Convective initiation ahead of precipitation bands: 14 June 2008 case

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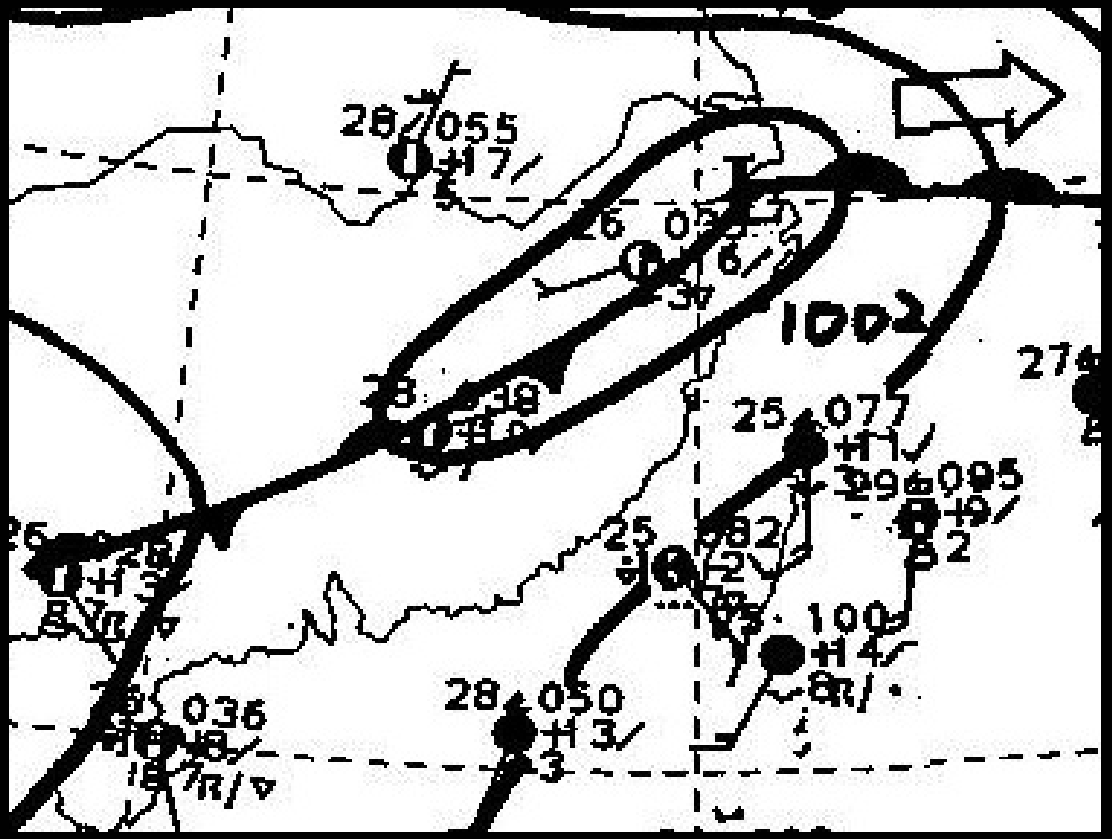
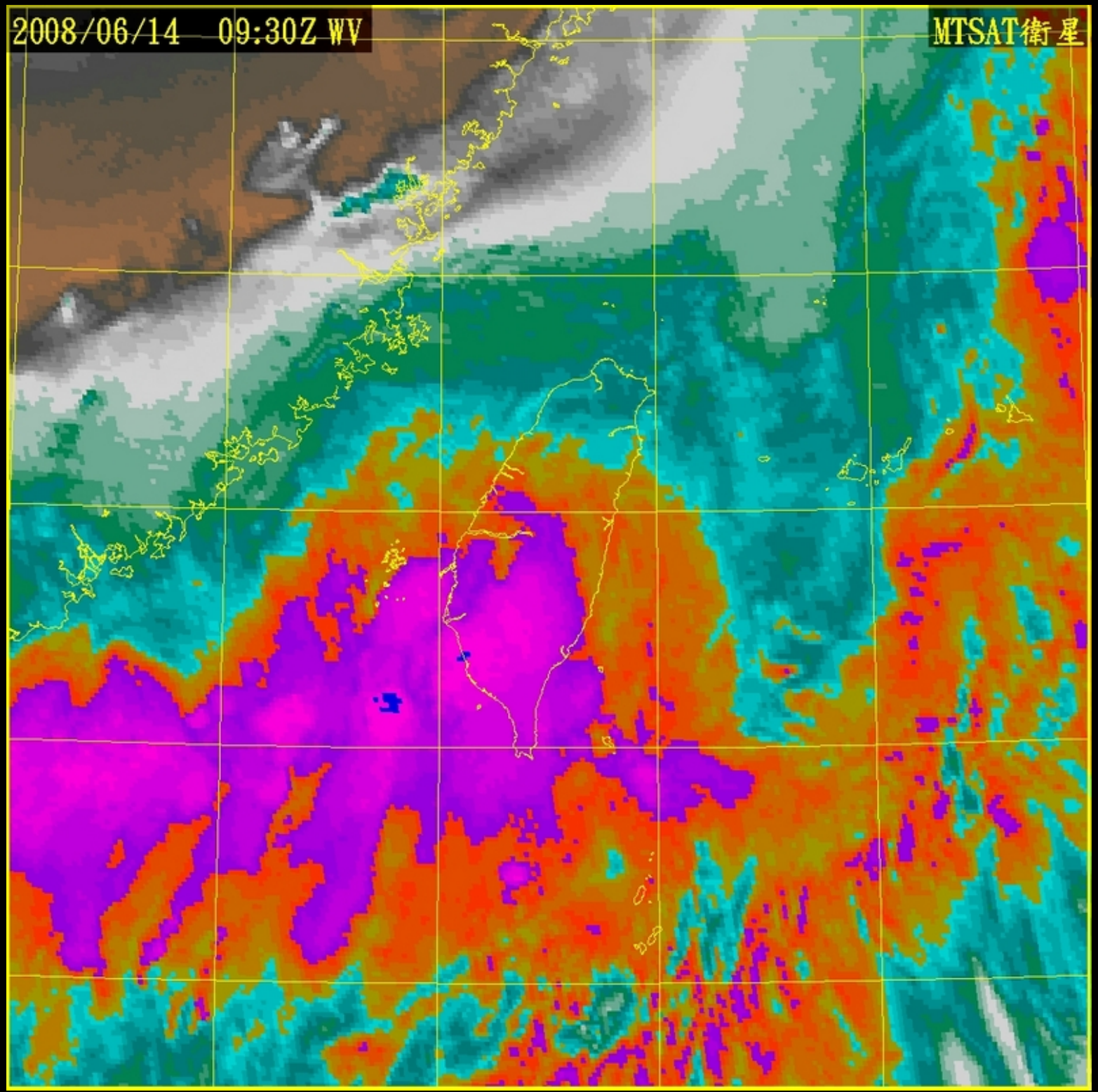
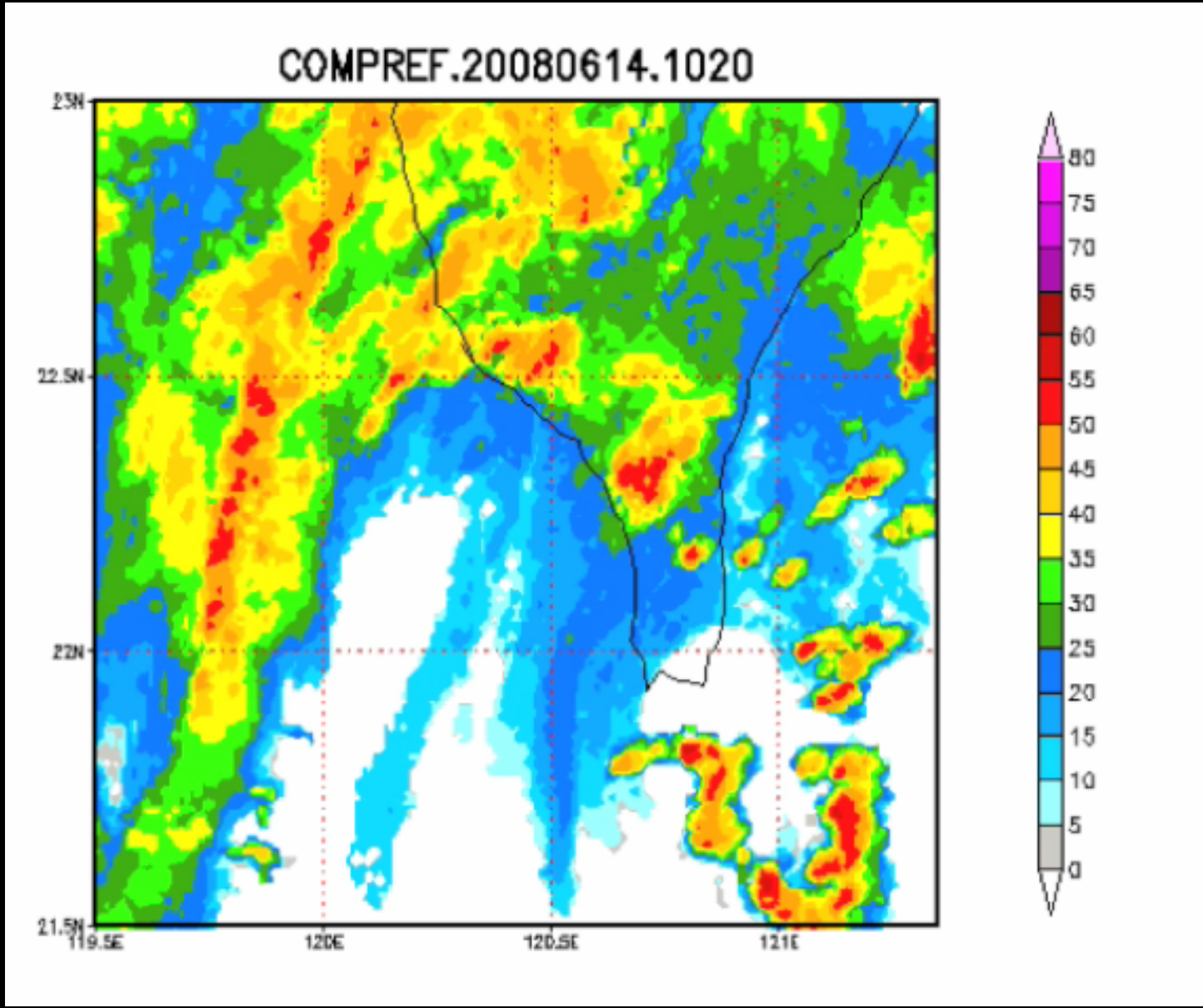
CWB surface analysis 1412Z 14 June 2008





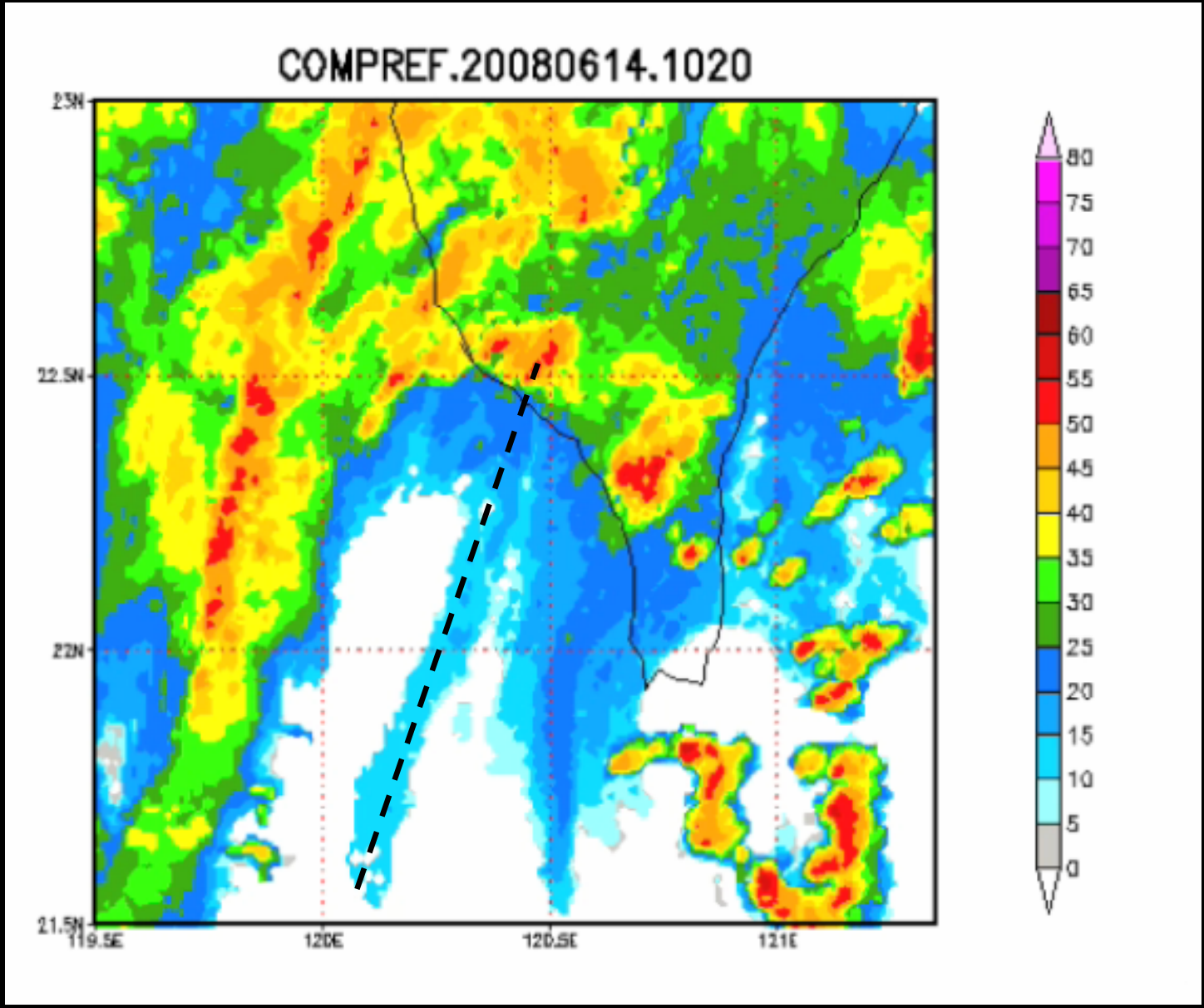
Water vapor image
for 0930Z

14 June 2008 - 1020Z

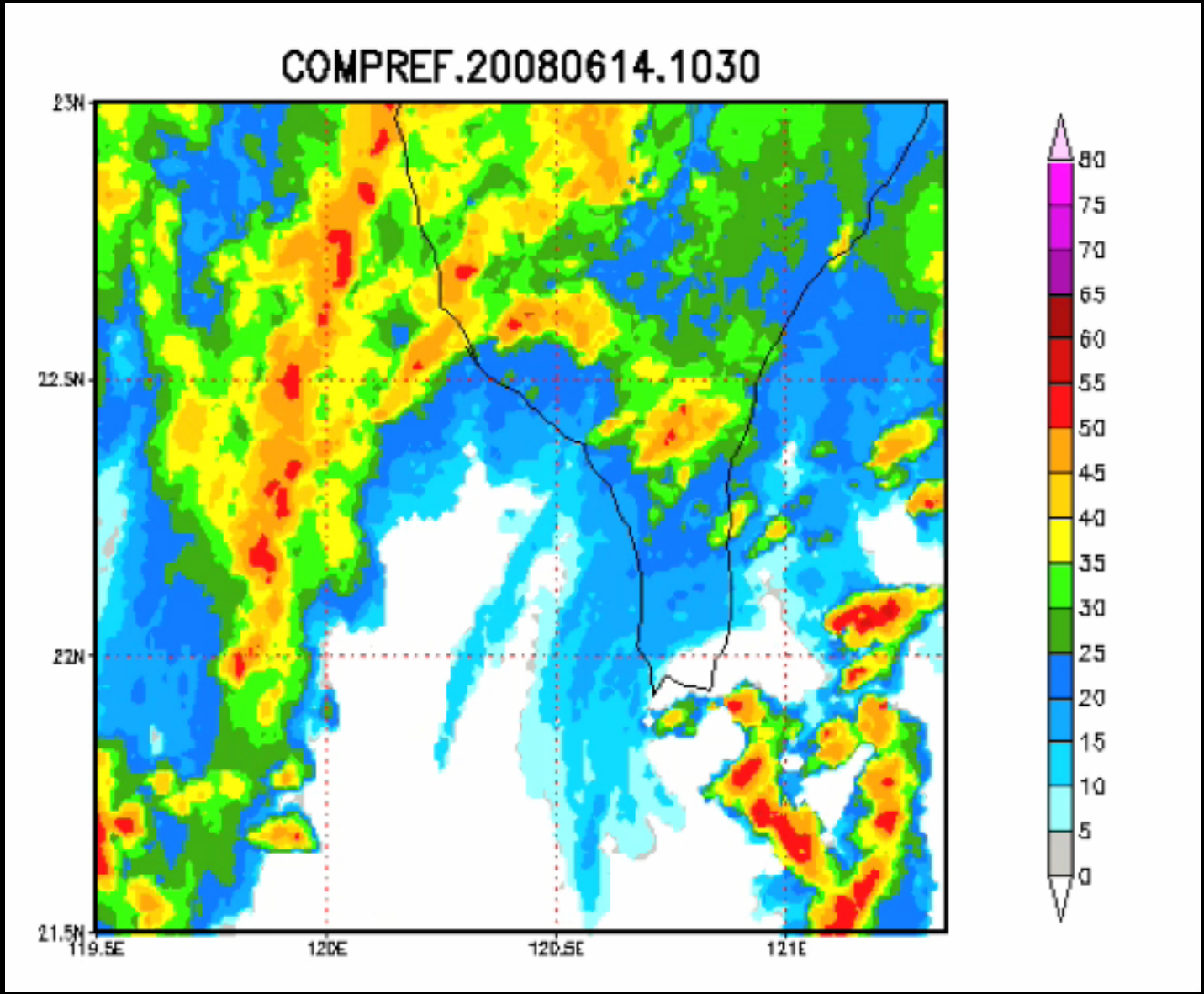


Thanks to Ben Jou's group

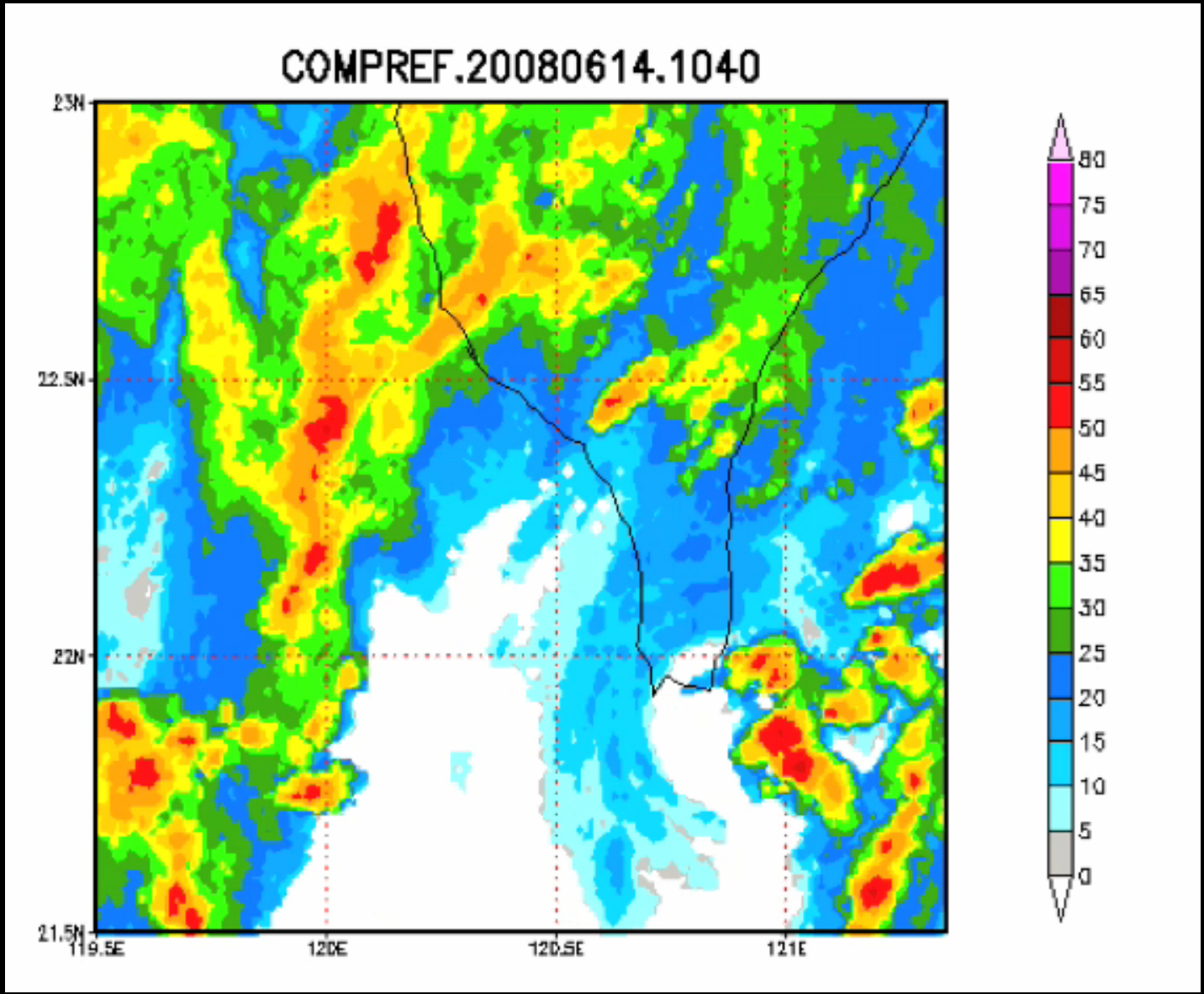
14 June 2008 - 1020Z



T + 10 min


COMPREF.20080614.1030
23N
22.5N
22N
21.5N
119.5E
120E
120.5E
121E
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

T + 20 min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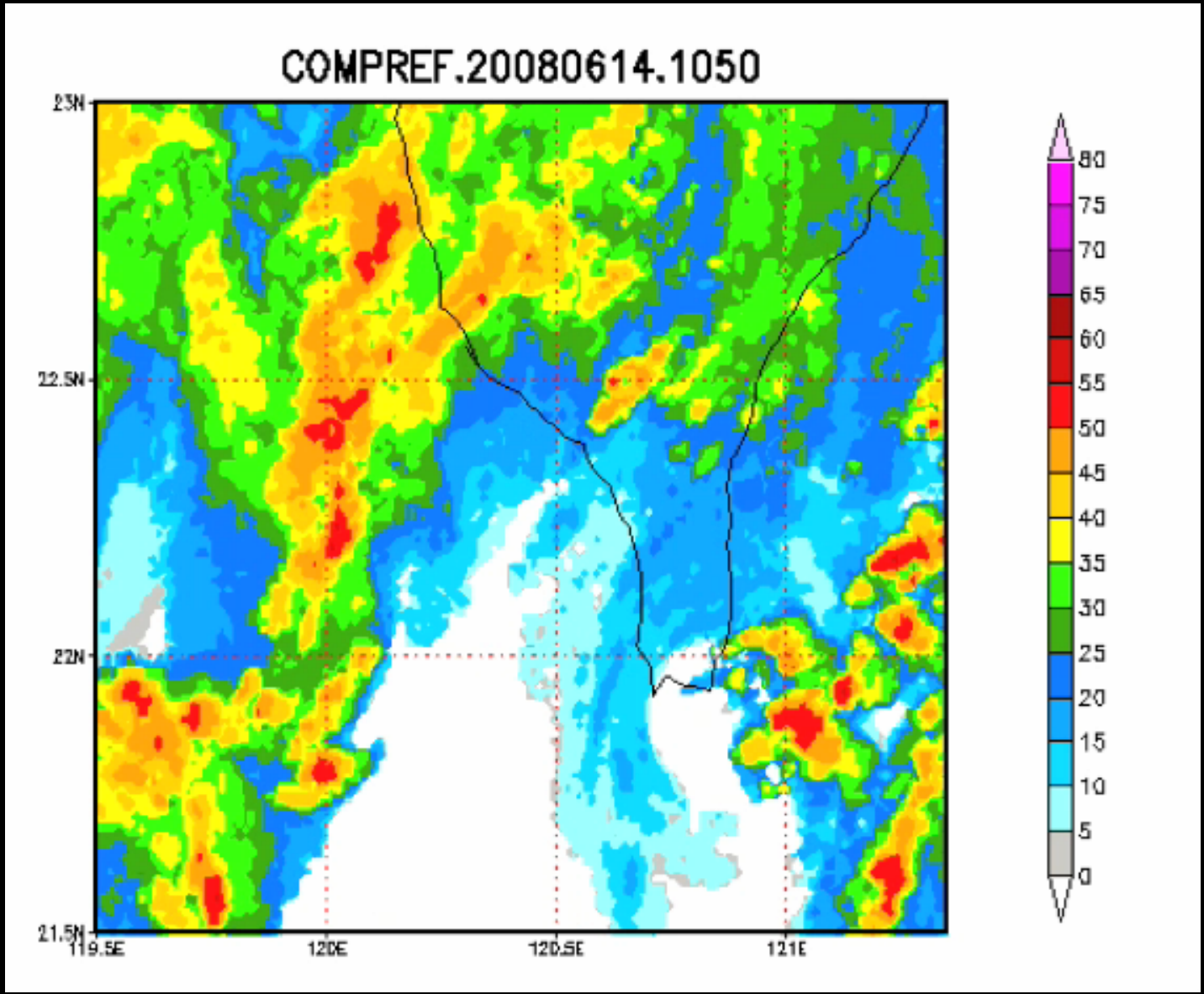
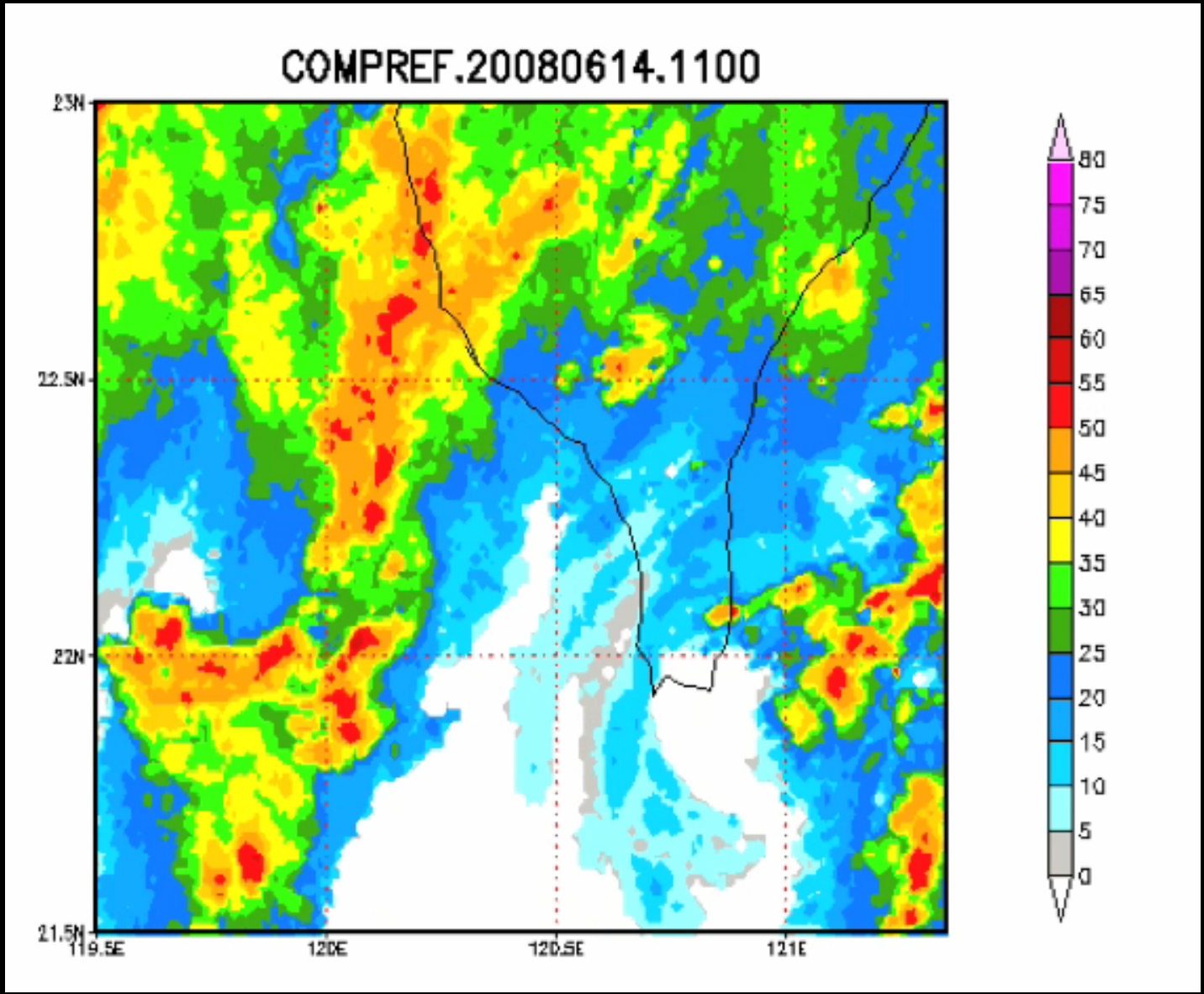
22N
21.5N
119.5E
120E
120.5E
121E
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

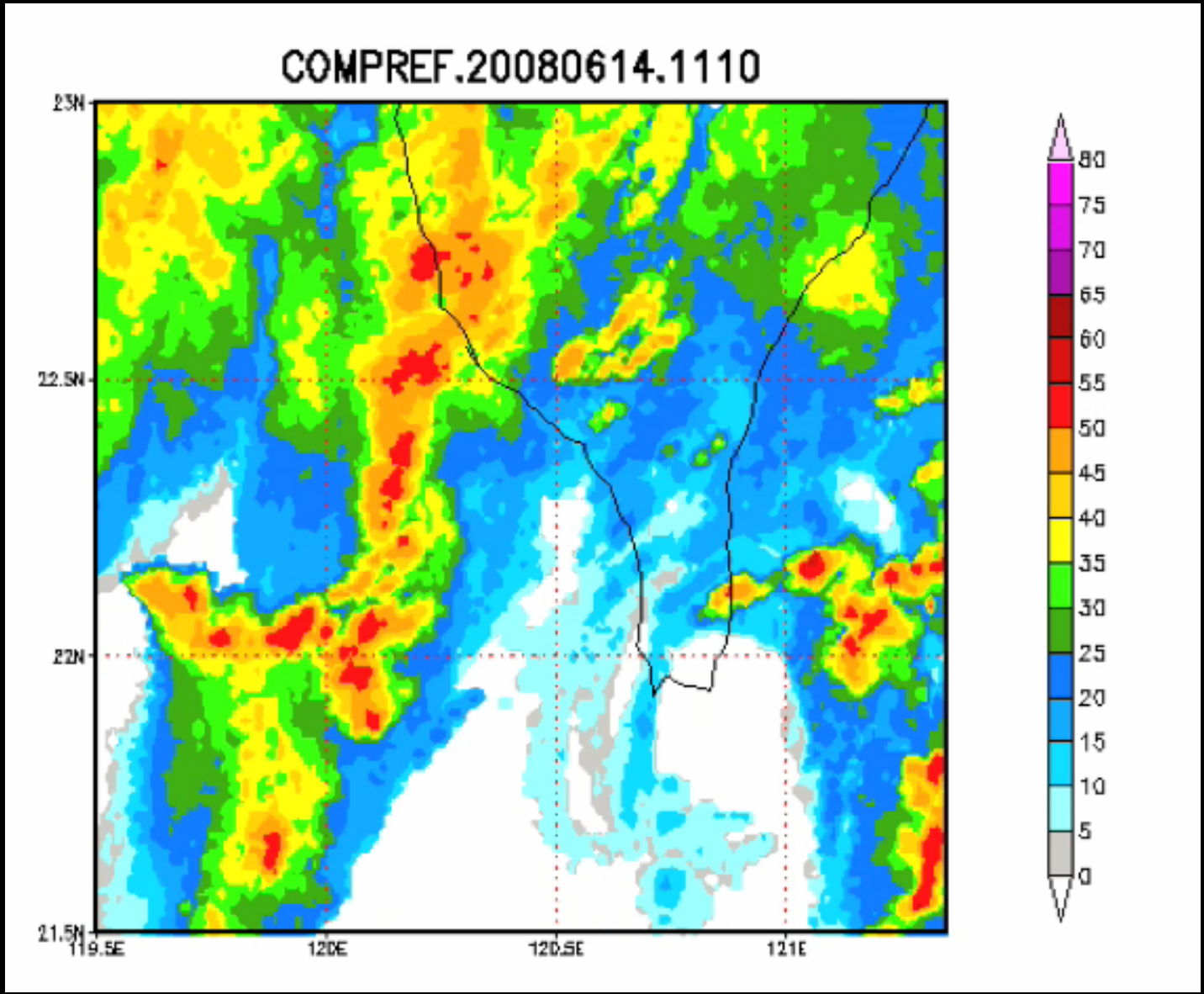
T + 30 min


COMPREF.20080614.1050
23N
22.5N
22N
21.5N
119.5E
120E
120.5E
121E
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

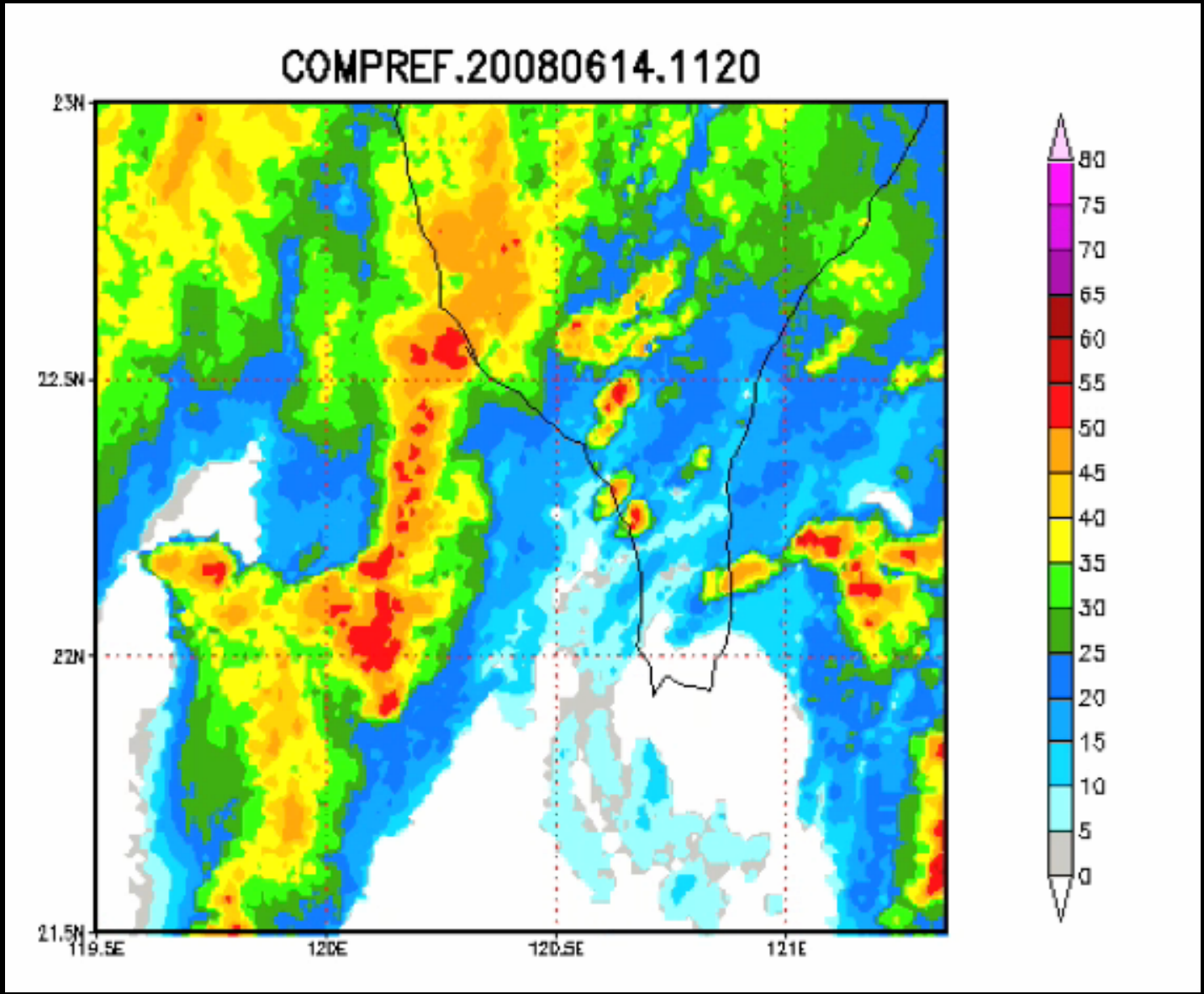
T + 40 min


COMPREF.20080614.1100
23N
22.5N
22N
21.5N
119.5E
120E
120.5E
121E
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

T + 50 min


COMPREF.20080614.1110
23N
22.5N
22N
21.5N
119.5E
120E
120.5E
121E
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

T + 60 min


COMPREF.20080614.1120
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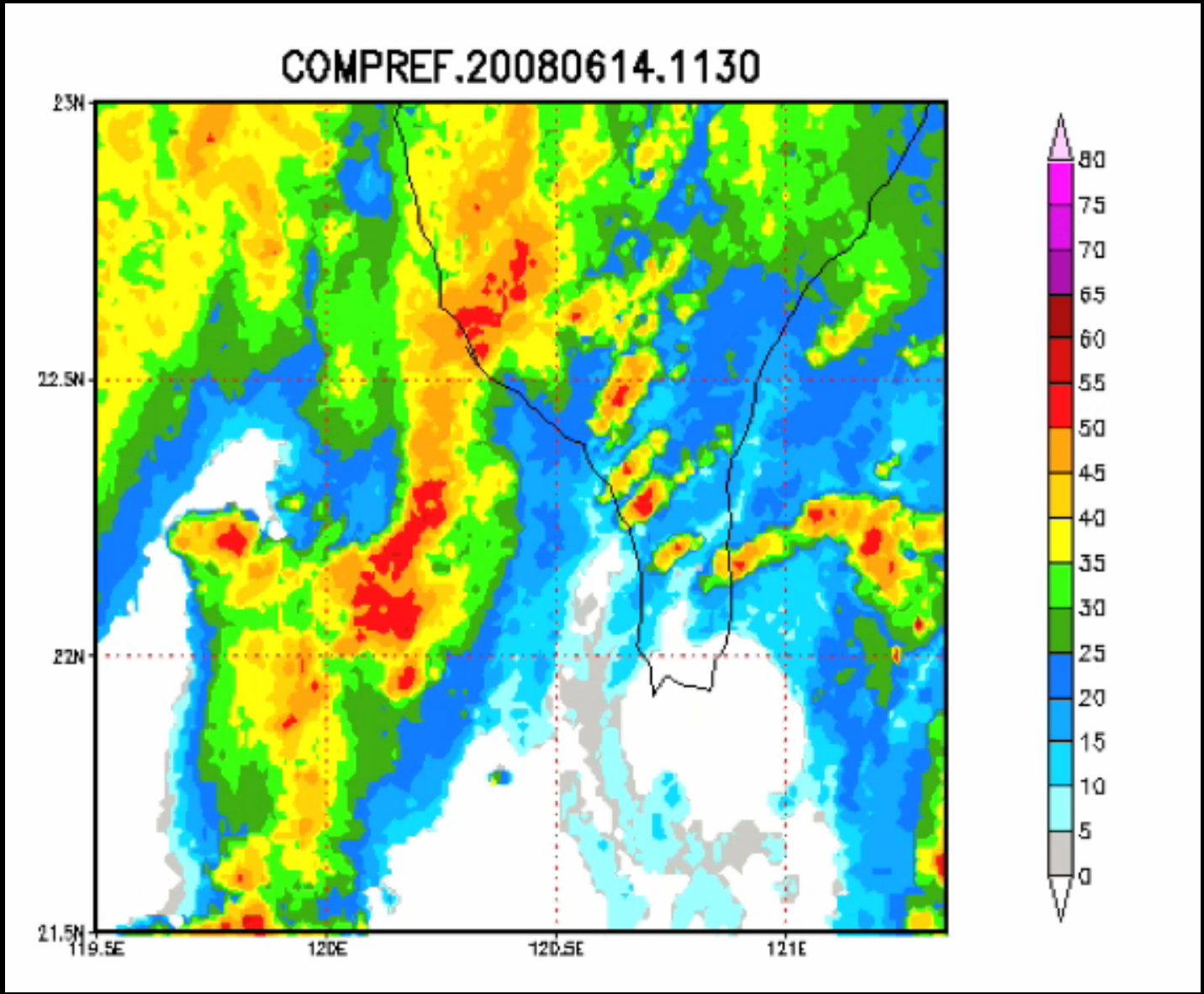
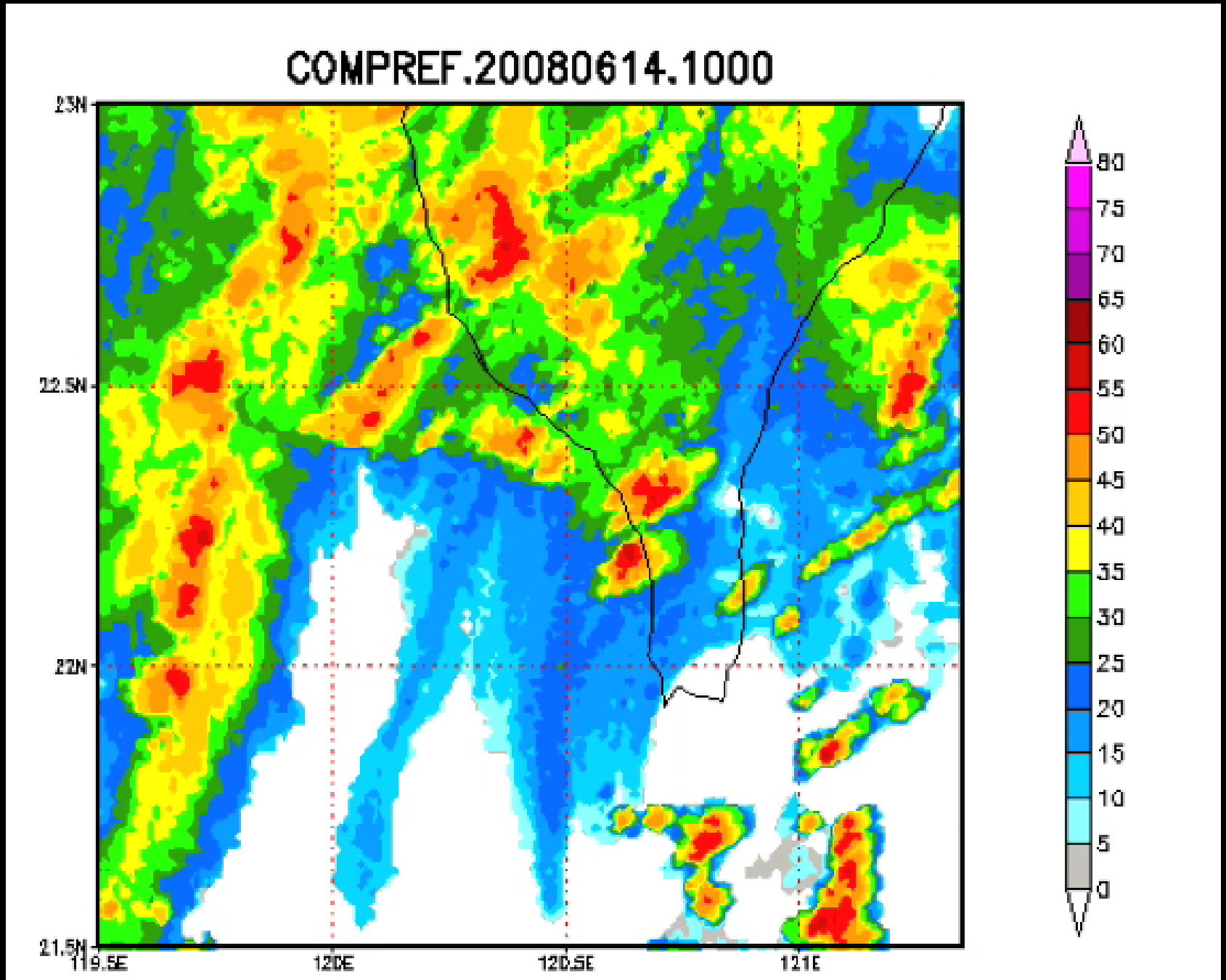
22.5N
22N
21.5N
119.5E
120E
120.5E
121E
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

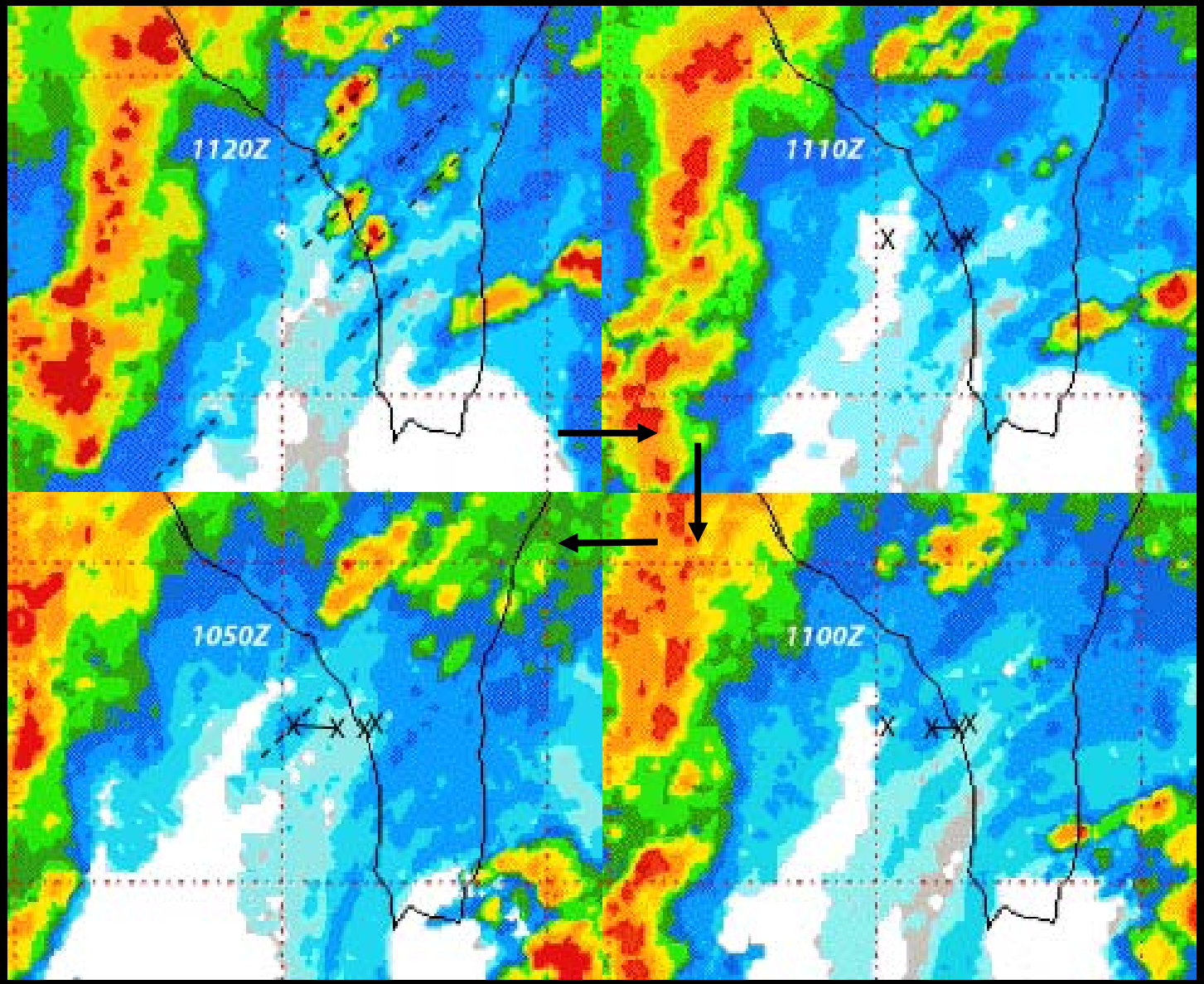
T + 70 min


COMPREF.20080614.1130
23N
22.5N
22N
21.5N
119.5E
120E
120.5E
121E
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

Animation

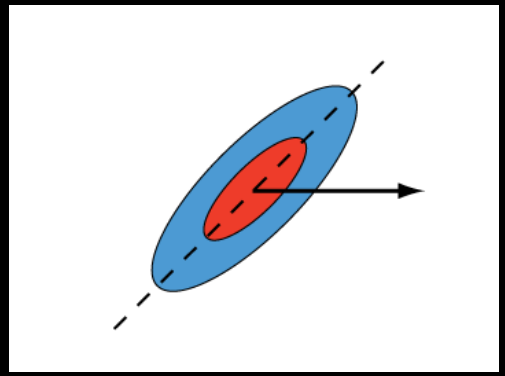

COMPREF.20080614.1000
23N
22.5N
22N
21.5N
119.5E
120E
120.5E
121E
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

Review



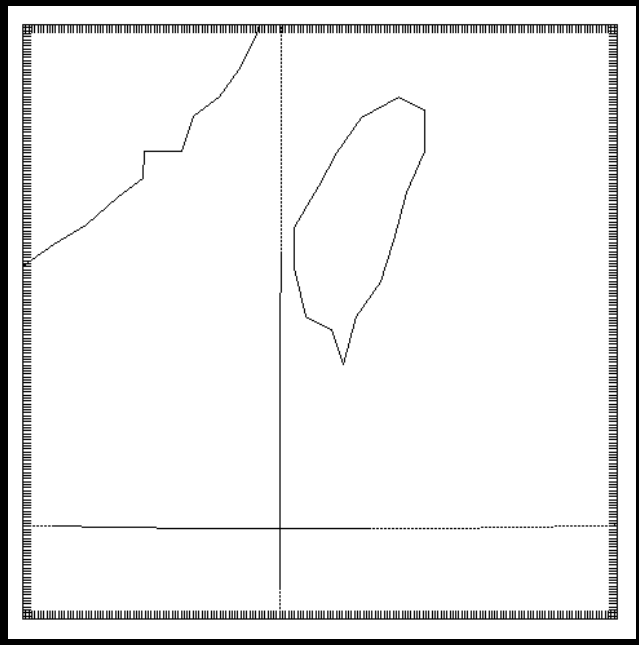
Many radar features oriented SW to NE

Feature motion mainly west to east



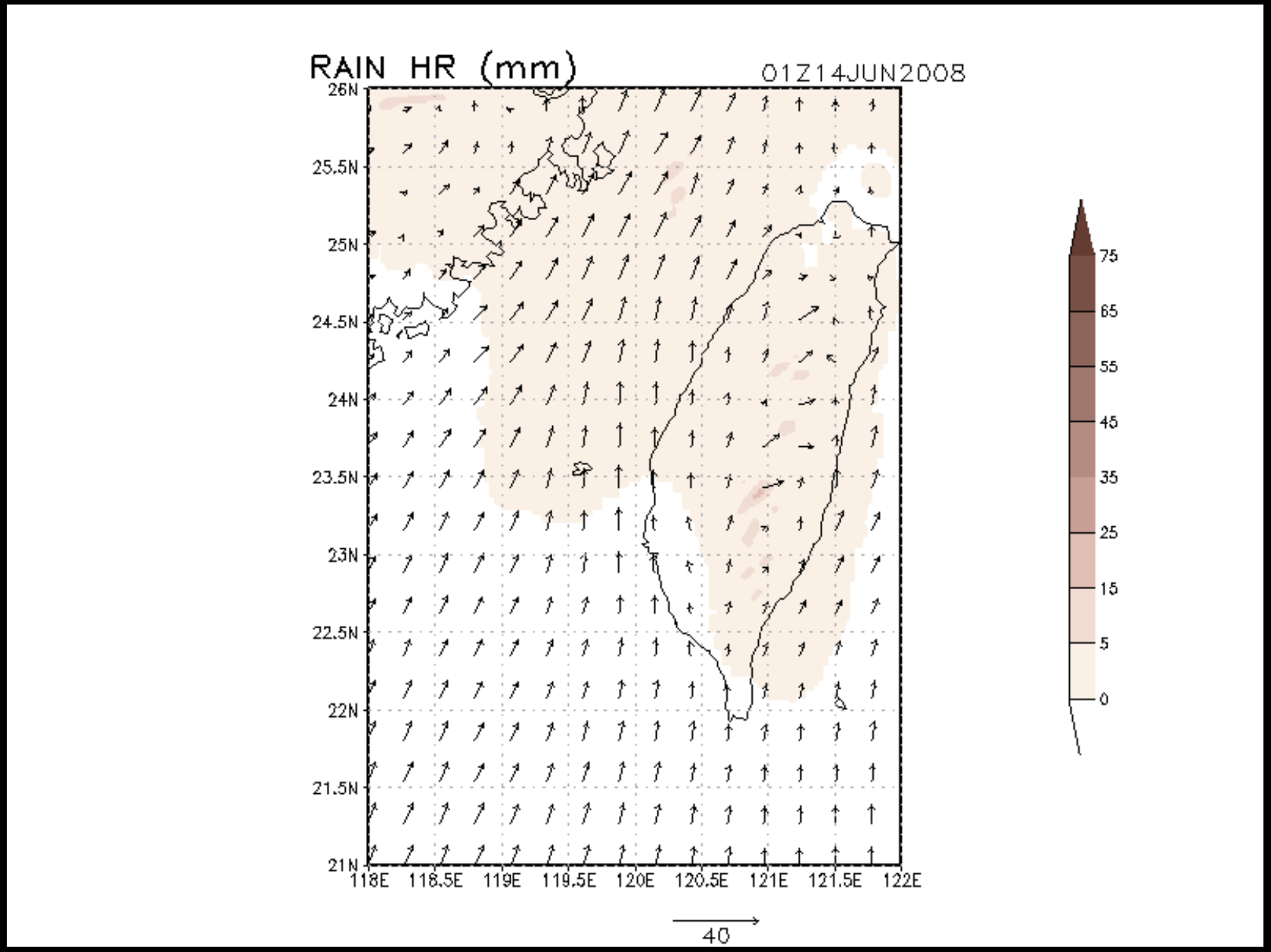
WRF simulation

- WRF-ARW 3.1
- 4 km resolution
- Initialized with GFS at 0000Z 14 June 2008
- LFO microphysics, YSU PBL, Noah land scheme
- Integrated for 18 hours
- Control and “dry” runs



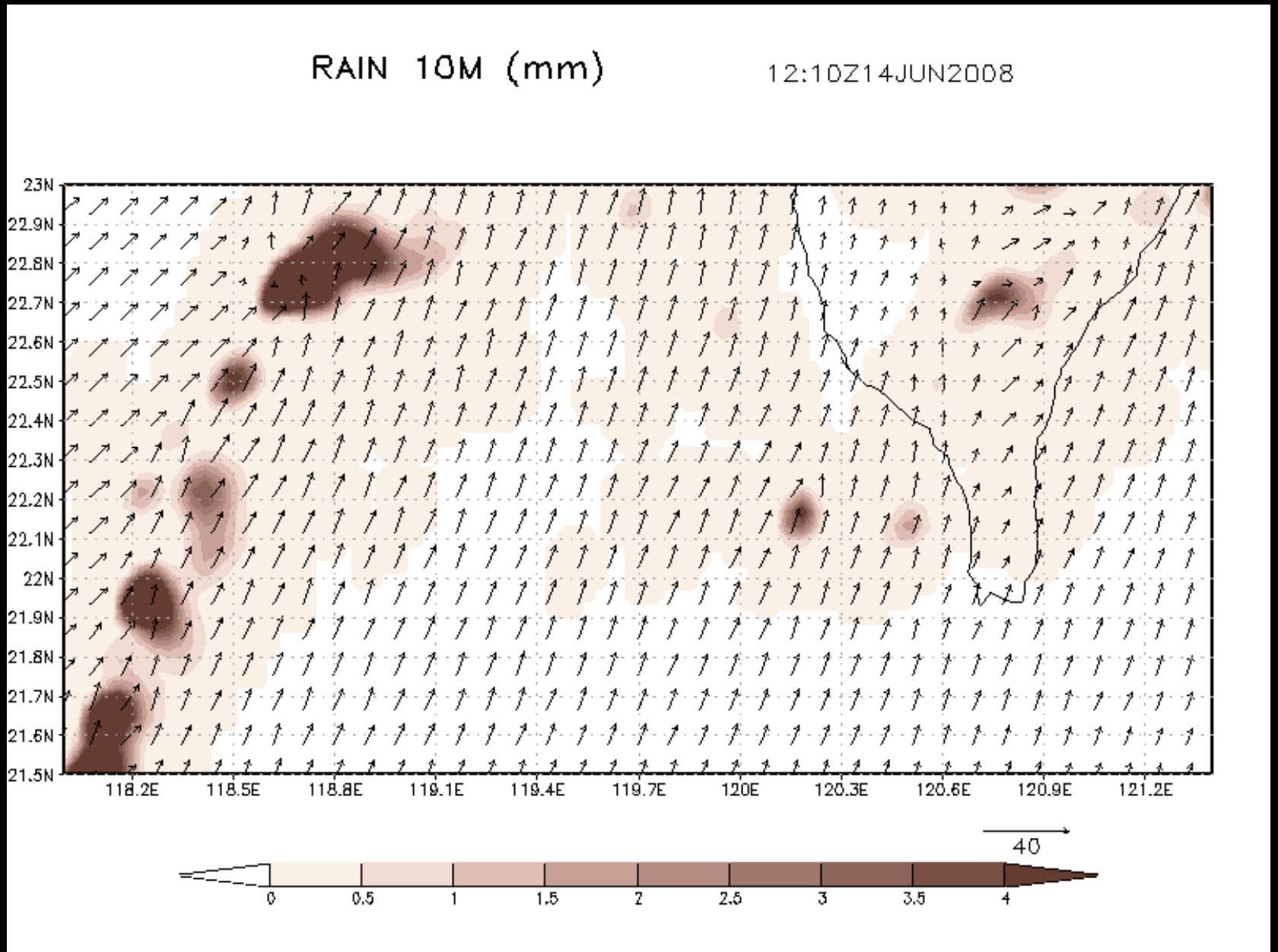
Hourly rainfall, 10 m winds

(part of domain shown)

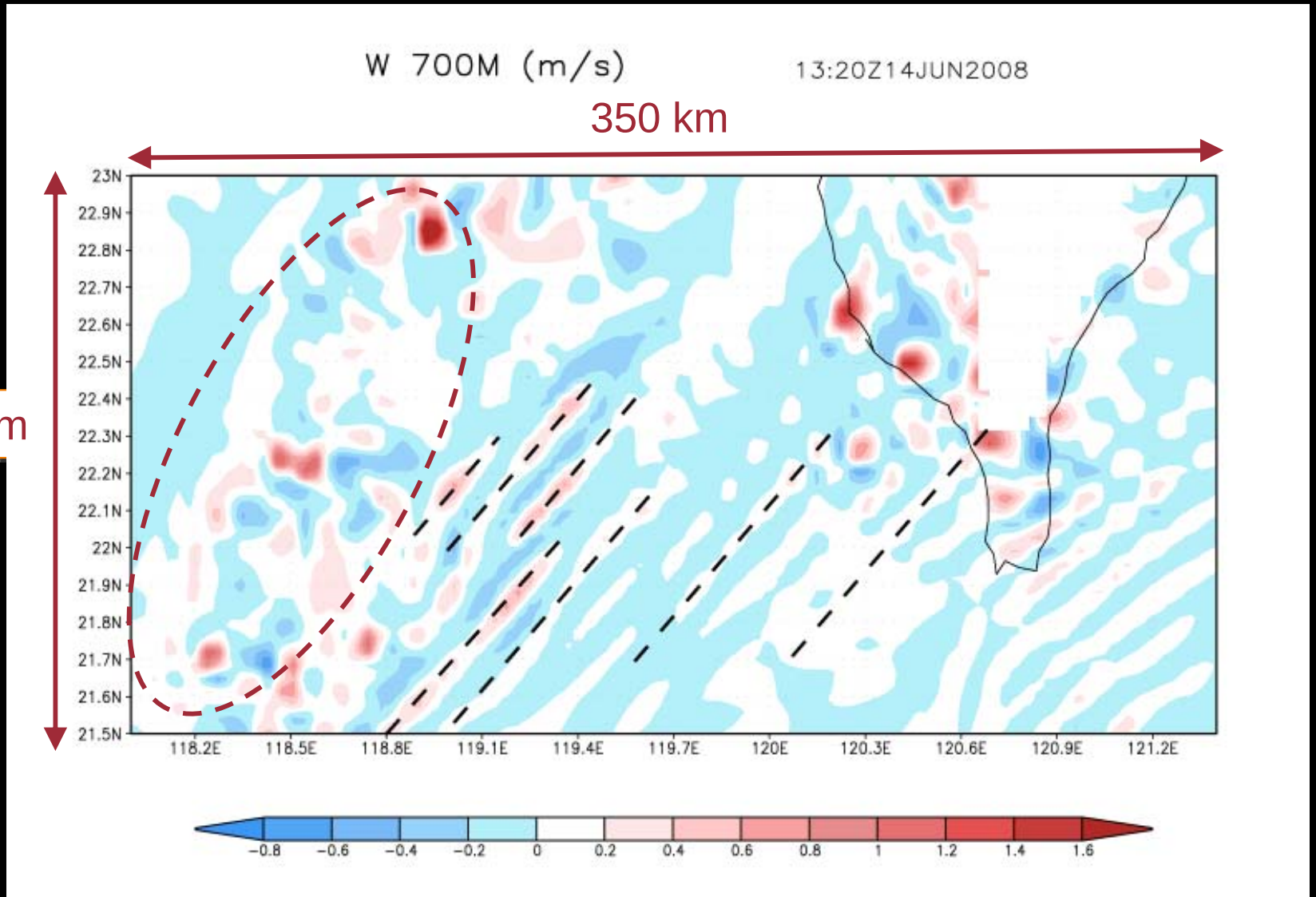


10 min rainfall, 10 m winds

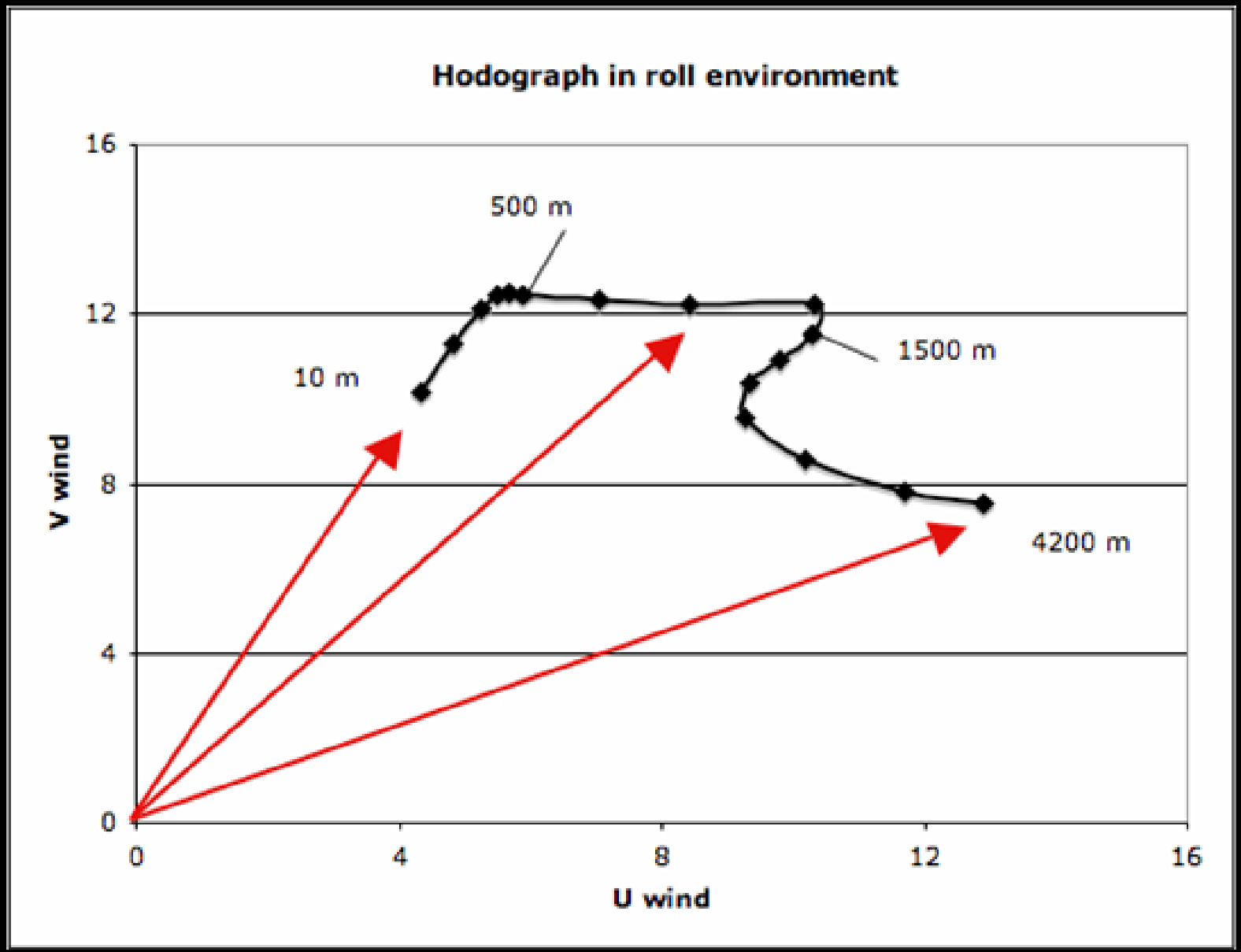
(focus on S Taiwan)



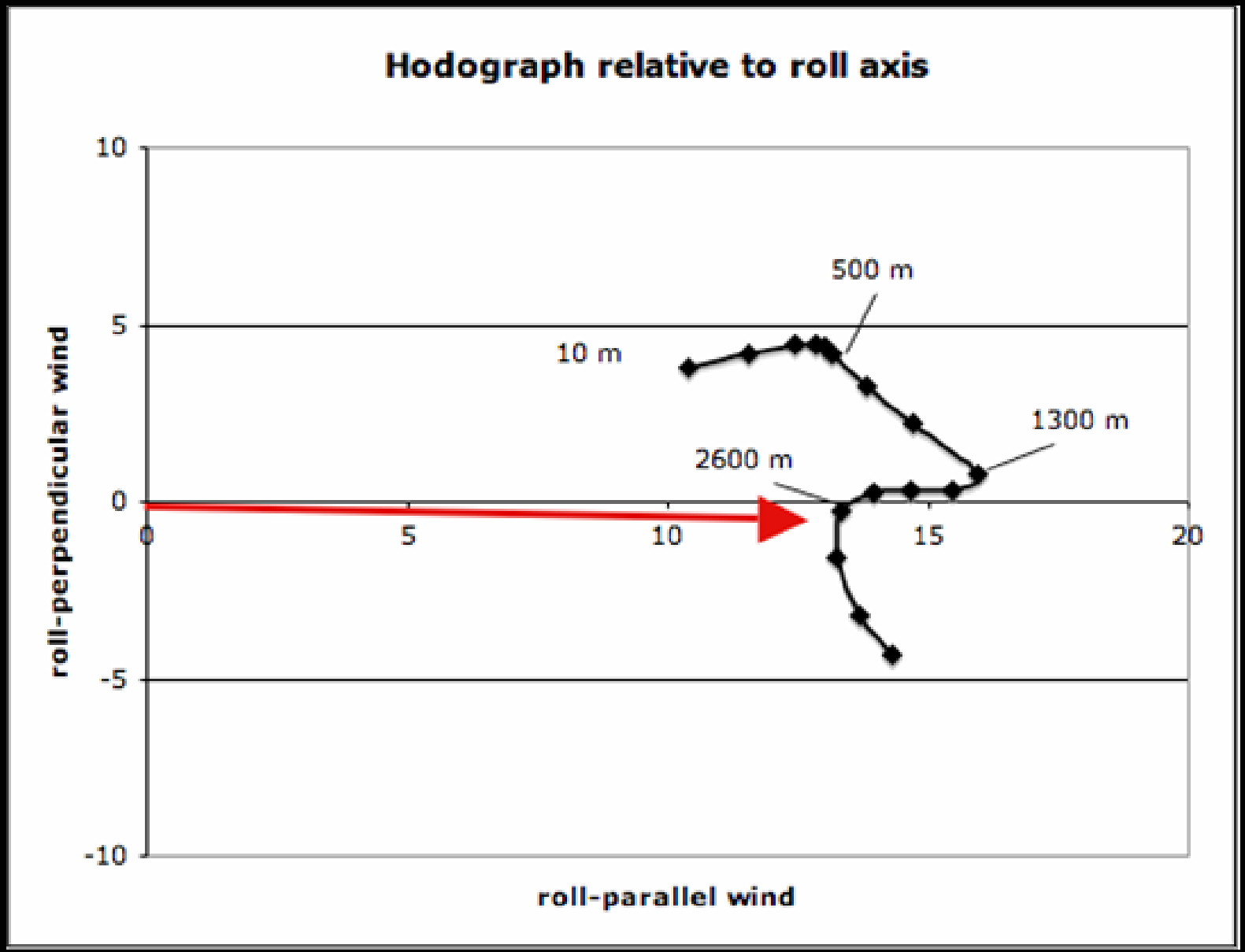
700 m W


W 700M (m/s)
13:20Z14JUN2008
350 km
167 km
23N
22.9N
22.8N
22.7N
22.6N
22.5N
22.4N
22.3N
22.2N
22.1N
22N
21.9N
21.8N
21.7N
21.6N
21.5N
118.2E
118.5E
118.8E
119.1E
119.4E
119.7E
120E
120.3E
120.6E
120.9E
121.2E
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

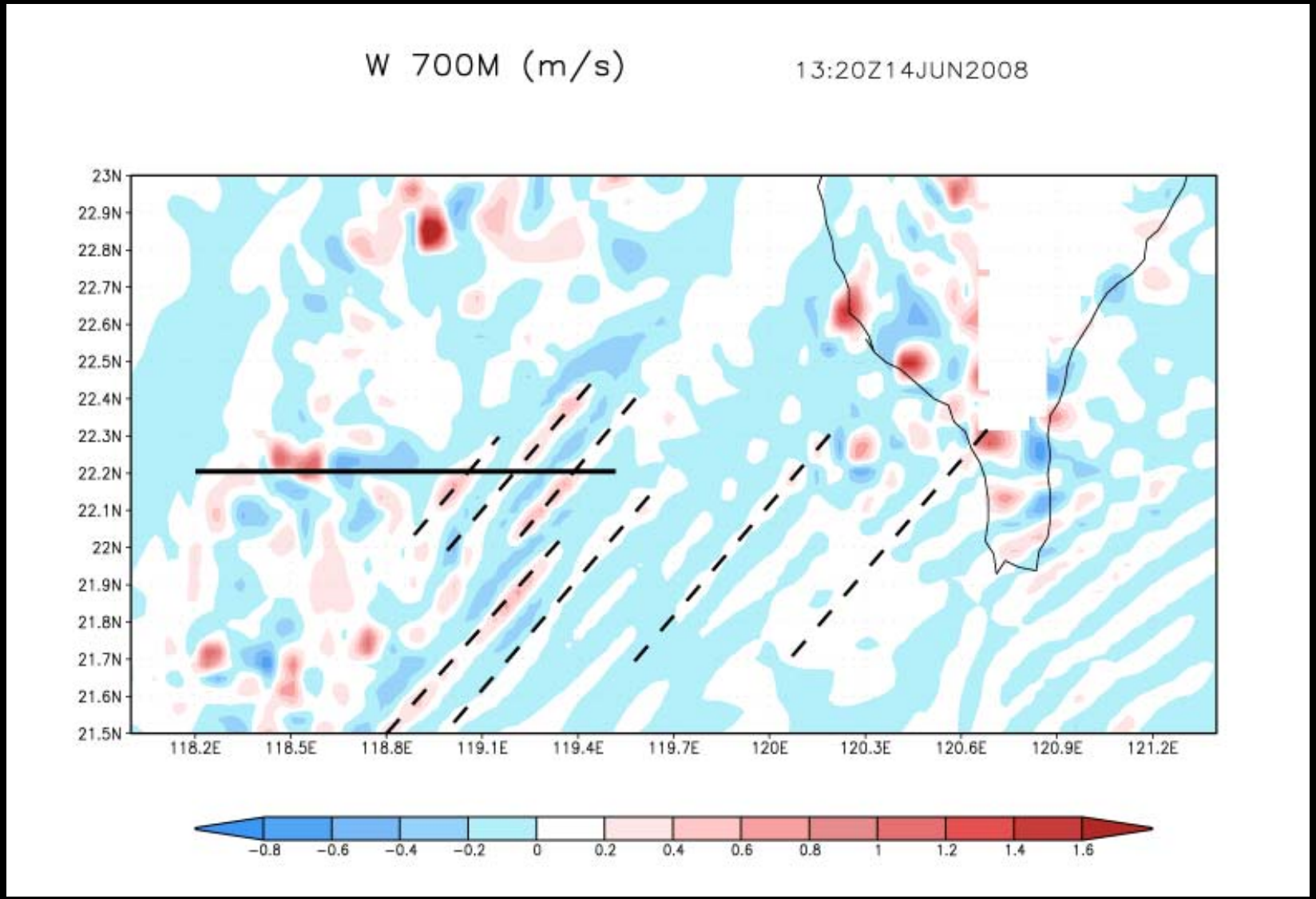
Hodograph in apparent roll environment



Hodograph relative to roll axes

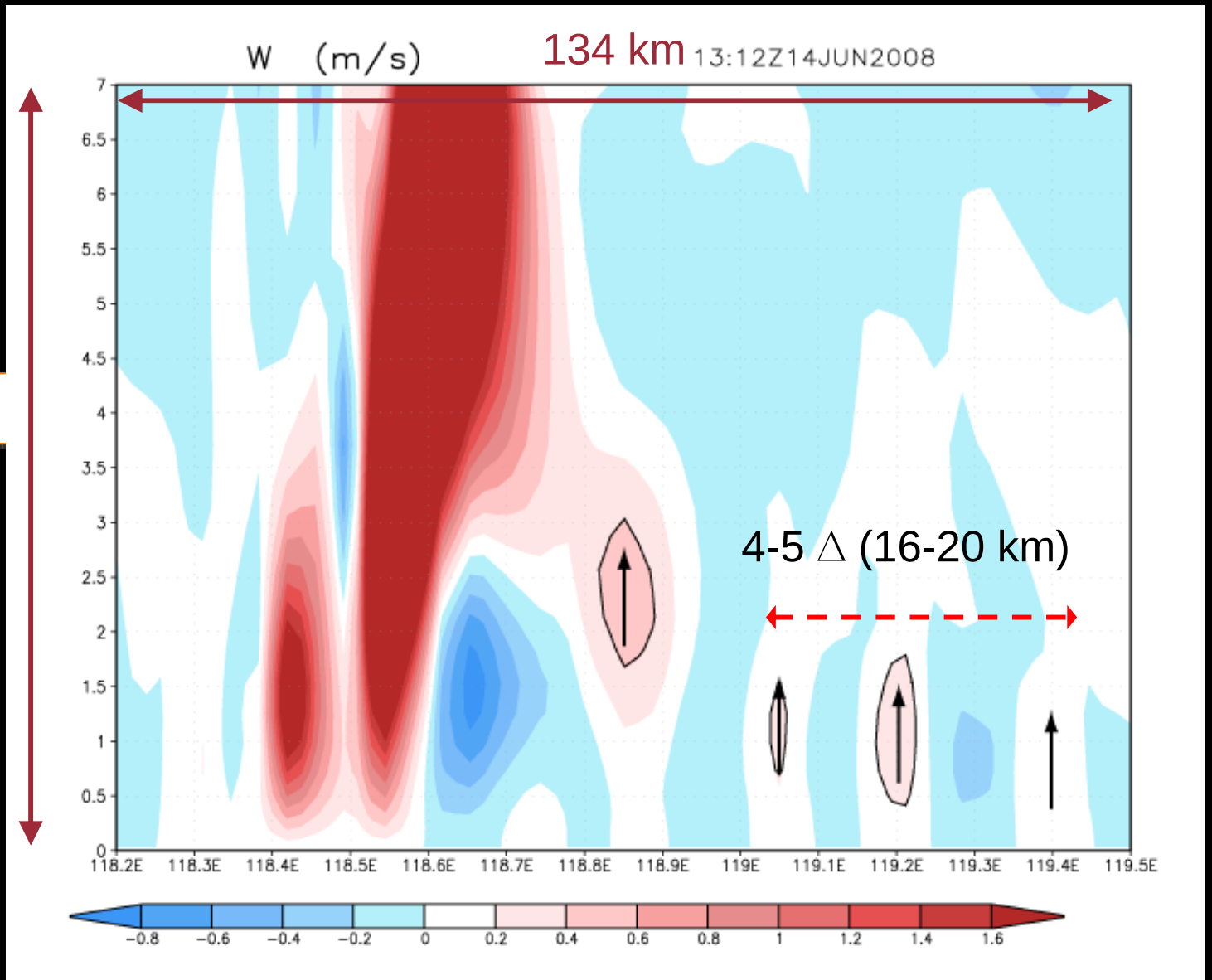


Location for vertical x-section



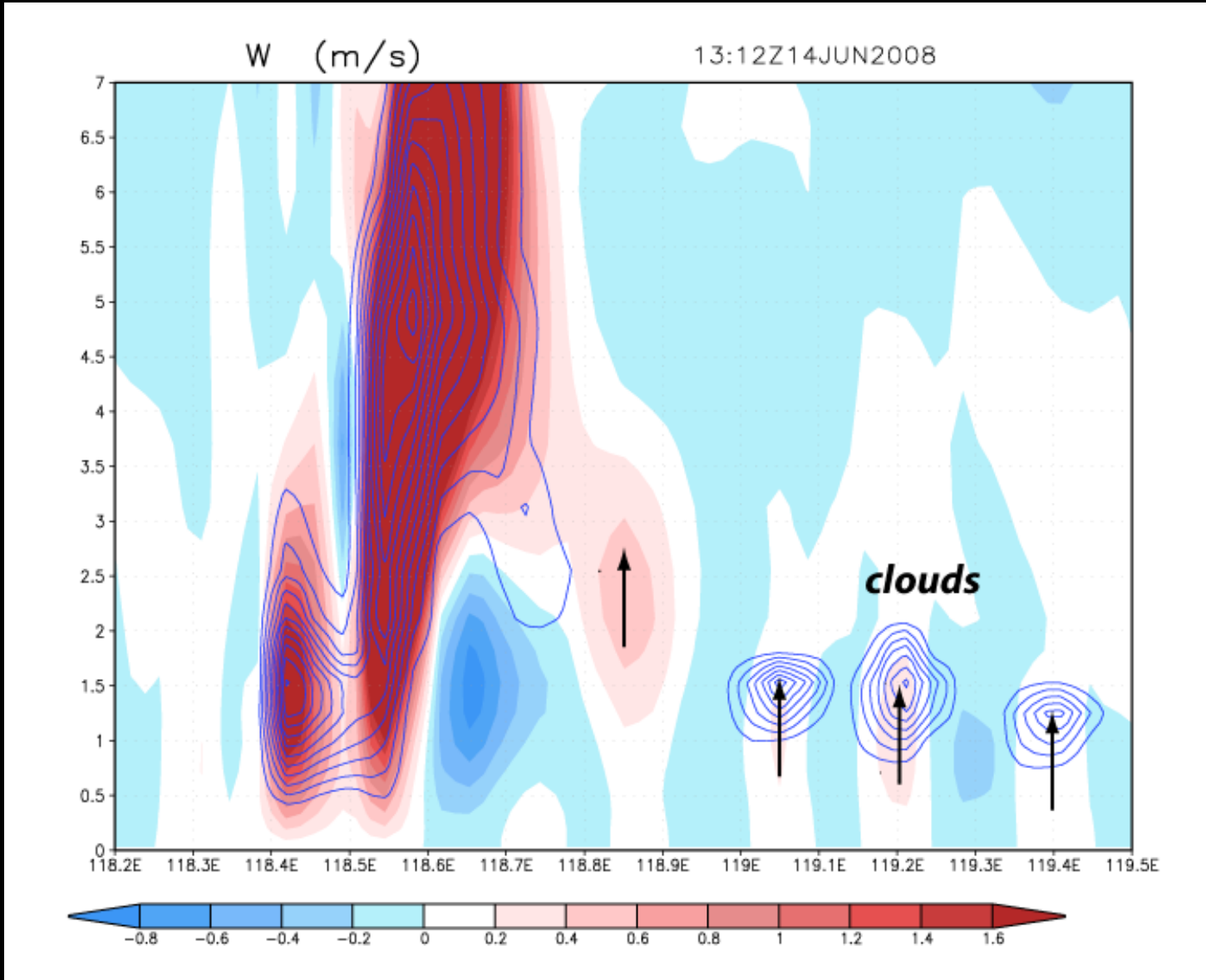
Vertical x-section of W at 1312Z

(8 min earlier)



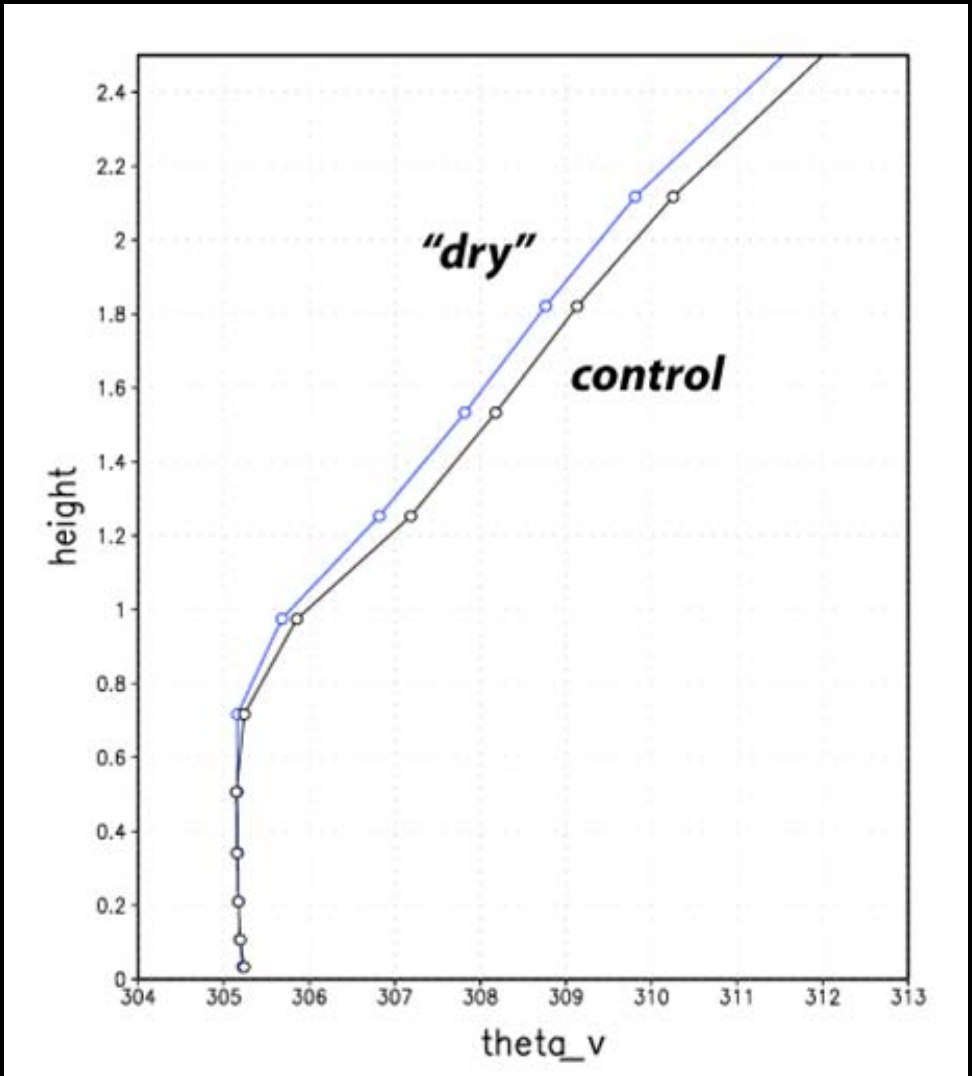
Apparent HCRs? (wavelength issue; PBL scheme issue)

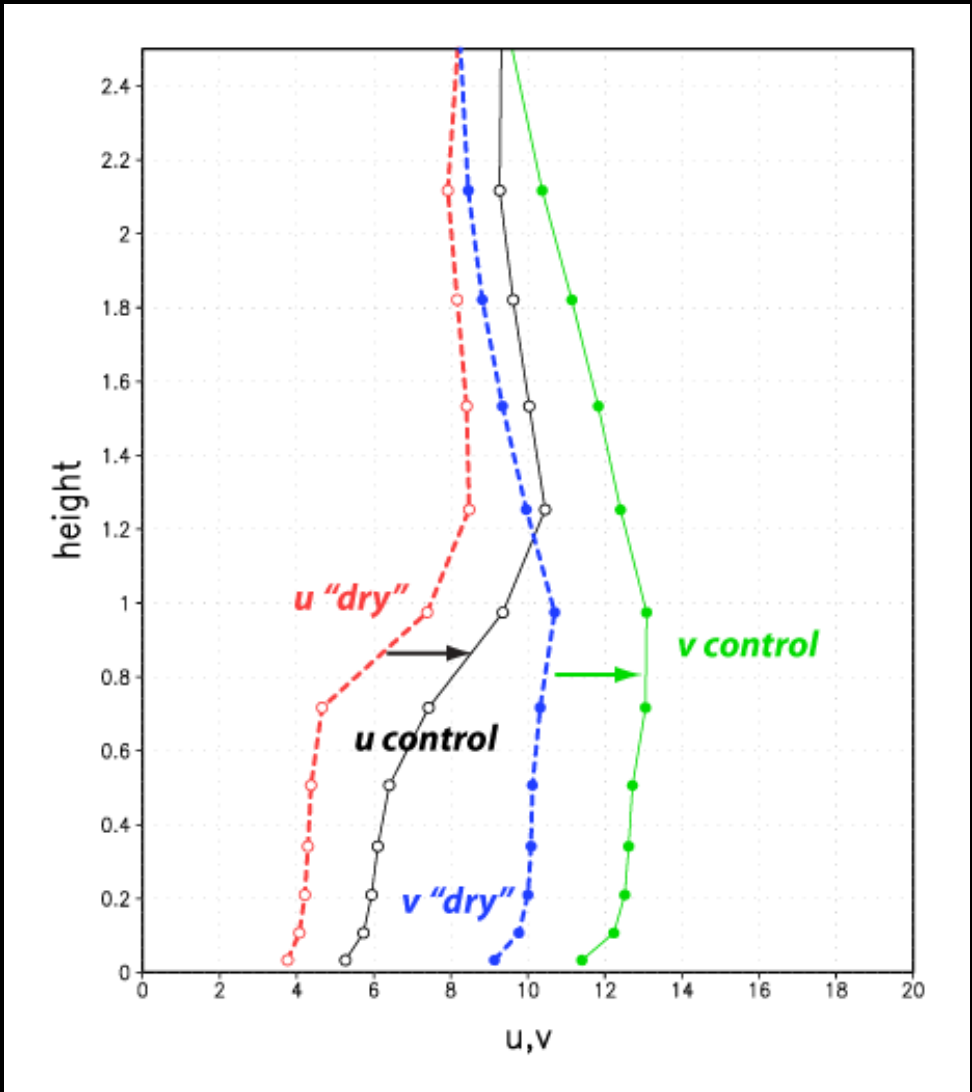
Clouds at 1312Z



Roll updrafts cloud-topped

Control vs. “dry” run

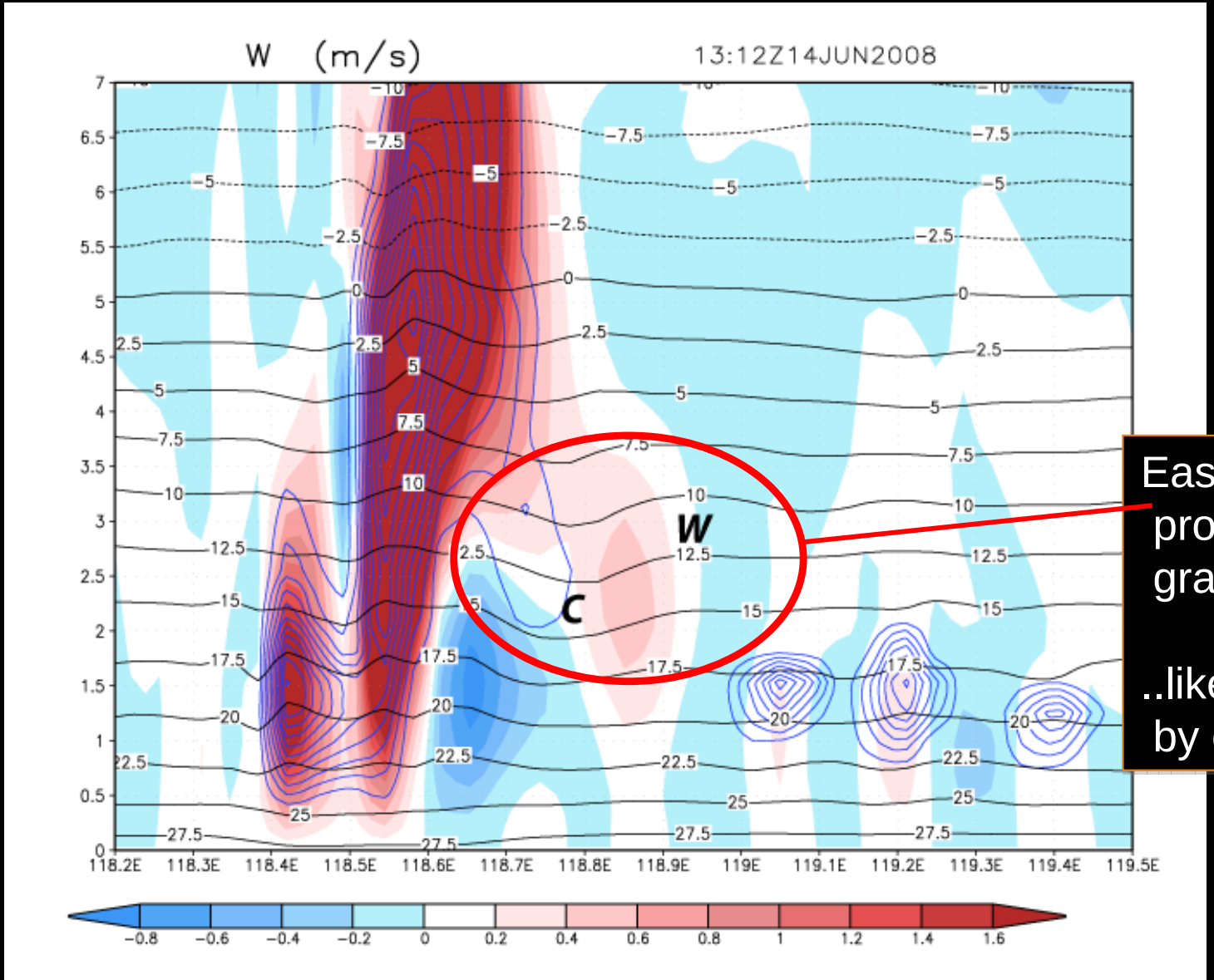




“Dry” run has no rolls.
WRF being mischievous? (**惡作劇的人**)

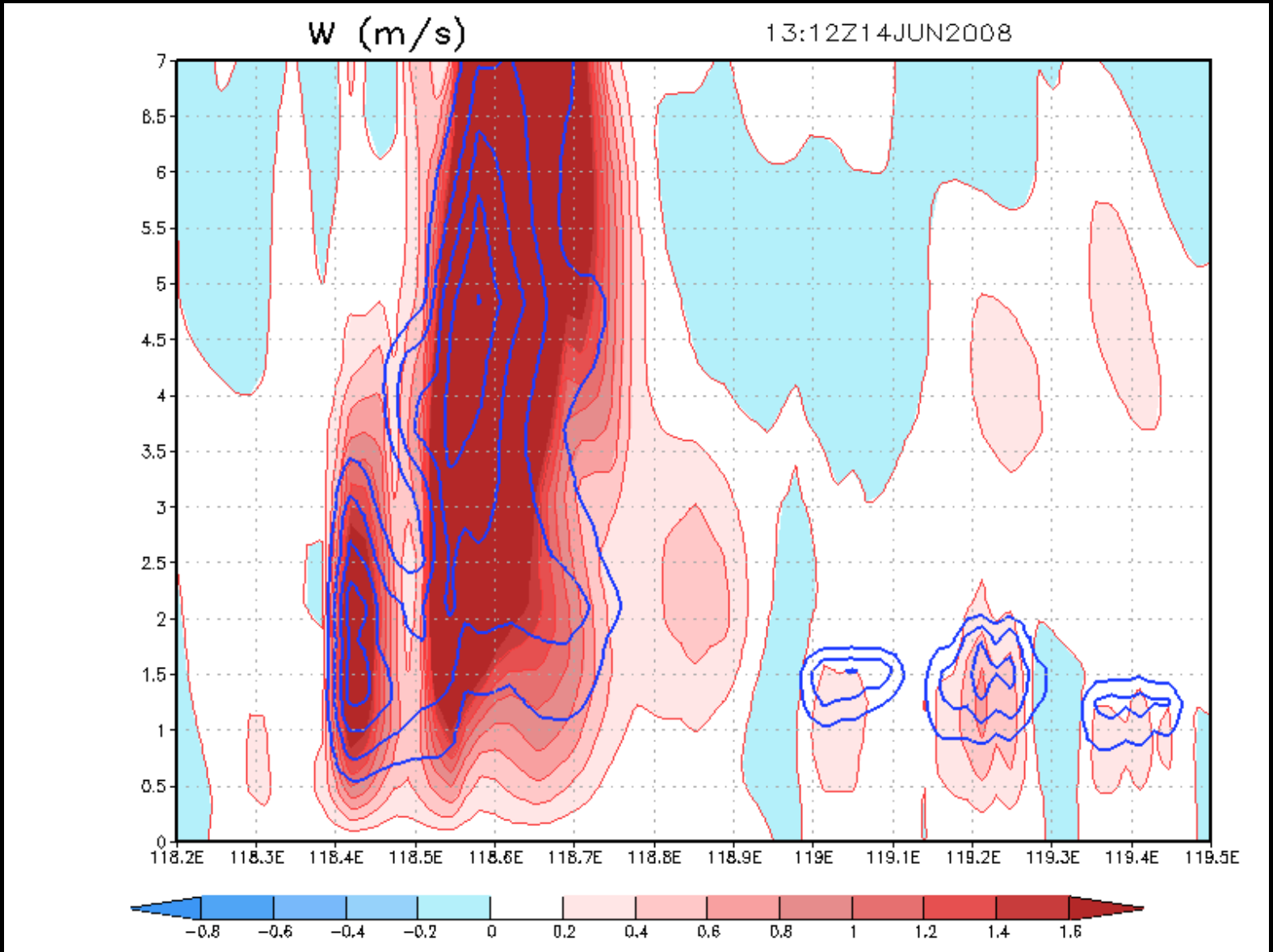
“All models are wrong. Some models are useful.” – George E. P. Box

Temperature at 1312Z

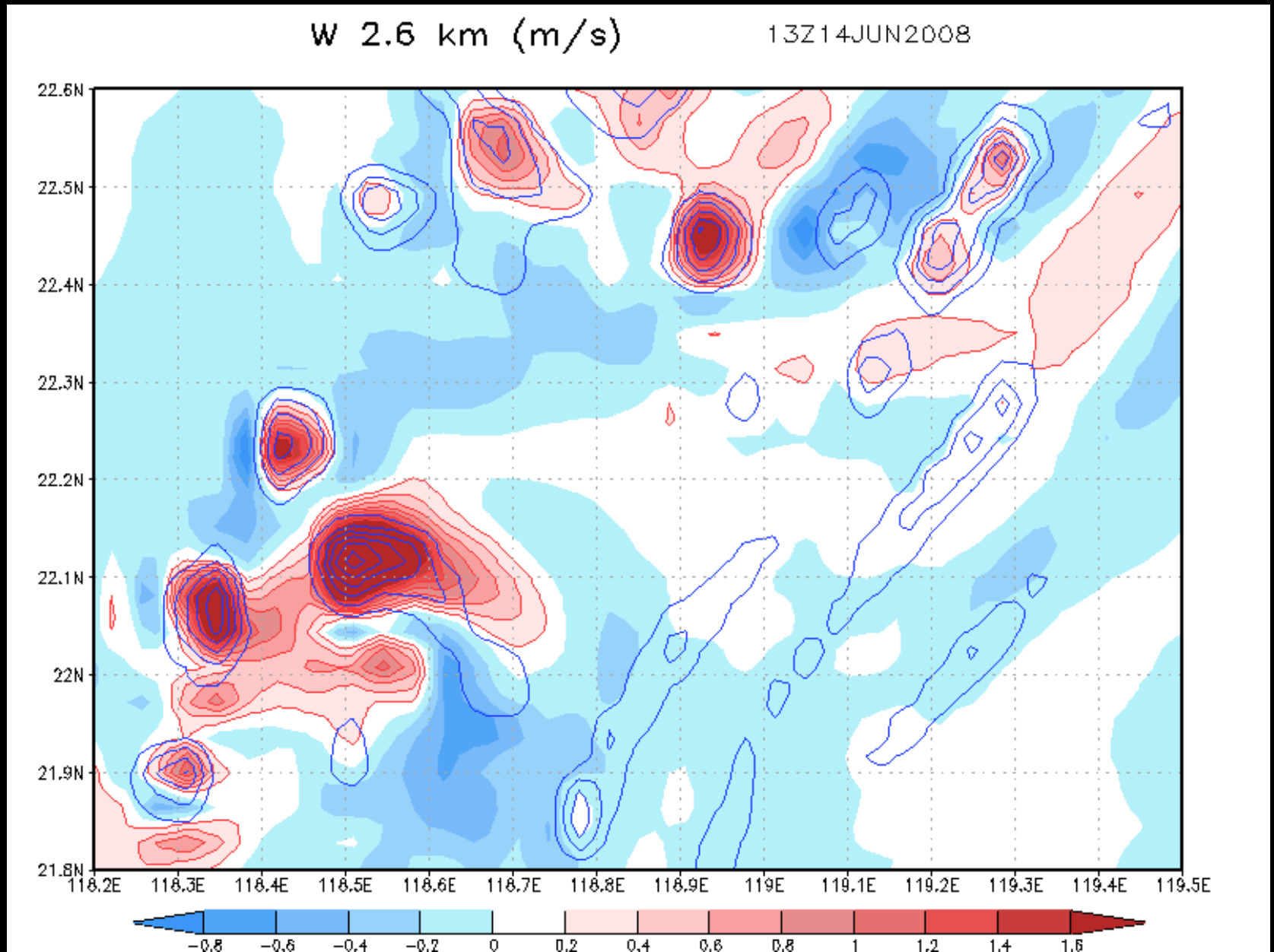


Animation

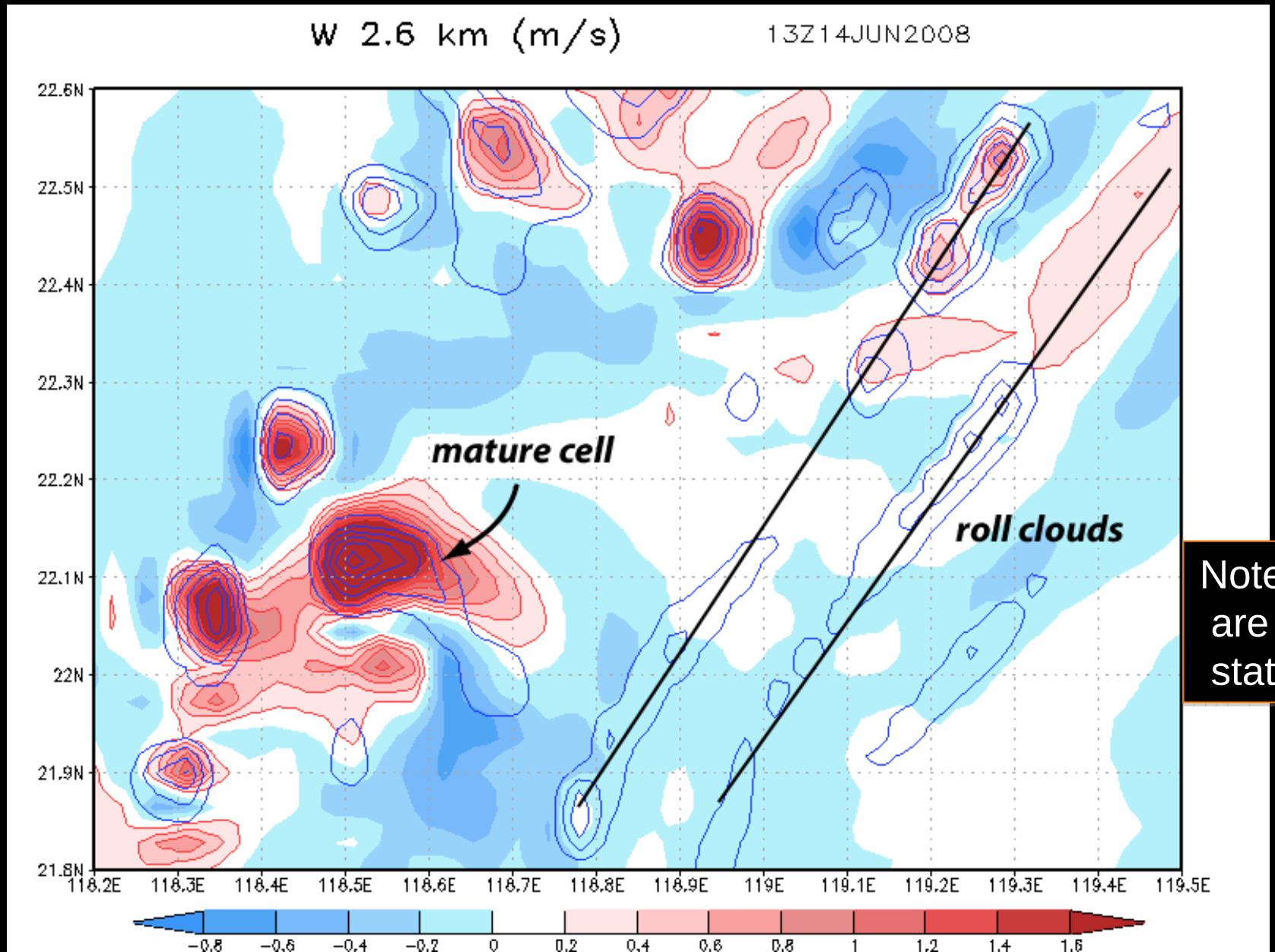
(shifted position, contour intervals)



2.6 km W, 0-5 km cloud water at T = 1300Z

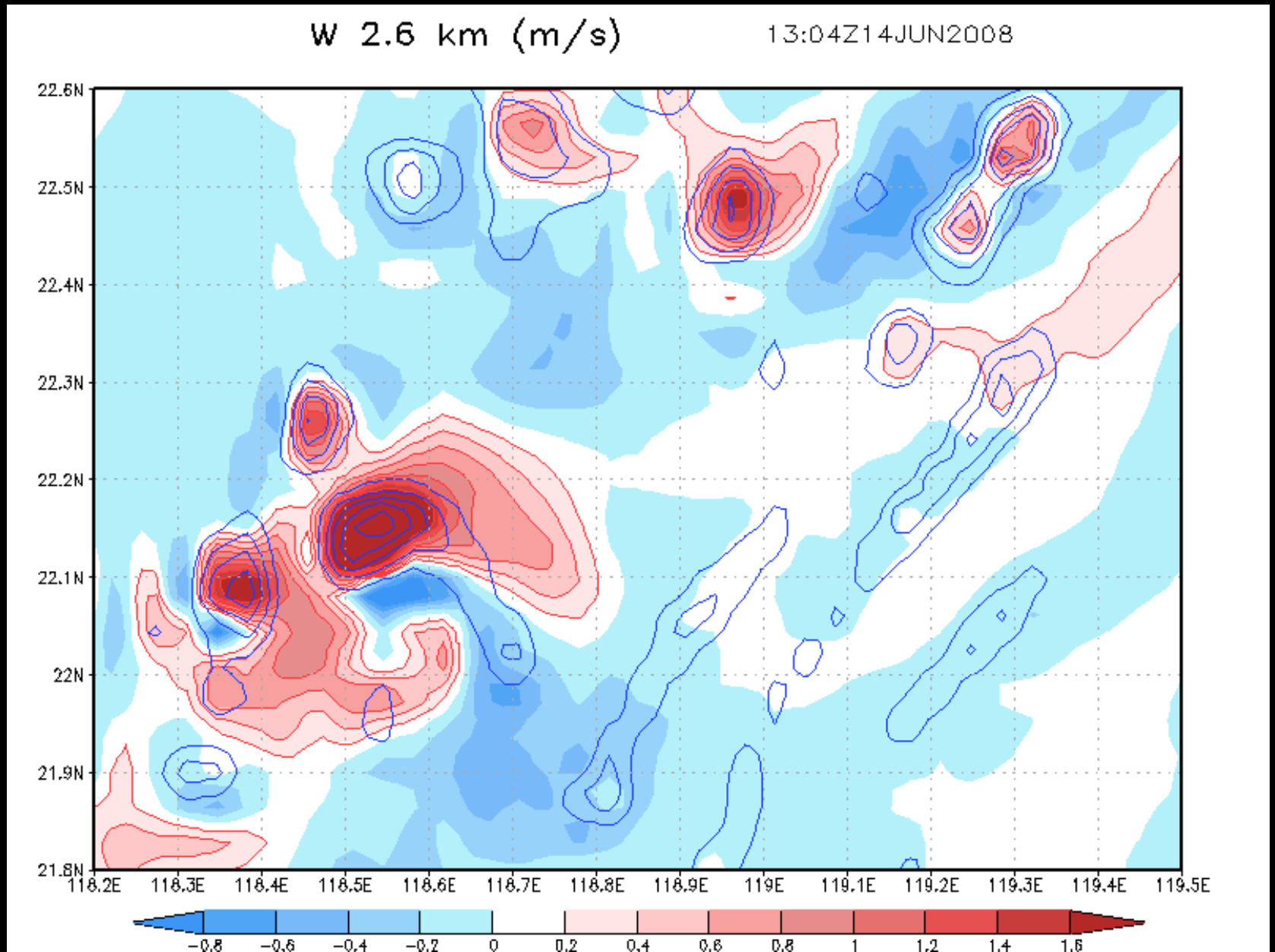


2.6 km W, 0-5 km cloud water at T = 1300Z

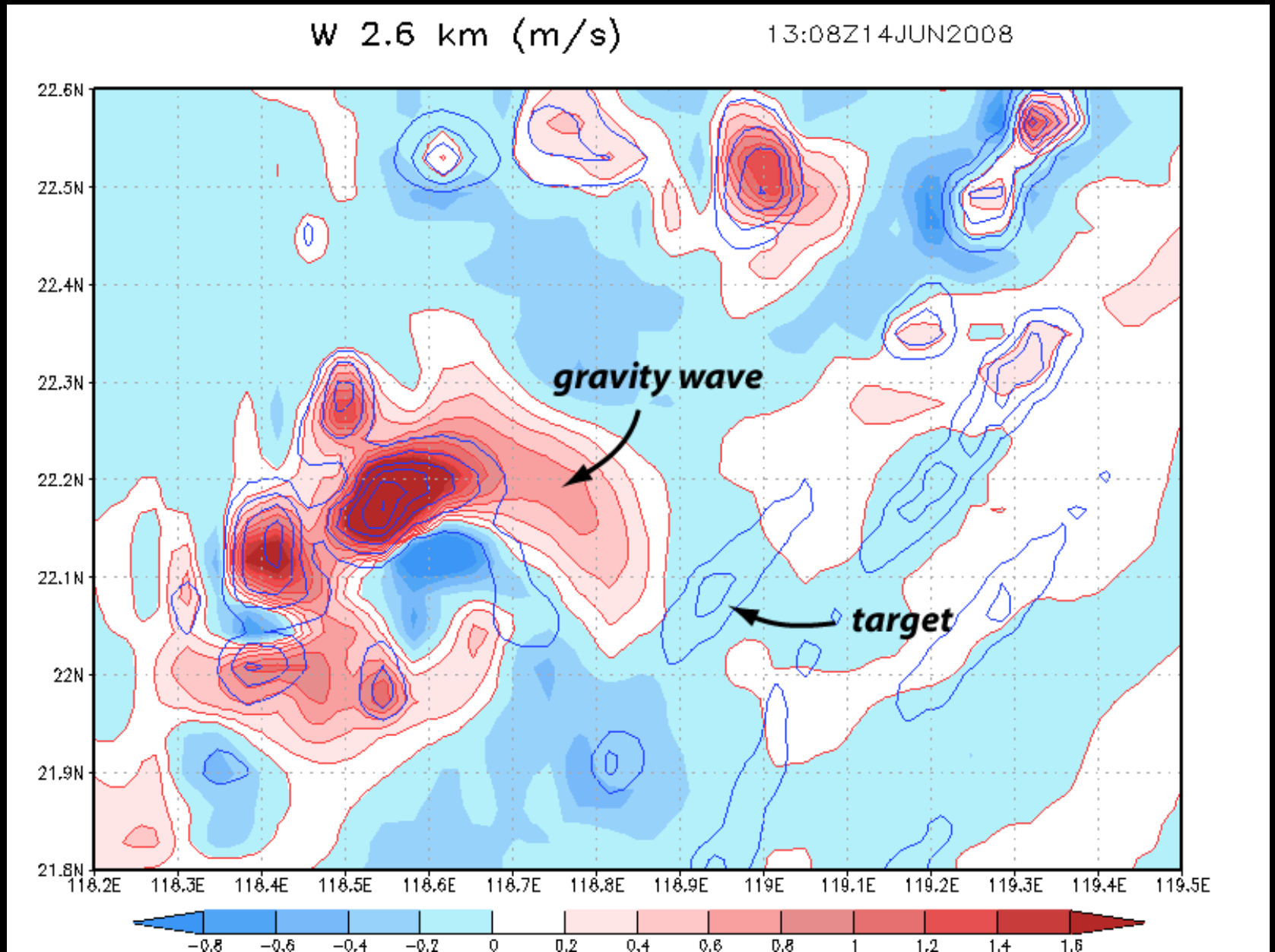


Note rolls are nearly stationary

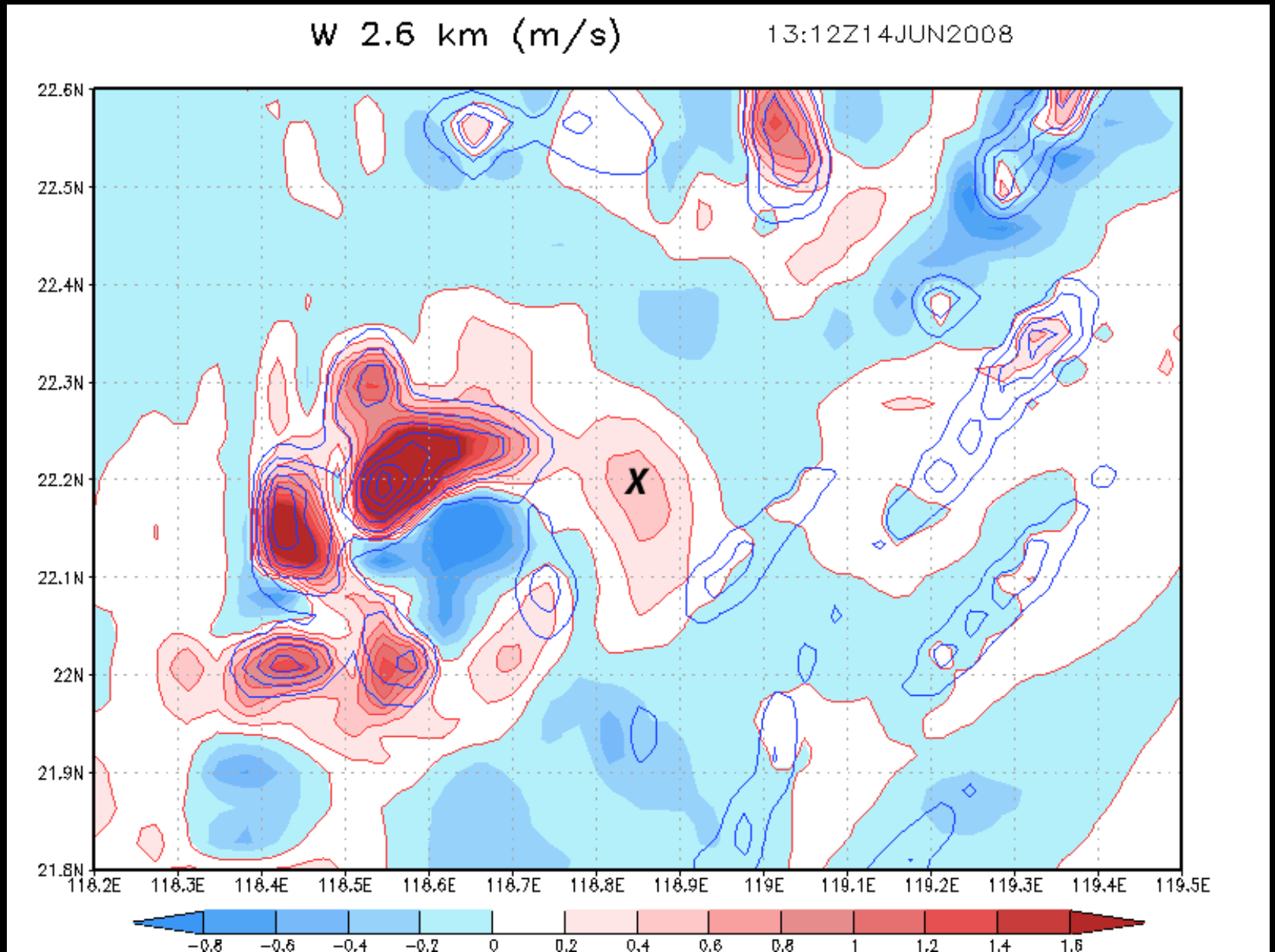
T + 4 min


W 2.6 km (m/s)
13:04Z14JUN2008
22.6N
22.5N
22.4N
22.3N
22.2N
22.1N
22N
21.9N
21.8N
118.2E
118.3E
118.4E
118.5E
118.6E
118.7E
118.8E
118.9E
119E
119.1E
119.2E
119.3E
119.4E
119.5E
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

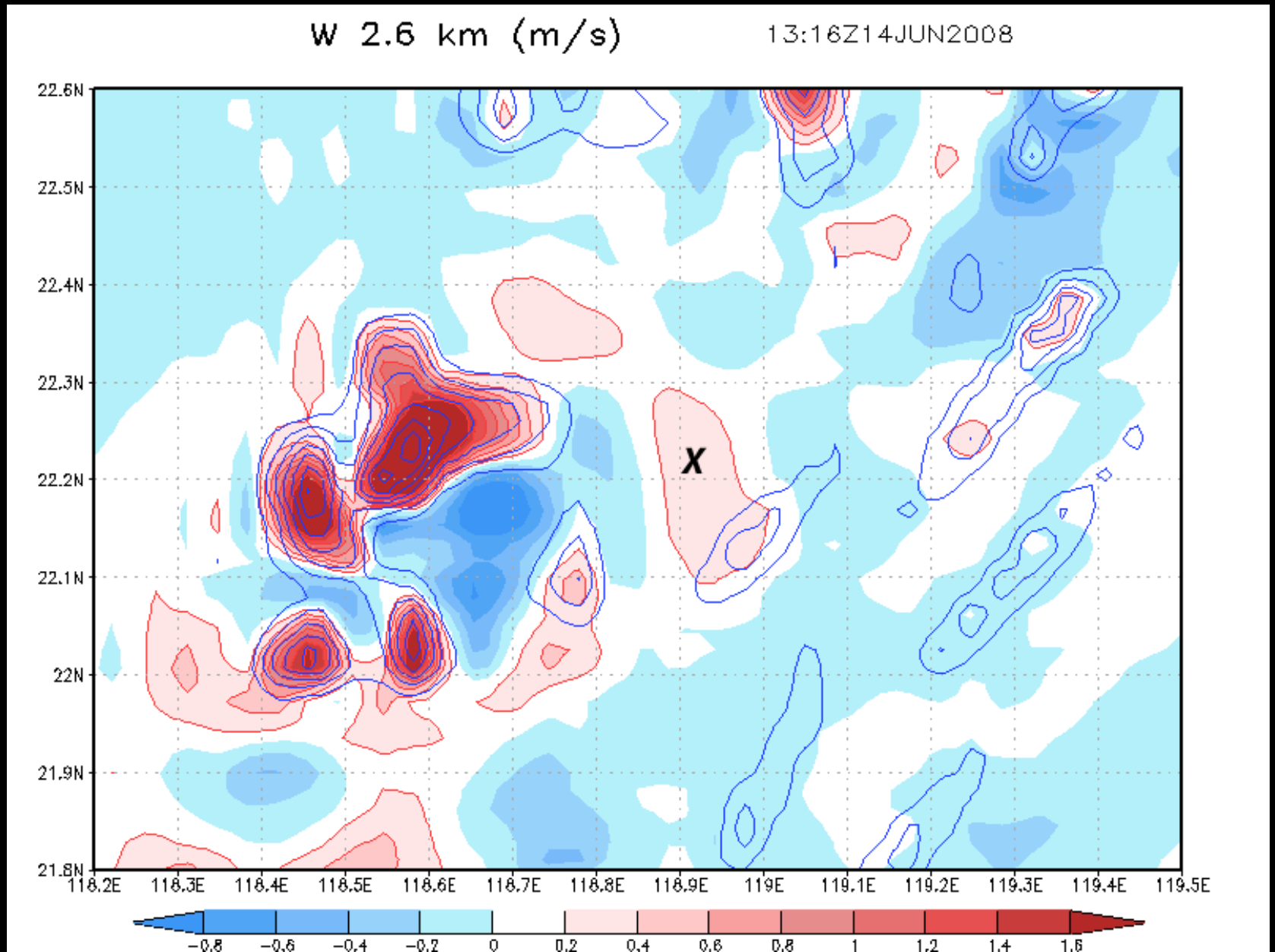
T + 8 min


W 2.6 km (m/s)
13:08Z14JUN2008
22.6N
22.5N
22.4N
22.3N
22.2N
22.1N
22N
21.9N
21.8N
118.2E
118.3E
118.4E
118.5E
118.6E
118.7E
118.8E
118.9E
119E
119.1E
119.2E
119.3E
119.4E
119.5E
gravity wave
target
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

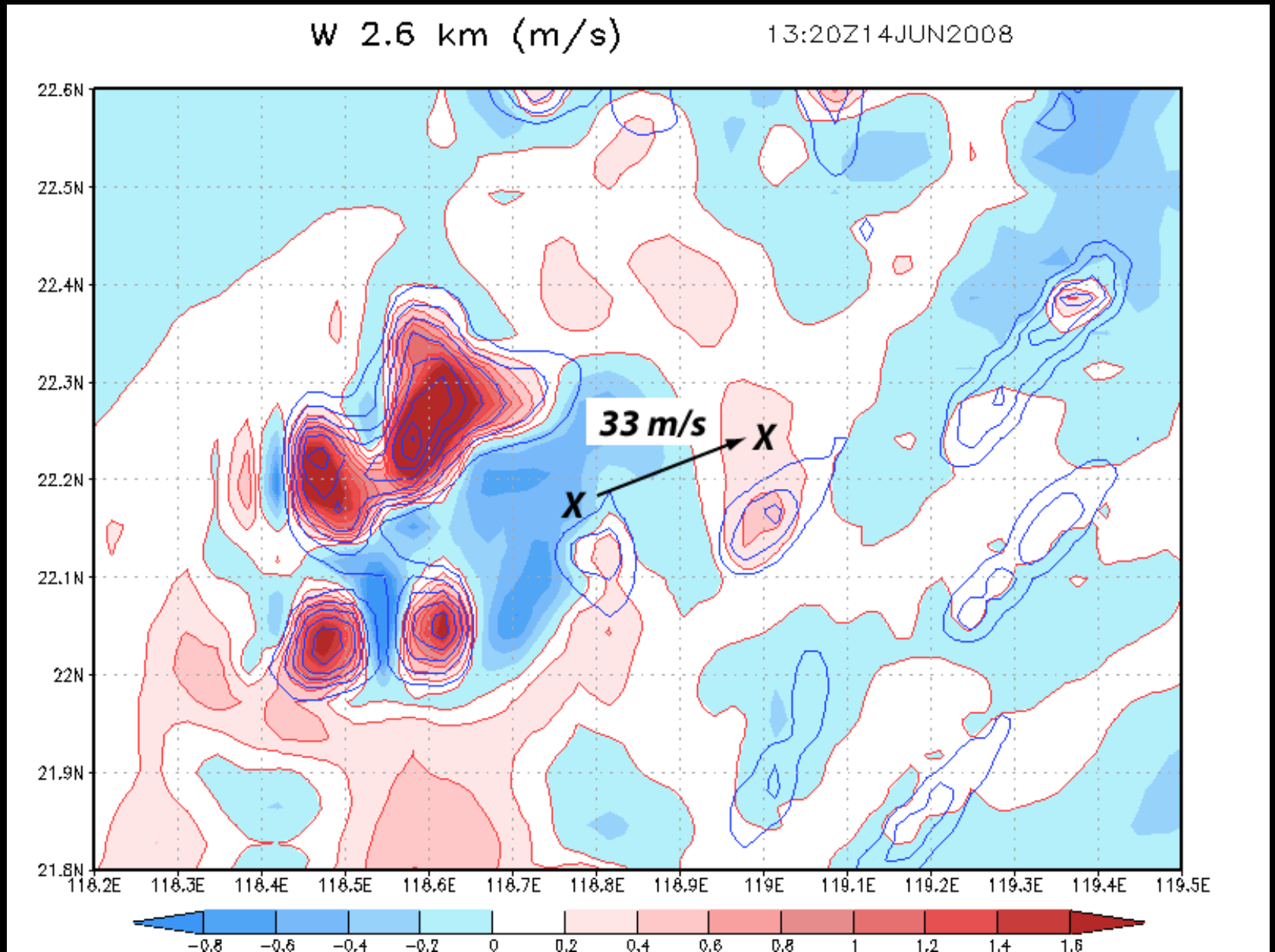
T + 12 min


W 2.6 km (m/s)
13:12Z14JUN2008
22.6N
22.5N
22.4N
22.3N
22.2N
22.1N
22N
21.9N
21.8N
118.2E
118.3E
118.4E
118.5E
118.6E
118.7E
118.8E
118.9E
119E
119.1E
119.2E
119.3E
119.4E
119.5E
X
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

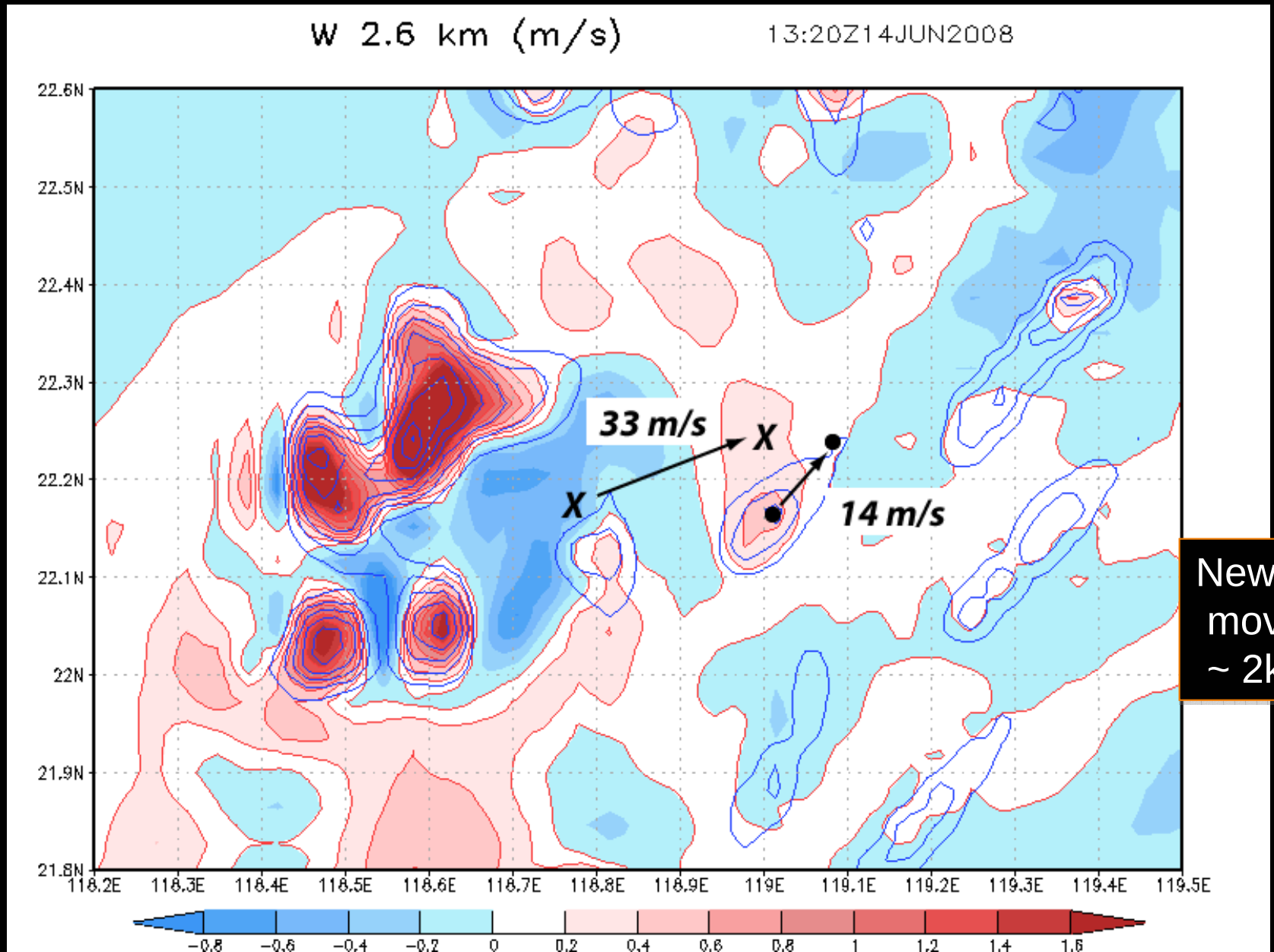
T + 16 min


W 2.6 km (m/s)
13:16Z14JUN2008
22.6N
22.5N
22.4N
22.3N
22.2N
22.1N
22N
21.9N
21.8N
118.2E
118.3E
118.4E
118.5E
118.6E
118.7E
118.8E
118.9E
119E
119.1E
119.2E
119.3E
119.4E
119.5E
X
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

T + 20 min

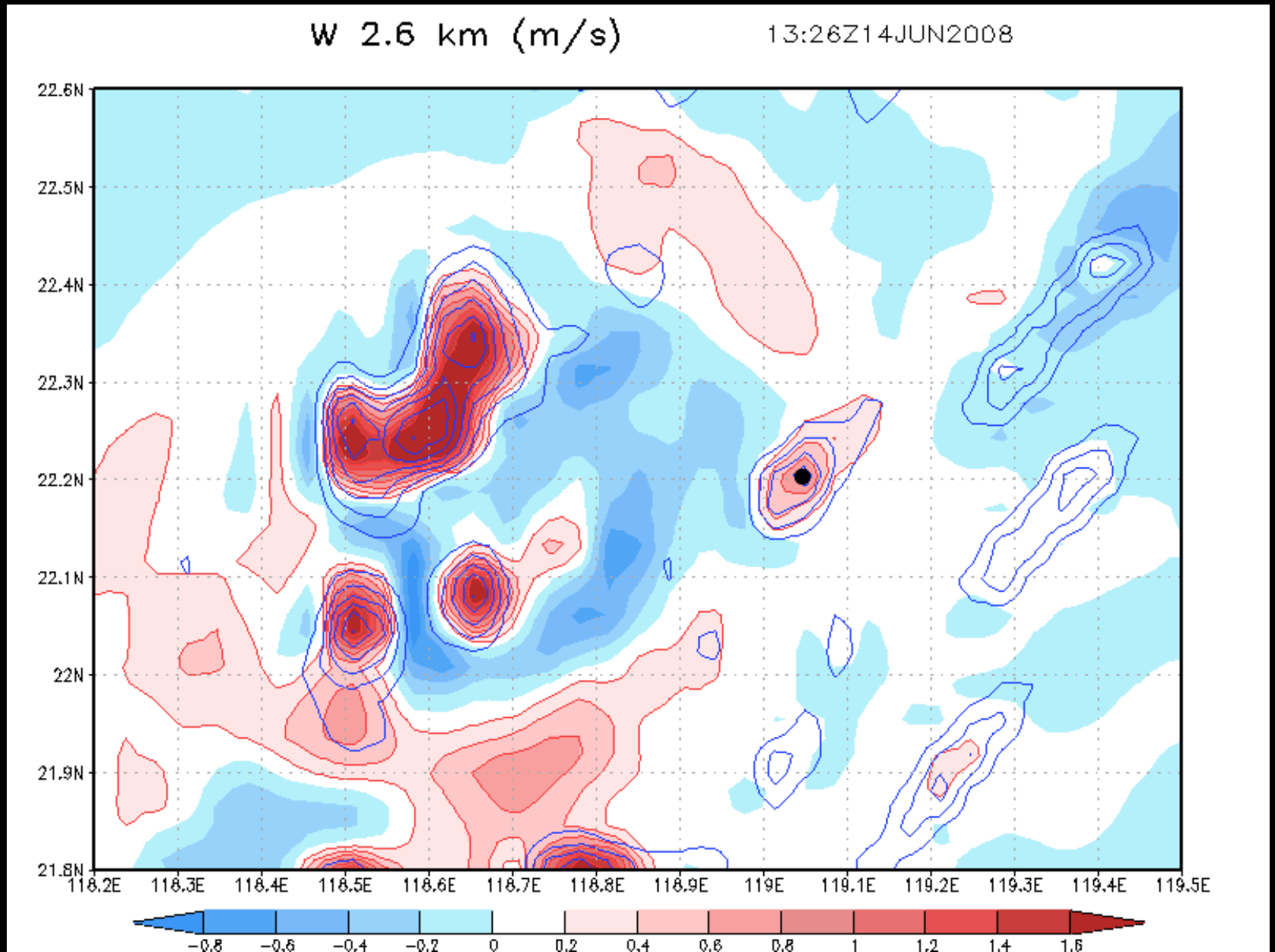

W 2.6 km (m/s)
13:20Z14JUN2008
22.6N
22.5N
22.4N
22.3N
22.2N
22.1N
22N
21.9N
21.8N
118.2E
118.3E
118.4E
118.5E
118.6E
118.7E
118.8E
118.9E
119E
119.1E
119.2E
119.3E
119.4E
119.5E
33 m/s
X
X
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

T + 20 min

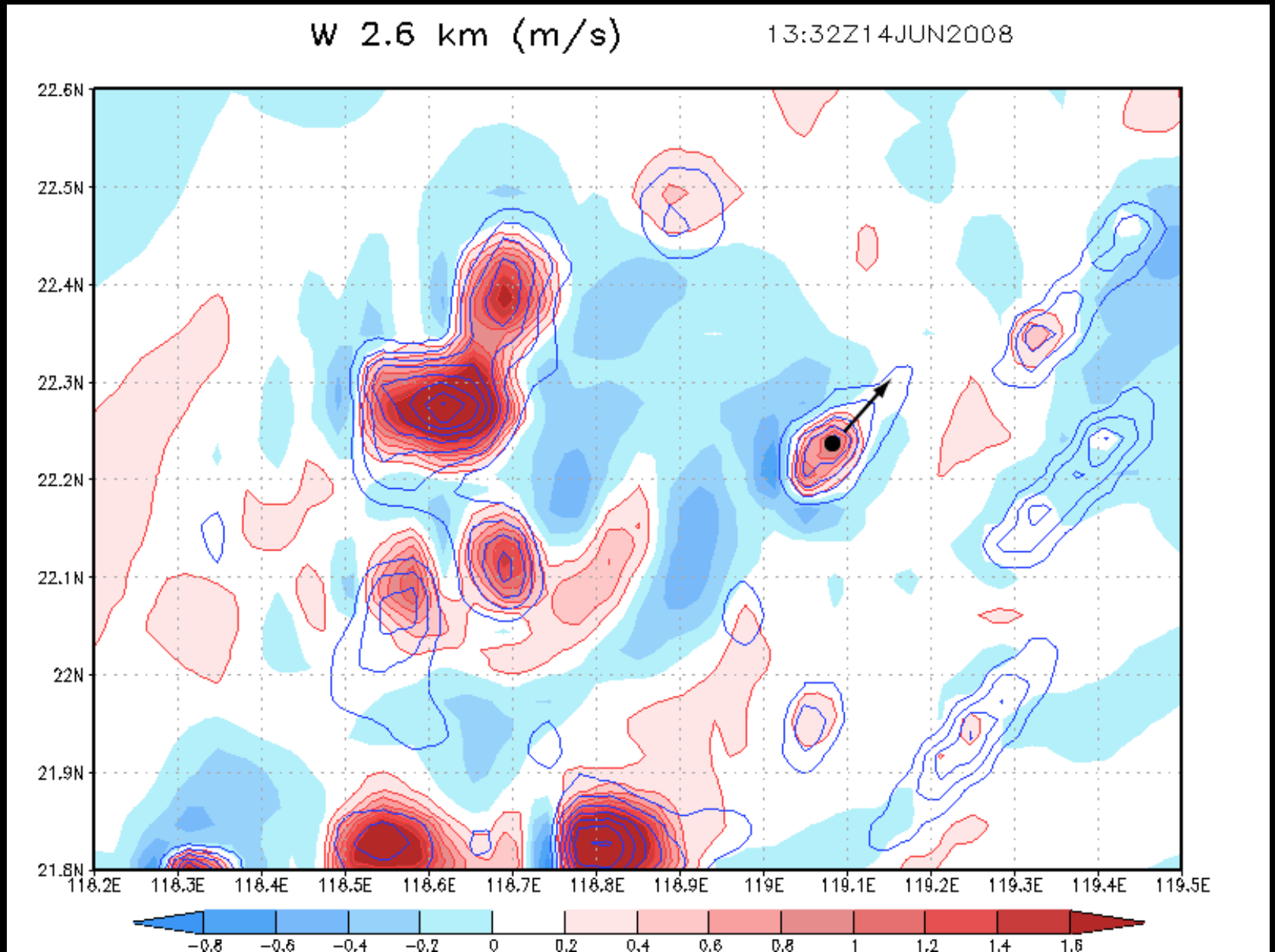


New cell moves with ~ 2km wind

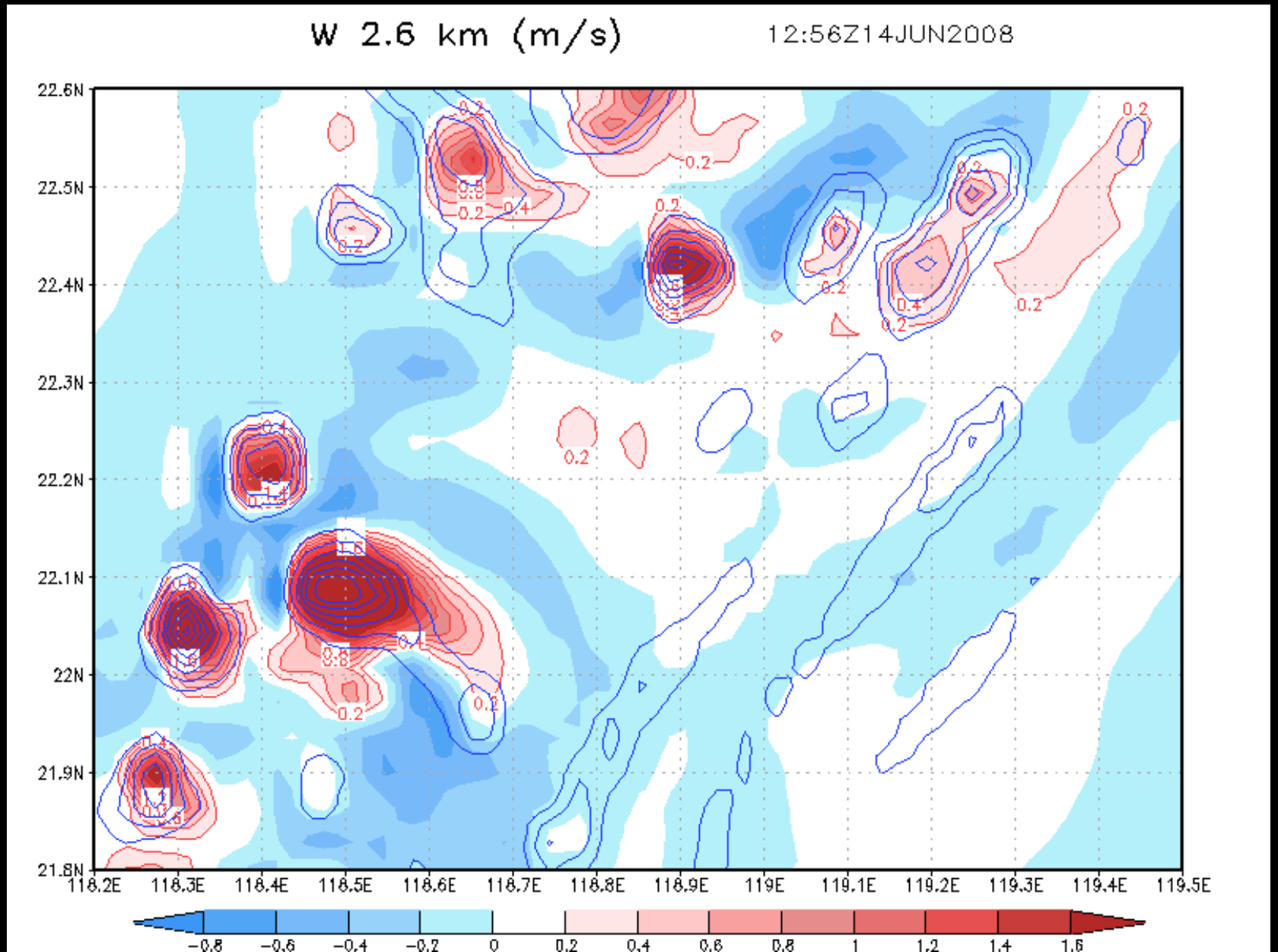
T + 26 min


W 2.6 km (m/s)
13:26Z14JUN2008
22.6N
22.5N
22.4N
22.3N
22.2N
22.1N
22N
21.9N
21.8N
118.2E
118.3E
118.4E
118.5E
118.6E
118.7E
118.8E
118.9E
119E
119.1E
119.2E
119.3E
119.4E
119.5E
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

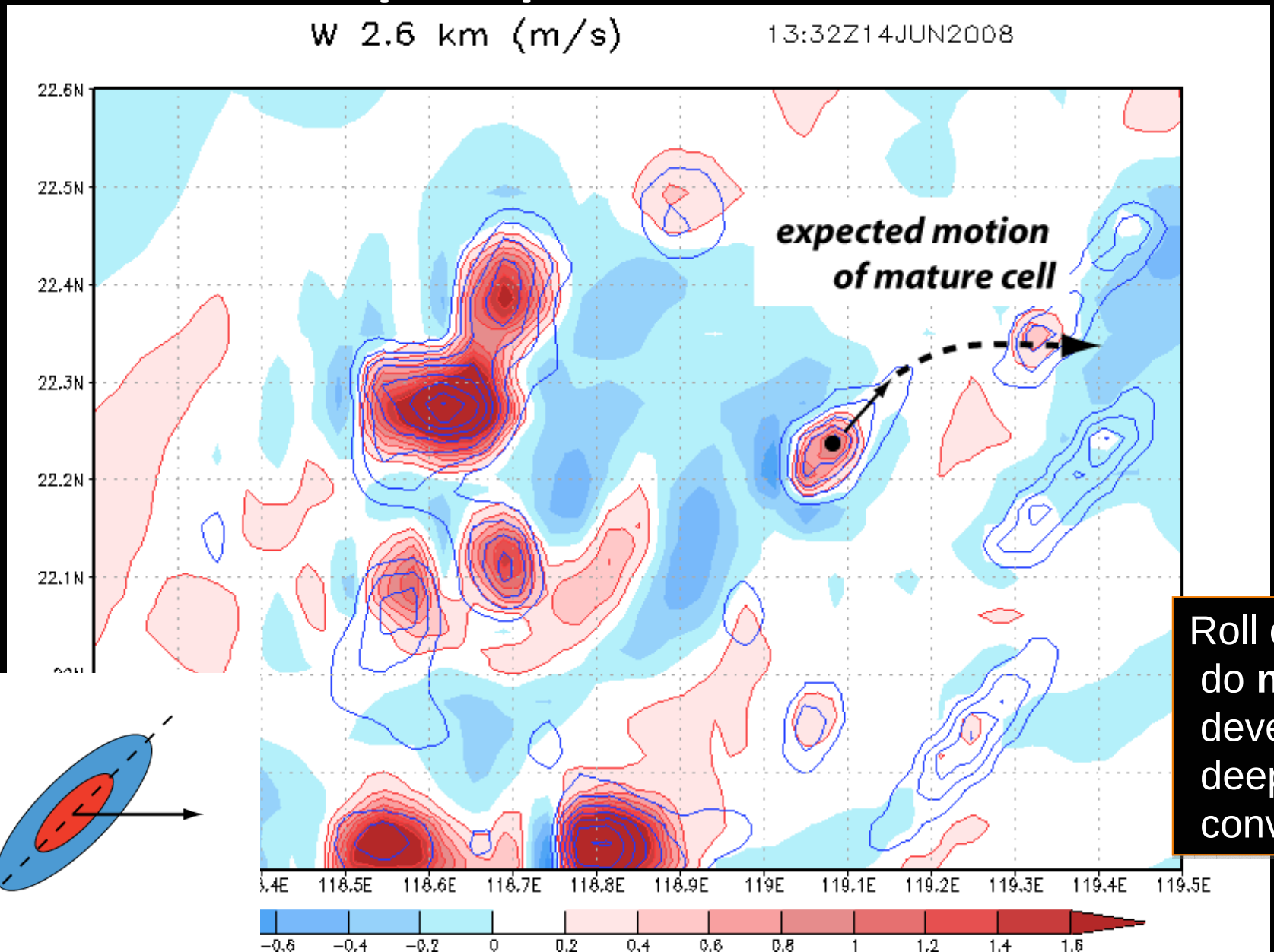
T + 32 min

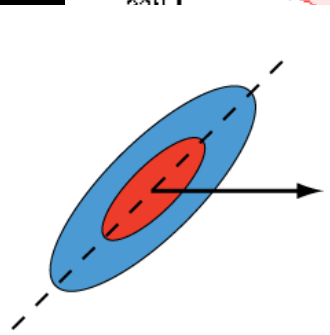

W 2.6 km (m/s)
13:32Z14JUN2008
22.6N
22.5N
22.4N
22.3N
22.2N
22.1N
22N
21.9N
21.8N
118.2E
118.3E
118.4E
118.5E
118.6E
118.7E
118.8E
118.9E
119E
119.1E
119.2E
119.3E
119.4E
119.5E
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

Animation


W 2.6 km (m/s)
12:56Z14JUN2008
22.6N
22.5N
22.4N
22.3N
22.2N
22.1N
22N
21.9N
21.8N
118.2E
118.3E
118.4E
118.5E
118.6E
118.7E
118.8E
118.9E
119E
119.1E
119.2E
119.3E
119.4E
119.5E
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

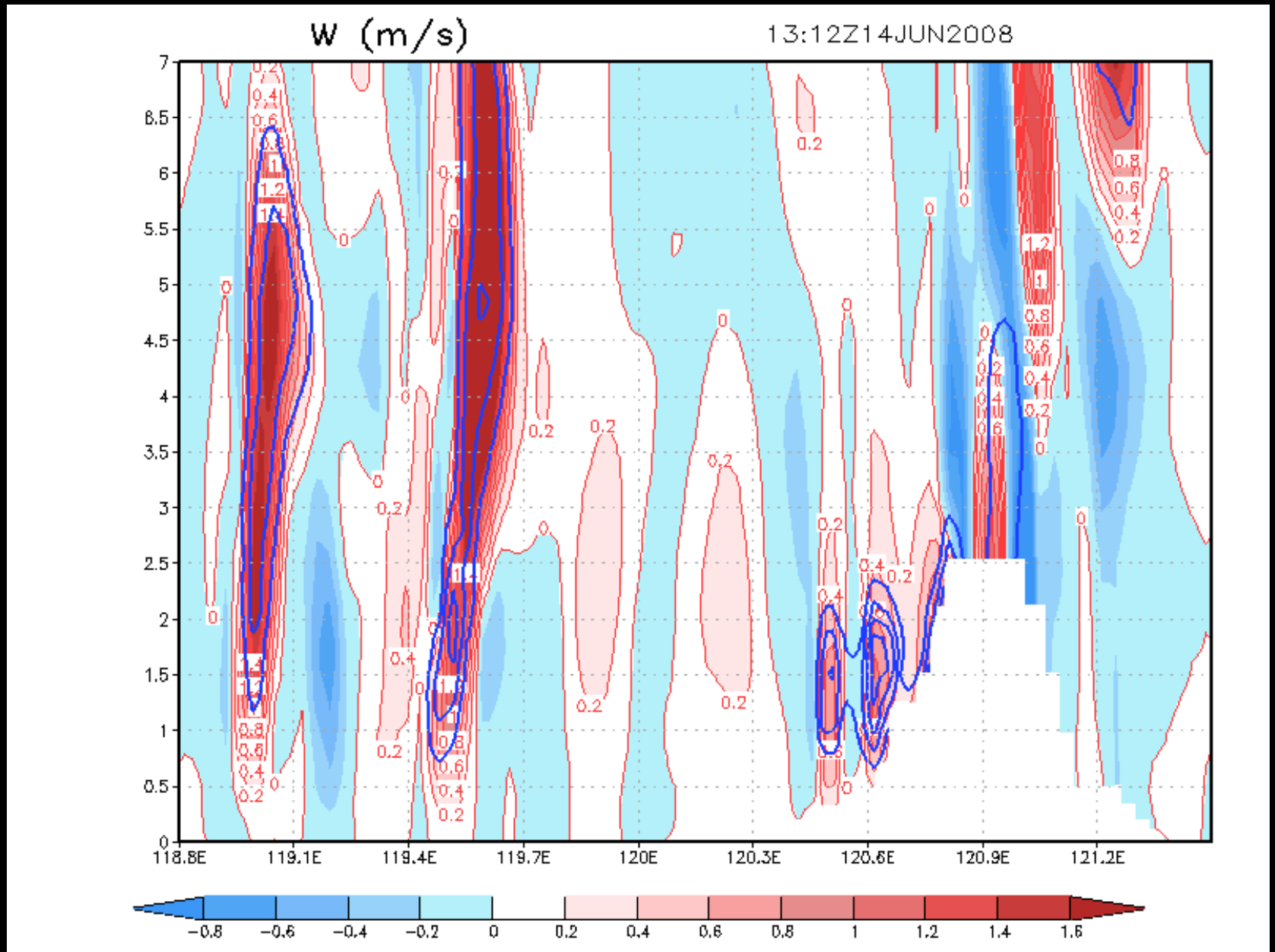
Expected motion with mid-tropospheric winds





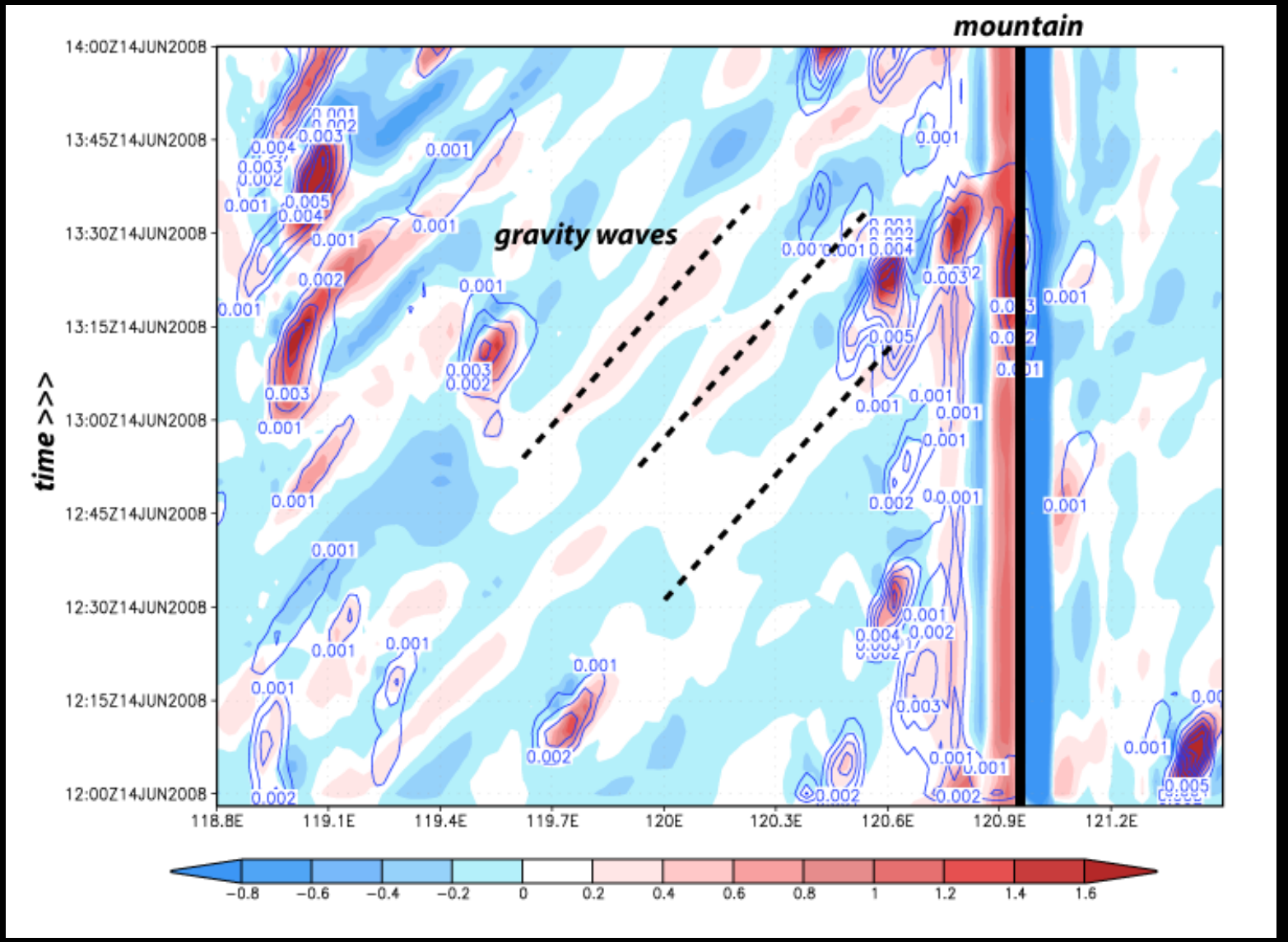
Roll clouds do **not** develop into deep convection

Vertical x-section farther N

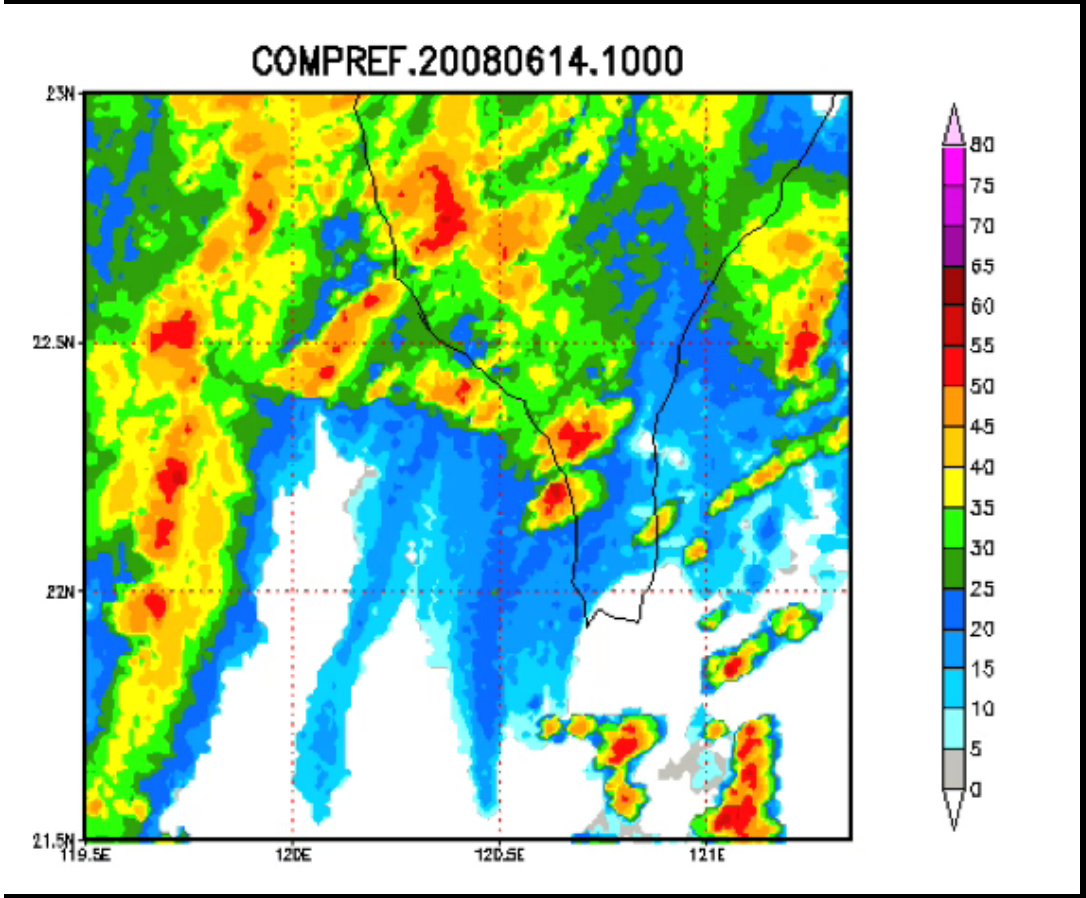


Hovmoller diagram

(W at 2.5 km; cloud water)



Summary



- Multiple parallel bands oriented SW-NE reached Taiwan on 6/14
  - Small and large-scale separations
- Model develops cloud-topped "rolls" parallel to SW'ly flow ~ 2 km AGL ahead of a single convergence zone
  - Rolls be of spurious or dynamic origin
  - Rolls do NOT appear in "dry" run (because PBL shear smaller?)
- Convectively-excited gravity waves can serve to "activate" shallow roll clouds
  - Fail to spawn deep convection over ocean in present simulation
- If model had been able to develop the roll clouds, multiple parallel bands might have been simulated