Is seasonal forecast alchemy?

The Israeli experience

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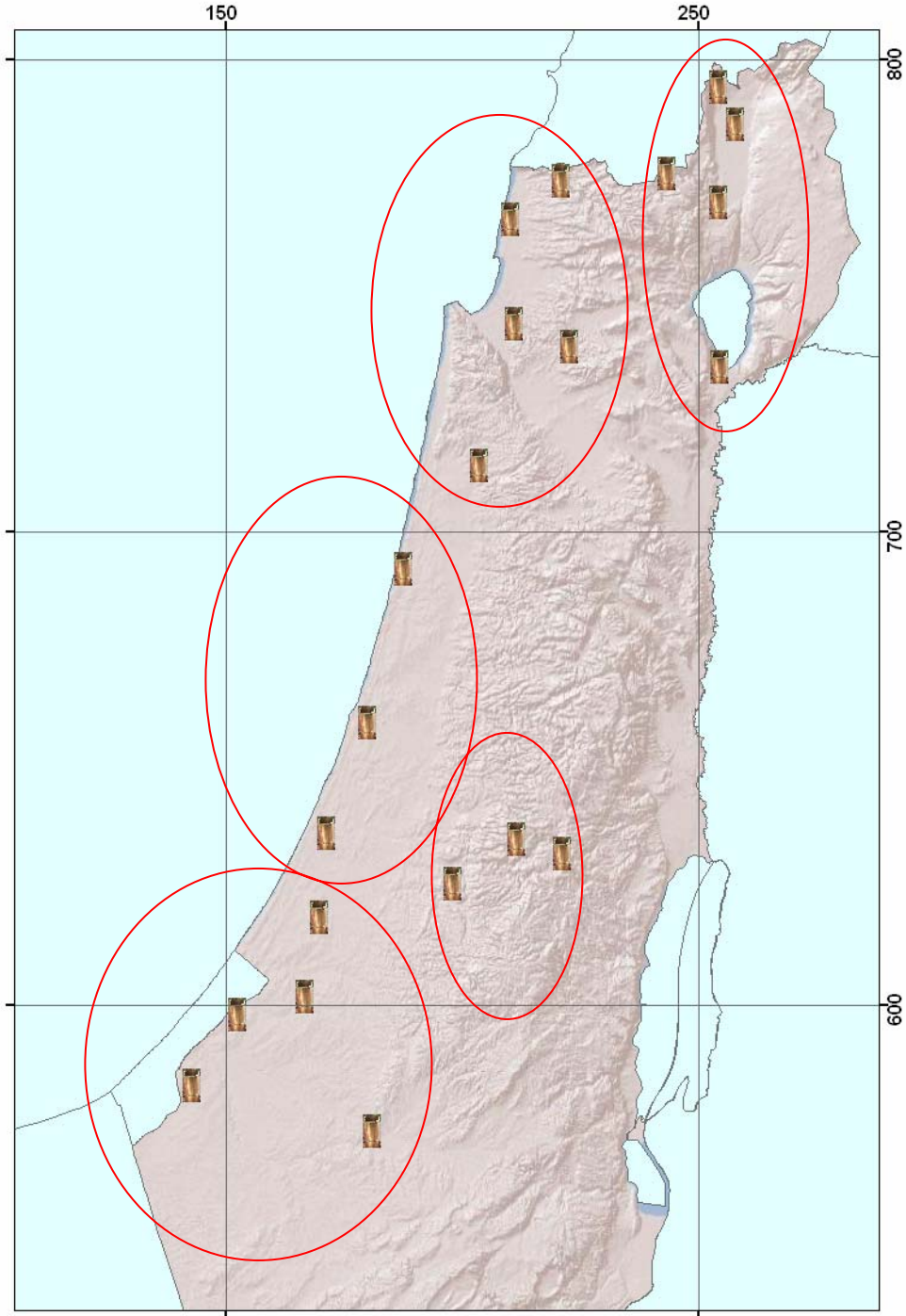
Israeli Met. Service

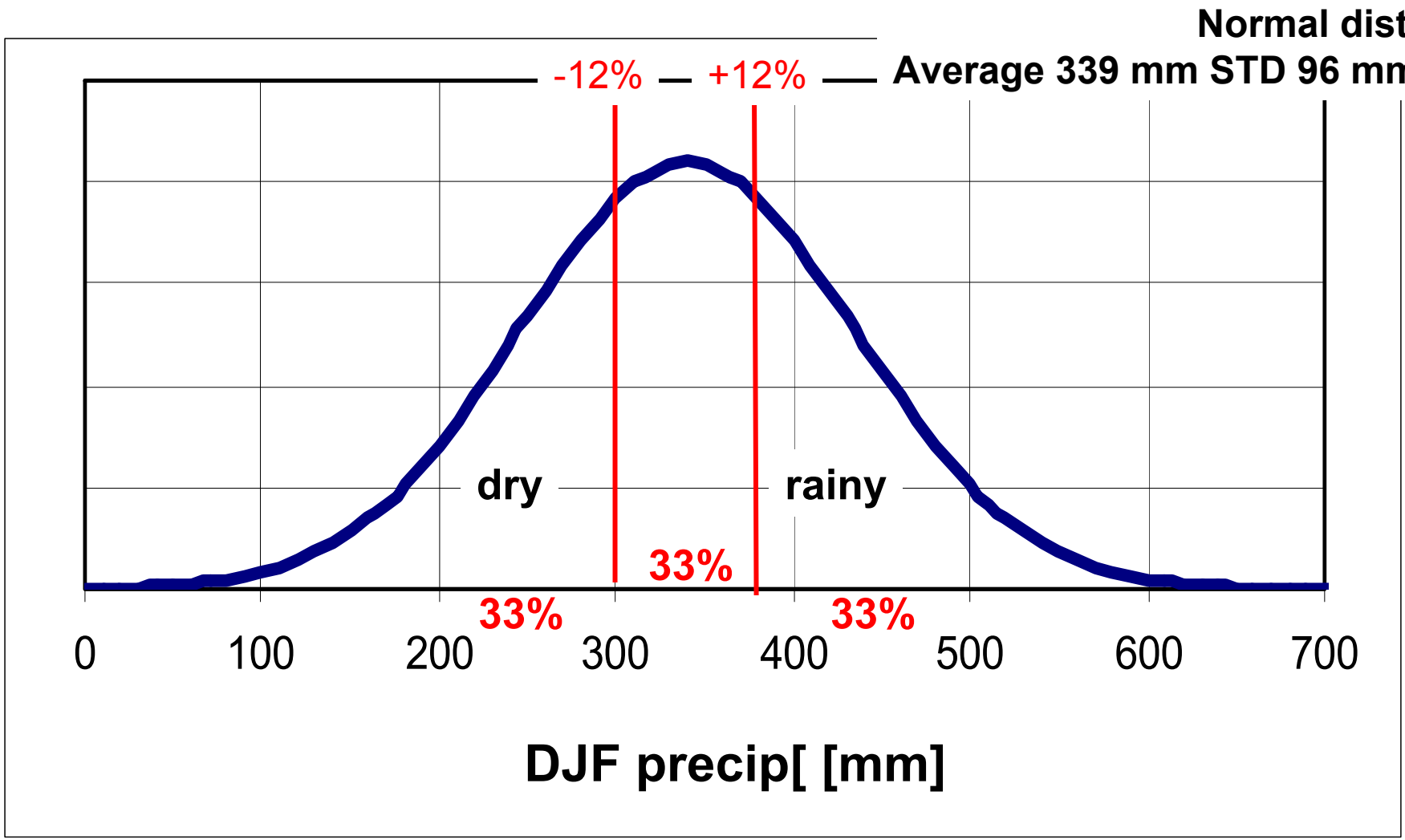
Alchemy

Pietro Longhi 1757



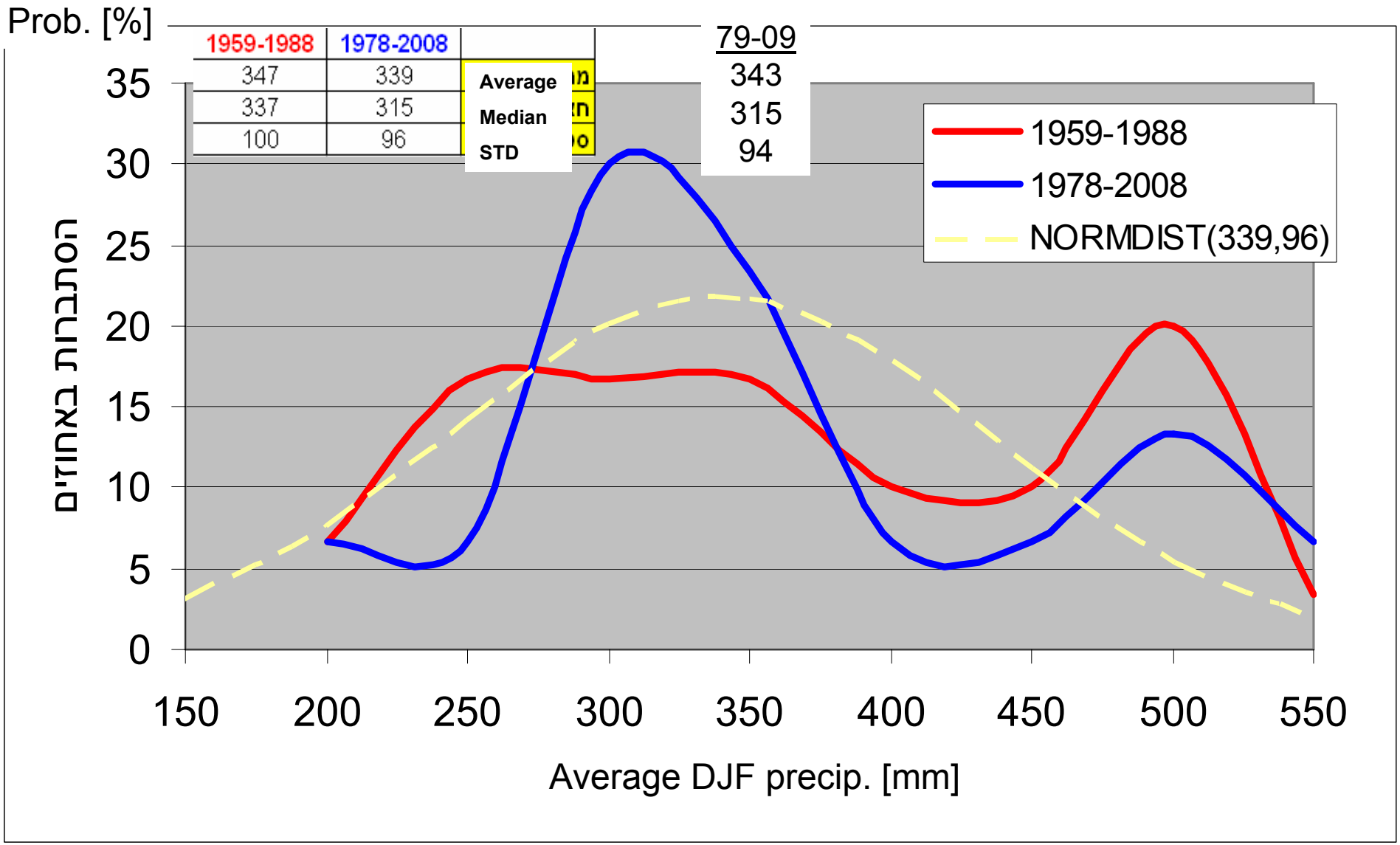
21 rain stations

If the precip. Is normal distributed



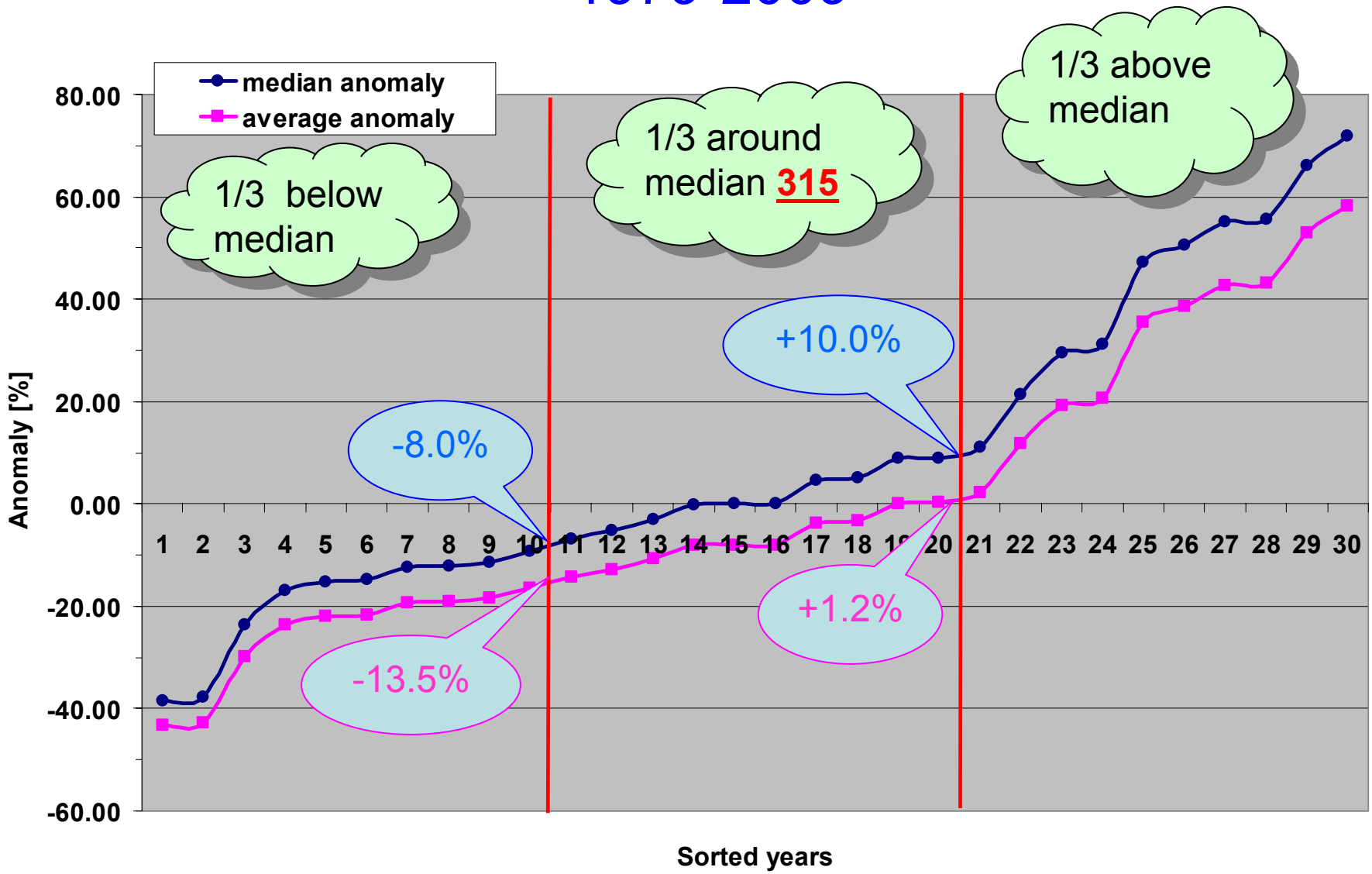
21 station ave. DJF precip,

1978-2008 and 1959-1988



3 equal groups

1979-2009

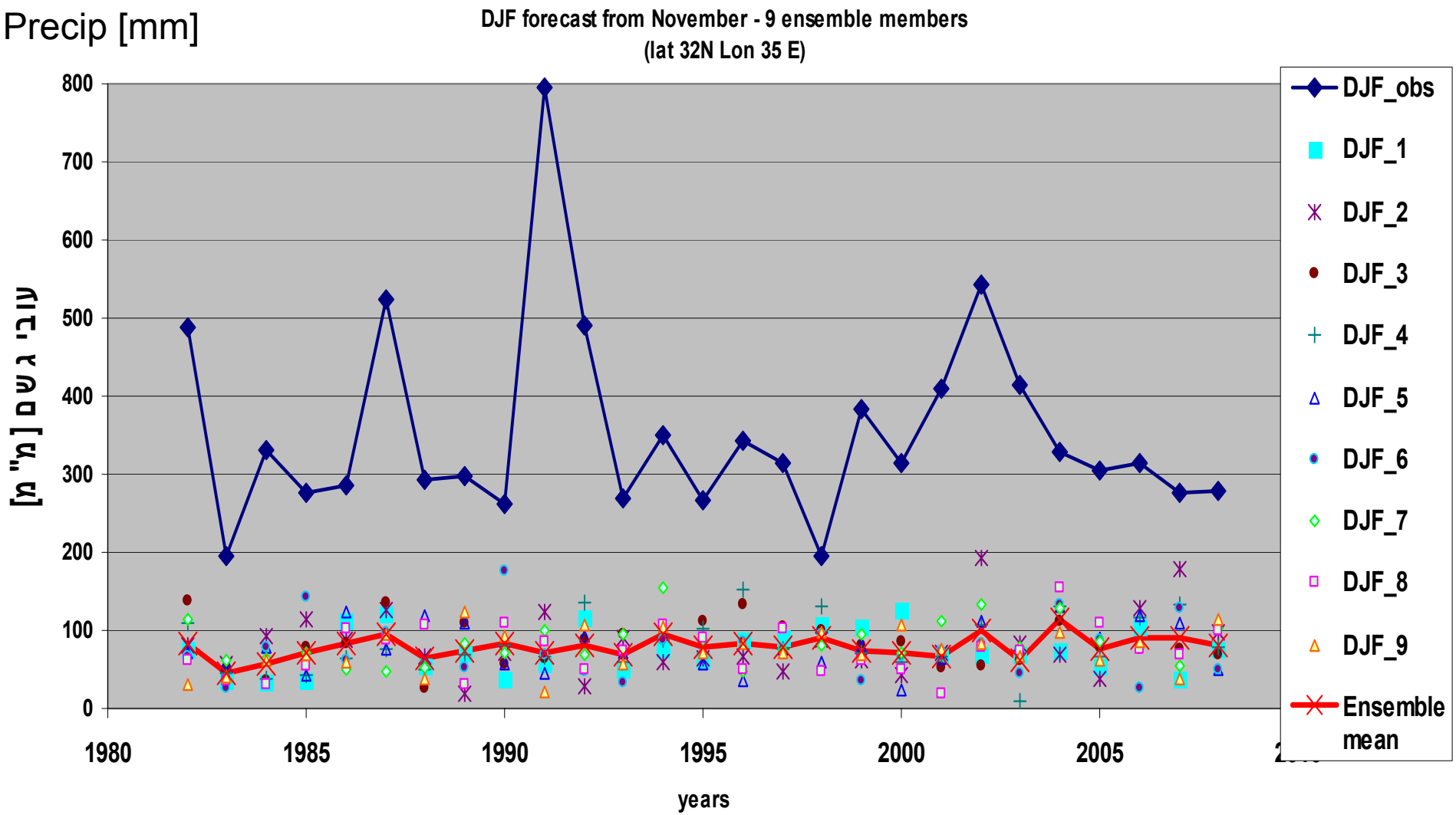


9 members of SINTEX coupled GCM

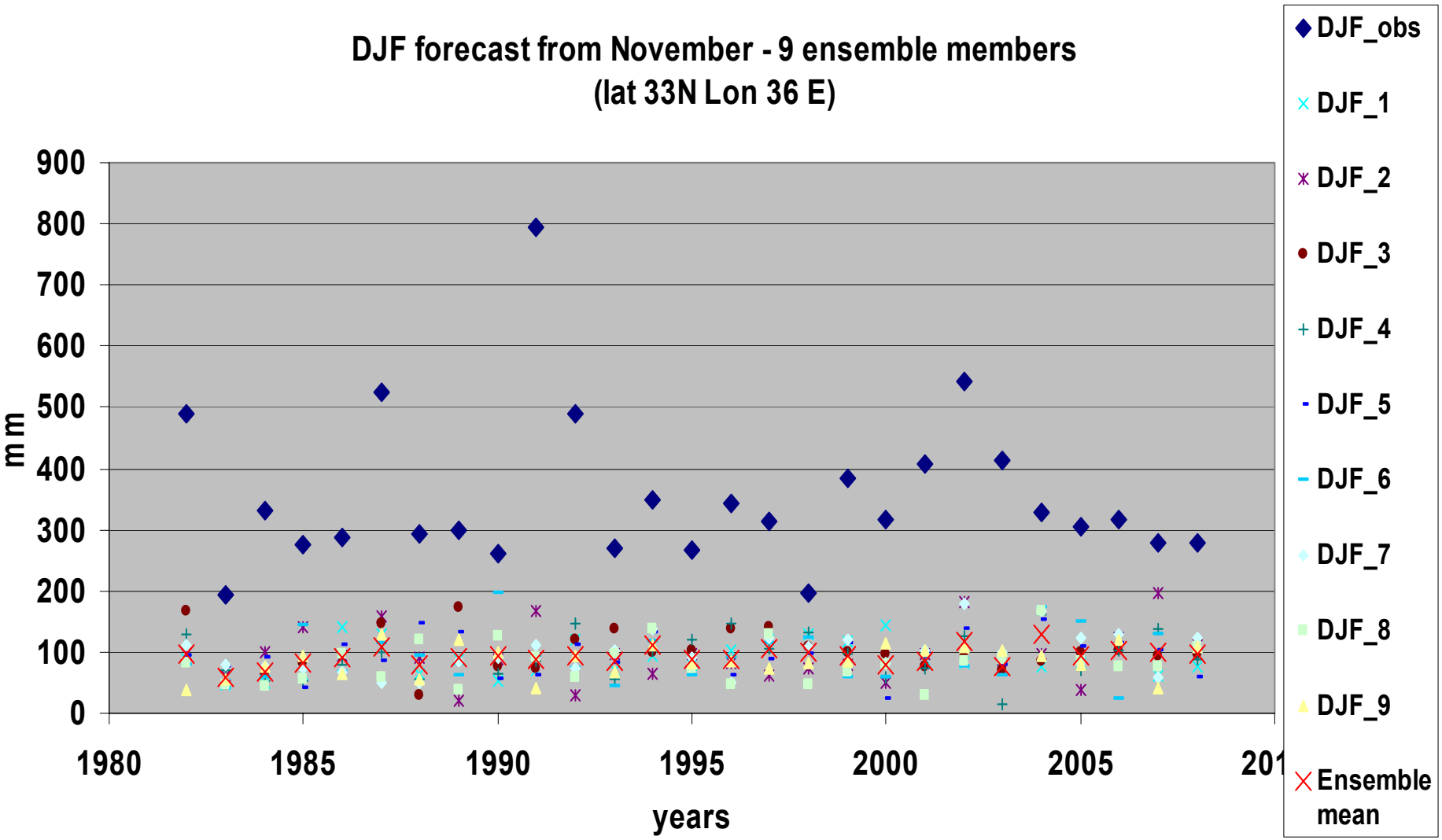
1.25 º x 1.25º

3 points near Israel

Central Point

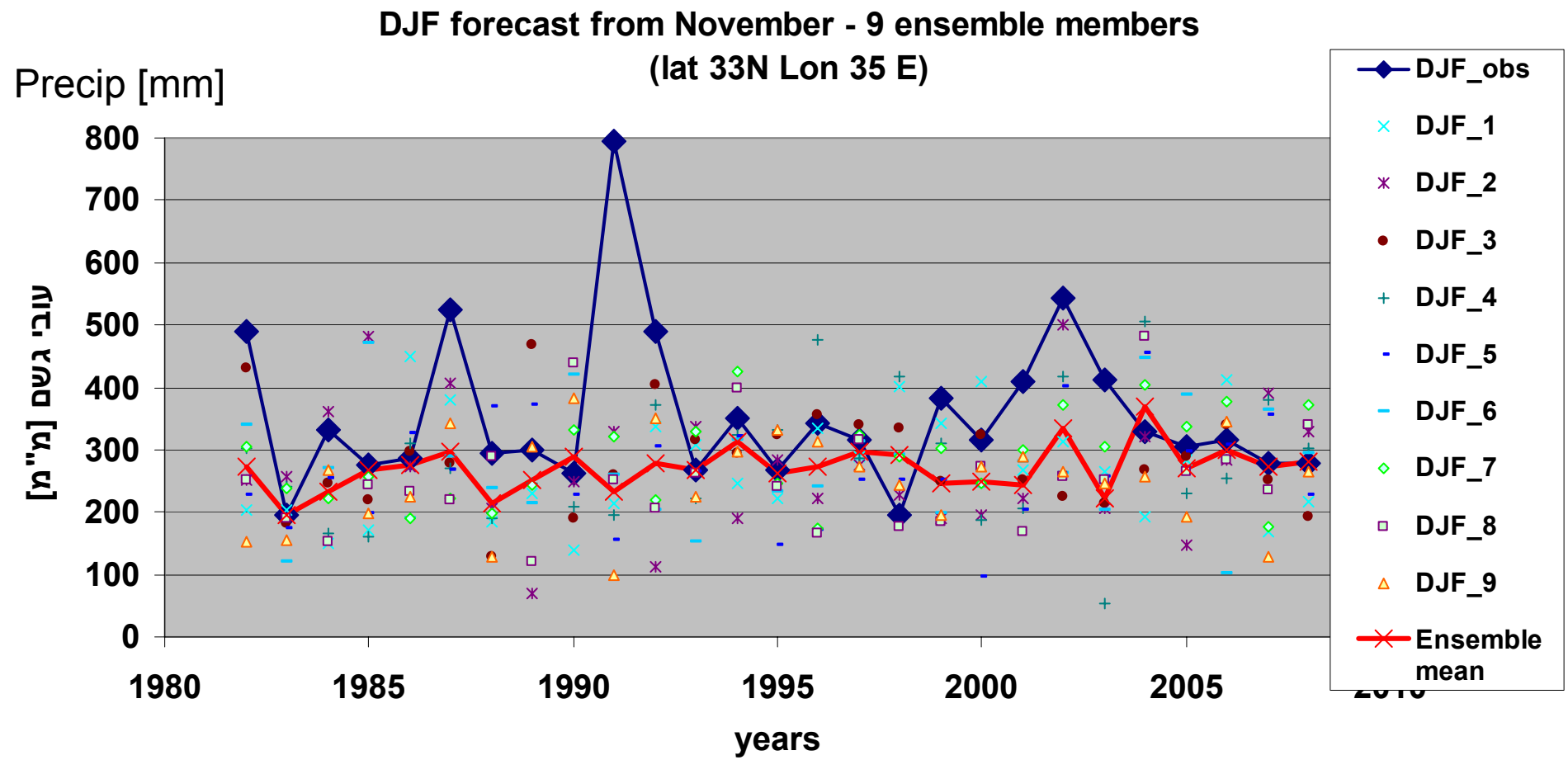


Syria Point


DJF forecast from November - 9 ensemble members
(lat 33N Lon 36 E)
mm
900
800
700
600
500
400
300
200
100
0
1980
1985
1990
1995
2000
2005
201
years
DJF_obs
DJF_1
DJF_2
DJF_3
DJF_4
DJF_5
DJF_6
DJF_7
DJF_8
DJF_9
Ensemble mean

Coast point hit score (1982-2008) by 3 categories

DJF_1	DJF_2	DJF_3	DJF_4	DJF_5	DJF_6	DJF_7	DJF_8	DJF_9	Ensemble mean	
40.74	29.63	40.74	33.33	29.63	25.93	22.22	14.81	37.04	25.93	Hit score



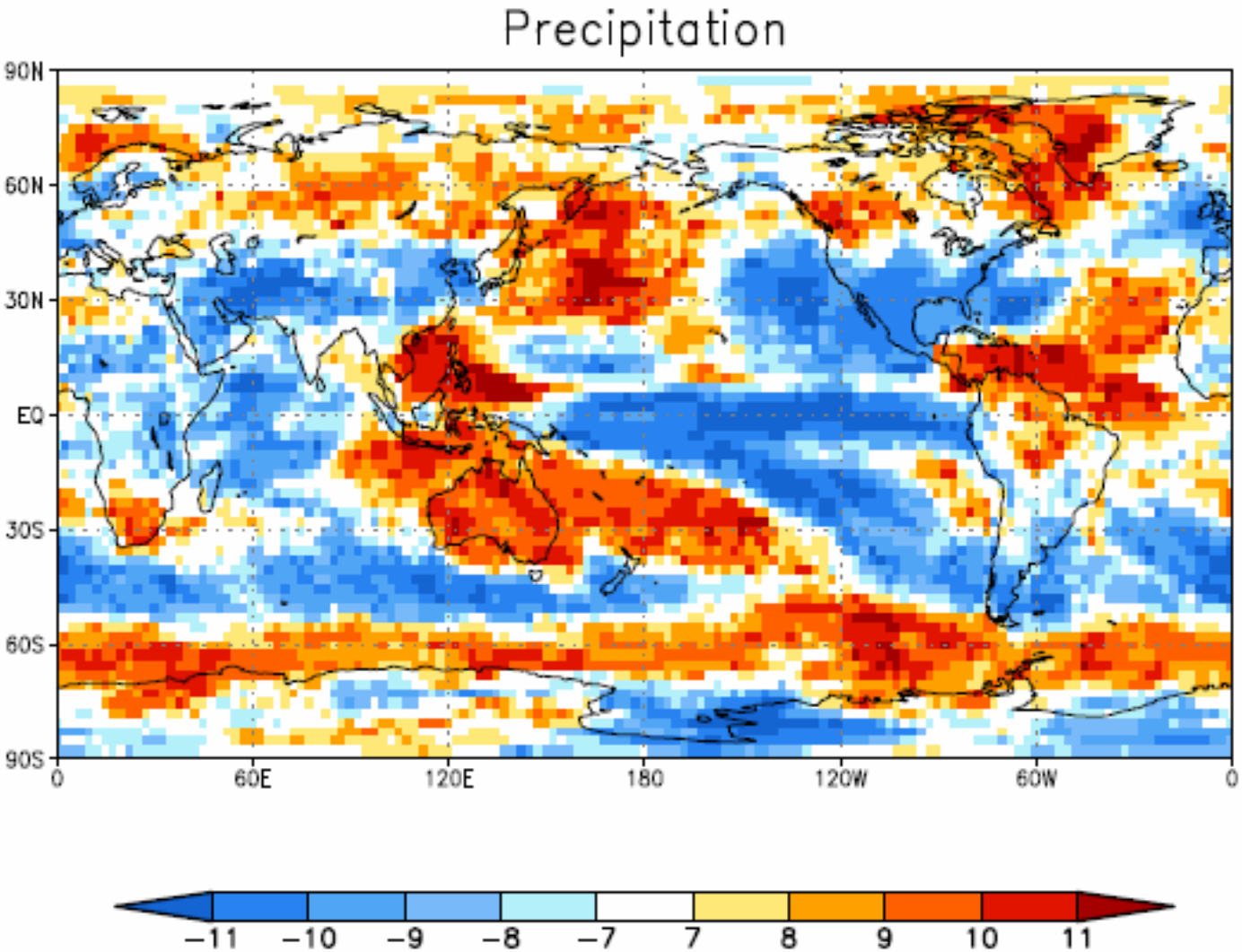
11 WMO
Global Producing Centers

Consistency Map

GPC_seoul/washington/melbourne/montreal/beijing/moscow/ecmwf/exeter/toulouse/tokyo/pretoria

SST : GPC_washington/seoul/melbourne/beijing/ecmwf/exeter/toulouse/tokyo

Oct2010 + NDJ forecast

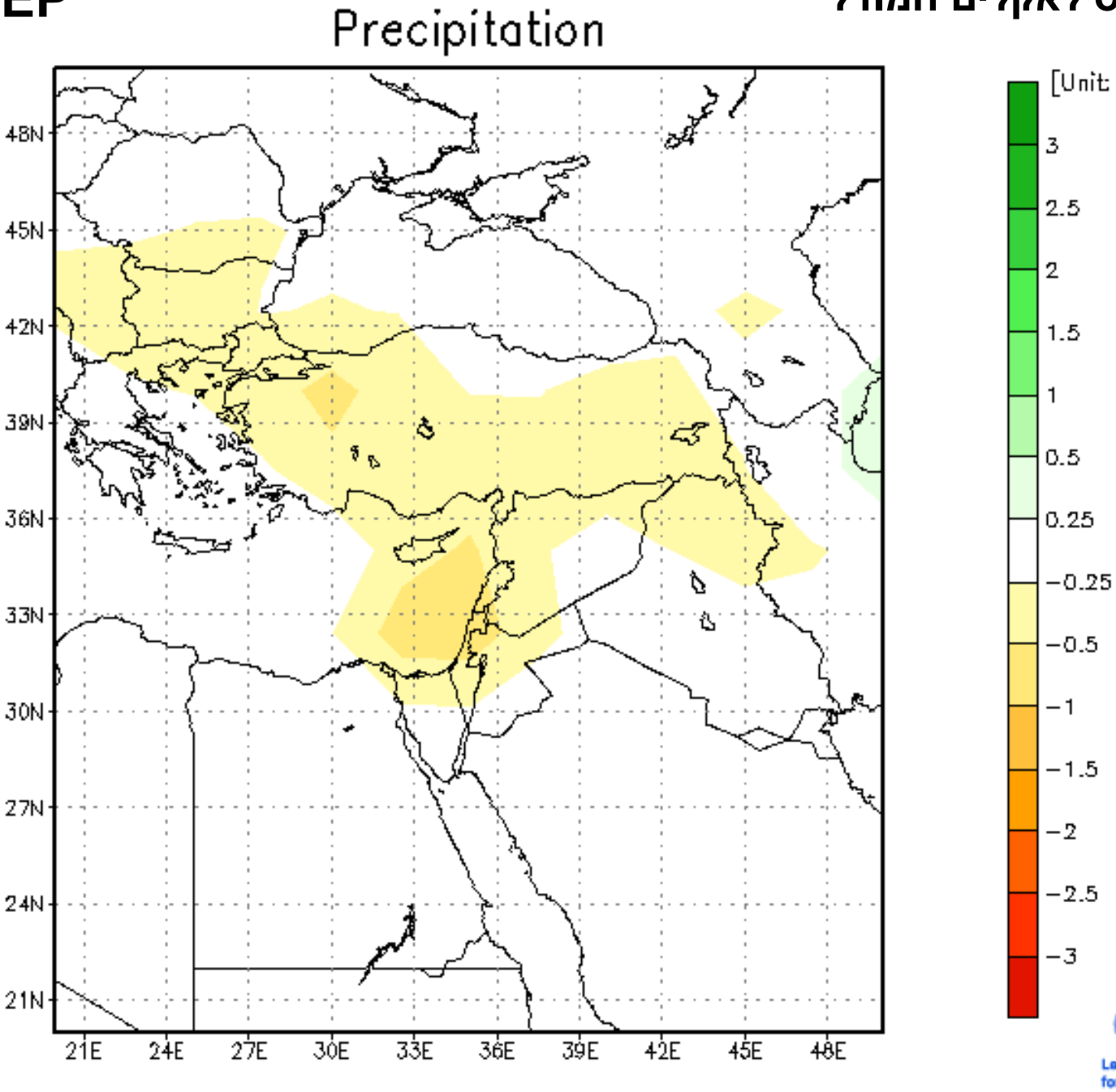


GPC_Washington
lat=20 50
lon=20 50
lev=0
t=2010:11 2011:01

NCEP

ביחס לאקלים המודל

NDJ



Lead Centre
for LRFMME

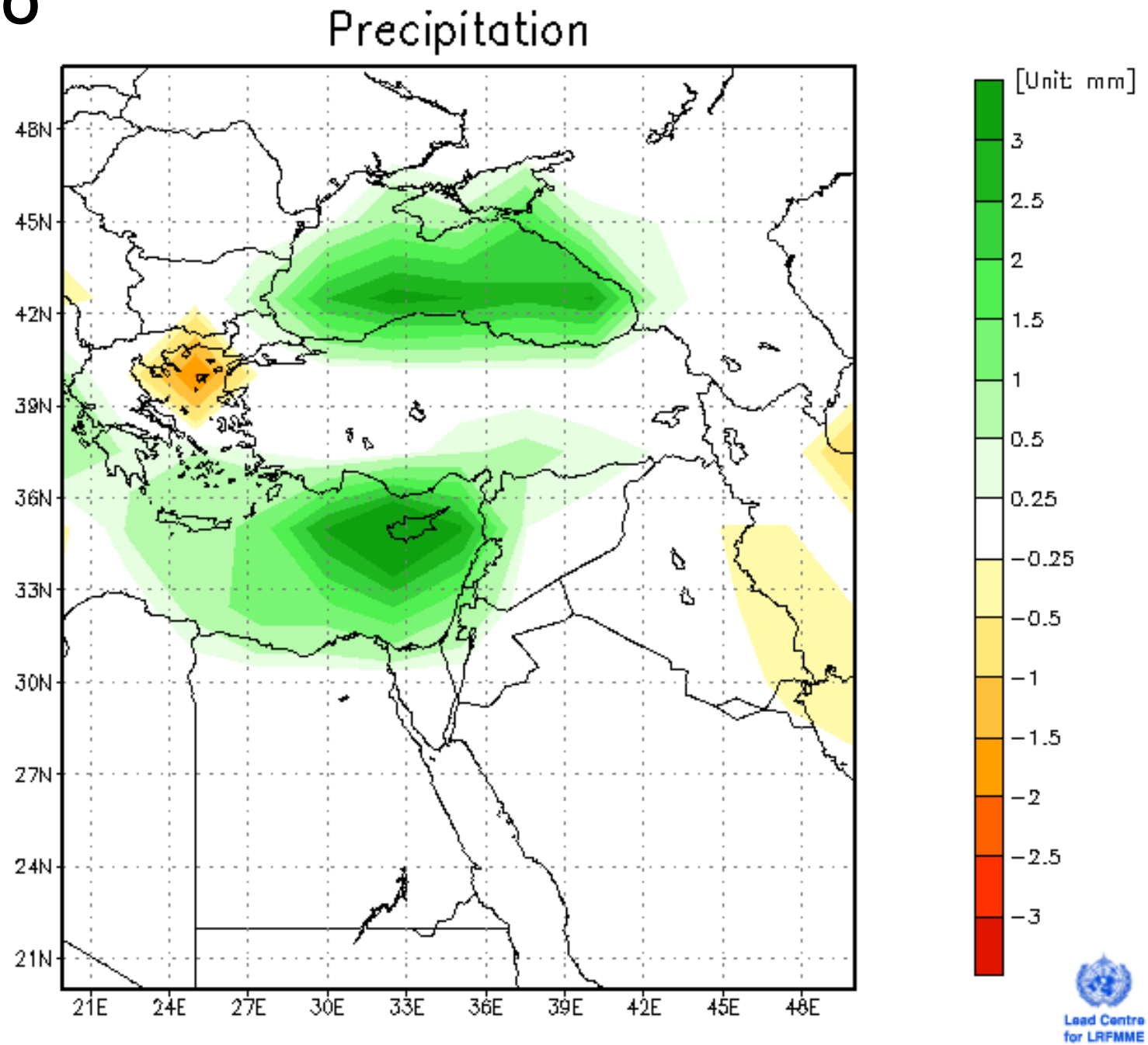
GrADS: COLA/IGES

2010-11-08-06:31

GPC_Exeter
lat=20 50
lon=20 50
lev=0
t=2010:11 2011:01

UKMO

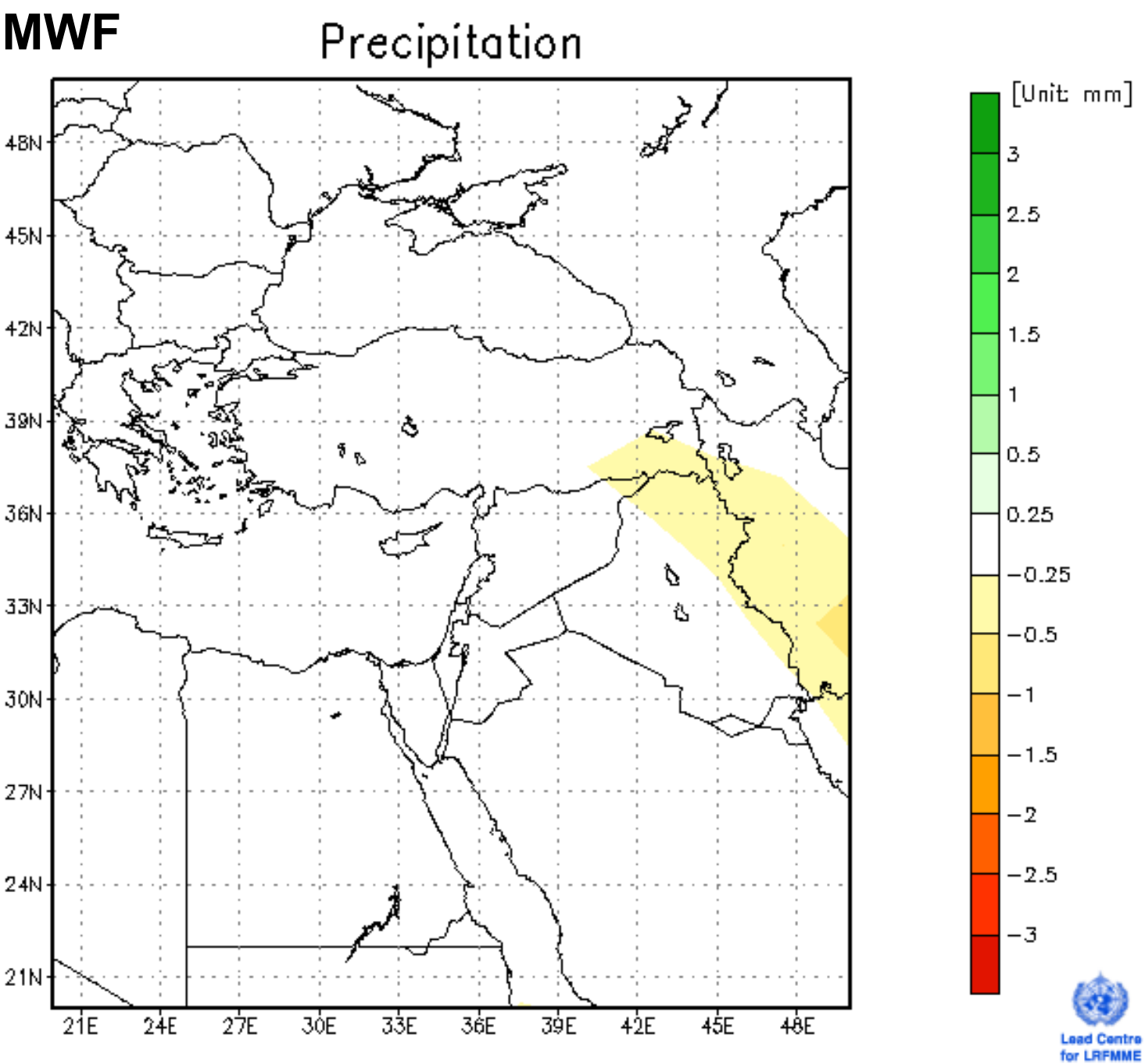
NDJ



GPC_ECMWF
lat=20 50
lon=20 50
lev=0
t=2010:11 2011:01

ECMWF

NDJ



Numerical predictions have low skill to forecast seasonal precipitation

Therefore, we continued with traditional Statistical teleconnection method

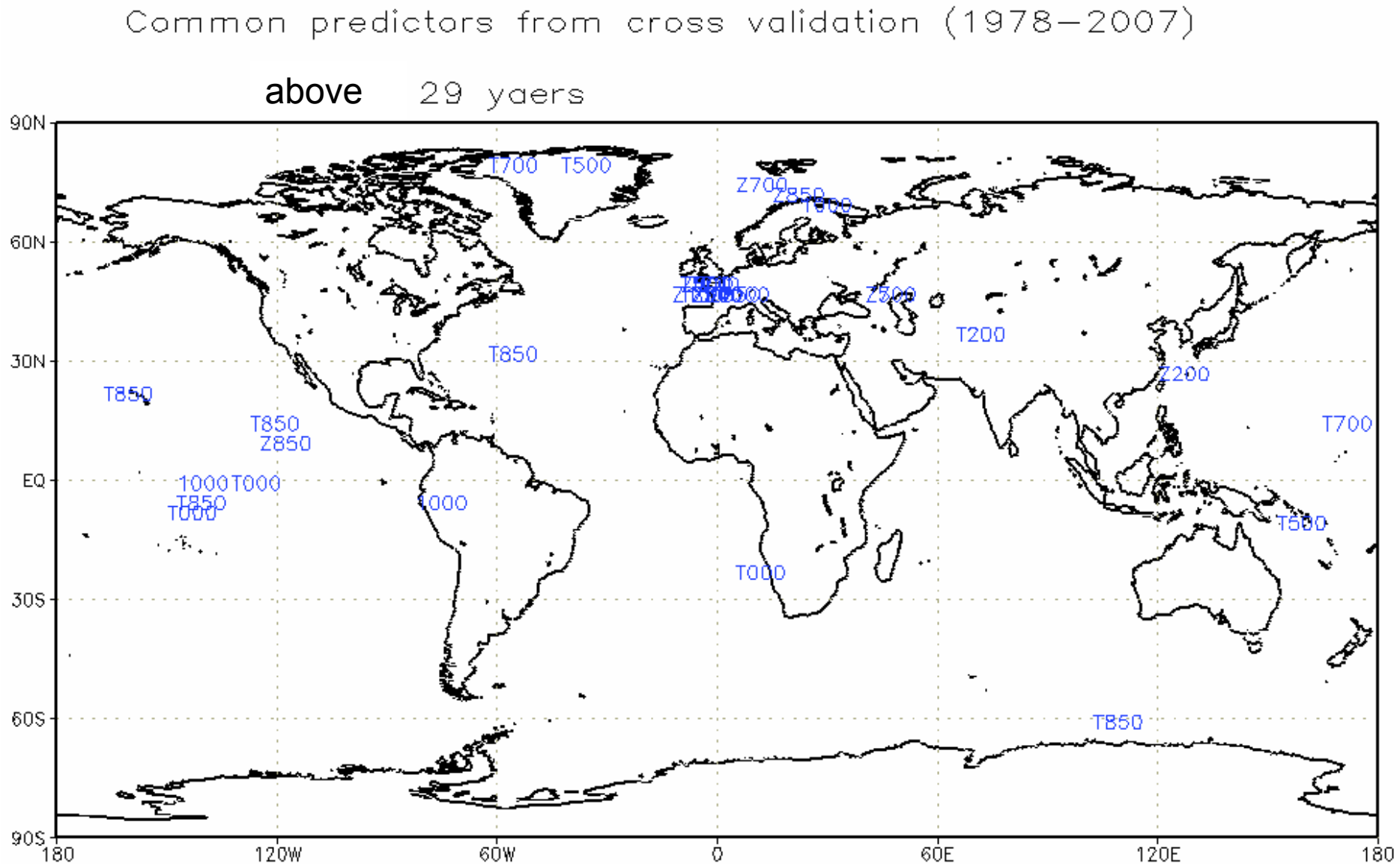
Tele-connection method

- Use NCEP 2.5ºx2.5º 1000-200 hPa heights, temperature and Kaplan SST anomalies (~90,000 predictors)

- extract correlation centers ($r > 0.45$) between 21 stations average rainfall and global predictors.

- Multiple linear regression of EOF's.

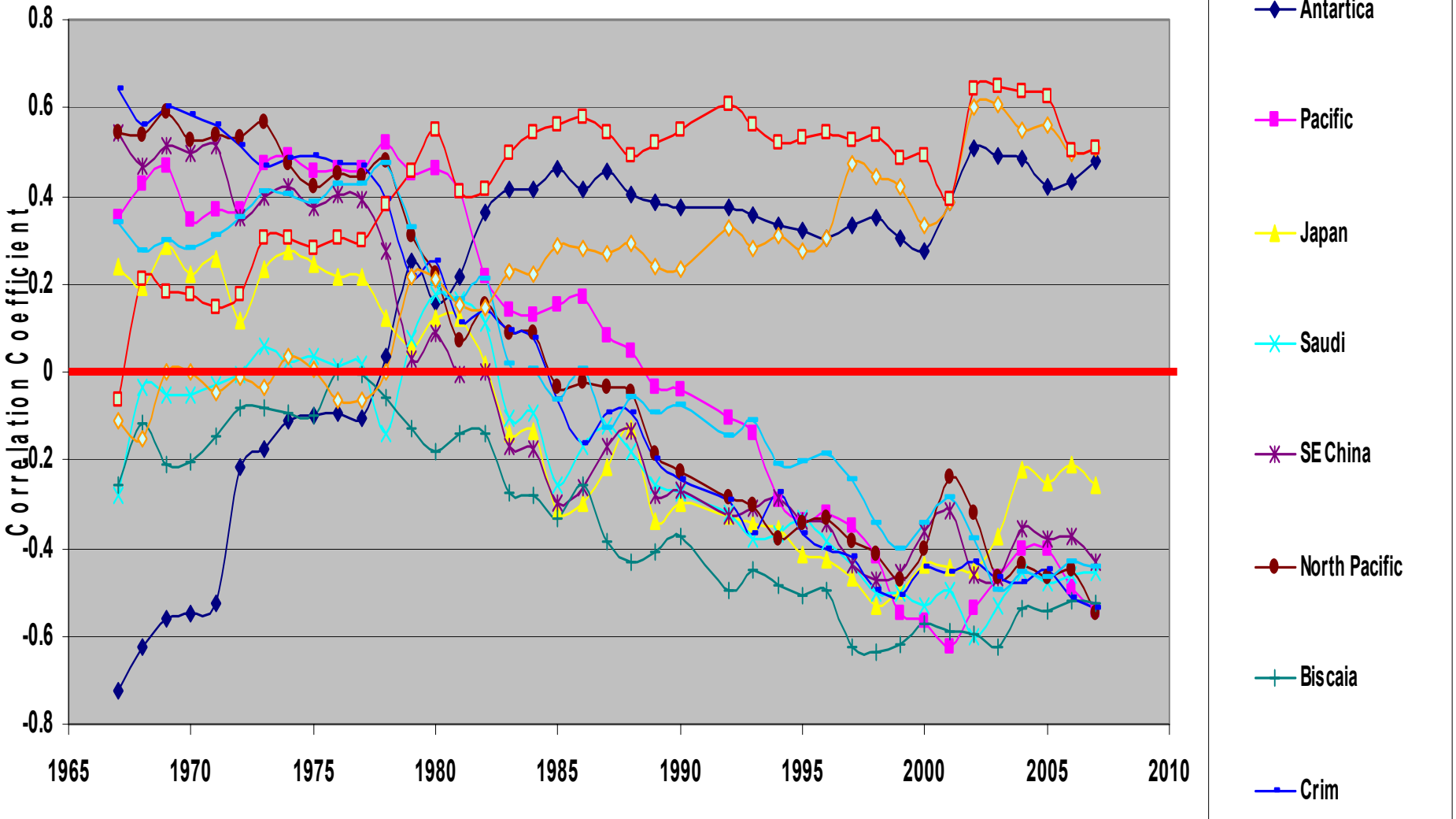
Predictor repeated for 29-30 years with correlation to DJF rain above 0.45



Hit score for 19 year data were not used to build the model 1989-2008 w/o 1991

W/O SST	With SST	30 year model
0.42	0.37	r>0.37
0.42	0.47	r>0.40
0.63 **Only 1 bust**	0.5	r>0.45

20 year moving average correlation between 21 station precipitation and global Z500 hPa



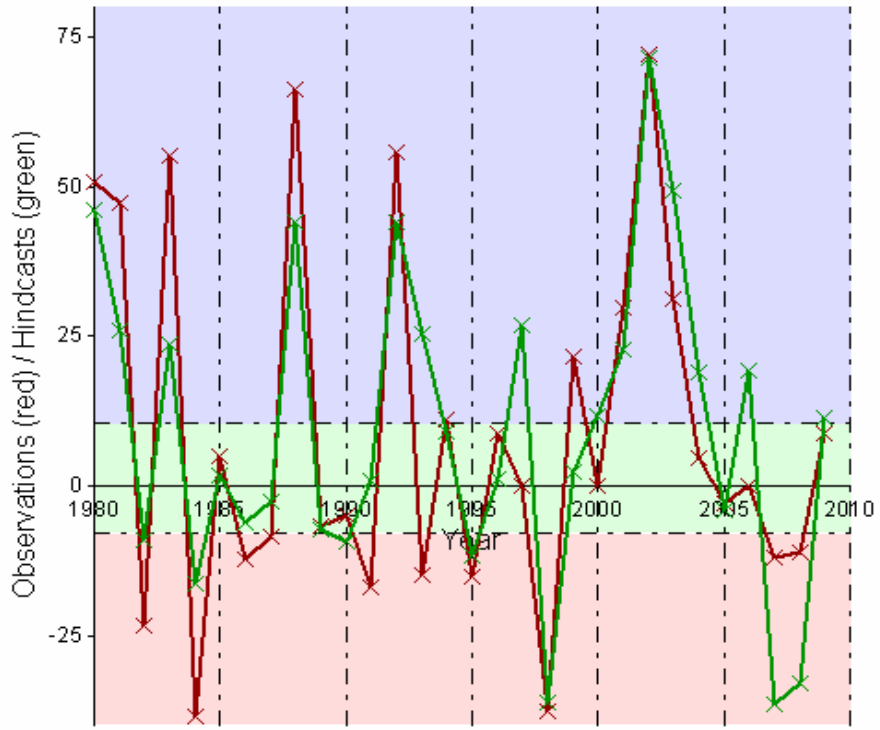
50 predictors with r>0.45 for 2010 DJF

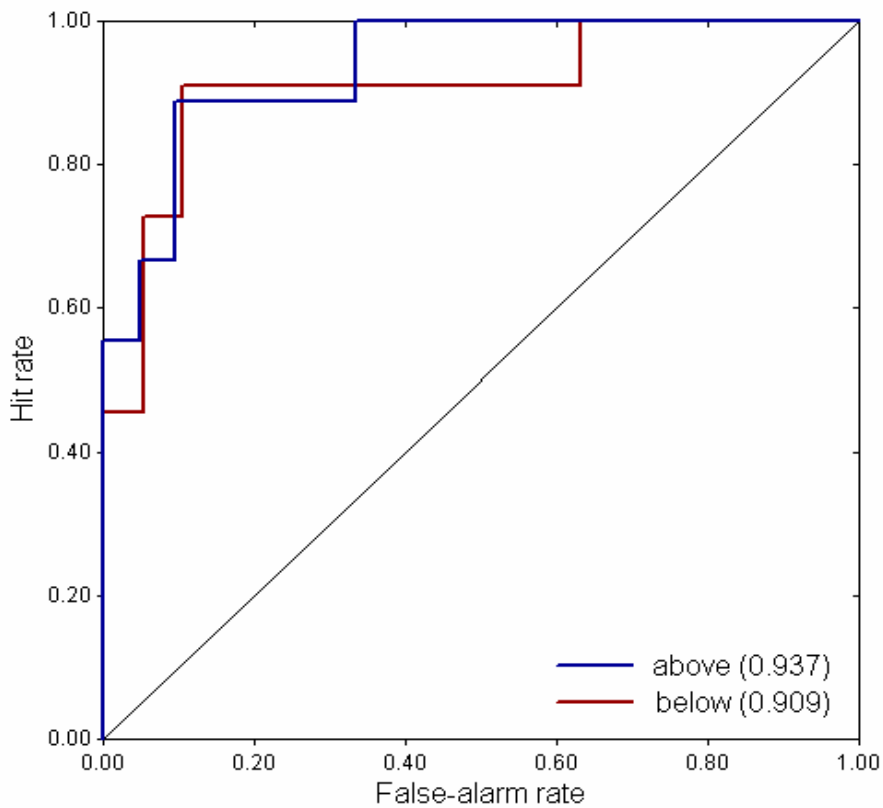
Continuous measures:

Pearson's correlation	0.8273
Spearman's correlation	0.8070
2AFC score (continuous)	80.69%
Mean squared error	272.35
Root mean squared error	16.50
Mean absolute error	12.94
Bias	0.68
Variance ratio	0.7596

Categorical measures:

Hit score	73.33%
Hit skill score	60.00%
LEPS score	70.00%
Gerrity score	68.90%
2AFC (forecast categories)	85.62%
2AFC (continuous forecasts)	90.64%
ROC area (below-normal)	0.9091
ROC area (above-normal)	0.9365





76% for a dry year

Series 1

anom

Thresholds:

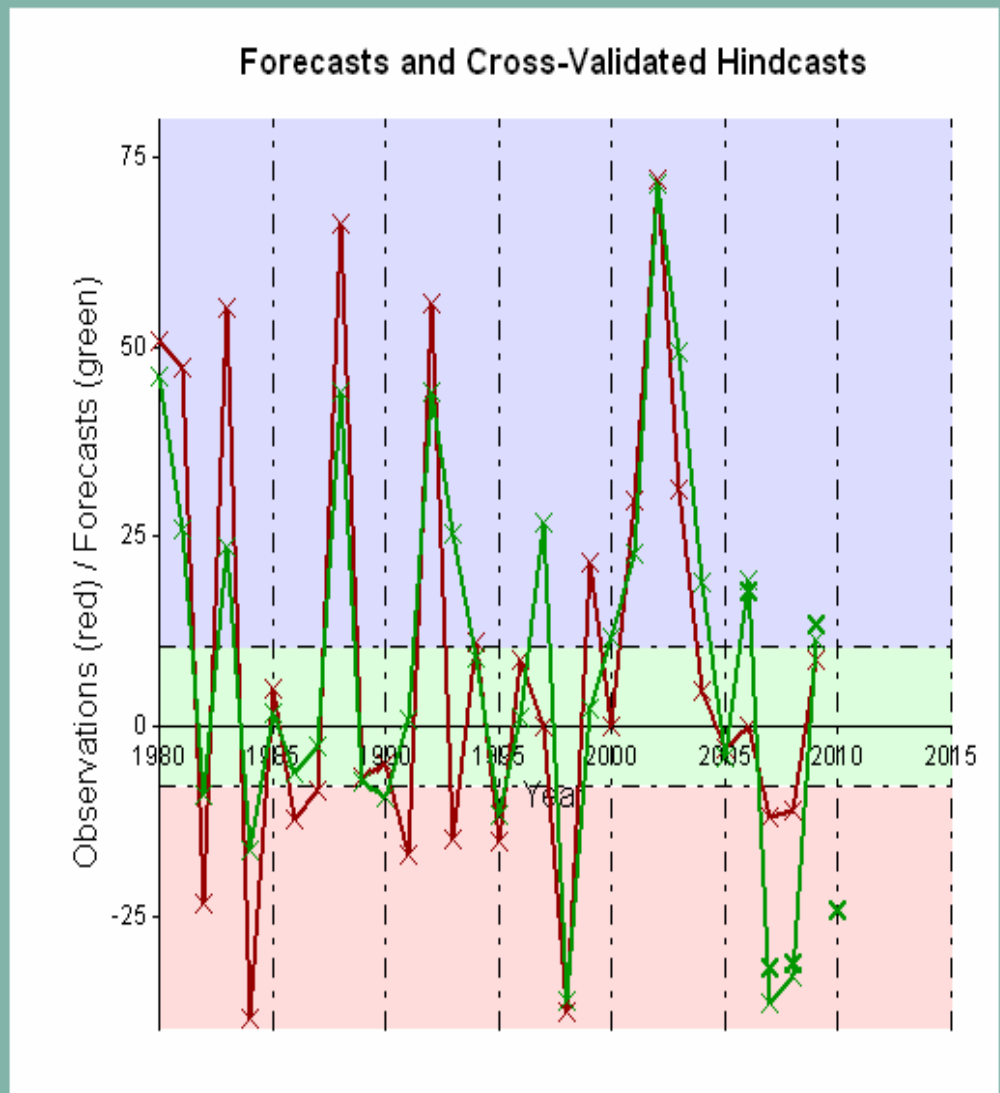
```
1980-2009 climatology
Thresholds
    upper    10.367
    lower    -7.967
Climatological probabilities
     above   33
    normal   33
     below   33
```

Forecasts:

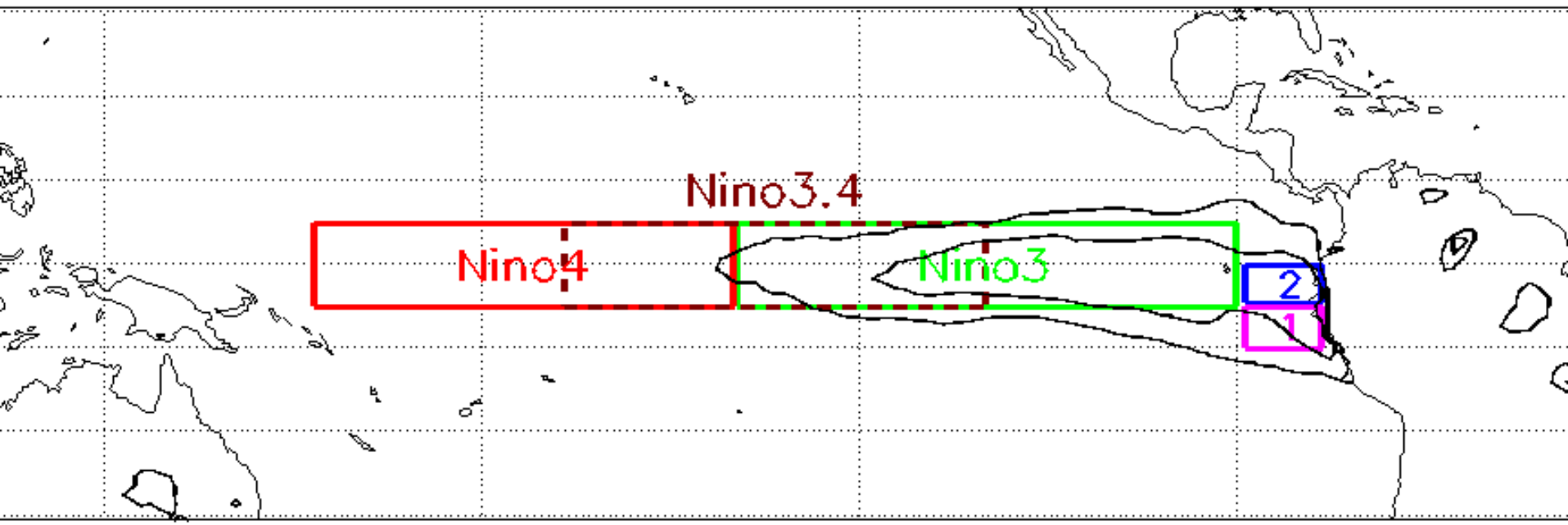
	B	N	A	Obs
2006	10	26	65	N
2007	88	10	2	B
2008	87	11	3	B
2009	15	29	56	N
2010	76	17	7	

Forecast ranges:

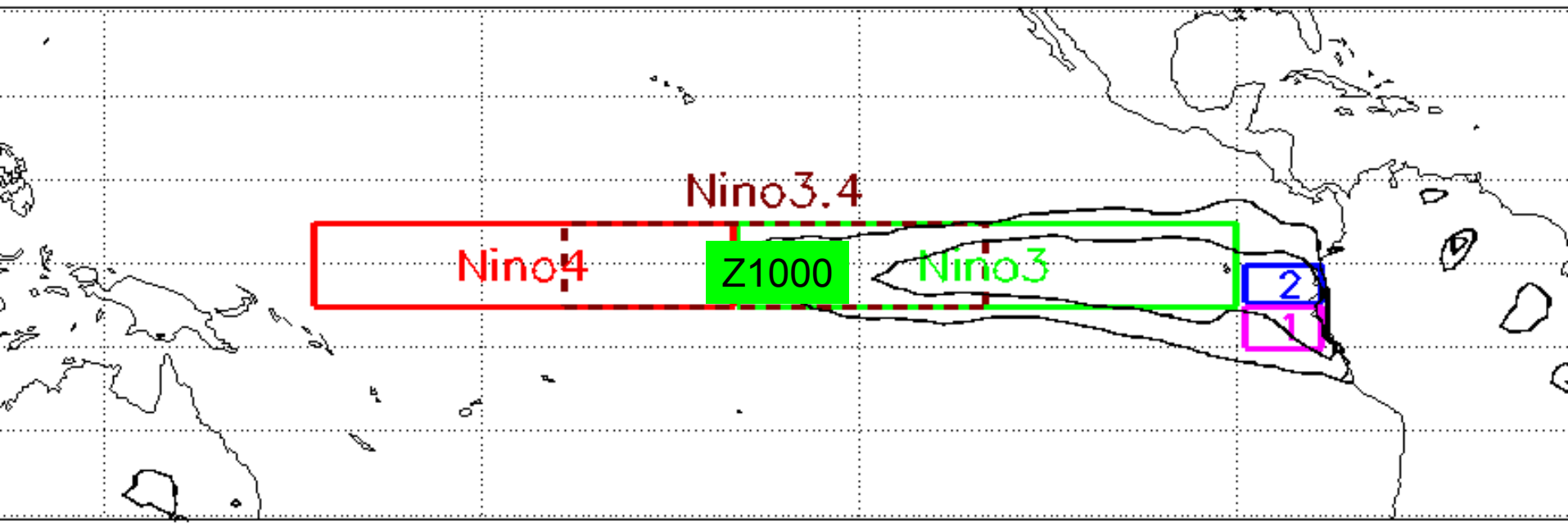
Year	Forecast	Lower	Upper
2006	17.775	-1.895	37.444
2007	-31.752	-51.753	-11.751
2008	-31.209	-52.104	-10.314
2009	13.523	-6.976	34.022
2010	-24.258	-47.149	-1.368



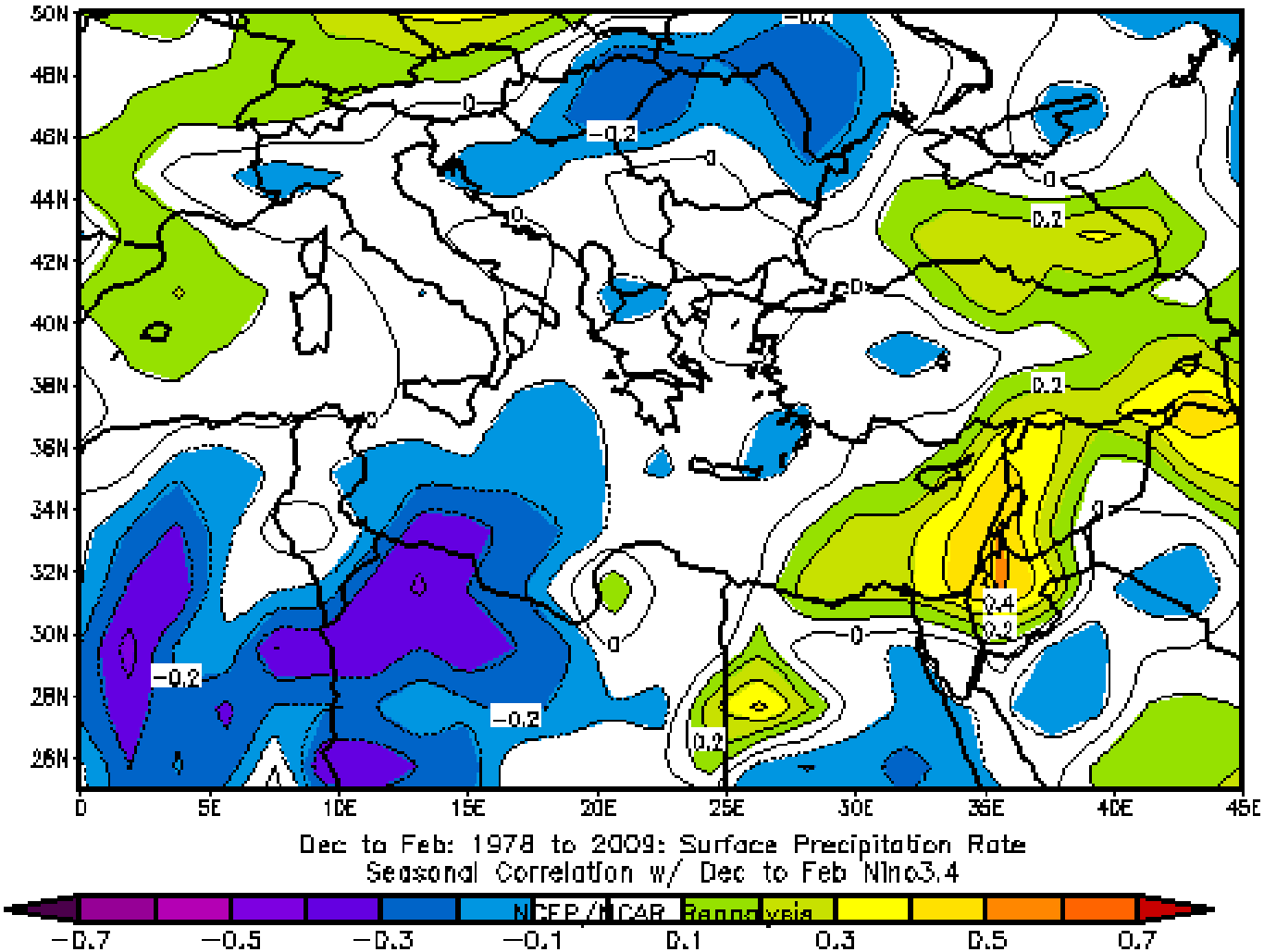
El Niño and DJF precipitation at 21 stations in Israel



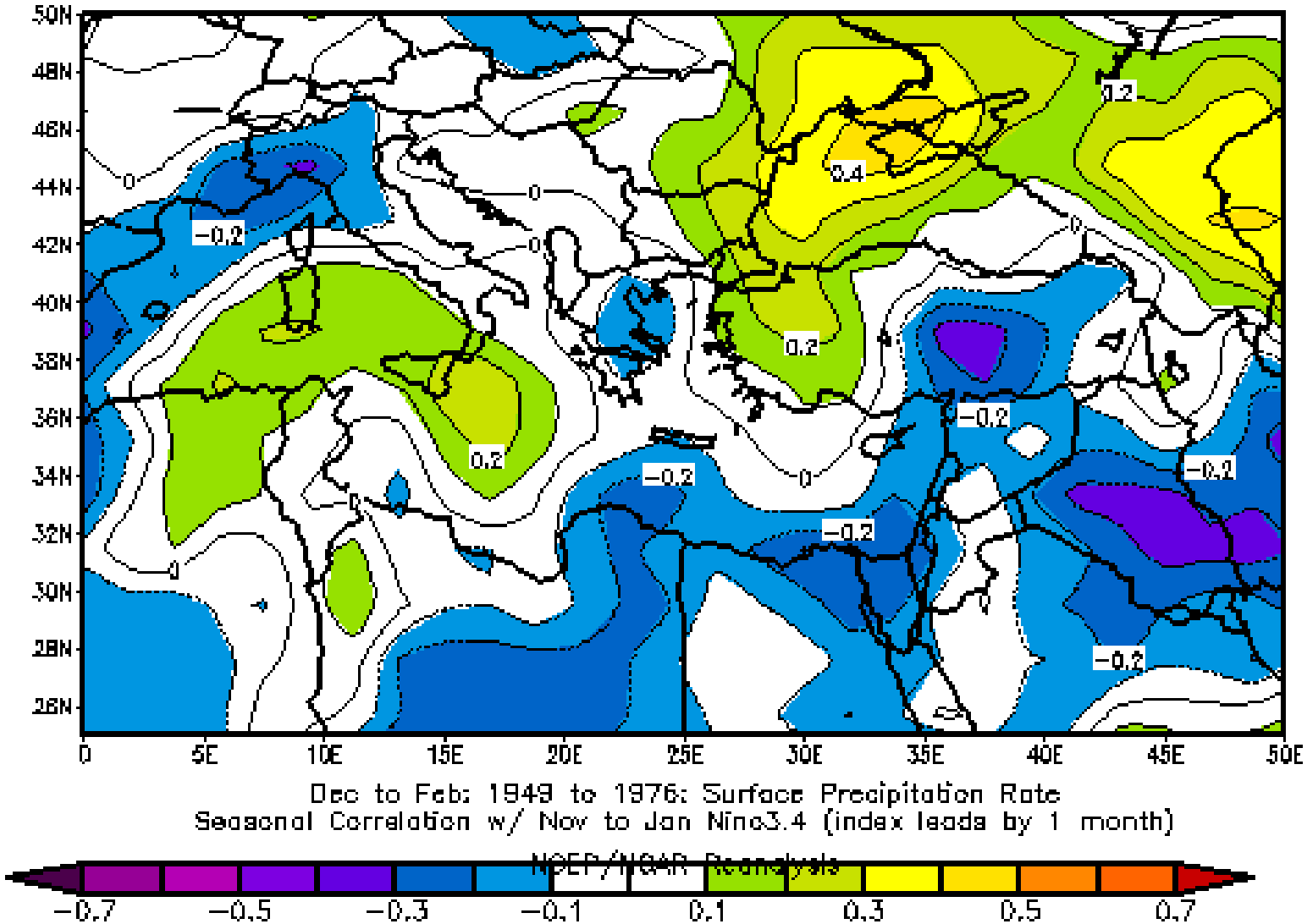
Z1000 at 2.5S, 145W
r=0.61 with DJF precipitation (21 stations) 1978-2008



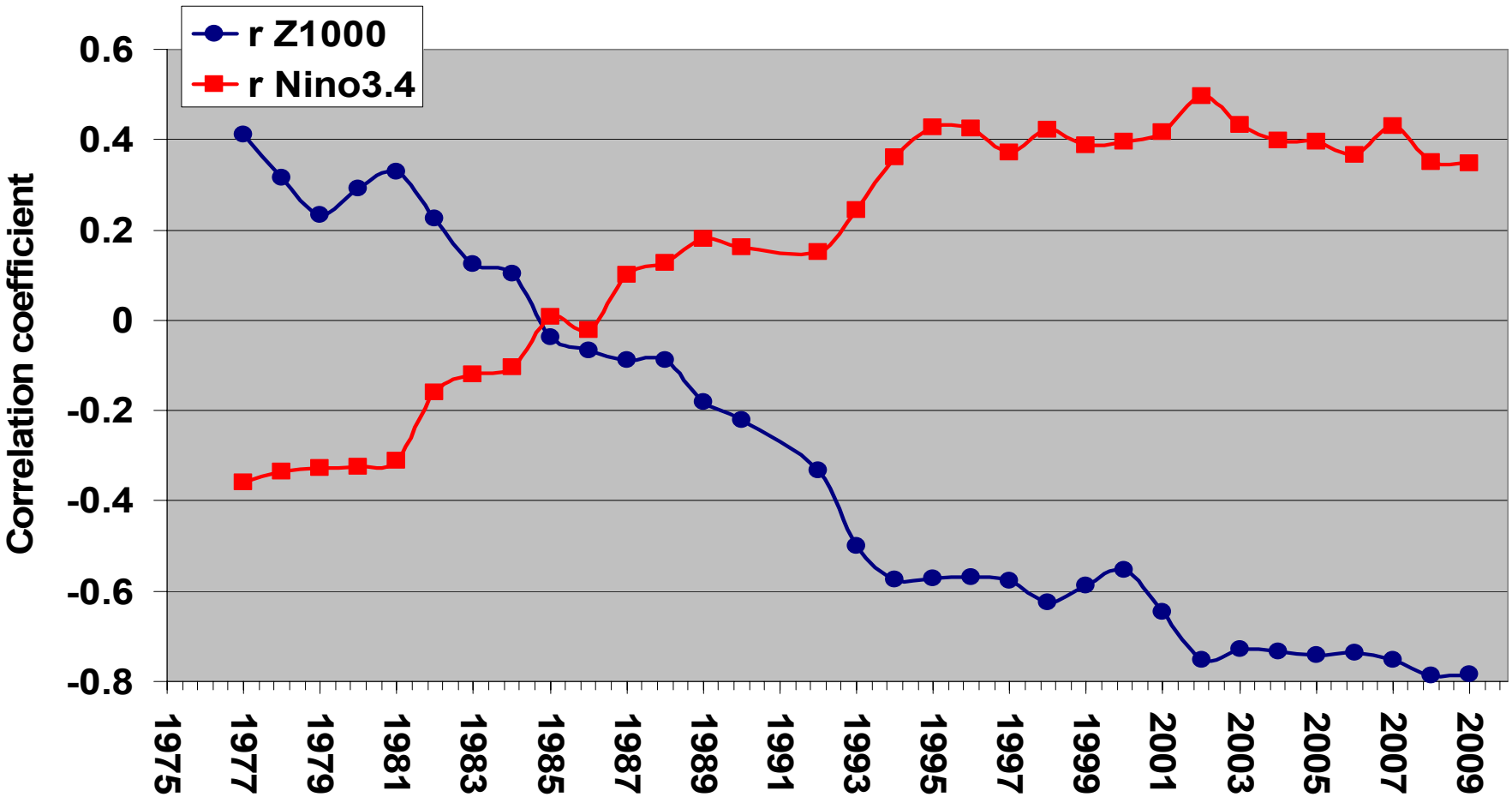
Nino3.4 1978-2009

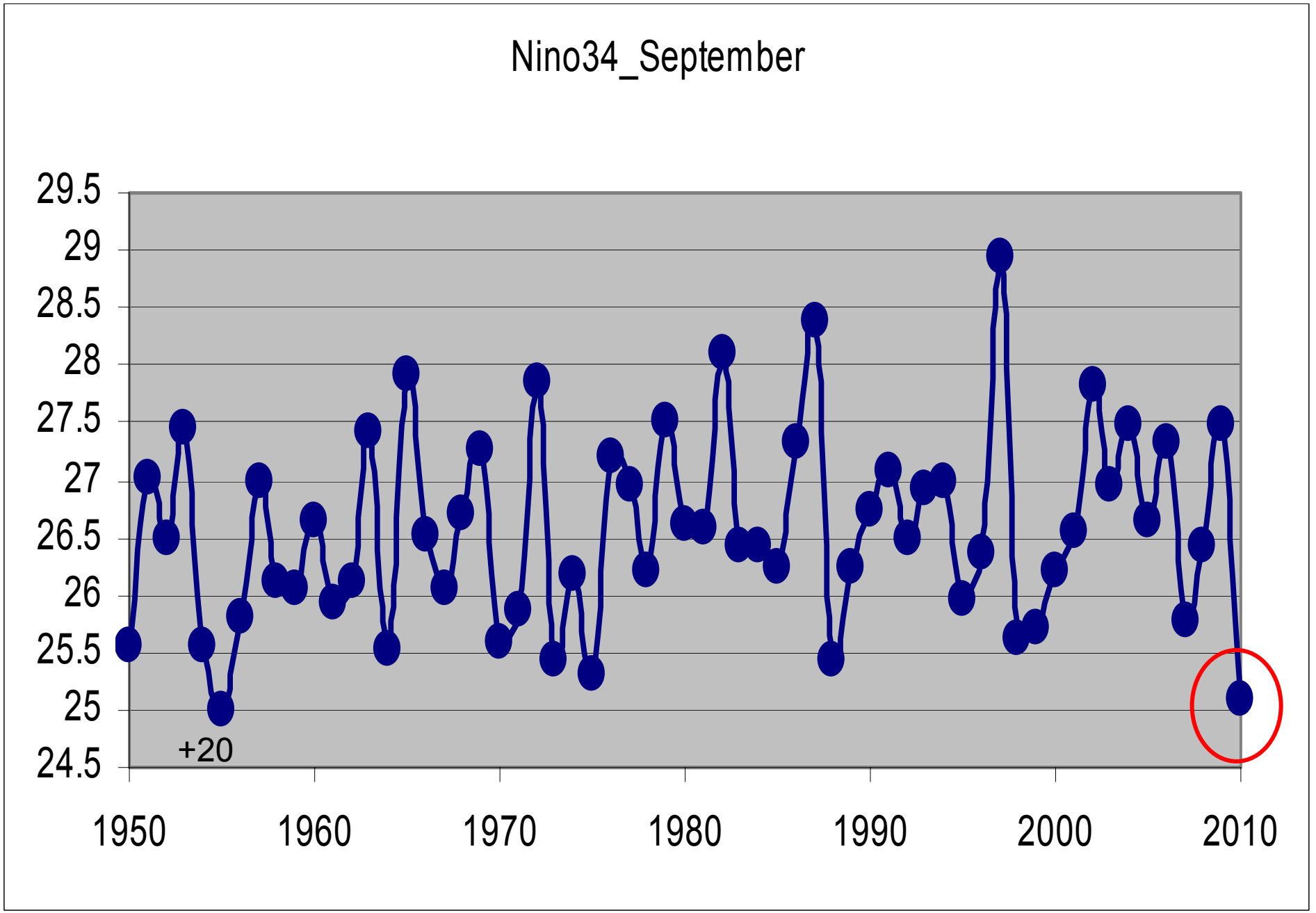


Nino3.4 1948-1976

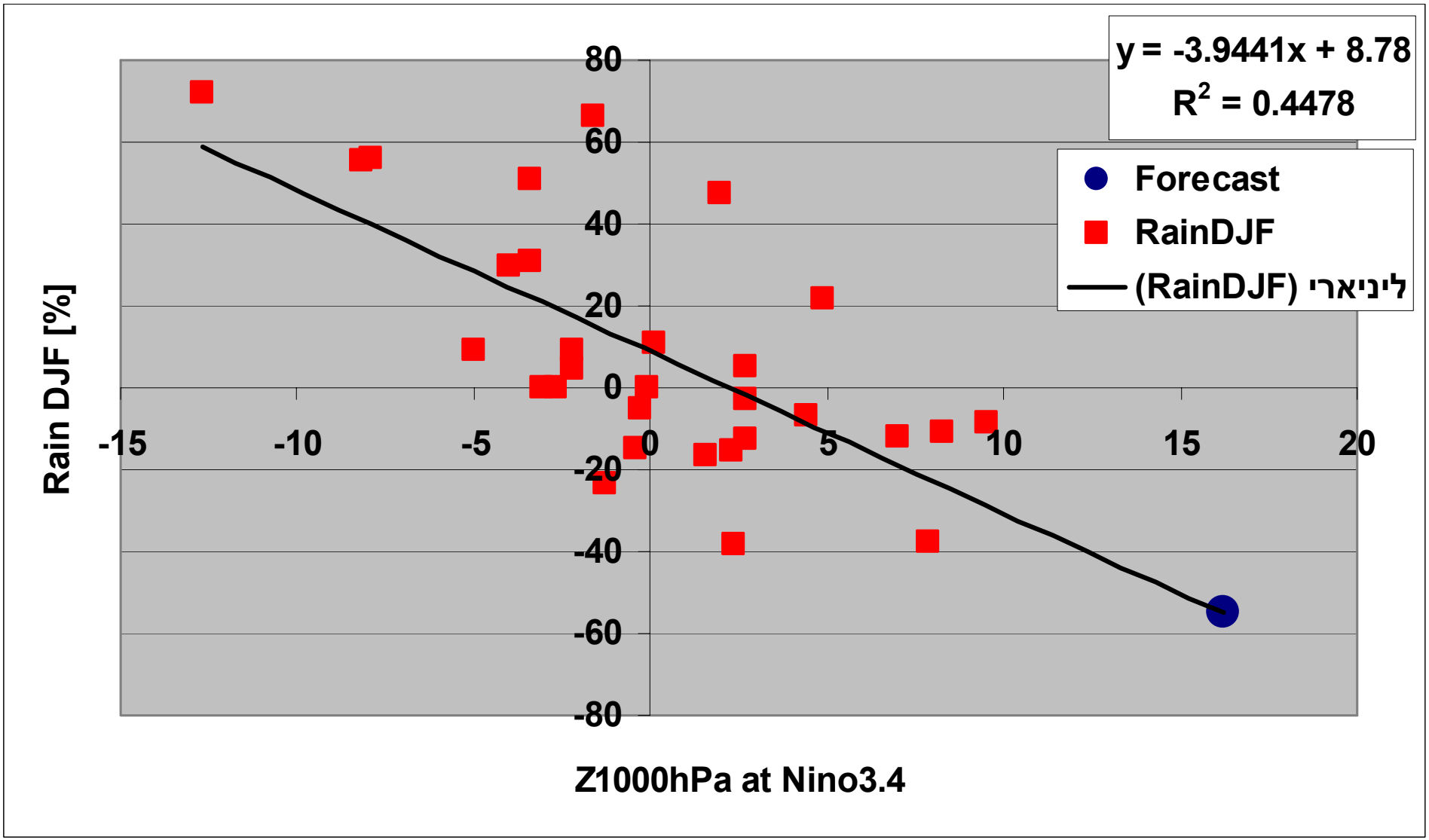


20 years moving average correlation between Z1000 at 2.5S, 145W and Nino3.4 anomalies with 21 DJF stations




Nino34_September
29.5
29
28.5
28
27.5
27
26.5
26
25.5
25
24.5
+20
1950
1960
1970
1980
1990
2000
2010

Forecast 2010 only by Z1000 at nino3.4



Only Z1000 hPa at nino3.4

Series 1

anom

Thresholds:

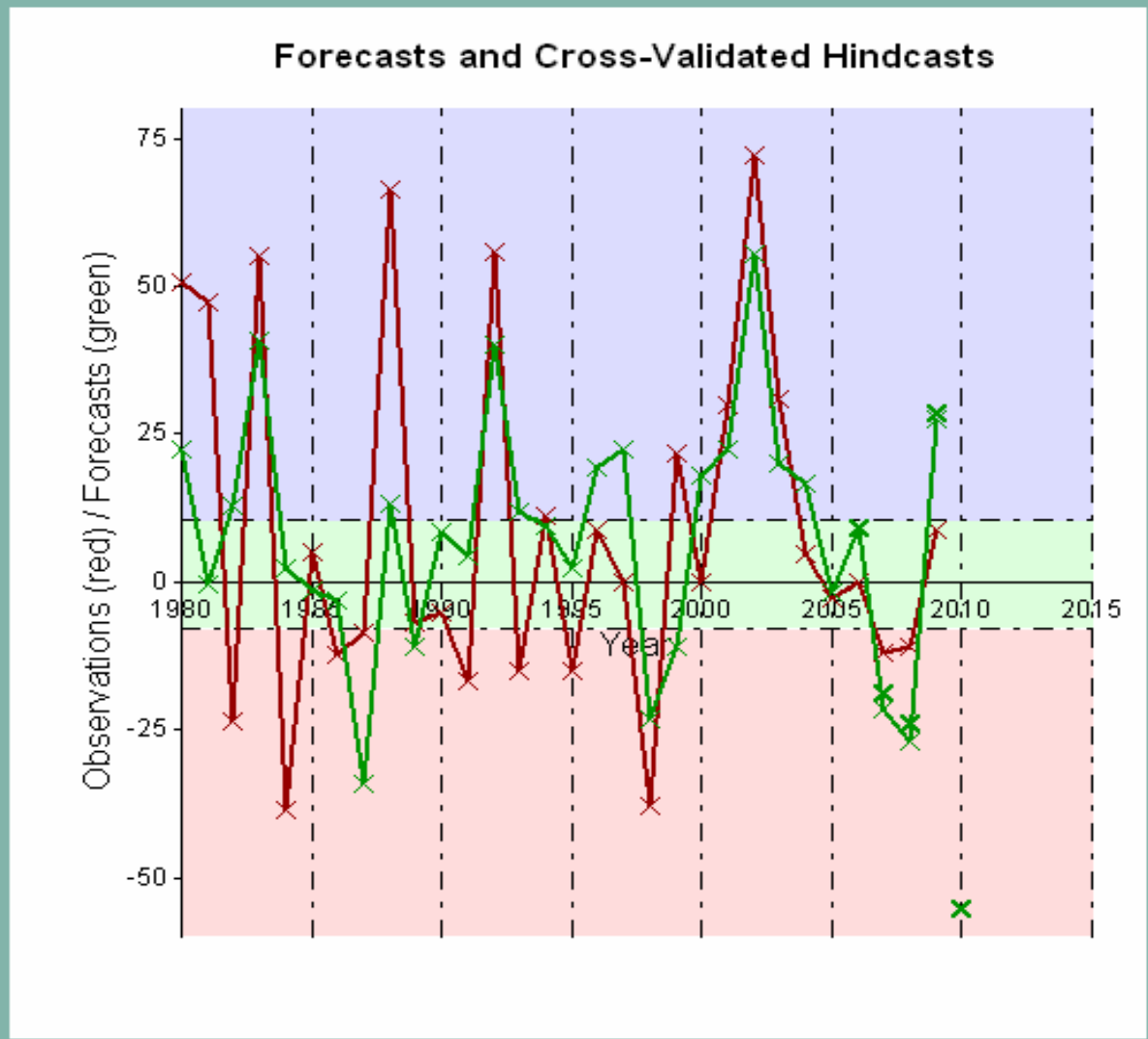
```
1980-2009 climatology
Thresholds
    upper     10.367
    lower     -7.967
Climatological probabilities
     above    33
    normal    33
     below    33
```

Forecasts:

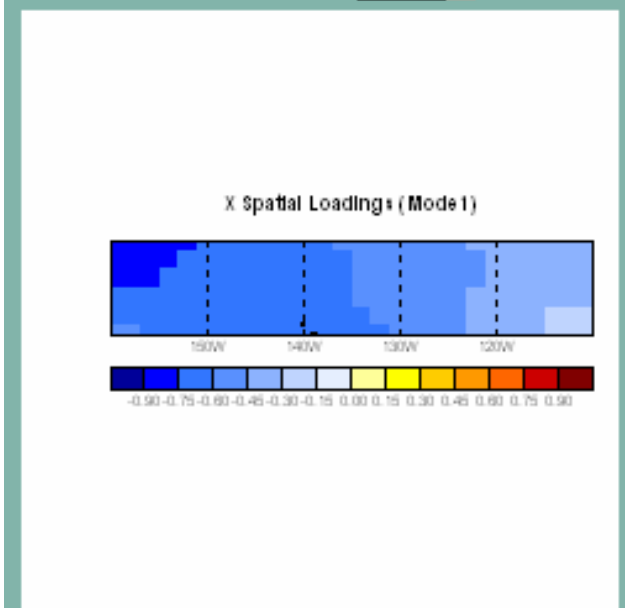
	B	N	A	Obs
2006	24	28	48	N
2007	67	21	12	B
2008	74	17	9	B
2009	7	16	77	N
2010	95	4	1	

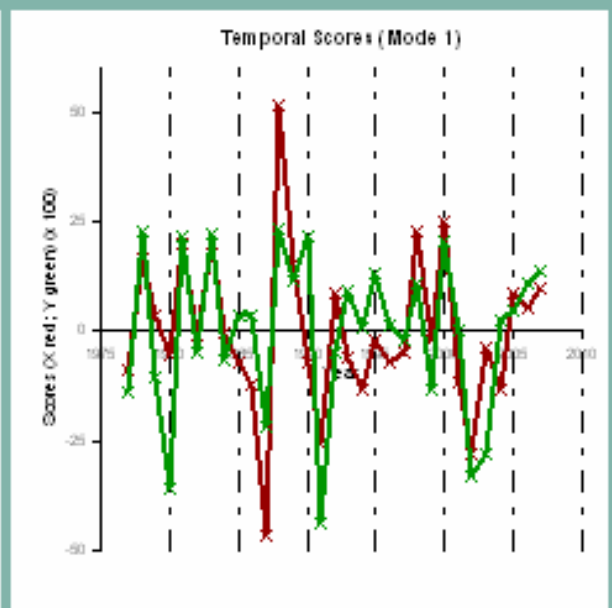
Forecast ranges:

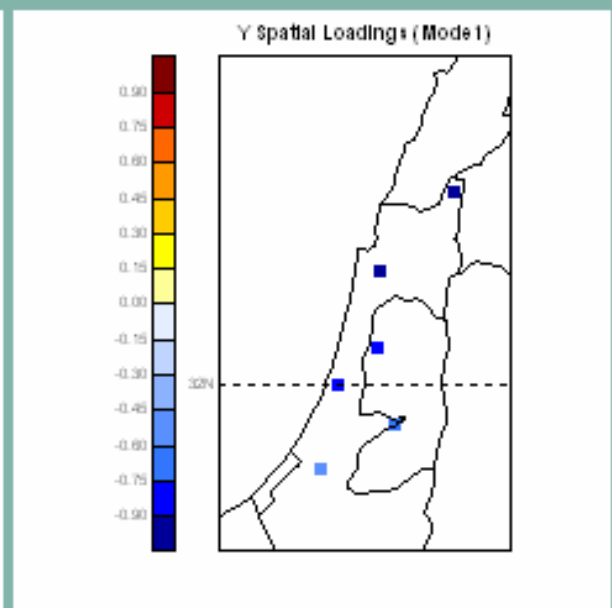
Year	Forecast	Lower	Upper
2006	9.174	-15.100	33.449
2007	-18.829	-43.869	6.212
2008	-23.956	-49.301	1.389
2009	28.500	3.832	53.169
2010	-55.114	-83.249	-26.979



CCA mode: 1 Canonical correlation: 0.6733







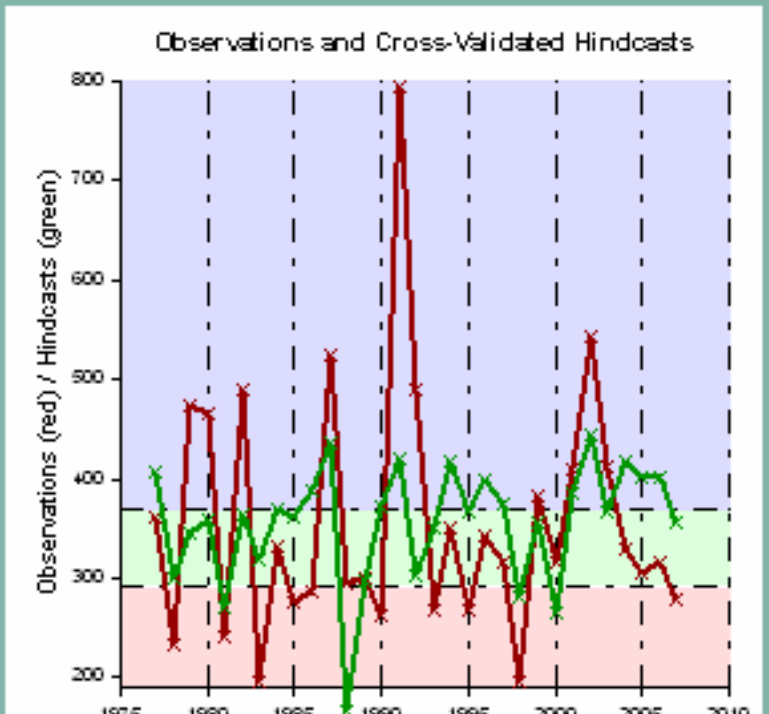
Station: average 32.23N, 35.0

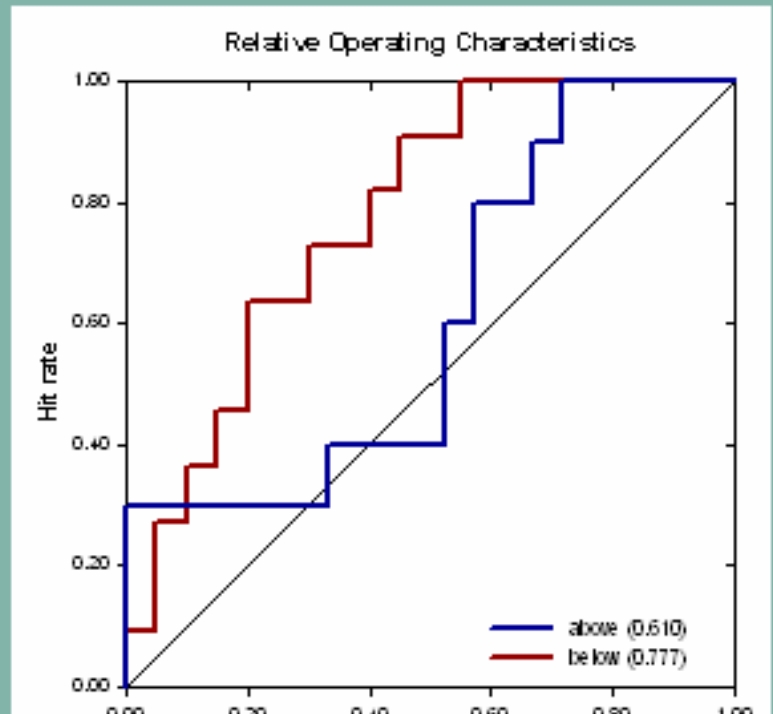
Continuous measures:

Pearson's correlation	0.4269
Spearman's correlation	0.4895
2AFC score (continuous)	66.24%
% variance	0.18%
Variance ratio	0.2298
Mean bias	0.29
Root mean squared error	110.58
Mean absolute error	89.85

Categorical measures:

Hit score	48.39%
Hit skill score	22.58%
LEPS score	32.98%
Gerrity score	31.85%
2AFC (forecast categories)	70.63%
2AFC (continuous forecasts)	67.81%
ROC area (below-normal)	0.7773
ROC area (above-normal)	0.6095





Station: average 32.23N, 35.0

Thresholds:

Climatology:
1977 to 2007

Thresholds:

upper	369.174	
lower	291.260	
above	33%	0.50
normal	33%	0.50
below	33%	0.50

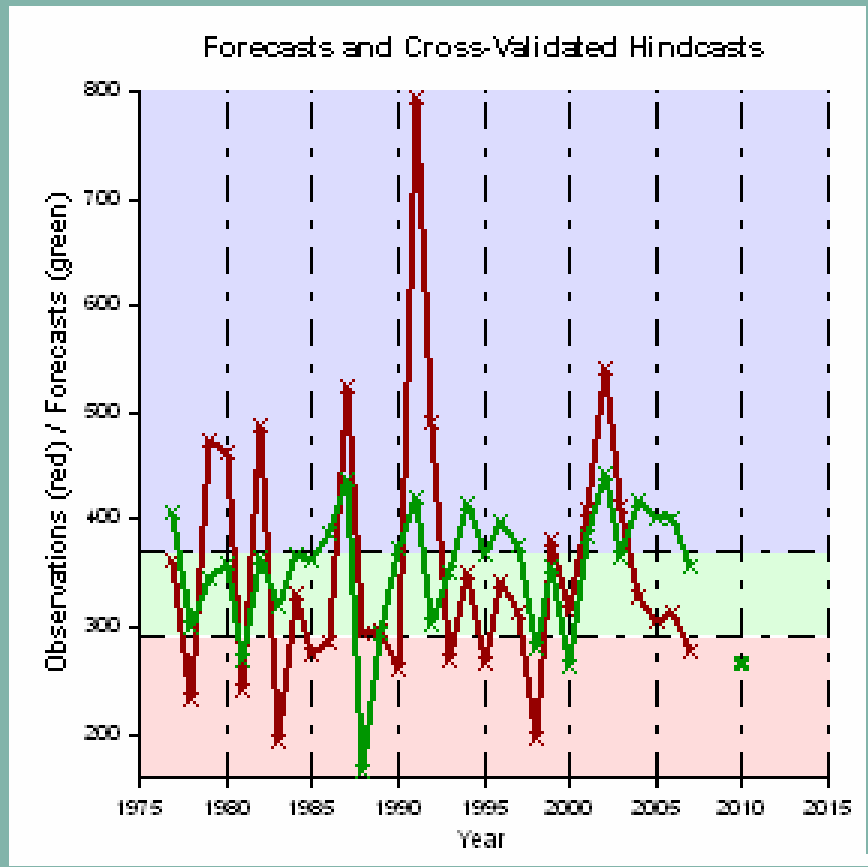
Forecasts:

Probabilities:

Year	Probabilities			Odds		
	B	N	A	B	N	A
2010	58	21	21	1.36	0.27	0.27

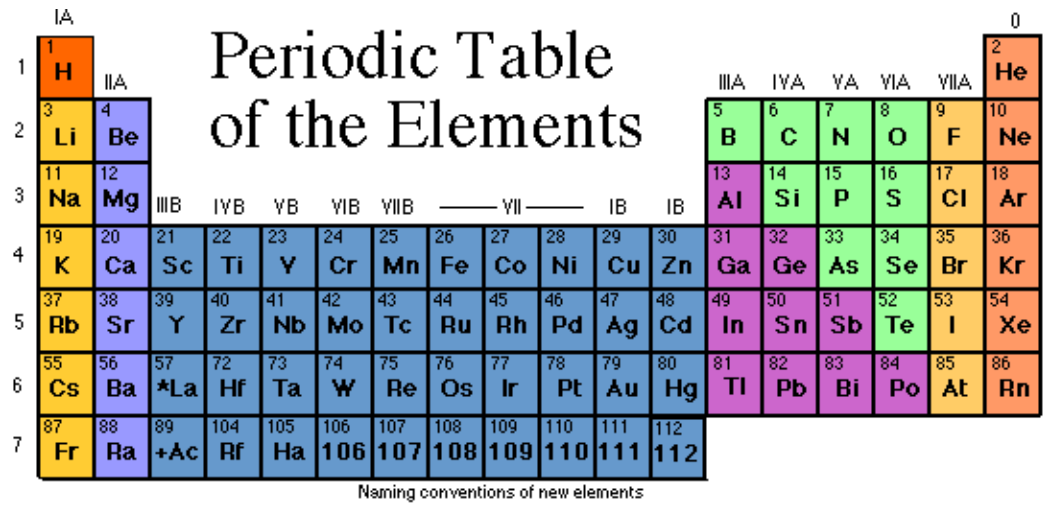
Forecast ranges:

Year	Forecast	Lower	Upper
2010	266.572	136.713	396.432



Summary

Lao Tzu;

'A journey* of a thousand miles *begins with one step

Alchemy evolved to Chemistry