Rain forecasts

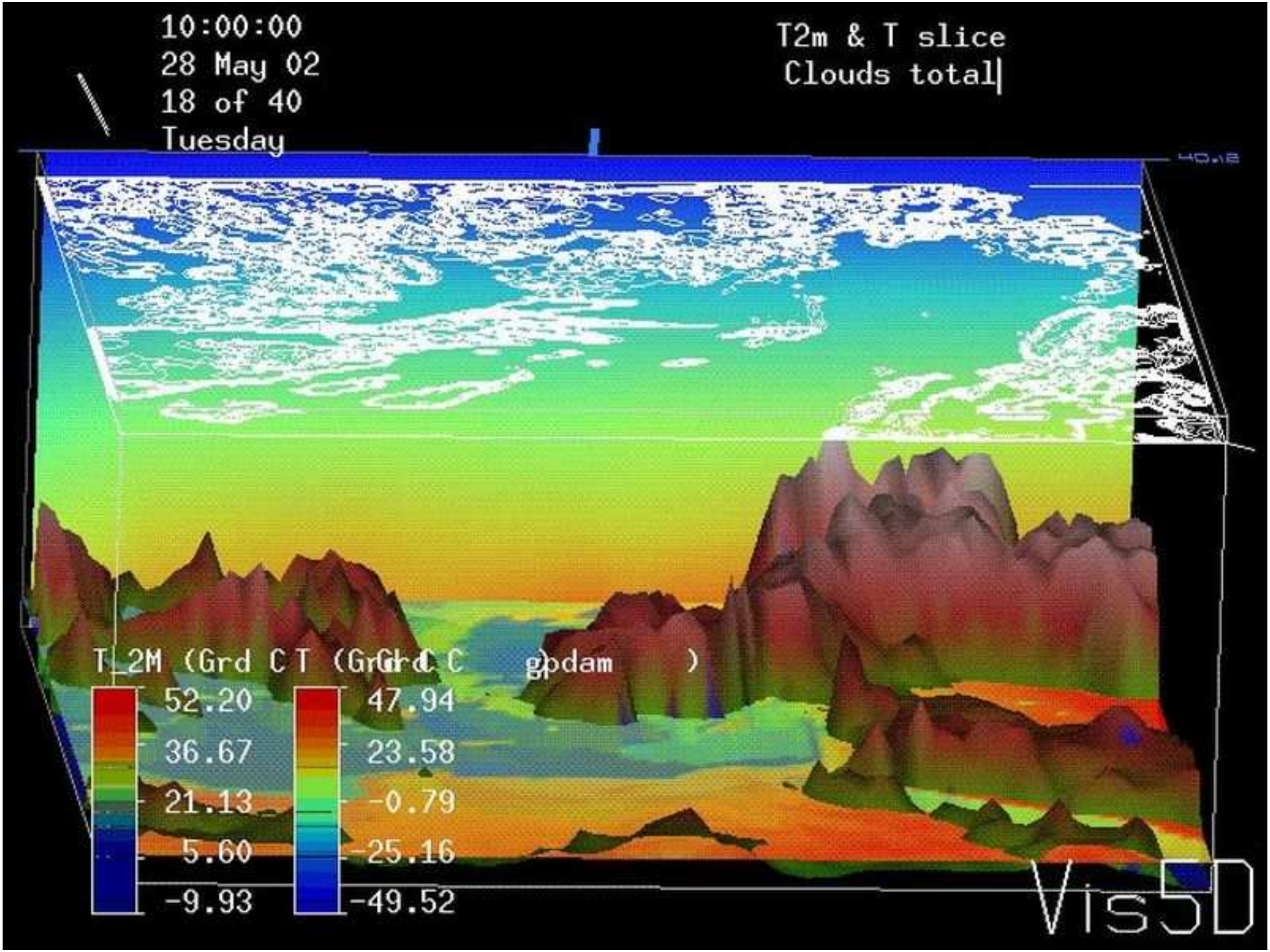
- Long range seasonal forecast.
  - Tele connections: Enso, Nao.
- Medium-long range forecast (5-10) days.
  - Synoptic maps.
- Medium-close range forecast (2-4) days.
  - Synoptic maps & satellites.
- Immediate forecast – Now casting.
  - Satellite, radar & automatic weather stations.

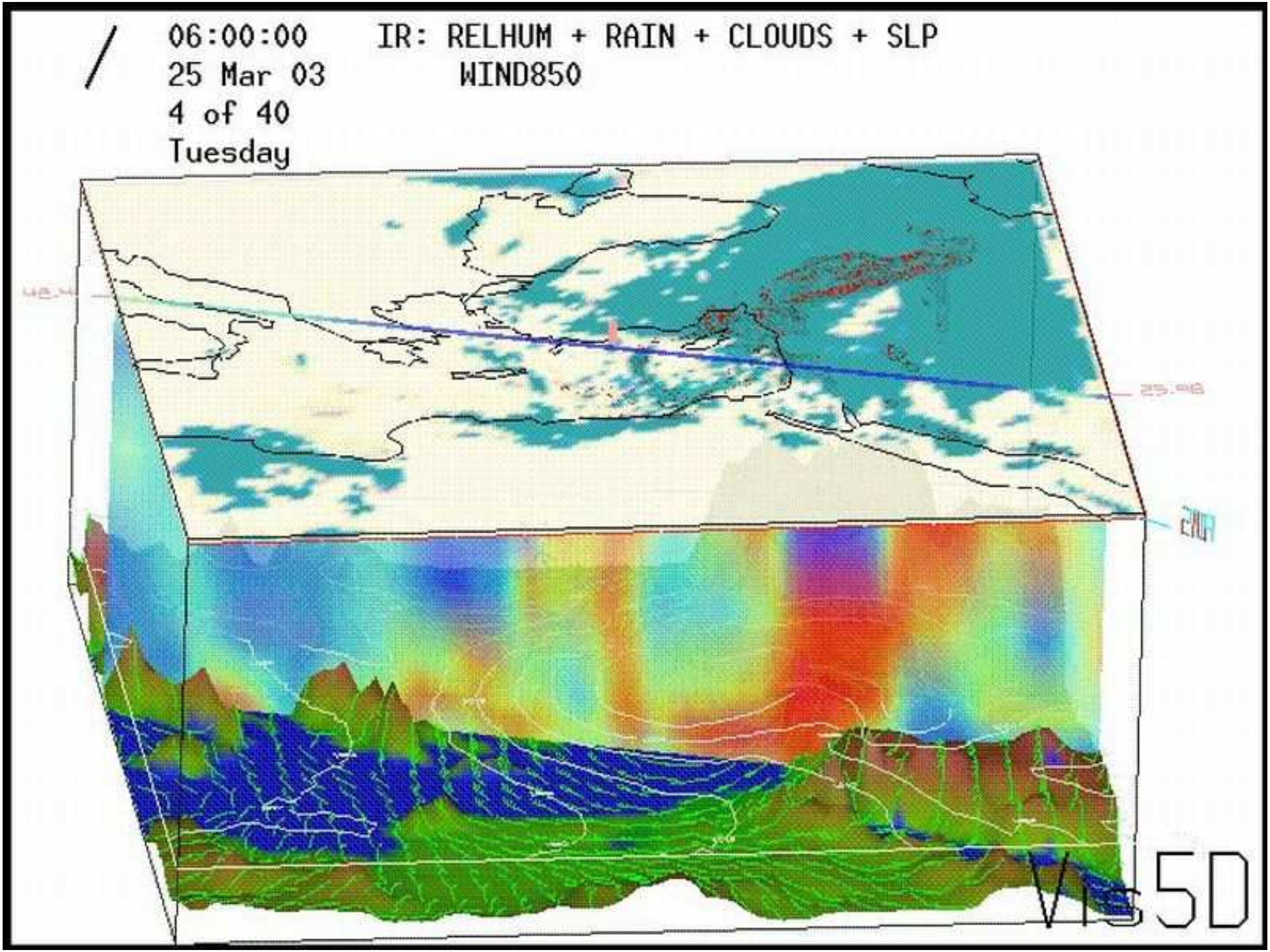
Forecasting rain

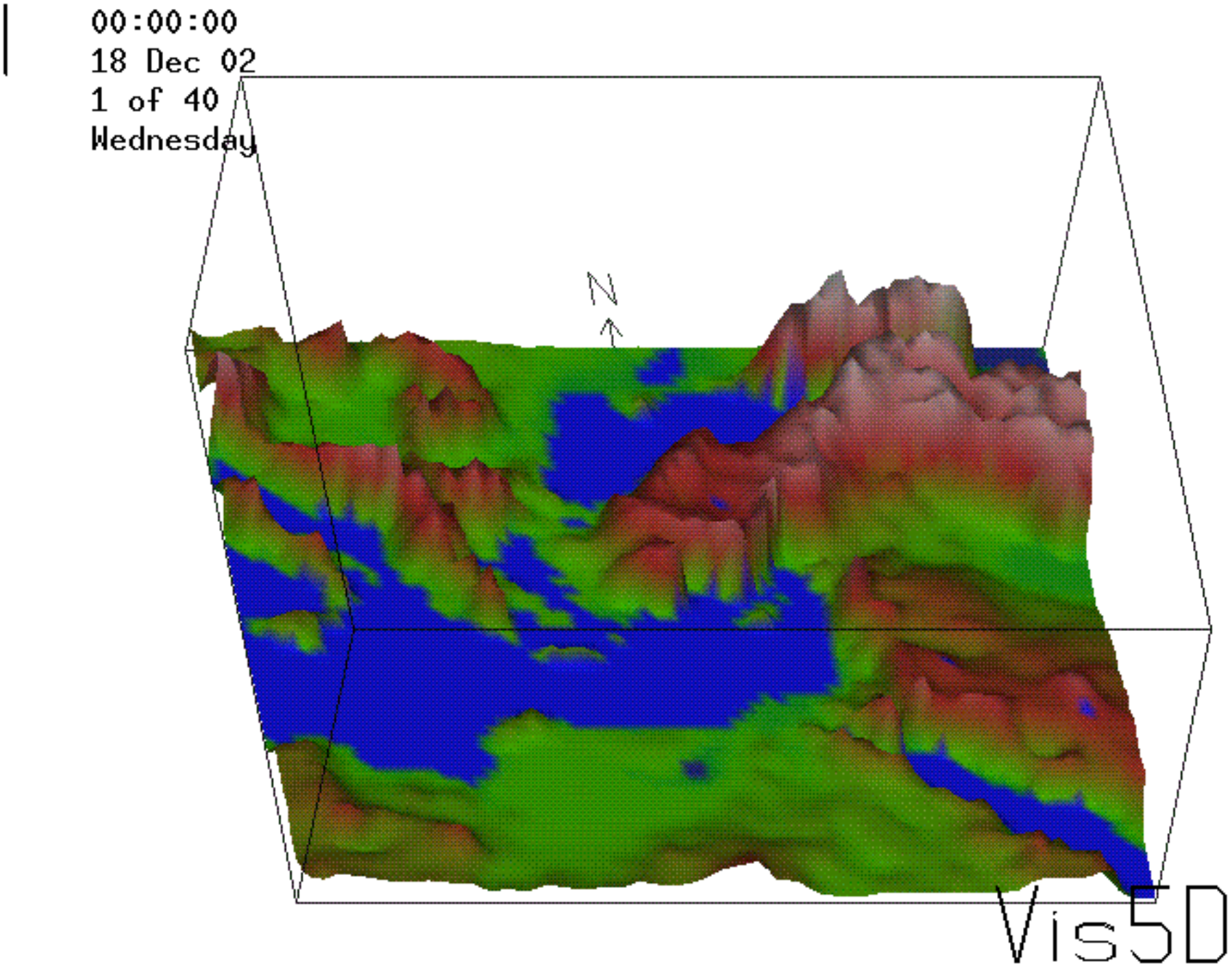
- Timing.
- Duration.
- Distribution.
- Intensity.
- Quantity.

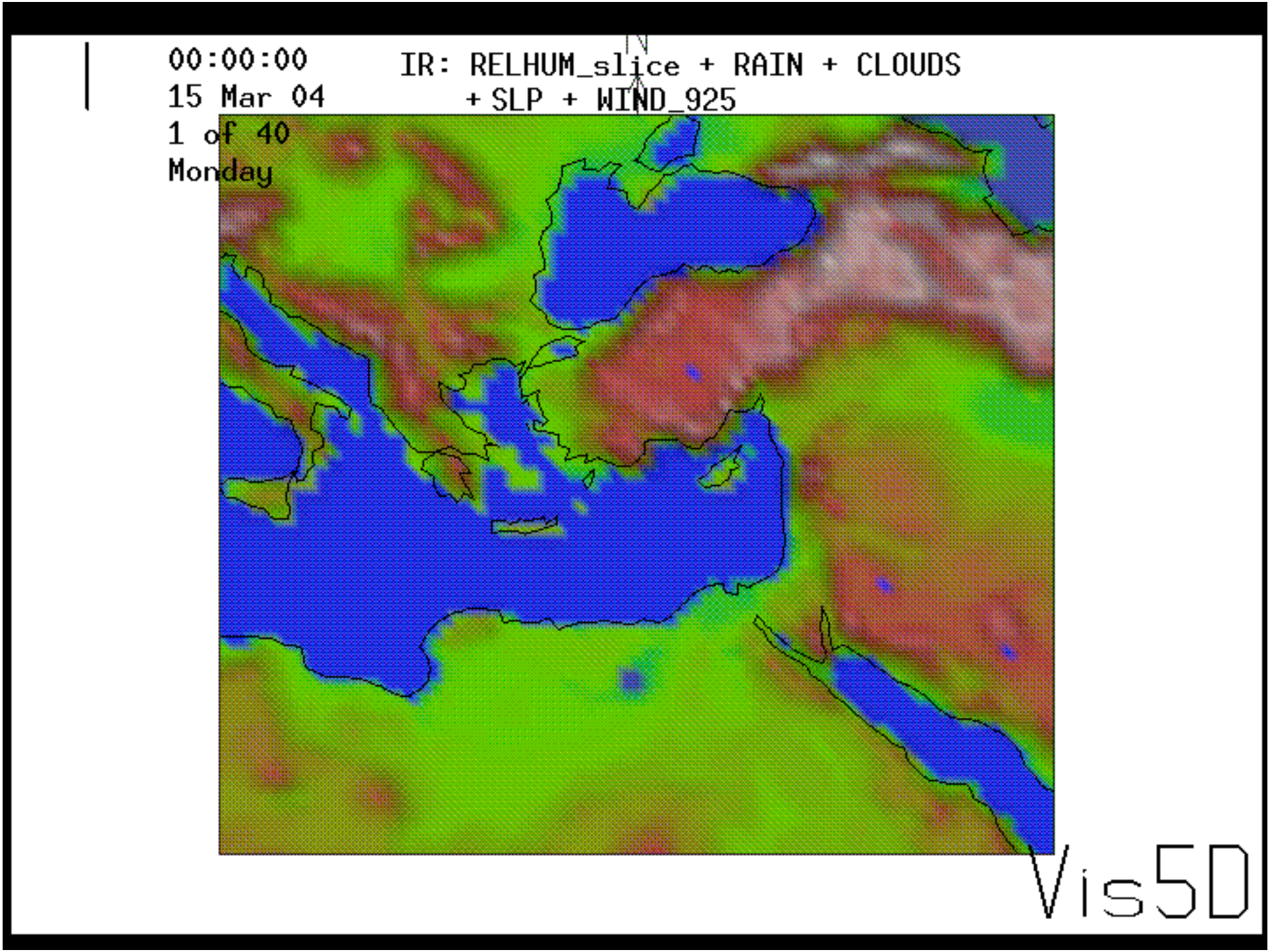
Current forecasting limitations

- Accuracy of synoptic weather models.
- Global models are more accurate over Europe & U.S.
- Resolution of 40 k”m. (Global models)
- Resolution of 13 k”m. (Mezzo scale)
- Long intervals between forecasts.

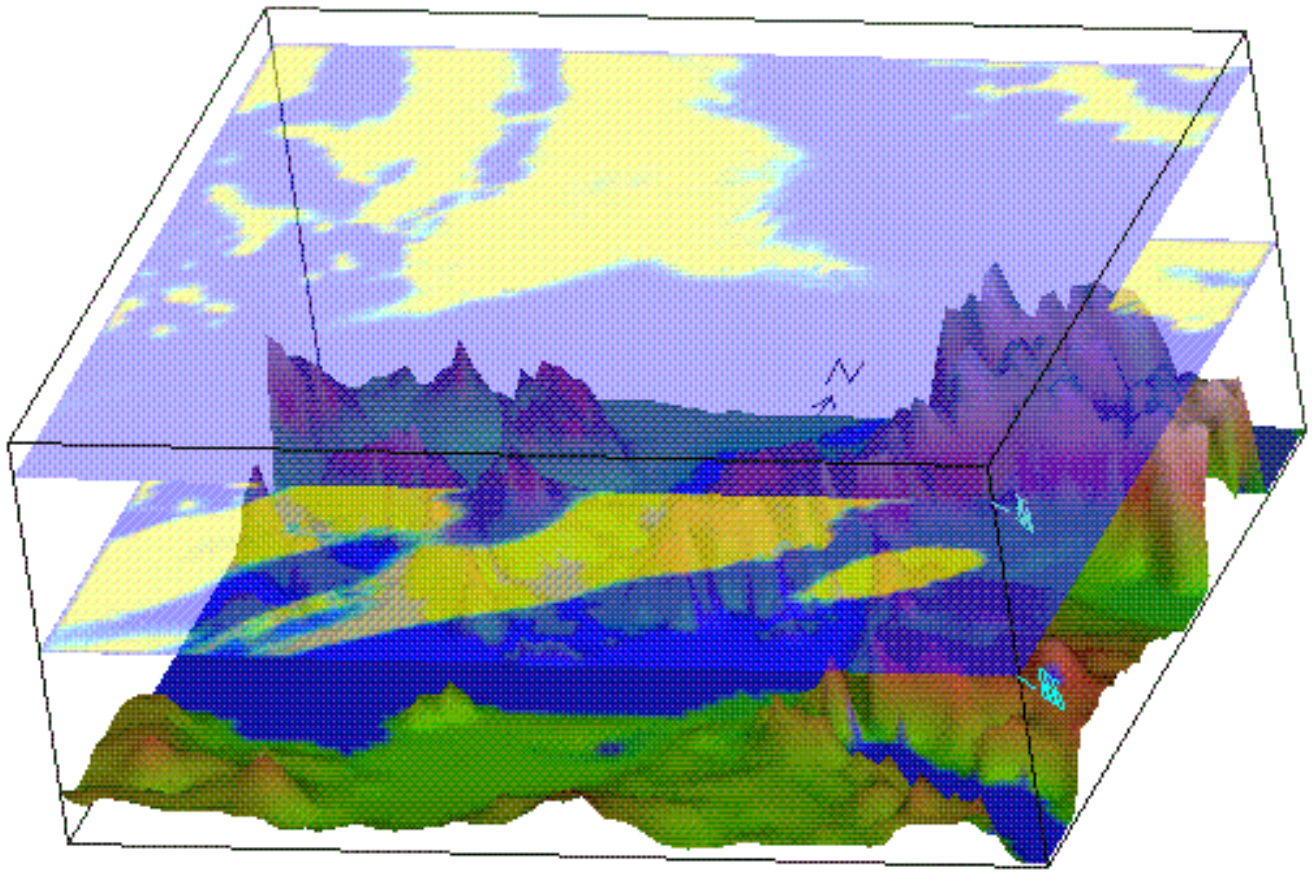

10:00:00
28 May 02
18 of 40
Tuesday
T2m & T slice
Clouds total
T_2M (Grd C
T (Grd C
Grd C
gpdam)
52.20
36.67
21.13
5.60
-9.93
47.94
23.58
-0.79
-25.16
-49.52
Vis5D


06:00:00
25 Mar 03
4 of 40
Tuesday
IR: RELHUM + RAIN + CLOUDS + SLP
WIND850
VIS5D

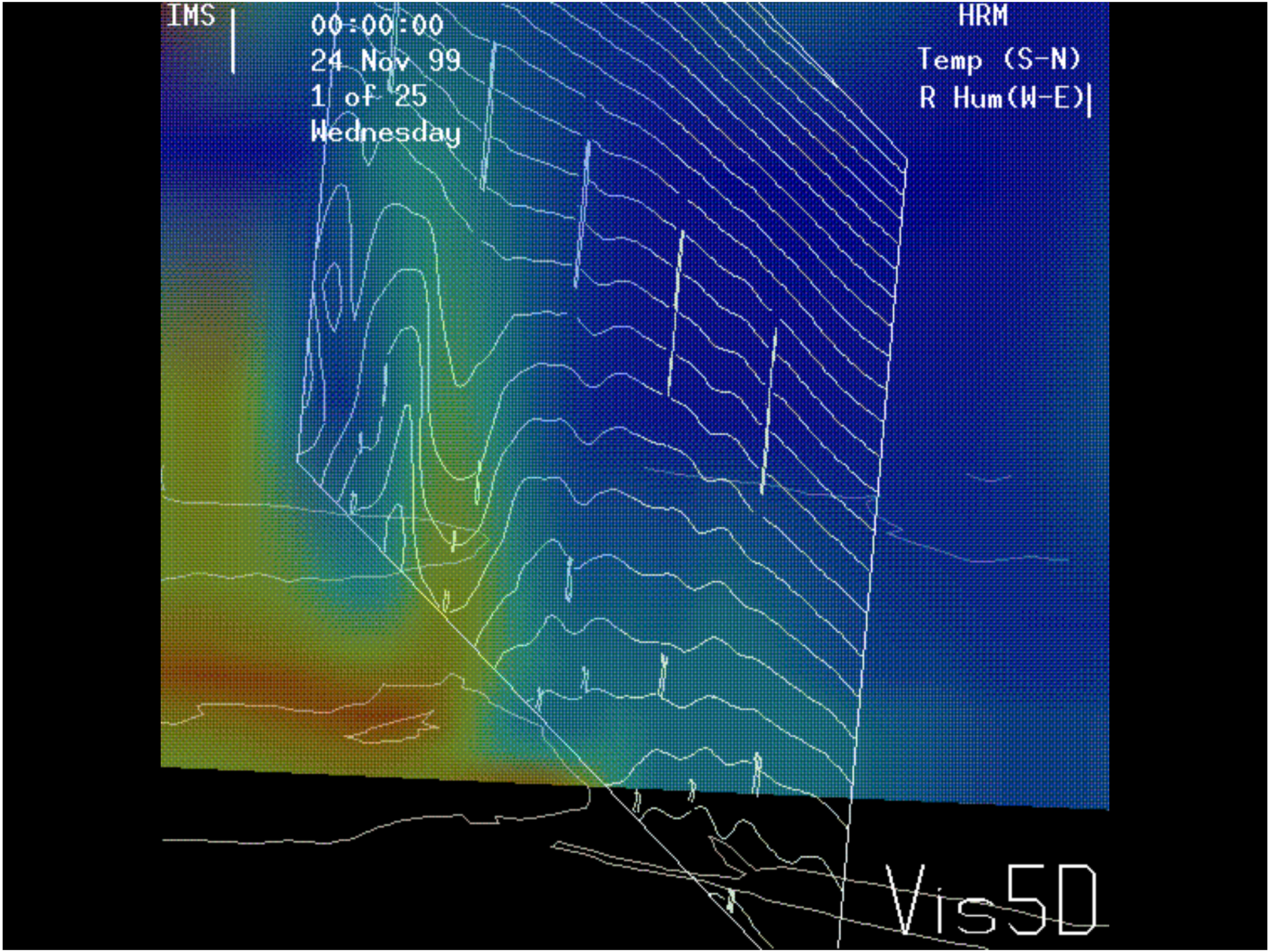

00:00:00
18 Dec 02
1 of 40
Wednesday
N
Vis5D

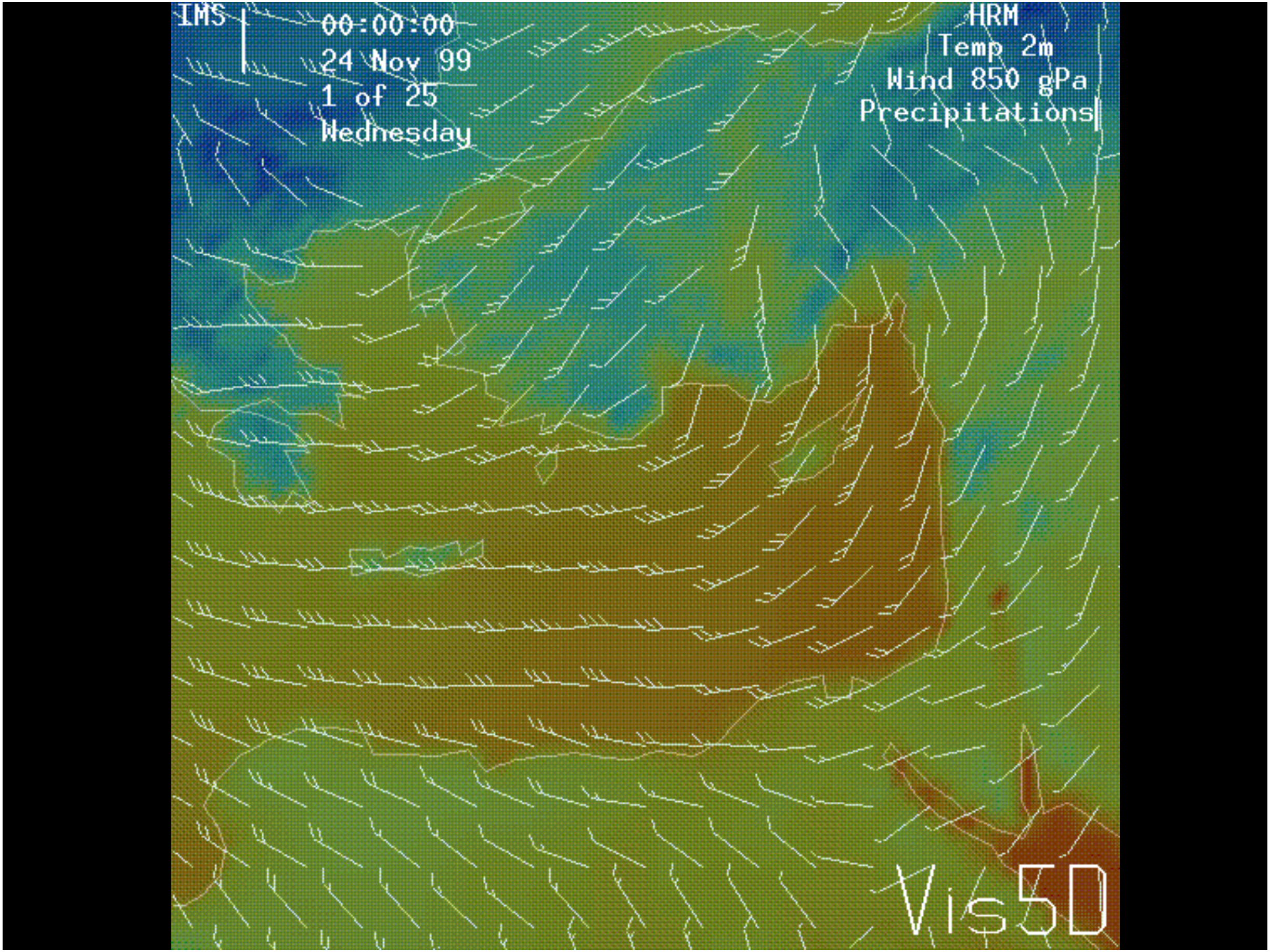

00:00:00
15 Mar 04
1 of 40
Monday
IR: RELHUM_slice + RAIN + CLOUDS
+ SLP + WIND_925
Vis5D

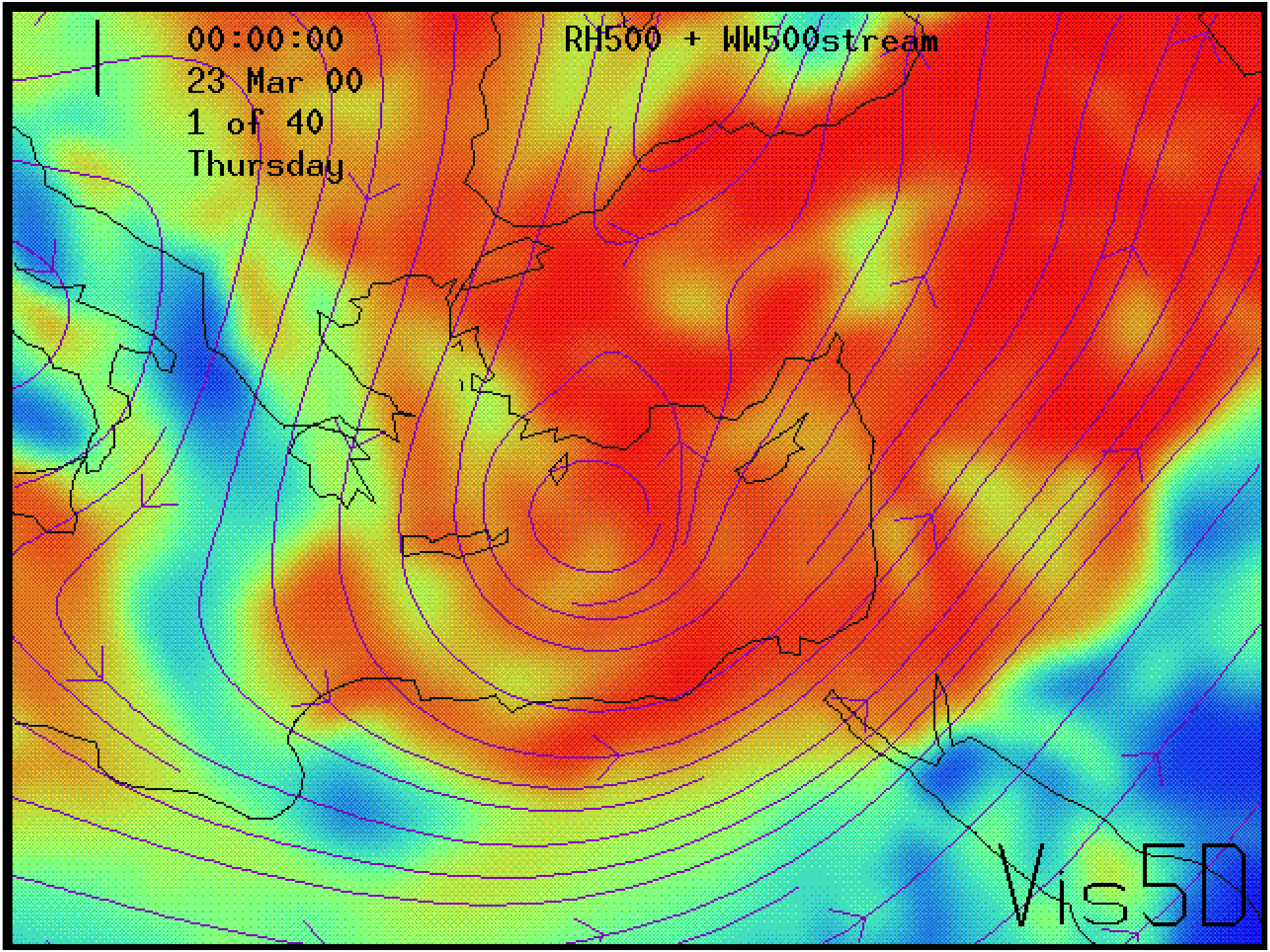
00:00:00
23 Nov 99
1 of 25
Tuesday

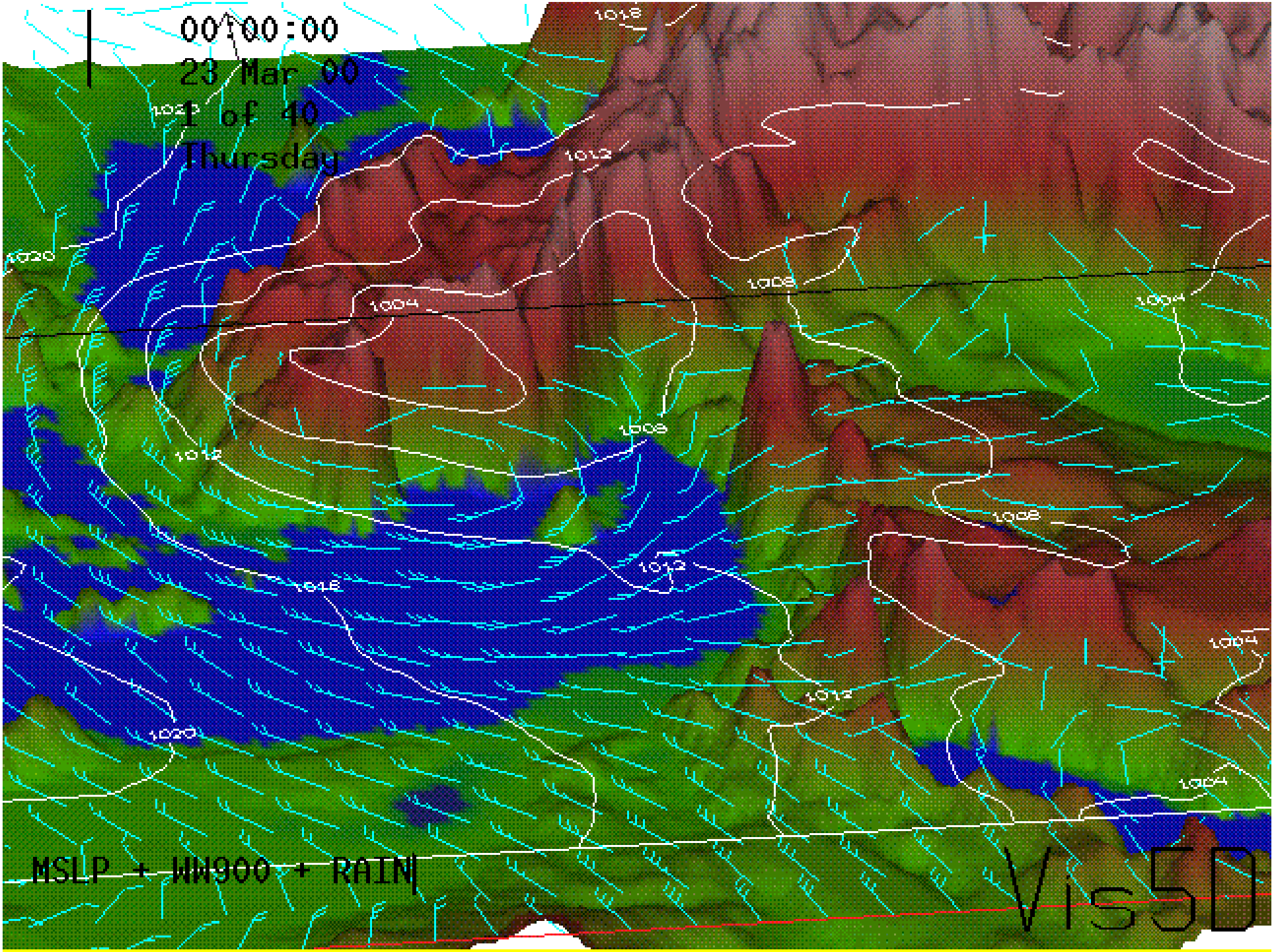


Vis5D


IMS
00:00:00
24 Nov 99
1 of 25
Wednesday
HRM
Temp (S-N)
R Hum(W-E)
Vis5D

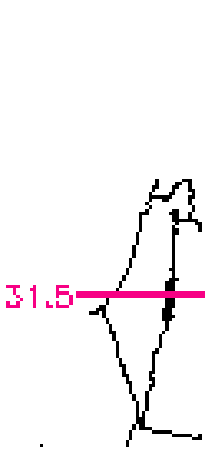

IMS
00:00:00
24 Nov 99
1 of 25
Wednesday
HRM
Temp 2m
Wind 850 gPa
Precipitations
Vis5D

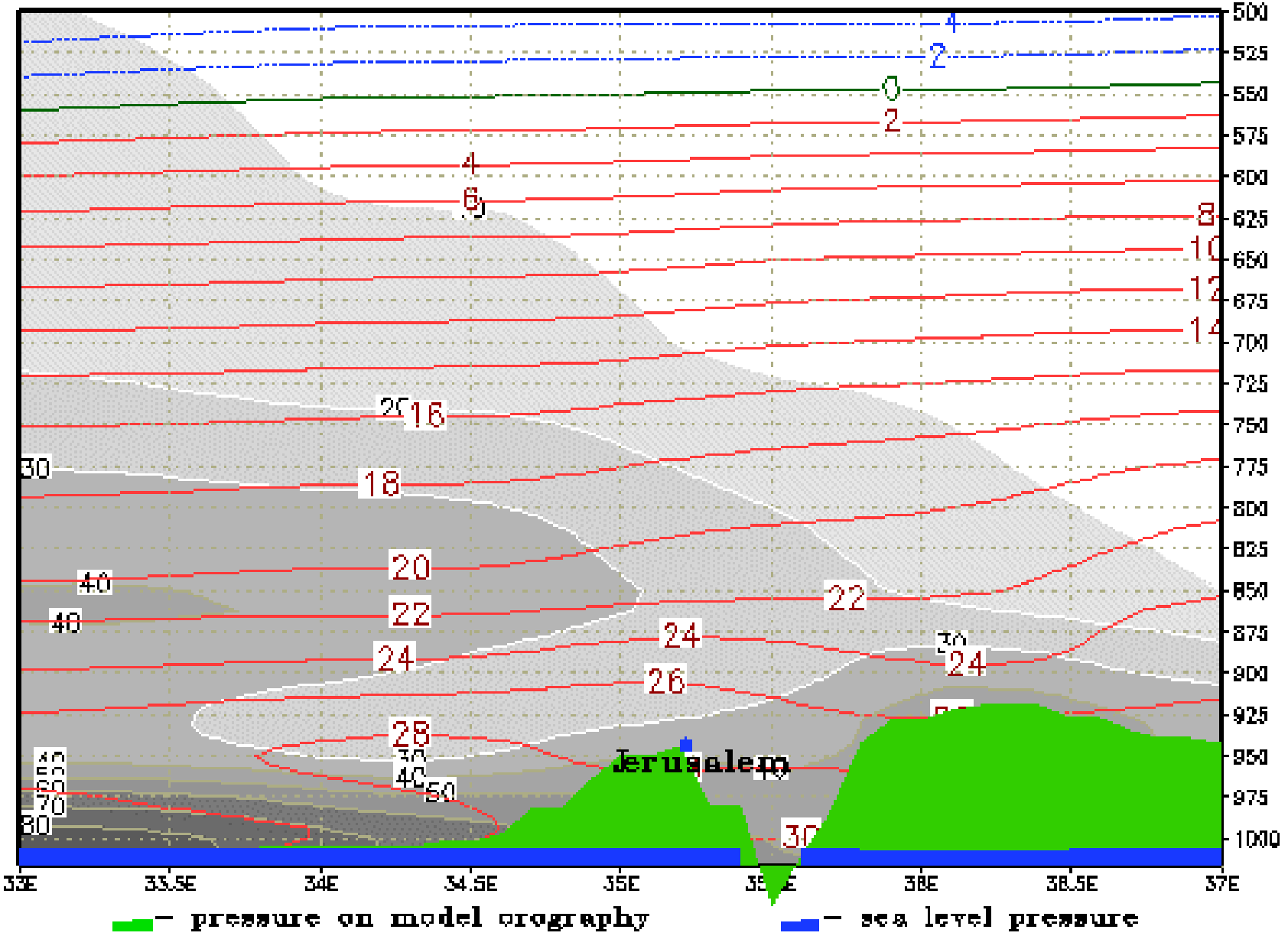

00:00:00
23 Mar 00
1 of 40
Thursday
RH500 + WW500stream
Vis5D

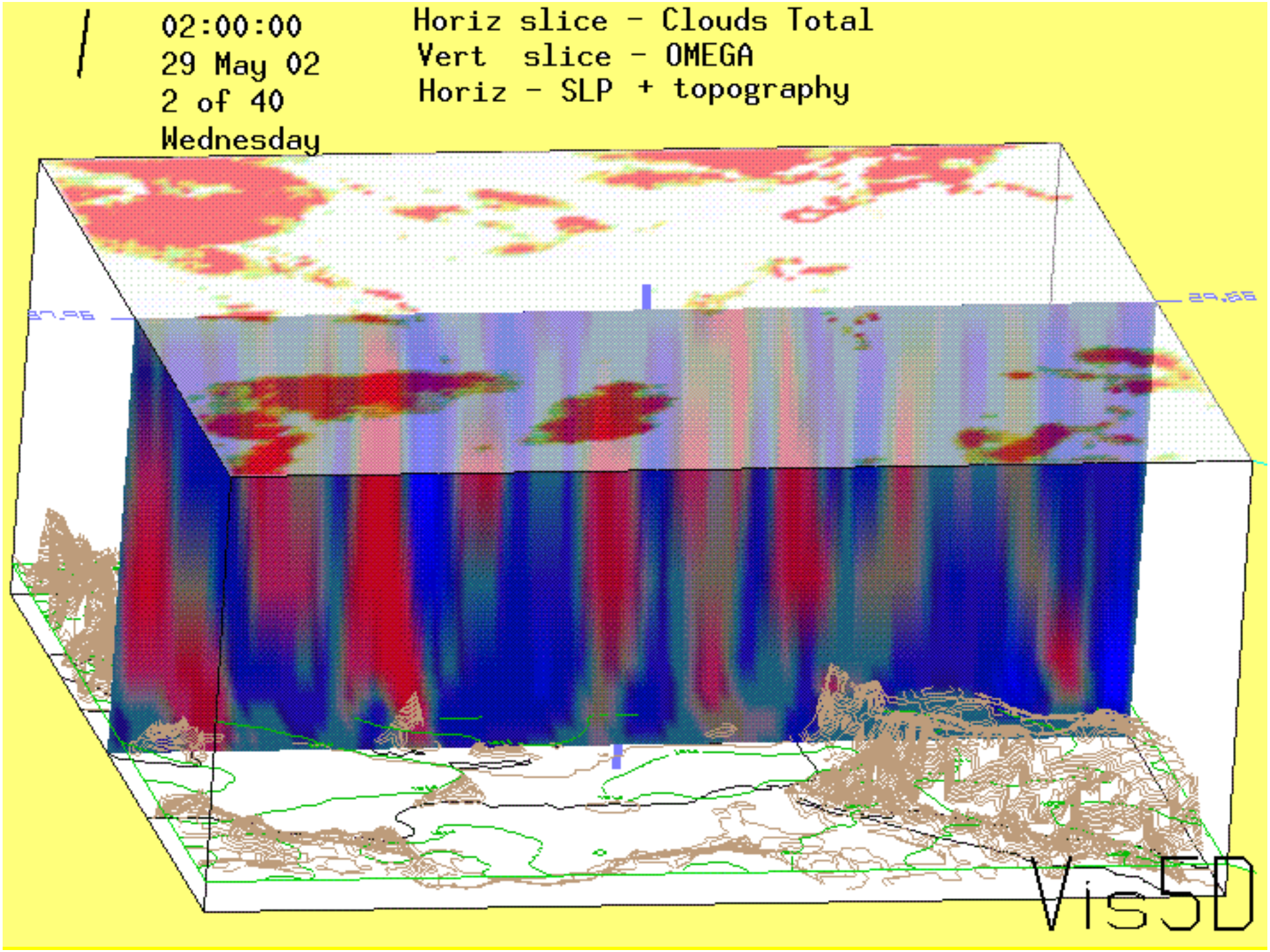

00:00:00
23 Mar 00
1 of 40
Thursday
1020
1016
1012
1008
1004
1000
MSLP + WW900 + RAIN
Vis5D

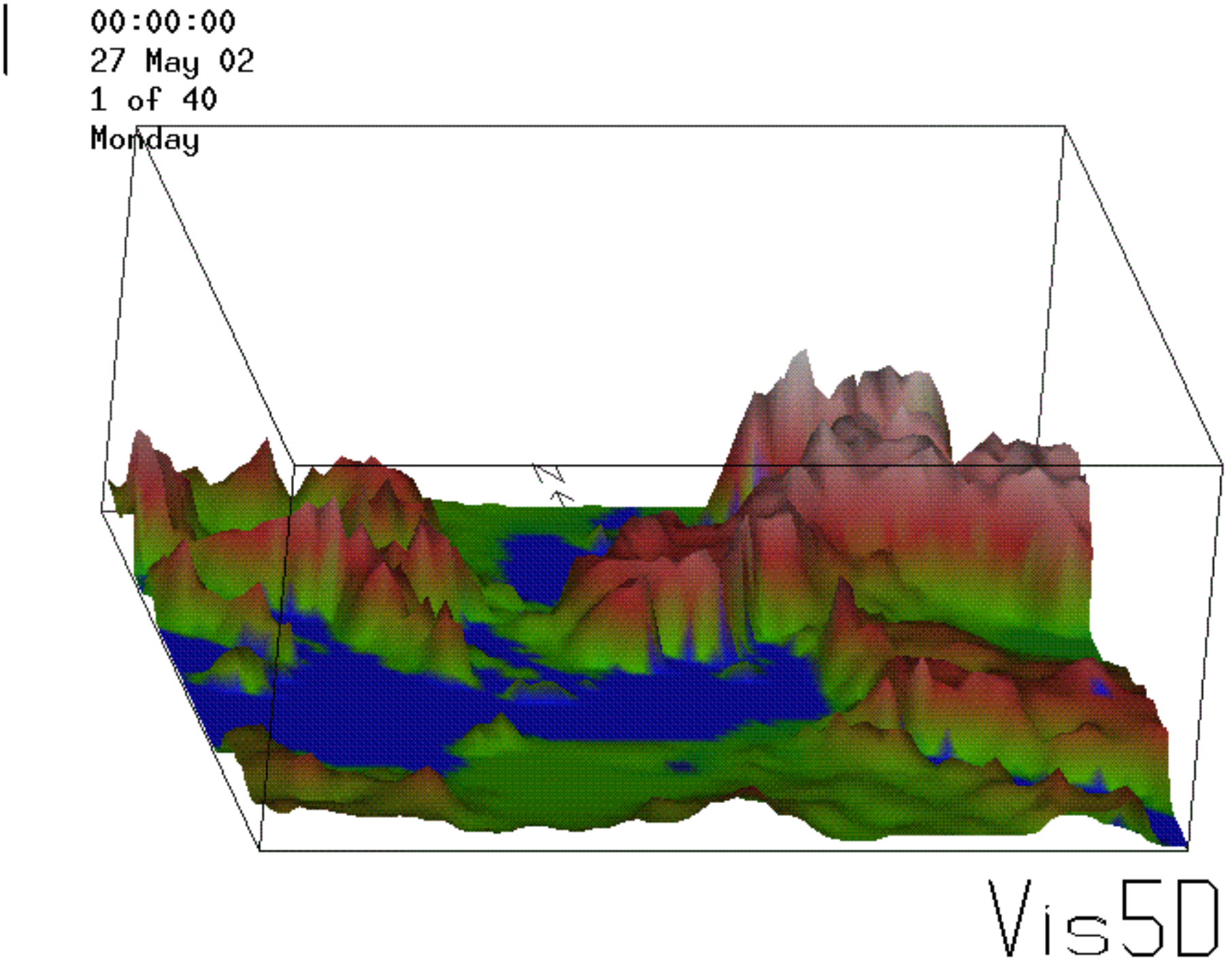
IR(HRM) FORECAST TEMPERATURE & REL. HUMIDITY

CROSS SECTION ALONG LAT:31.5 STARTING FROM 10/07/2002 00Z TO 00h

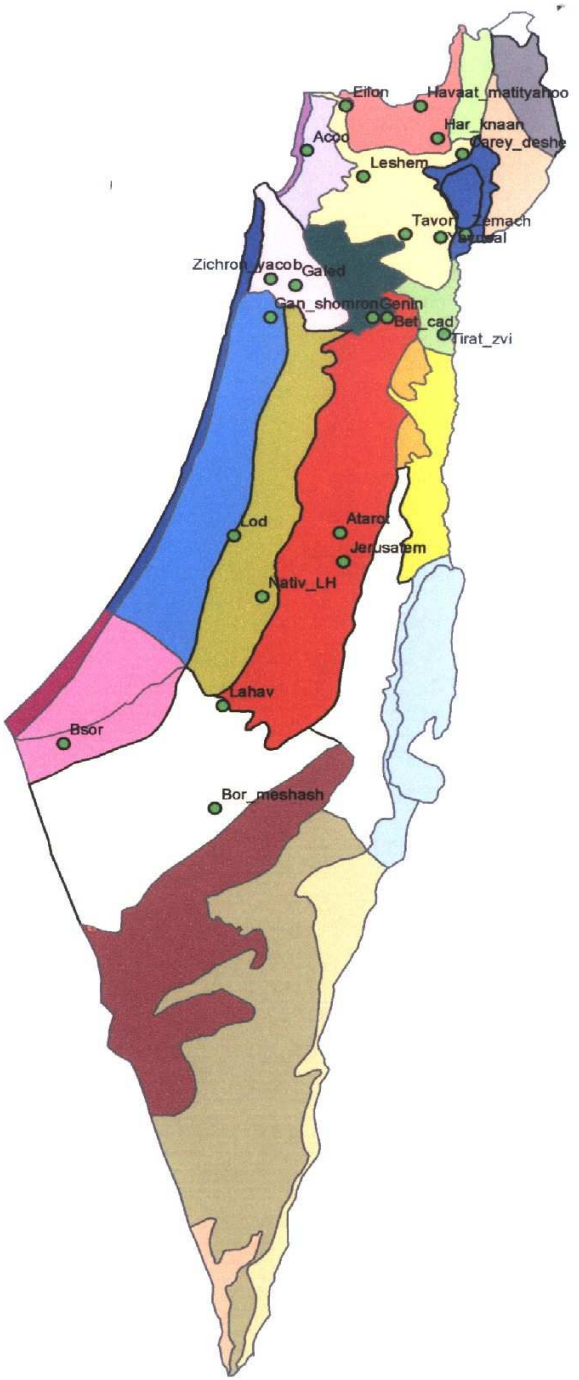


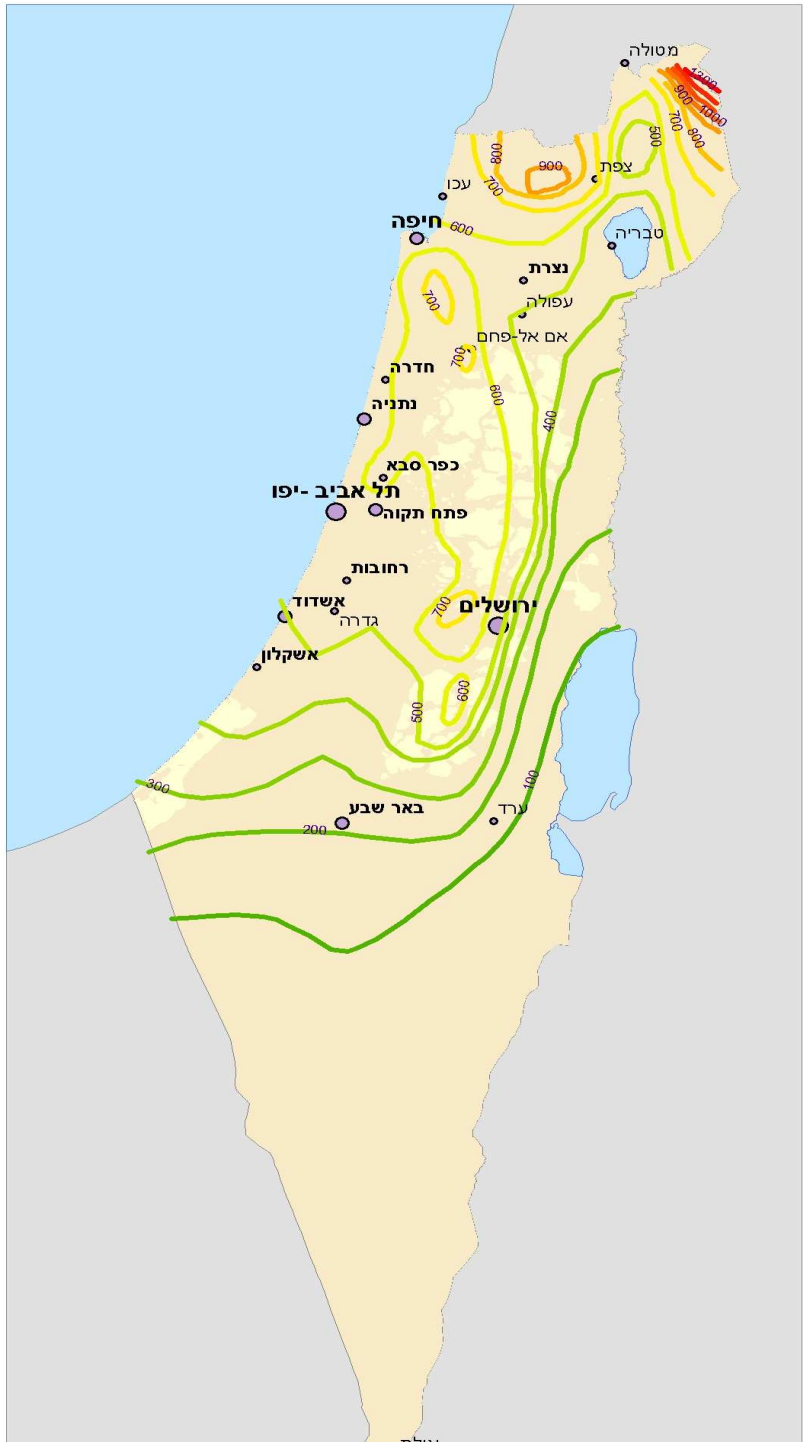



02:00:00
29 May 02
2 of 40
Wednesday
Horiz slice - Clouds Total
Vert slice - OMEGA
Horiz - SLP + topography
29.66
VisSD

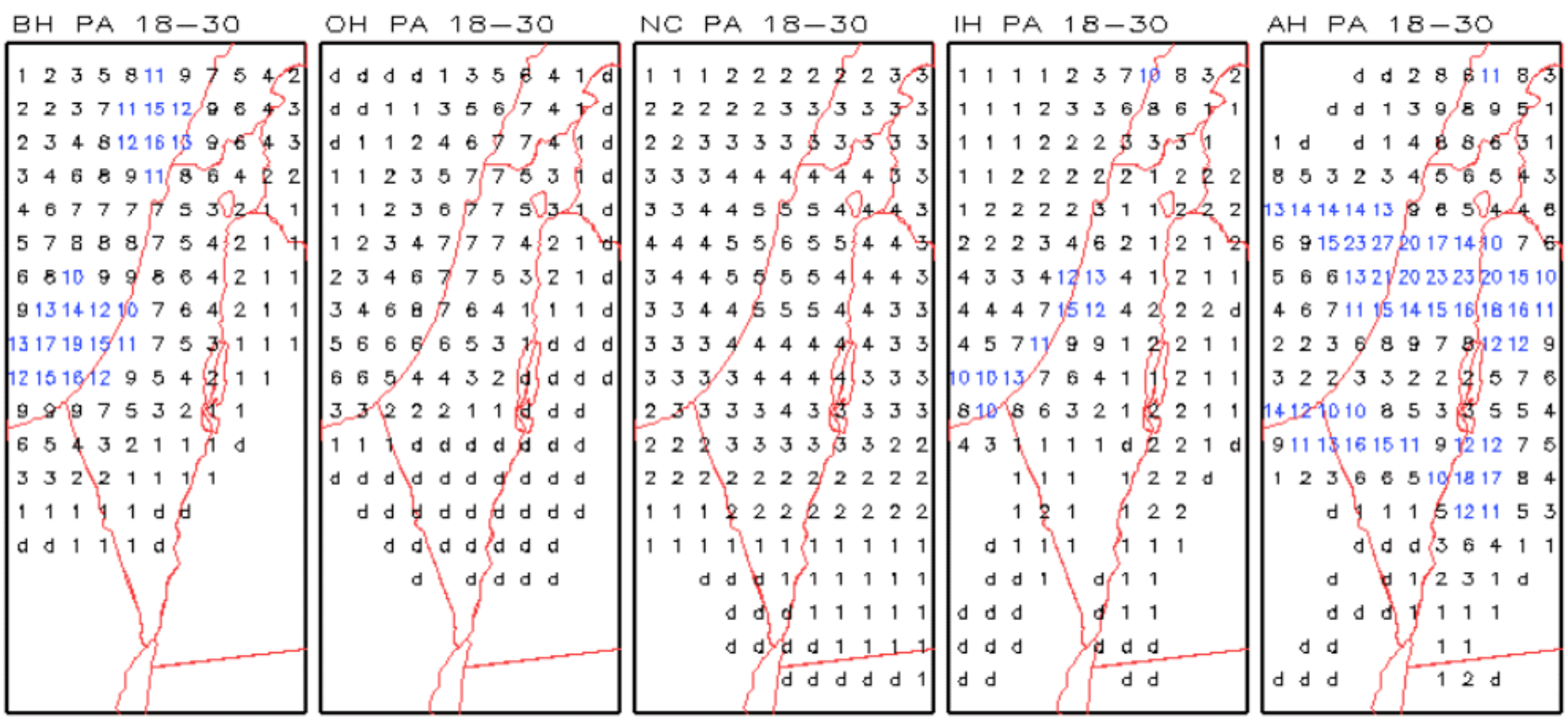

00:00:00
27 May 02
1 of 40
Monday
N
Vis5D

Geoclimate zones in Israel




מטולה
צפת
עכו
חיפה
טבריה
נצרת
עפולה
אם אל-פחם
חדרה
נתניה
כפר סבא
תל אביב -יפו
פתח תקוה
רחובות
אשדוד
גדרה
אשקלון
ירושלים
באר שבע
ערד
1300
900
800
700
600
500
400
300
200
100

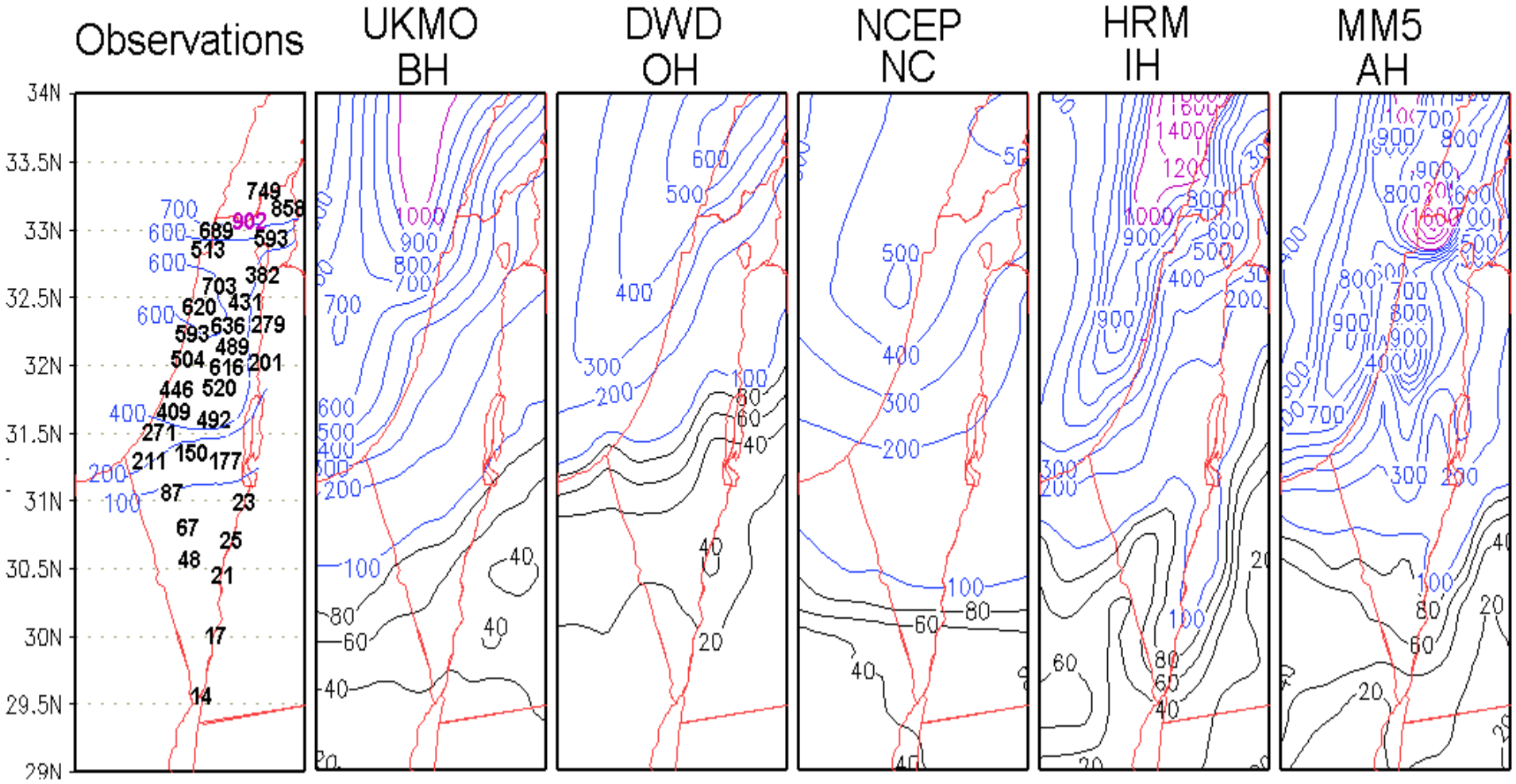
Example of the rain forecast presentation in the IMS Intranet



* rain forecast from all models interpolated to grid points with DS=0.25deg

Precipitation accumulated (1.10.05 - 30.04.06)

daily forecasts from 06h to 30h



THE VERIFICATION OF MODELS

EVERY MODEL SHOULD BE VERIFIED BY THREE CRITERIAS:

- **ACCURACY, BY THE ROOT MEAN SQUARE ERROR -RMSE – (FOR EXAMPLE, THE TEMPERATURE FORECAST SHOULD BE GIVEN WITH AN AVERAGE ACCURACY OF ± 1.5°C.**

- **SKILL- SHOWS HOW BETTER THE FORECAST IS COMPARED TO RANDOM HITS OR TO CLIMATOLOGY.**

- **VALUE- REFFERS TO THE ECONOMICAL ADVANTAGE OF THE FORECAST. FOR EXCAMPLE THE VALUE OF REPLACED IRRIGATION.**

Categorical verifications		Observed		
		yes	no	Total
Forecast	yes	hits	False alarms	Forecast yes
	no	misses	Correct negatives	forecast no
Total		Observed yes	Observed no	total

Probability of detection (hit rate) -

$$POD = hits / (hits + misses)$$

Answers the question: *What fraction of the observed "yes" events were correctly forecast?*

Probability of true alarms -

$$POA = hits / (hits + false\ alarms)$$

Answers the question: *What fraction of the predicted "yes" events actually did occur?*

Threat score (critical success index)

$$TS = hits / (hits + misses + false\ alarms)$$

Answers the question: *How well did the forecast "yes" events correspond to the observed "yes" events?*

Range: 0 to 1, 0 indicates no skill. **Perfect score:** 1.

Region 7 (נגב צפוני)

Choice category of forecast for dangerous rain (>= 10mm)

Forecasts >= 10mm 6-30h

N (Obs. >10mm) = 22	UKMO	DWD	NCEP	HRM	MM5	MIX
hits	5	1	4	9	14	16
misses	17	21	18	13	8	6
False alarms	2	10	1	4	8	11
Probability of detection	0.23	0.05	0.18	0.41	0.64	0.73
Probability of true alarms	0.71	0.5	0.8	0.69	0.64	0.59
Threat score	0.21	0.04	0.17	0.35	0.47	0.48

Forecasts >= 7.5mm

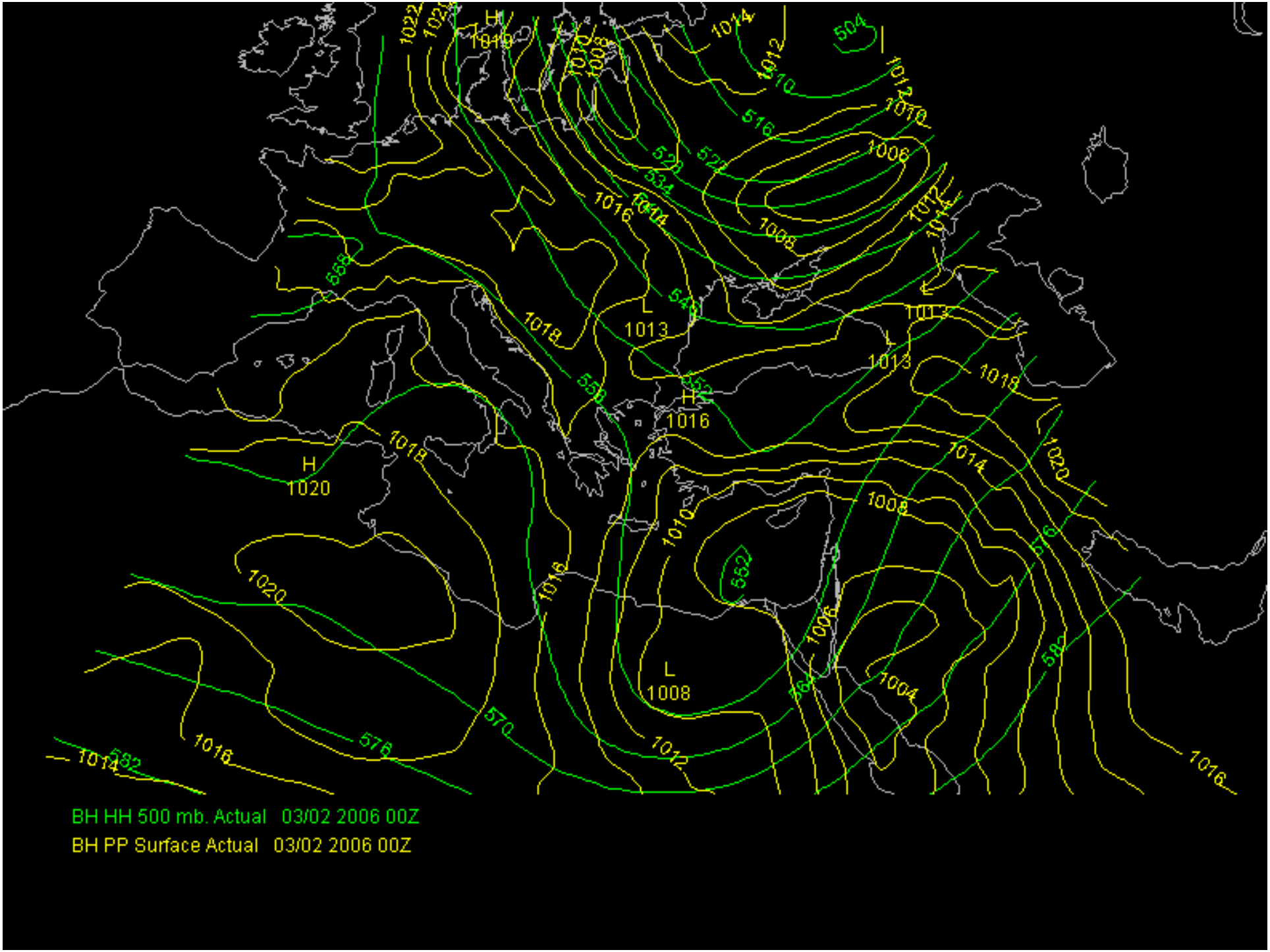
N (Obs. >10mm) = 22	UKMO	DWD	NCEP	HRM	MM5	MIX
hits	10	1	5	14	17	19
misses	12	21	17	8	5	3
False alarms	3	1	3	6	10	16
Probability of detection	0.45	0.05	0.23	0.64	0.77	0.86
Probability of true alarms	0.77	0.5	0.63	0.7	0.63	0.54
Threat score	0.4	0.04	0.2	0.5	0.53	0.5

Forecasts > 5mm

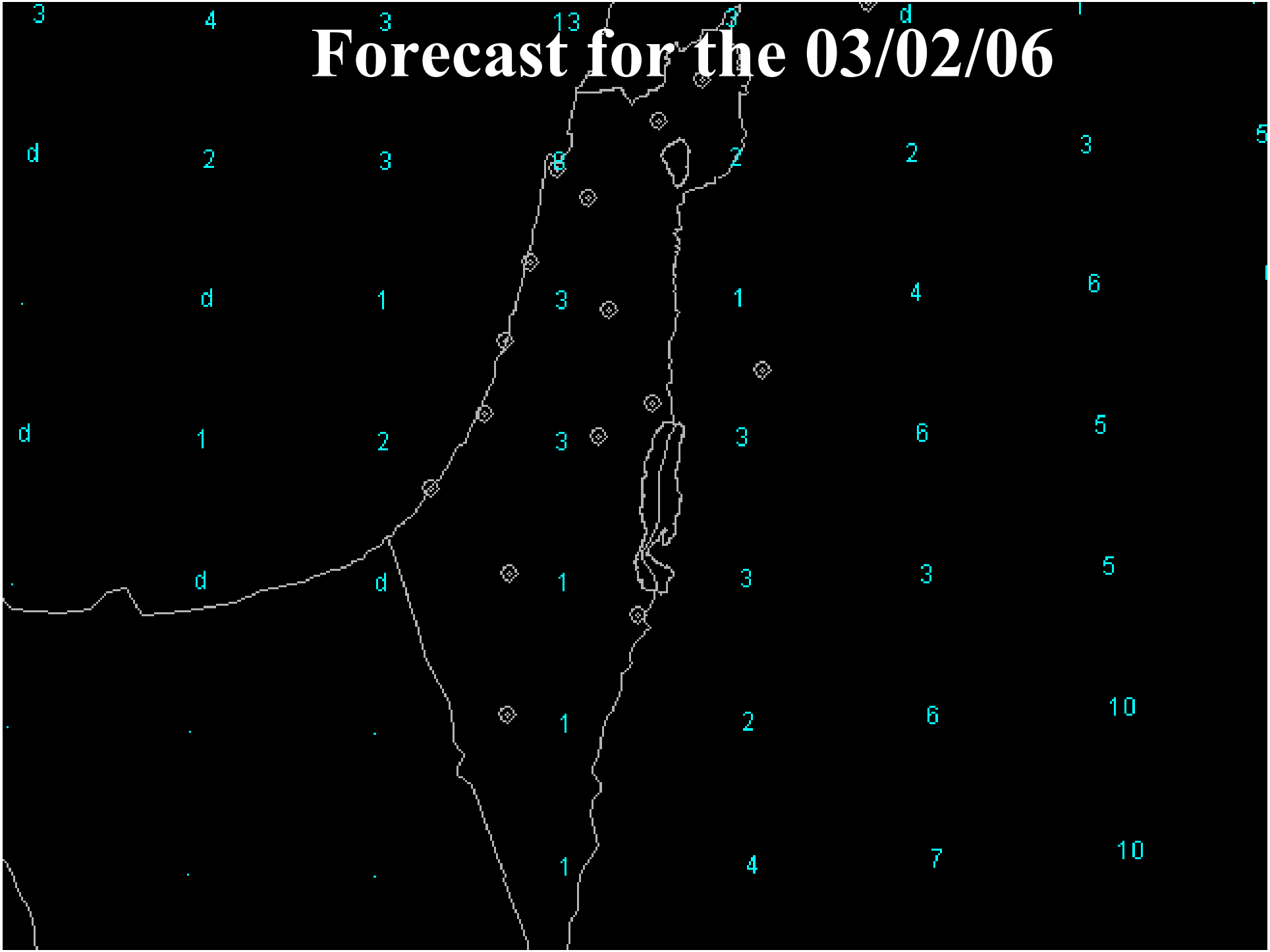
N (Obs. >10mm) = 22	UKMO	DWD	NCEP	HRM	MM5	MIX
hits	17	2	12	15	18	21
misses	5	20	10	7	4	1
False alarms	7	2	4	6	14	20
Probability of detection	0.77	0.09	0.55	0.68	0.82	0.95
Probability of true alarms	0.71	0.5	0.75	0.71	0.56	0.51
Threat score	0.59	0.08	0.46	0.54	0.5	0.5

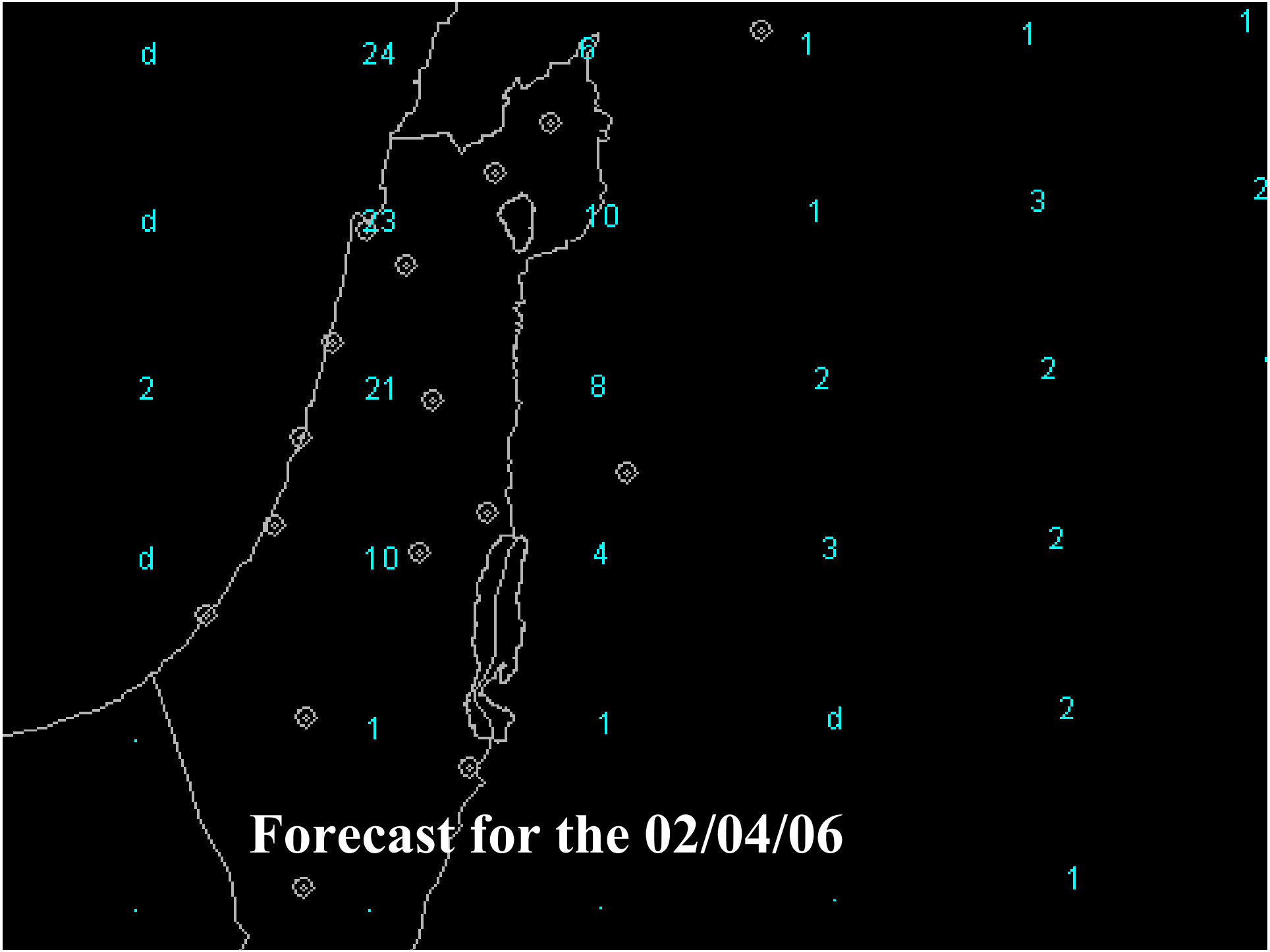
Current precipitation forecasting criterions

- Analysis of the synoptic conditions- Pressure, temp', R.H, wind.
- Searching for uniformity between the different models.
- Searching for uniformity in the models runs.
- Paying attention to the models rain forecast, knowing its limitations.
- Acquaintance of the different geo climatic zones.
- Experience- Previously forecasting "similar" synoptic conditions.

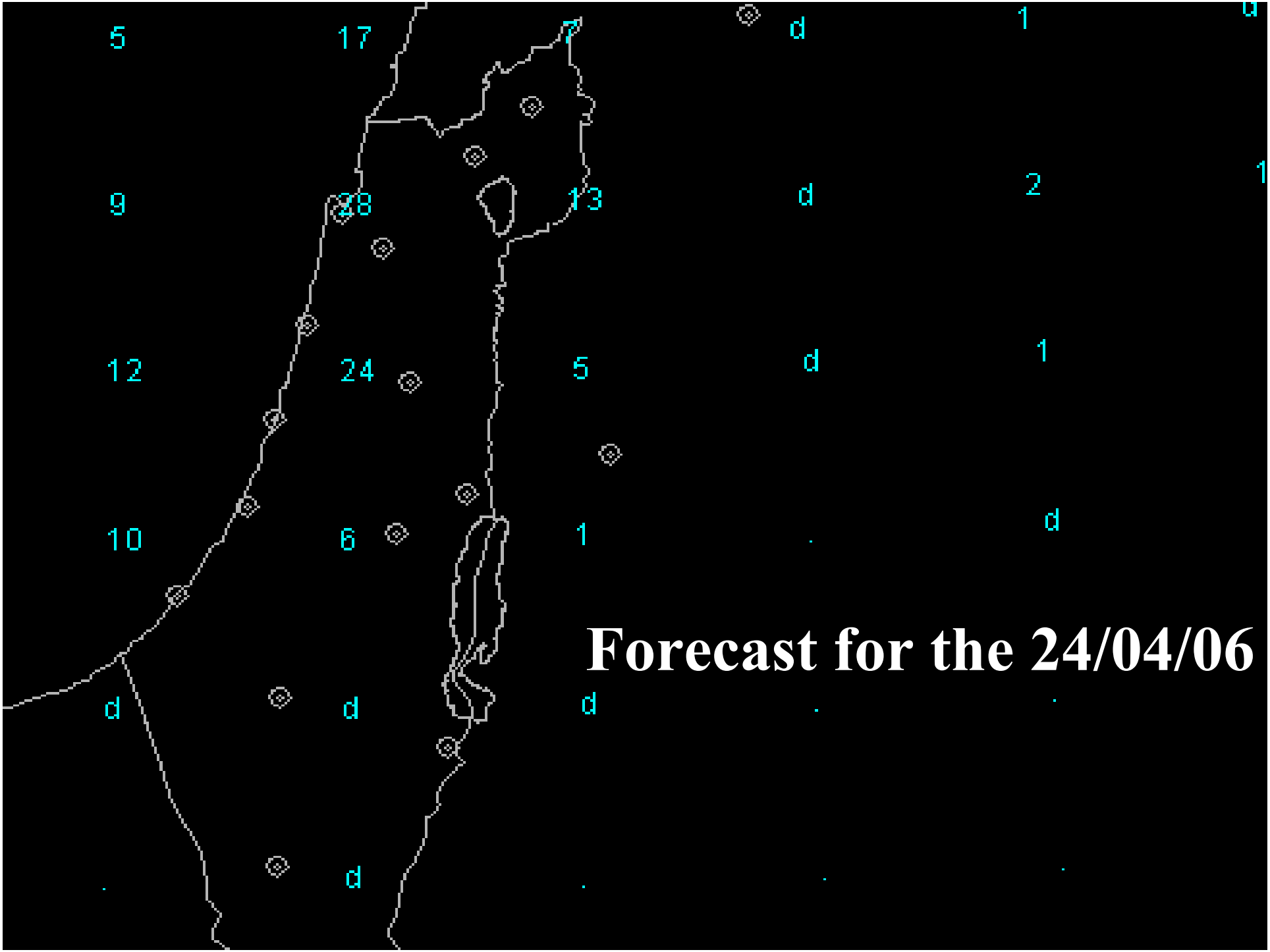

BH HH 500 mb. Actual 03/02 2006 00Z
BH PP Surface Actual 03/02 2006 00Z

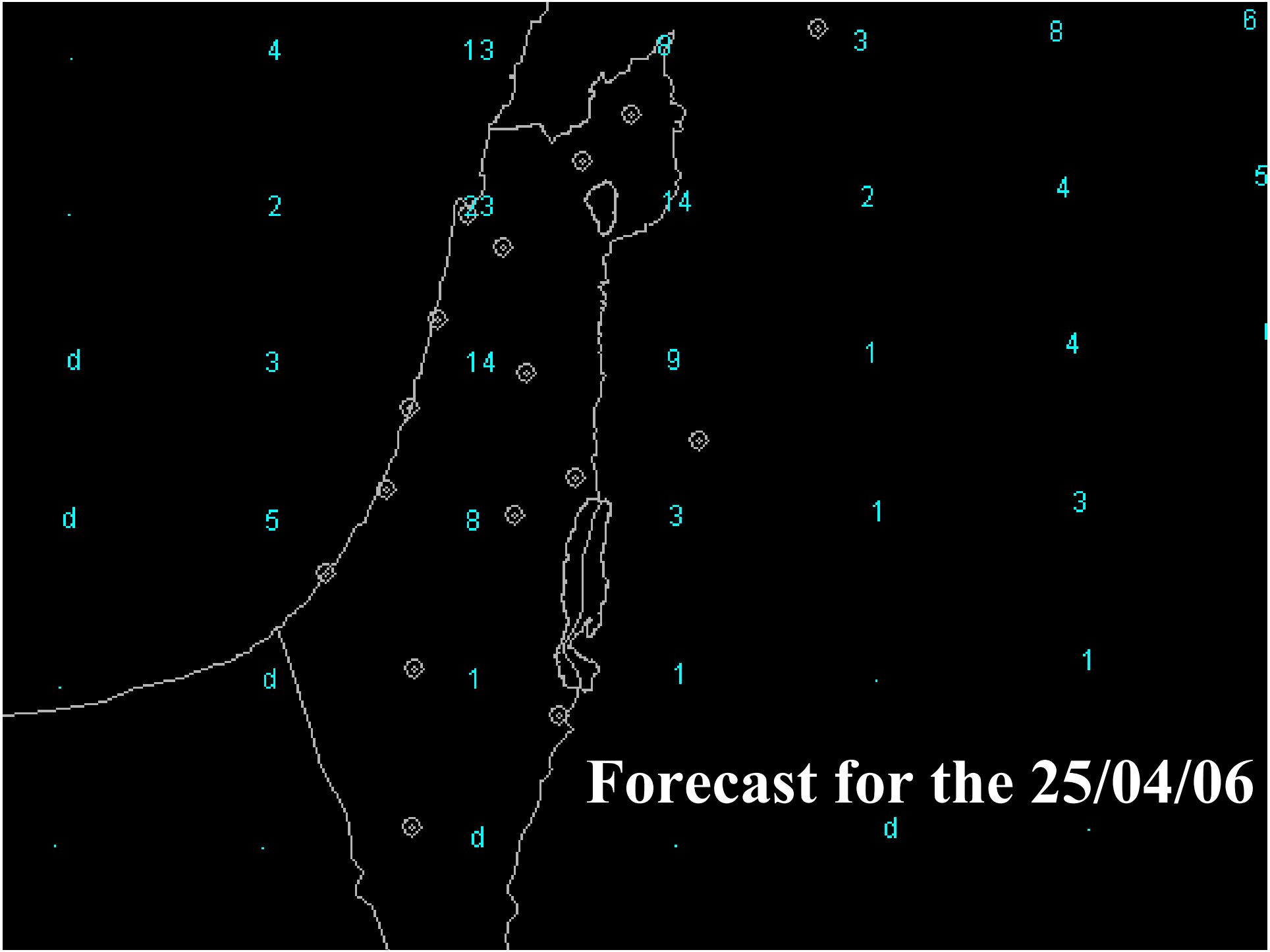
Forecast for the 03/02/06

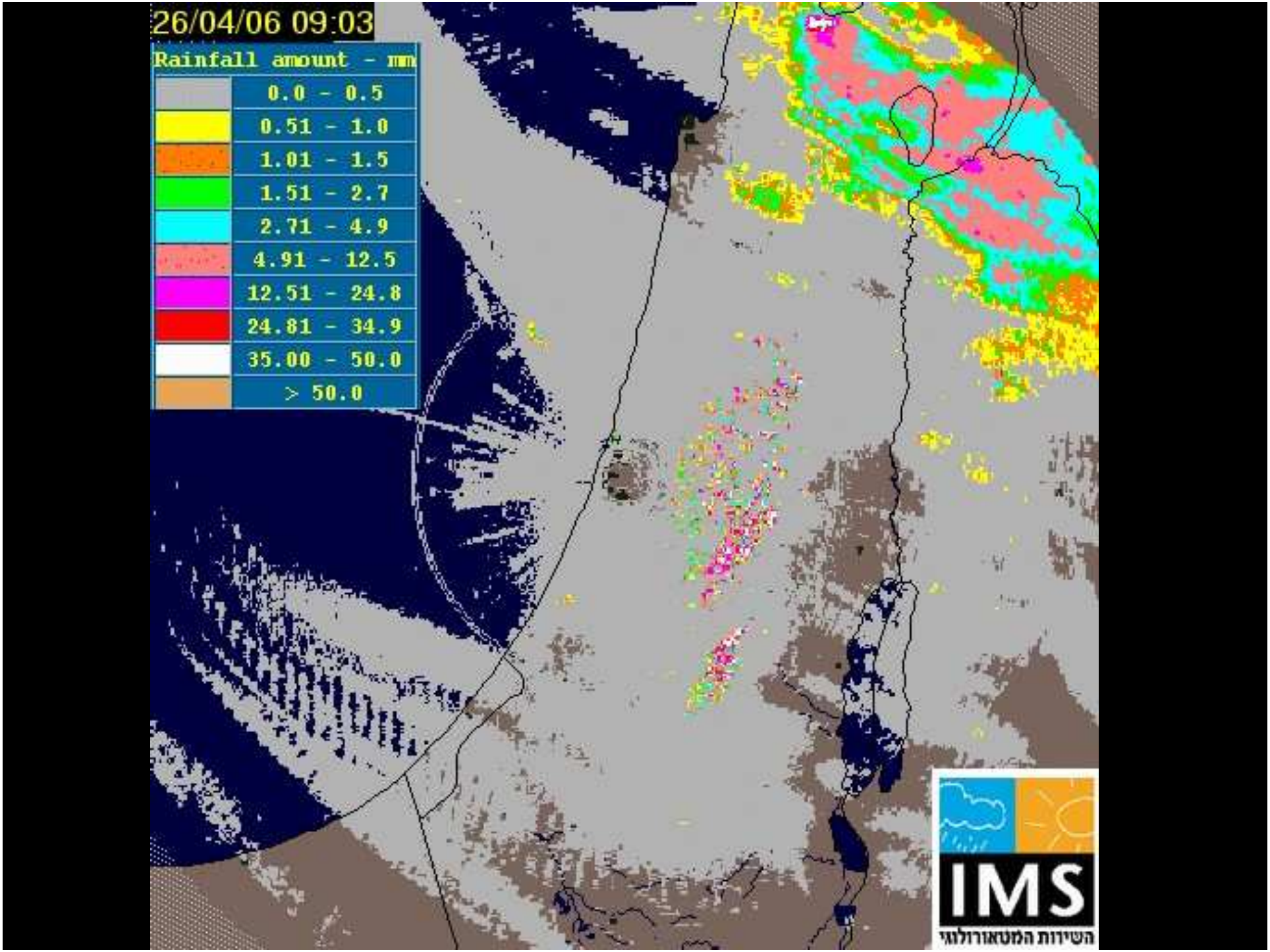




Forecast for the 02/04/06


5
17
d
1
9
28
13
d
2
12
24
5
d
1
10
6
1
d
d
d
d
d
Forecast for the 24/04/06


Forecast for the 25/04/06


26/04/06 09:03
Rainfall amount - mm
0.0 - 0.5
0.51 - 1.0
1.01 - 1.5
1.51 - 2.7
2.71 - 4.9
4.91 - 12.5
12.51 - 24.8
24.81 - 34.9
35.00 - 50.0
> 50.0
IMS
השירות המטאורולוגי

Future requirements in forecasting

- More accurate models.
- Better satellite and radar coverage & resolution.
- A deeper understanding of world pressure oscillations.
- A well developed system of automatic weather stations.
- A modern & efficient forecast distribution system: Internet, Email, cell phone messages and exc'.

Future applications in forecasting

- Long term forecasting ability.
- Pin point precipitation forecasts.
- A computerized data base from stations all around the country accessible to all via the internet.
- Farmers planning their crop selection & work schedule according to the information that is sent to them.