Princess Chulabhorn Science High School Trang.

Model Forecasting of the number of Dengue Fever Diseases in trang during the El Niño phenomenon.

MEMBERS

Thanapat parichatnon

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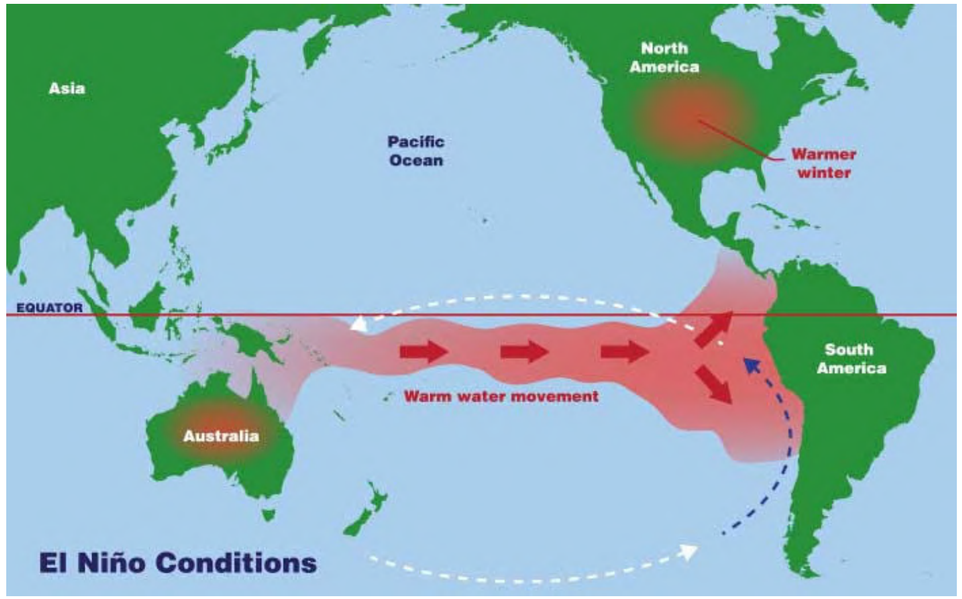
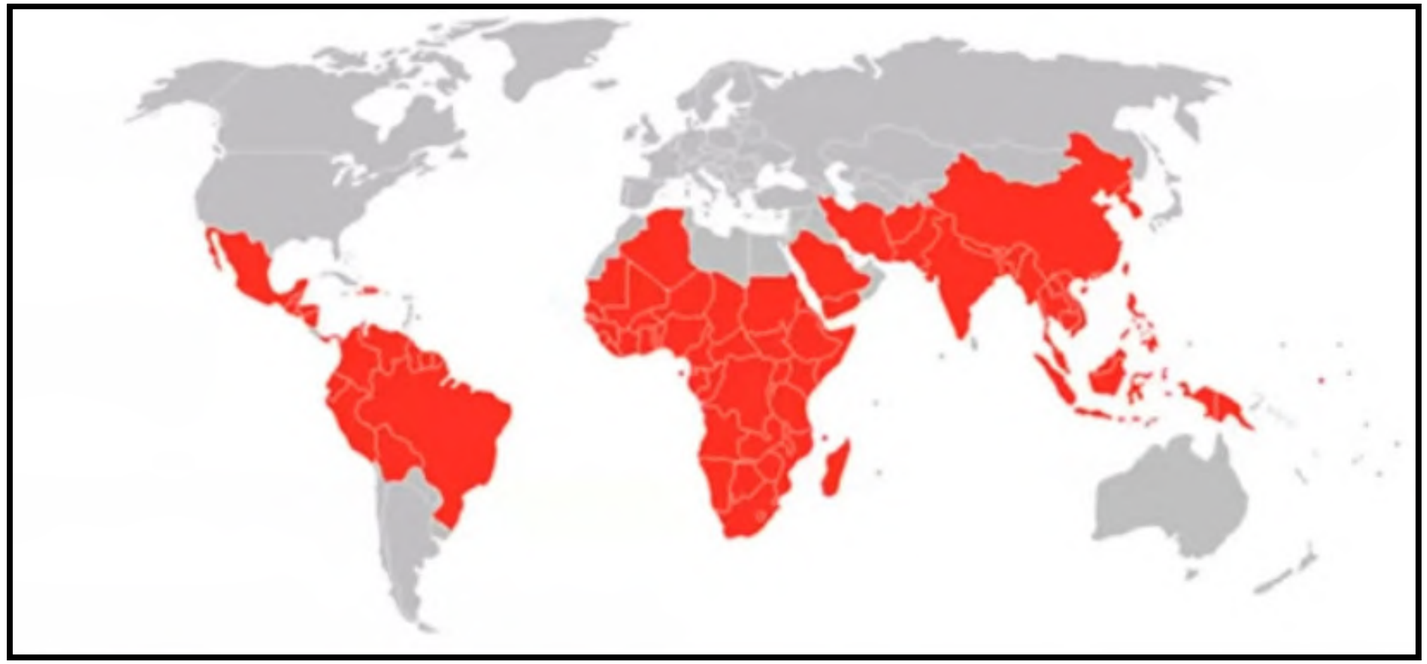
Introduction



(From https://www.cpc.ncep.noaa.gov/affect El Niño)

The area was affected by El Niño.



(From https://groups.google.com/forum/#!forum/rworldmap)

Areas with Risk of Dengue

Research Questions

1. Does the occurrence of the El Niño phenomenon increase the incidence of dengue fever in Trang Province?

2. What weather factors are related to the incidence of dengue fever in Trang Province?

3. Can the Deep Learning model from ARIMAX (1,1,1) accurately predict the number of dengue fever cases in Trang Province in the future? How?

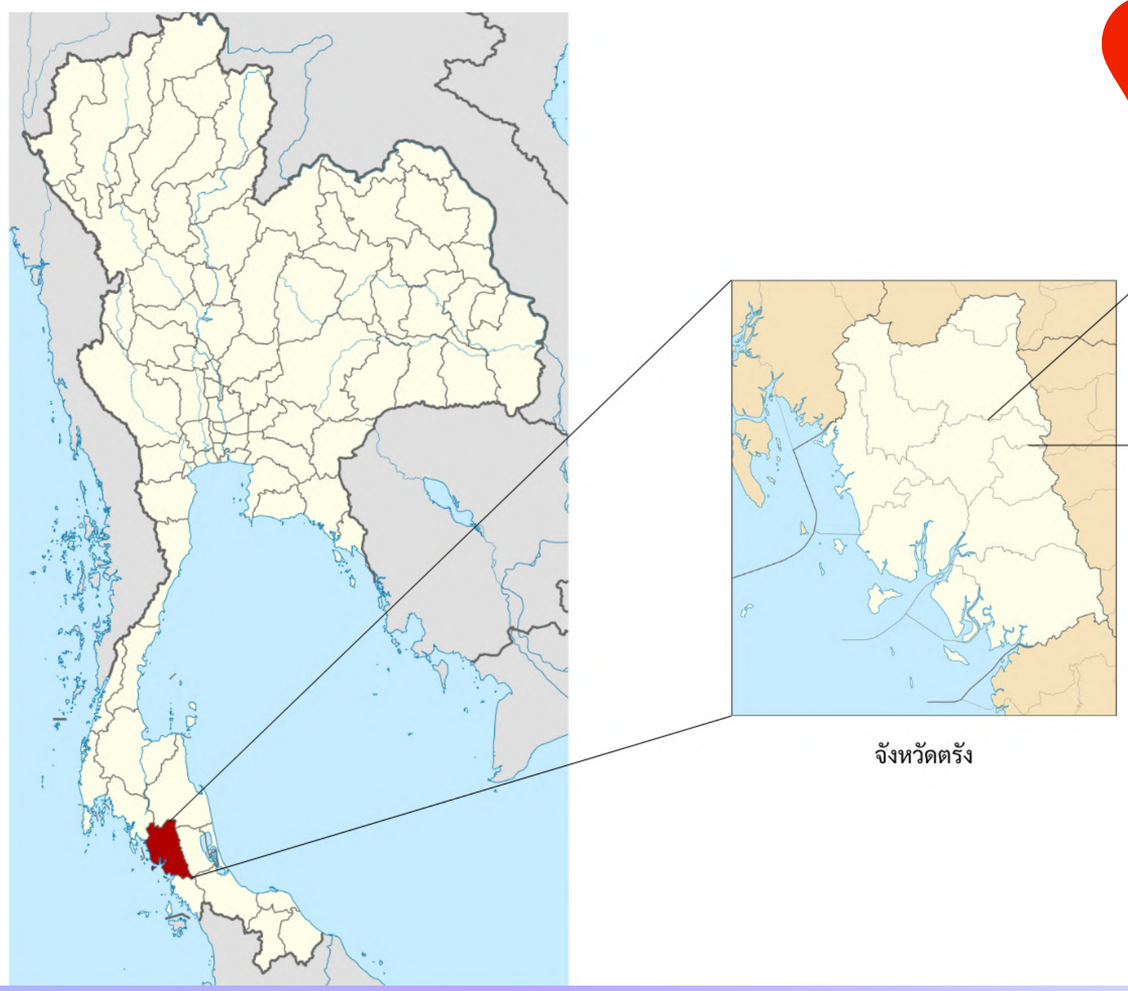
Hypotheses

1. The occurrence of the El Niño phenomenon causes the rate The incidence of dengue fever in Trang Province has increased.

2. Highest air pressure. and average air pressure It has the greatest impact on the incidence of dengue fever in Trang Province.

3. The Deep Learning model from ARIMAX (1,1,1) can accurately predict the number of dengue fever cases in Trang Province in the future.

Study Sites



จังหวัดตรัง

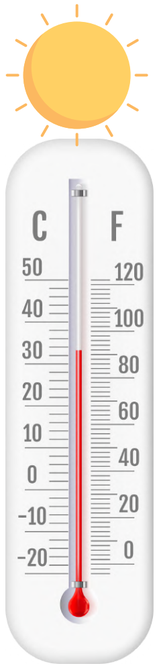
Meteorological Department Trang

Specify one study point for weather data including temperature, humidity, air pressure, wind speed, and rainfall.

Collection and compilation of weather data

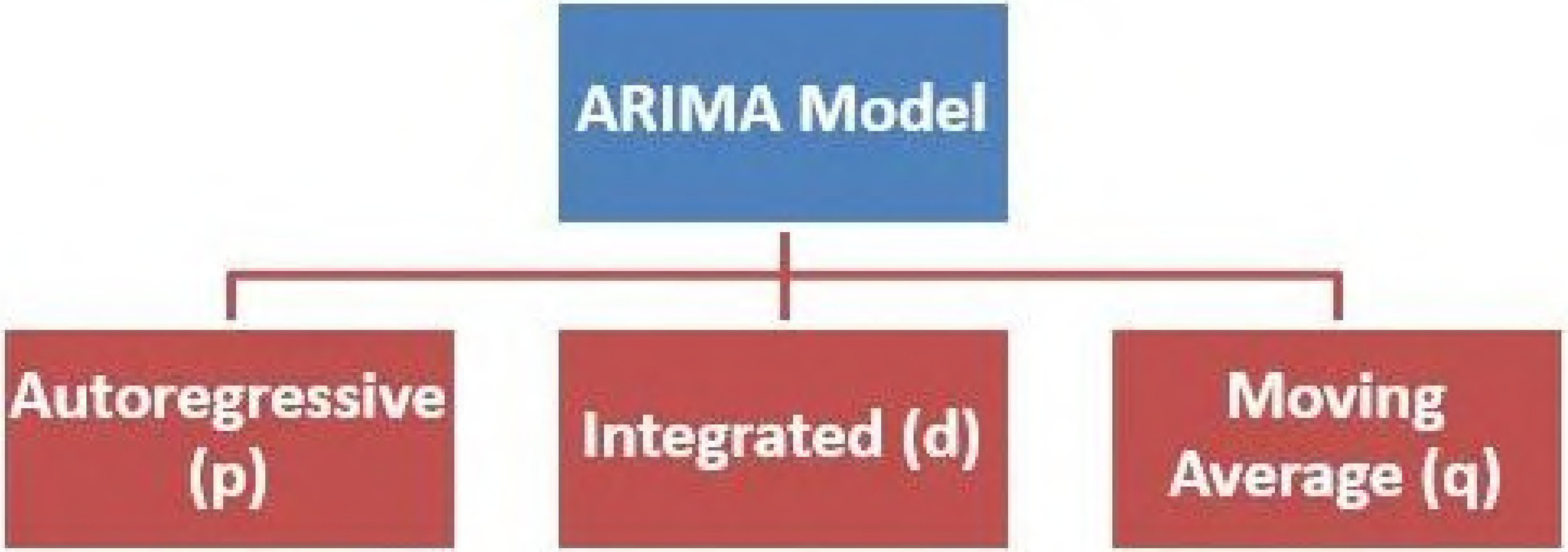
Excel

Pearson's Correlation Coefficient



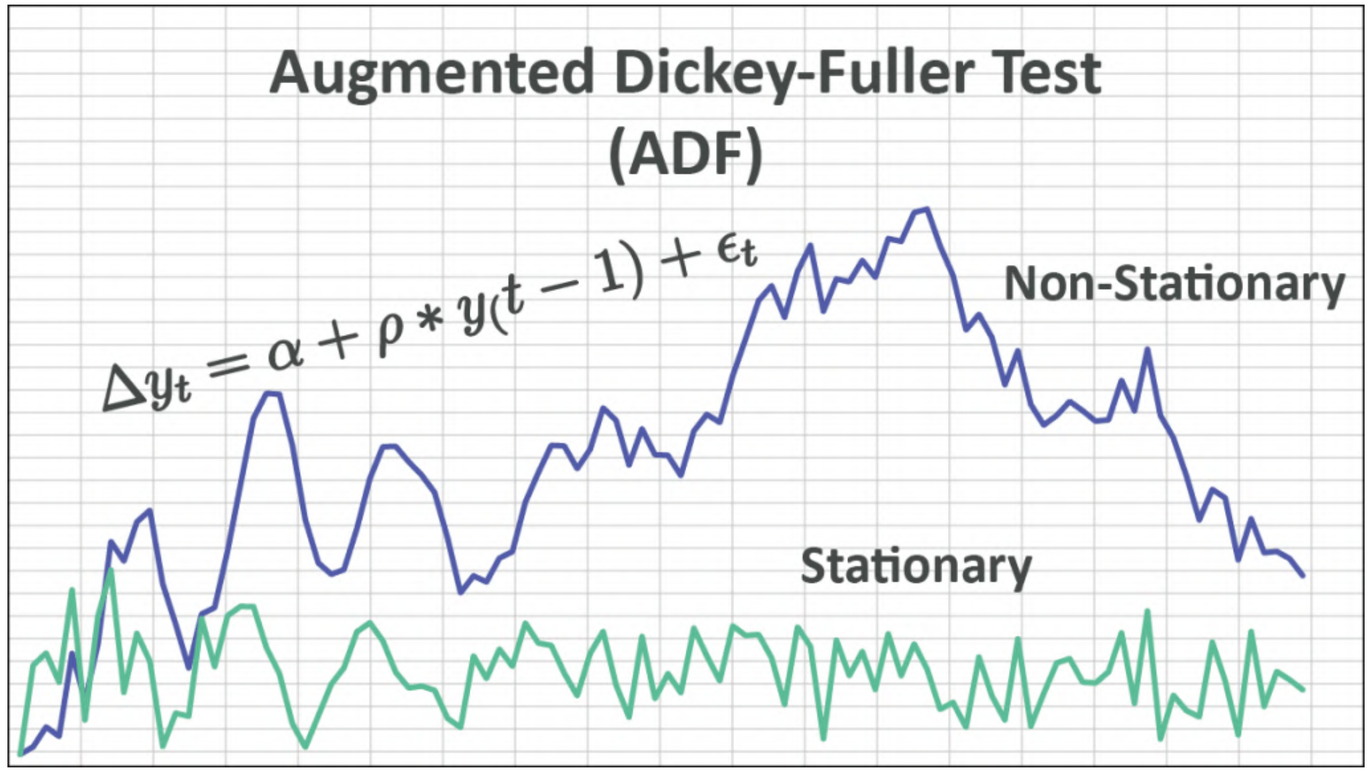
(From https://cementconcrete.org/water-resources/hydrology/rain-gauge/2637/)

Creating a Deep Learning model from ARIMAX (1,1,1)



(From https://www.researchgate.net/figure/Parameters-of-the-ARIMAX-4-1-2-model_tbl2_356173081)

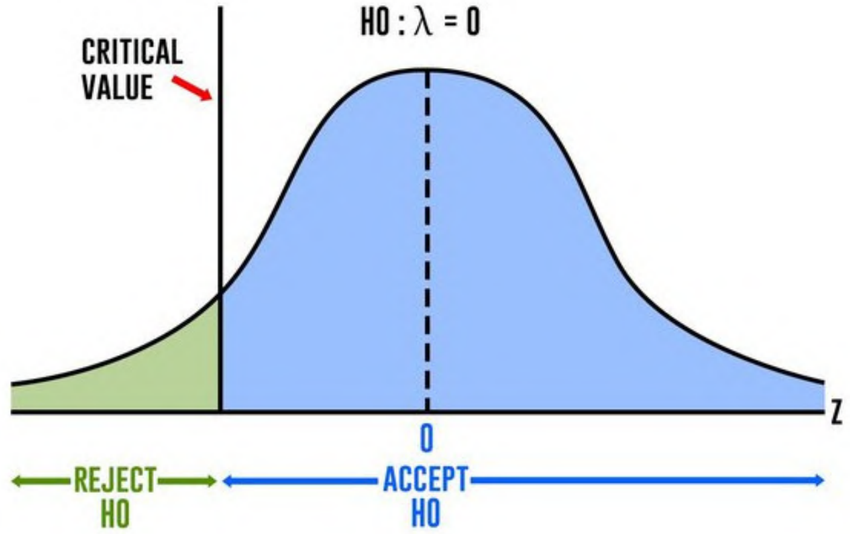
Check the consistency of patient number data.



(From https://spureconomics.com/adf-test-augmented-dickey-fuller-equation/)

ADF test

Augmented Dickey-Fuller (ADF) test



(From https://www.quora.com/What-is-an-Augmented-Dickey-Fuller-test)

Results

Test Statistic: -2.686707 p-value: 0.076367

ARIMAX Modeling

SARIMAX Results

Dep. Variable:	Blood Loss Patients	No. Observations:	9
Model:	SARIMAX(1, 1, 1)	Log Likelihood	-48.194
Date:	Sat, 02 Mar 2024	AIC	104.388
Time:	15:40:00	BIC	104.706
Sample:	0	HQIC	102.245
	- 9		
Covariance Type:	opg		

	coef	std err	z	P>|z|	[0.025	0.975]
Pressure(Mean)	-92.2622	48.764	-1.892	0.058	-187.837	3.313
ar.L1	0.9997	0.312	3.205	0.001	0.388	1.611
ma.L1	-0.9974	1.247	-0.800	0.424	-3.441	1.446
sigma2	1.002e+04	0.018	5.45e+05	0.000	1e+04	1e+04

Ljung-Box (L1) (Q):	0.00	Jarque-Bera (JB):	0.60
Prob(Q):	1.00	Prob(JB):	0.74
Heteroskedasticity (H):	7.68	Skew:	-0.58
Prob(H) (two-sided):	0.13	Kurtosis:	2.32

ARIMAX(p, d, q)

$$Y_t = \underbrace{dif_d}_{\text{Integration}}\Big(\overbrace{\textstyle\sum_i^p \Phi_i Y_{t-i}}^{\text{Endogenous Autocorrelation (AR)}} - \underbrace{\textstyle\sum_j^q \varepsilon_{t-j}}_{\text{Residual Autocorrelation (MA)}}\Big) + \overbrace{\zeta(X_t)}^{\text{Exogenous Model}} + c$$

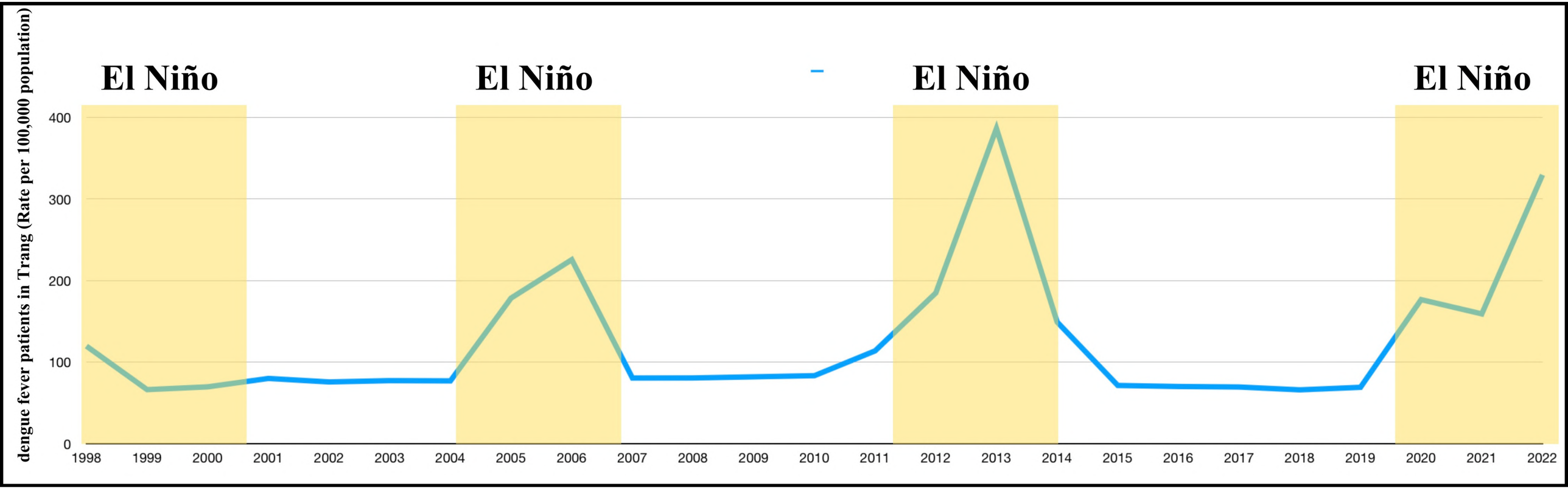
(From https://www.investopedia.com/terms/a/autoregressive-integrated-moving-average-arima.asp)

The coefficient for Pressure(Mean) is -92.2622 p-value of 0.058.

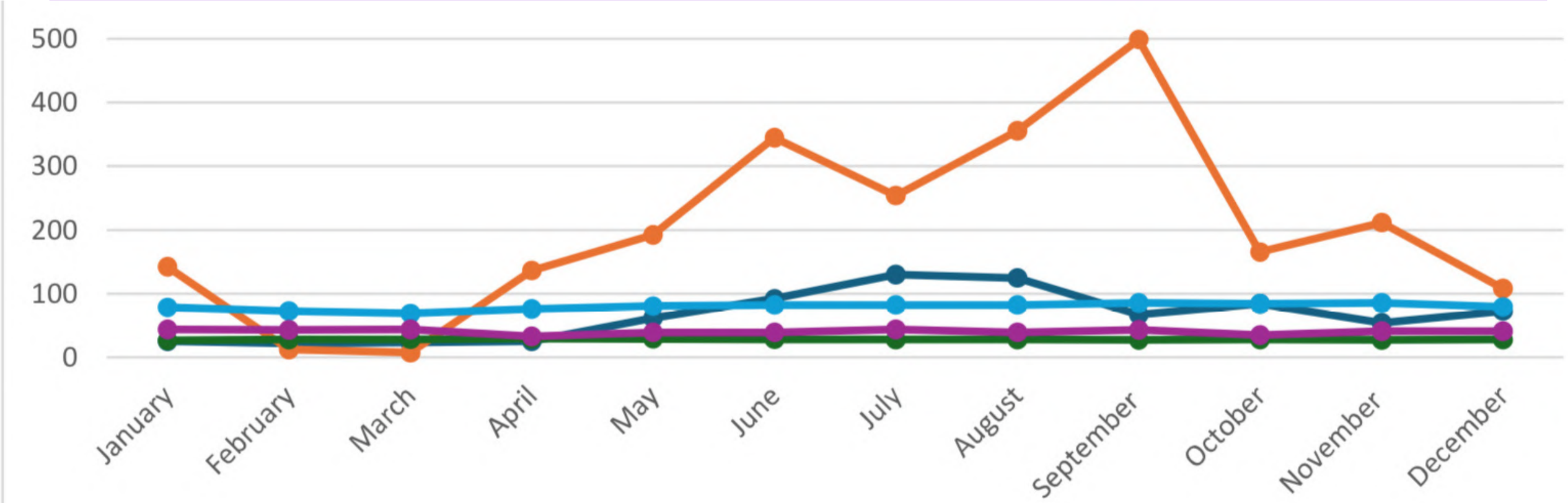
Parameters AR and MA have p-values less than 0.05.

Results

Results of the study of the occurrence of the El Niño phenomenon and the incidence of dengue fever. In Trang Province It is as in Graph



The results of weather studies include temperature, humidity, rainfall and wind speed. with the number of dengue fever patients of Trang Province in 2023 is as shown in the graph.



The dark blue line graph shows the number of patiens(people). The orange line graph shows rainfall(millimeter) .
The green line graph shows temperature(degree celsius). The blue line graph shows humidity(%).
The purple line graph shows wind speed (km/h).

When the data was analyzed for the relationship between weather data and the rate of dengue fever cases with the Pearson's Correlation Coefficient using the SPSS program, there was a value According to Table

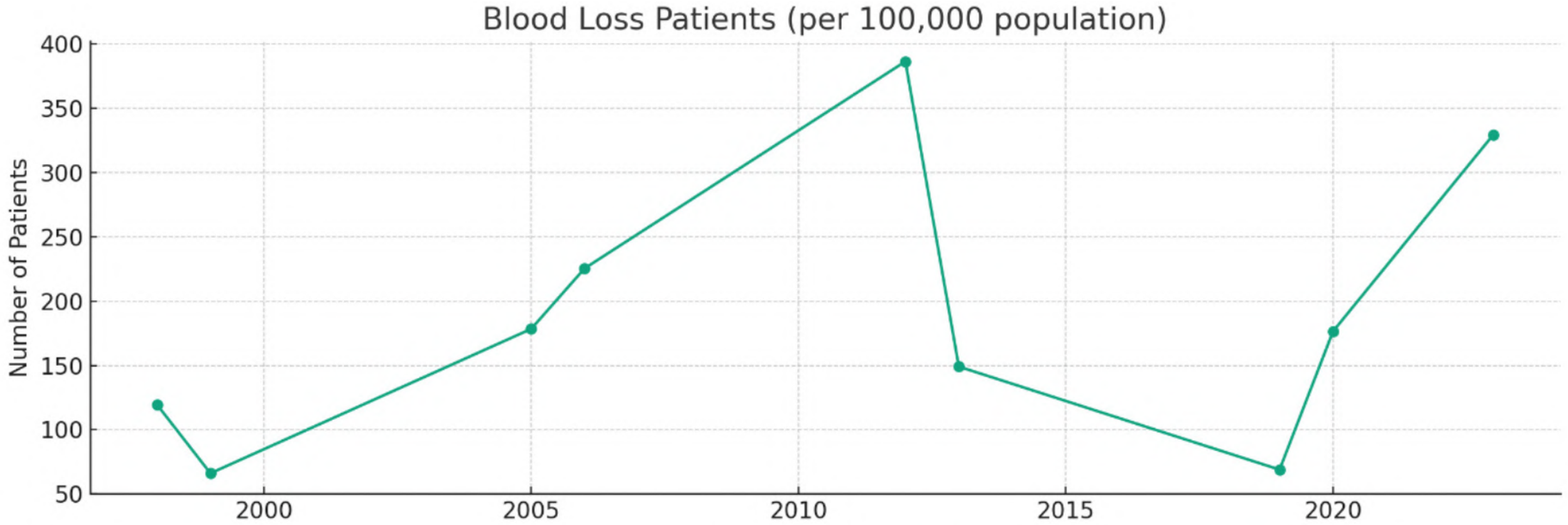
Correlations

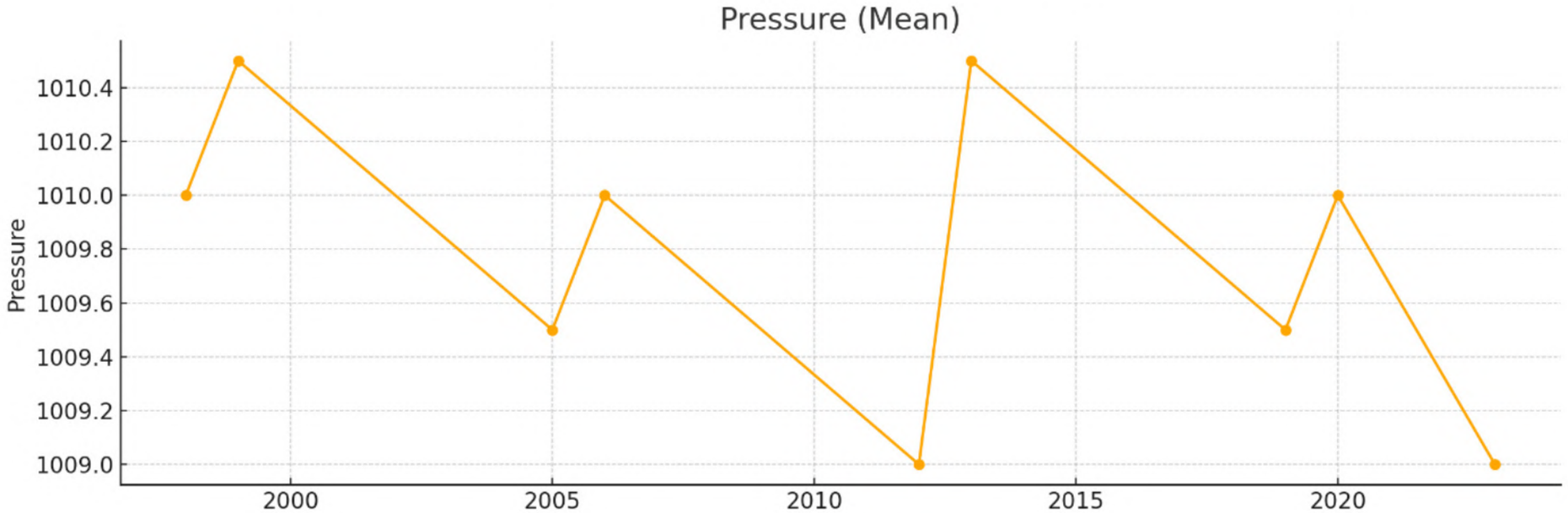
		MaxRain	MeanRain	MinRain	MaxPress	MeanPress	MinPress	MaxWin	MeanWind	MinWind	MaxHumidity	MeanHumidity	MinHumidity	MaxTemp	MeanTemp	MinTemp
Patients	Pearson Correlation	-.354	-.261	.022	-0.66	-.714*	.016	.510	.533	.543	-.111	.120	-.264	.537	.533	.533
	Sig. (2-tailed)	.349	.497	.955	.043	.031	.967	.160	.140	.131	.777	.758	.493	.136	.140	.140
	N	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

**. Correlation is significant at the 0.01 level (2-tailed).

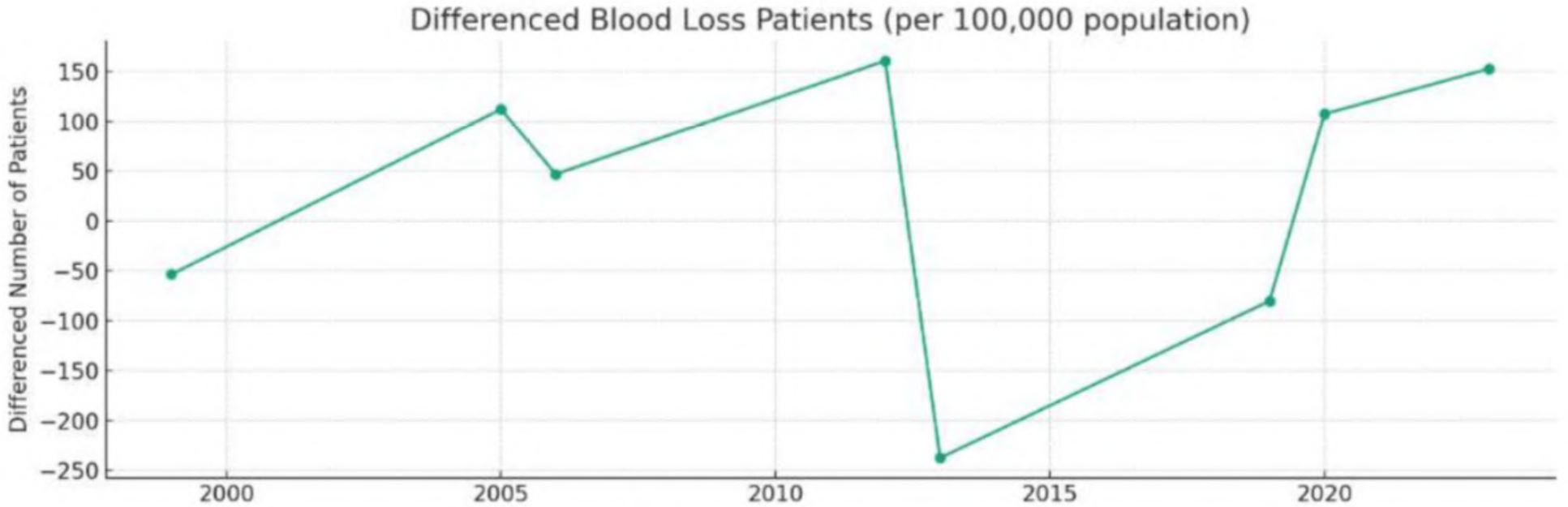
*. Correlation is significant at the 0.05 level (2-tailed).

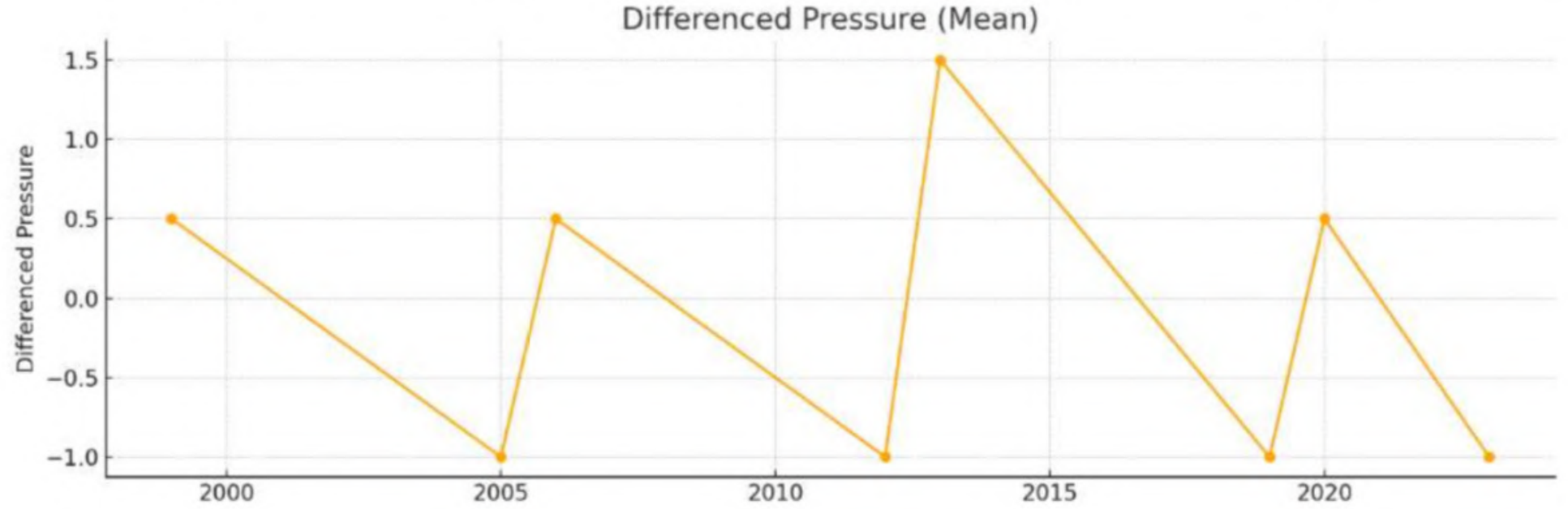
Results of the study of creating equations to predict the number of patients. Using ARIMAX Checking the consistency of the data



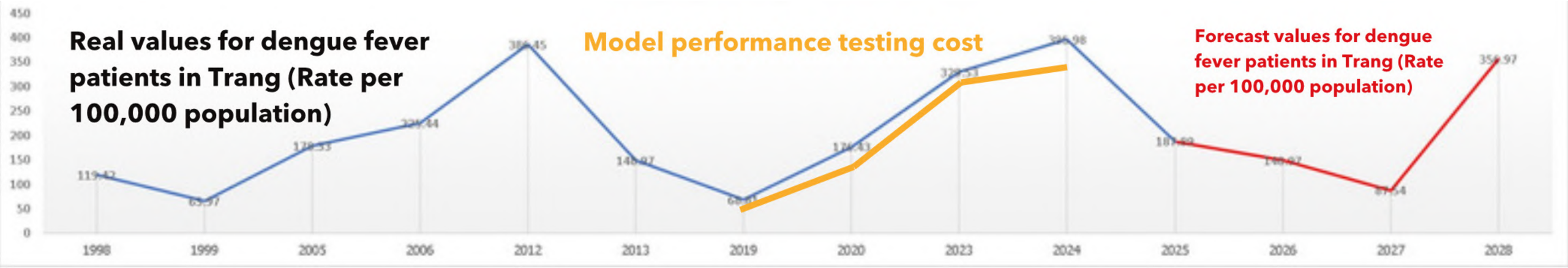


Checking the consistency of the data





The graph shows the study of data from Model ARIMAX that shows the number of dengue fever cases in waves from 1998-2024 and predicts the number of dengue fever cases that will occur in 2025-2028 from the El Niño phenomenon as shown in the graph.



The blue line graph shows the number of people. Suffering from dengue fever Information from the Trang Provincial Public Health Office

The red line graph is the forecast for the number of dengue patients from the program from 2025 to 2028.

The yellow line graph is an estimate of the accuracy of the ARIMAX model to compare with the actual value in the period 2019-2023.

Summary

1. El Niño and Dengue Fever: Data analysis from 1998 to 2022 showed an increase in dengue fever cases during El Niño years

2. 2.Dengue Fever Trends: The model revealed a significant cyclical pattern in dengue fever cases corresponding to climate changes. The number of cases increased from 1999 to 2012, decreased sharply from 2012 to 2019, and increased again from 2019 to 2024.

3. 3. Predicted Dengue Fever Cases: Based on the observed trends and El Niño predictions, a decrease in dengue fever cases is expected from 2025 to 2027, followed by an increase from 2027 to 2028 due to a new El Niño event.

References

Ministry of Health (Myanmar). (2022). **Coordination Meetings in 2022 for Preventing Dengue Outbreaks and Monitoring Monkeypox Epidemic 2022.** From https://www.mohs.gov.mm/page/18212.

Ministry of Health (Myanmar). (2020) **National Strategic Plan for Dengue Prevention and Control 2016-2020. Nay Pyi Daw: Vector Borne Disease Control Programme 2016.** From http://mohs.gov.mm/ su/nzodH0.

World Health Organization (WHO). (2024). **Dengue in the South-East Asia 2023.** From https://www.who.int/southeastasia/health-topics/dengue- and-severe-dengue.

Thank you

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