A Model for Predicting Rainfall and Drought by Fuzzy Set Theory

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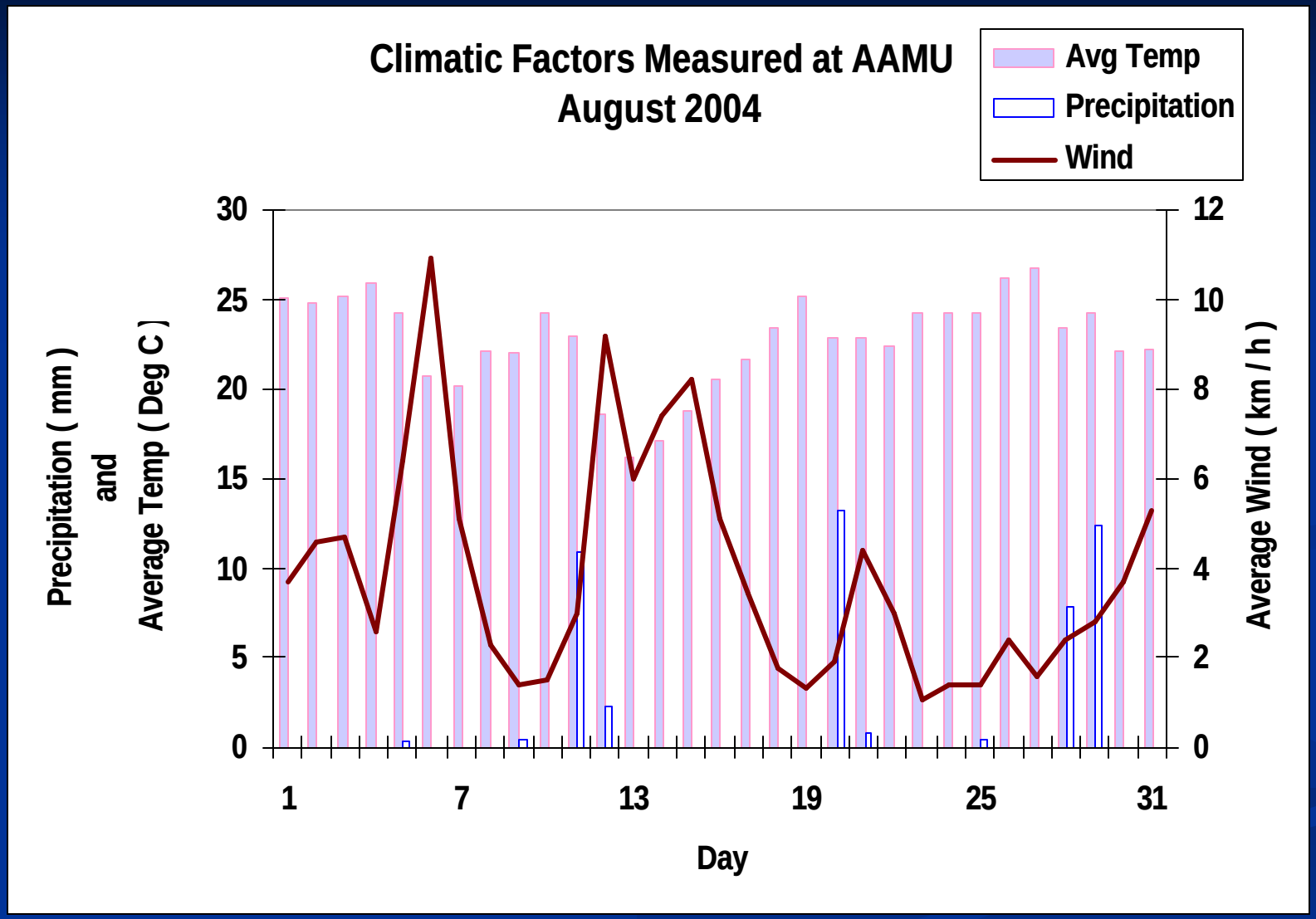
Data collections from

1. AAMU Campus

2. Bragg Farm

3. WATARS Farm


Climatic Factors Measured at AAMU
August 2004
Avg Temp
Precipitation
Wind
Precipitation (mm)
and
Average Temp (Deg C)
Average Wind (km / h)
30
25
20
15
10
5
0
12
10
8
6
4
2
0
1
7
13
19
25
31
Day

Conditions:

(1) Temperature i

If average temperature on ith day < temperature on (i-1) th day **Then** Temperature i is 1 else 0.

(2) Wind i

If Wind Speed on the ith day > Wind Speed on (I - 1)th day **Then** Windi-1 is 1 else 0

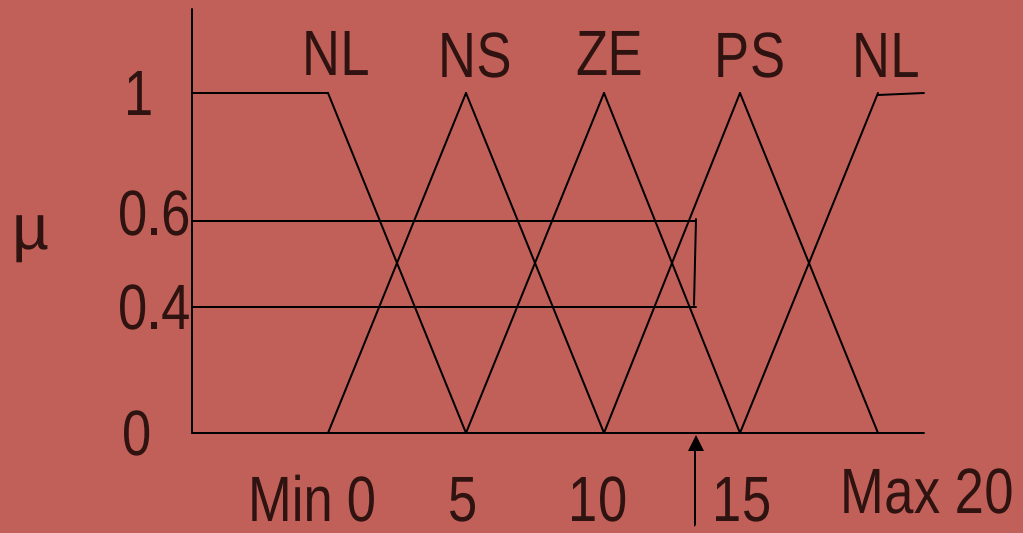
If results of conditions 1 and 2 are 1
Then
Rainfall i is 1 else 0

Basic Operations involved in the Modeling with Fuzzy Set Theory

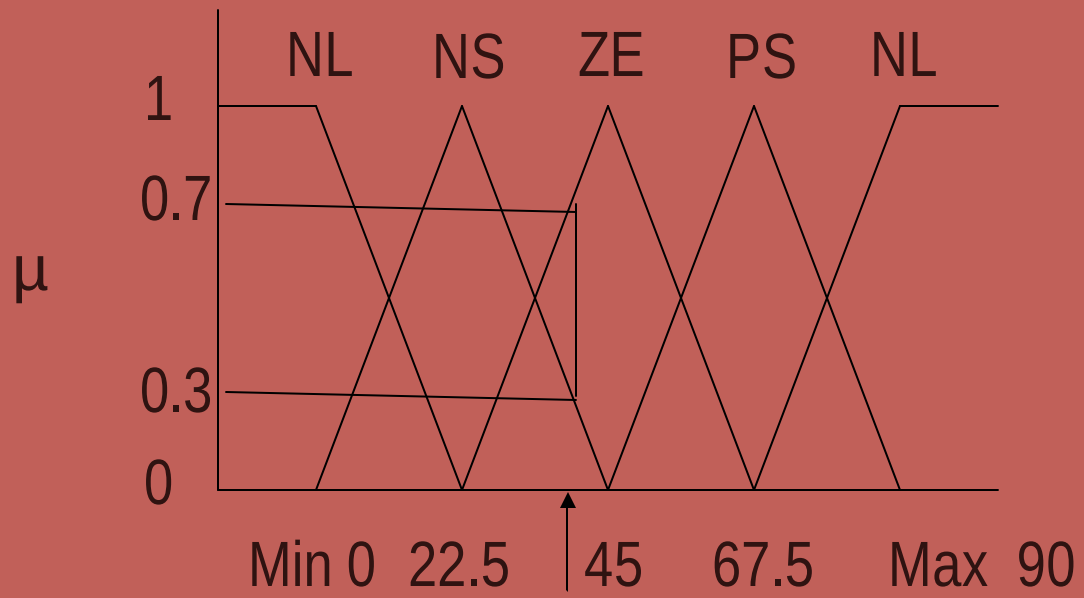
1. Fuzzification

2. Min-Max Composition

3. Defuzzification



Fuzzification of wind speed



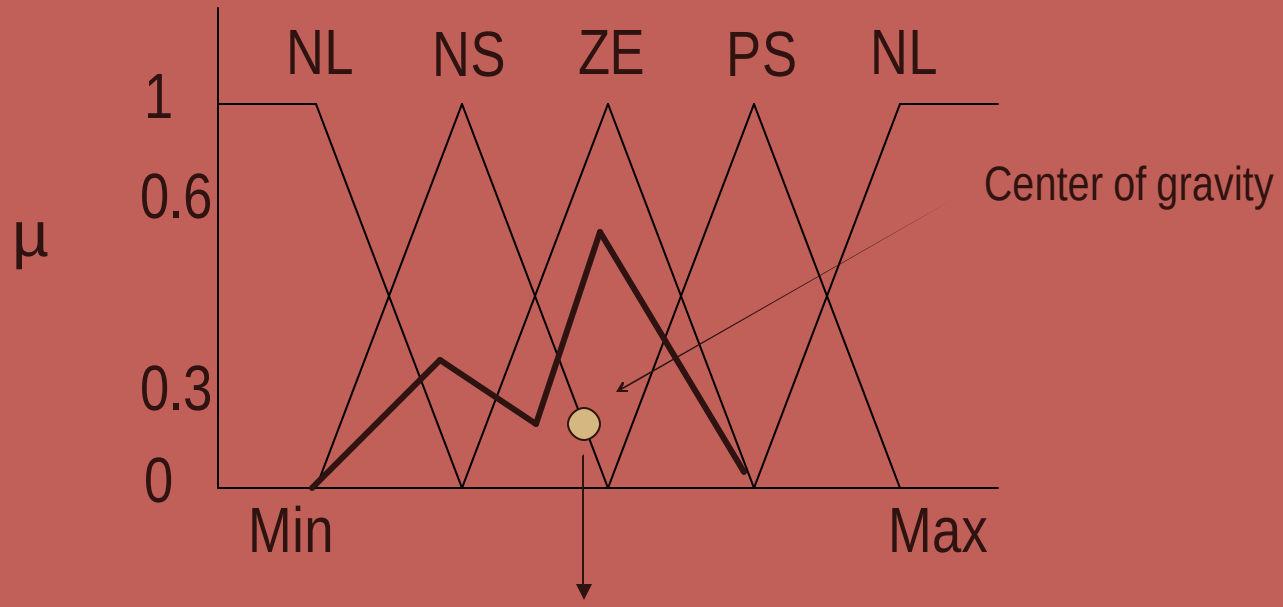
Fuzzification of average temperature

Wind Speed

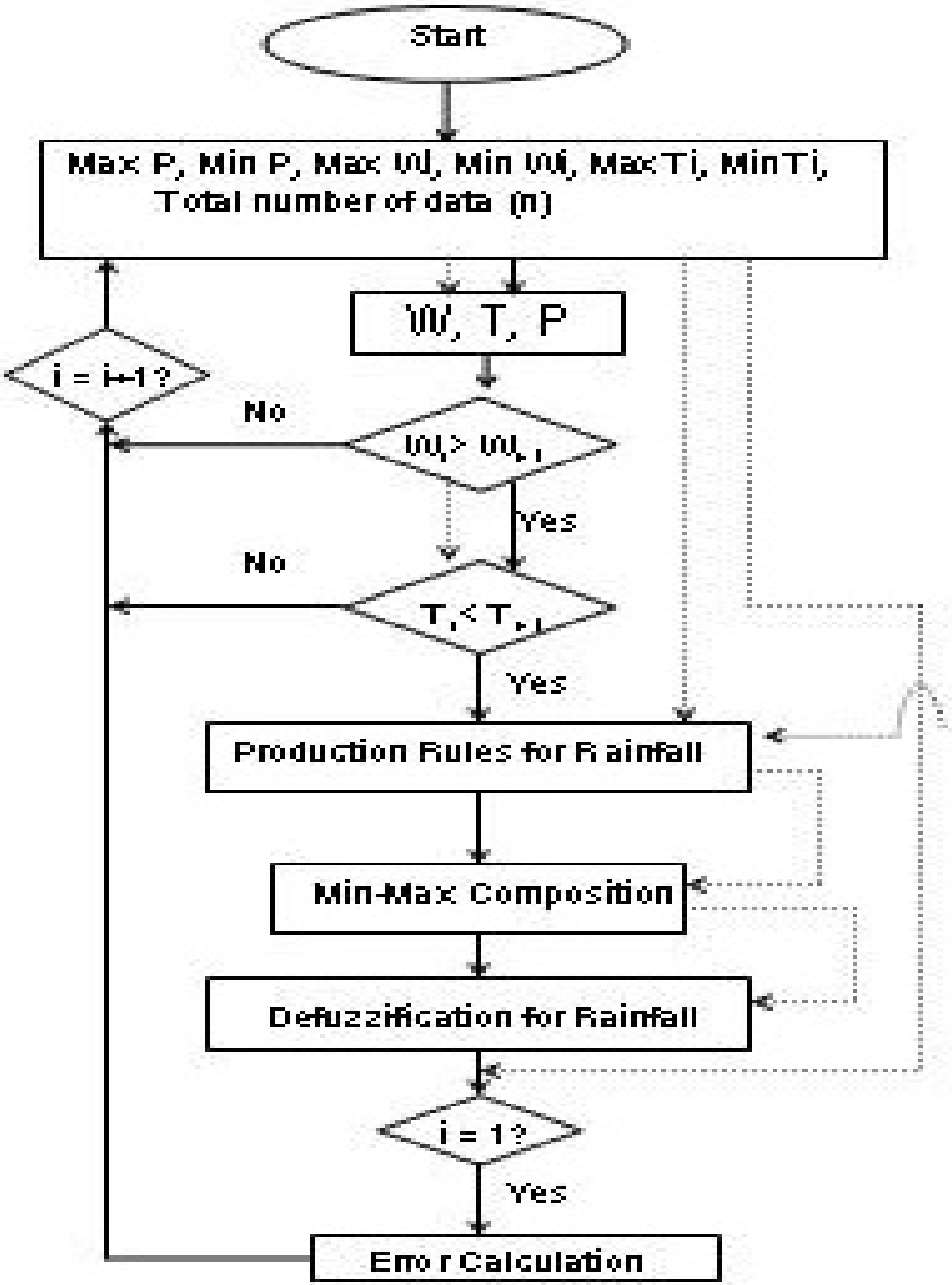
Temp

NL	NS	ZE 0.4	PS 0.6	PL
NS 0.3		NS 0.3	ZE 0.3	
ZE 0.7		ZE 0.4	ZE 0.6	
PS				
PL				

Min-Max Composition

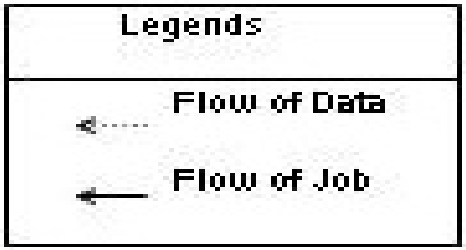


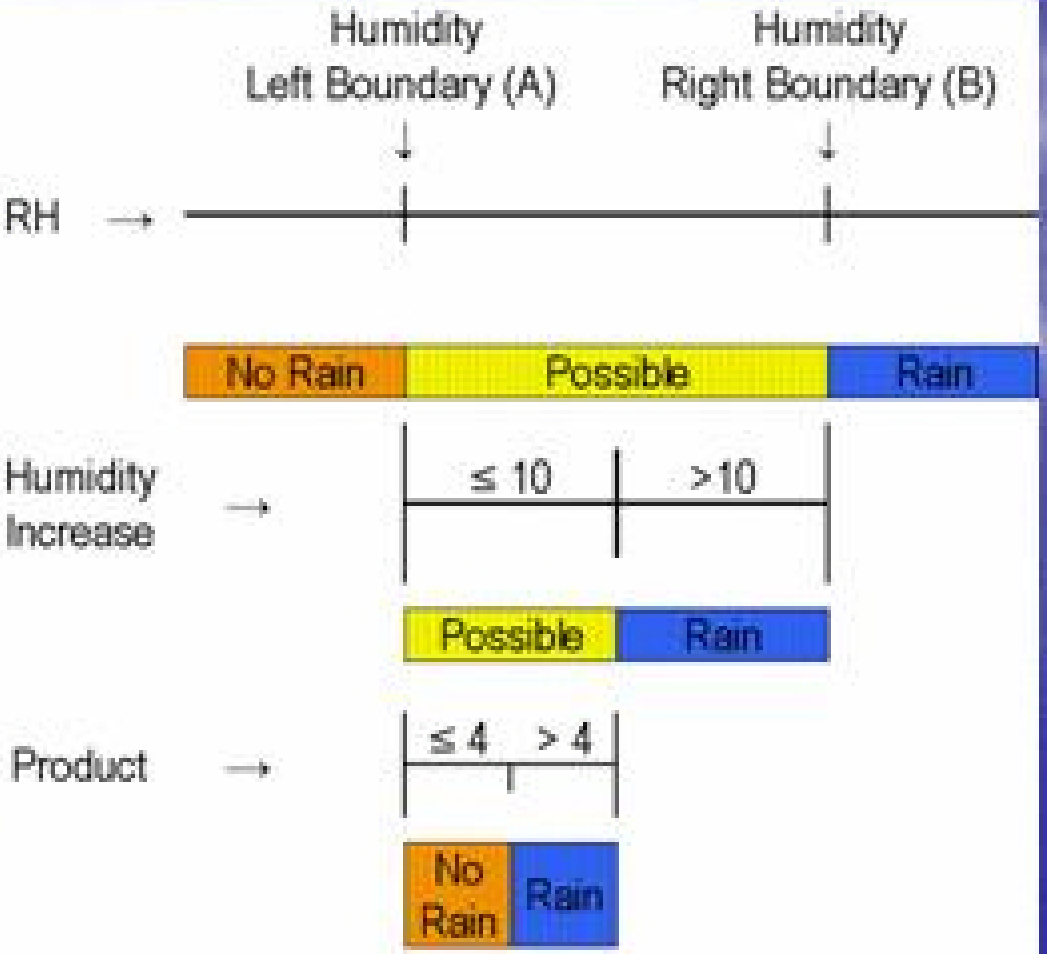
Defuzzification



Production Rules for Rainfall

T_i \ W_i	NL	NS	ZE	PS	PL
NL	NL	NL	NL	NS	NS
NS	NS	NS	NS	NS	NS
ZE	NS	NS	NS	NS	NS
PS	ZE	ZE	ZE	PS	PS
PL	PS	PS	PL	PS	PS





			A	B
Jan 1	to	Apr 30	70	85
May 1	to	Sep 30	80	90
Oct 1	to	Dec 31	75	90

$$Error1 = \frac{\sum_{i=1}^{n} Abs(R_{ac} - R_{cal})}{\sum_{i=1}^{n} R_{ac}} \times 100\%$$

Where

R_{ac} = Number of actual rainfall occurrences

R_{cal} = Number of rainfall occurrences by model

$$Error2 = \frac{\sum_{i=1}^{n} abs(R_{acam} - R_{Calam})}{\sum_{i=1}^{n} R_{acam}} \times 100\%$$

Where

R_{acam} = Actual rainfall amount

R_{calam} = Calculated rainfall amount

Wind Speed

1	2	3	4	5
NL	NS	ZE	PS	PL

Average Temperature

1	NL
2	NS
3	ZE
4	PS
5	PL

NL	NL	NL	NL	NL
NL	NL	NL	NL	NS
NL	NL	NL	NS	ZE
NL	NL	NS	NL	PS
NL	NS	ZE	PS	PL

AAMU

2004

Error 1 = 33.80%

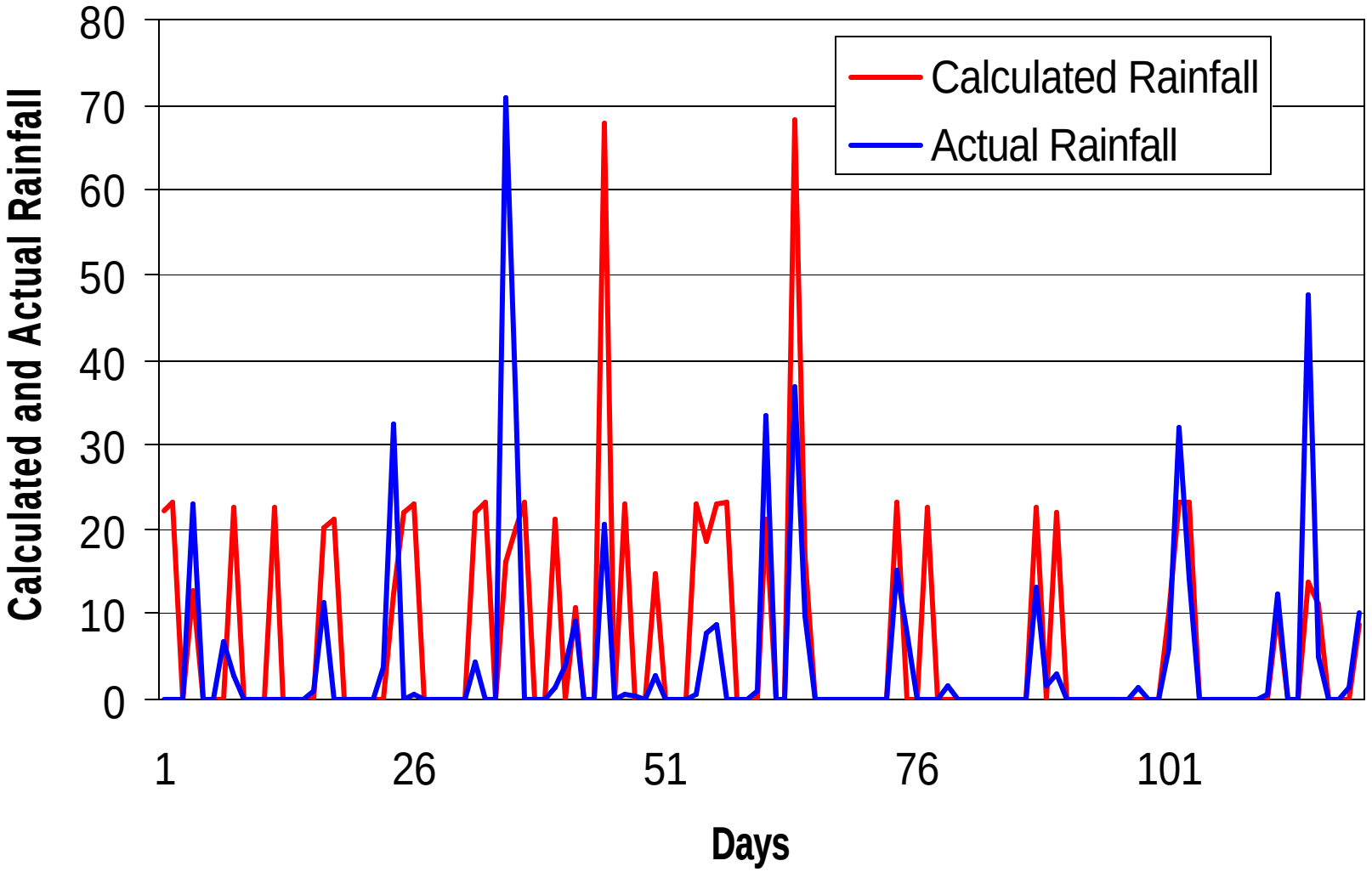
Error 2 = 35.89%

2005

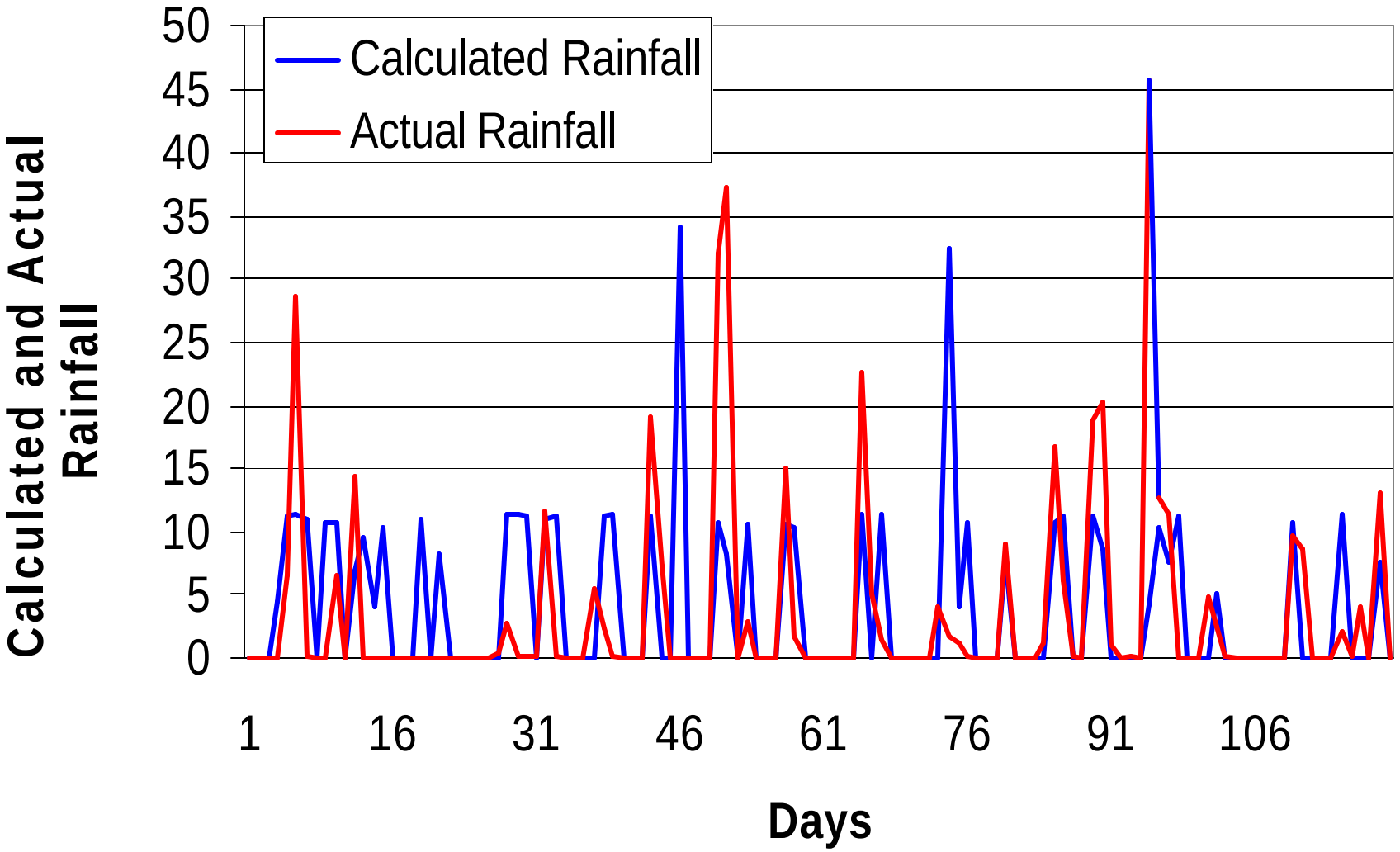
Error 1 = 35.20%

Error 2 = 4.90%

Actual and Calculated Rainfall
Jan to Apr AAMU 2004 Data



Calculated and Actual Rainfall
Jan to Apr AAMU 2005 Data



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