ANALYSIS
ZOM 152 – EAST JAVA
WET SEASON

- Normal: NOV I
- Onset variation is not large but the mode of onset is 1 dasarian later (Nov II) than normal (Nov I)
- Frequenncy of onset
  - ➢ Mode of Onset (13) is 1 dasarian later than Normal (4) at Nov II
  - ➢ Earlier than normal: 9
  - ➢ Later than normal: 26
- early onset : 2000/2001
- late onset : 2001/2002, 2012/2013

Wet Season		
Normal (1981-2010)	1837	
Standard Deviation	1.67	
No. of Data	38	
Onset (Dasarian)		
OCT I	1	9
OCT II	2	
OCT III	6	
NOV I	4	**Normal**
NOV II	13	26
NOV III	6	
DEC I	5	
DEC II	2	





SUMMARY

ZONE 152 (EAST JAVA)

- Onset Variation during 1981-2019 for both dry and wet season is not too large (-/+ around 1 month from its normal)
- Dry Season Onset during 1981-2019 mostly similar to its Normal (Apr III)
- Wet Season Onset 1981-2019 mostly 1 dasarian later (Nov II) than its Normal (Nov I)
- Large gap of the rainfall fluctuation to the threshold makes it easier to determine the onset
- It seems ENSO may be one of the main factors for significant early/late onset and we need to continue studying influence of ENSO as well as other important factors in detail

ZONE 299 (SOUTH SULAWESI)

- Onset Variation during 1981-2019 for both dry and wet season is very large (up to -/+3 month from its normal).
- Mode of Dry Season Onset during 1981-2019 (Jul II) is 1 month later to its Normal (Jun III)
- Mode of Wet Season Onset during 1981-2019 (Jul II) is similar to its Normal (Mar II)
- Small gap of the rainfall fluctuation to the threshold makes it difficult to determine the onset
- It seems ENSO may be one of the main factors for significant early/late onset and we need to continue studying influence of ENSO as well as other important factors in detail

Evaluation on Season Onset in Indonesia

DATA AND METHOD

DATA
Hist Rainfall Data 1981-2019
(Obs+CHIRP)

Representative value can be determined by calculating Mean, Median, and Mode

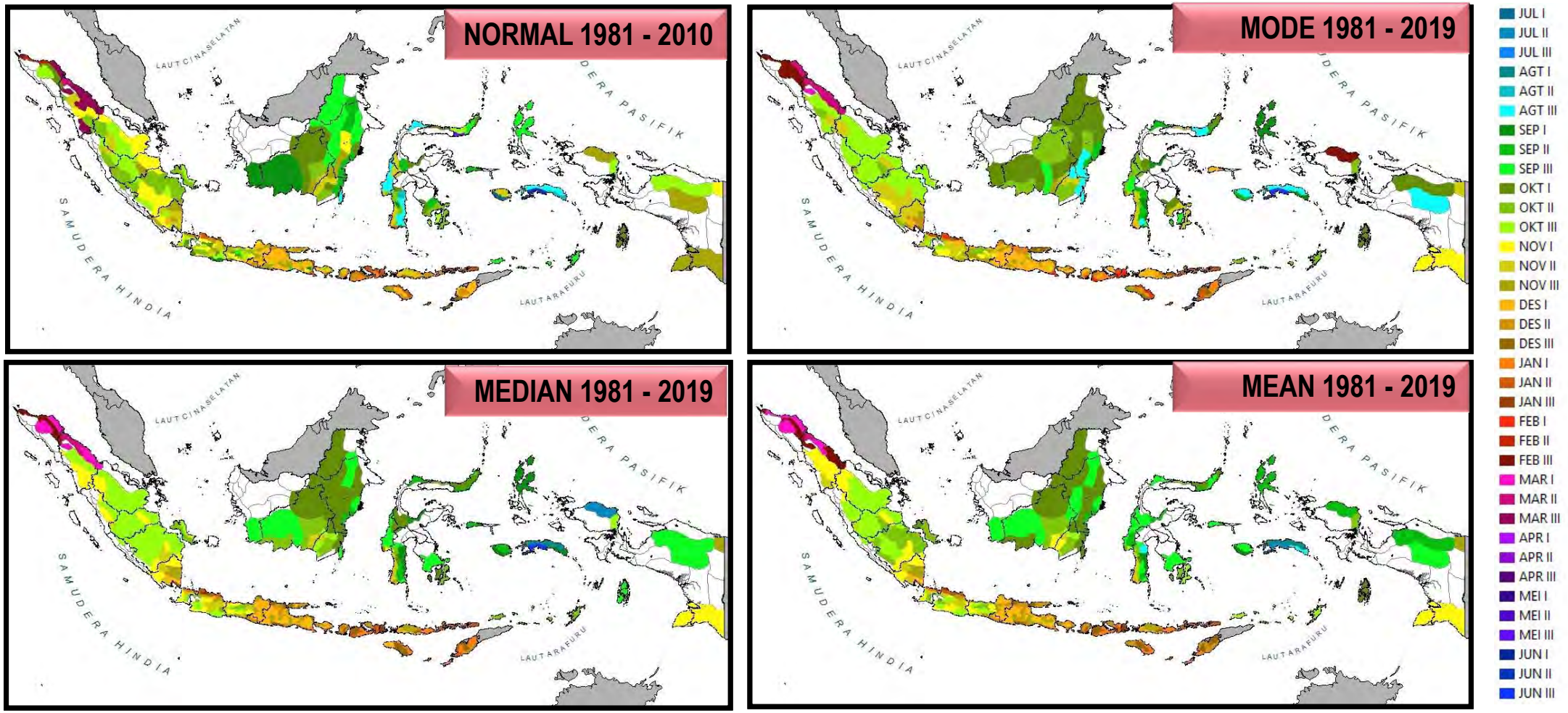
Statistics Formula

$$\text{Mean } \bar{x} = \frac{\sum xi}{N}$$

$$\text{Median} = \begin{cases} \frac{(N+1)^{th}}{2} \text{ term; when N is even} \\ \frac{\frac{N^{th}}{2} \text{ term} + \left(\frac{N}{2}+1\right) \text{term}}{2} \text{ ; when N is even} \end{cases}$$

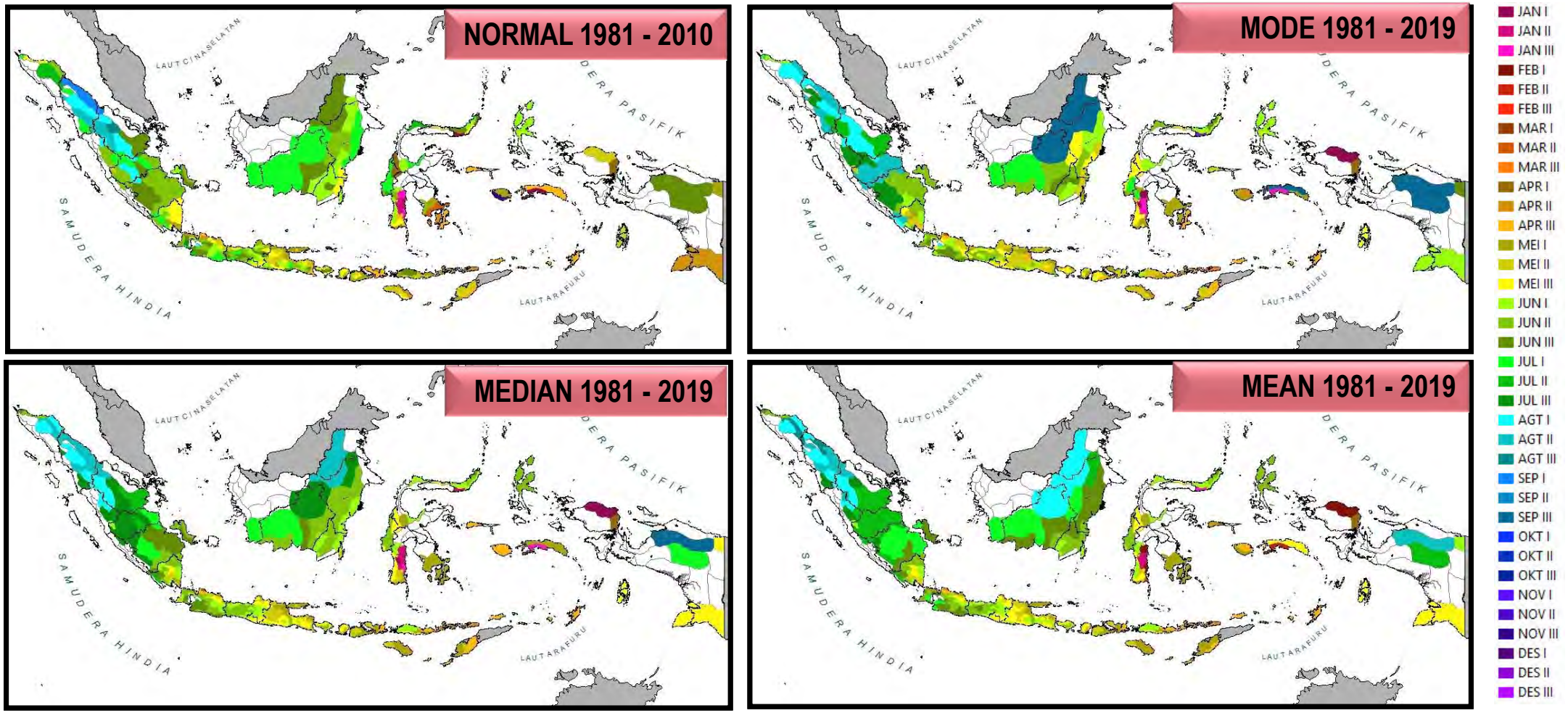
Mode = The value in the data set that occurs most frequently

Wet Season Onset



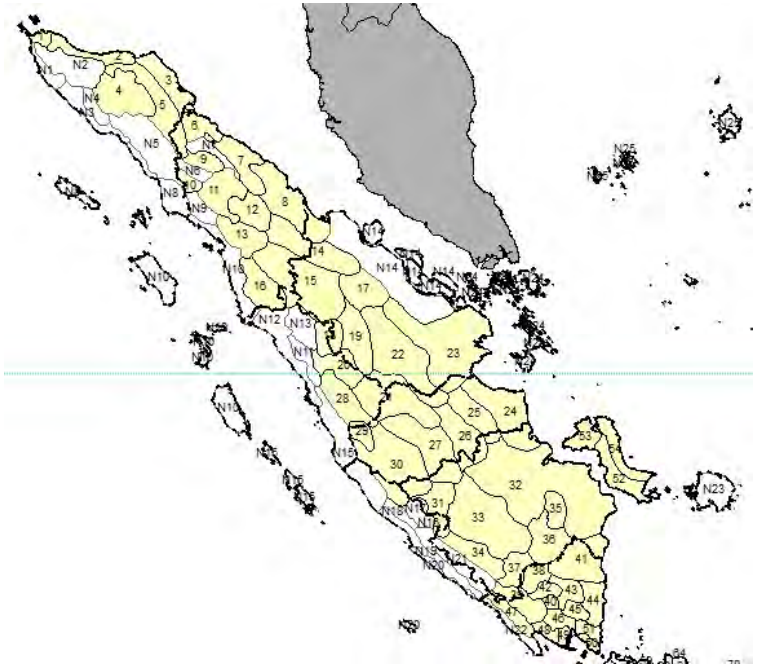
Generally, Mode, Median, and Mean of Dry Season Onset are -/+ 1 dasarian to Normal (1981-2010)

Dry Season Onset

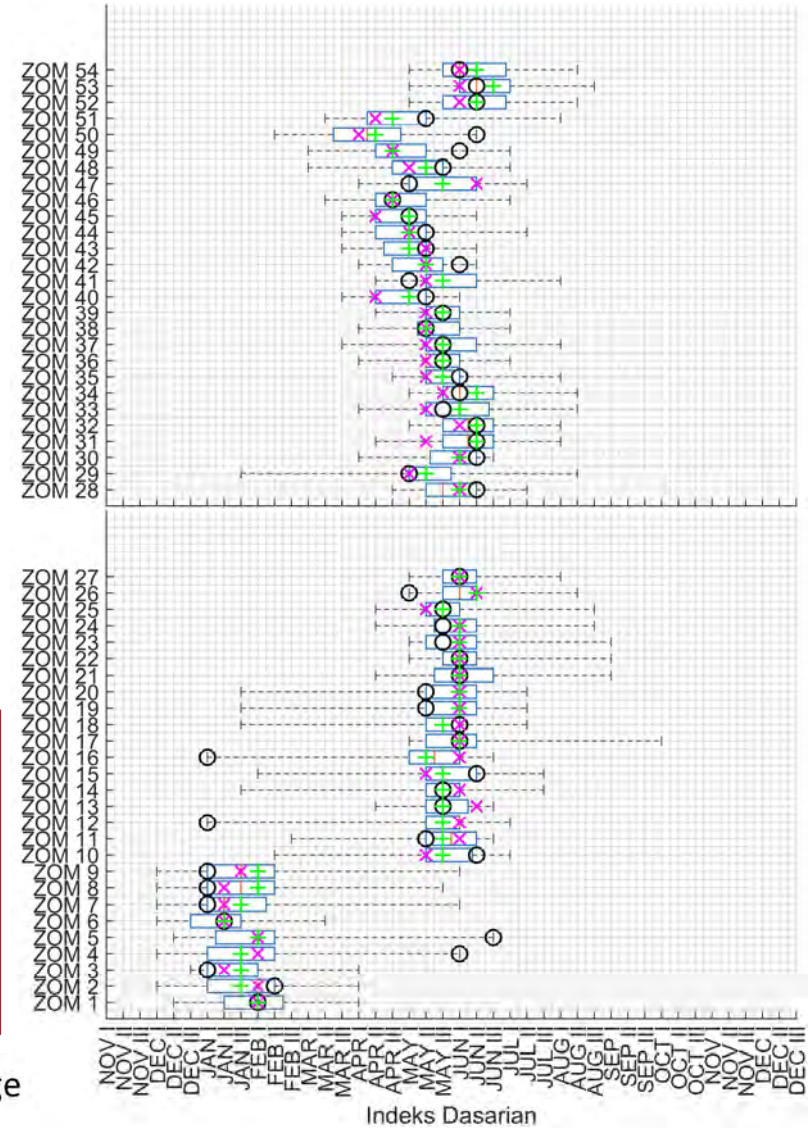


Generally, Mode, Median, and Mean of Dry Season Onset are -/+ 1 dasarian to Normal (1981-2010)

Distribution of Wet Season Onset



SUMATERA

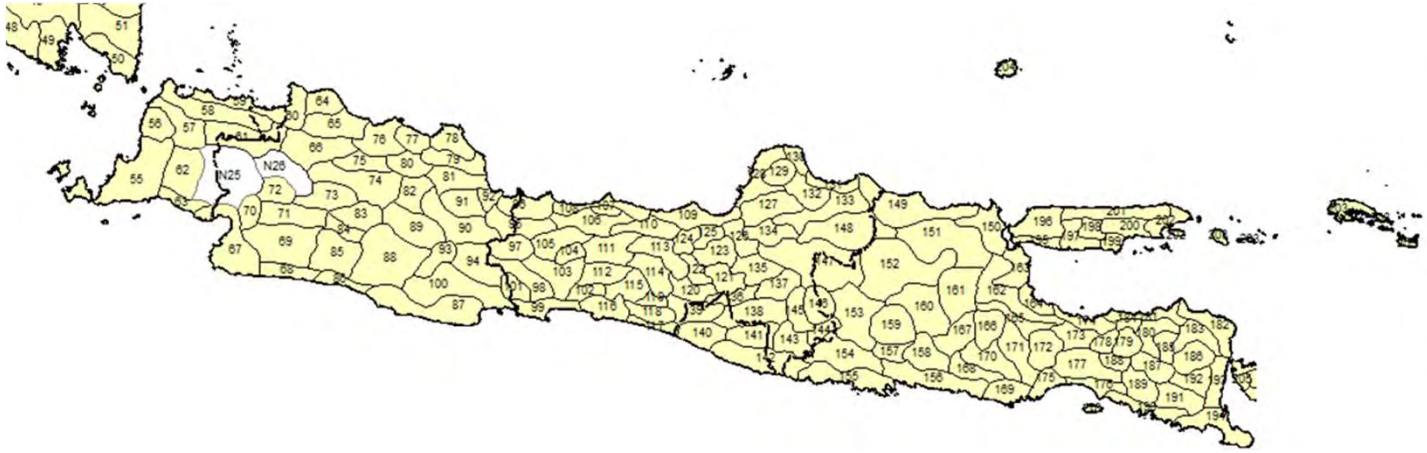


Equatorial → ZOM 6-9, 12, 16
Norm on boxplot is 2nd WS Onset

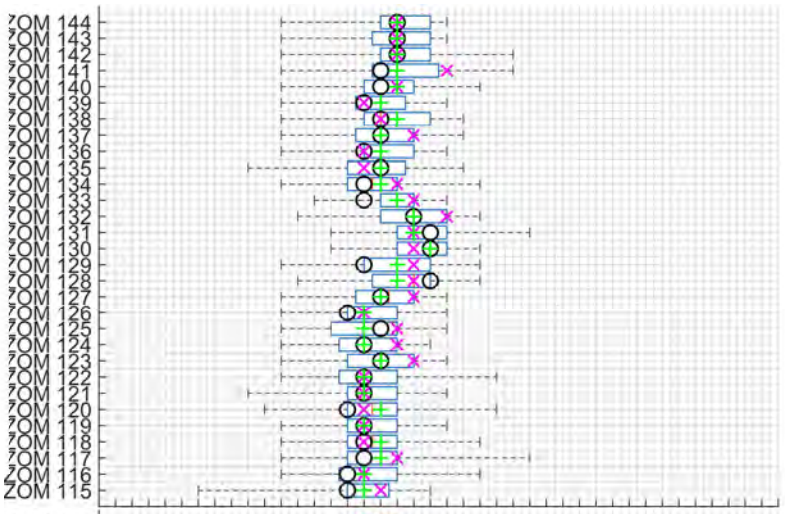
- Some ZOMs have very large distribution of Wet Season Onset, most of them are equatorial type (except ZOM 5)
- ZOM 6 and 8 has largest distribution of WS Onset

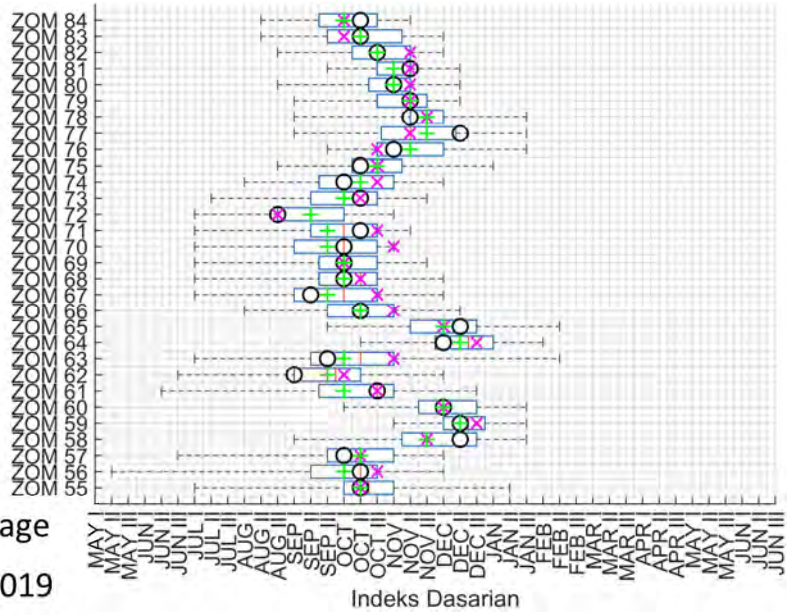
Season Onset during 1981 - 2019 | Normal | Median | X Mode | + Average

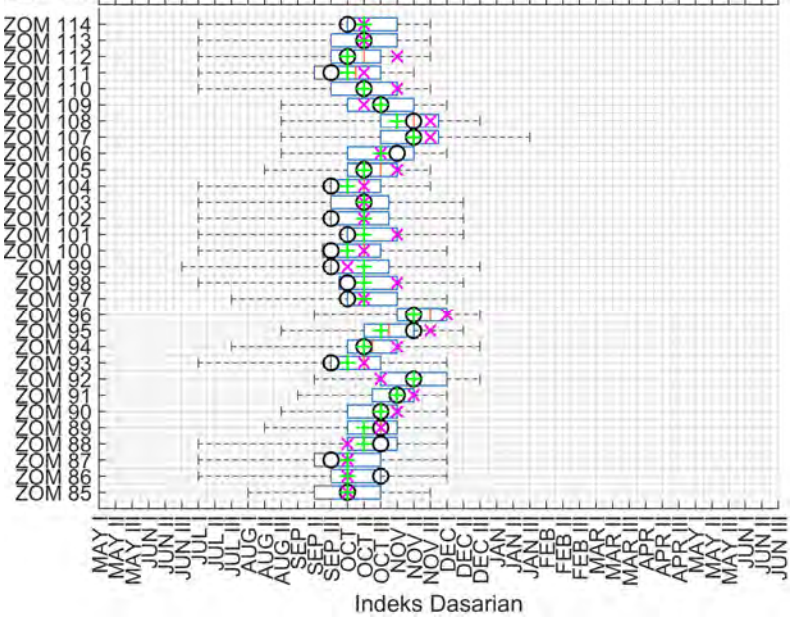
Distribution of Wet Season Onset



JAWA





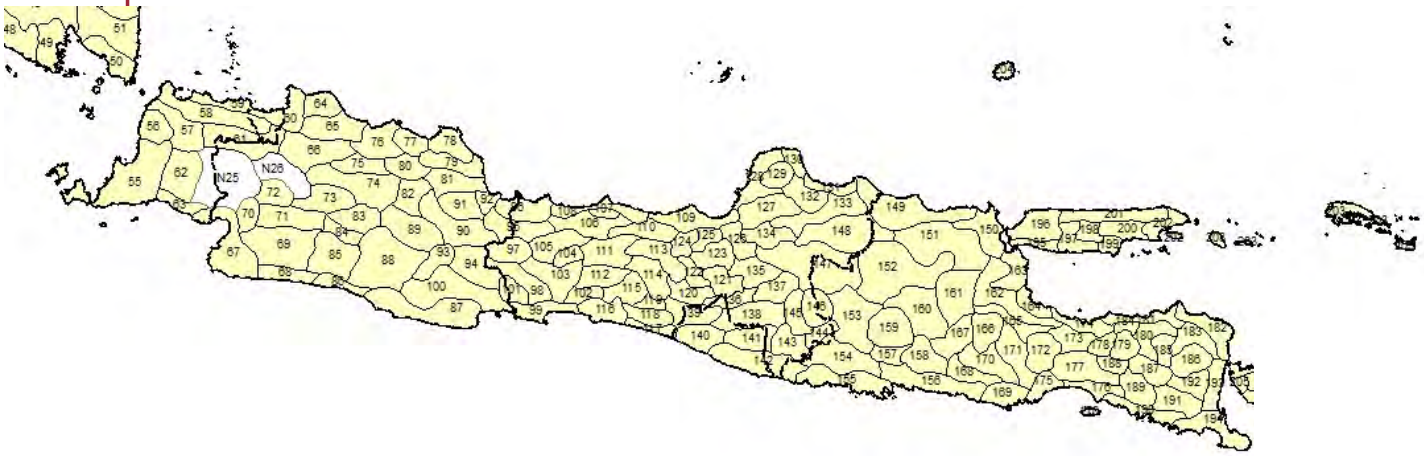


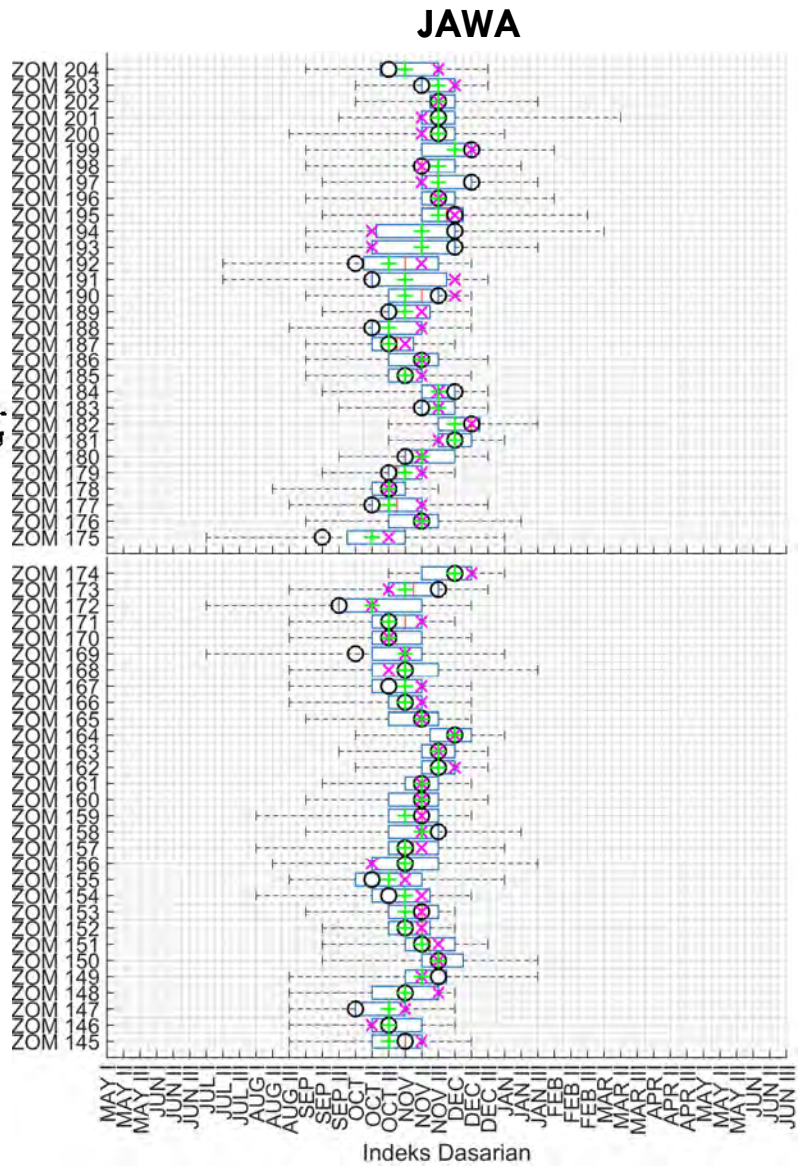
- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.

O Normal | Median X Mode + Average

Season Onset during 1981 - 2019

Distribution Wet Season Onset

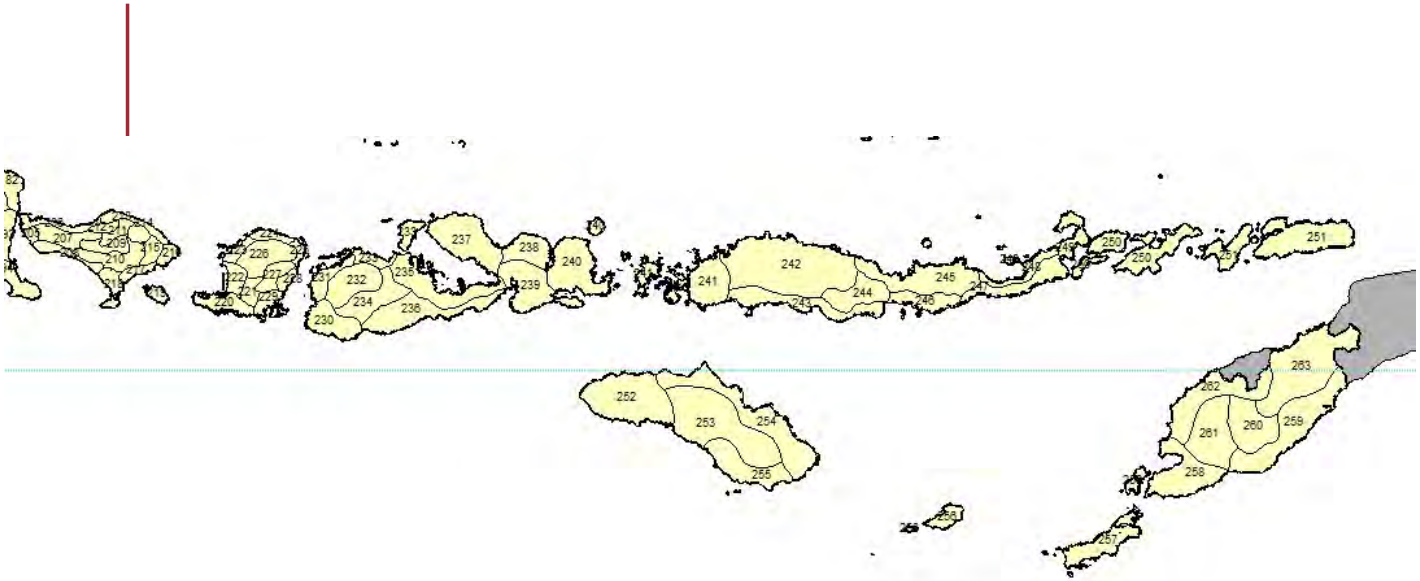




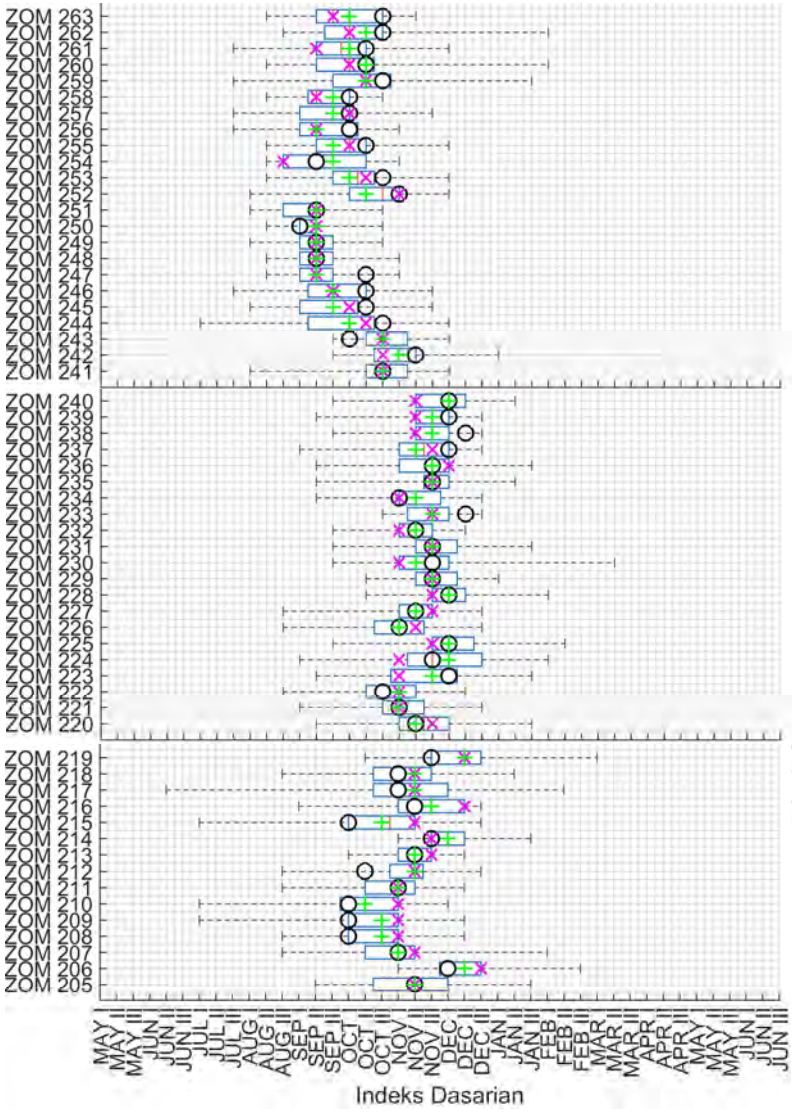
- There are several ZOMs where Normal is not similar with even one of Median, Mode, or mean.

Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

Distribution of Wet Season Onset



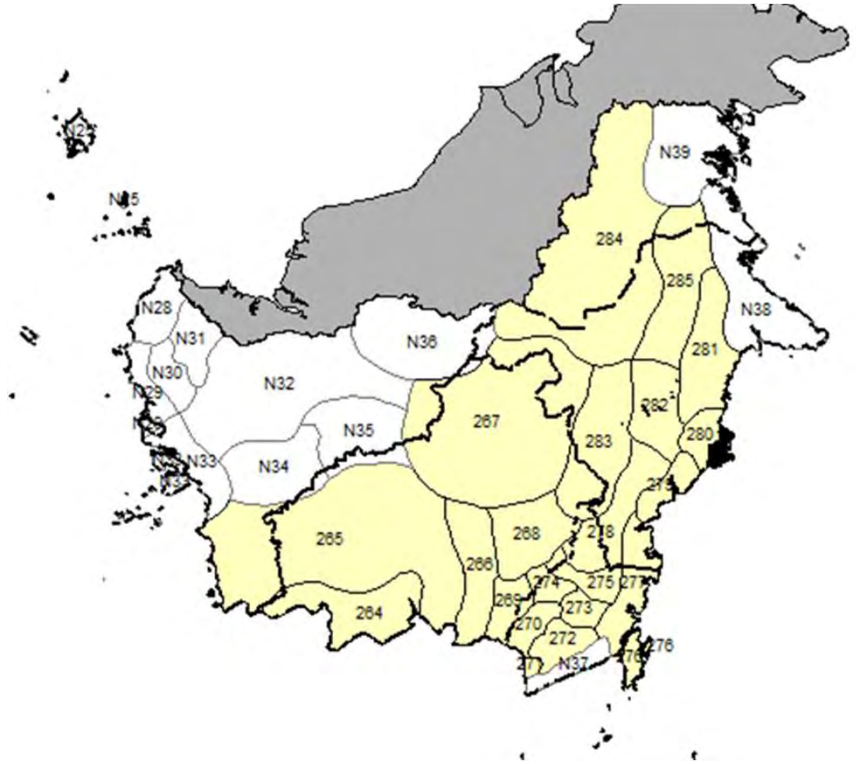
BALI NUSRA

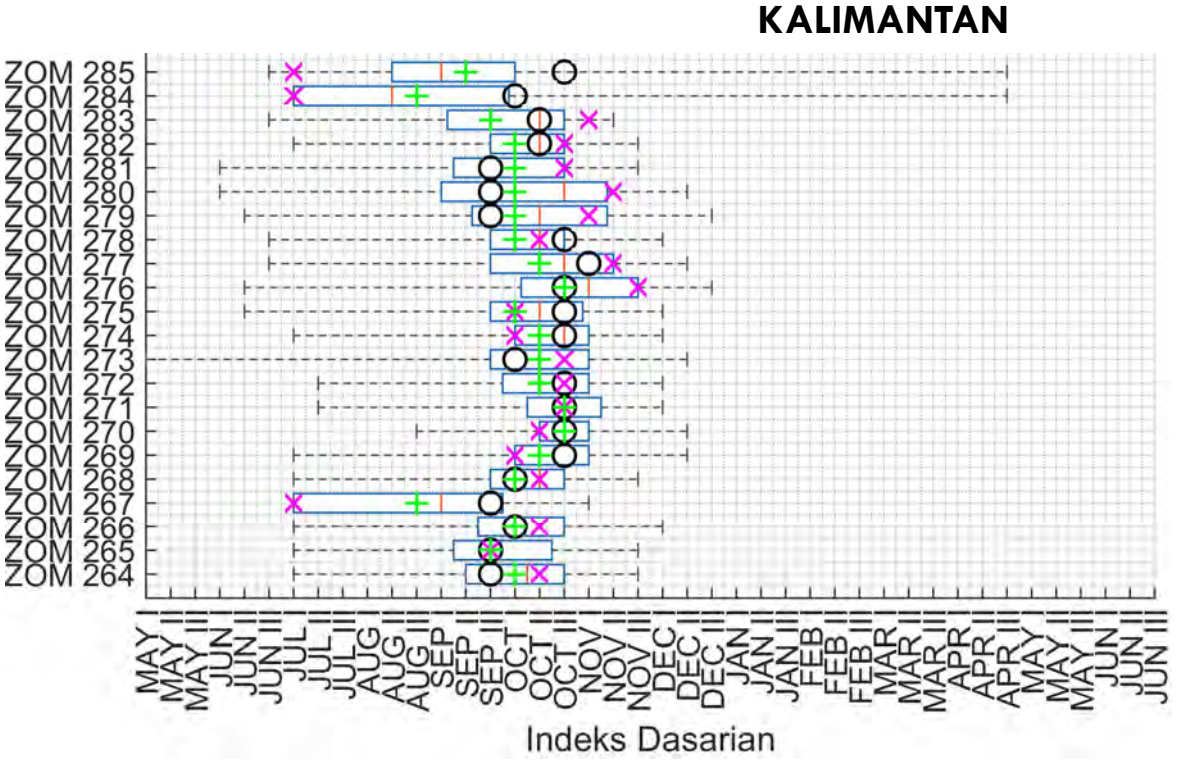


- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- ZOM 217 has large distribution of Wet Season Onset

Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

Distribution of Wet Season Onset





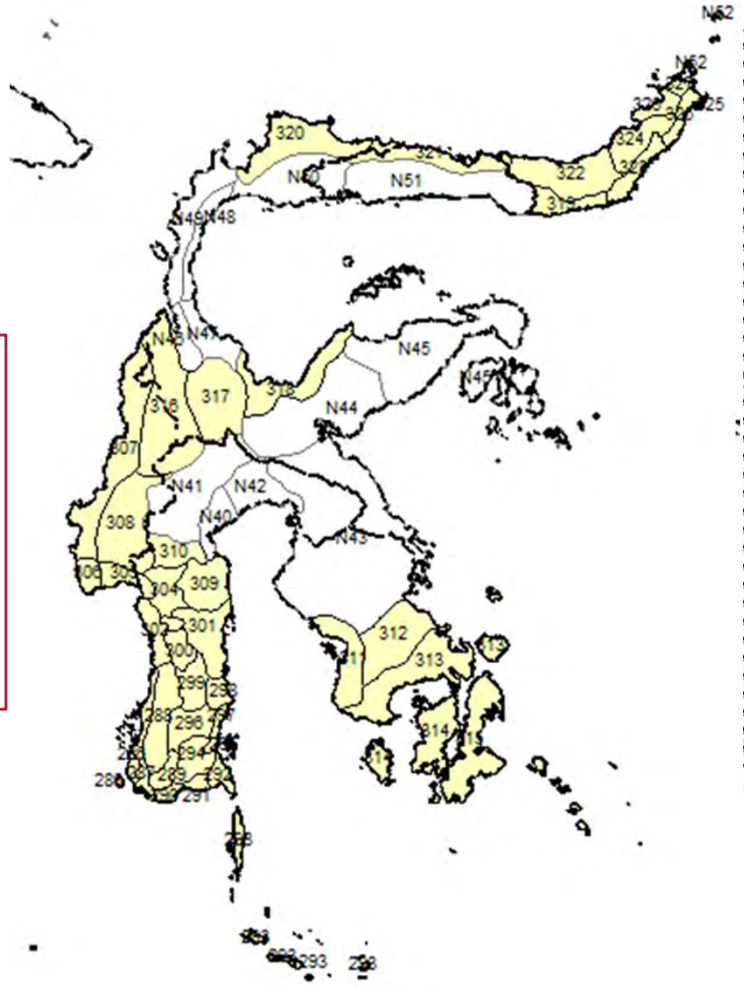
- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- ZOM 284 and 285 has very large distribution of Wet Season Onset

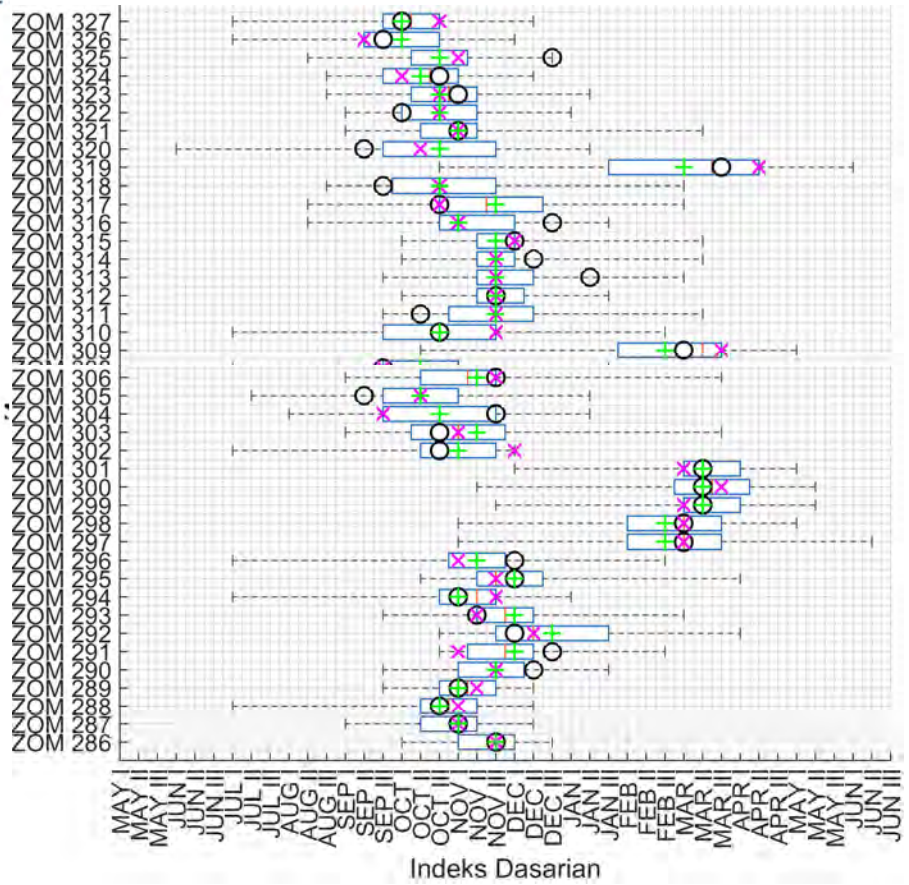
Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

Distribution of Wet Season Onset

SULAWESI

- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- Several ZOMs are Anti-monsoonal type (WS Onset around first half of the year)

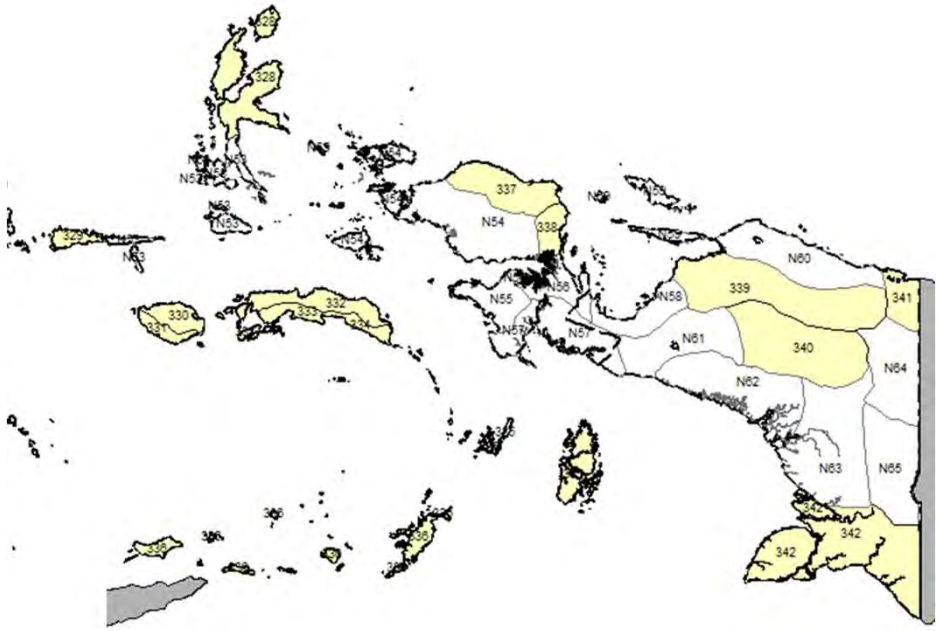


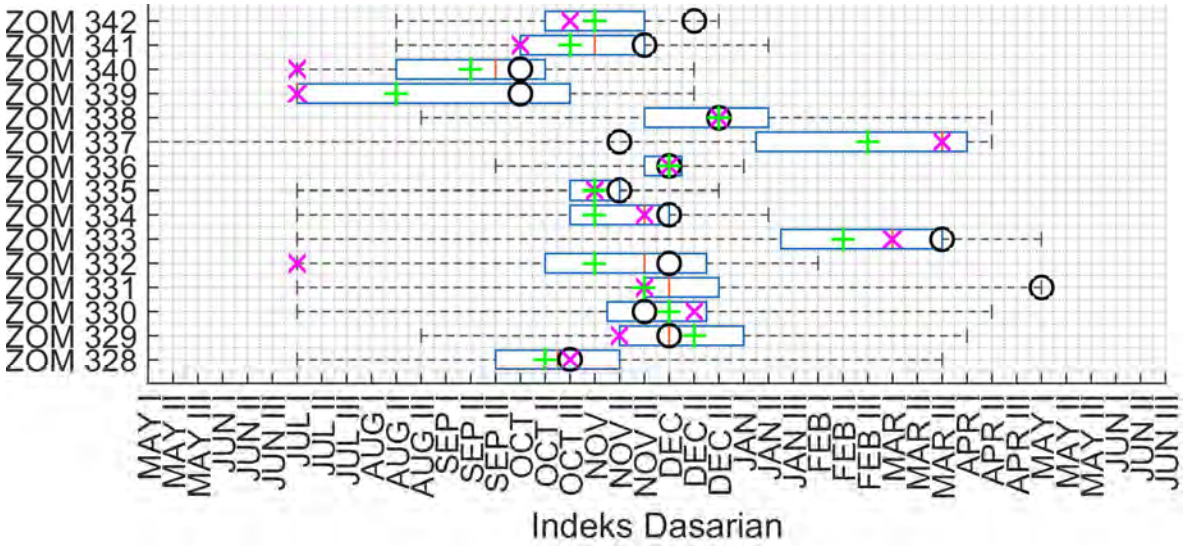


Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

Distribution Wet Season Onset

MALPAP

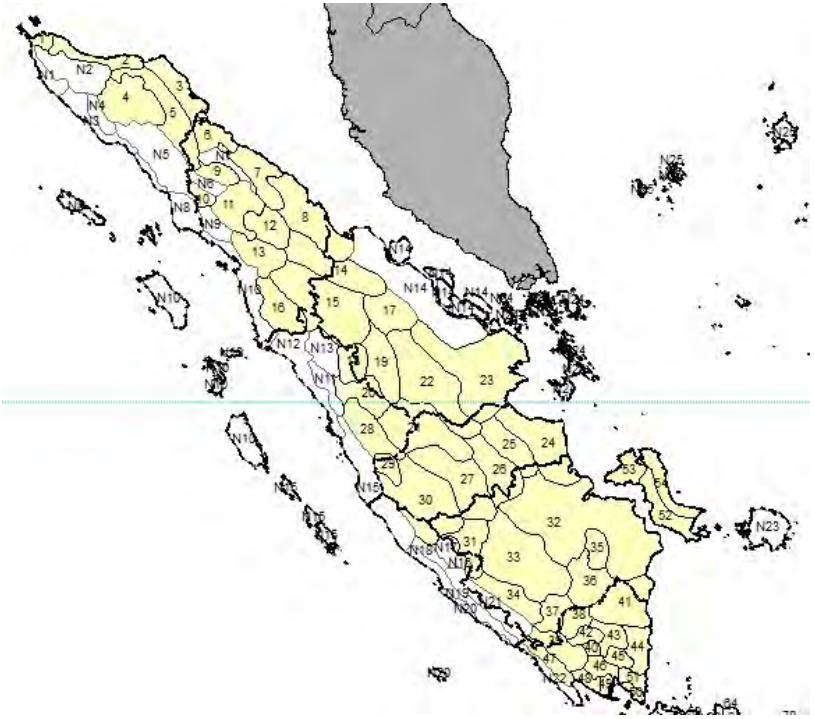




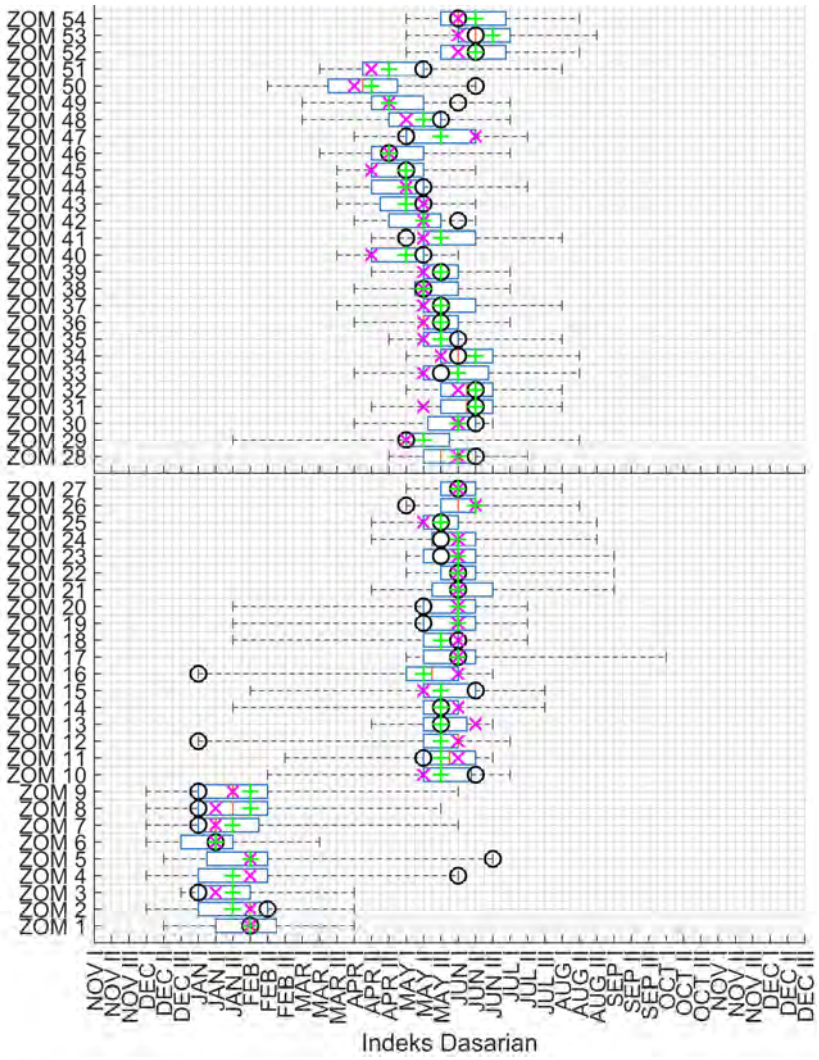
- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- Mostly ZOMs have very large distribution of WS Onset
- Some ZOMs are Anti-monsoonal type (WS Onset around first half of the year)
- ZOM 337 largest distribution of WS Onset

Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

Distribution of Dry Season Onset



SUMATERA

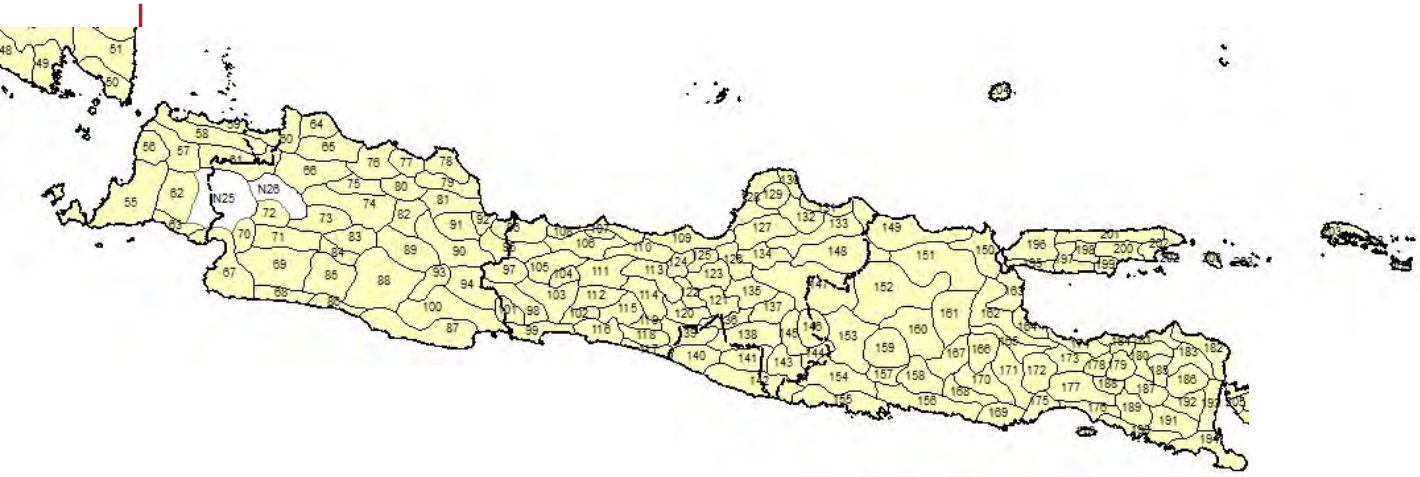


Equatorial → ZOM 6-9, 12, 16
Norm on boxplot is 1st DS Onset

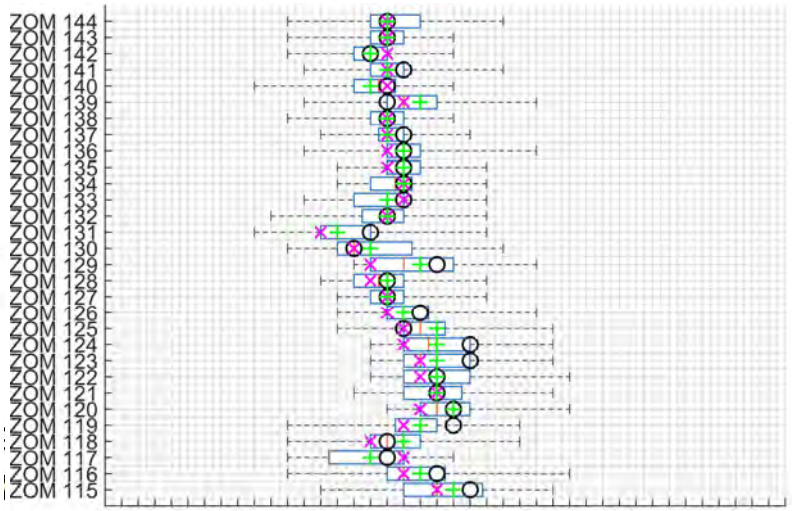
- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- Some ZOMs has Normal on outside of 25-75% range of distribution

Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

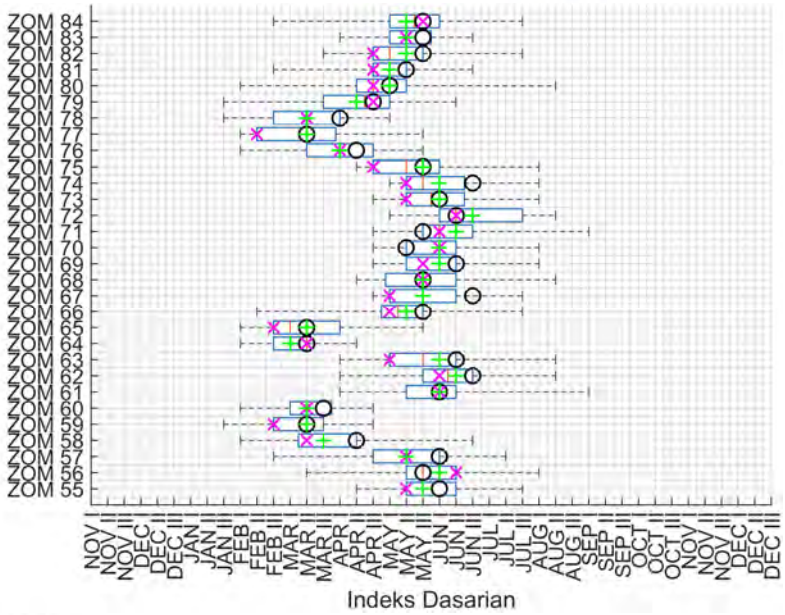
Distribution of Dry Season Onset

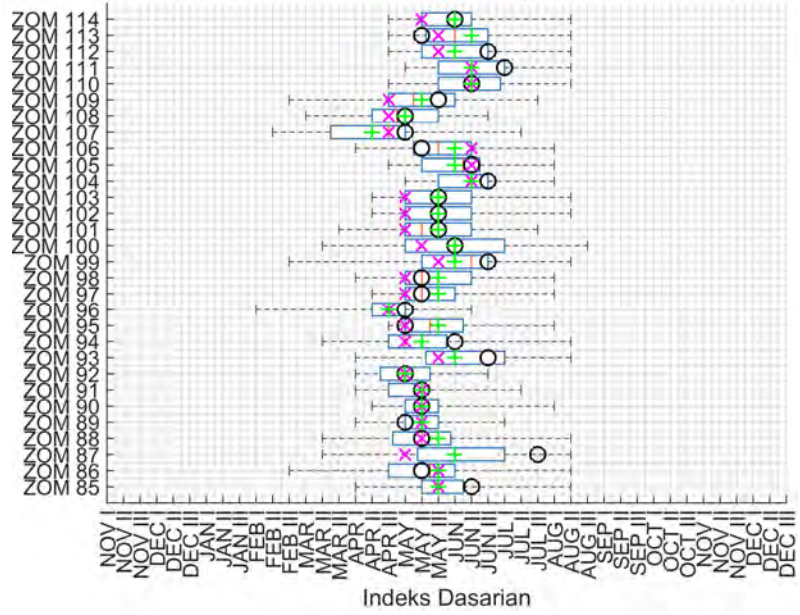


JAWA



- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- Some ZOMs has Normal on outside of 25-75% range of distribution

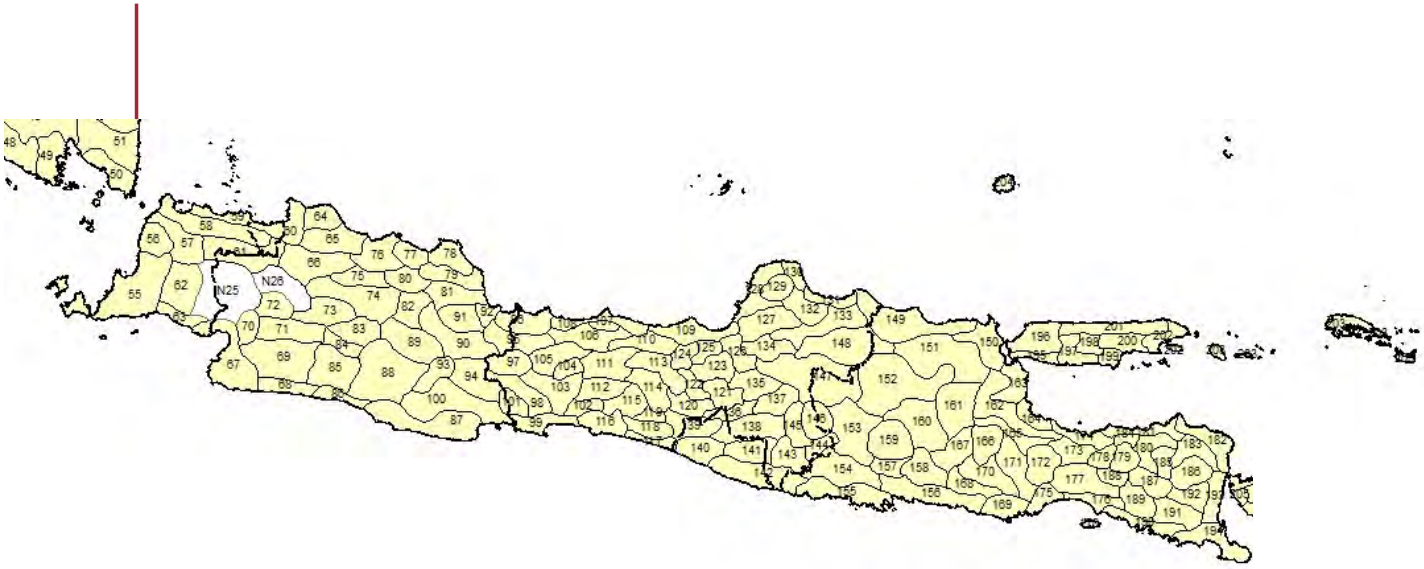


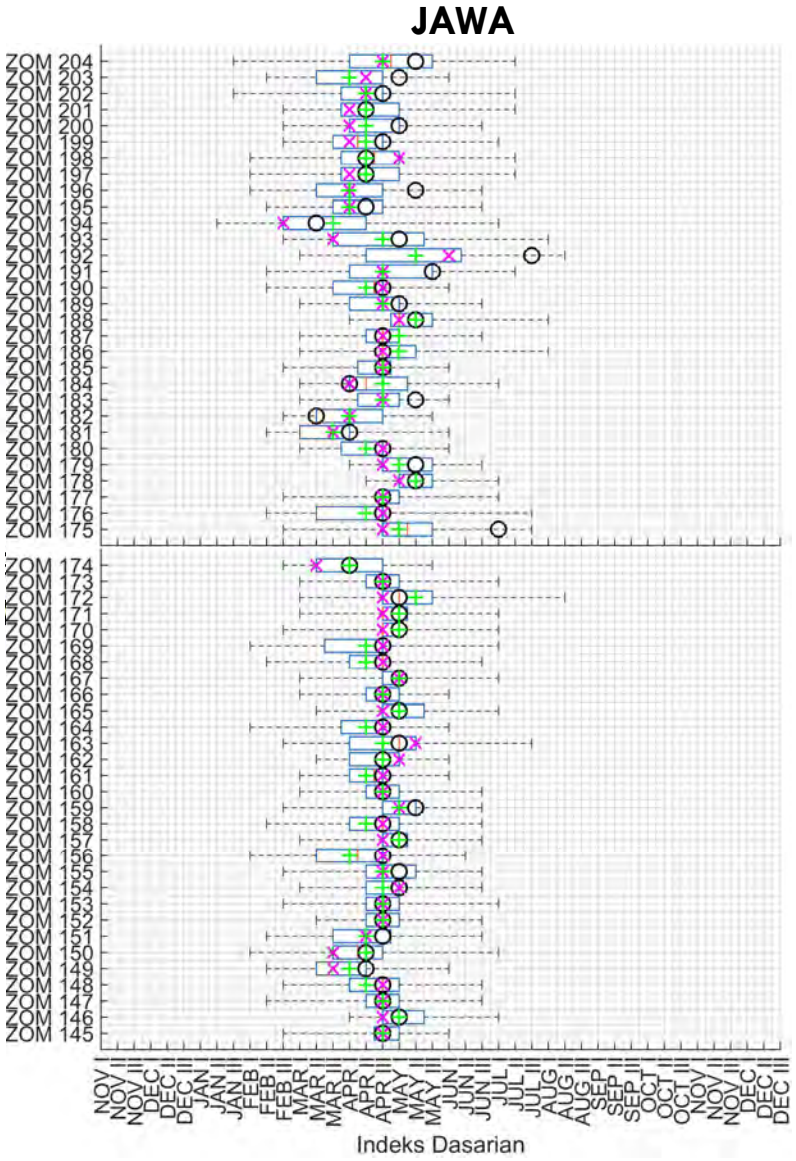


Normal | Median | Mode | Aver

Season Onset during 1981 - 2

Distribution of Dry Season Onset

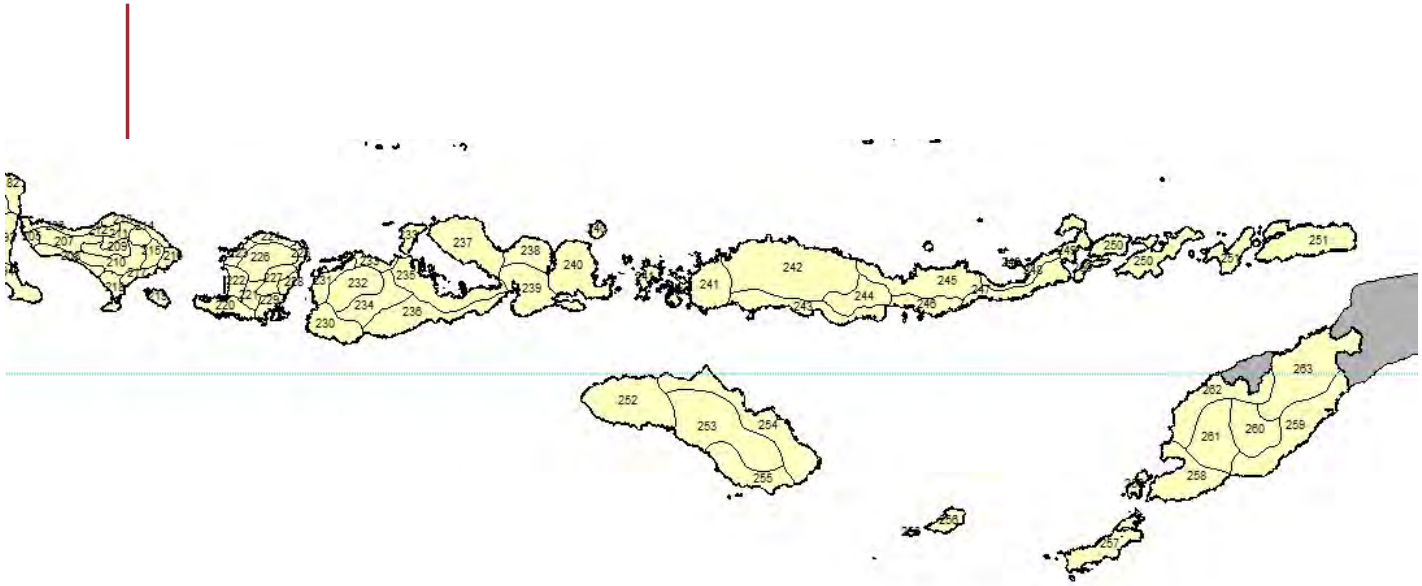




- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- Some ZOMs has Normal on outside of 25-75% range of distribution

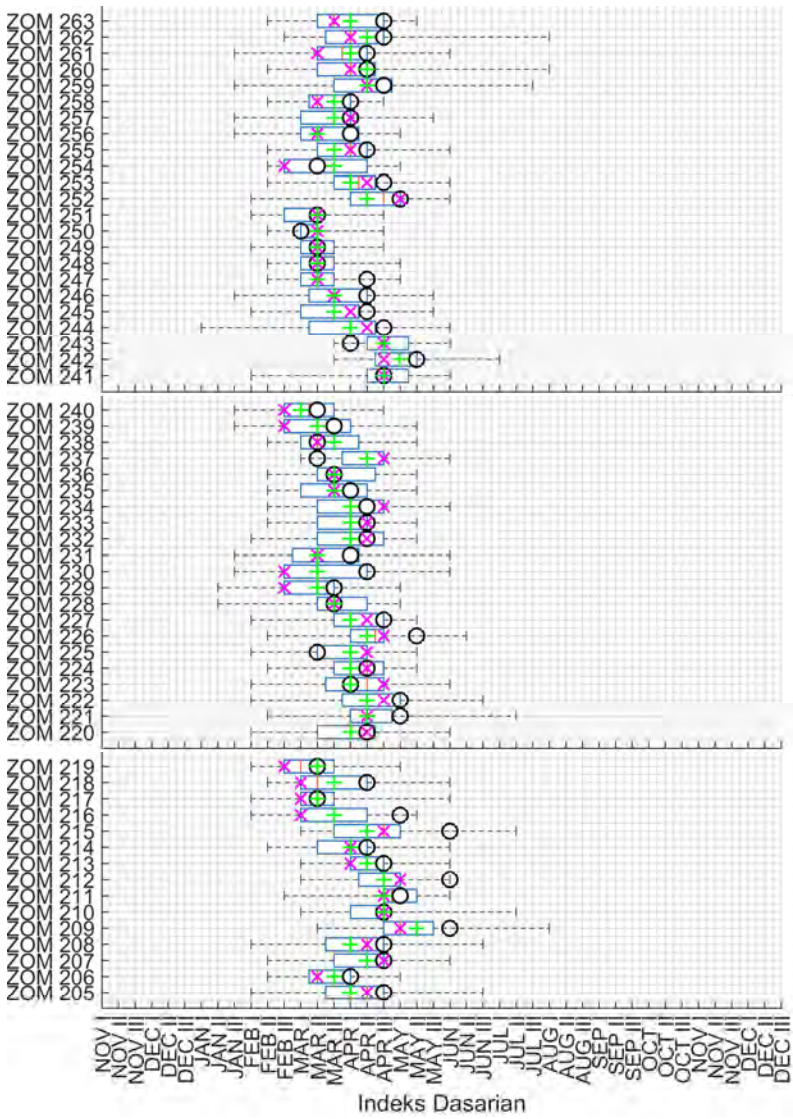
Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

Distribution of Dry Season Onset



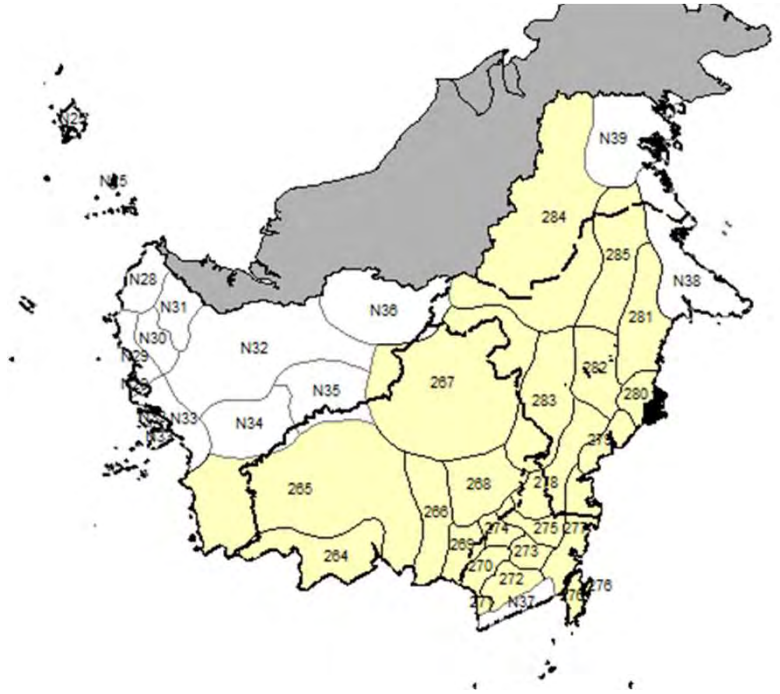
- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- Some ZOMs has Normal on outside of 25-75% range of distribution

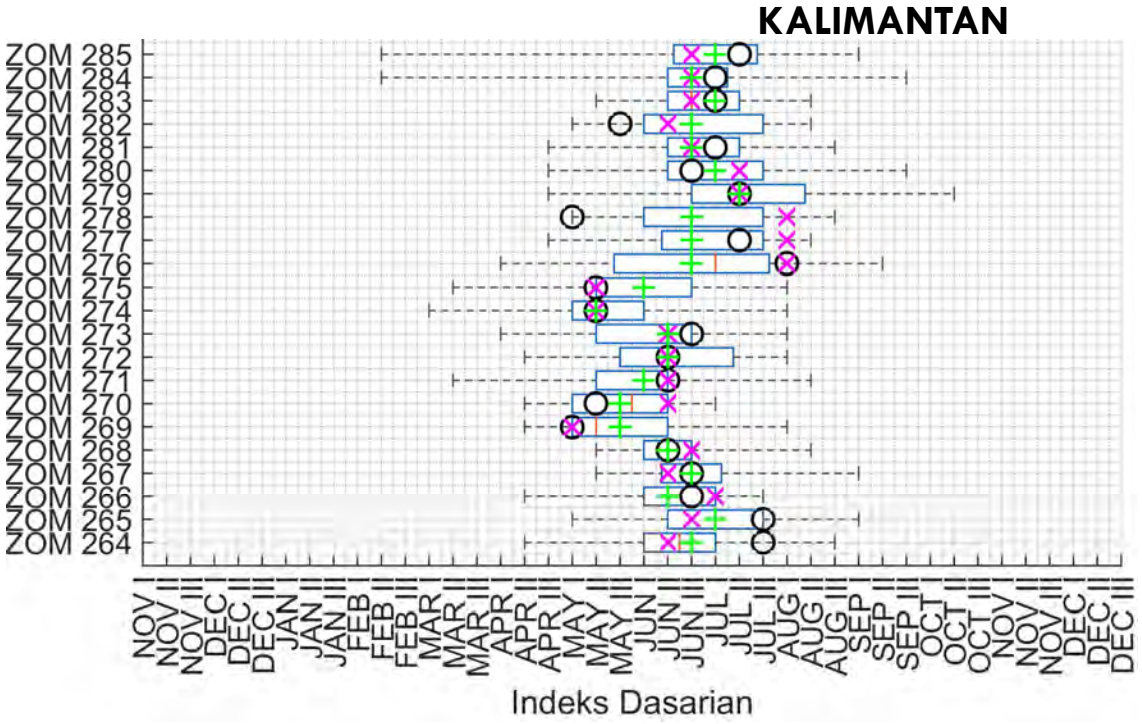
BALI NUSRA



Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

Distribution of Dry Season Onset



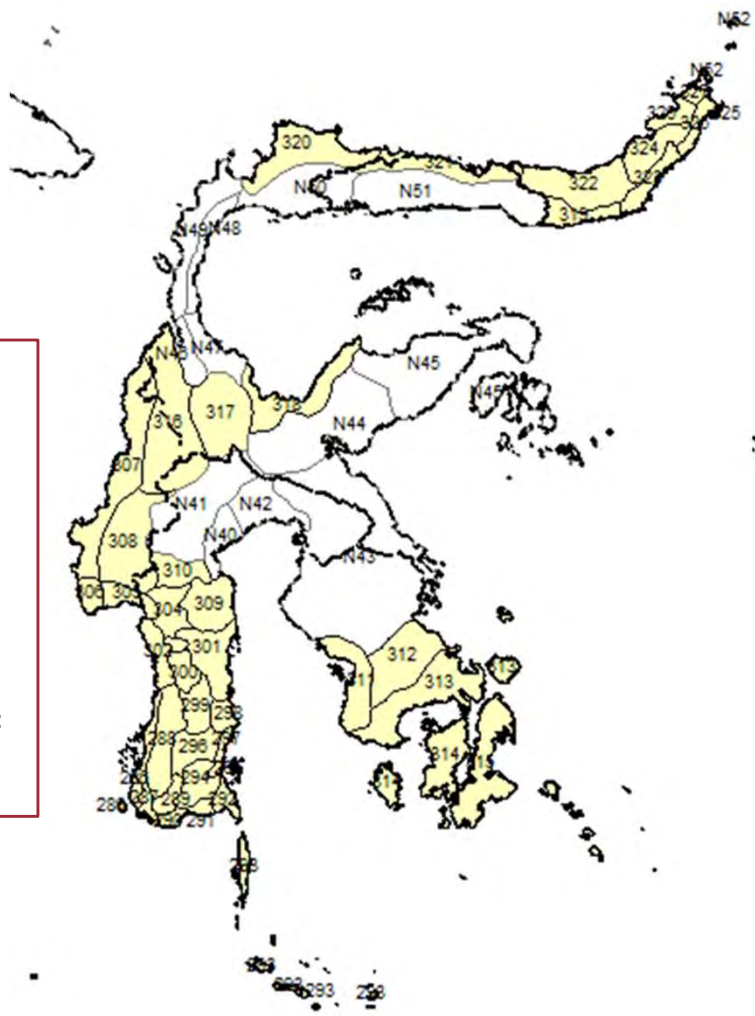


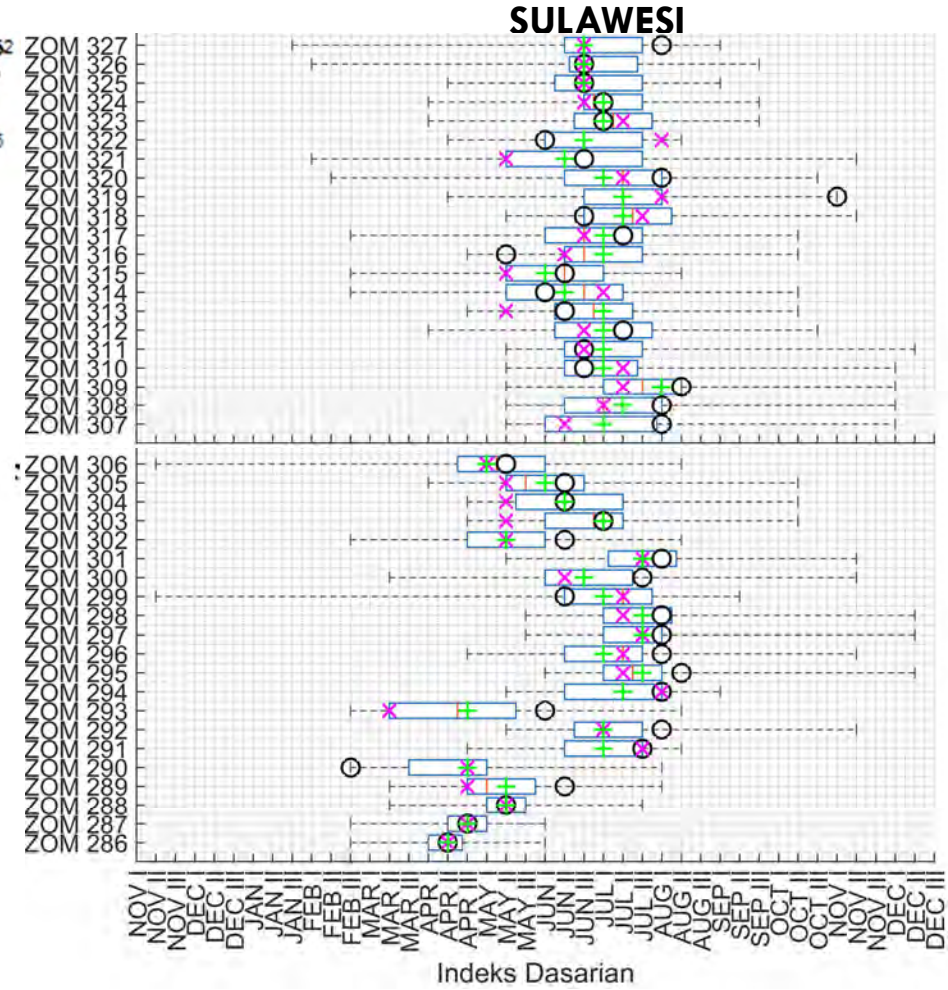
- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- Some ZOMs has Normal on outside of 25-75% range of distribution
- ZOM 284 and 285 has very large distribution of Dry Season Onset

Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

Distribution of Dry Season Onset

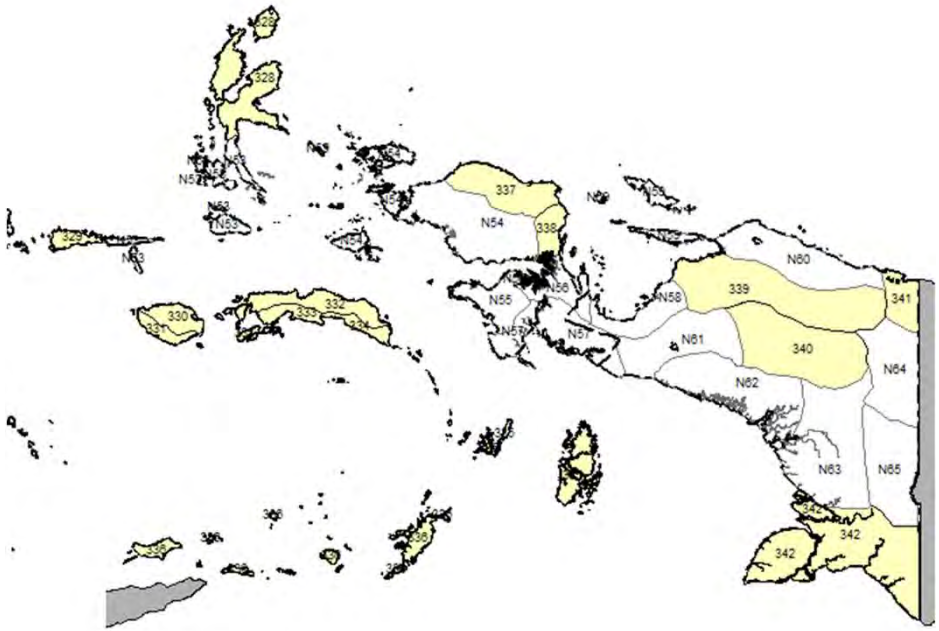
- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- Several ZOMs are Anti-monsoonal type
- Some ZOMs has Normal on outside of 25-75% range of distribution



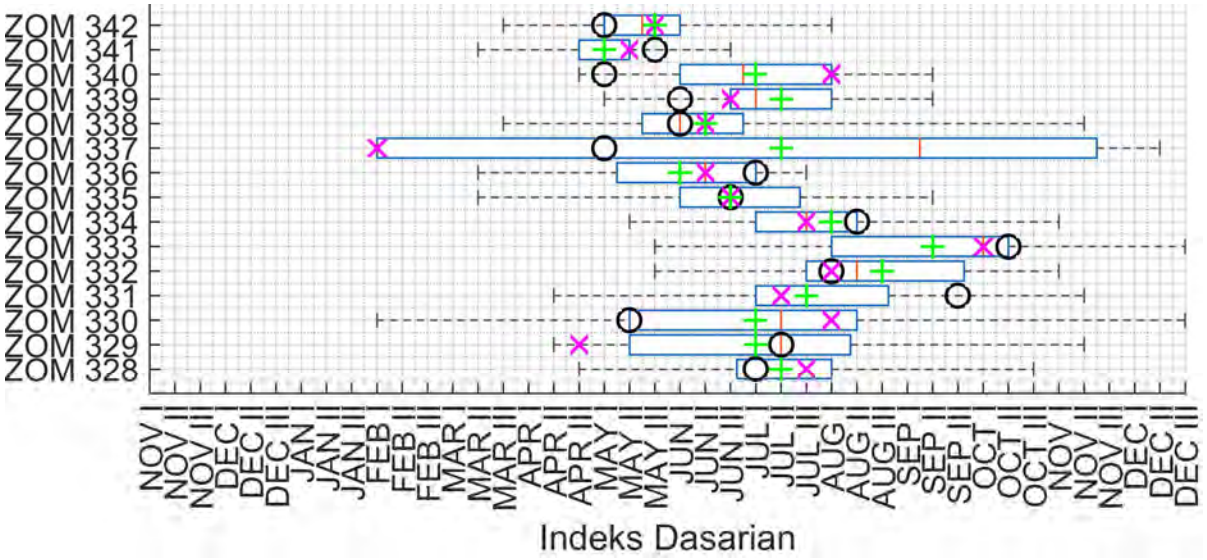


Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

Distribution of Dry Season Onset



MALPAP



- There are several ZOMs where Normal is not similar with even one of Median, Mode, or Mean.
- Some ZOMs are Anti-monsoonal type
- ZOM 337 and 330 has largest distribution of WS Onset
- Some ZOMs has Normal on outside of 25-75% range of distribution

Season Onset during 1981 - 2019 | Normal | Median | Mode | Average

SUMMARY

- In half of ZOMs all over Indonesia, none of the representative values (Median, Mode, or Mean) of Wet/Dry Season Onset during 1981-2019 is similar with Normal (1981-2010). But mostly Mode, Median, and Mean of Wet/Dry Season Onset during 1981-2019 all over Indonesia are -/+ 1 dasarian to Normal (1981-2010).
- Normal Wet/Dry Onset in several ZOMs are outside of 25-75% range of the distribution during 1981-2019
- Generally, ZOM with Monsoonal Type has smaller distribution than Equatorial and Anti-Monsoonal Type.

Remarks

- Advanced analysis on ZOM with irrepresentative Normal Onset is required since new period of Normal Standard 1991-2020 is about to come.
- Current method in determination of Wet/Dry Season Onset using 50 mm/das rainfall threshold is still suitable for Monsoonal type in southern part of Sumatra, Java, and Bali Nusra. But for other regions and types need improvement to determine the Wet/Dry Season Onset more precisely. For ex. add other parameters, adjusting the threshold according to its rainfall type.

THANK YOU

-Evaluation on Normal Season Onset-

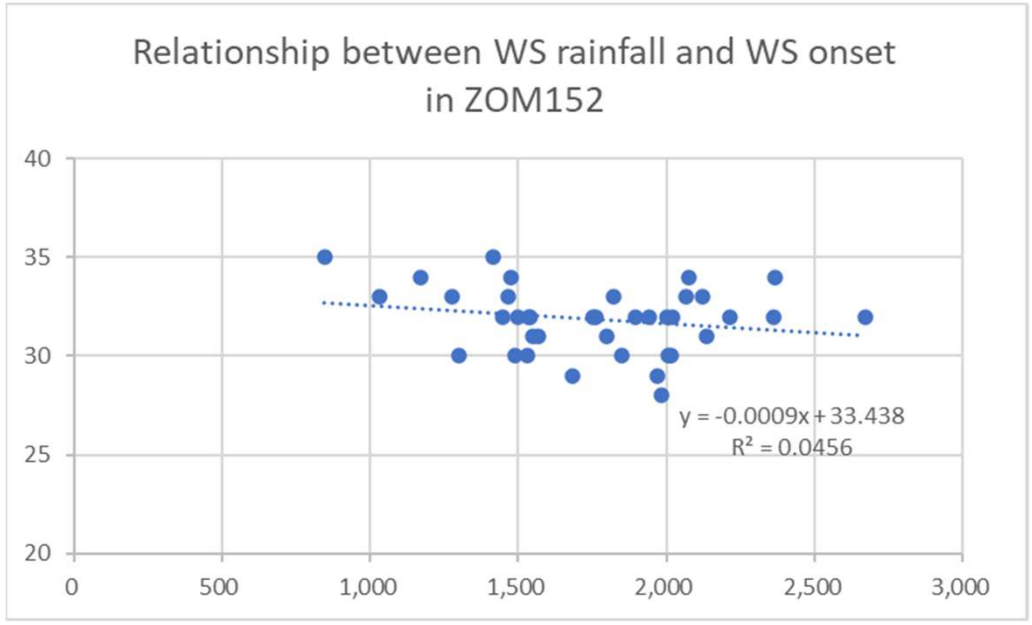
For Further Study

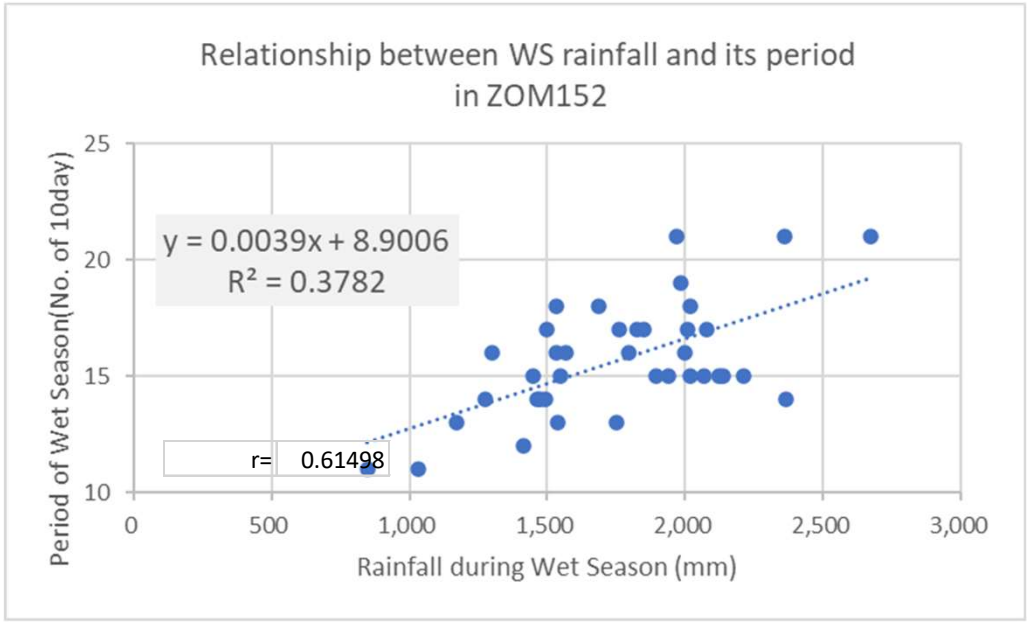
Presented by:
Dr. Koichi Kurihara
Rosi Hanif Damayanti, S.Tr

NATIONAL MEETING ON THE
2020/2021 RAINY SEASON FORECAST

Wednesday
August 5, 2020

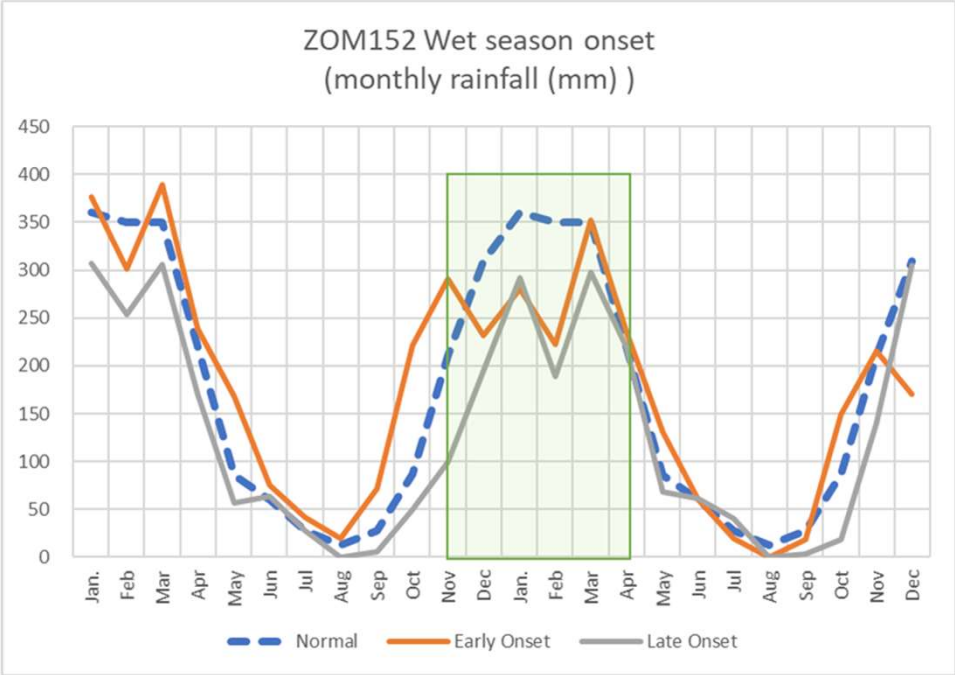
0. Relation between WS rainfall and WS onset time(left)/WS period(right)





- No significant relation between WS total rainfall and WS onset variability(Left figure)
- Statistically significant correlation between WS total rainfall and WS length(Right figure, 95% level)

Time series of monthly rainfall in WS early onset years and WS late onset years



	onset		retreat(next yr)		WS period	Rainfall(mm)
Normal	32	NovII	12	AprIII	16	1,837
Early	29	OctII	12	AprIII	19	1,878
Late	35	DecII	11	AprII	12	1,131

Definition

- Normal: Average monthly rainfall for 1981 to 2010
- Early: Average of the years when WS onset is significantly early.
- Late : Average of the years when WS onset is significantly late.

- In early onset years rainfall tends to be above normal from Sep. to Nov. and followed by below normal rainfall until around March next year.
- In late onset years rainfall tends to below normal from Sep. to March next year.

Further Study

- To study variability of Onset, Retreat, WS/DS period(length), and rainfall amount of the season.
- To study factors of these variations such as ENSO, IOD, Asian-Australian monsoon, etc.
- To Study these topics not only in the East Java/South Sulawesi but also in other regions in Indonesia.

Thank you for your kind attention

Terima kasih

ご清聴ありがとうございました