



# **CLIMATE IMPACT ASSESSMENT**

for  
**Philippine Agriculture  
(Rice and Corn)**



**Impact Assessment and Applications Section (IAAS)  
Climatology and Agrometeorology Division (CAD)**  
Philippine Atmospheric, Geophysical and Astronomical Services  
Administration (**PAGASA**)  
Department of Science and Technology

**DECEMBER 2019**

**Number 12 / Volume 35**

# Preface

The Impact Assessment and Applications Section (IAAS) of Climatology and Agrometeorology Division (CAD) regularly issue this monthly/bulletin which will provide users such as food security managers, economic policy makers, agricultural statisticians and agricultural extension officials with qualitative information on the current and potential effects of climate and weather variability on rainfed crops, particularly rice and corn. This bulletin, entitled "Climate Impact Assessment for Agriculture in the Philippines", represents a method for converting meteorological data into economic information that can be used as supplement to information from other available sources.

For example, an agricultural statistician or economist involved in crop production and yield forecast problems can combine the assessment with analysis from area survey results, reports on the occurrence of pests and diseases, farmers' reports and other data sources.

The impact assessments are based on agroclimatic indices derived from historical rainfall data recorded for the period 1951 to the present. The indices, expressed in raw values percent of normals and percentile ranks, together with real time meteorological data (monthly rainfall, in percent of normal), percent of normal cumulative rainfall, as well as the occurrence of significant event such as typhoons, floods and droughts are the tools used in the assessment of crop performance. Crop reports from PAGASA field stations are also helpful.

The narrative impact assessment included in the bulletin depicts the regional performance of upland, 1st lowland and 2nd lowland palay; and dry and wet season corn crops, depending on the period or the season. Tabulated values of normal rainfall and generalized monsoon and yield moisture indices are provided for ready reference. Spatial analysis of rainfall, percent of normal rainfall and the generalized monsoon indices in percentile ranks are also presented on maps to help users visualize any unusual weather occurring during the period. The generalized monsoon indices in particular, are drought indicators; hence, the tables (see Appendices) together with the threshold values can be used in assessing drought impact, if there are any. It also helps assess any probable crop failure.

It is hoped therefore that this bulletin would help provide the decision-makers, planners and economist with timely and reliable early warning/information on climatic impact including the potential for subsistence food shortfalls, thereby enabling them to plan alternate cropping, if possible, food assistance strategies/mitigation measures to reduce the adverse impact of climate and eventually improve disaster preparedness.

Impact assessment for other principal crops such as sugarcane and coconut, for energy and for water resources management, are from time to time will be included in the forthcoming issues of this bulletin.

The IAAS of CAD will appreciate suggestions/comments from end-users and interested parties for the improvement of this bulletin.

## Definition of Terms

The Generalized Monsoon Index (GMI) helps determine the performance of the rains during the season and serves as a good indicator of potential irrigation supplies. It is a tool used to assess rainfed crops.

The GMI for the southwest monsoon (GMIs<sub>w</sub>) in an area during June to September is defined as follows:

$$GMIs_w = W_6P_6 + W_7P_7 + W_8P_8 + W_9P_9$$

The GMI for the northeast monsoon (GMIne) in an area during October to January is defined as:

$$GMIne = W_{10}P_{10} + W_{11}P_{11} + W_{12}P_{12} + W_1P_1$$

where:

W = weight coefficient of monthly rainfall for the season;

P = rainfall amount in the *i*<sup>th</sup> month

(i = 1 for January, 2 = for February, etc.)

The Yield Moisture Index (YMI) is a simple index that helps the users assess agroclimatic crop conditions during the crop season. The YMI for a particular crop is defined as follows:

$$YMI = \sum_i^n [P_i K_i]$$

where:

*i* = crop stage (1 = planting/transplanting, 2 = vegetative, 3 = flowering, 4 = maturity, etc.)

*n* = total no. of crop stages;

P = rainfall during the *i*<sup>th</sup> crop stage; and

K = appropriate crop coefficient for the *i*<sup>th</sup> crop stage.

Tentatively, the threshold values of categories of indices for interpretation being adopted for both **YMI** and **GMI** are as follows:

Percentile Rank	Interpretation
> 80	Potential for flood damage
41 - 80	Near normal to above- normal crop condition
21 - 40	Moderate drought impact with reduced yield
11 - 20	Drought impact with major yield losses
< 10	Severe drought impact with crop failure and potential food shortages

# AGROCLIMATIC / CROP ASSESSMENT FOR DECEMBER 2019

## OVERVIEW

Land preparation, planting and transplanting activities for late-planted lowland 2<sup>nd</sup> palay as well as dry-season corn has now started in Aparri, Basco, Tuguegarao, Baler, Casiguran, CALABARZON, most parts of MIMAROPA, Bicol Region, Panay Island, Eastern Visayas, Mactan, Dipolog, Surigao del sur and Surigao del Norte. Those areas received sufficient amount of rainfall needed for planting rice and corn crops. In contrast, any planting activities might have been hampered in CAR, Ilocos region, Zambales, Cabanatuan, Cuyo, Puerto Princesa, Bohol, Negros Oriental, Zamboanga del Sur, Misamis Oriental, Bukidnon, Davao region, SOCSARGEN, Butuan and ARMM because of inadequate moisture available during the month. Standing newly planted lowland 2<sup>nd</sup> palay is faring well in Casiguran, most of CALABARZON, Calapan, Coron, Bicol Region, Catarman, Surigao del Sur and Surigao del Norte. Early-planted dry season corn in Tuguegarao, Tayabas, Calapan, Romblon, Masbate, and Panay Island are in good crops condition. Contrastingly, standing crops in Ilocos Sur, Ilocos Norte, and Cabanatuan experienced moisture stress.

The weather systems that affected the country during the month were the Northeast (NE) Monsoon, Low pressure Areas (LPAs), Tail end of Cold Front, Easterlies, Inter-tropical convergence zone (ITCZ), and the passage of two (2) tropical cyclones (TCs) namely: Typhoon (TY) "Tisoy" (30 November - 05 December), and Typhoon (TY) "Ursula" (December 23-28). From a tropical depression, both TY "Tisoy" (with international name "Kammuri") and TY "Ursula" (with international name "Phanfone") rapidly became a typhoon as they traversed eastern and northern Visayas. These brought significant rainfall and strong winds that caused damages to properties and casualties in areas of CALABARZON, MIMAROPA, Regions V, VI, VIII and CARAGA. Domestic and international flights were also cancelled due to bad weather, as reported by the National Disaster Risk Reduction and Management council (NDRRMC), dated 28 December 2019 (Sit Rep No. 12).

General assessment of rainfall for the month showed that near to above normal rainfall conditions were received in most parts of Luzon, most parts of the Visayas and some parts of Davao Region. Meanwhile, below to way below normal rainfall conditions were experienced in the remaining parts of Mindanao.

### **REGION I (Ilocos Region)**

Land preparation, planting and transplanting activities for late-planted lowland 2<sup>nd</sup> palay as well as dry season corn in Ilocos region may be hampered because of inadequate rainfall received during the month. Hence, newly planted lowland 2<sup>nd</sup> palay in Ilocos sur and Ilocos Norte now suffered moisture stress.

### **CAR (Cordillera Autonomous Region)**

Any planting activities related to planting rice and corn may not be undertaken across the region because of insufficient moisture available during the month.

### **REGION II (Cagayan Valley)**

Land preparation, planting and transplanting activities for late-planted lowland 2<sup>nd</sup> palay as well as dry season now started in Cagayan Valley. Sufficient moisture received during the month also favors early planted dry-season corn, crops are in good condition in Tuguegarao.

### **REGION III (Central Luzon)**

Land preparation, planting and transplanting activities for dry-season corn and late-planted lowland 2<sup>st</sup> palay had commenced in Baler and Casiguran because of sufficient moisture available during the month, while in Zambales and Cabanatuan due to inadequate rainfall received, all farming activities are hampered. Likewise, early planted dry season corn in Cabanatuan is affected by moisture stress, while crops in Casiguran is faring well.

**REGION IV-A (CALABARZON)**

In CALABARZON, adequate moisture favors the land preparation, planting, and transplanting activities for late-planted lowland 2<sup>nd</sup> palay as well as dry season corn. Standing early planted dry-season corn and the newly –planted lowland 2<sup>nd</sup> palay in Quezon experienced good crops condition.

**REGION IV-B (MIMAROPA)**

Land preparation, planting and transplanting activities for lowland 2<sup>nd</sup> palay as well as dry season corn had just begun in most parts of the region. Such activities were favored by sufficient moisture supply available during the month. In contrast, inadequate moisture in Cuyo and Puerto Princesa, hampered any farming activities to be done. Meanwhile, standing rice and corn crops in Romblon, Coron and Calapan are faring well.

**REGION V (Bicol Region)**

Land preparation, planting and transplanting activities for late-planted lowland 2<sup>nd</sup> palay as well as dry season corn have just commenced across the region. These were made possible despite of below normal rainfall received during the month in Albay and Camarines Norte but still sufficient for such farming activities. Standing rice and corn crops experienced good crops condition.

**REGION VI (Western Visayas)**

Above normal rainfall received during the month favors land preparation, planting and transplanting activities for the late-planted lowland 2<sup>nd</sup> palay as well as dry-season corn in Panay Island. Standing early-planted dry season is favored by sufficient moisture available during the month.

**REGION VII (Central Visayas)**

Sufficient moisture available during the month favors land preparation, planting and transplanting activities for late-planted lowland 2<sup>nd</sup> palay as well as dry season corn in Mactan, On the contrary, any farming activities related to planting rice and corn in Bohol and Negros Oriental might be hampered because of very low rainfall received during the month.

**REGION VIII (Eastern Visayas)**

Sufficient rainfall received during the month favors land preparation, planting and transplanting activities for late-planted lowland 2<sup>nd</sup> palay as well as dry-season corn in most parts of the region. Standing newly-planted lowland 2<sup>nd</sup> palay in Catarman experienced good crops condition.

**REGION IX (Zamboanga Peninsula)**

In northern part of the region, ample amount of rainfall received during the month has favored land preparation, planting and transplanting activities for late-planted lowland 2<sup>nd</sup> palay as well as dry season corn. While in the southern part, any farming activities related to planting rice and corn across the region might be hampered due to very minimal rainfall received during the month.

**REGION X (Northern Mindanao)**

Inadequate moisture available in Misamis Oriental and below normal rainfall received in Bukidnon indicate that land preparation, planting, and transplanting activities related to rice and corn may not be possible to be undertaken.

**REGION XI (Davao Region)**

Good weather prevailed during the month but moisture available are not sufficient for planting rice and corn of any kind across the region.

**REGION XII (SOCCSKSARGEN)**

Inadequate rainfall received all over the region might have hampered any farming activities to be done during the month.

**REGION XIII (CARAGA Region)**

Land preparation, planting, and transplanting activities for late-planted lowland 2<sup>nd</sup> palay as well as dry season corn have started in most parts of the region. Sufficient moisture favored such activities except in Butuan, inadequate rainfall received during the month, hampered such farming activities to be done. Standing lowland 2<sup>nd</sup> palay in Surigao del Norte and Surigao del sur are faring well.

**ARMM (Autonomous Region of Muslim Mindanao)**

Very low rainfall received during the month hampered any farming activities to be done relative to planting rice and corn.

For Particulars, please contact:

THELMA A. CINCO, Impact Assessment and Applications Section (IAAS)  
Climatology and Agrometeorology Division (CAD), PAGASA-DOST  
Telefax No.: 434-58-82/ telacebes@yahoo.com

**TABLE 1.0 GENERALIZED NORTHEAST MONSOON INDICES**  
In Millimeters and Percentile Rank (October 2019 to January 2020)

STATIONS	OCTOBER		NOVEMBER		DECEMBER		JANUARY	
	GMI	%RANK	GMI	%RANK	GMI	%RANK	GMI	%RANK
<b>CAR (Cordillera Autonomous Reg.)</b>								
Baguio	94	24	123	29	124	29		
<b>Region I (Ilocos Reg.)</b>								
Dagupan	41	19	67	31	67	29		
Vigan	10	15	68	56	69	56		
Laoag	0	7	50	49	50	49		
<b>Region II (Cagayan Valley)</b>								
Aparri	52	22	259	78	353	81		
Basco	47	25	140	37	188	44		
Tuguegarao	42	19	151	32	199	42		
<b>Region III (Central Luzon)</b>								
Iba	41	20	77	24	77	25		
Cabanatuan	61	39	101	42	105	42		
Baler	56	17	91	7	189	14		
Casiguran	41	14	87	3	262	19		
<b>Region IV-A (CALABARZON)</b>								
Ambulong	18	2	53	8	103	14		
Infanta	52	7	106	7	176	7		
Tayabas	102	42	169	31	222	34		
<b>Region IV-B (MIMAROPA)</b>								
Calapan	104	25	144	19	213	20		
Coron	101	47	155	49	207	61		
Cuyo	70	24	91	22	96	19		
Puerto Princesa	43	19	62	5	65	5		
Romblon	68	29	104	20	153	31		
San Jose	40	41	93	49	179	69		
<b>Region V (Bicol Reg.)</b>								
Daet	136	64	227	29	327	27		
Legaspi	37	22	90	5	239	19		
Masbate	24	15	63	17	173	54		
Virac Synop	66	37	105	5	265	32		
<b>Region VI (Western Visayas)</b>								
Roxas	181	92	248	83	303	85		
<b>Region VII (Central Visayas)</b>								
Mactan	94	90	109	66	158	75		
Dumaguete	60	71	74	41	94	37		
Tagbilaran	41	41	58	5	85	7		
<b>Region VIII (Eastern Visayas)</b>								
Catarman	45	32	107	5	419	69		
Catbalogan	54	25	79	3	180	20		
Tacloban	35	51	70	24	165	20		
<b>Region IX (Western Mindanao)</b>								
Dipolog	65	39	95	7	133	7		
Zamboanga	24	8	30	3	44	7		
<b>Region X (Northern Mindanao)</b>								
Lumbia	26	10	49	12	53	7		
Malaybalay	112	44	138	31	158	34		
<b>Region XI (Davao Reg.)</b>								
Davao	73	83	111	83	142	73		
<b>Region XII (SOCSARGEN)</b>								
General Santos	24	41	48	53	62	54		
<b>Region XIII (CARAGA)</b>								
Surigao	23	31	73	17	175	20		
Hinatuan	22	32	75	29	210	20		
<b>ARMM (Autonomous reg. of Muslim Mindanao)</b>								
Cotabato	100	59	113	25	118	17		



**TABLE 2.0 CUMULATIVE YIELD MOISTURE INDICES FOR  
LOWLAND 2<sup>nd</sup> PALAY in Millimeters and Percentile Rank.  
(November 2019 to February 2020)**

STATIONS	NOVEMBER		DECEMBER		JANUARY		FEBRUARY	
	YMI	%RANK	YMI	%RANK	YMI	%RANK	YMI	%RANK
<b>CAR (Cordillera Autonomous Reg.)</b>								
Baguio	103	81	119	69				
<b>Region I (Ilocos Reg.)</b>								
Dagupan	92	86	102	76				
Laoag	177	98	182	97				
Vigan	207	98	211	98				
<b>Region III (Central Luzon)</b>								
Iba	125	83	132	78				
Cabanatuan	140	81	171	78				
Casiguran	162	8	733	31				
<b>Region IV-A (CALABARZON)</b>								
Ambulong	123	51	308	75				
Tayabas	235	29	654	36				
Infanta	192	8	583	10				
Alabat	237	10	614	15				
<b>Region IV-B (MIMAROPA)</b>								
Calapan	139	32	365	51				
Coron	190	85	397	95				
Cuyo	73	49	94	41				
<b>Region V (Bicol Reg.)</b>								
Daet	322	34	639	19				
Legaspi	186	3	643	25				
Virac	141	5	684	42				
<b>Region VIII (Eastern Visayas)</b>								
Catarman	221	7	1206	76				
Catbalogan	86	3	442	31				
<b>Region XIII (CARAGA)</b>								
Hinatuan	189	15	618	10				
Surigao	179	19	616	25				

**TABLE 3.0 CUMULATIVE YIELD MOISTURE INDICES FOR DRY SEASON CORN in Millimeters and Percentile Rank. (November 2019 to January 2020)**

STATIONS	NOVEMBER		DECEMBER		JANUARY	
	YMI	%RANK	YMI	%RANK	YMI	%RANK
<b>Region II (Cagayan Valley)</b>						
Tuguegarao	295	88	607	95		
<b>Region IV-A (CALABARZON)</b>						
Tayabas	180	29	642	47		
<b>Region IV-B (MIMAROPA)</b>						
Calapan	106	32	356	51		
Romblon	98	25	464	73		
Puerto Princesa	50	14	77	10		
<b>Region V (Bicol Region)</b>						
Masbate	106	31	518	69		
<b>Region VI (Western Visayas)</b>						
Roxas	182	68	443	69		
<b>Region VII (Central Visayas)</b>						
Cebu	39	34	273	71		
Dumaguete	36	15	123	19		
<b>Region IX (Western Mindanao)</b>						
Zamboanga	16	14	103	39		
<b>Region X (Northern Mindanao)</b>						
Lumbia	63	63	81	39		
Malaybalay	71	19	185	29		

**TABLE 4.0 CUMULATIVE YIELD MOISTURE INDICES FOR  
LOW LAND PALAY in Millimeters and Percentile Rank.  
(December 2019 to March 2020)**

STATIONS	DECEMBER		JANUARY		FEBRUARY		MARCH	
	YMI	%RANK	YMI	%RANK	YMI	%RANK	YMI	%RANK
<b>CAR (Cordillera Autonomous Reg.)</b>								
Baguio	14	46						
<b>Region I (Ilocos Reg.)</b>								
Dagupan	9	61						
Vigan	5	75						
Laoag	4	66						
<b>Region II (Cagayan Valley)</b>								
Aparri	418	98						
Basco	178	63						
Tuguegarao	253	92						
<b>Region III (Central Luzon)</b>								
Iba	6	44						
Cabanatuan	28	61						
Baler	379	75						
Casiguran	511	69						
<b>Region IV-A (CALABARZON)</b>								
Ambulong	165	80						
Infanta	350	27						
Tayabas	374	58						
Alabat	338	29						
<b>Region IV-B (MIMAROPA)</b>								
Calapan	202	61						
Coron	186	93						
Cuyo	19	44						
Puerto Princesa	21	19						
Romblon	296	86						
San Jose	269	97						
<b>Region V (Bicol Reg.)</b>								
Daet	284	27						
Legaspi	409	49						
Masbate	334	76						
Virac	486	68						
<b>Region VI (Western Visayas)</b>								
Roxas	212	75						
<b>Region VII (Central Visayas)</b>								
Dumaguete	71	51						
Mactan, Cebu	104	53						
Tagbilaran	189	86						
<b>Region VIII (Eastern Visayas)</b>								
Catarman	882	90						
Catbalogan	319	68						
Tacloban	269	46						
<b>Region IX (Western Mindanao)</b>								
Dipolog	129	29						
Zamboanga	71	66						
<b>Region X (Northern Mindanao)</b>								
Lumbia	15	37						
Malaybalay	92	46						
<b>Region XI (Davao Reg.)</b>								
Davao	87	58						
<b>Region XII (SOCSARGEN)</b>								
General Santos	59	58						
<b>Region XIII (CARAGA)</b>								
Surigao	391	44						
Hinatuan	384	27						
Butuan	97	42						
<b>ARMM(Autonomous reg. of Muslim Mindanao)</b>								
Cotabato	24	8						



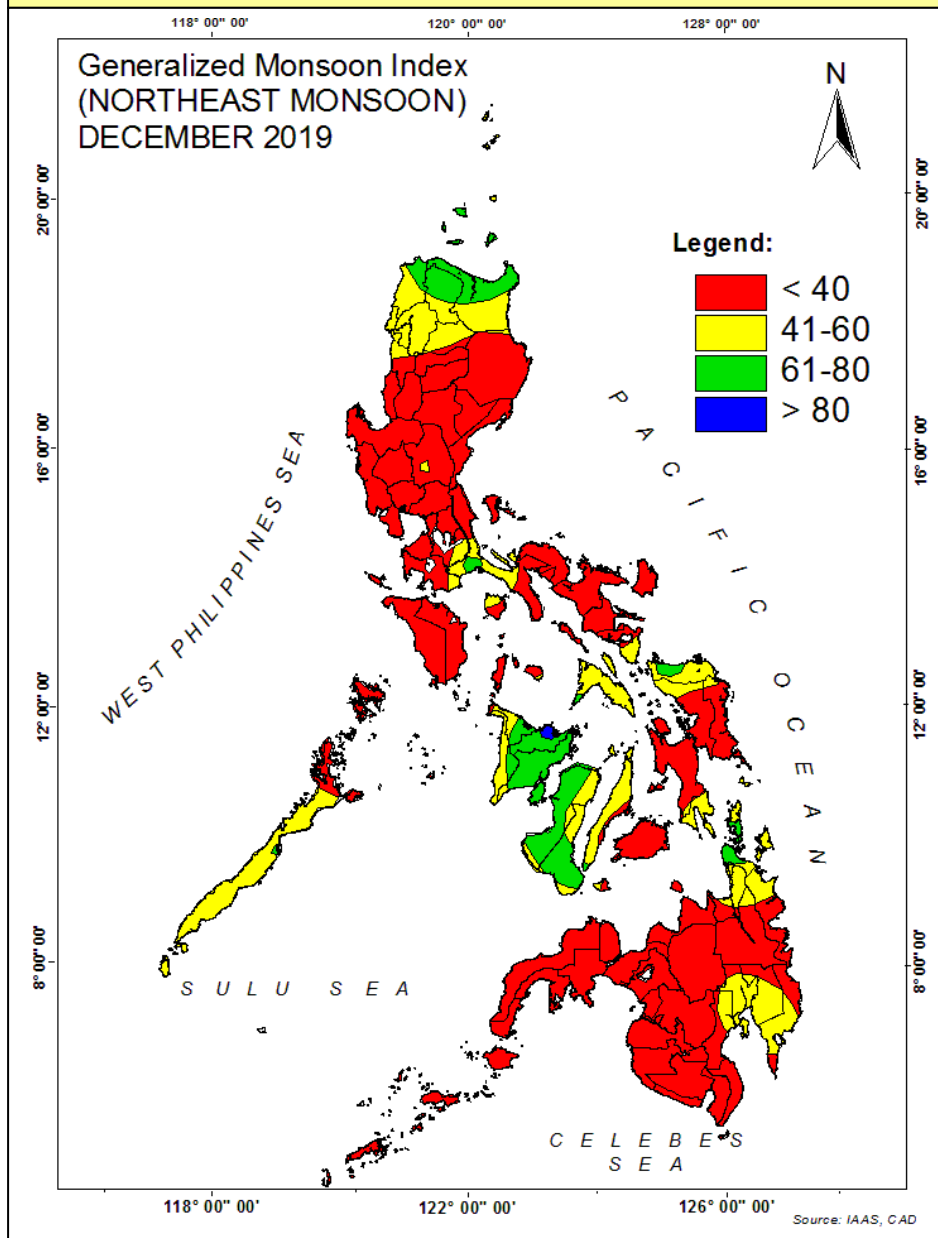
**TABLE 5.0 CUMULATIVE YIELD MOISTURE INDICES FOR DRY SEASON CORN in Millimeters and Percentile Rank. (December 2019 to February 2020)**

STATIONS	DECEMBER		JANUARY		FEBRUARY	
	YMI	%RANK	YMI	%RANK	YMI	%RANK
<b>CAR (Cordillera Autonomous Reg.)</b>						
Baguio	11	46				
<b>Region I (Ilocos Reg.)</b>						
Dagupan	7	61				
Vigan	4	75				
Laoag	3	66				
<b>Region II (Cagayan Valley)</b>						
Aparri	320	98				
Basco	136	63				
Tuguegarao	193	92				
<b>Region III (Central Luzon)</b>						
Iba	4	44				
Cabanatuan	21	61				
Baler	290	73				
Casiguran	391	69				
<b>Region IV-A (CALABARZON)</b>						
Ambulong	126	78				
Infanta	267	27				
Tayabas	286	58				
Alabat	258	31				
<b>Region IV-B (MIMAROPA)</b>						
Calapan	154	61				
Coron	142	95				
Cuyo	14	44				
Puerto Princesa	16	17				
Romblon	226	85				
San Jose	206	97				
<b>Region V (Bicol Reg.)</b>						
Daet	217	25				
Legaspi	313	49				
Masbate	255	76				
Virac	371	68				
<b>Region VI (Western Visayas)</b>						
Roxas	162	75				
<b>Region VII (Central Visayas)</b>						
Dumaguete	145	86				
Mactan, Cebu	54	51				
Tagbilaran	79	53				
<b>Region VIII (Eastern Visayas)</b>						
Catarman	674	90				
Catbalogan	244	66				
Tacloban	206	46				
<b>Region IX (Western Mindanao)</b>						
Dipolog	99	29				
Zamboanga	54	66				
<b>Region X (Northern Mindanao)</b>						
Lumbia	11	37				
Malaybalay	70	46				
<b>Region XI (Davao Reg.)</b>						
Davao	66	58				
<b>Region XII (SOCSARGEN)</b>						
General Santos	45	58				
<b>Region XIII (CARAGA)</b>						
Surigao	299	44				
Hinatuan	293	27				
Butuan	74	44				
<b>ARMM(Autonomous reg. of Muslim Mindanao)</b>						
Cotabato	18	8				

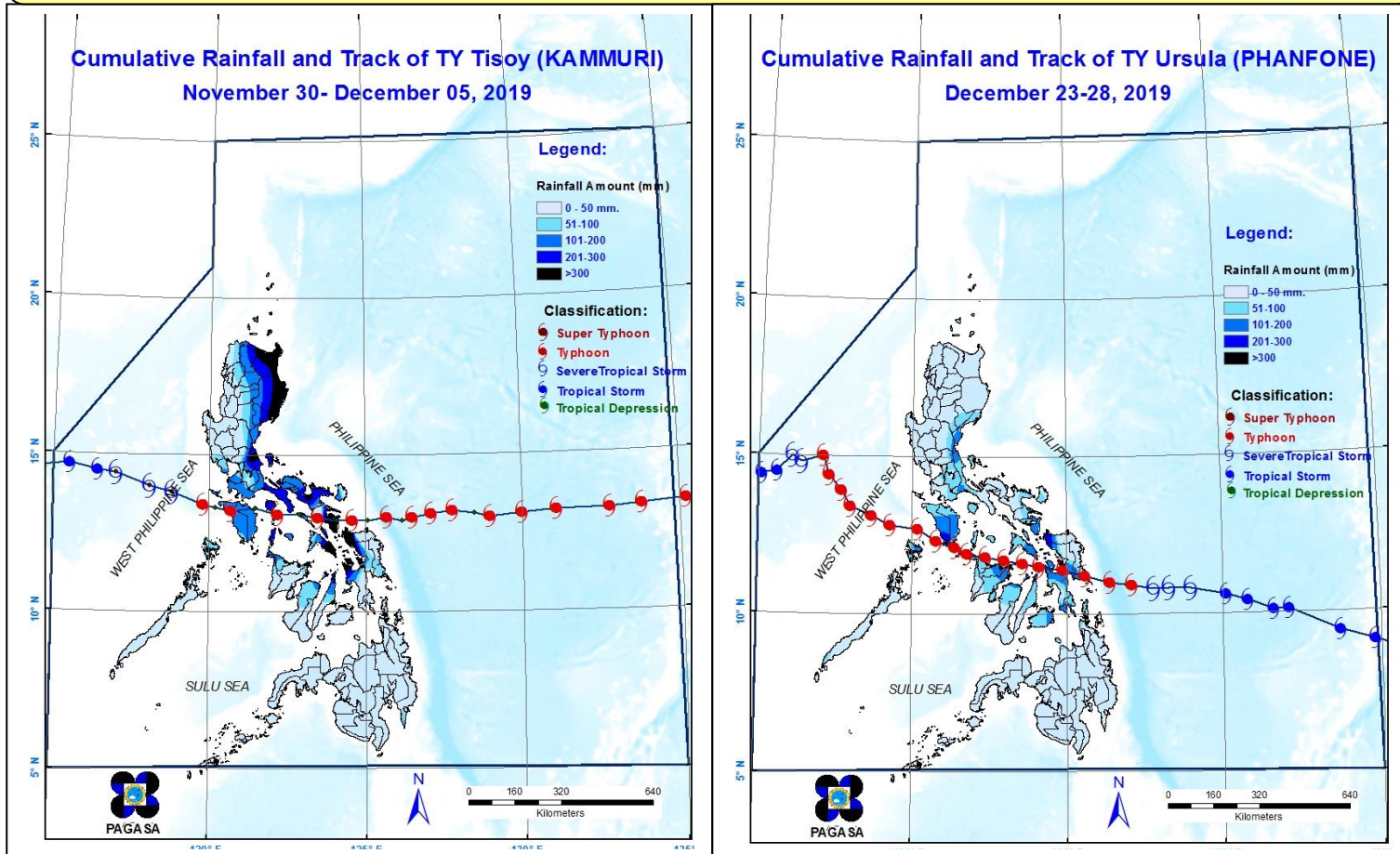
**TABLE 6.0 DECADAL AND CUMULATIVE DECADAL RAINFALL**  
**For the month of DECEMBER 2019**  
**[actual values (in mm) and percent of normal ]**

	<i>REGION</i>	<i>DECADE</i>	<i>ACTUAL DEC.</i>	<i>% Normal of Actual</i>	<i>CUMULATIVE JAN- DEC.</i>	<i>% Normal Cumulative</i>
<b>R01</b>	Ilocos Region	34	27	439	2762.2	106
		35	4	53	2766.7	105
		36	5	59	2771.3	105
<b>CAR</b>	CAR	34	126	477	2668.1	109
		35	17	56	2685.0	108
		36	16	60	2700.8	108
<b>R02</b>	Cagayan Valley	34	241	306	2420.8	99
		35	57	63	2477.6	97
		36	47	64	2524.9	96
<b>R03</b>	Central Luzon	34	70	178	2571.8	100
		35	23	38	2594.7	99
		36	32	85	2627.2	99
<b>R04-A</b>	CALABARZON	34	185	130	1972.4	75
		35	49	41	2021.8	74
		36	73	57	2094.9	73
<b>R04-B</b>	MIMAROPA	34	76	188	1750.2	93
		35	6	16	1755.8	92
		36	71	215	1827.2	94
<b>NCR</b>	NCR	34	78	249	2129.6	91
		35	3	10	2133.1	90
		36	53	142	2186.4	91
<b>R05</b>	Bicol Region	34	307	166	2086.2	78
		35	51	34	2136.7	76
		36	83	51	2220.0	74
<b>R06</b>	Western Visayas	34	45	91	1529.6	81
		35	20	61	1550.0	80
		36	110	292	1659.8	84
<b>R07</b>	Central Visayas	34	45	101	1200.0	83
		35	55	140	1255.1	84
		36	66	146	1321.3	86
<b>R08</b>	Eastern Visayas	34	253	197	1886.1	77
		35	101	85	1987.4	77
		36	133	104	2120.6	79
<b>R09</b>	Zamboanga Peninsula	34	35	77	1058.7	60
		35	63	128	1121.3	62
		36	1	1	1121.8	60
<b>R10</b>	Northern Mindanao	34	21	51	1462.9	72
		35	43	93	1505.9	73
		36	14	30	1520.3	72
<b>R11</b>	Davao Region	34	34	66	1968.9	99
		35	104	167	2073.1	101
		36	12	21	2085.6	99
<b>R12</b>	SOCCSKSARGEN	34	10	52	1079.6	76
		35	26	117	1105.9	76
		36	2	6	1107.7	75
	CARAGA	34	20	19	1835.1	66
		35	210	163	2045.3	70
		36	50	40	2095.1	69
	ARMM	34	10	50	1001.6	65
		35	24	100	1026.1	65
		36	1	5	1027.4	64

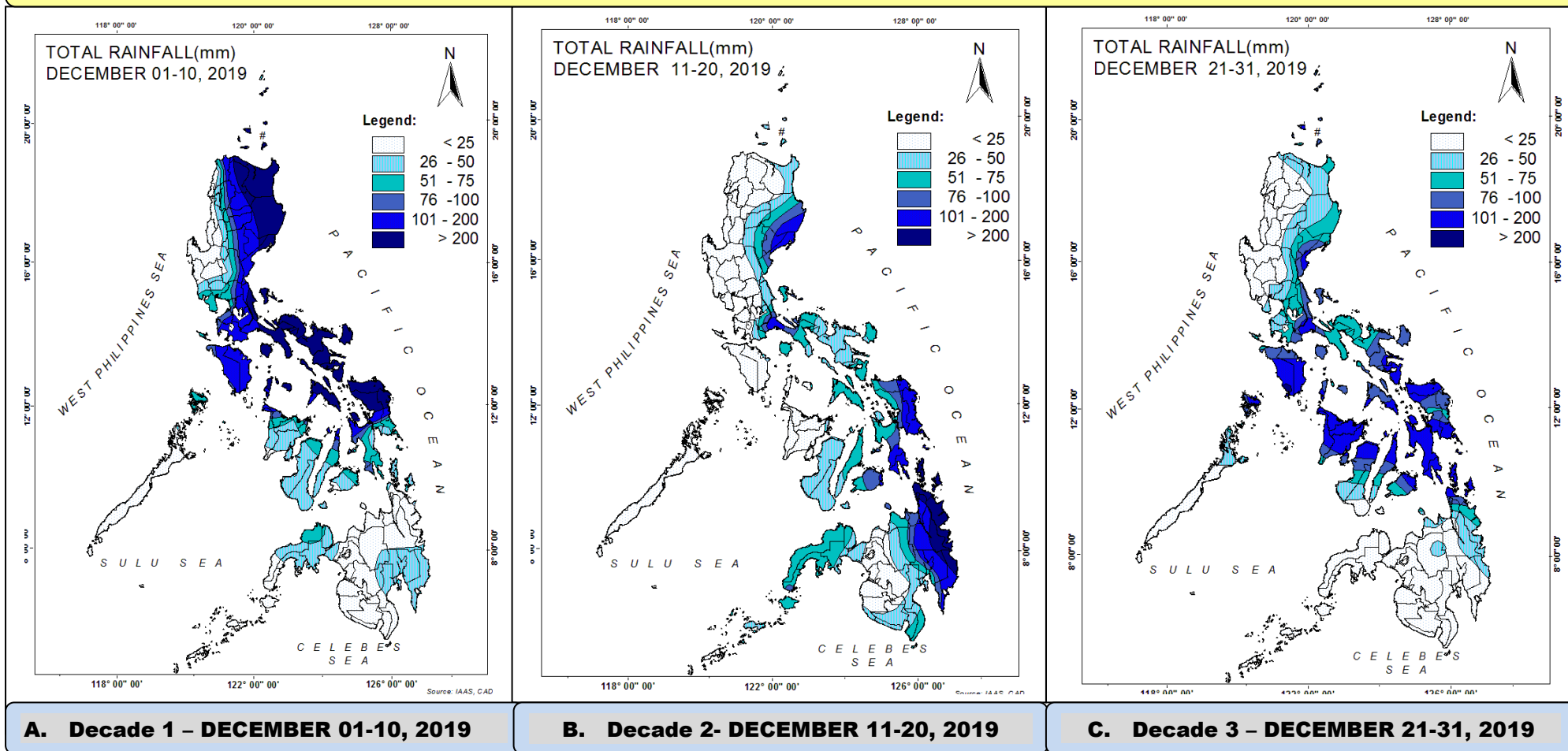
**FIG. 1.0 Spatial Analysis of GENERALIZED NORTHEAST MONSOON INDEX Ending DECEMBER 2019 in Percentile Rank**



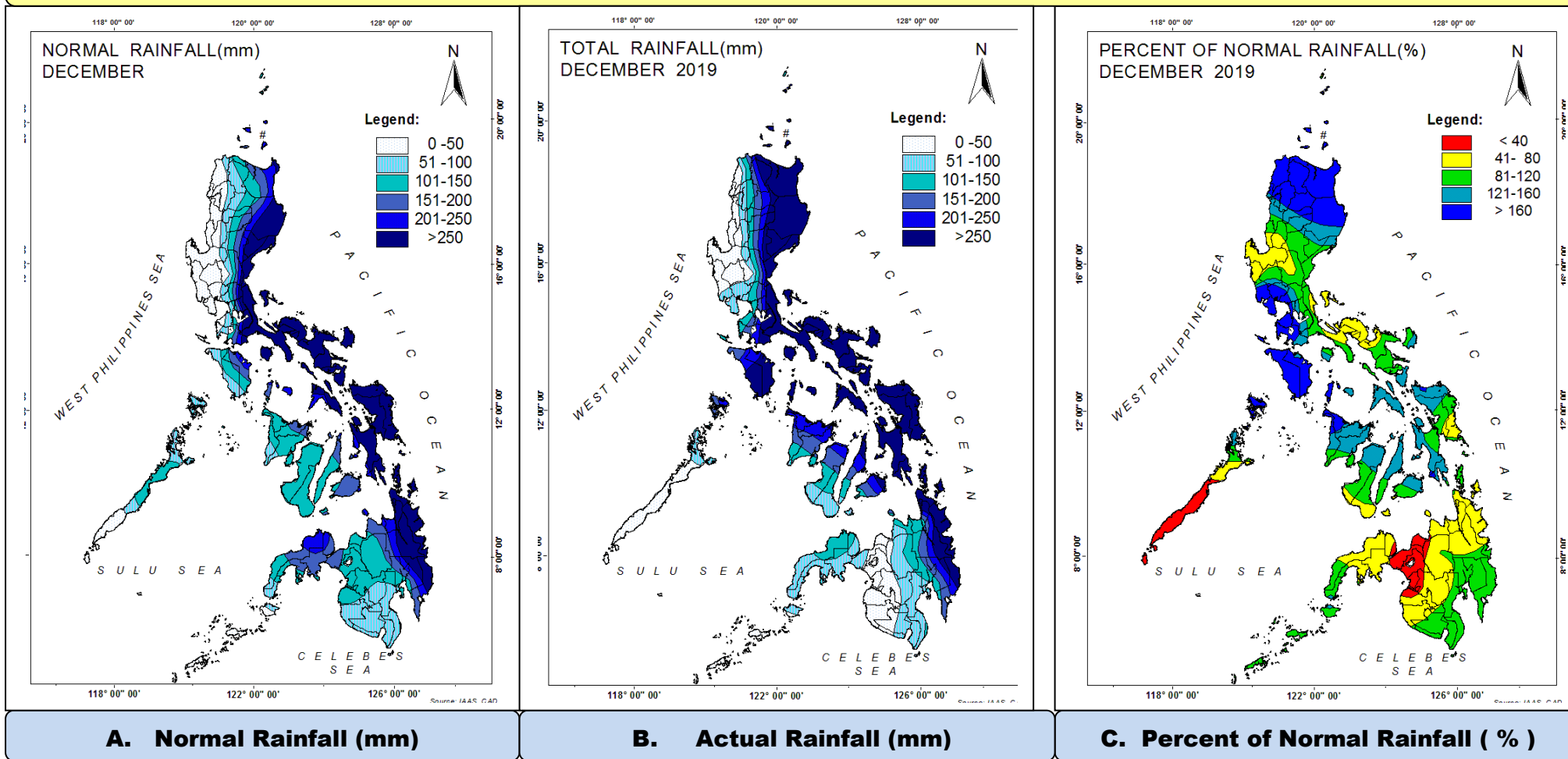
**FIG. 2.0 ACTUAL CUMULATIVE RAINFALL DURING THE PASSAGE OF TROPICAL CYCLONE IN THE PHILIPPINES**



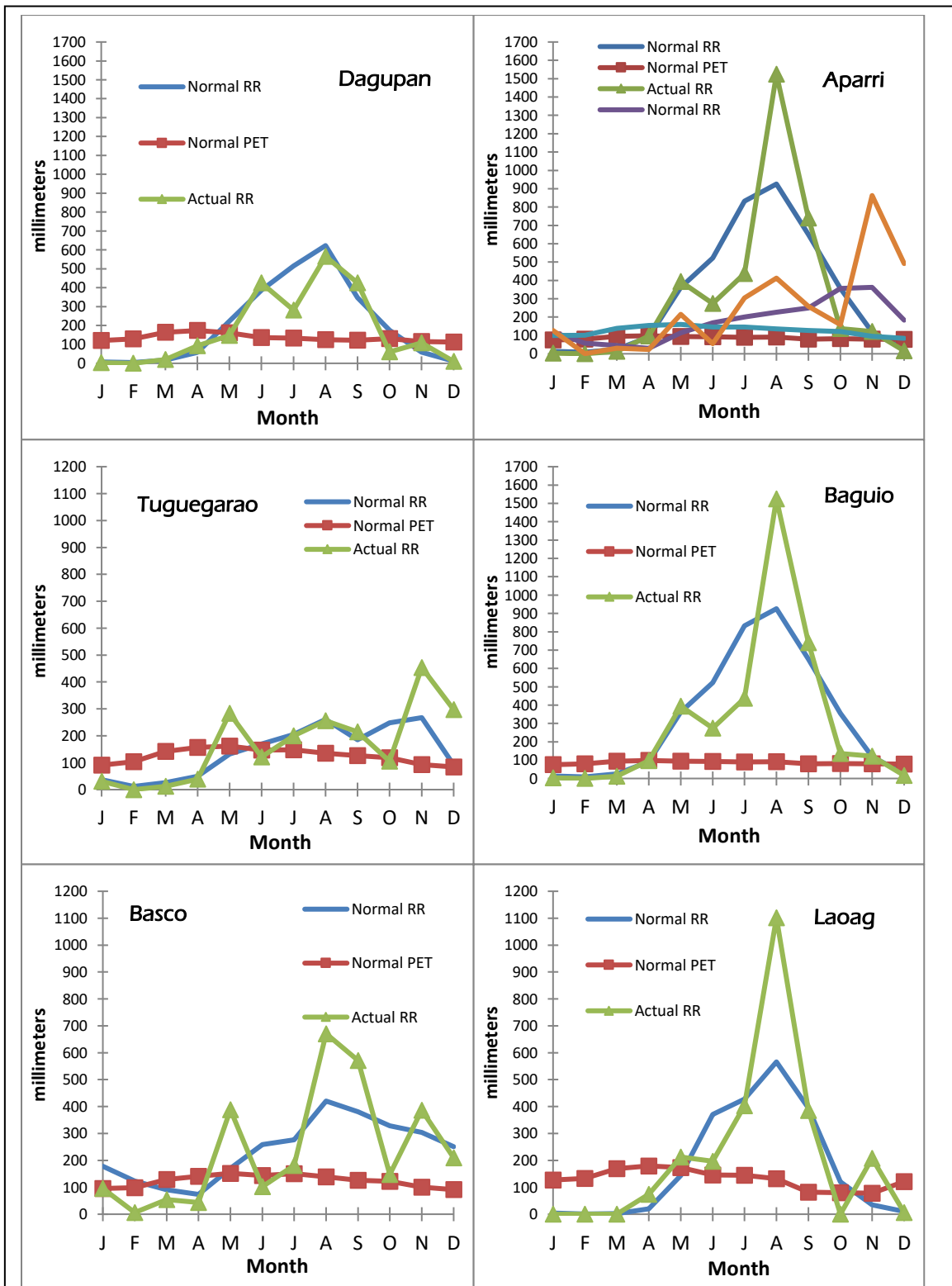
**FIG. 3.0 TEN DAYS ACTUAL RAINFALL DISTRIBUTION IN THE PHILIPPINES for the month of DECEMBER 2019**



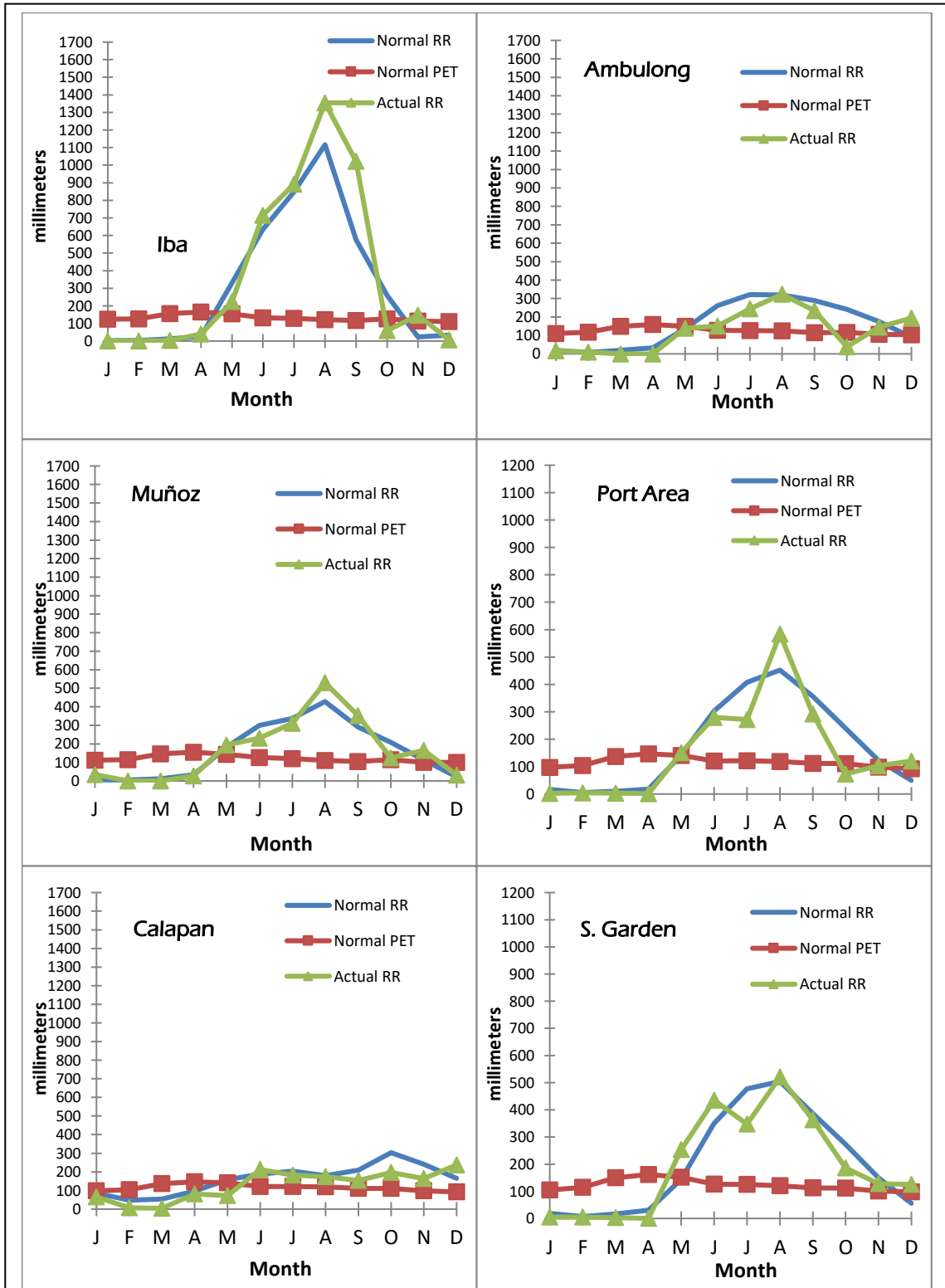
**FIG. 4.0 RAINFALL IN THE PHILIPPINES for the month of DECEMBER 2019**



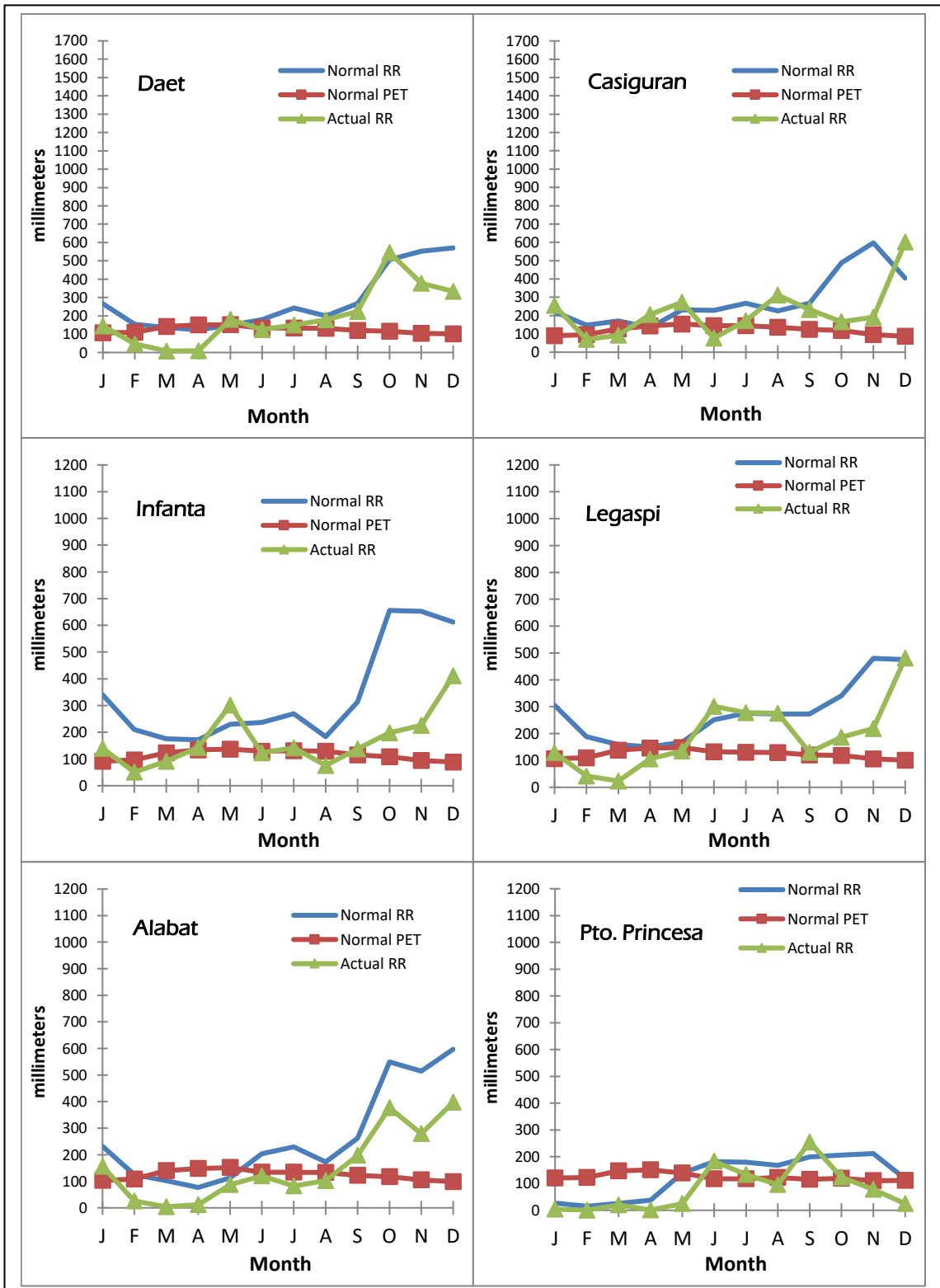




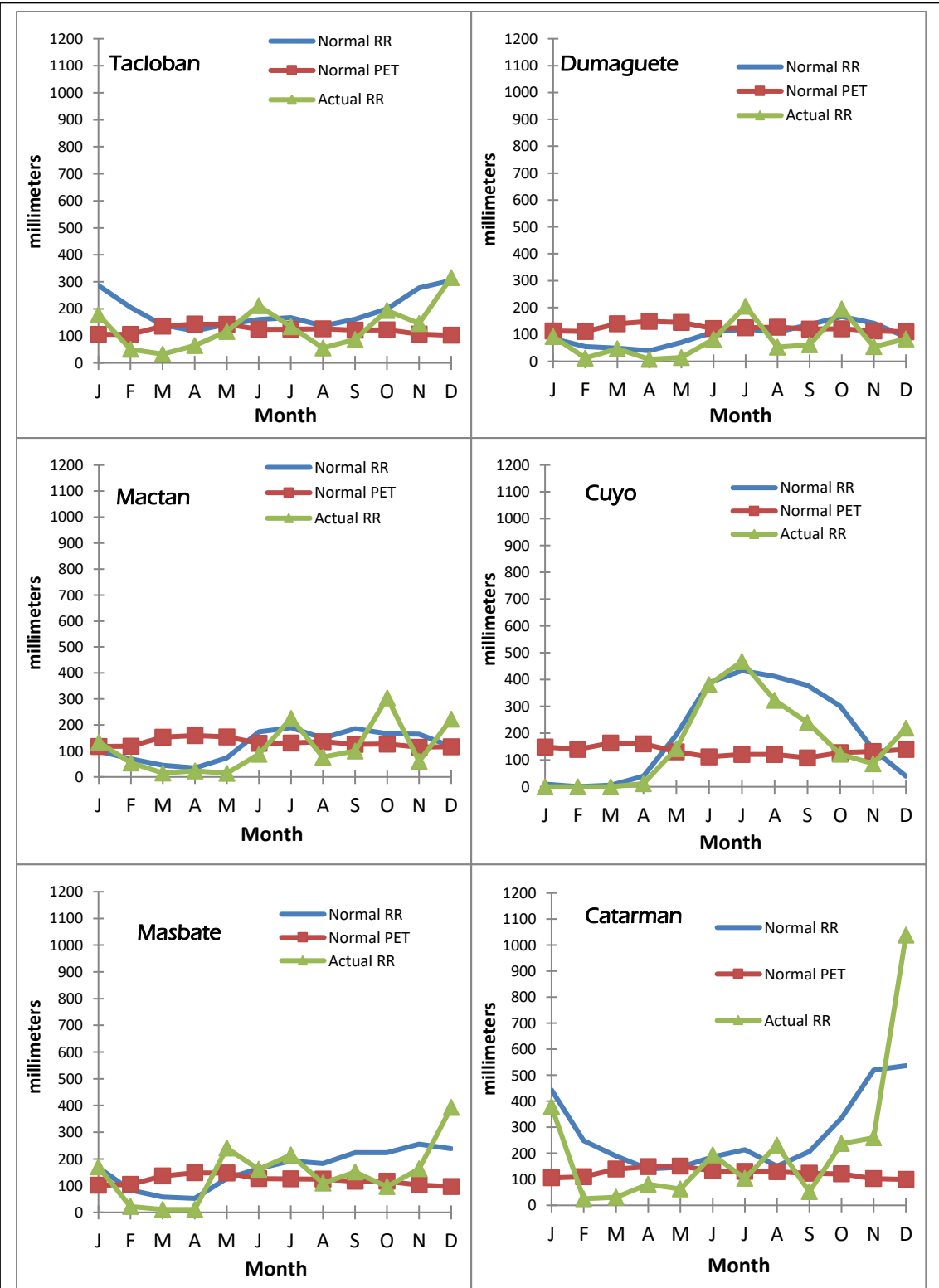
**Fig. 5.0 Comparison of normal rainfall and potential evapotranspiration with the actual monthly rainfall at Laoag, Basco, Baguio, Aparri, Dagupan, and Tuguegarao.**



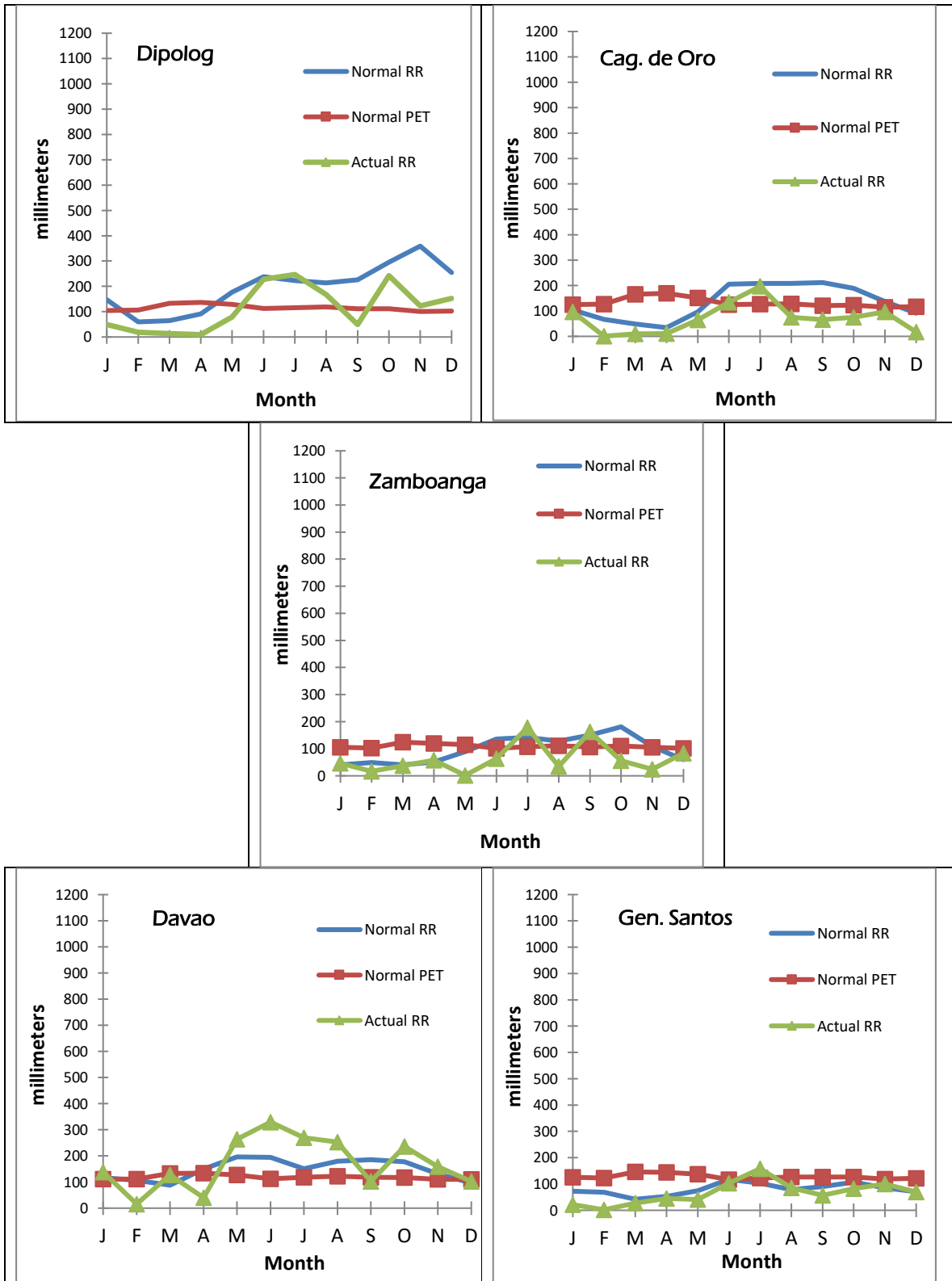
**Fig 5a. Comparison of normal rainfall and potential evapotranspiration with the actual monthly rainfall at Iba, Ambulong, Muñoz, Port Area, Calapan, and Science Garden.**



**Fig. 5b. Comparison of normal rainfall and potential evapotranspiration with the actual monthly rainfall at Daet, Casiguran, Infanta, Legaspi, Alabat, and Puerto Princesa.**



**Fig. 5c. Comparison of normal rainfall and potential evapotranspiration with the actual monthly rainfall at Cuyo, Masbate, Mactan, Tacloban, Catarman and Dumaguete.**



**Fig 5d. Comparison of normal rainfall and potential evapotranspiration with the actual monthly rainfall at Davao, General Santos, Zamboanga, Cagayan de Oro, and Dipolog.**