Precipitation Plots SET-1
Tunisia (Medjerda Basin)

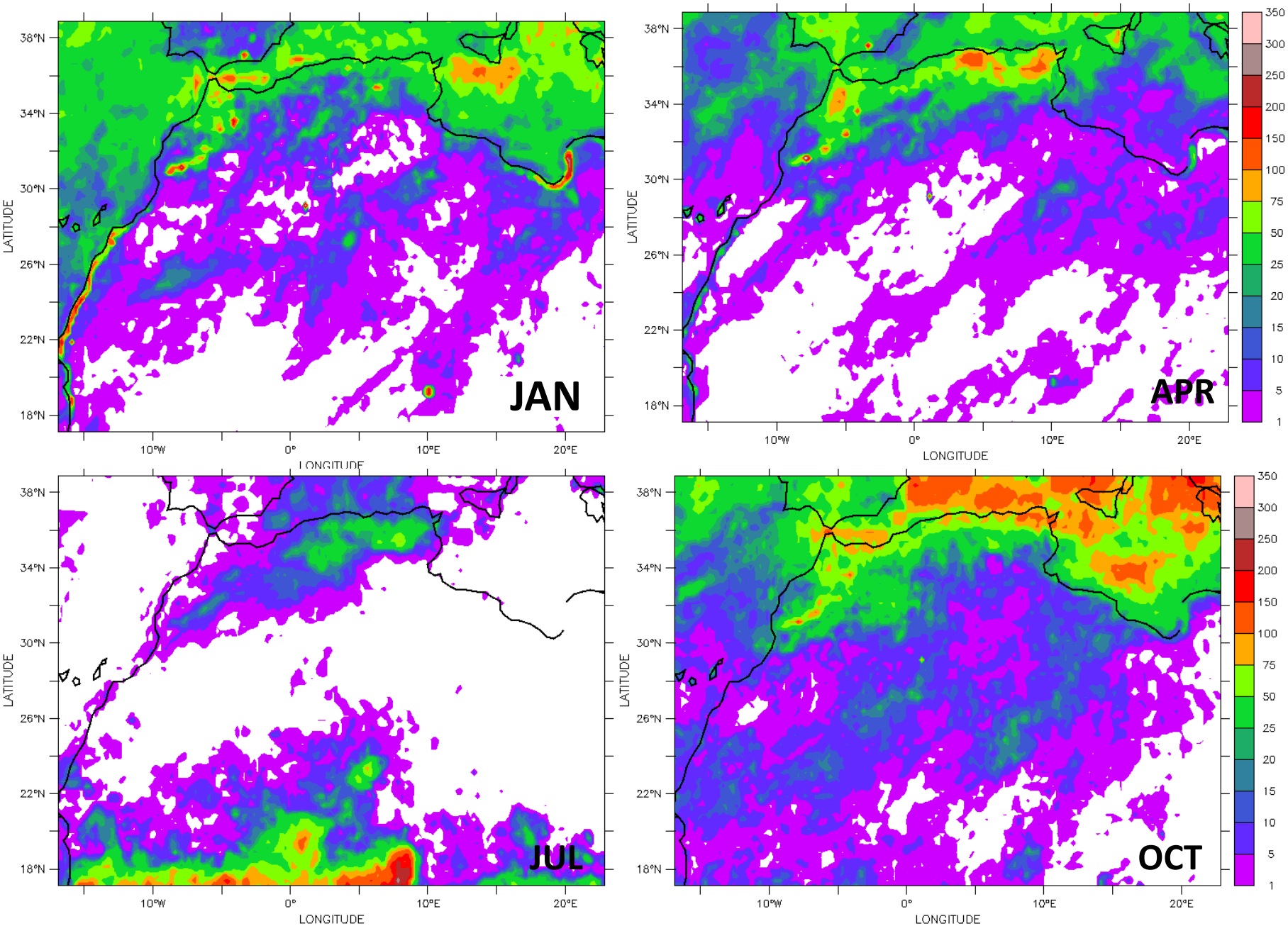
Kunhikrishnan Thengumthara
3/31/2014

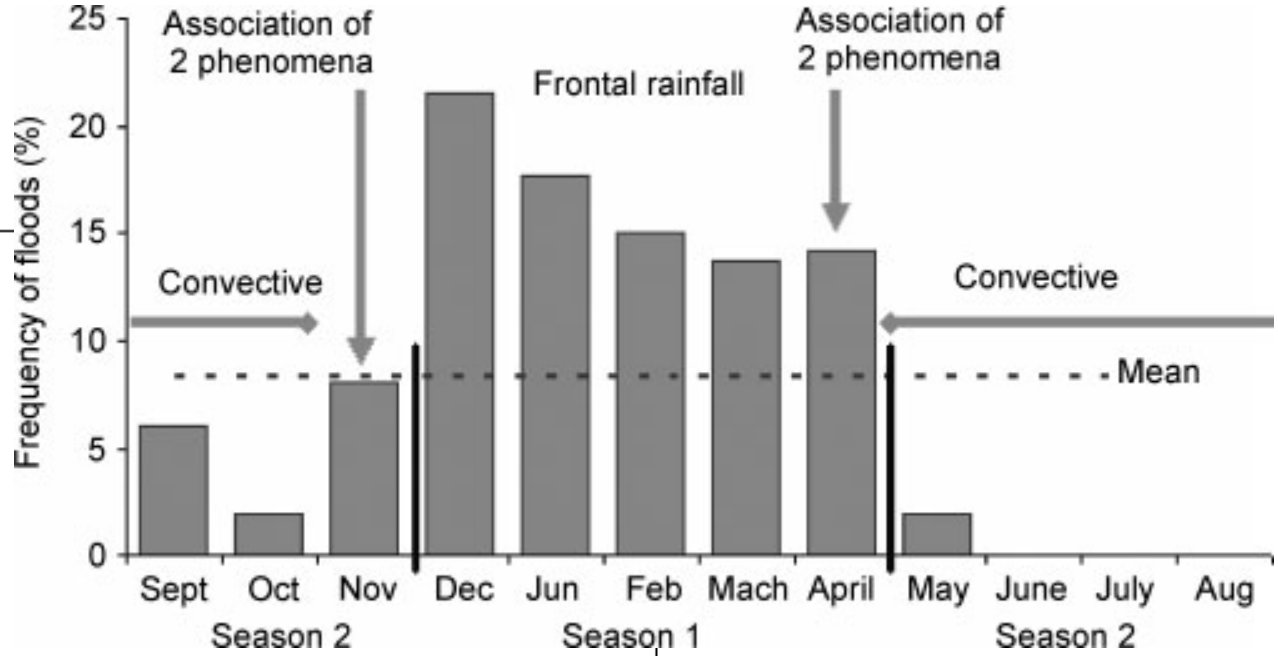
Medjerda : Rain-Gauge Stations

Rain-Gauge

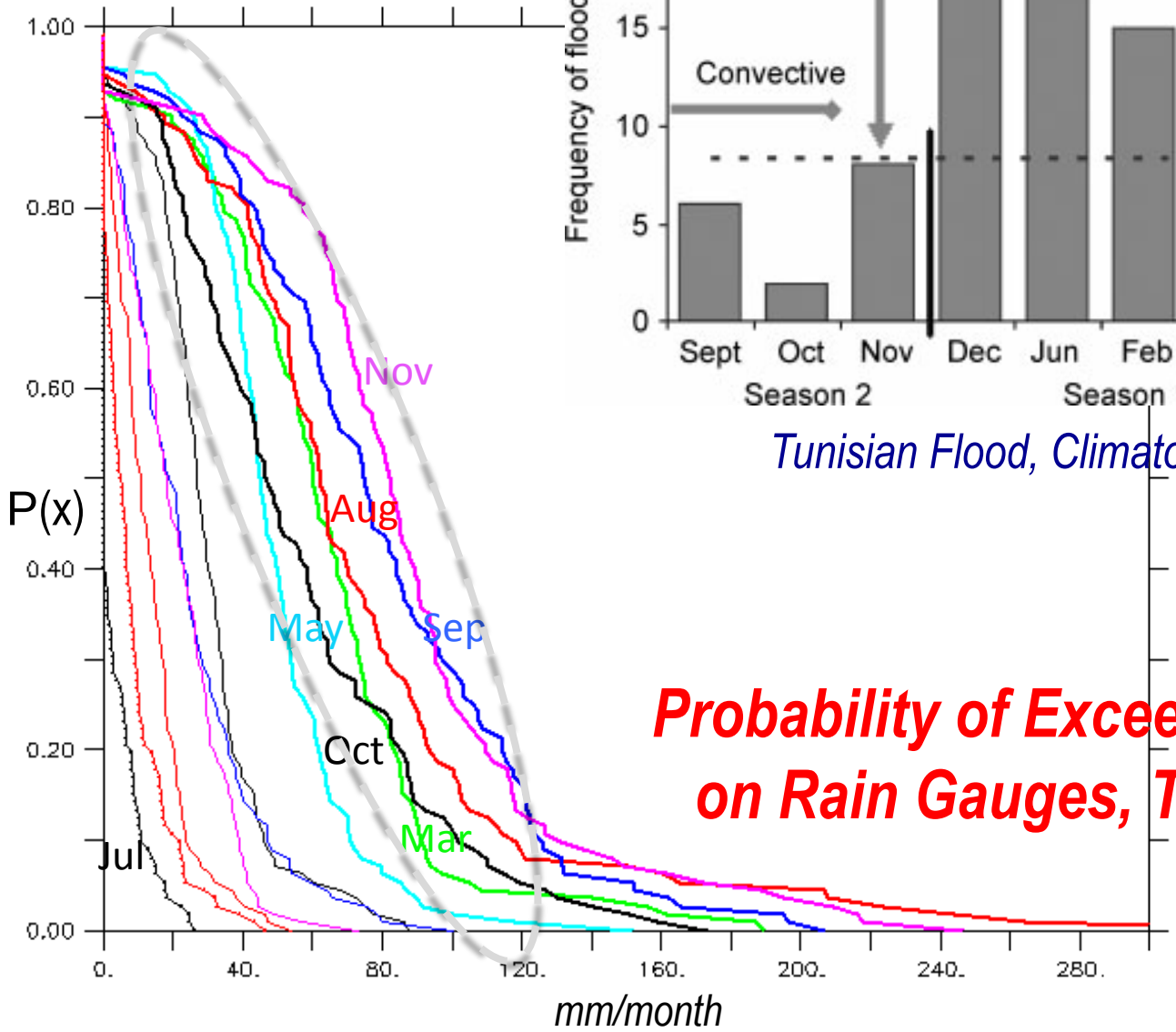
Rainfall Data Source: Tunisia
(Email dated January, March, July/2013, from Mr. Bacha Sinan
Remote Sensing Center, Tunisia)

MENAW, TMPA(3B42RT-V7R2) mean monthly (mm/month) Climatology (2007-2011)



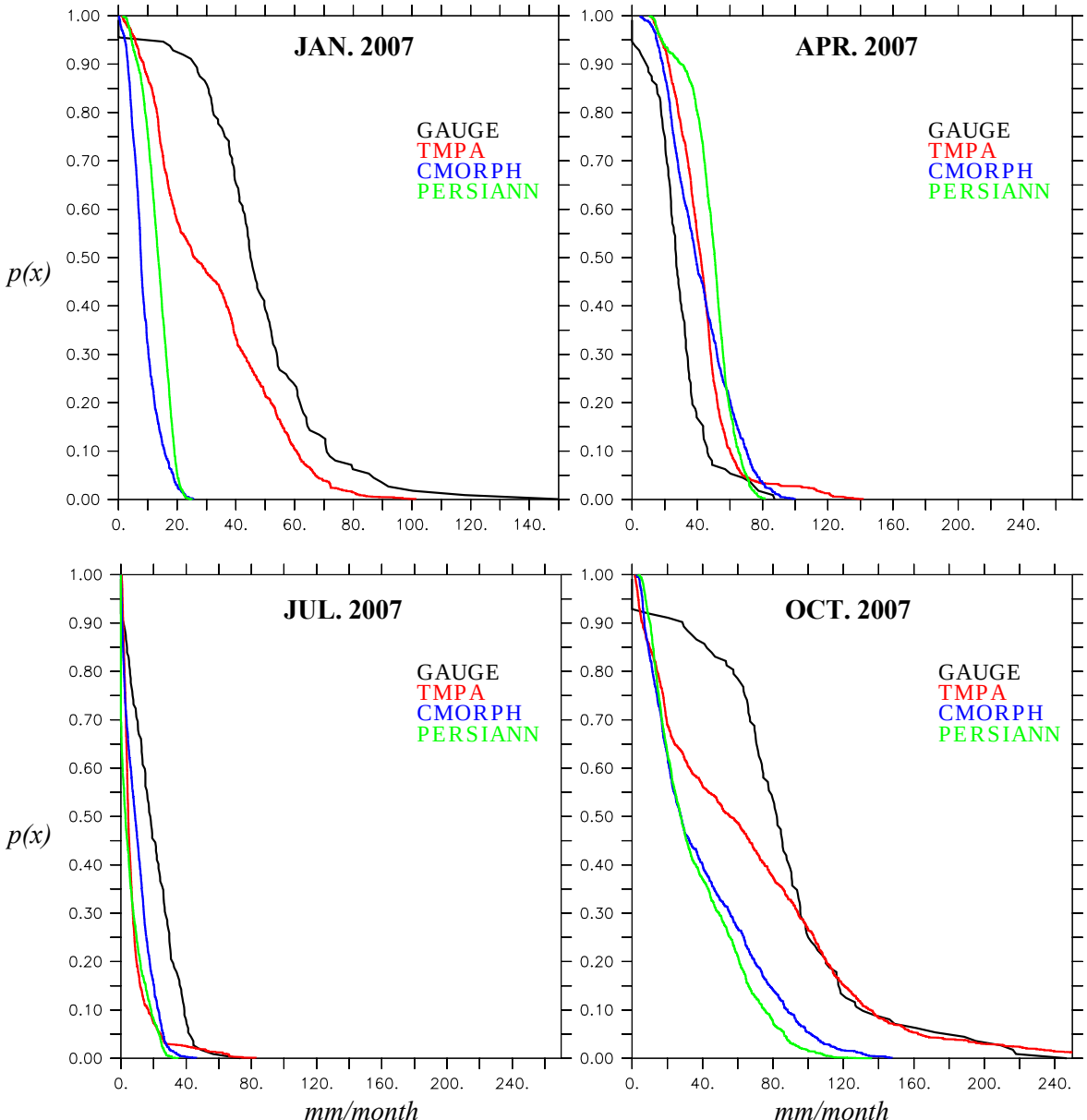


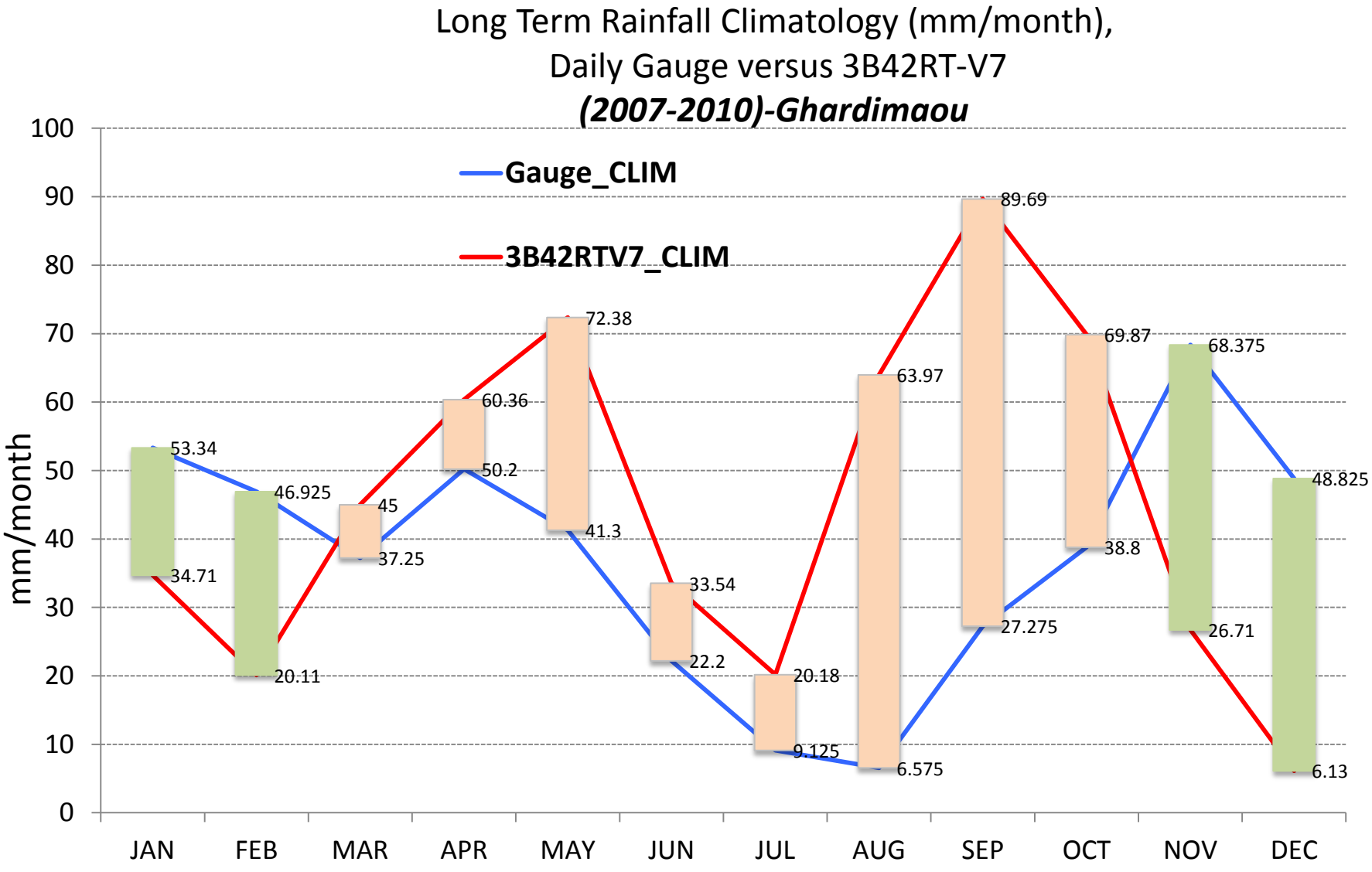
Tunisian Flood, Climatology, Ref: QJRMS(RMS)



Probability of Exceedance based on Rain Gauges, Tunisia, 2007

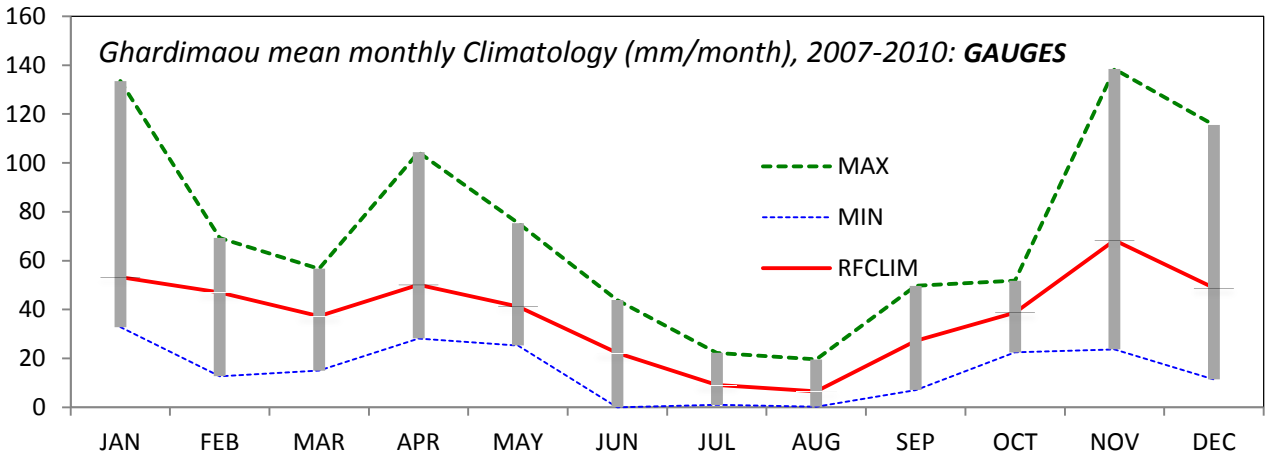
Exceedance Probability of getting extreme Rainfall based on Gauge, TMPA(3B43), CMORPH and PERSIANN

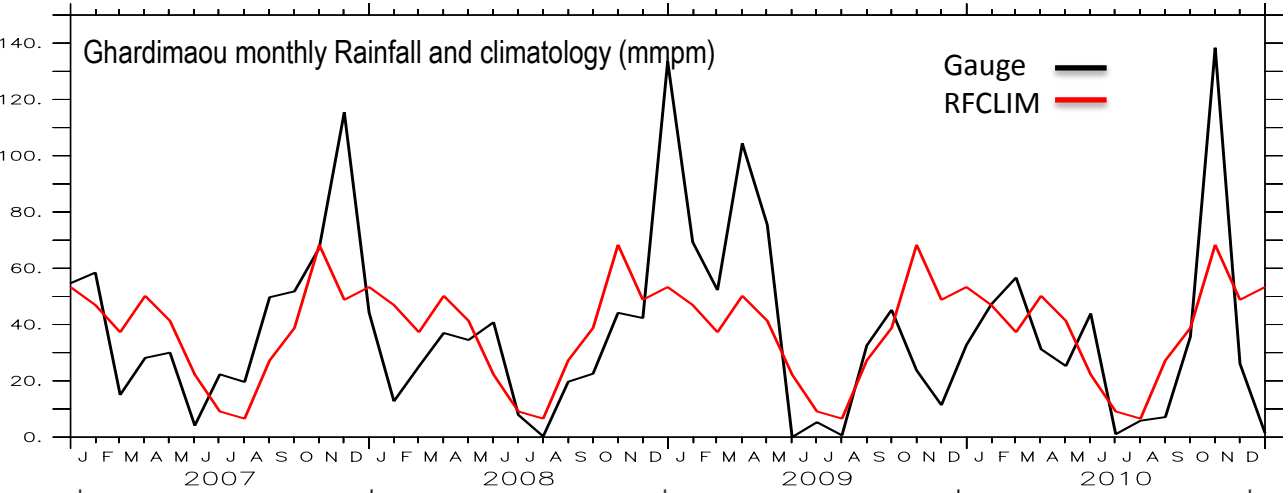


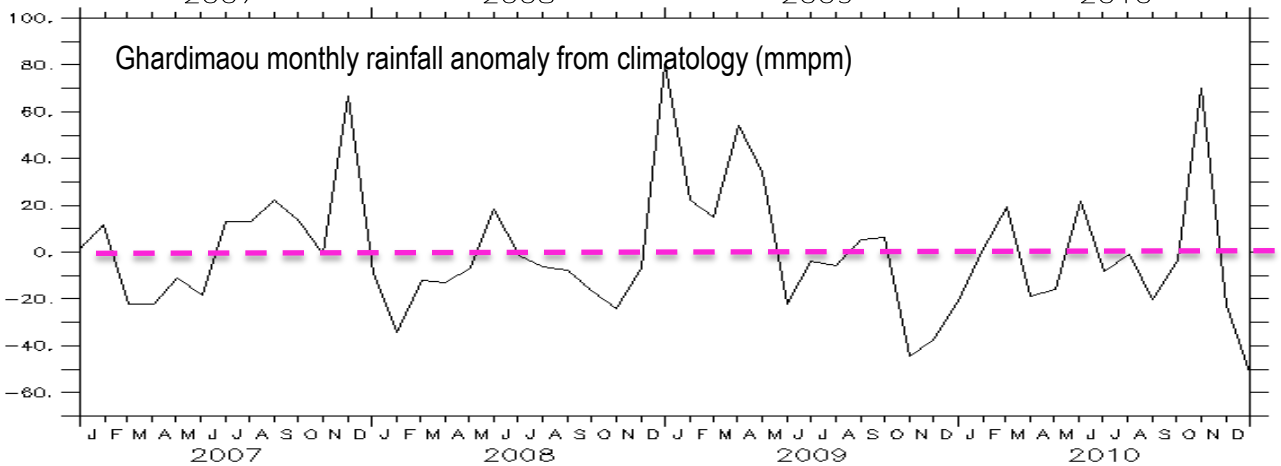

Long Term Rainfall Climatology (mm/month),
Daily Gauge versus 3B42RT-V7
(2007-2010)-Ghardimaou
Gauge_CLIM
3B42RTV7_CLIM
mm/month
100
90
80
70
60
50
40
30
20
10
0
53.34
34.71
46.925
20.11
45
37.25
60.36
50.2
72.38
41.3
33.54
22.2
20.18
9.125
63.97
6.575
89.69
27.275
69.87
38.8
68.375
26.71
48.825
6.13
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

RF07

Ghardimaou Rainfall Observed Climatology, Range and Anomaly (mm/month)

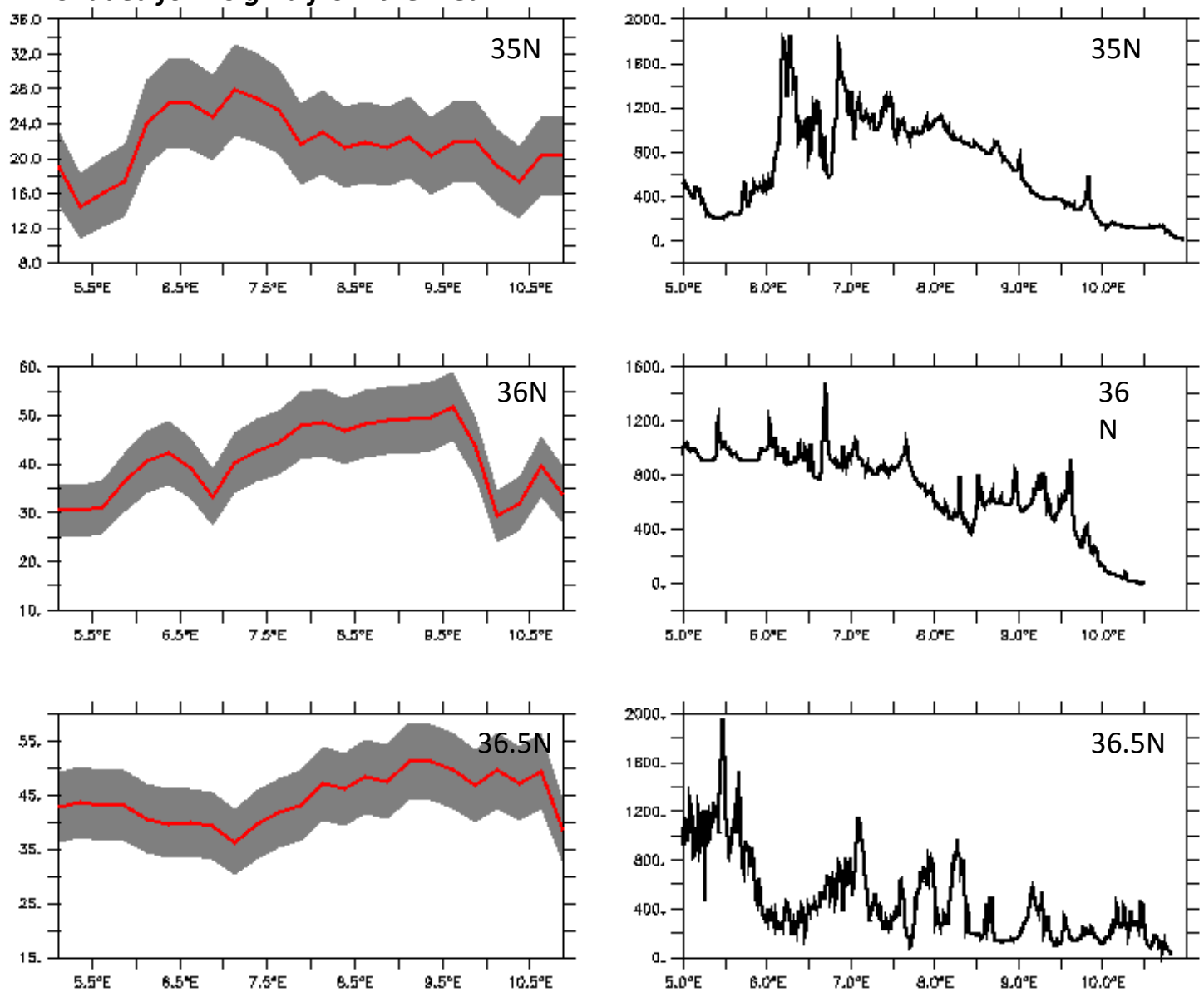


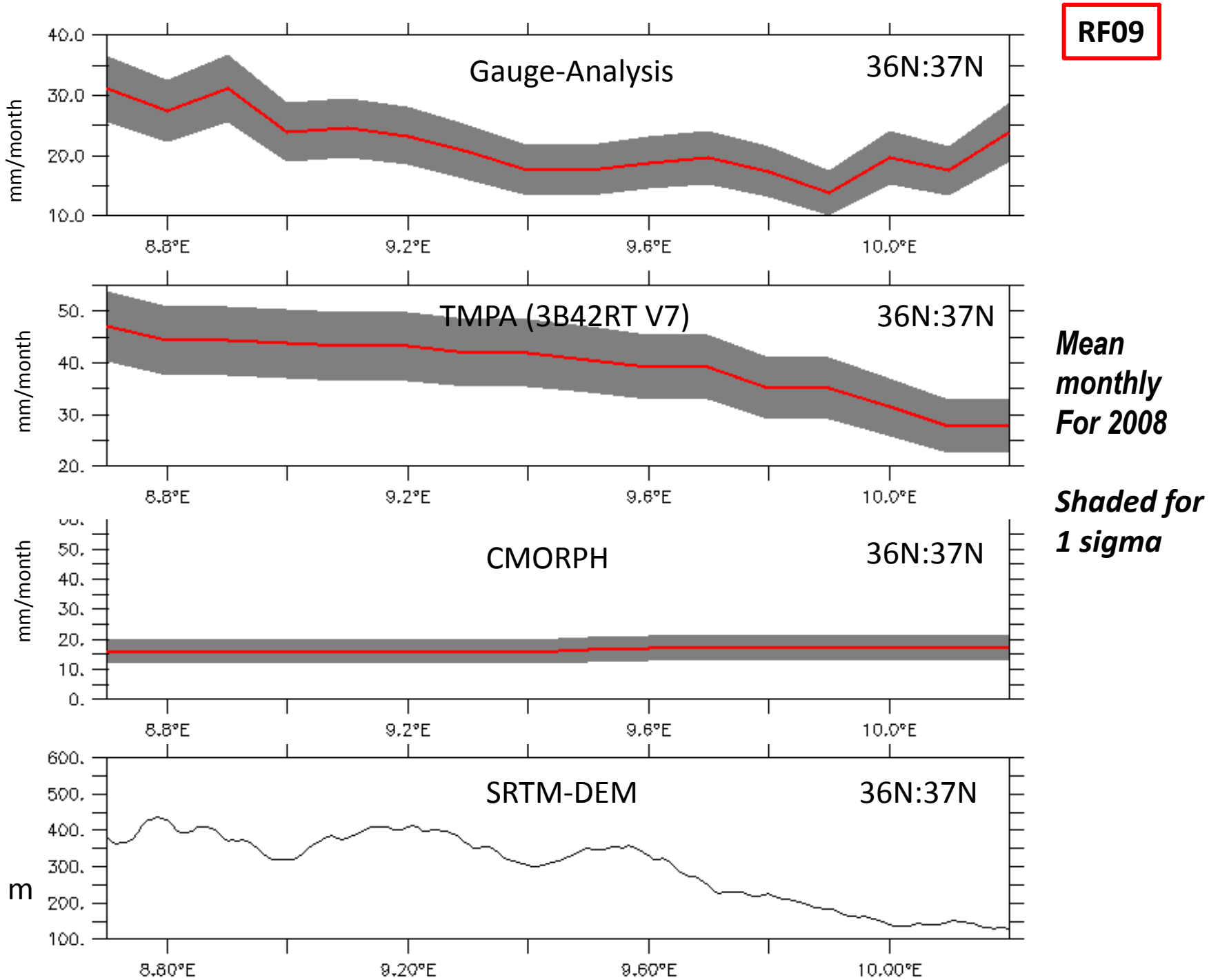




TMPA (3B42RT-V7) Climatology (2007-2010), Mean Monthly (mm/month) Shaded for 1 sigma from the mean

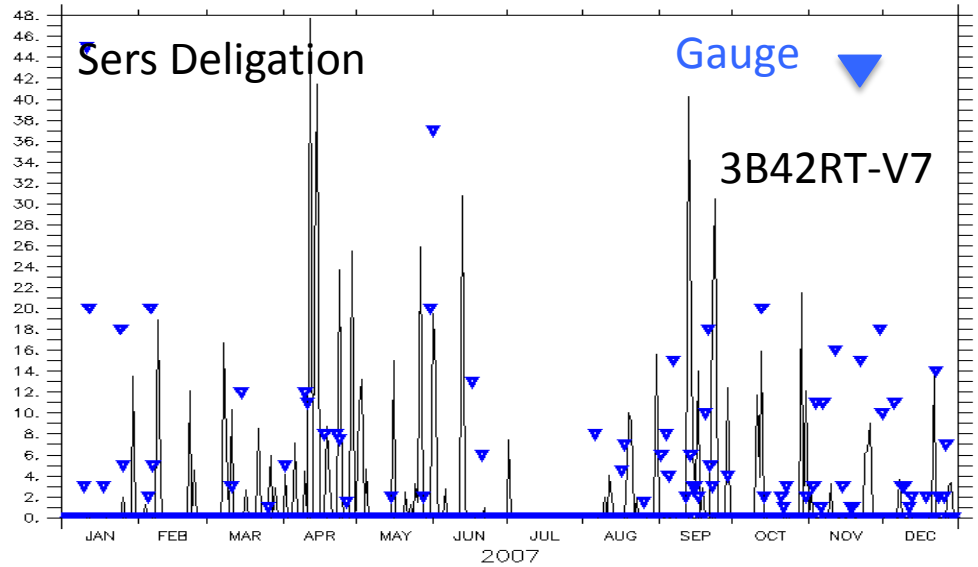
SRTM-DEM (m) **RF08**

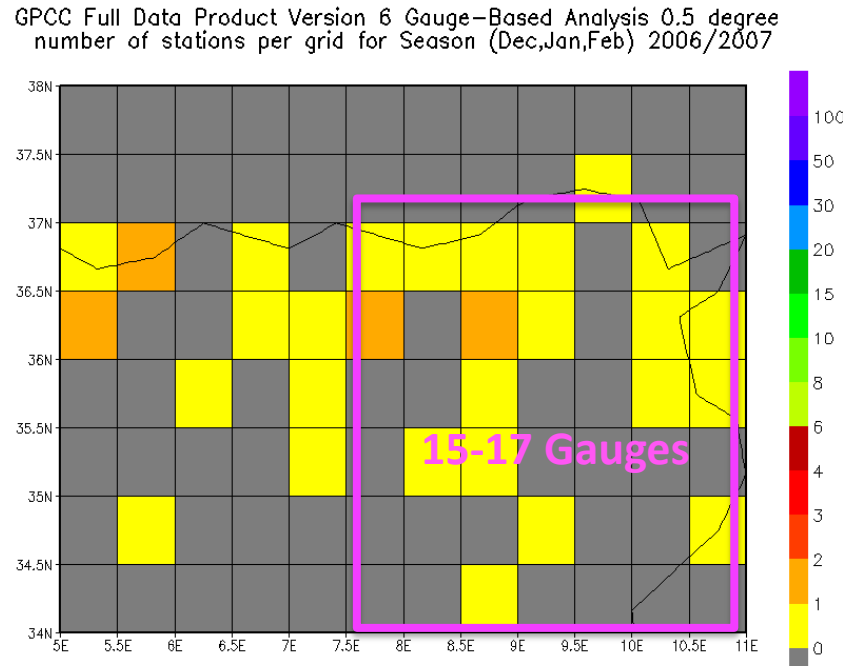


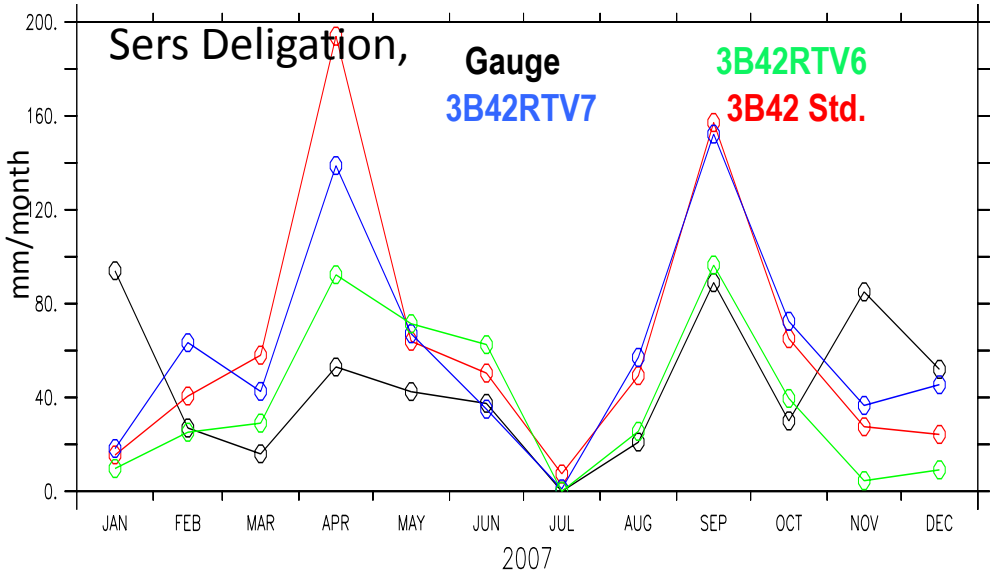

RF09
Gauge-Analysis
36N:37N
mm/month
40.0
30.0
20.0
10.0
8.8°E
9.2°E
9.6°E
10.0°E
TMPA (3B42RT V7)
36N:37N
mm/month
50.
40.
30.
20.
8.8°E
9.2°E
9.6°E
10.0°E
CMORPH
36N:37N
mm/month
50.
40.
30.
20.
10.
0.
8.8°E
9.2°E
9.6°E
10.0°E
SRTM-DEM
36N:37N
m
600.
500.
400.
300.
200.
100.
8.80°E
9.20°E
9.60°E
10.00°E
Mean monthly For 2008
Shaded for 1 sigma

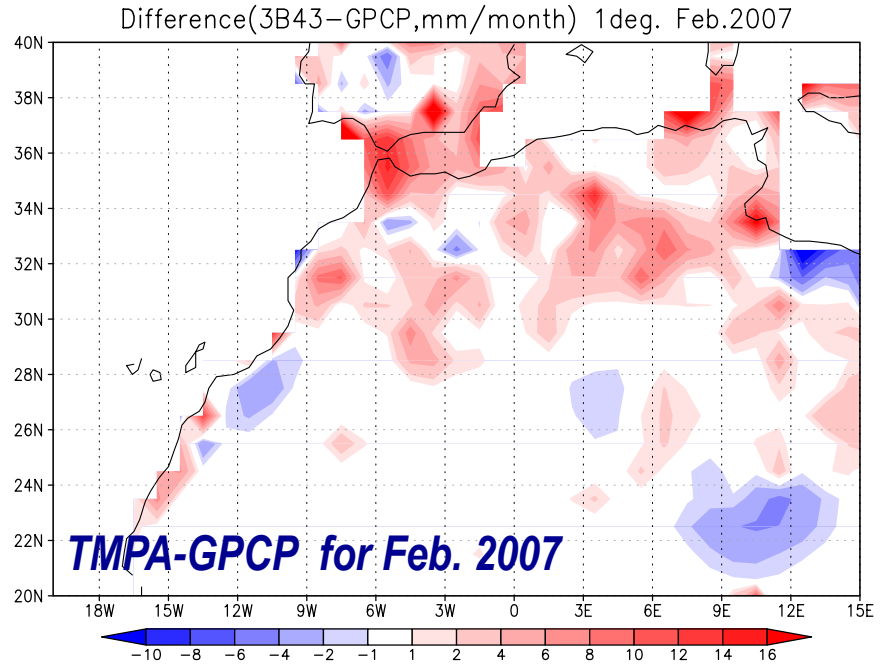
RF10

TMPA V7 vs. Gauges, Daily and Monthly









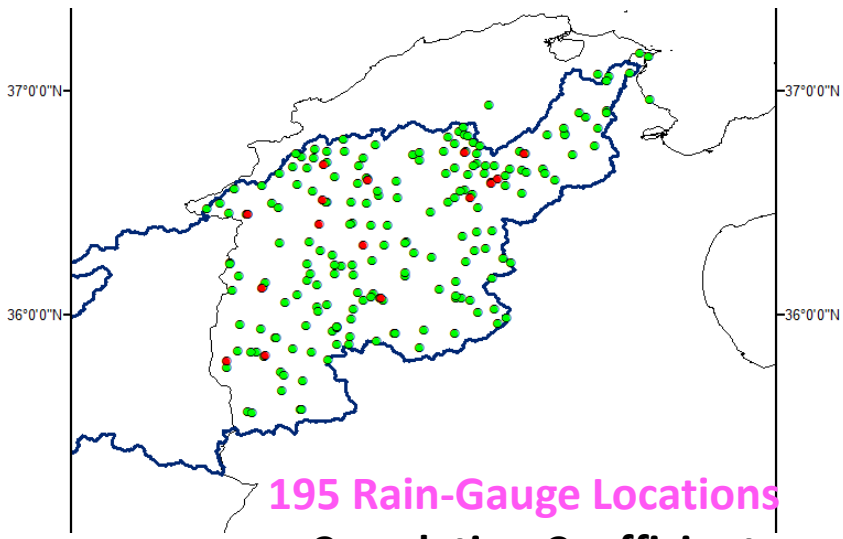
RF11

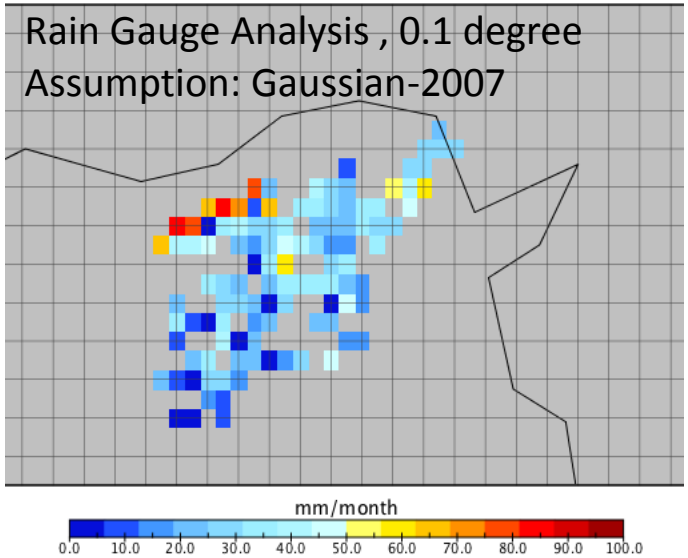
Monthly Rainfall Statistics (mm/day), (TMPA vs Gauge)

SLOUGUIA	Mean	Max	Min	SD	cv(%) (σ/μ)*100	Corr. TMPA vs. Gauge (2007)	Corr. TMPA vs Gauge (2007 except winter, March-Sep)
3B42RT_V7R2	1.48	3.72	0	1.22	**82.5**	**0.22**	**0.76**
3B42RT_V7R	1.76	4.14	0	1.38	**78.1**	**0.08**	**0.68**
3B42RT_V6	1.21	3.04	0	0.93	**77.3**	**0.21**	**0.77**
Guage	1.29	3.45	0.02	1.01	**78.3**		
DJEBEL							
3B42RT_V7R2	1.65	4.68	0.063	1.52	**91.66**	**0.13**	**0.91**
3B42RT_V7R	1.71	4.75	0.063	1.31	**76.21**	**0.11**	**0.90**
3B42RT_V6	1.30	3.83	0	1.41	**108.27**	**0.03**	**0.72**
Guage	1.51	3.45	0.009	1.10	**72.83**		
JENDOUBHA							
3B42RT_V7R2	1.15	2.37	0.24	0.84	**73.04**	**0.07**	**0.84**
3B42RT_V7R	1.32	4.11	0.34	1.05	**77.7**	**0.05**	**0.81**
3B42RT_V6	1.12	2.76	0	0.89	**80.2**	**0.02**	**0.85**
Guage	1.43	3.64	0	1.21	**84.081**		
SERS DELIGATION							
Gauge	1.50	3.03	0	0.99	**66.28**		
3B42RT_V7R2	2.08	6.46	0.24	1.88	**90.62**	**0.26**	**0.81**
3B42RT_V7R	2.01	5.07	0.03	1.49	**73.99**	**0.33**	**0.90**
3B42RT_V6	1.28	3.21	0	1.13	**87.85**	**0.21**	**0.92**

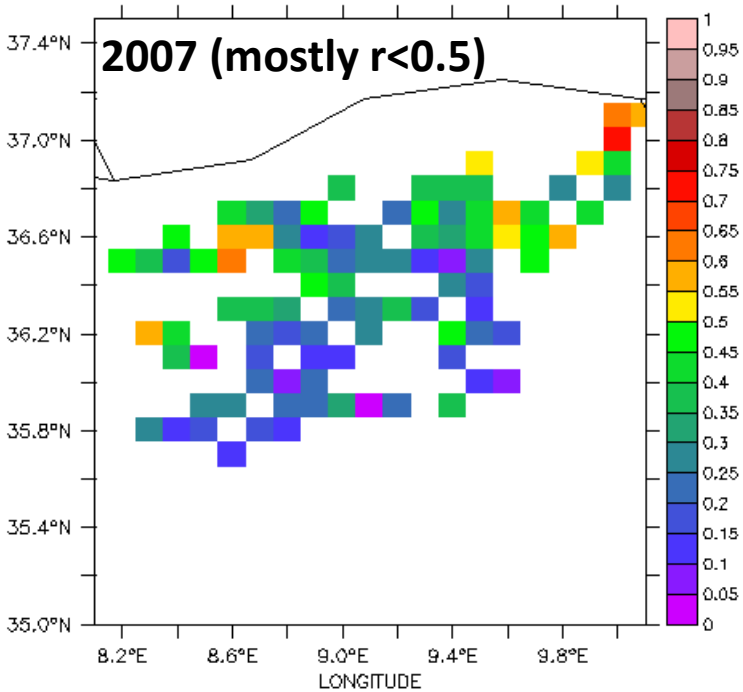
Spatial Correlation: TMPA(3B43) vs. Rain-Gauge Analysis

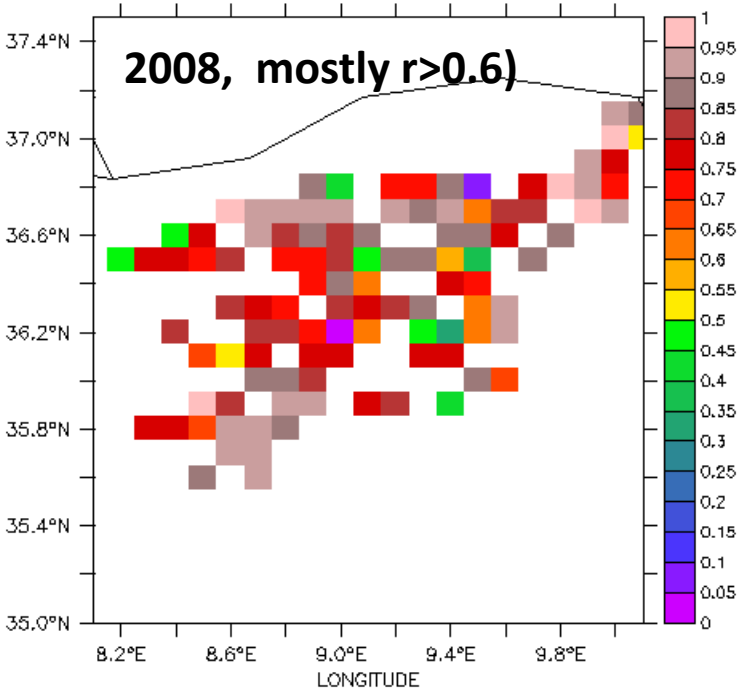
RF12



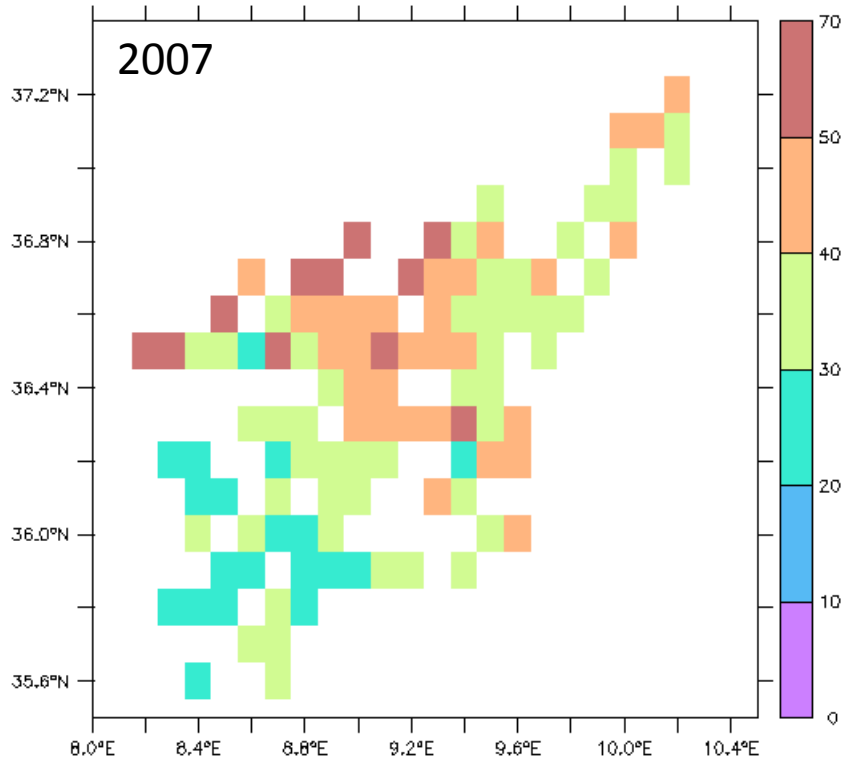


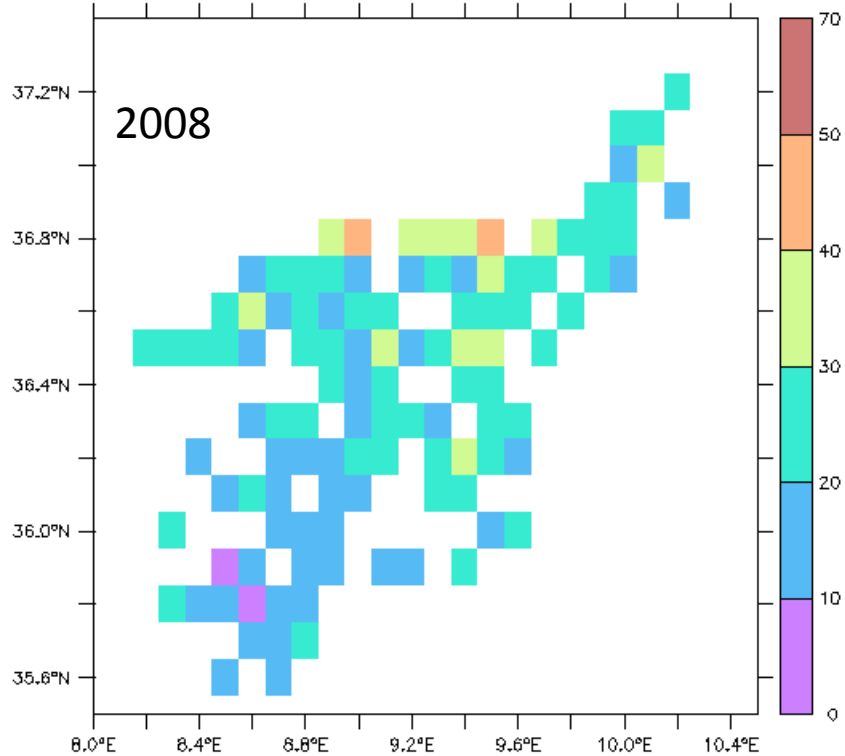
r: Correlation Coefficient





RMS errors between TMPA(3B43) monthly Rain and Gauge analysis (mm/month)

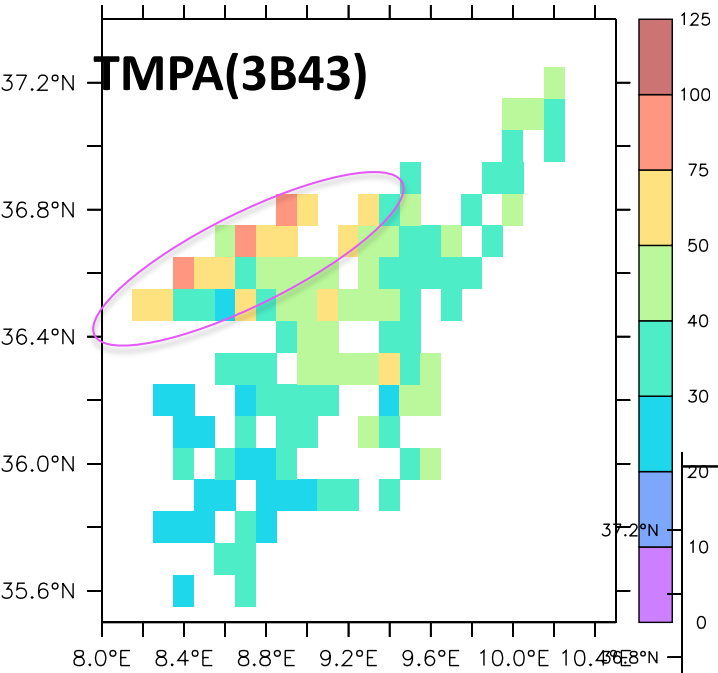




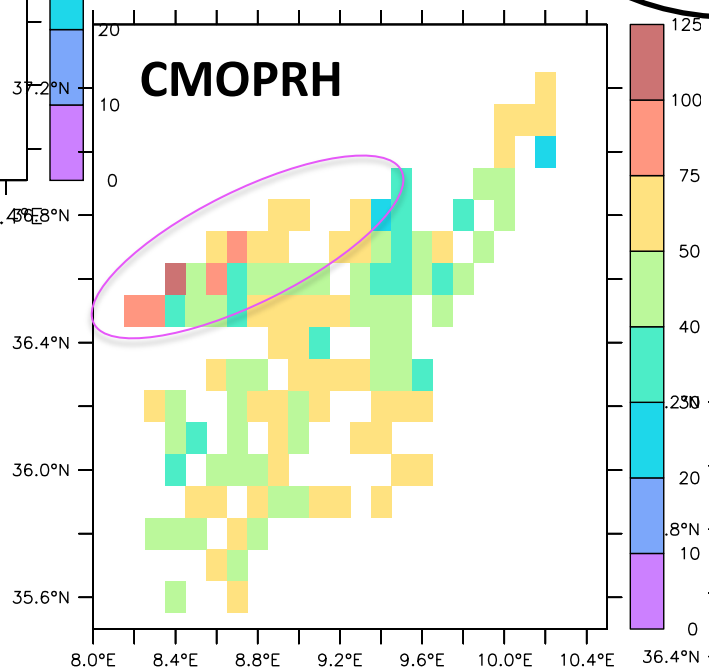
RMS Error (mm/month)	2007	2008
Maximum	70.91	44.79
Mean	38.99	21.67
Minimum	23.41	8.36
SD	10.06	6.89

RF13

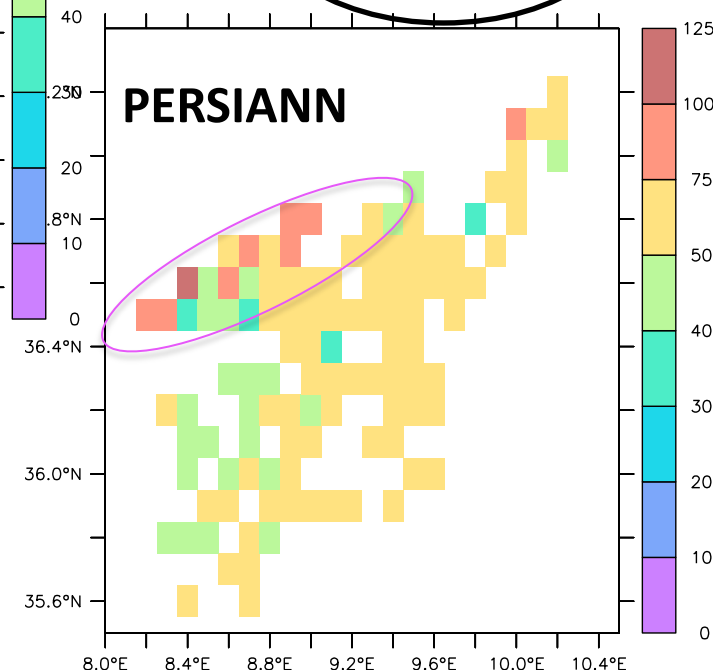
Medjerda Basin -Tunisia



Min.: 23.42
Max.: 70.91
Mean : 38.99
SD: 10.06



Min.: 28.47
Max.: 103.2
Mean: 50.9
SD: 12.1



Min: 30.731
Max: 111.47
Mean: 57.447

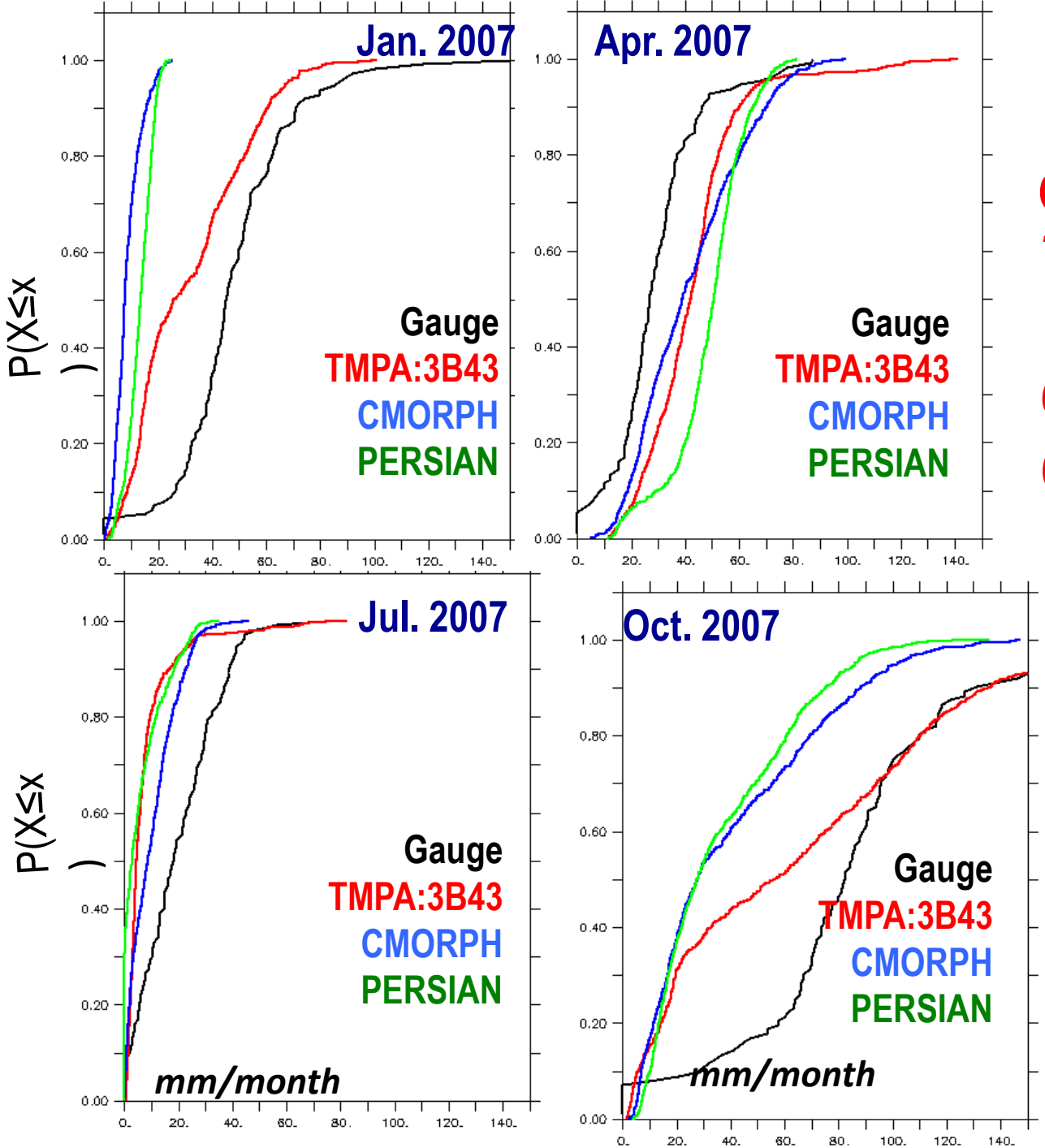
Generally Maximum RMS errors are found to be in regions close to Atlas mountain areas. RMS error is relatively small for TMPA

RMS Error (RMSE, mm/month) against Rain-Gauge Analysis for 2007

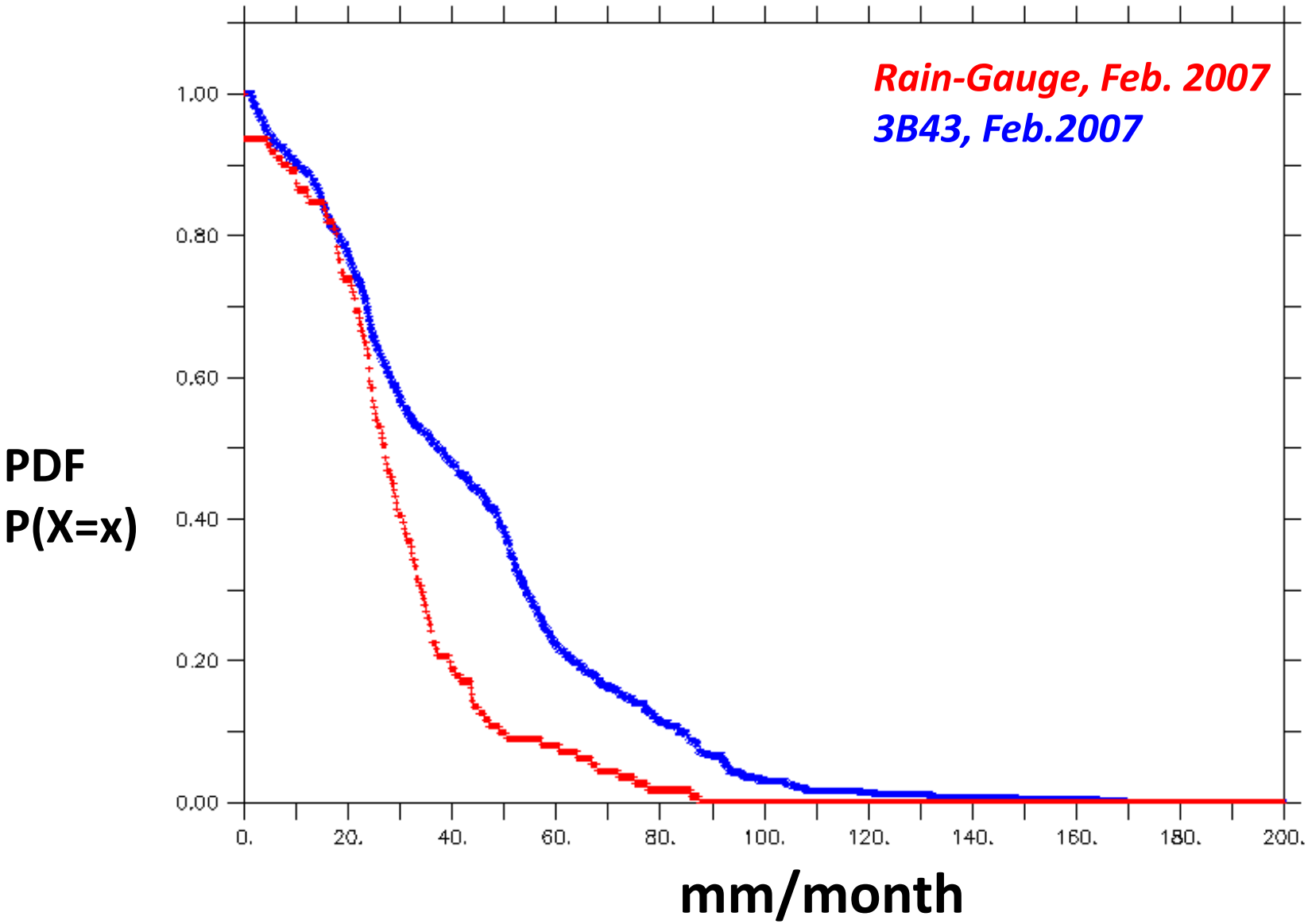
RF14

CDF of Seasonal Rainfall
Tunisia, 2007:

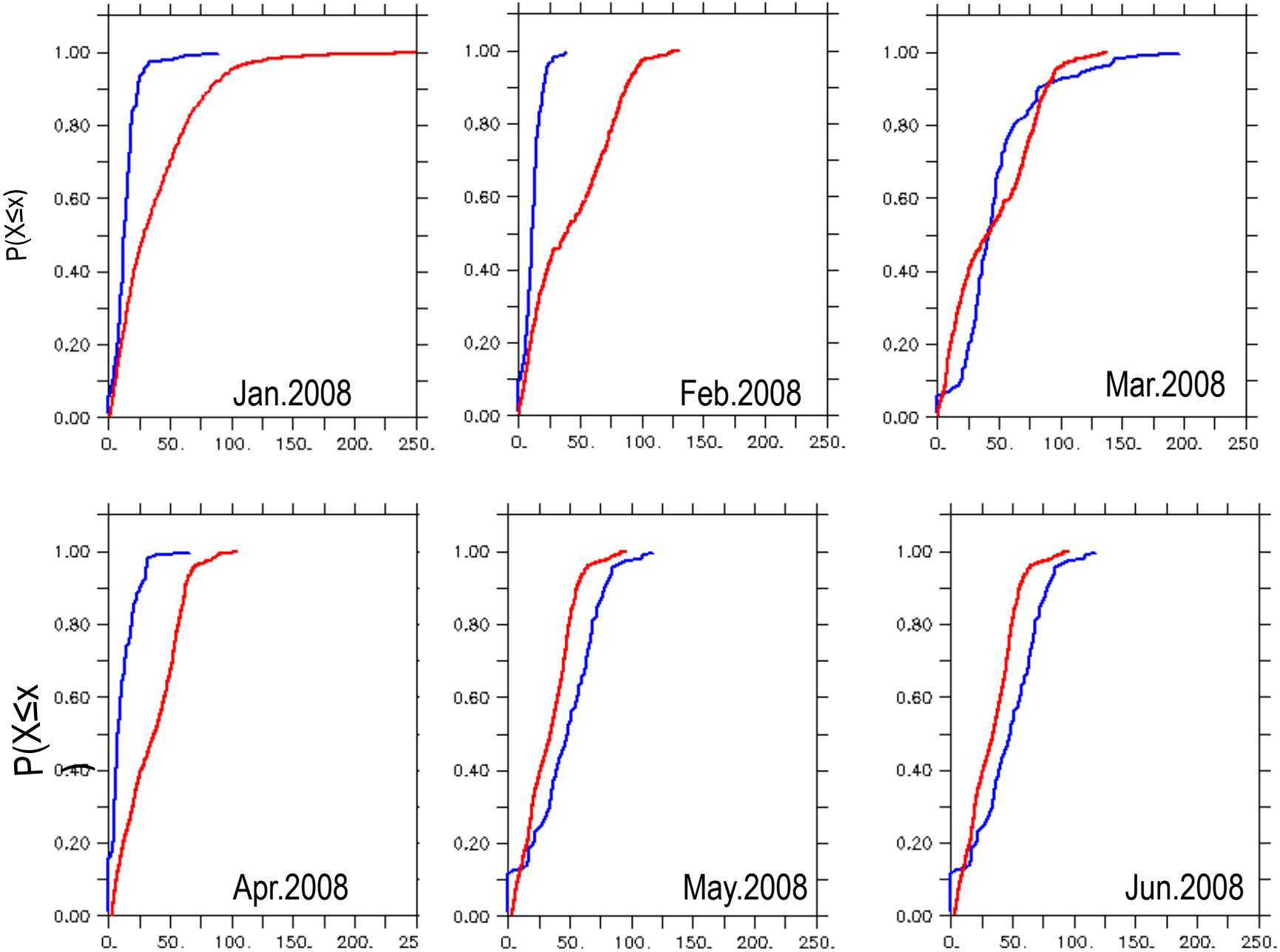
Gauge, TMPA(3B43), CMORPH, PERSIANN



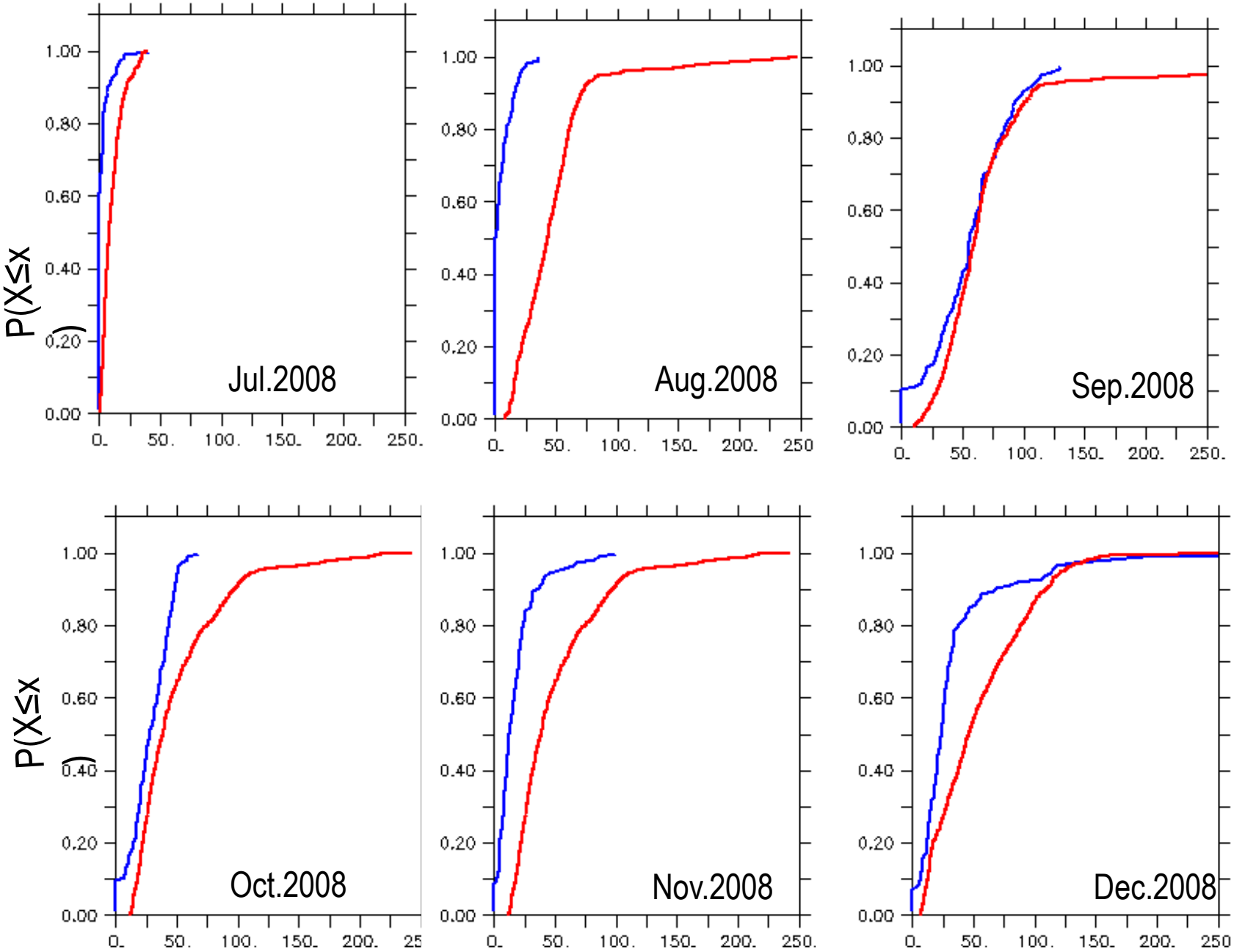
TMPA versus Rain Gauge, Check for a month, Feb.2007



CHECK CDFs for 2008 (Monthly Rainfall)
Gauge +TMPA(3B43)



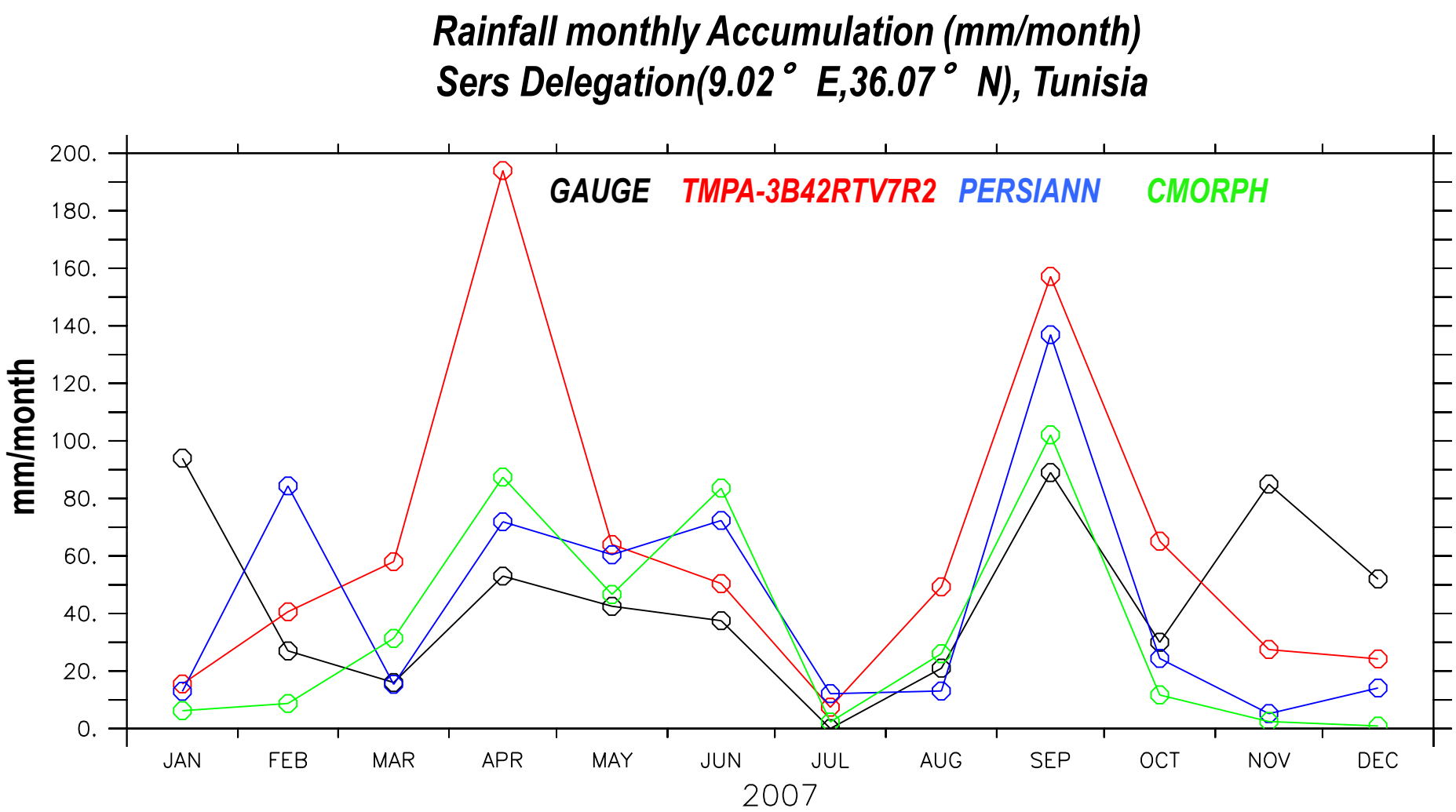
Gauge RF TMPA (3B43) RF



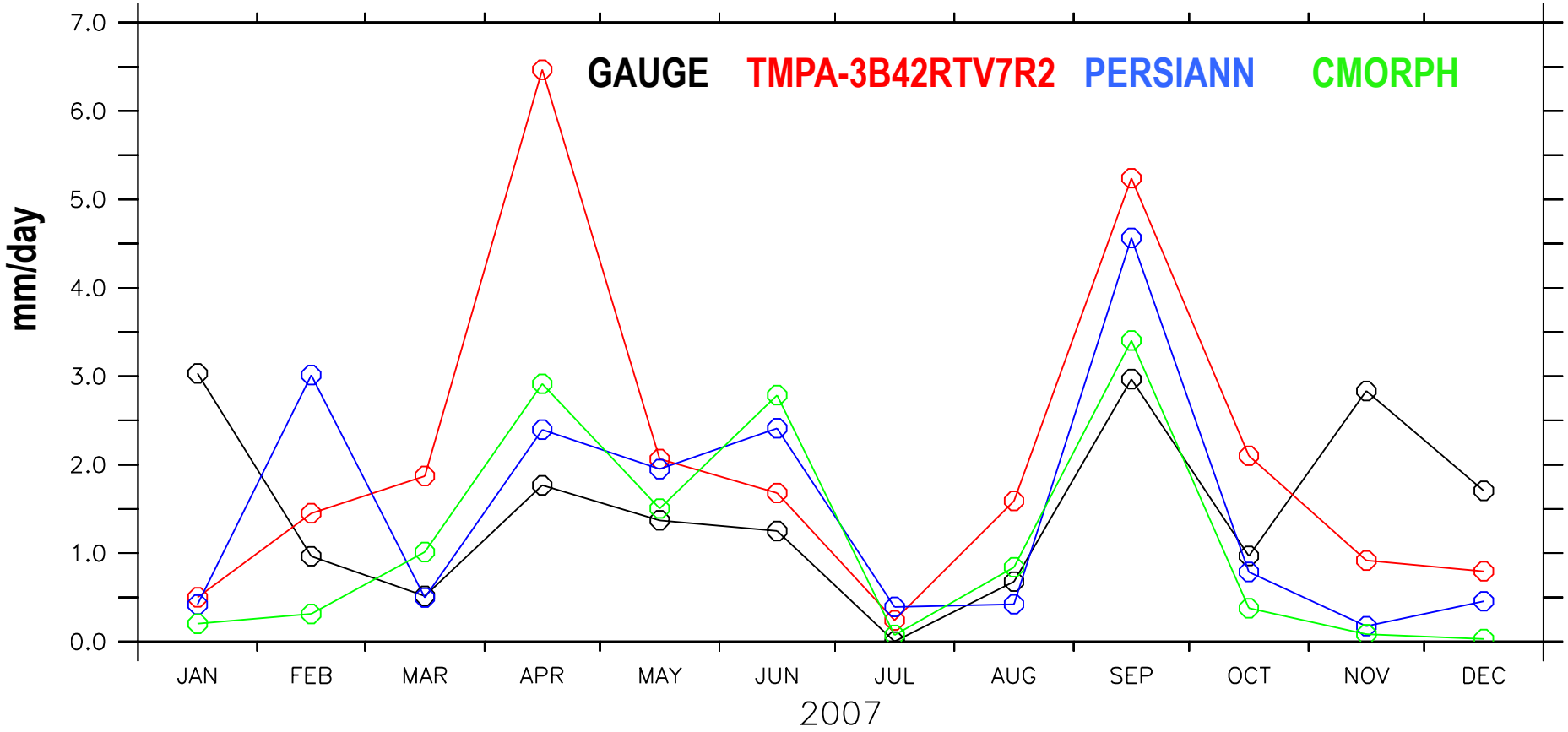
Gauge RF TMPA (3B43) RF

Rainfall monthly mean (mm/day) and accumulated (mm/month): TUNISIA

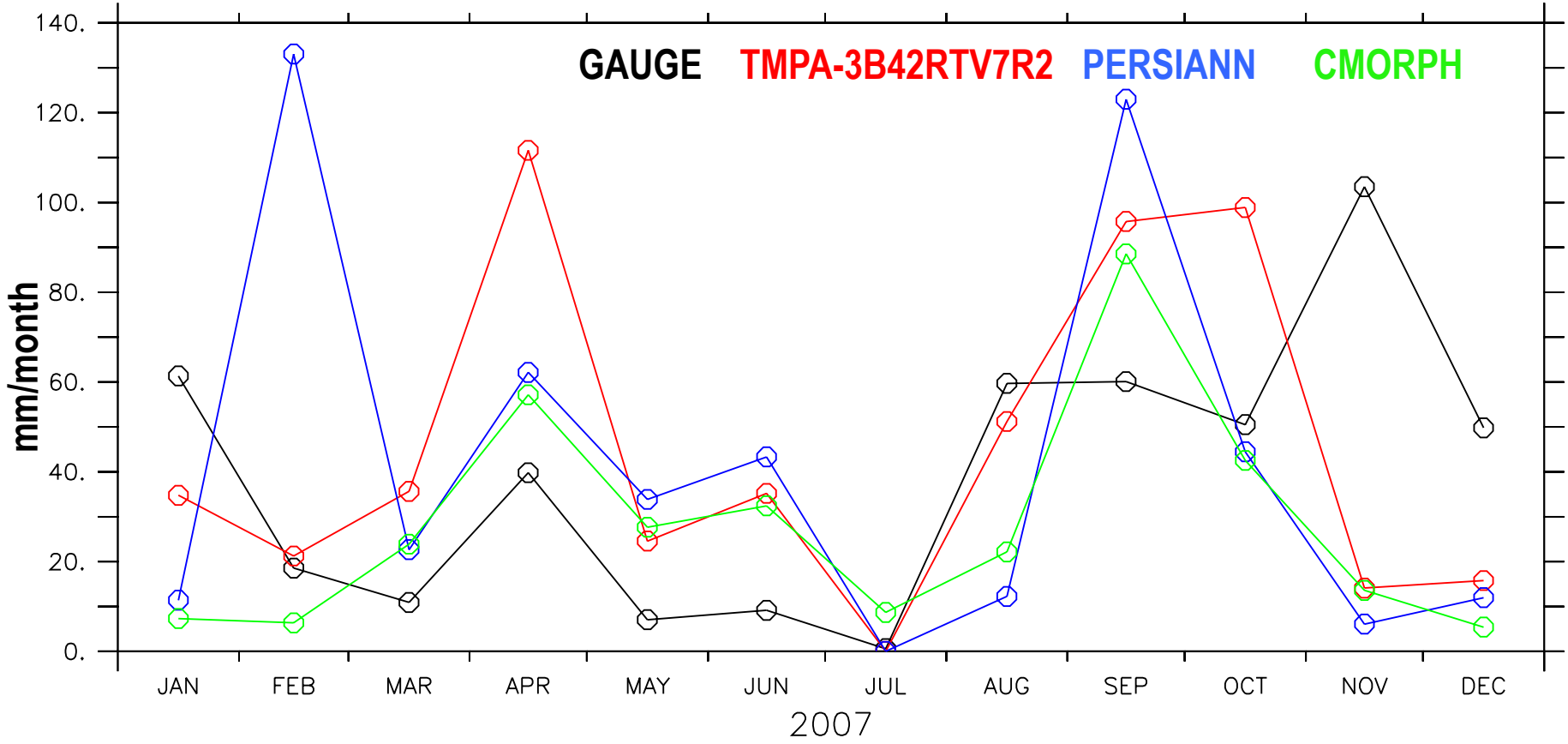
1. **CMORPH**
2. **PERSIANN**
3. **TMPA**
4. **GAUGE**


Rainfall monthly Accumulation (mm/month)
Sers Delegation(9.02° E,36.07° N), Tunisia
GAUGE
TMPA-3B42RTV7R2
PERSIANN
CMORPH
mm/month
200.
180.
160.
140.
120.
100.
80.
60.
40.
20.
0.
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
2007

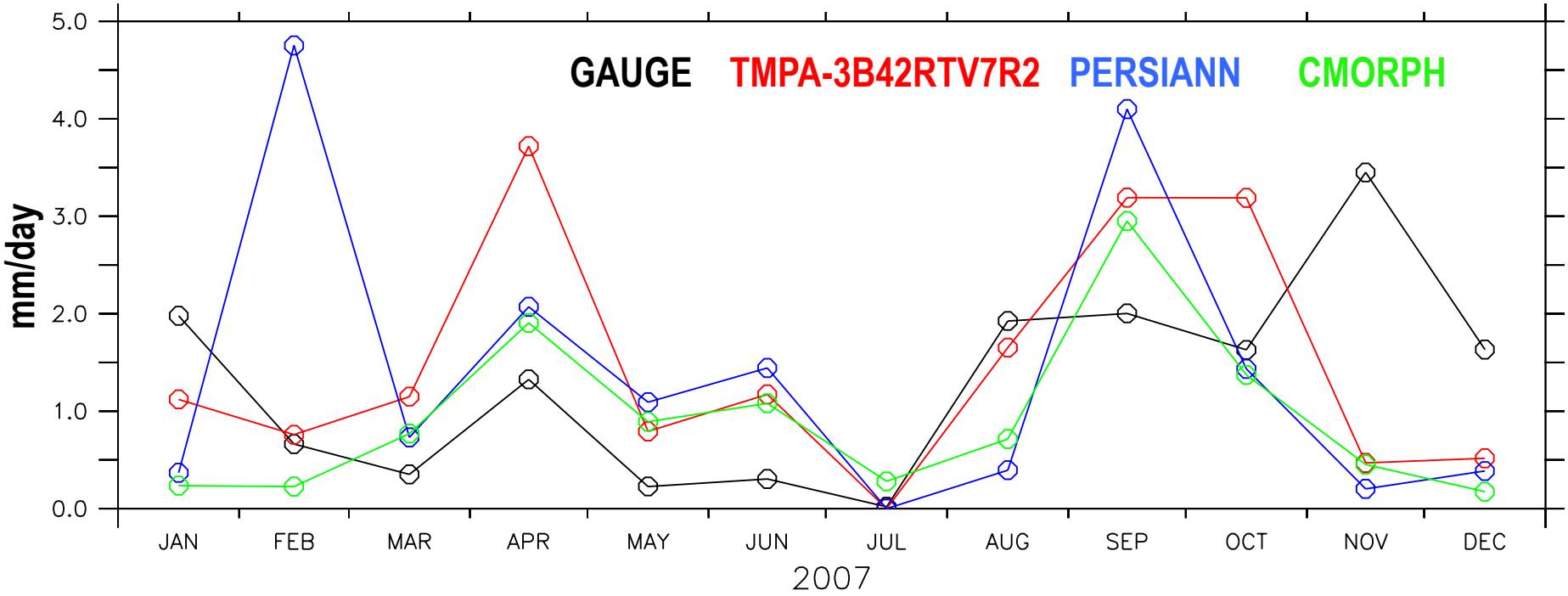
Rainfall monthly mean (mm/day)
Sers Delegation(9.02°E,36.07°N), Tunisia



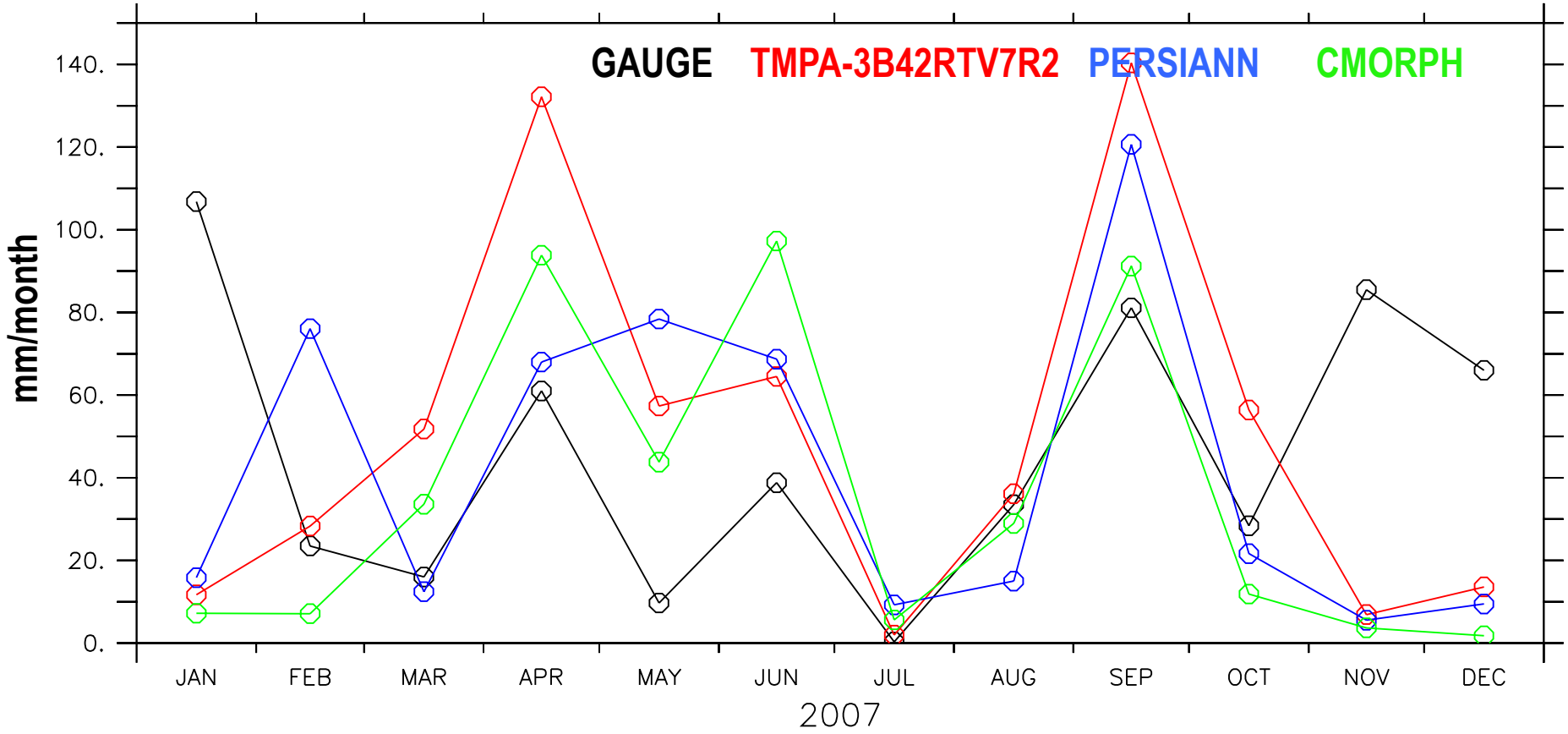
Rainfall monthly Accumulation (mm/month)
Slouguia(9.52°E, 36.58944°N), Tunisia



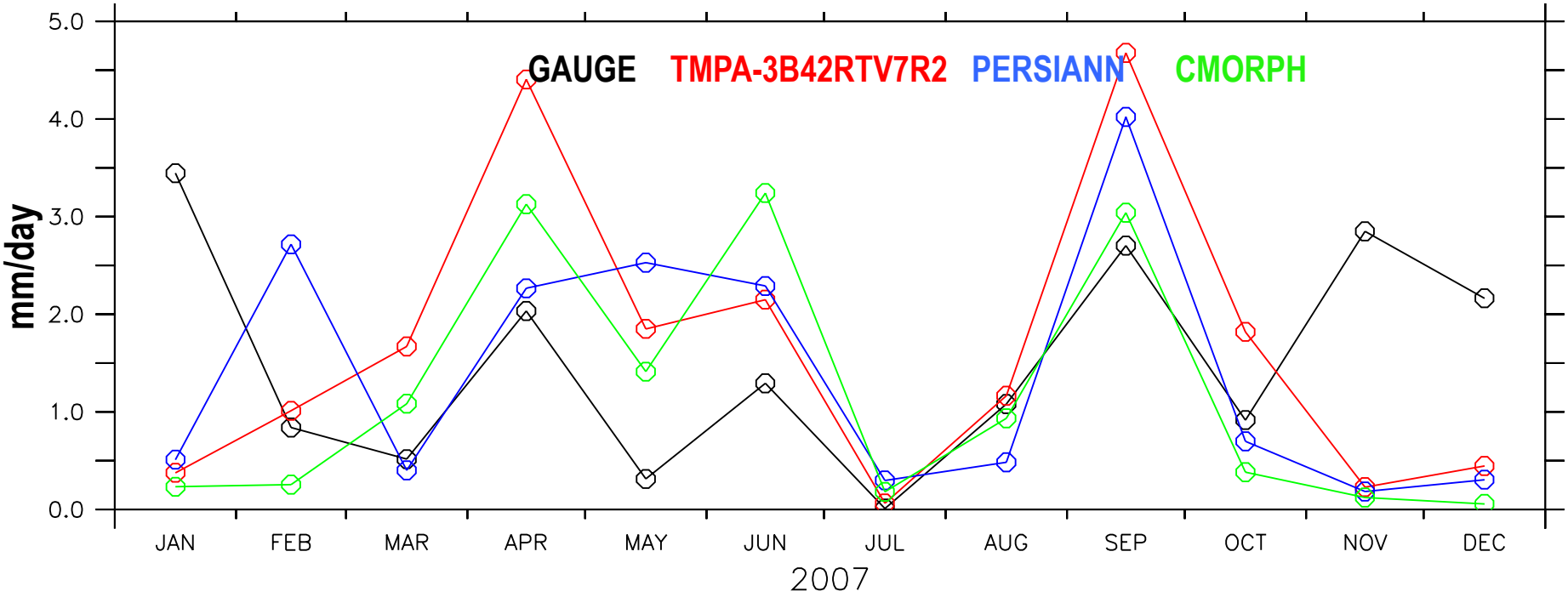
Rainfall monthly mean (mm/day)
Slouguia(9.52°E, 36.58944°N), Tunisia

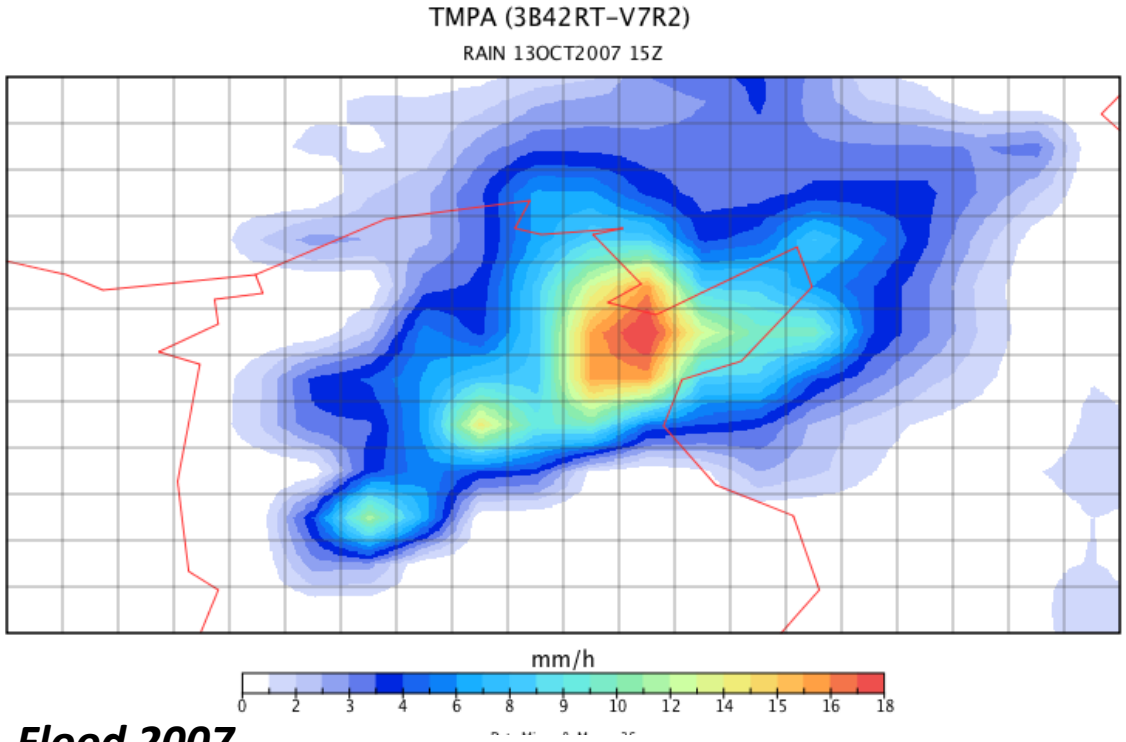


Rainfall monthly Accumulation (mm/month)
Djebel Kbouch PF (8.899445°E, 36.22306°N), Tunisia



Rainfall monthly mean (mm/day)
Djebel Kbouch PF (8.899445°E, 36.22306°N), Tunisia

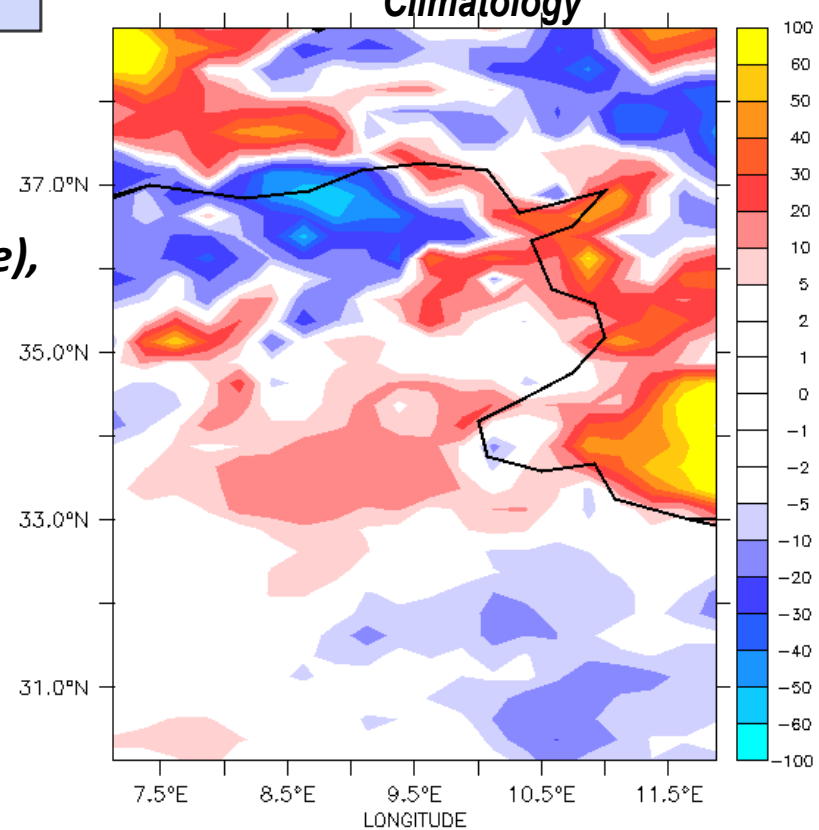


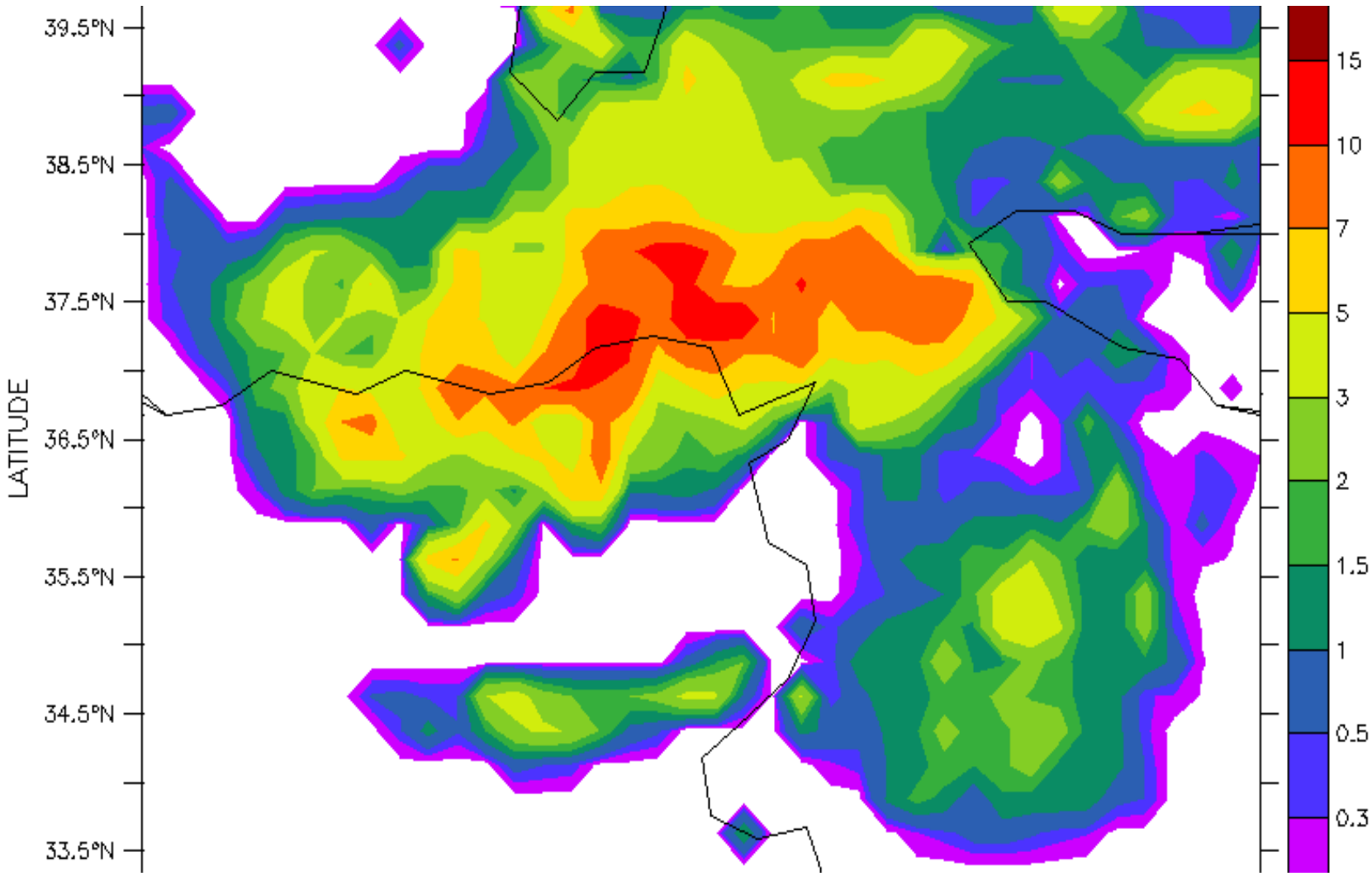


Flood 2007,

TMPA(3B42RT-V7), 13 OCT.2007, 15Z (Flood peak time),

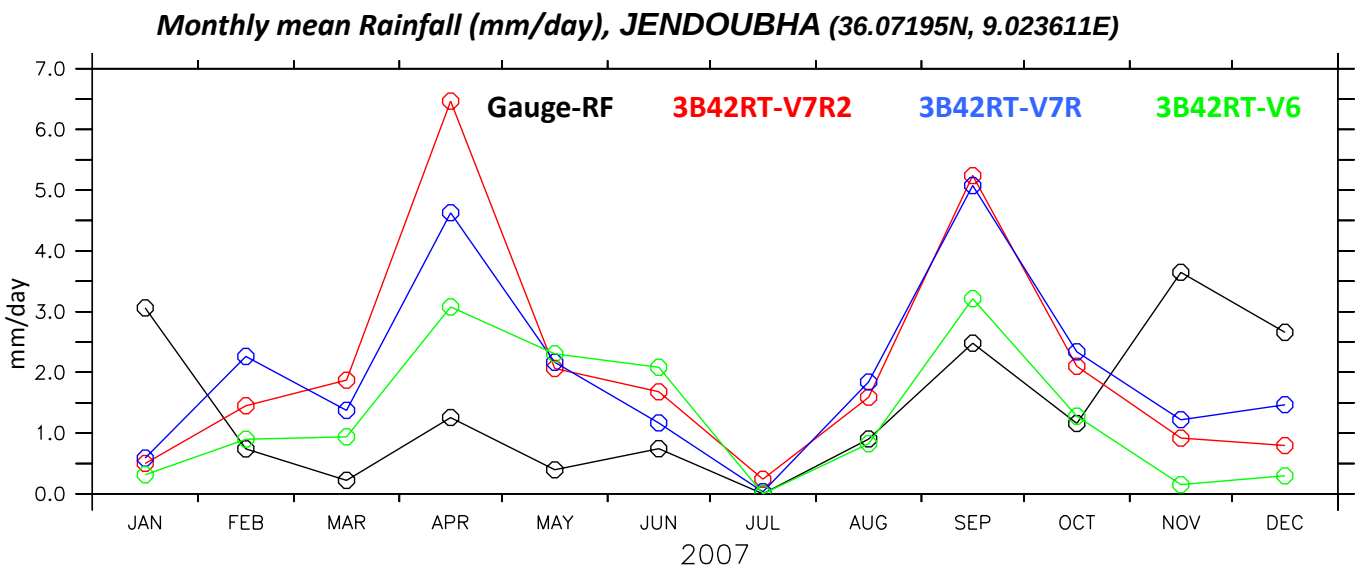
TMPA:3B42RTV7R2 monthly anomaly for Oct.2007 from 2007-2012 Climatology

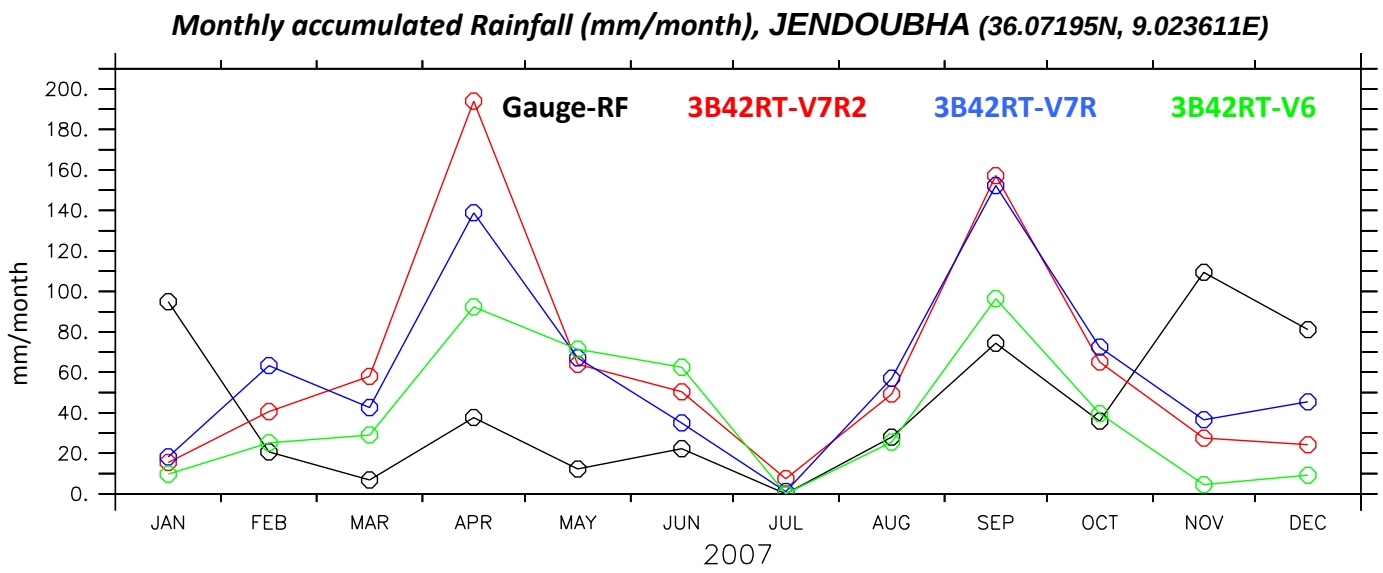


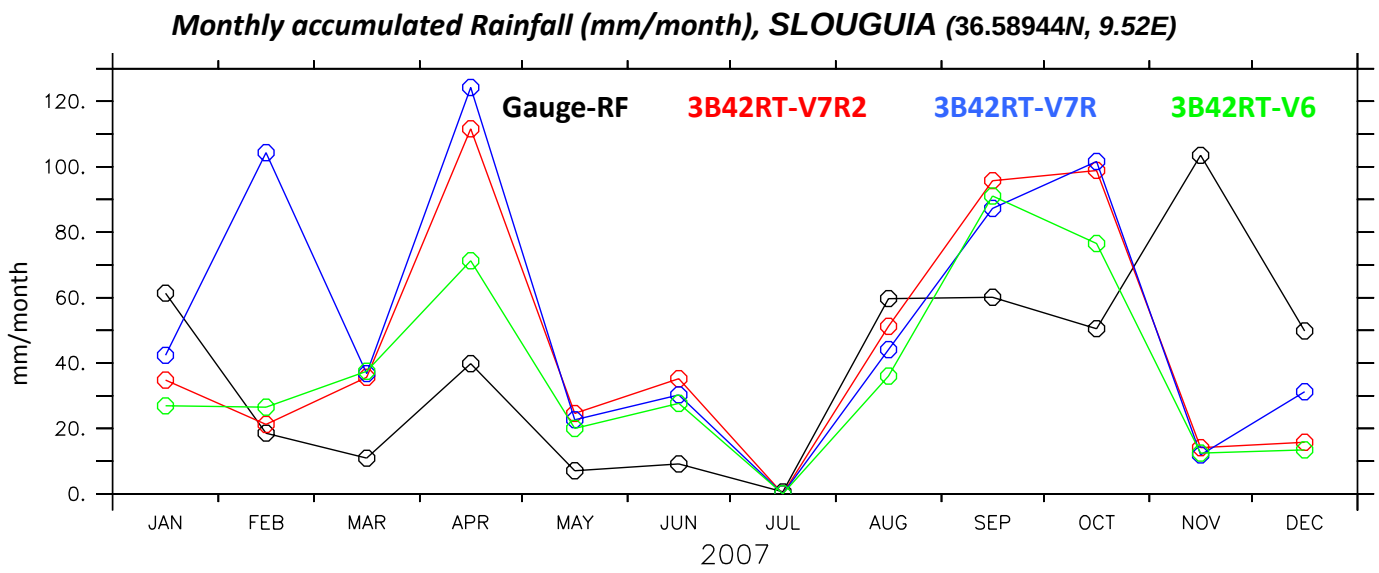


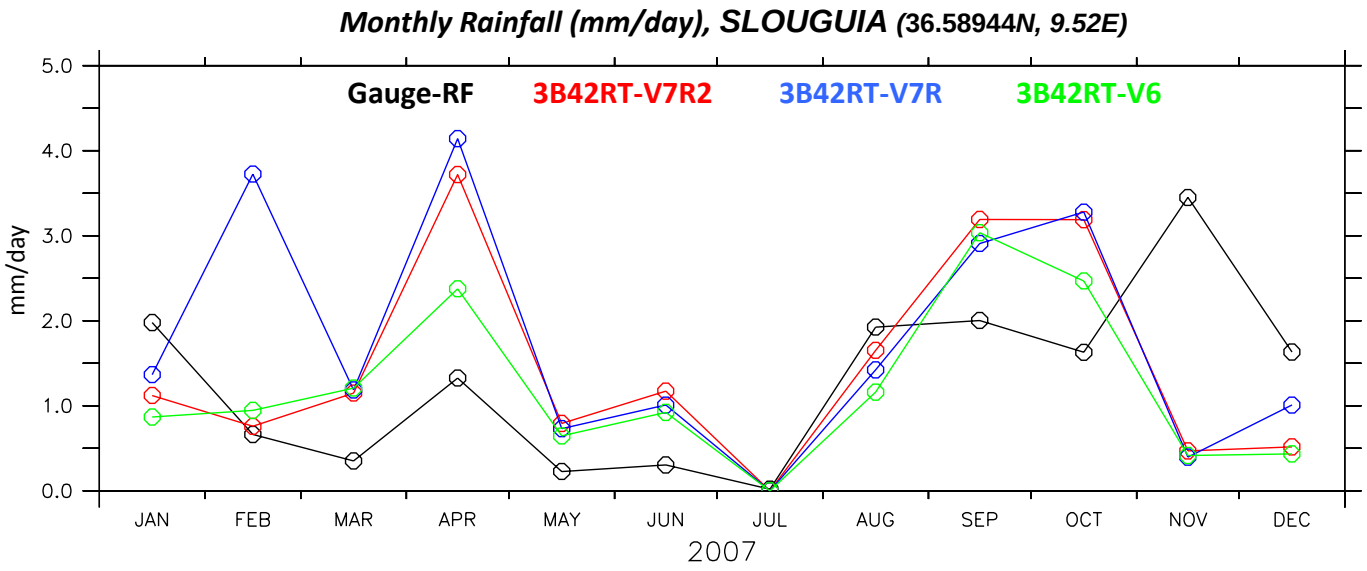
TMPA (3B42RTV7), 23rd Feb. 2009, 0Z
(mm/h)

Gauges vs. Different TMPA versions


Monthly mean Rainfall (mm/day), JENDOUBHA (36.07195N, 9.023611E)
Gauge-RF
3B42RT-V7R2
3B42RT-V7R
3B42RT-V6
mm/day
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
2007


Monthly accumulated Rainfall (mm/month), JENDOUBHA (36.07195N, 9.023611E)
Gauge-RF
3B42RT-V7R2
3B42RT-V7R
3B42RT-V6
mm/month
200.
180.
160.
140.
120.
100.
80.
60.
40.
20.
0.
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
2007


Monthly accumulated Rainfall (mm/month), SLOUGUIA (36.58944N, 9.52E)
Gauge-RF
3B42RT-V7R2
3B42RT-V7R
3B42RT-V6
mm/month
120.
100.
80.
60.
40.
20.
0.
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
2007


Monthly Rainfall (mm/day), SLOUGUIA (36.58944N, 9.52E)
Gauge-RF
3B42RT-V7R2
3B42RT-V7R
3B42RT-V6
mm/day
5.0
4.0
3.0
2.0
1.0
0.0
JAN
FEB
MAR
APR
MAY
JUN
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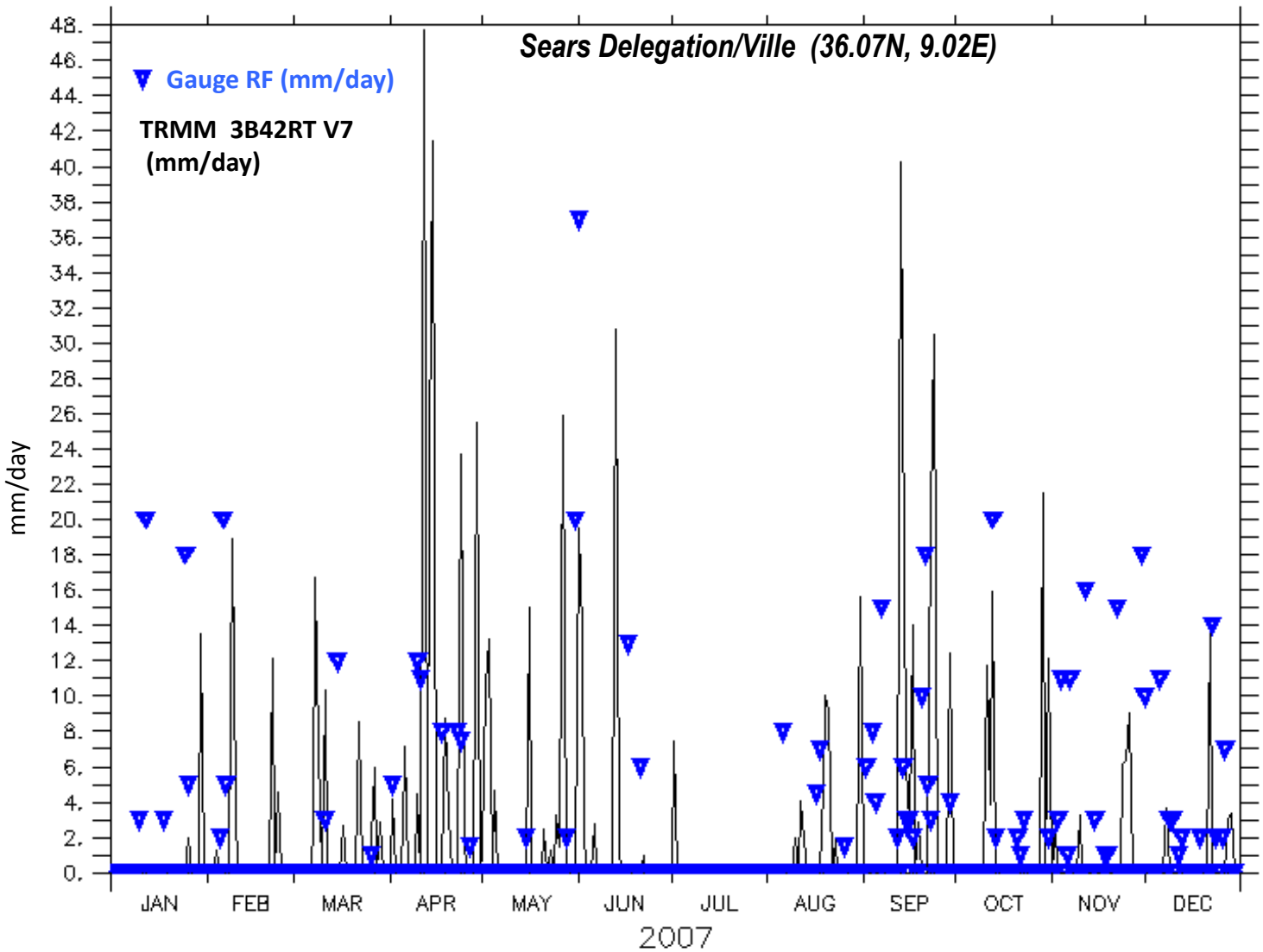
2007

TRMM 3B42RT V7R2 and and Gauge observations

STATION	LAT	LON
JEBEL LAOUEJ	36.54	9.46
Slouguia	36.57	9.52
EL HERRI	36.72	9.68
JOUEOUDA	37.13	9.09
RARAI SUPERIEUR	36.67	8.77
GHARDIMAOU	36.45	8.44
BOU SALEM GP6	36.60	8.97
MELLEGUE	36.41	8.75
MELLEGUE K13	36.12	8.50
PONT ROUTE	35.81	8.57
SIDI MEDIENE	36.28	8.95
SERS VILLE	36.07	9.03
Ain Jemmala	36.50	9.33
Jantoura	36.69	8.73
Ain Beya Oues Rheza	36.03	8.74
Dahmani Delegation	35.94	8.83
Daouess Ferme	36.41	8.89
Djebel Kbouch	36.22	8.89
Ain Jemmala	36.50	9.32

Note: Daily rainfall from TRMM 3 hourly (mm/hr.) data:
The 3B42 rain rate is a 3-hourly average centered at the middle of each 3-hour period (i.e., 0Z, 3Z, 6Z, 9Z, 12Z, 15Z, 18Z, and 21Z). To convert these rainfall rates to total daily rainfall, first multiply each 3-hourly rainfall rate by 3 hours, to get the total rainfall for each 3-hour period. Then, for your desired 24-hour-day begin and end times, sum all the 3-hourly total rainfalls in your defined 24-hour period, to get the total daily rainfall.


Sears Delegation/Ville (36.07N, 9.02E)
Gauge RF (mm/day)
TRMM 3B42RT V7
(mm/day)
mm/day
48.
46.
44.
42.
40.
38.
36.
34.
32.
30.
28.
26.
24.
22.
20.
18.
16.
14.
12.
10.
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6.
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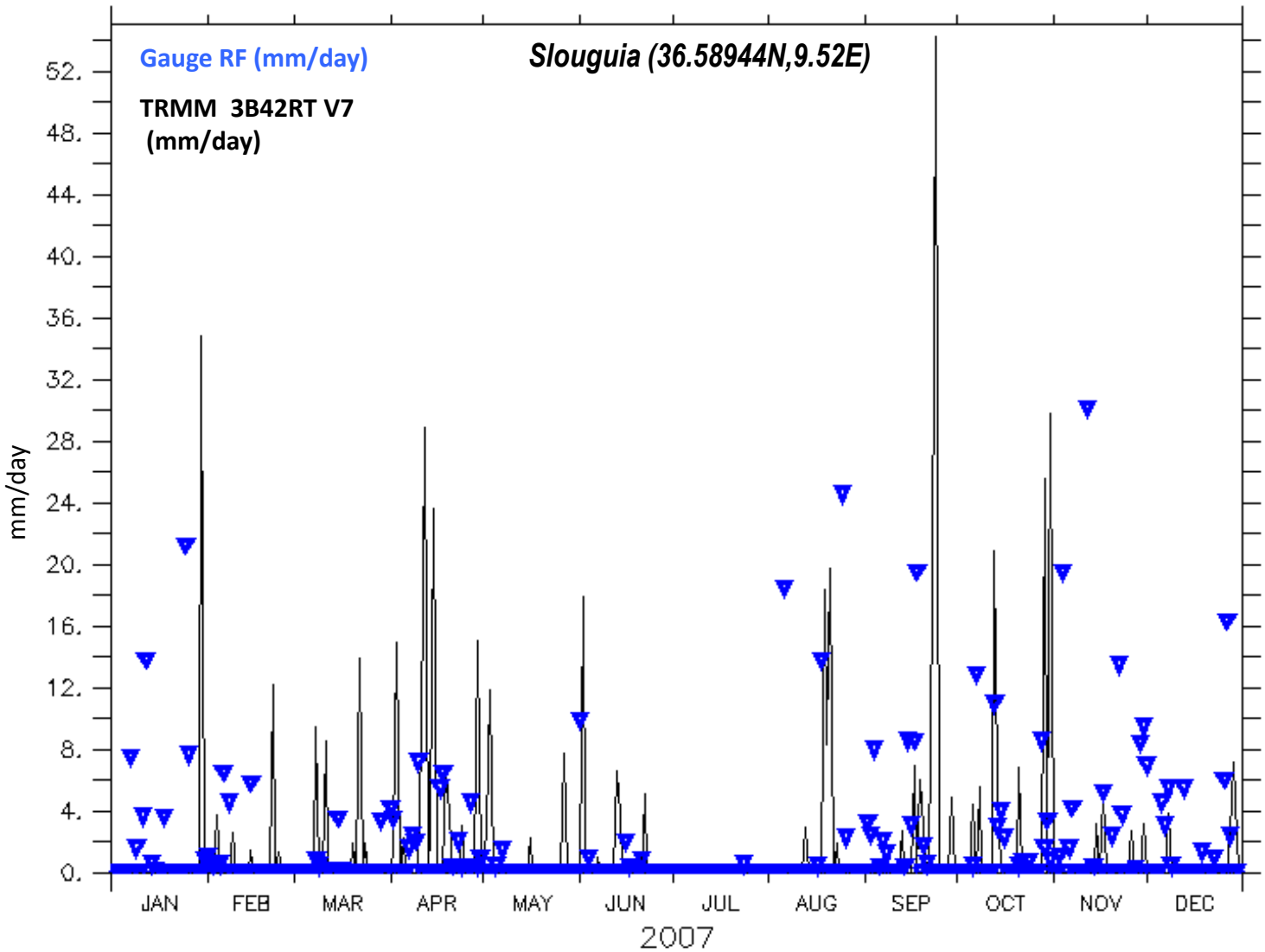
Gauge RF (mm/day)
Slouguia (36.58944N,9.52E)
TRMM 3B42RT V7
(mm/day)
mm/day
52.
48.
44.
40.
36.
32.
28.
24.
20.
16.
12.
8.
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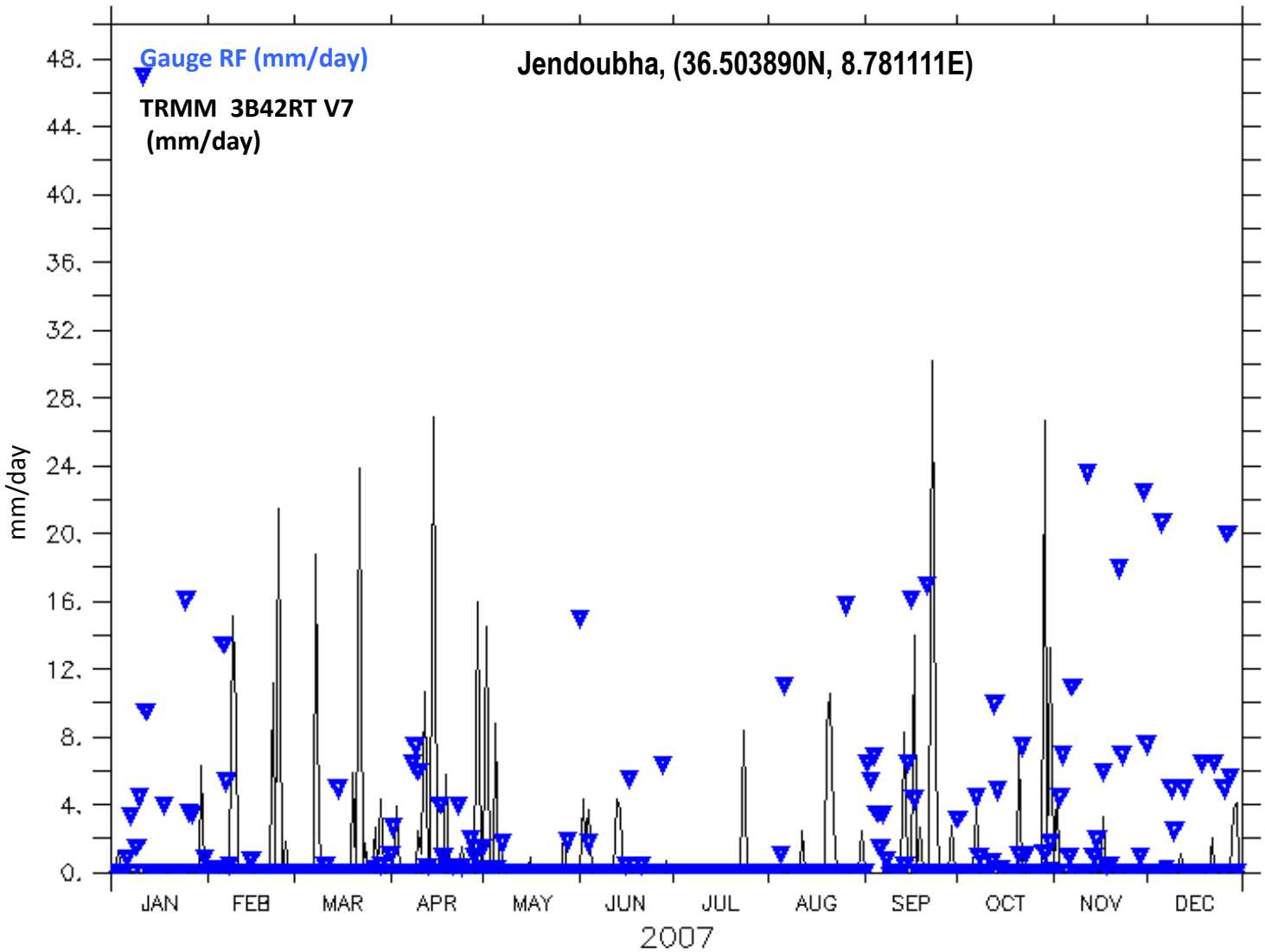
2007


Gauge RF (mm/day)
TRMM 3B42RT V7
(mm/day)
Jendoubha, (36.503890N, 8.781111E)
mm/day
48.
44.
40.
36.
32.
28.
24.
20.
16.
12.
8.
4.
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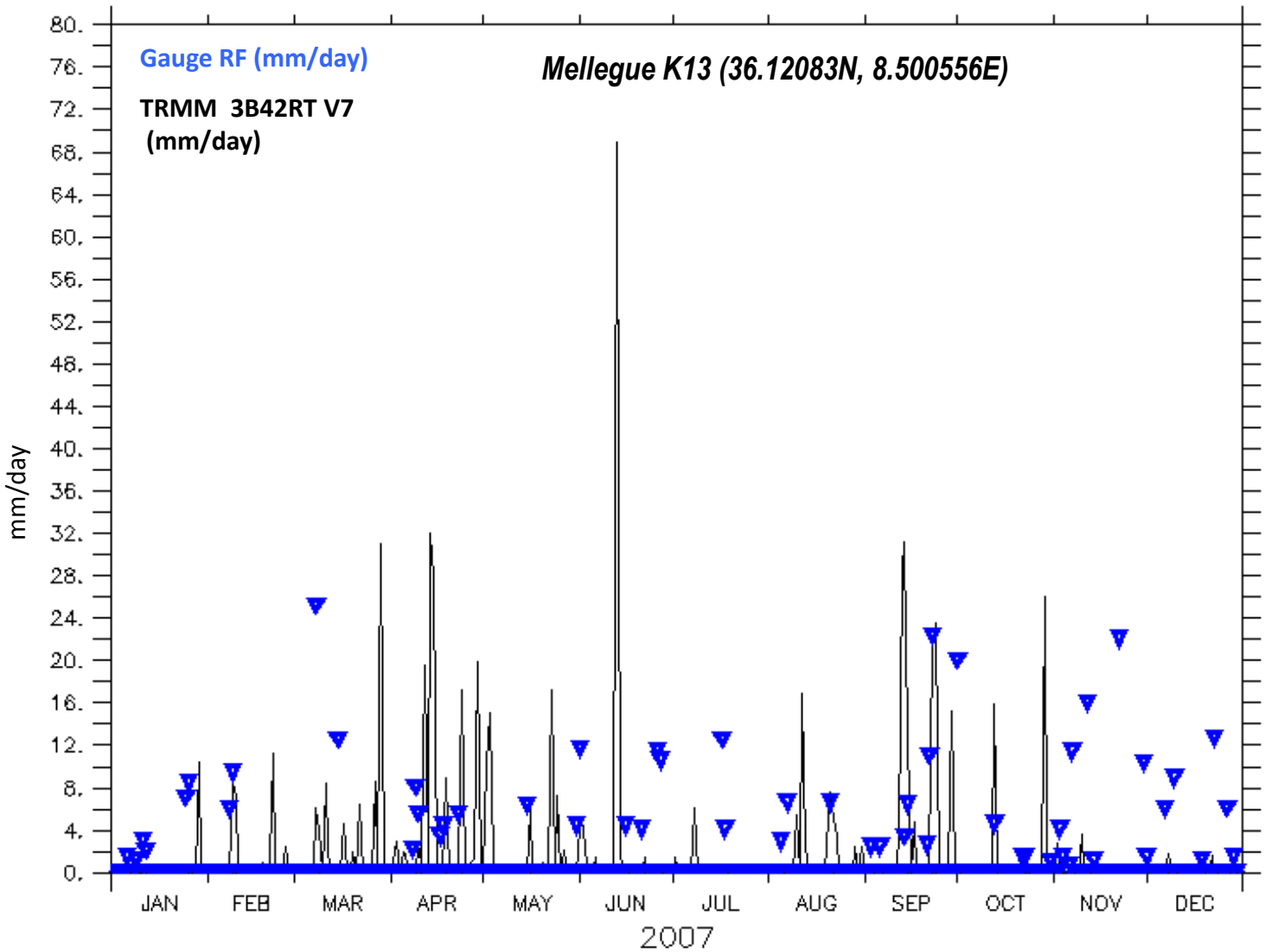
Gauge RF (mm/day)
TRMM 3B42RT V7
(mm/day)
Mellegue K13 (36.12083N, 8.500556E)
mm/day
80.
76.
72.
68.
64.
60.
56.
52.
48.
44.
40.
36.
32.
28.
24.
20.
16.
12.
8.
4.
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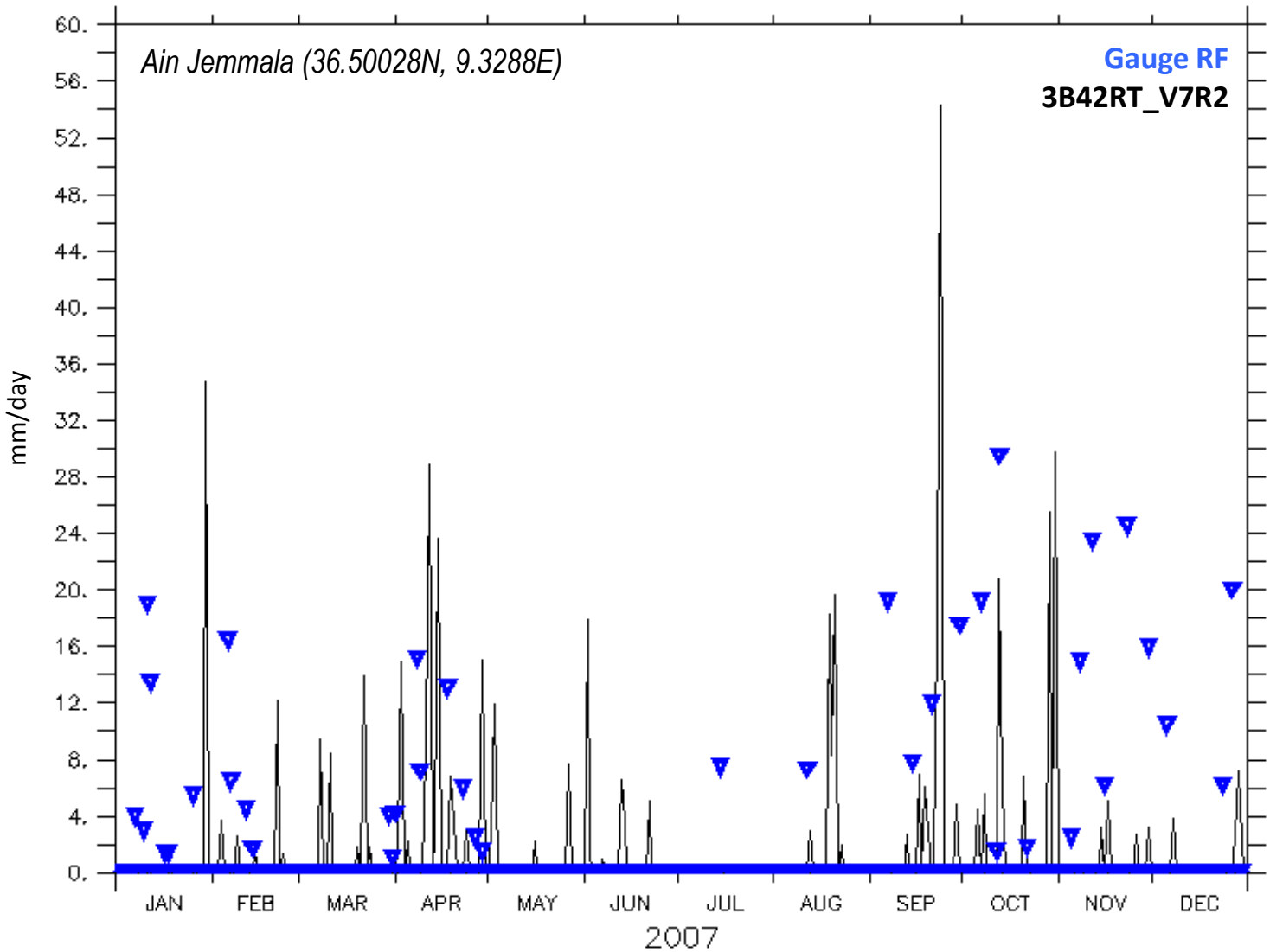
Ain Jemmala (36.50028N, 9.3288E)
Gauge RF
3B42RT_V7R2
mm/day
60.
56.
52.
48.
44.
40.
36.
32.
28.
24.
20.
16.
12.
8.
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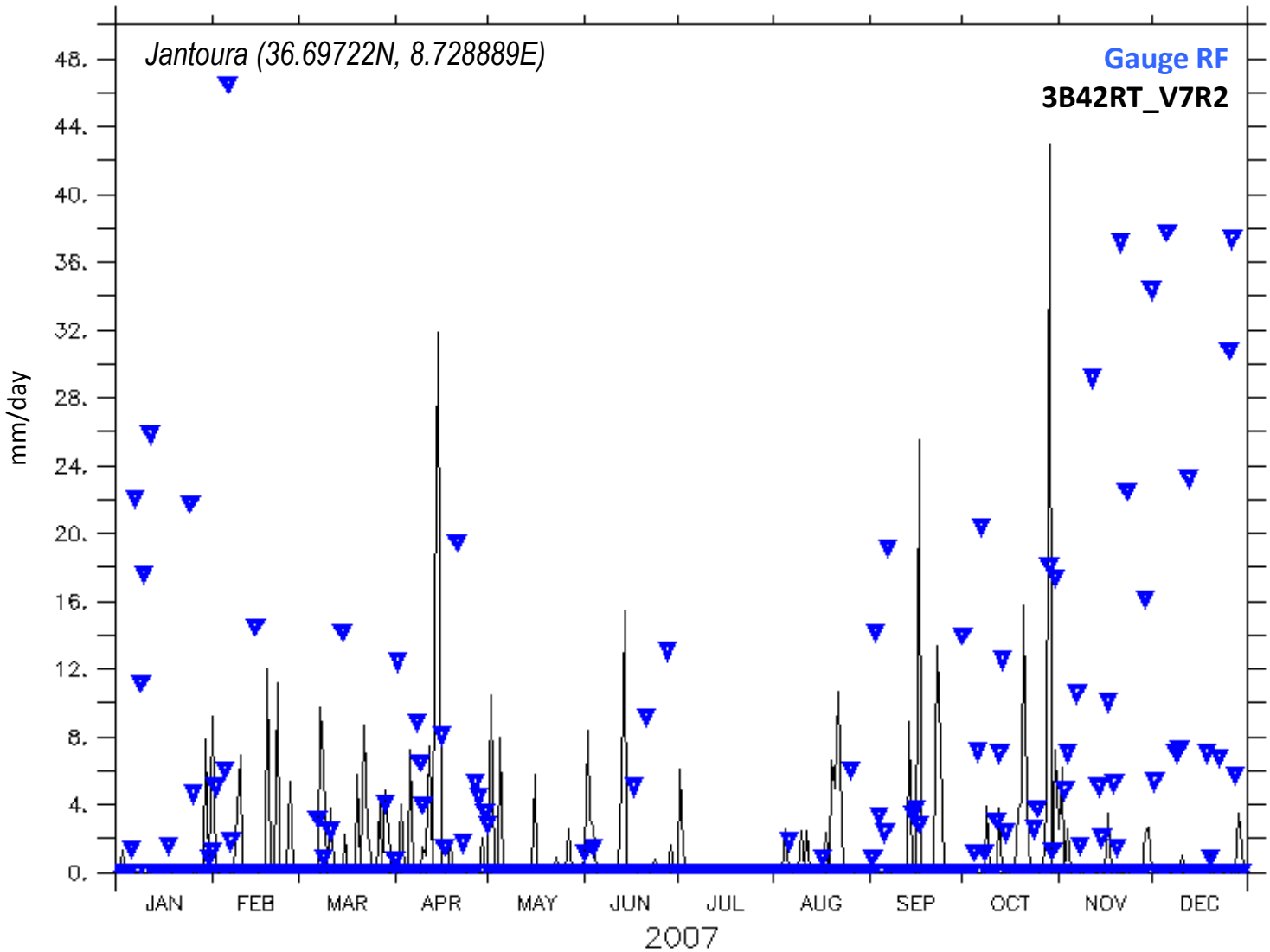
Jantoura (36.69722N, 8.728889E)
Gauge RF
3B42RT_V7R2
mm/day
48.
44.
40.
36.
32.
28.
24.
20.
16.
12.
8.
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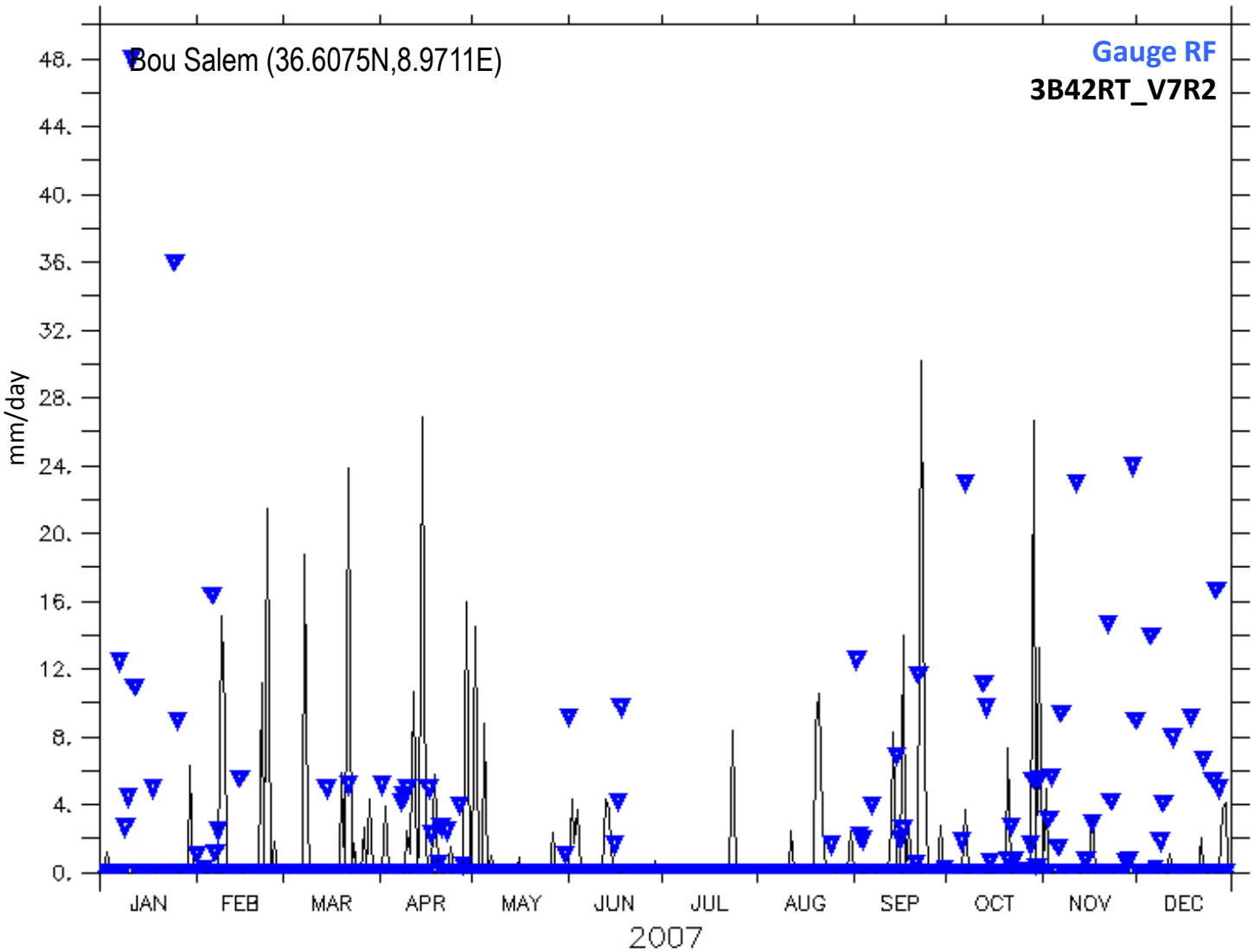
Bou Salem (36.6075N,8.9711E)
Gauge RF
3B42RT_V7R2
mm/day
48.
44.
40.
36.
32.
28.
24.
20.
16.
12.
8.
4.
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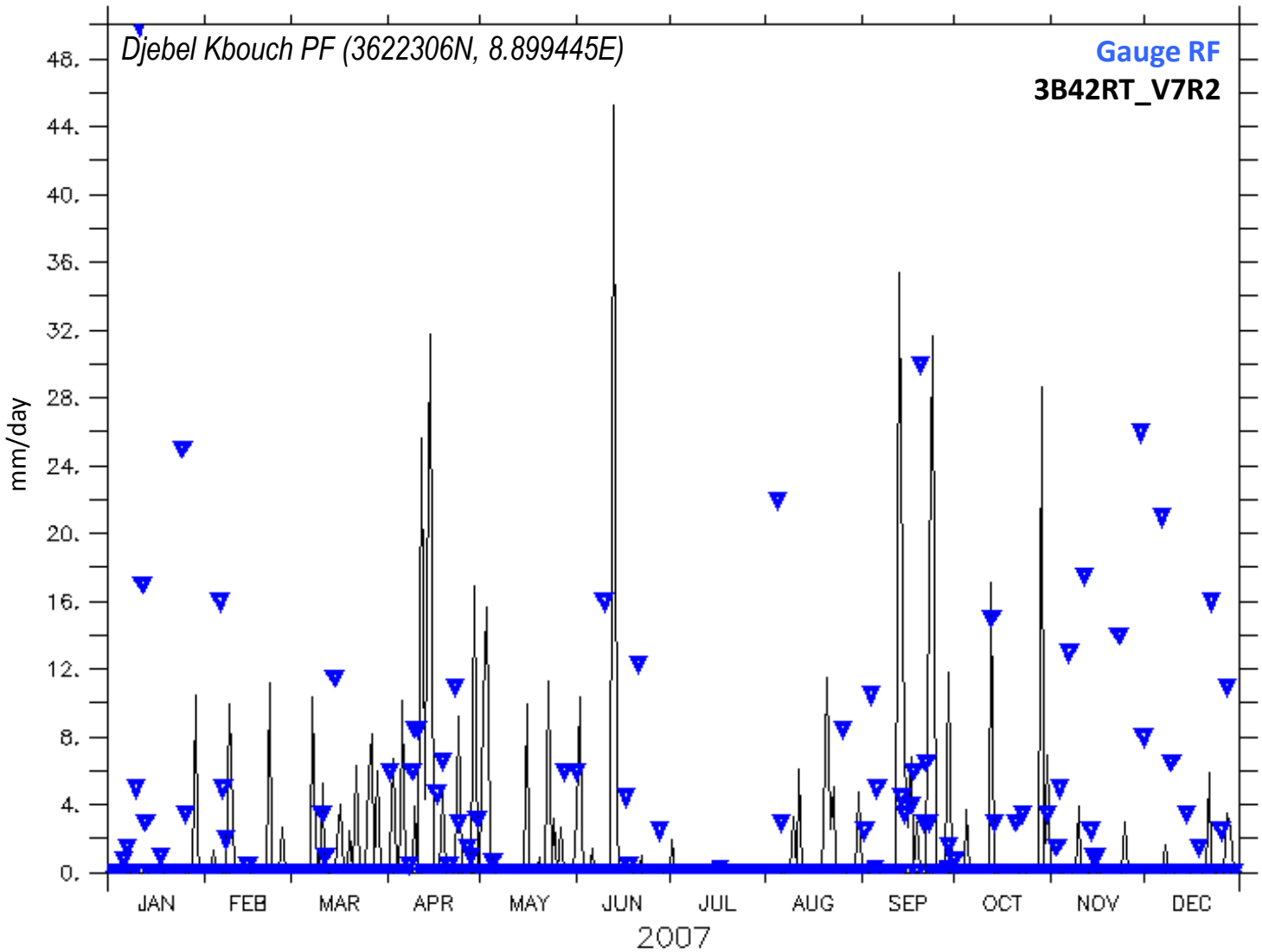
Djebel Kbouch PF (3622306N, 8.899445E)
Gauge RF
3B42RT_V7R2
mm/day
48.
44.
40.
36.
32.
28.
24.
20.
16.
12.
8.
4.
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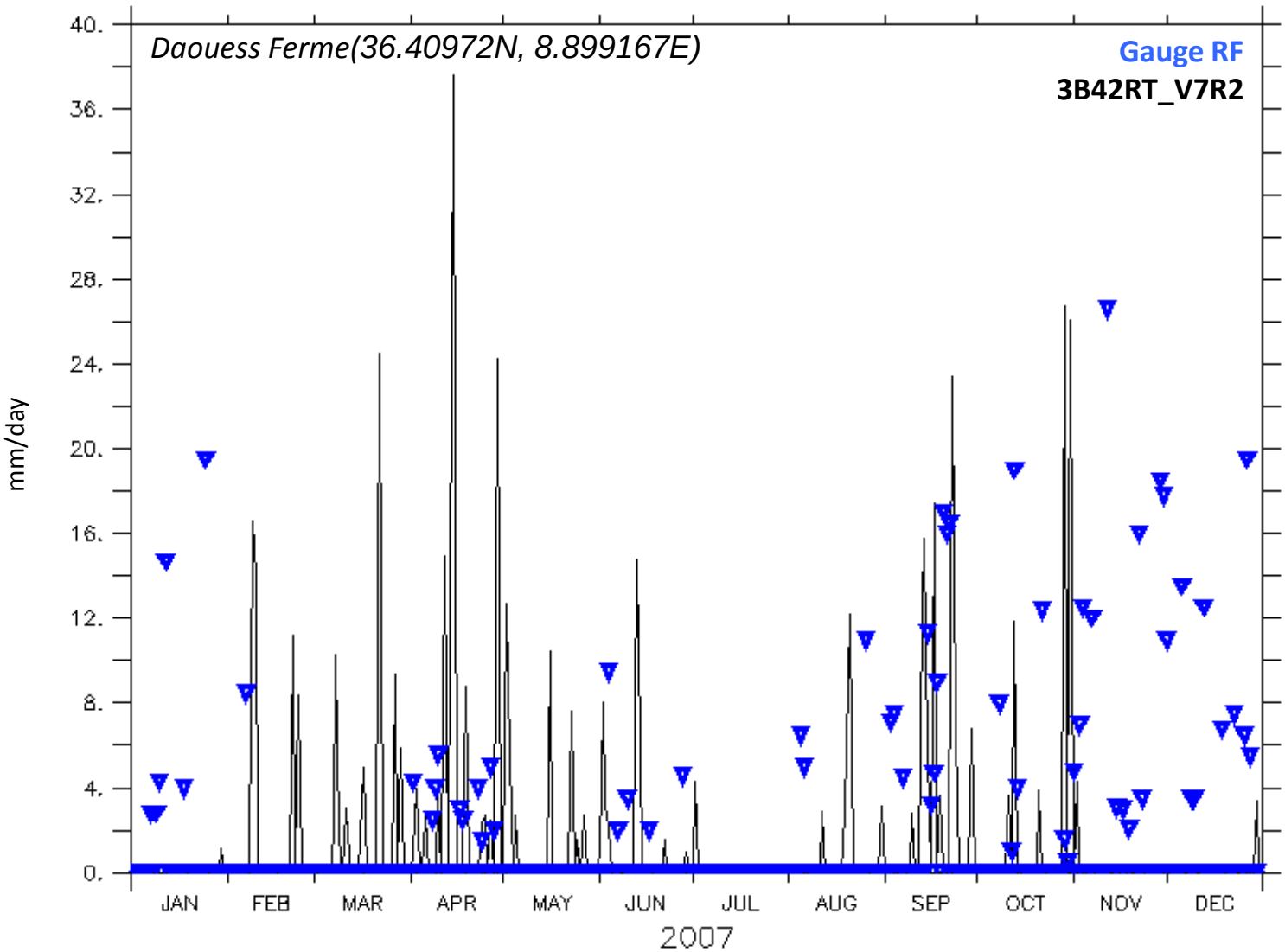
3B42RT_V7R2


Daouess Ferme(36.40972N, 8.899167E)
Gauge RF
3B42RT_V7R2
mm/day
40.
36.
32.
28.
24.
20.
16.
12.
8.
4.
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JAN
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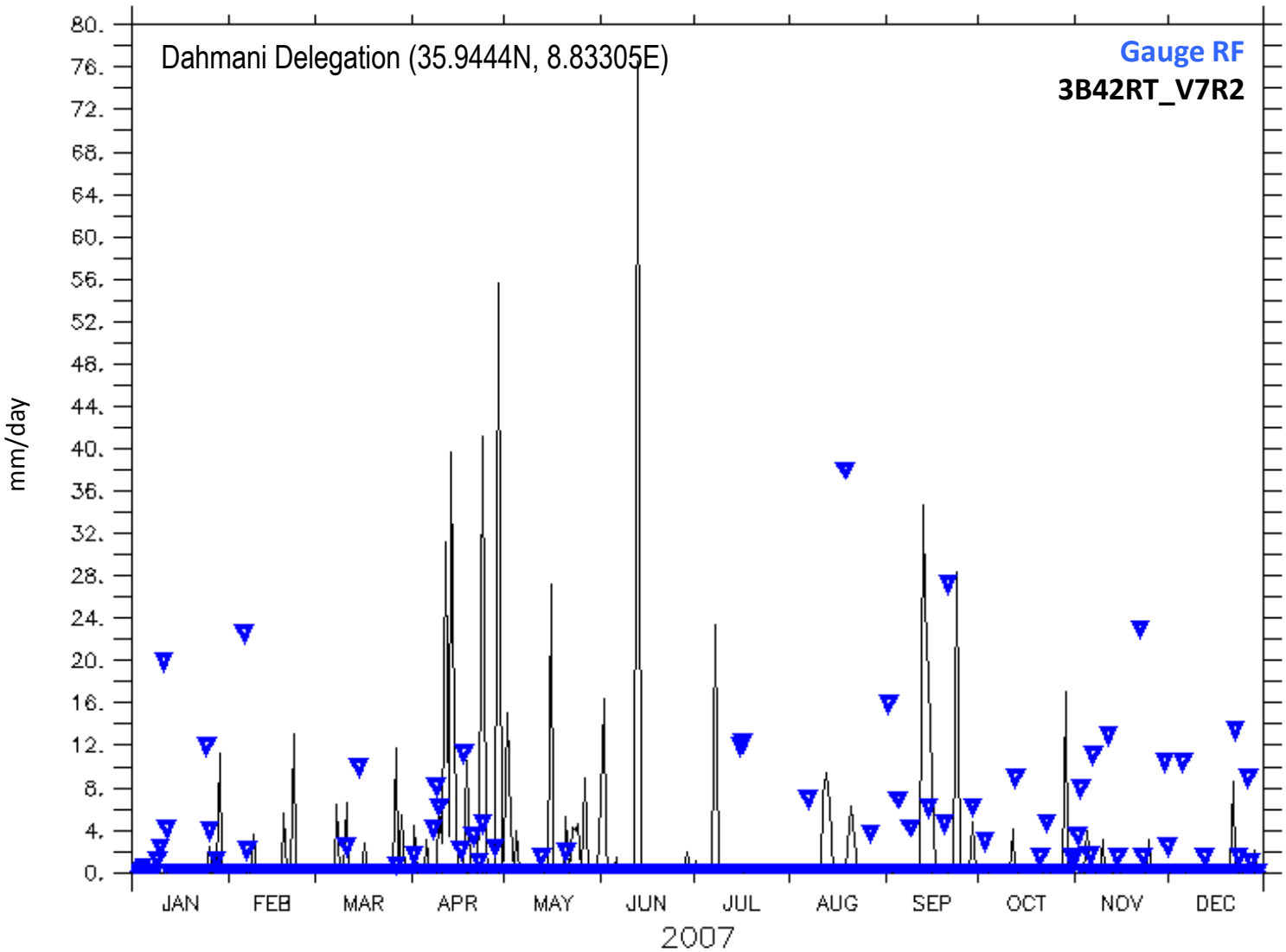
Dahmani Delegation (35.9444N, 8.83305E)
Gauge RF
3B42RT_V7R2
mm/day
80.
76.
72.
68.
64.
60.
56.
52.
48.
44.
40.
36.
32.
28.
24.
20.
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8.
4.
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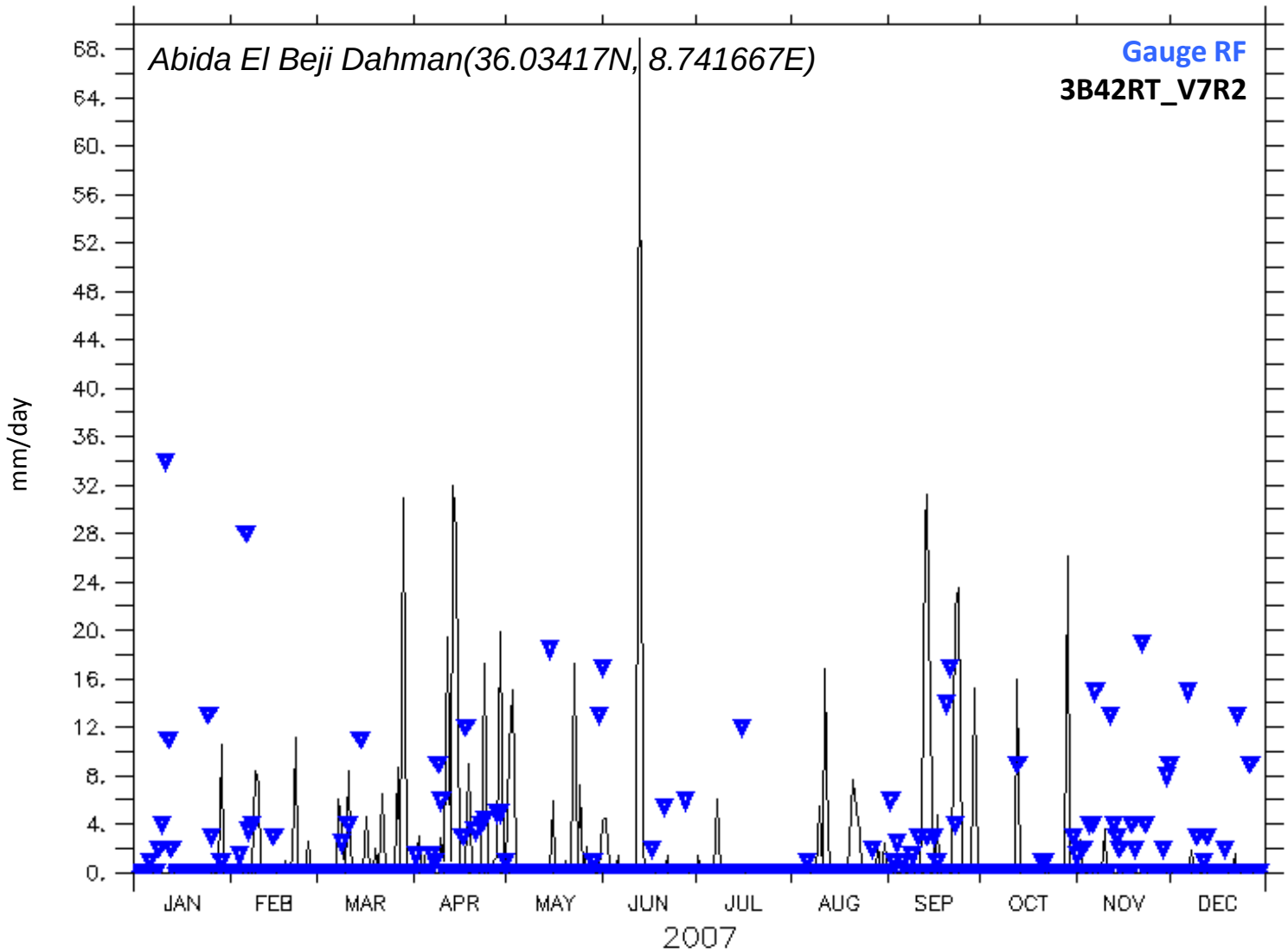
Abida El Beji Dahman(36.03417N, 8.741667E)
Gauge RF
3B42RT_V7R2
mm/day
68.
64.
60.
56.
52.
48.
44.
40.
36.
32.
28.
24.
20.
16.
12.
8.
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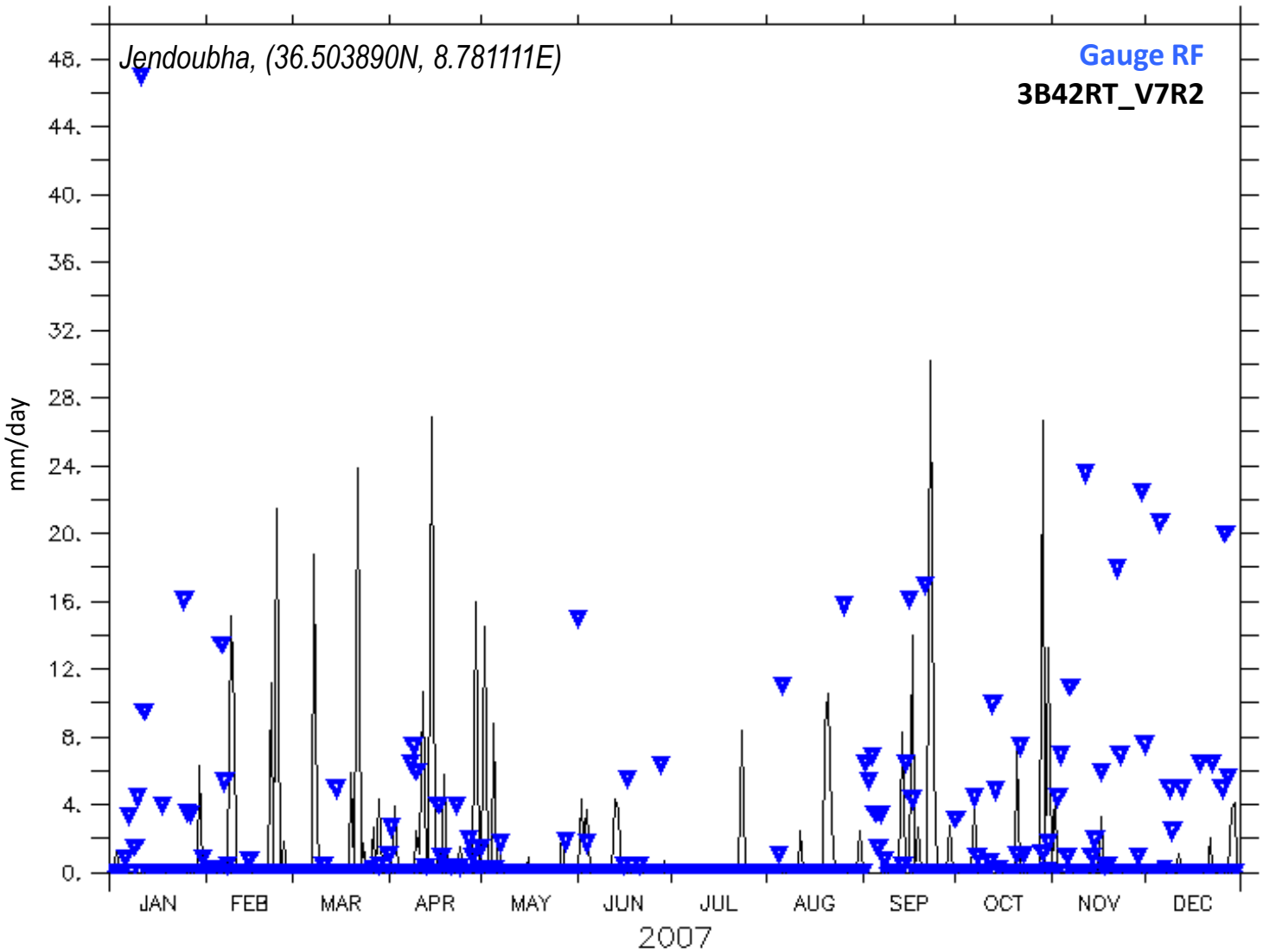
Jendoubha, (36.503890N, 8.781111E)
Gauge RF
3B42RT_V7R2
mm/day
48.
44.
40.
36.
32.
28.
24.
20.
16.
12.
8.
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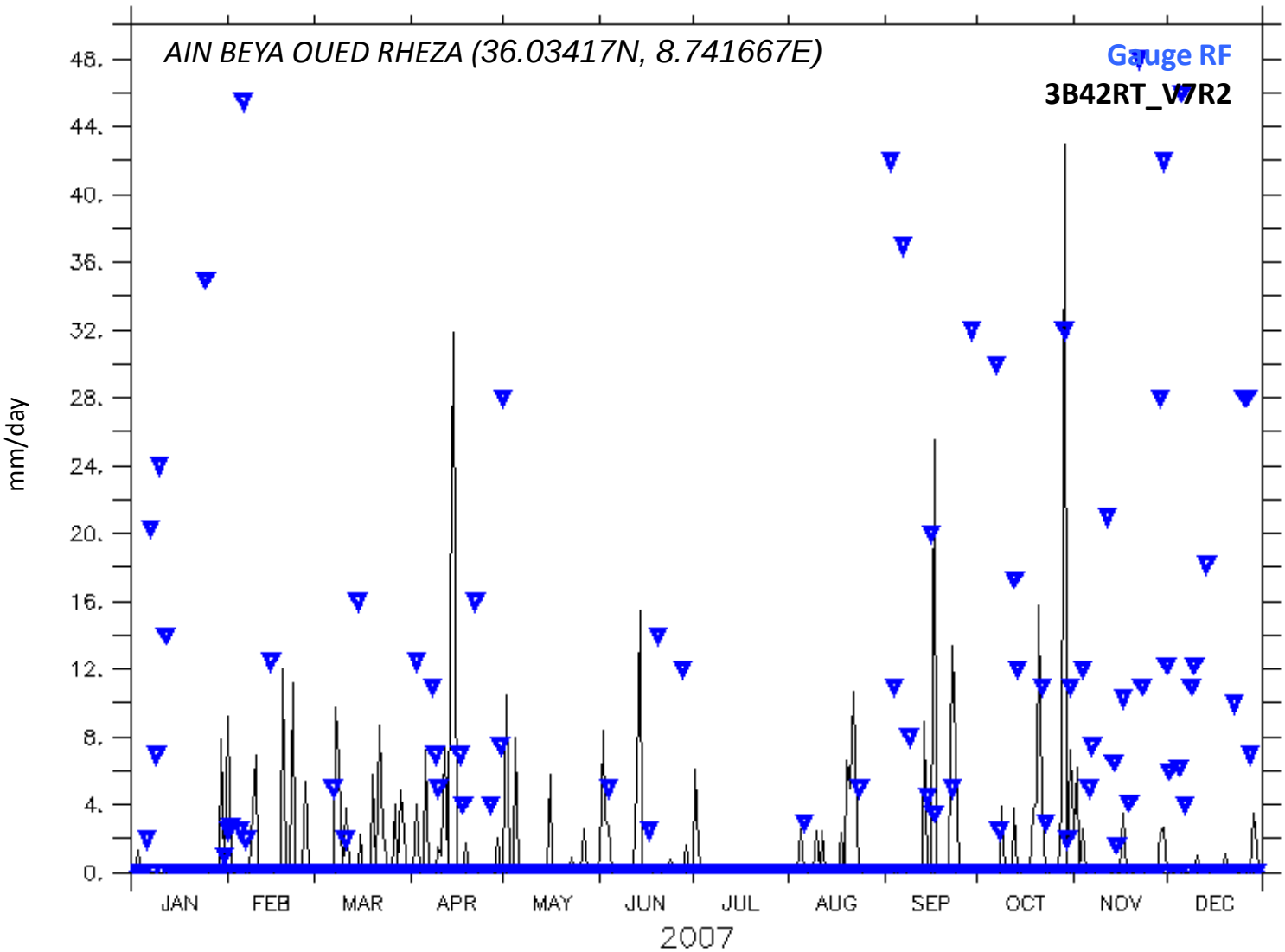
AIN BEYA OUED RHEZA (36.03417N, 8.741667E)
Gauge RF
3B42RT_V7R2
mm/day
48.
44.
40.
36.
32.
28.
24.
20.
16.
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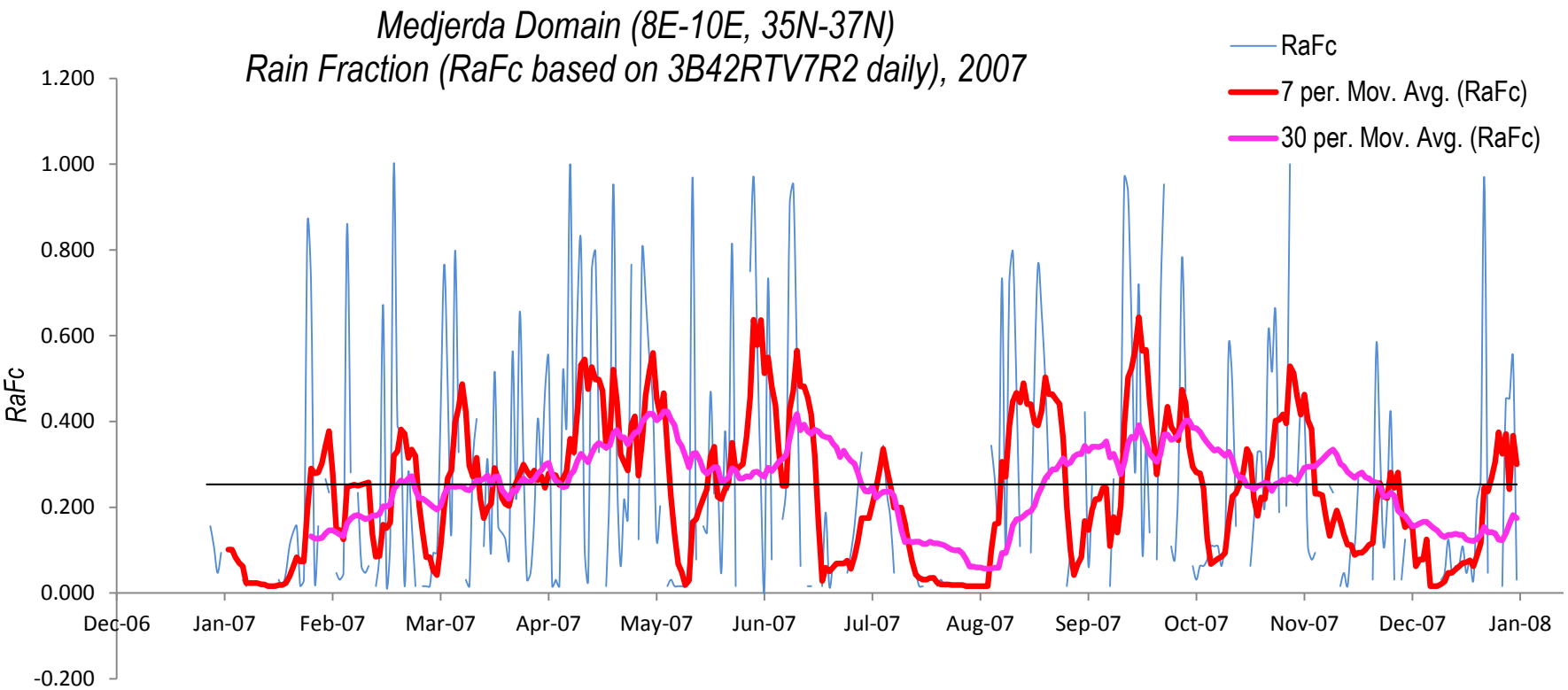
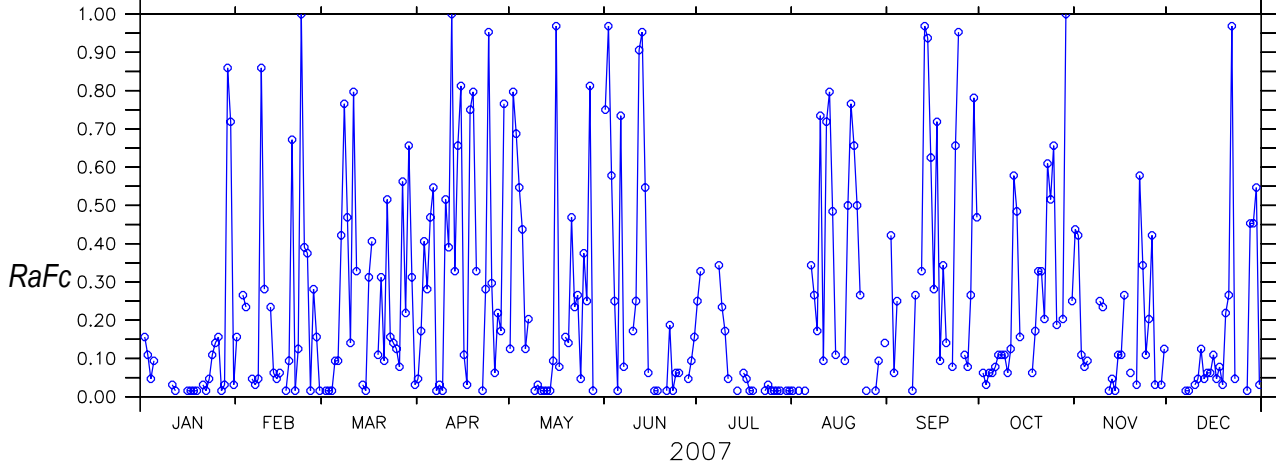
RAIN FRACTION



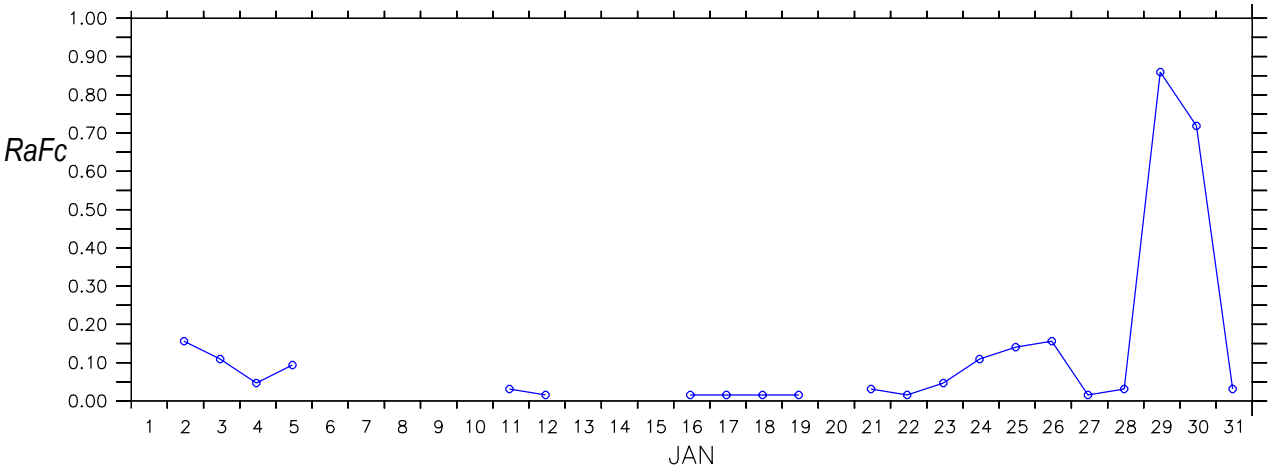
Rain Fraction : Number of rainy pixels to total number of pixels in a desired domain (Medjerda) (3b42RTV7R2)

Weekly and monthly moving averages.

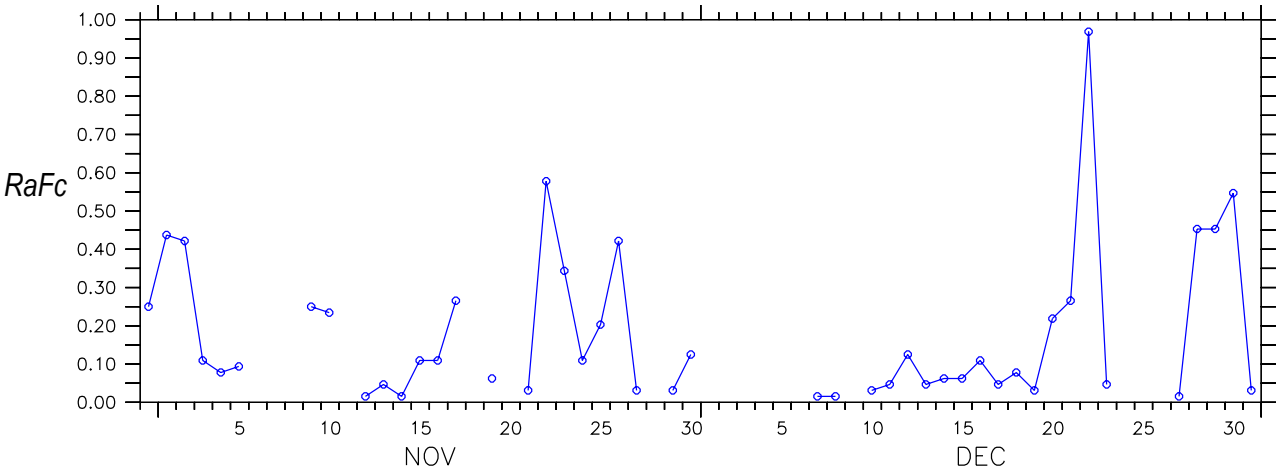
DAILY, 3B42RTV6



3B42RTV6 Daily, 2007
Rain Fraction(RaFc)
Medjerda Basin
~(8°E:10°E, 35°N:37°N)

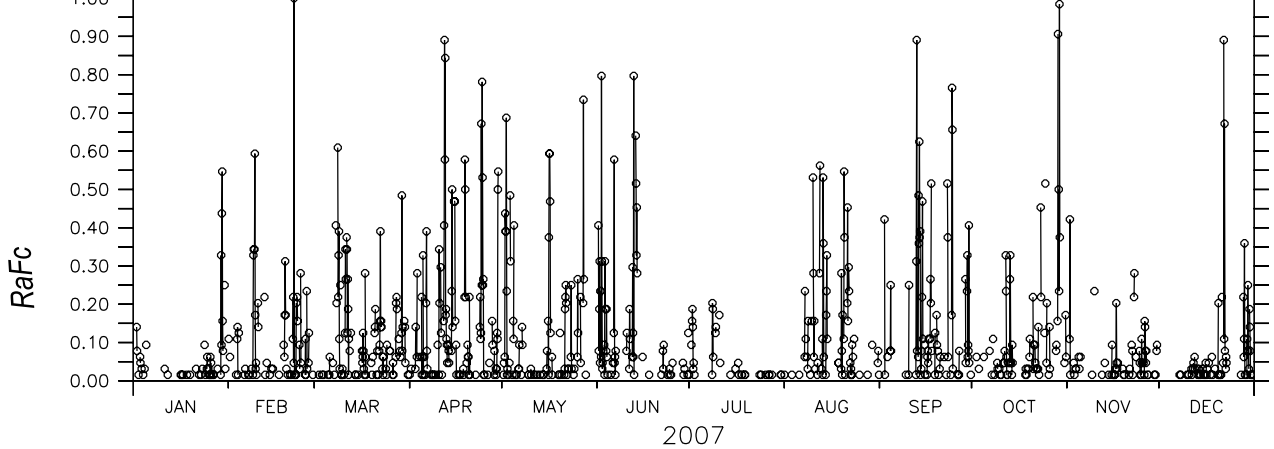


3B42RTV6 Daily,
Jan 2007
Rain Fraction(RaFc)
Medjerda Basin
~(8°E:10°E, 35°N:37°N)

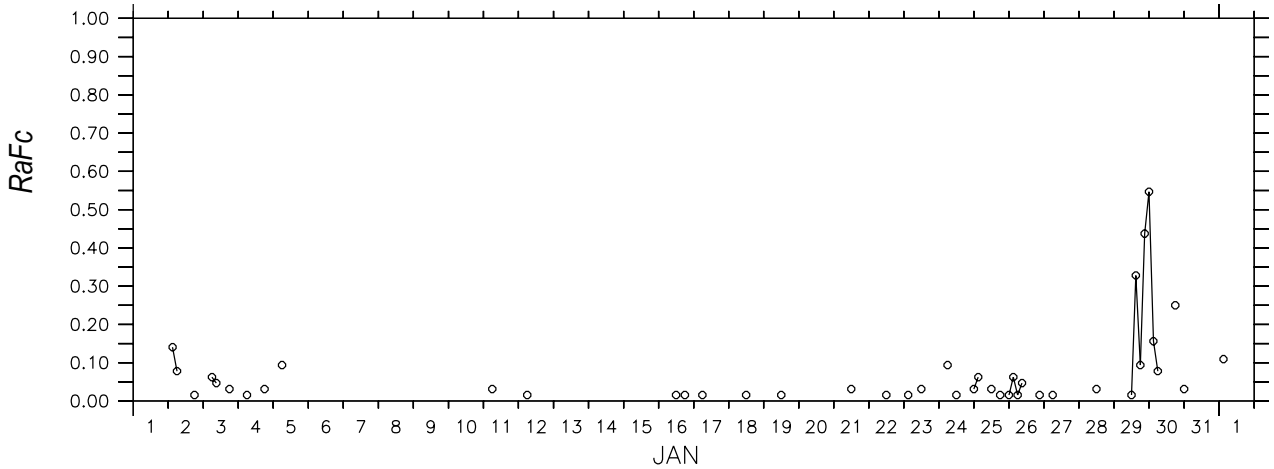


3B42RTV6 Daily,
Nov-Dec. 2007
Rain Fraction(RaFc)
Medjerda Basin
~(8°E:10°E, 35°N:37°N)

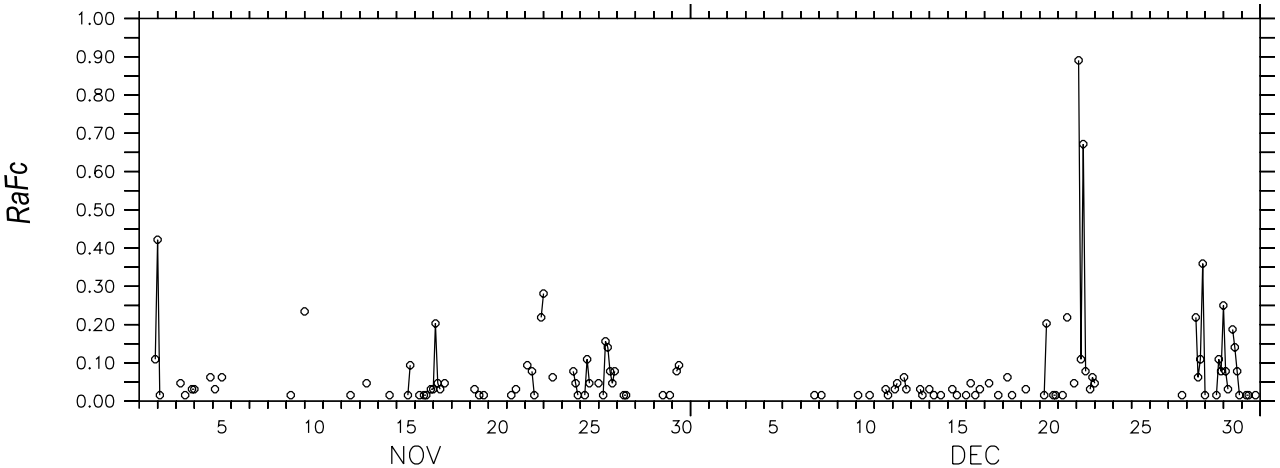
3Hrly, 3B42RTV6



3B42RTV6 3hrly, 2007
Rain Fraction(RaFc)
Medjerda Basin
~(8°E:10°E, 35°N:37°N)

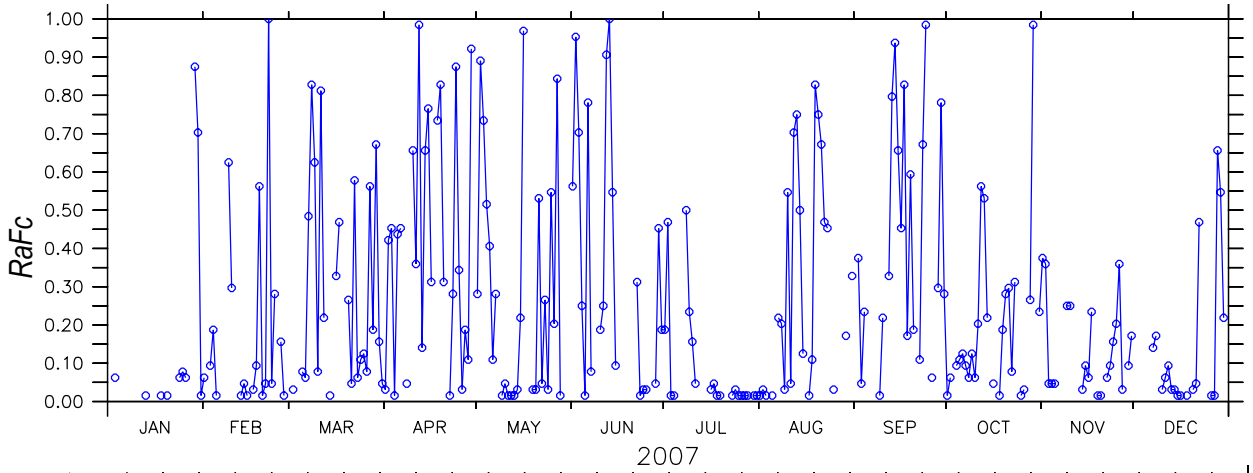


3B42RTV6 , 3hrly.,
Jan 2007
Rain Fraction(RaFc)
~(8°E:10°E, 35°N:37°N)

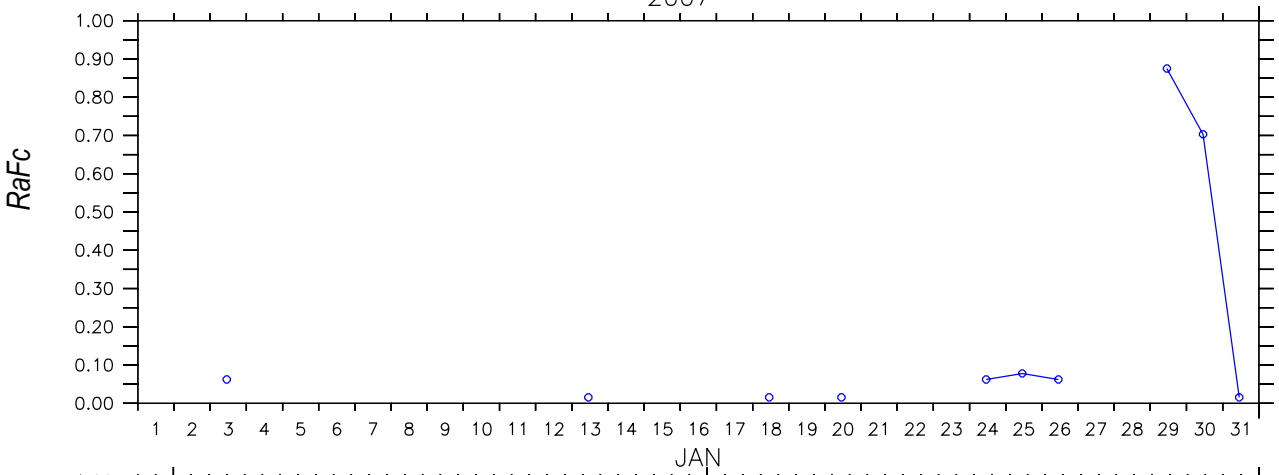


3B42RTV6 3hrly,
Nov-Dec. 2007
Rain Fraction(RaFc)
~(8°E:10°E, 35°N:37°N)

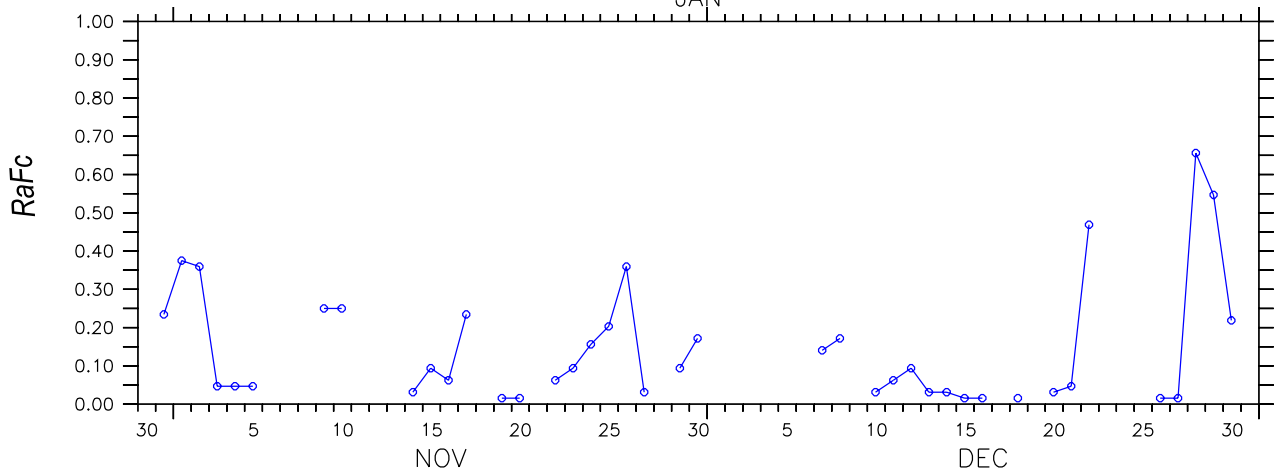
DAILY, 3B42RTV7R2



3B42RTV7R2 Daily, 2007
Rain Fraction frequency (RaFc)
Medjerda Basin
~(8°E:10°E, 35°N:37°N)



3B42RTV7R2 Daily,
Jan 2007
Rain Fraction frequency (RaFc)
Medjerda Basin
~(8°E:10°E, 35°N:37°N)



3B42RTV7R2 Daily,
Nov-Dec. 2007
Rain Fraction frequency (RaFc)
Medjerda Basin
~(8°E:10°E, 35°N:37°N)

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T Kunhikrishnan, F. S. Policelli, S. Habib, J. L. David, K. A. Melocik, G.J.Huffman, M. C. Anderson, A.B.H.Ali, S. Bacha, and E. R. Ahmed: 2014, Monitoring and Forecasting Floods over North Africa based on Satellite data: Uncertainties and Challenge, Session on Remote sensing application to Hydrology, 28th conference on Hydrology, AMS annual meeting, Atlanta, GA., https://ams.confex.com/ams/94Annual/webprogram/Paper241363.html