*1st MAHASRI/AMY Workshop*
*January 8, 2007*
*University of Tokyo, JAPAN*

# Operational Hydro-Meteorological Facility of Vietnam

Nguyen Thi Tan Thanh
National Hydro – Meteorological Service (NHMS) of Vietnam

# content

1. Introduction
2. Network of Stations
3. Operational High – Resolution Model in NCHMF
4. The application of CTS model to forecast storm surge in Vietnam Coastal Zone
5. Contribution to AMY
6. Collaboration in MAHASRI

# 1 - INTRODUCTION

- Up to now, Vietnam H-M network has more than 1200 stations and gauging places.

- Modernization of the network is going on

- Improving the operational forecasting High - Resolution Models output

- More actively participate in the regional and international collaboration

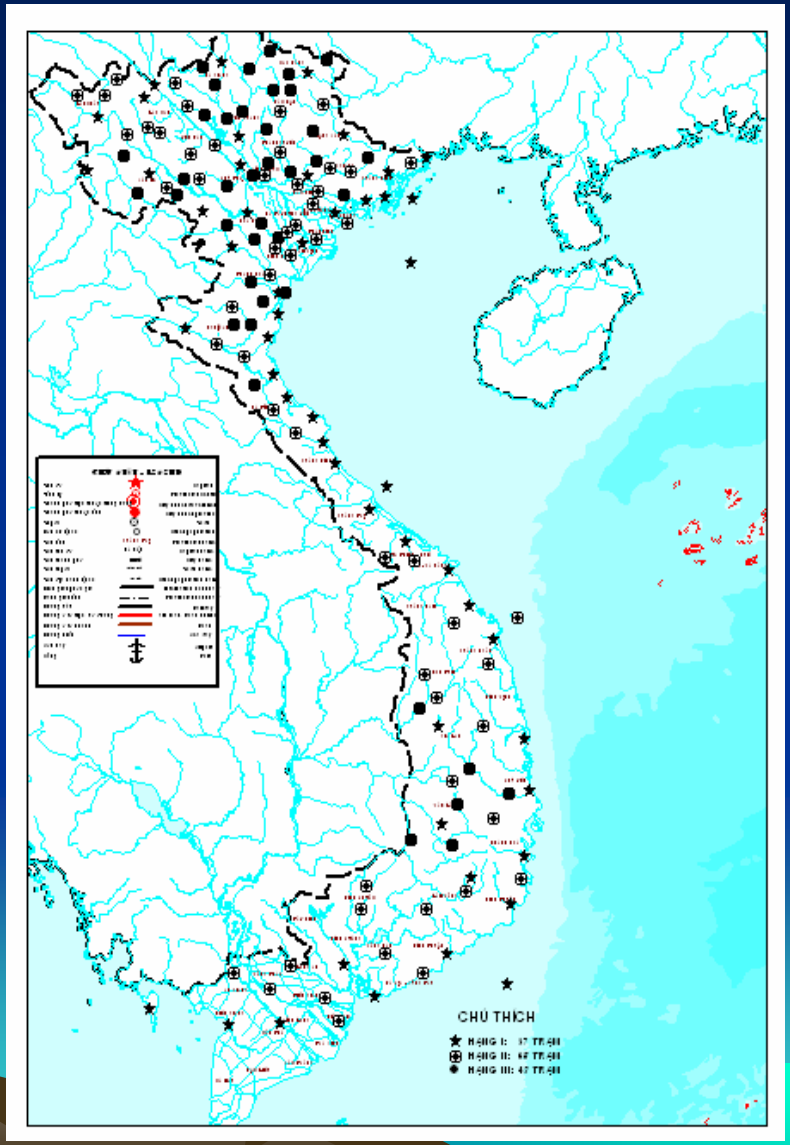
# 2 – Network of Stations

**2.1. Meteorological station network**: 174 stations

- 57 class I
- 69 class II
- 48 class III

Among this:

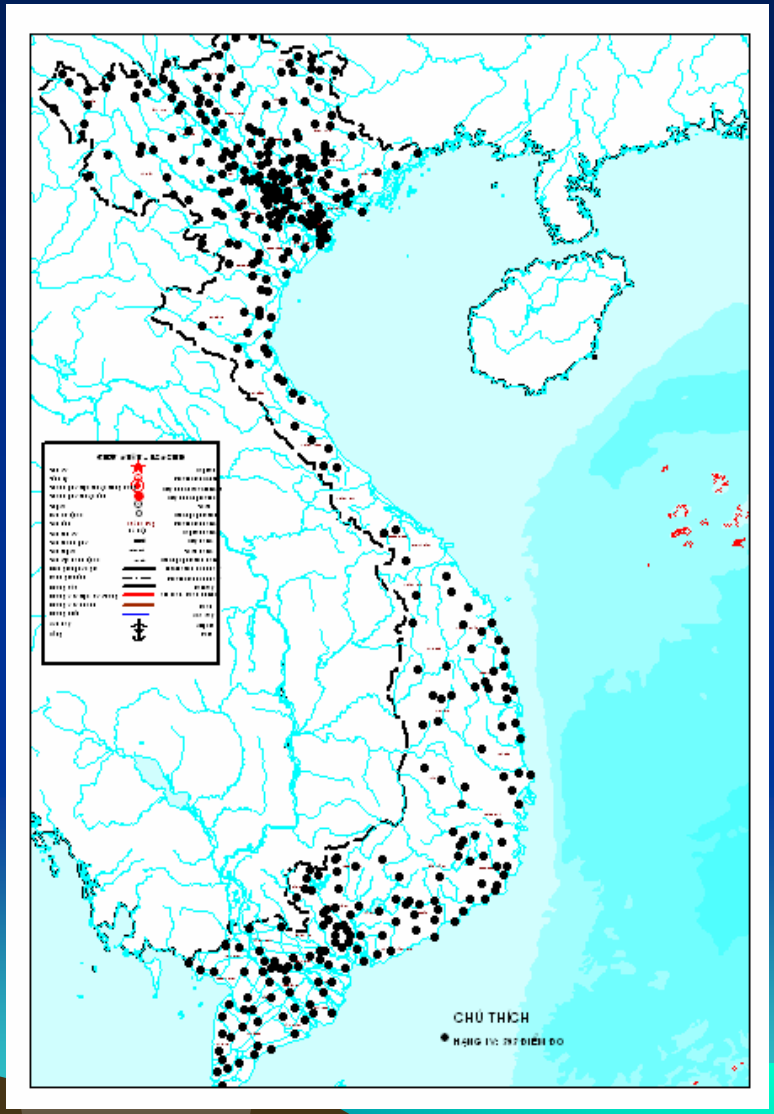
- 25 International reported stations
- 125 National synoptic reported Stations
- 29 Agro-Meteorological reported stations



# 2 – Network of Stations (cont.)

**2.2. Rainfall measurement stations/places**: 764 places

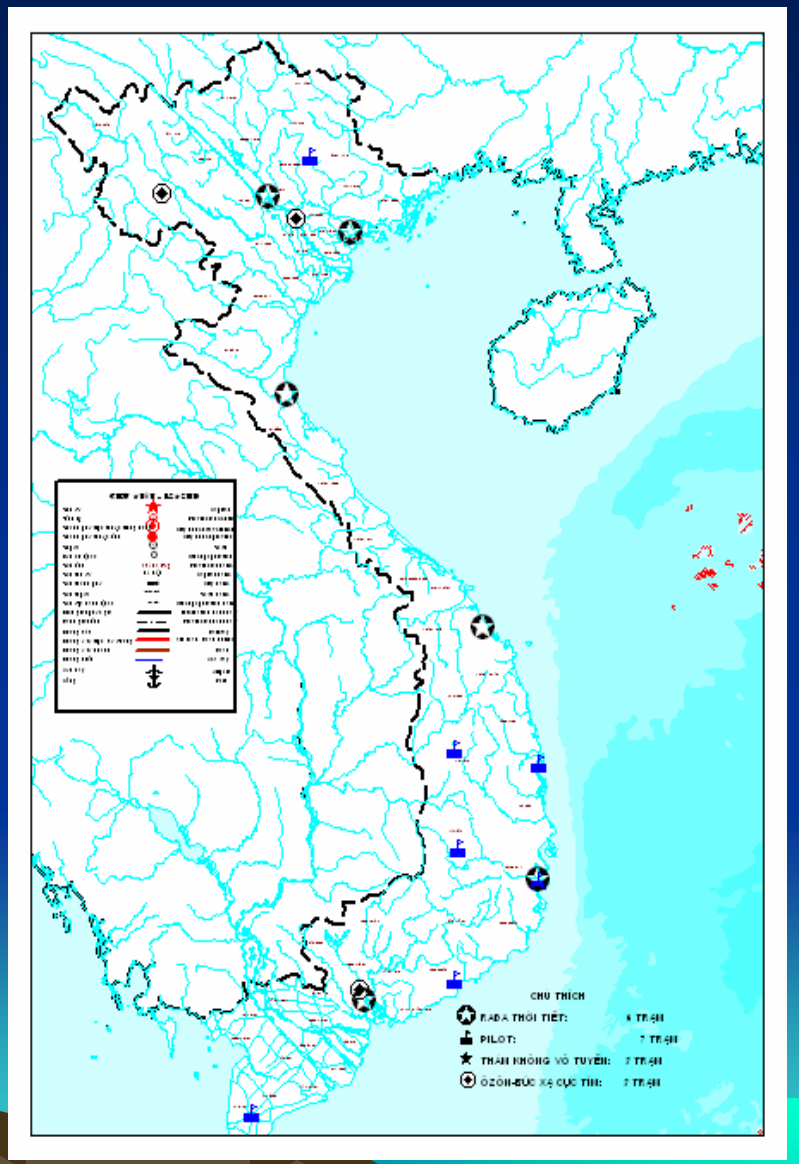
- 371 raingauges located in the hydro-meteorological station network
- 393 raingauges located outside of the hydro-meteorological station network



# 2 – Network of Stations (cont.)

## 2.3. Upper – Air Stations

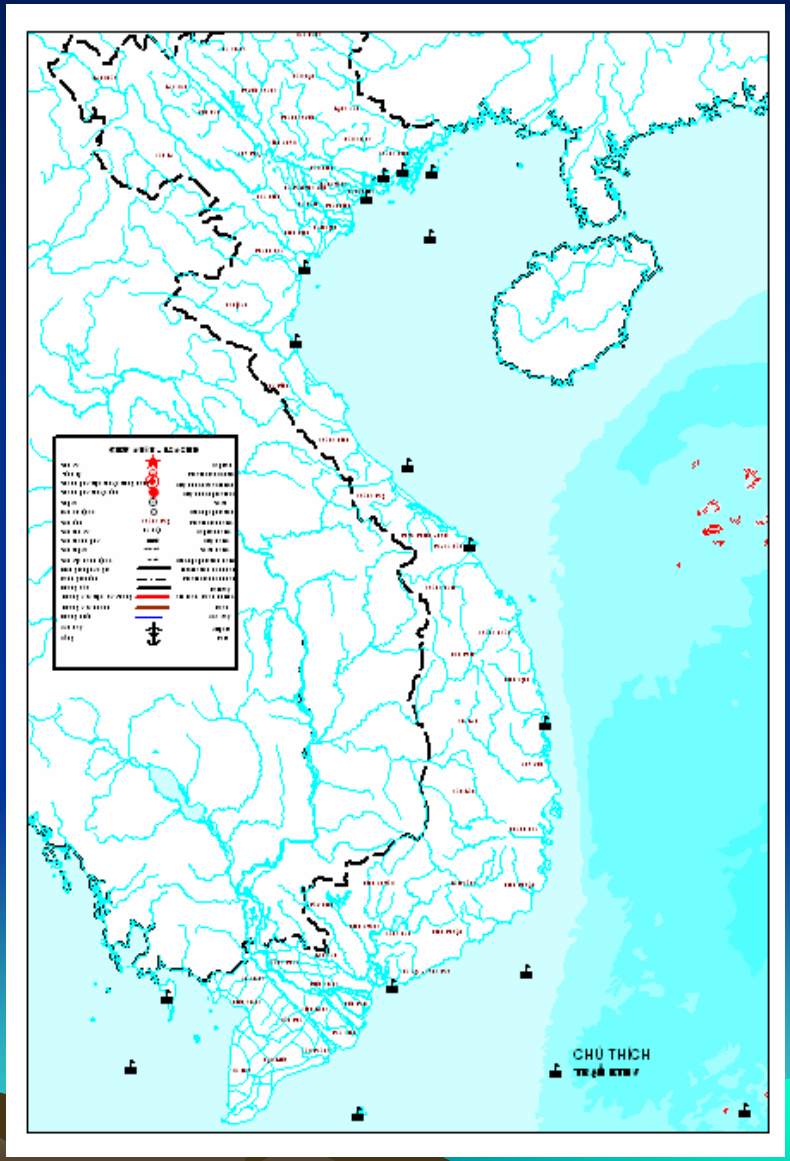
- 3 radiosounding stations with DigiCORA MW31 – RS92 + 2 new stations in 2007
- 8 upper air wind stations
- 3 conventional weather radar stations and 3 Doppler WR stations + 2 new DWR up to 2008



# 2 – Network of Stations (cont.)

**2.4. Marine H-M station network**: 17 stations

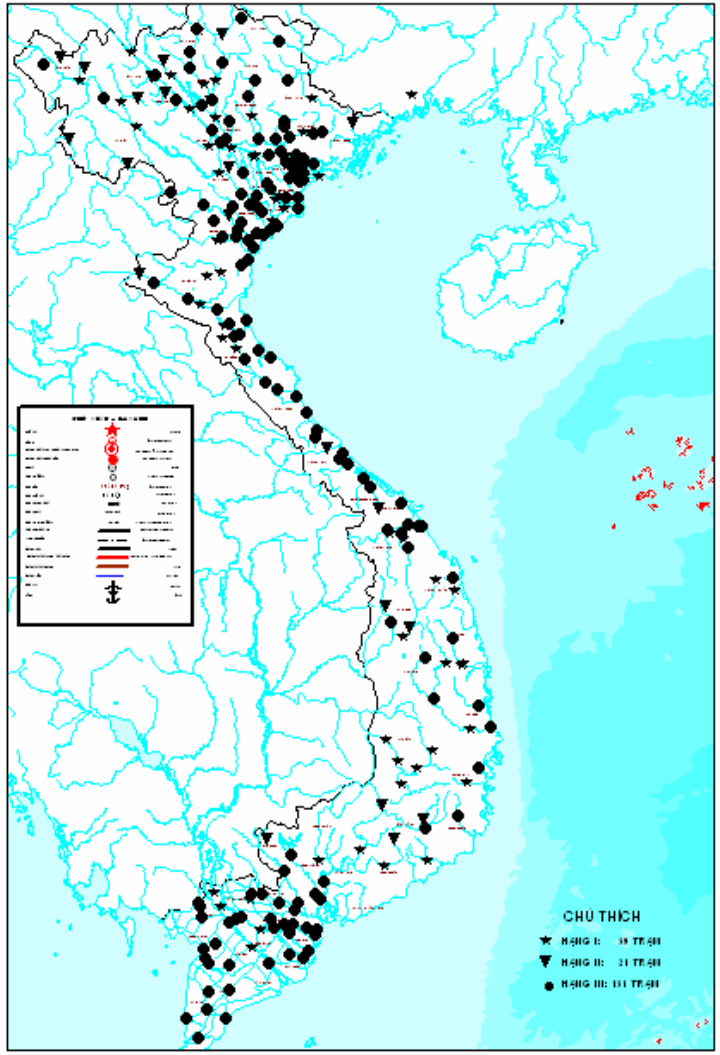
- 11 stations on island
- 5 coastal stations
- 1 station on drilling rig



# 2 – Network of Stations (cont.)

**2.5. Gauging-station network**: 231 stations

- 59 class I
- 21 class II
- 151 class III



# 2 – Network of Stations (cont.)

- 32 air-environment stations integrate with meteorological observation stations
- 93 observation of water-environment stations integrate with gauging-stations
- Marine research vessel

**Table 1: Main Technical Parameters of Weather Radars in Viet Nam**

| Parameter | TRS-2730 | DWSR 93C | DWSR 2500C |
|---|---|---|---|
| Beam width | 1.25° ± 0.1 | 1.0° ± 0.1 | 1.0° ± 0.1 |
| Speed of antenna | 2.5°/sec | 6°/sec – 36°/sec | 6°/sec – 36°/sec |
| Number of elevation/volume scan | NA | 5-15 in 20min (120, 240, 480km) | 5-15 in 20min (120, 240, 480km) |
| Range of scan (km) | 64, 128, 256, 384 | 30, 60, 120, 240, 480 | 30, 60, 120, 240, 480 |
| PRF (Hz) | 250 | 250/1180 | 250/1180 |
| Wavelength (cm) | 5.5 | 5.6 | 5.6 |
| Transmitter | Magnetron | Magnetron | Magnetron |
| Power, Pulse length | 250Kw, 2μs | 250Kw, 2/0.8μs | 250Kw, 2/0.8μs |
| Sample size | | 35-50 | 35-50 |
| Processed video signals | 8 bit, logZ | 16 bit, I, Q, logZ | 24 bit, I, Q, logZ |
| Clutter suppression | NA | Doppler filter | Static map/Doppler filter |
| Callibration (noise source) | NA | Every vol.scan | Every vol.scan |
| Calibration (sig.generator) | NA | 1 per month | 1 per month |
| Real-time basic products | PPI (Z, R) RHI (Z, R) | PPI (Z, U, V, R, S) RHI (Z, U, V, R, S) | PPI (Z, U, V, R, S) RHI (Z, U, V, R, S) |
| Derived products | NA | CAPPI, ETOPS, CMAX, HMAX, PCP, VIL, VAD, TRACK, GUST, VECTOR, SUBCATMENT, FLASH FLOOD | CAPPI, ETOPS, CMAX, HMAX, PCP, VIL, VAD, TRACK, GUST, VECTOR, SUBCATMENT, FLASH FLOOD |
| Warning products (need criteries and real – time raingauge calibration) | NA | | |

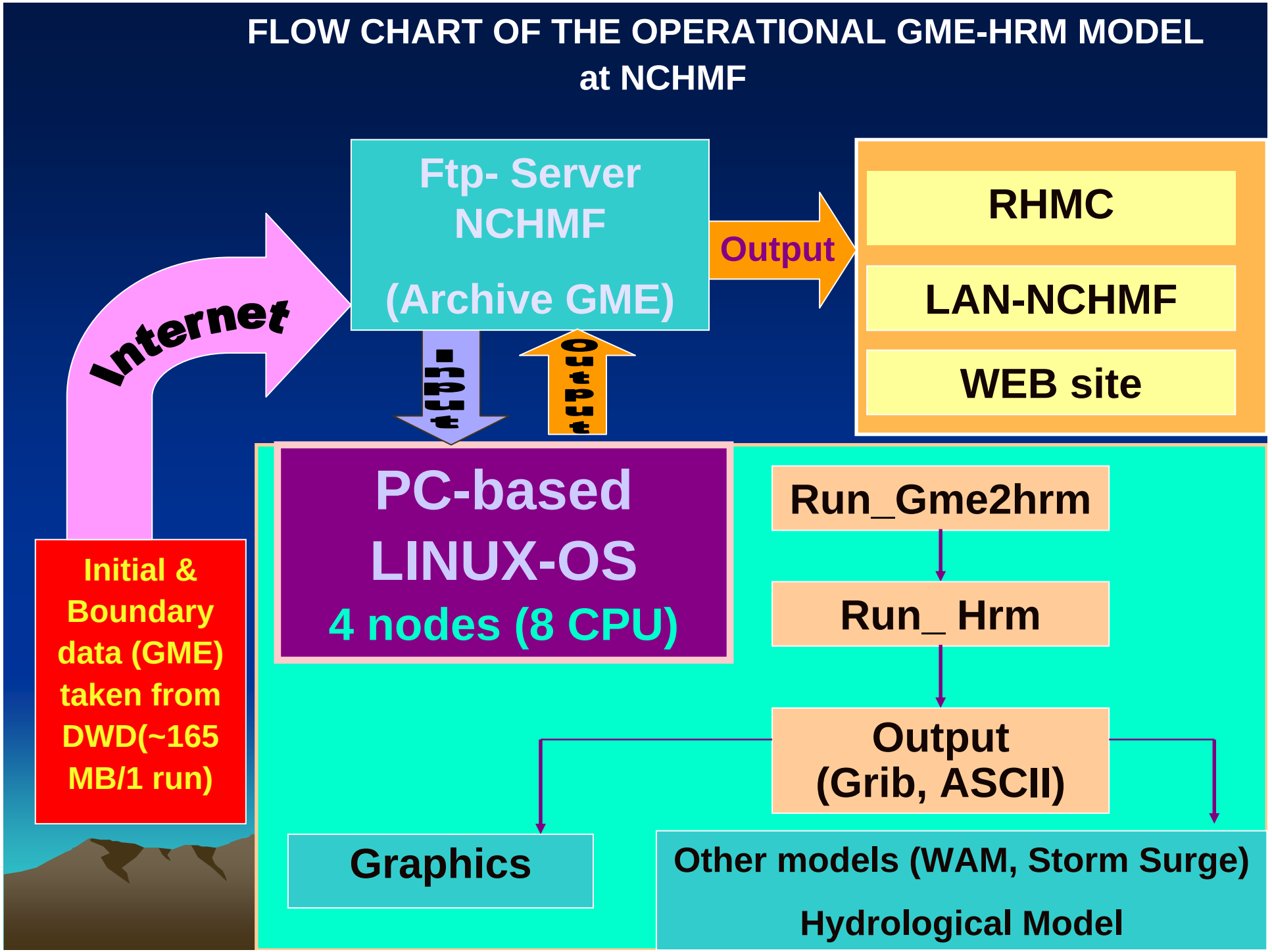
# 3. operational Hm Model in NCHMF

# International GTS channels

- HaNoi - MOSCOW: 100 bps
- HaNoi -Bejing: 75 bps
- HaNoi - Bangkok: 1200bps
- PCVSAT: HaNoi - Bejing: 9600bps

# 3.1. NWP models

- Run operationally HRM (28 km) since 5/2002, (14km) since 7/2004.
- ETA model run (22 km) in experimental mode since June 2005, semi-operational (May, 2006)
- Barotropic models for TC tracking (BARO & BAR) for typhoon season 2003, 2004, 2005, 2006
- Post processing (display & diagnostic output): **GSM(**JMA), TLAPS (BoM), AVN(NCEP), NOGAPS, ECMWF ...
- Other software to serve as tools for forecasters


FLOW CHART OF THE OPERATIONAL GME-HRM MODEL
at NCHMF
Ftp- Server
NCHMF
(Archive GME)
Output
RHMC
LAN-NCHMF
WEB site
Internet
Input
Output
PC-based
LINUX-OS
4 nodes (8 CPU)
Run_Gme2hrm
Run_ Hrm
Output
(Grib, ASCII)
Initial &
Boundary
data (GME)
taken from
DWD(~165
MB/1 run)
Graphics
Other models (WAM, Storm Surge)
Hydrological Model

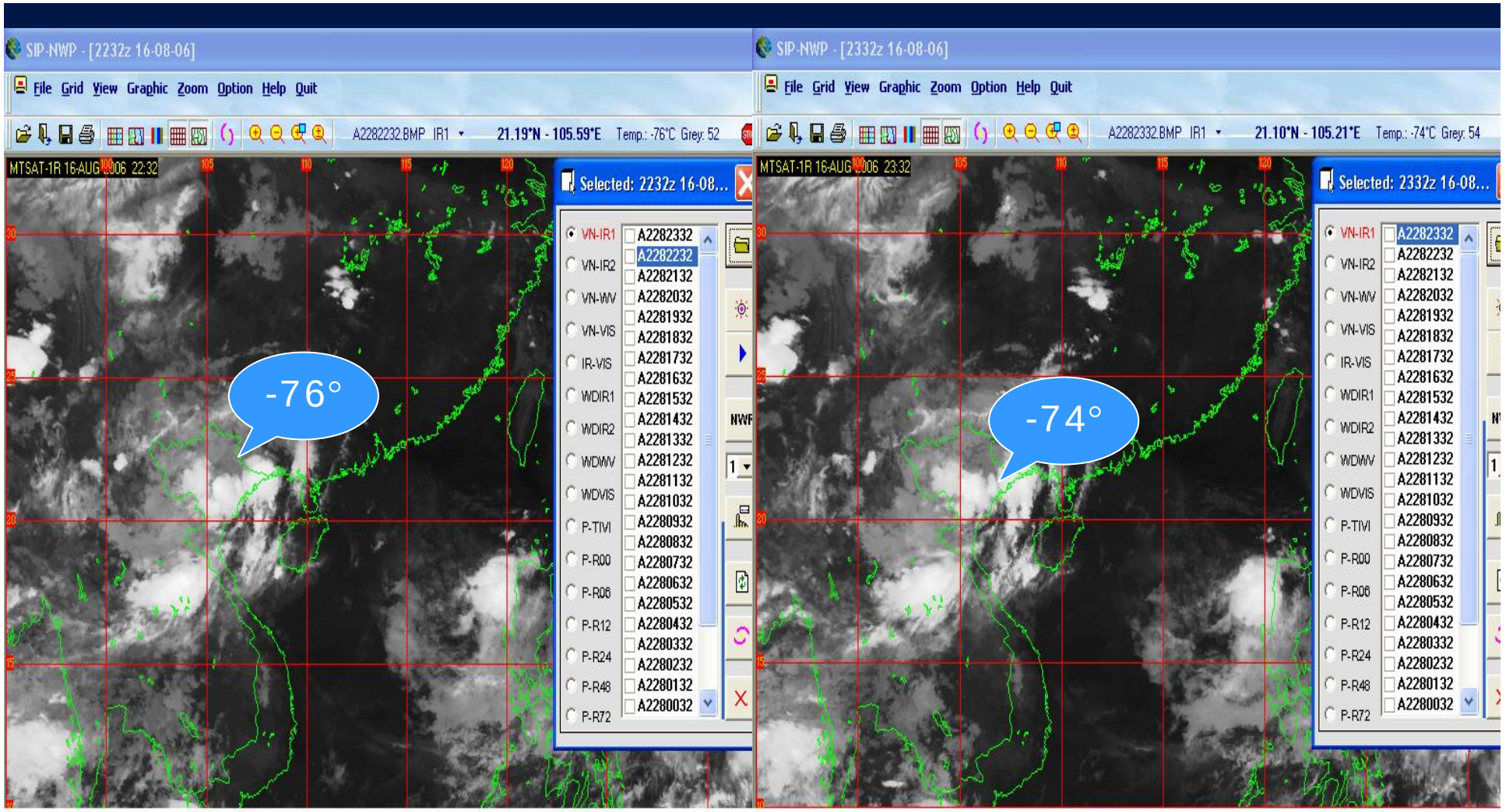
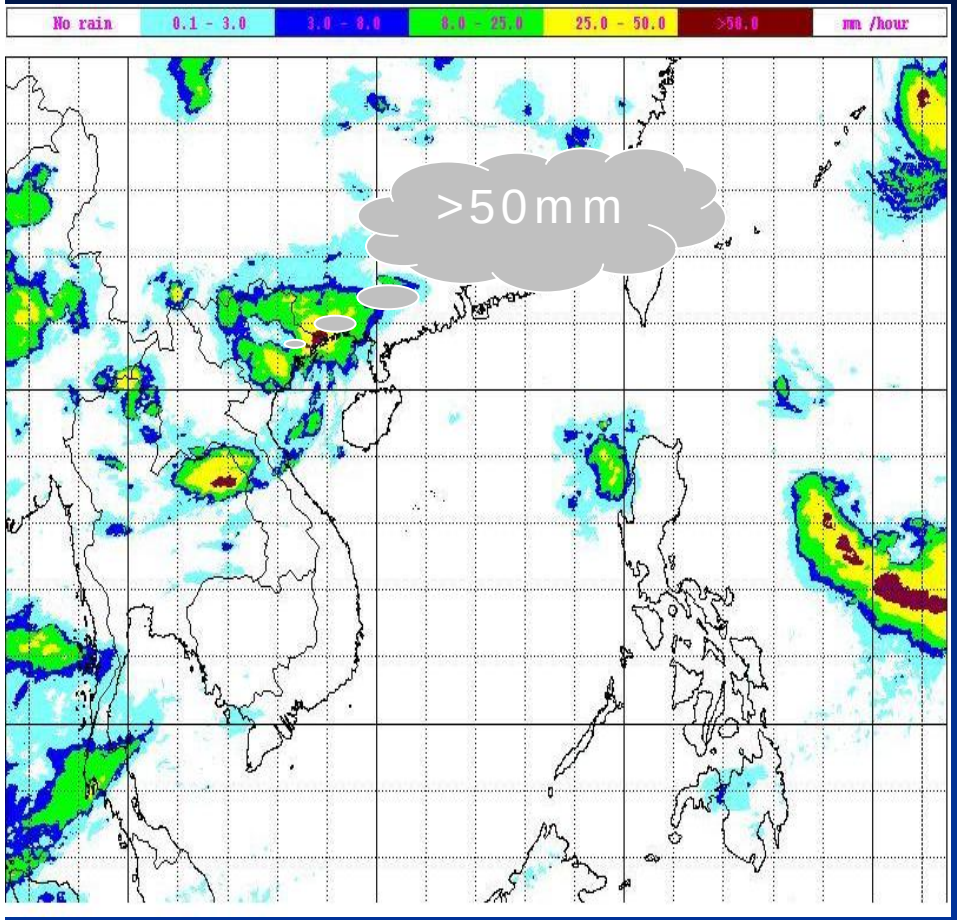



**Fig 1: Cloud pictures (IR1) captured from MTSAT**

**at 2230 UTC and 2330 UTC 16 AUG 2006**



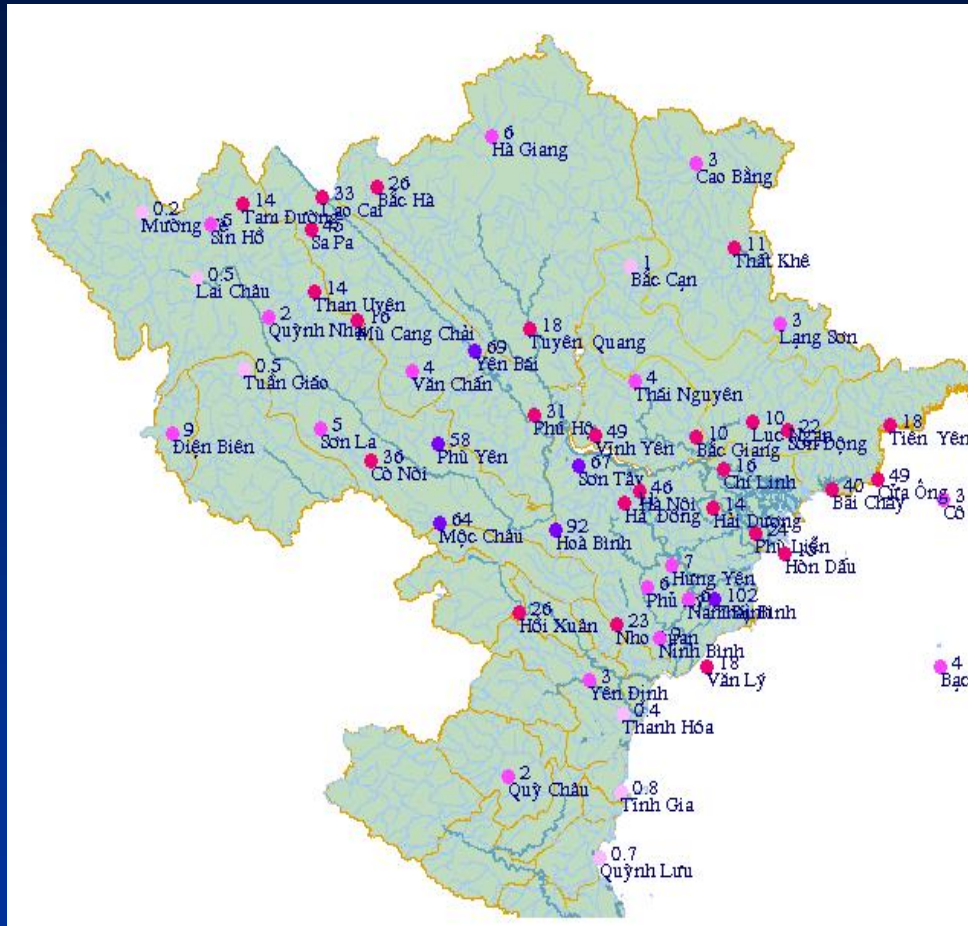




**Fig 2: Accumulated precipitation estimatted from MTSAT (left) and Observation (right)**

**(from 12UTC 16/08 to 00UTC 17/08/06): Cua Ong 49, Bai chay 40, Ha Noi 46**

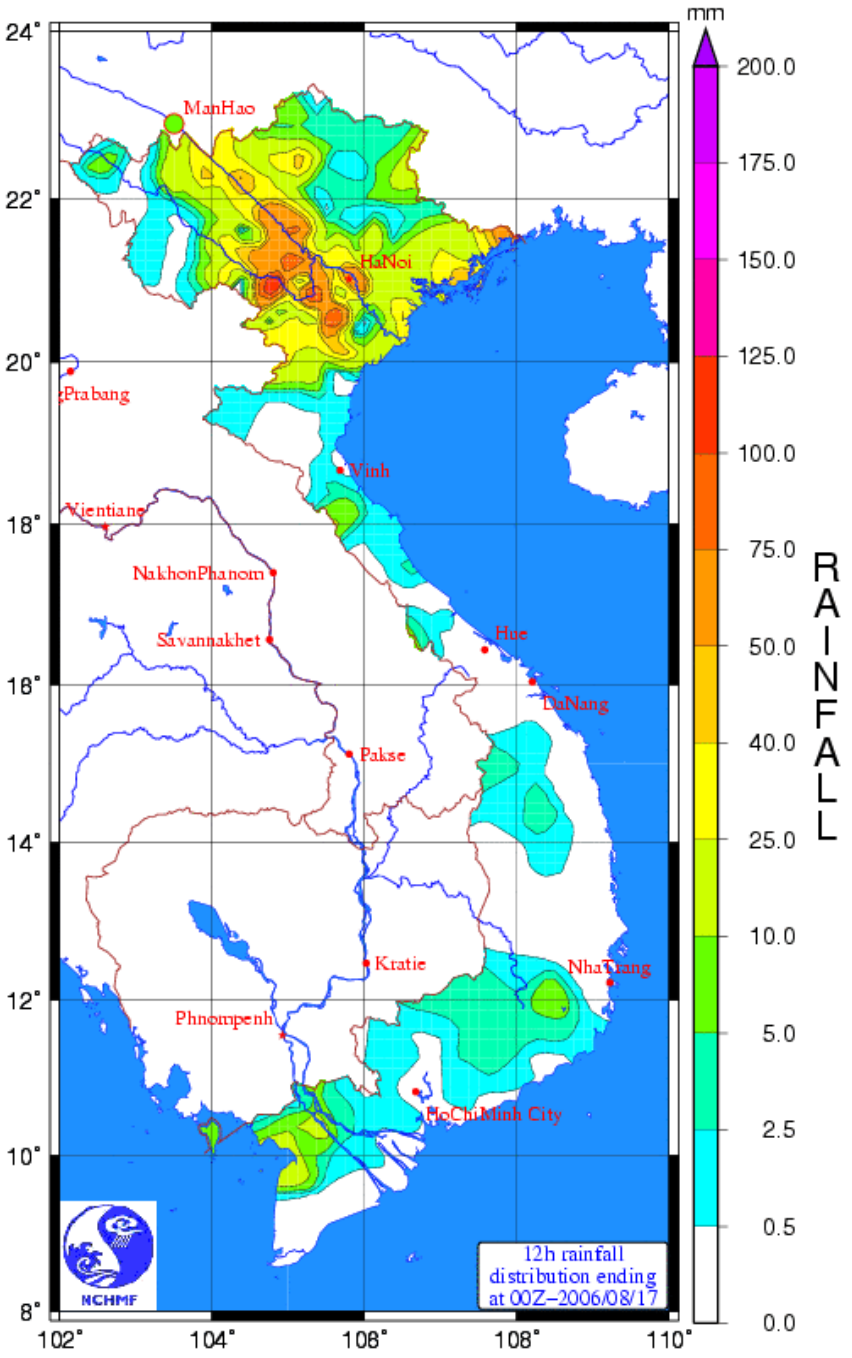



**Fig 3: Rainfall Observation (from 12UTC 16/08 to 00UTC 17/08/06): Cua Ong 49, Bai chay 40, Ha Noi 46,**

**Mong cai : 76, Yen Bai: 69, Son Tay: 67, Hoa Binh : 92, Thai Binh : 102**


**Fig 4: Left : Big Inundation in Hanoi caused by very heavy rainfall (during only 2 hours)**

**Left : Nui Truc Street**

**at 19UTC 14 July 2006**

**Right : Nguyen Khuyen Street**

**at 00UTC 17 Aug 2006**

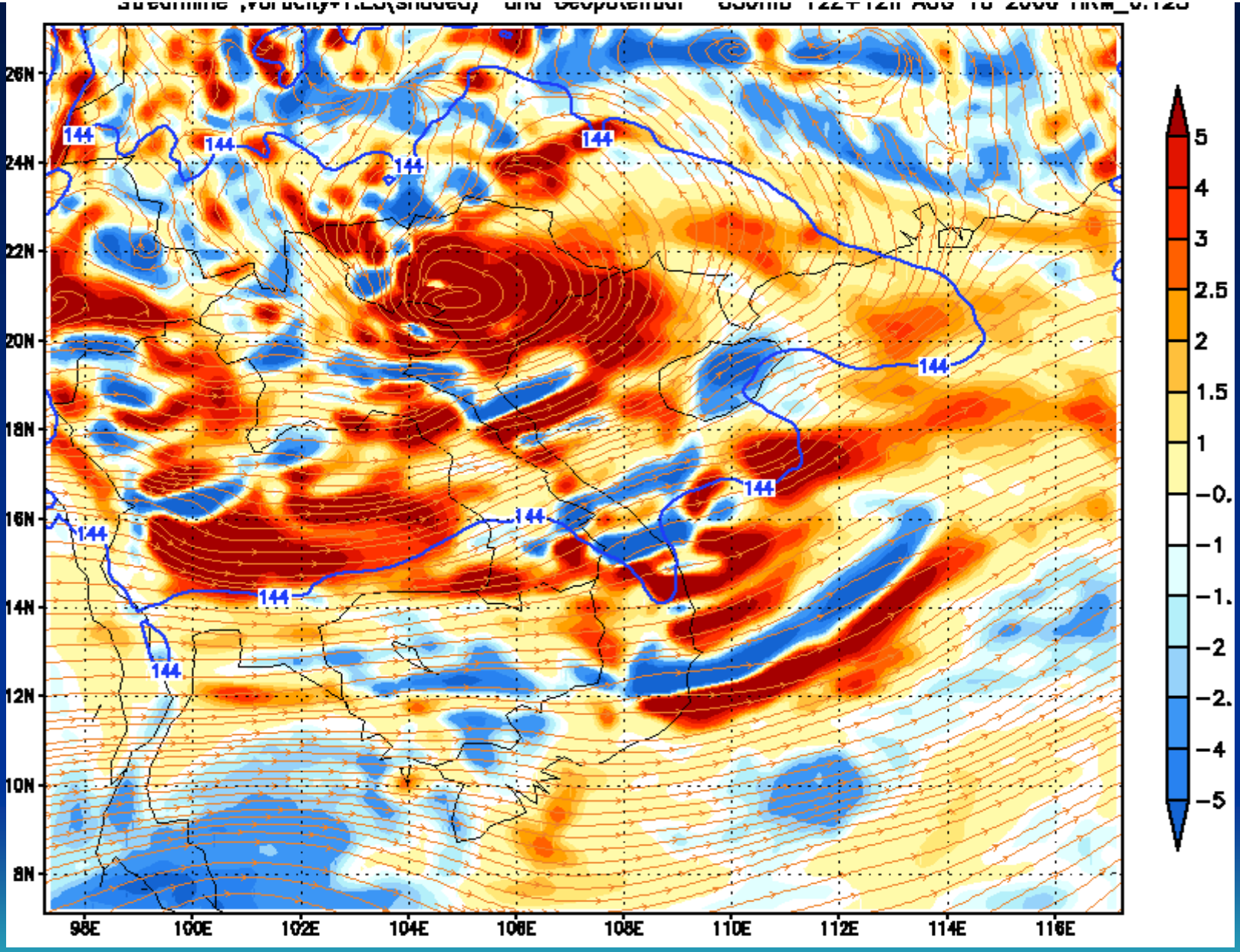



**Fig 5: Streamline and Vorticity (+12h) at 850hPa, Initial data at 12UTC 16 AUG 2006 (from HRM model)**

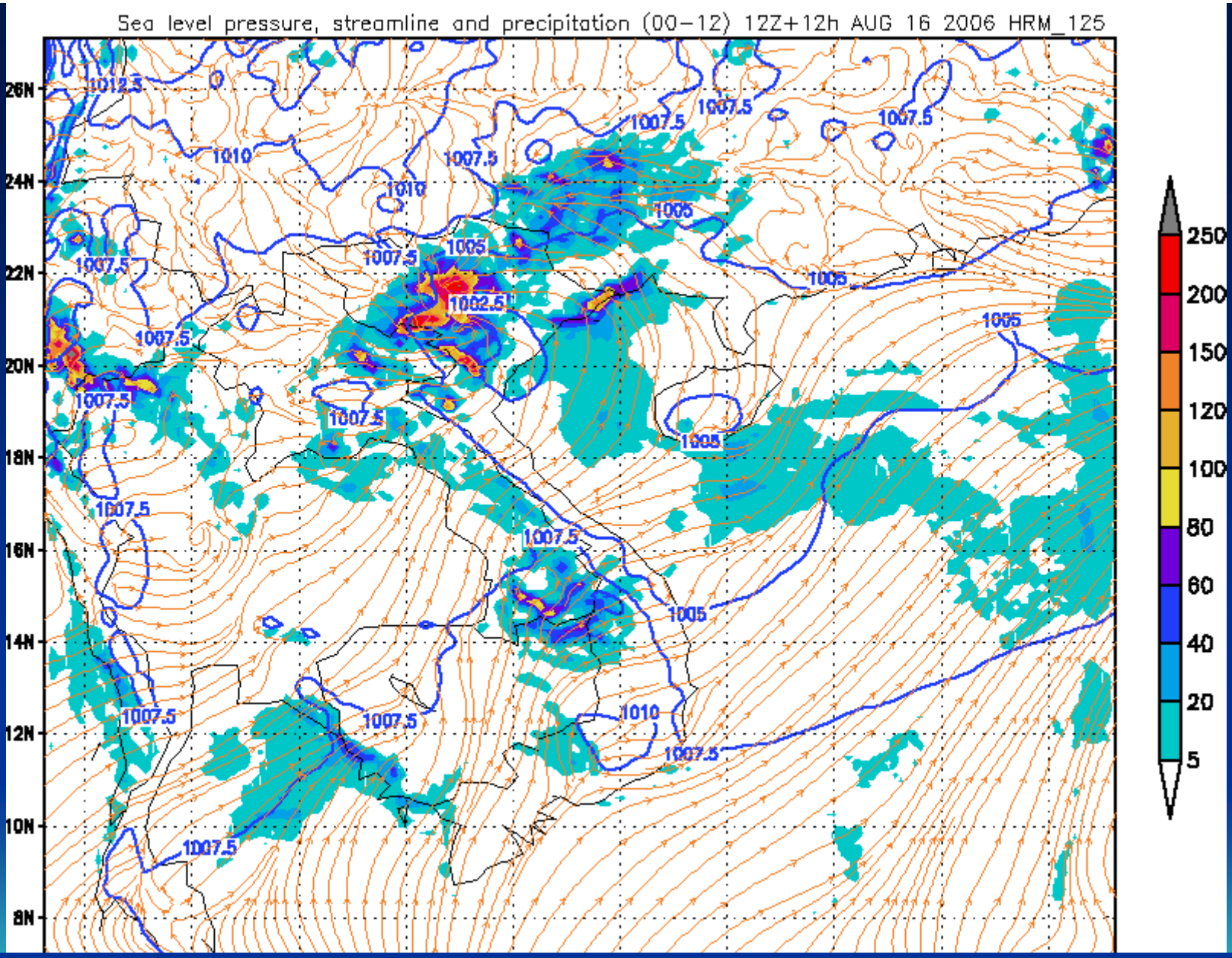



**Fig 6: Accumulated rainfall (+12h). Initial data at 12UTC 16 AUG 2006 (from HRM model)**

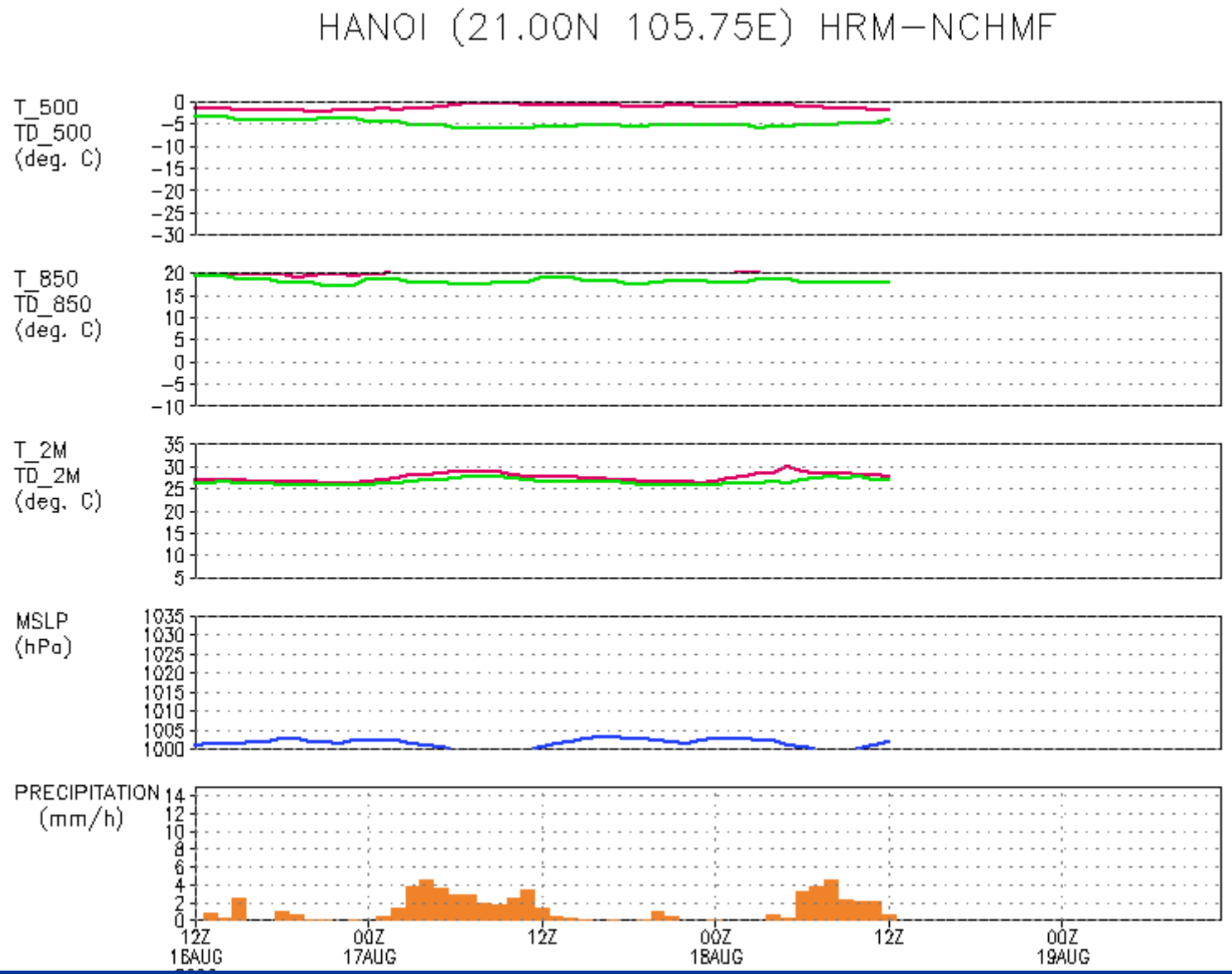



**Fig 7: Height and Time cross section at Hanoi statton**

**From 12UTC 16 Aug to 12UTC 18 Aug 2006**

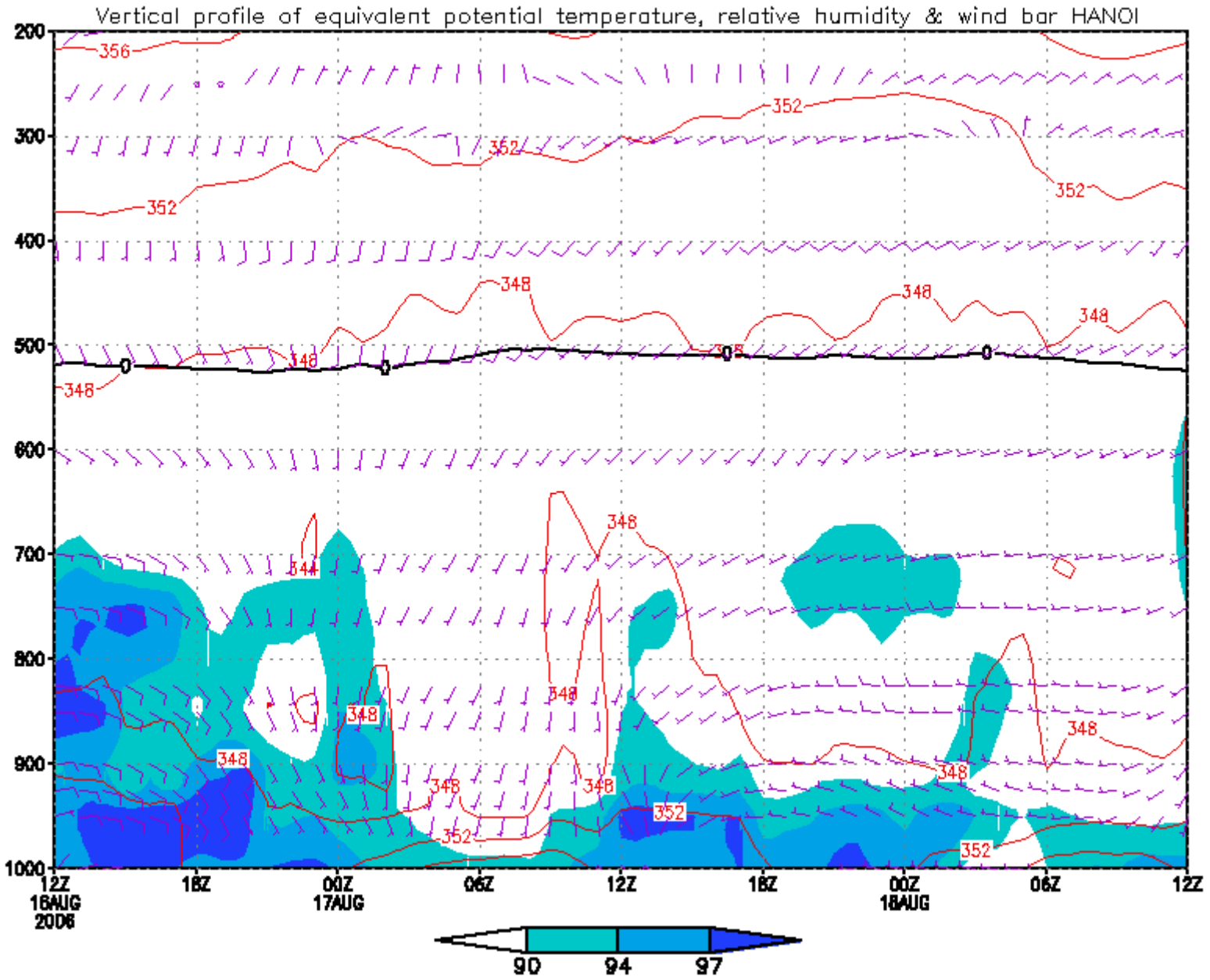



**Fig 8: Vertical profile and Equivalent potential temperature at Hanoi statton Form 12UTC 16 AUG to 12UTC 18 AUG 2006**

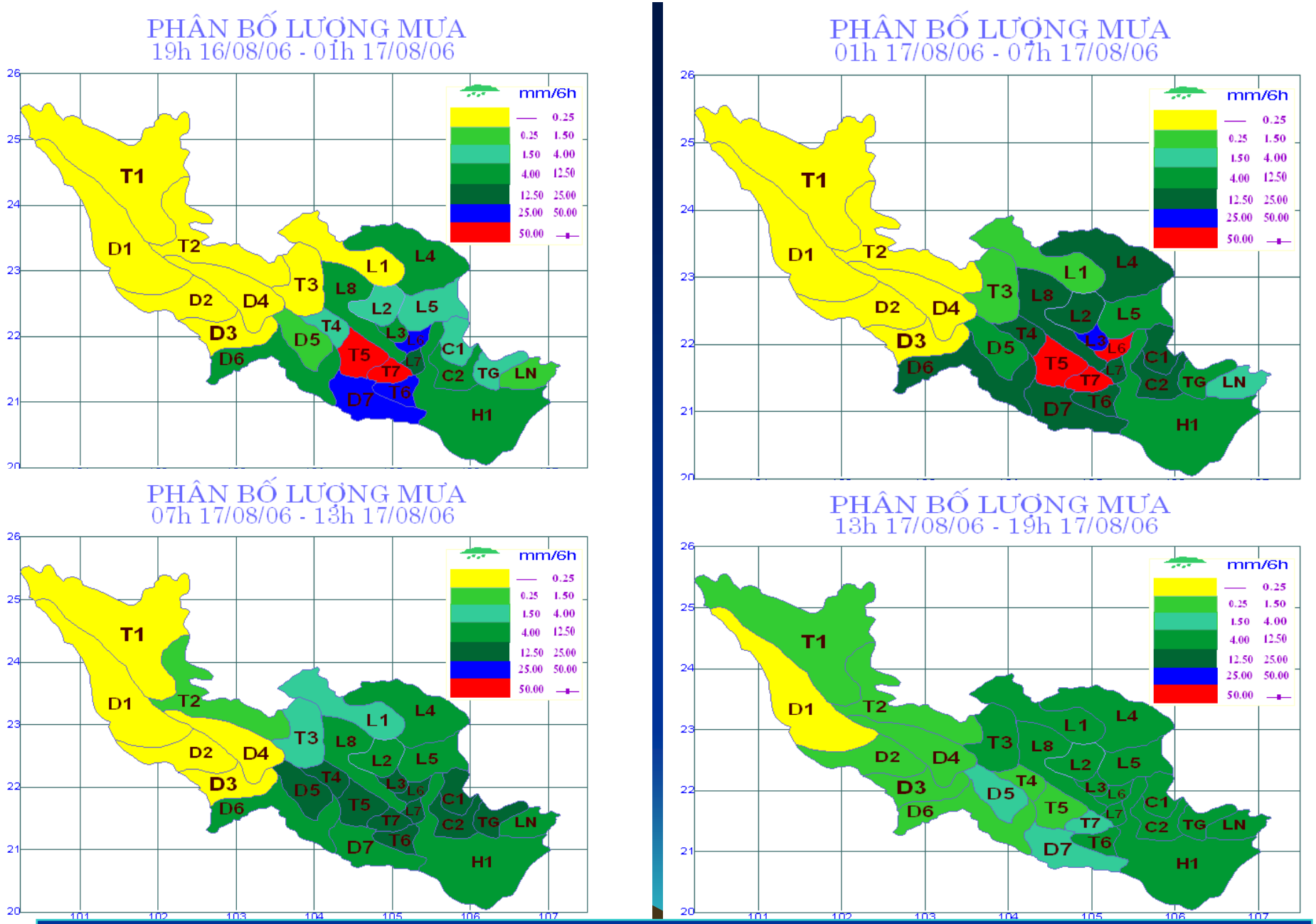



**Fig 9: Accumulated Rainfall forecast (every 6h, initial at 12UTC 16 Aug 2006) for Da, Thao, Lo and Red River basins (00-06,06-12,12-18,18-24)**

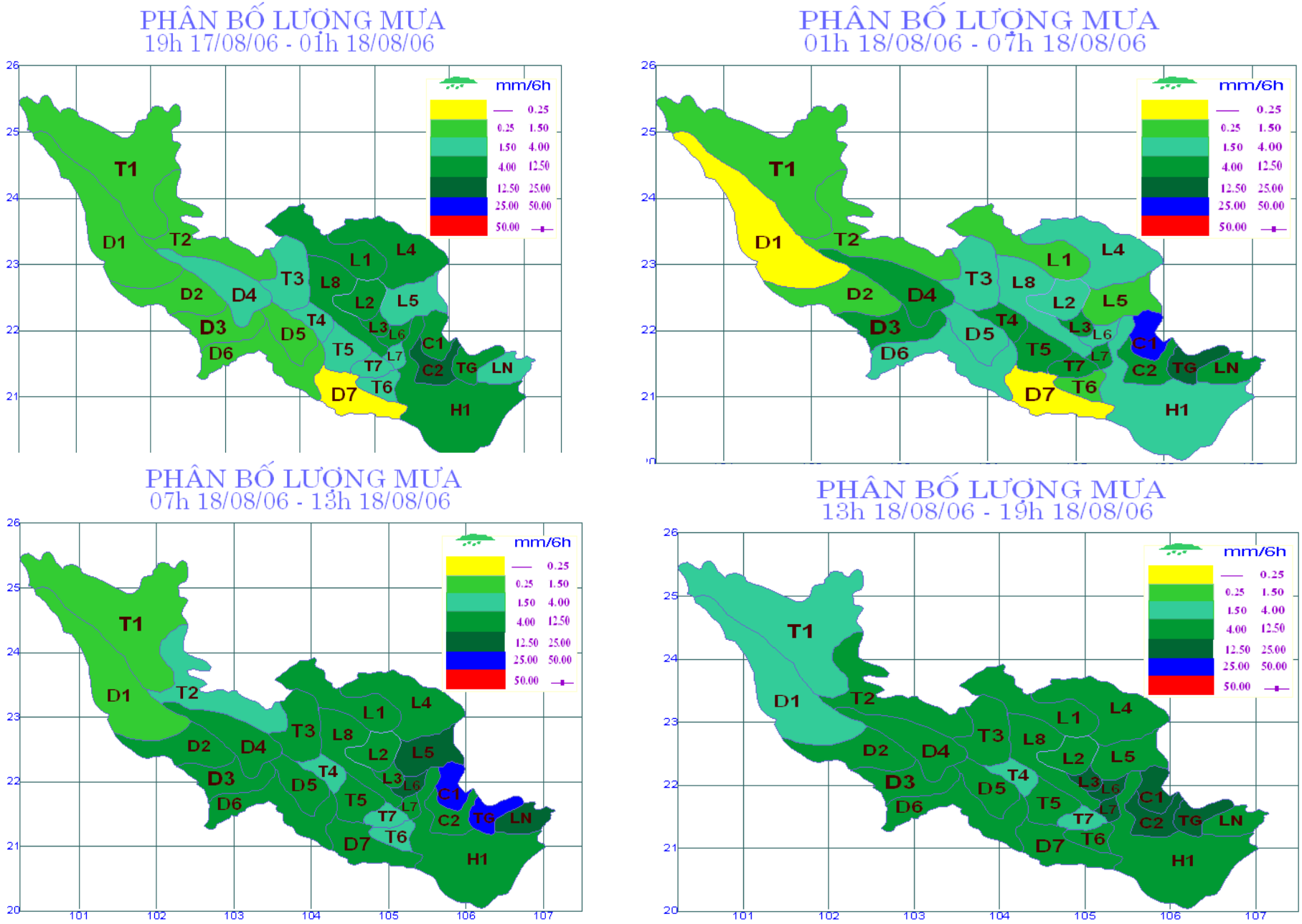



**Fig 10: Accumulated Rainfall forecast (every 6h, initial at 12UTC 16 Aug 2006) for Da, Thao, Lo and Red River basins (24-30,30-36,36-42, 42-48)**

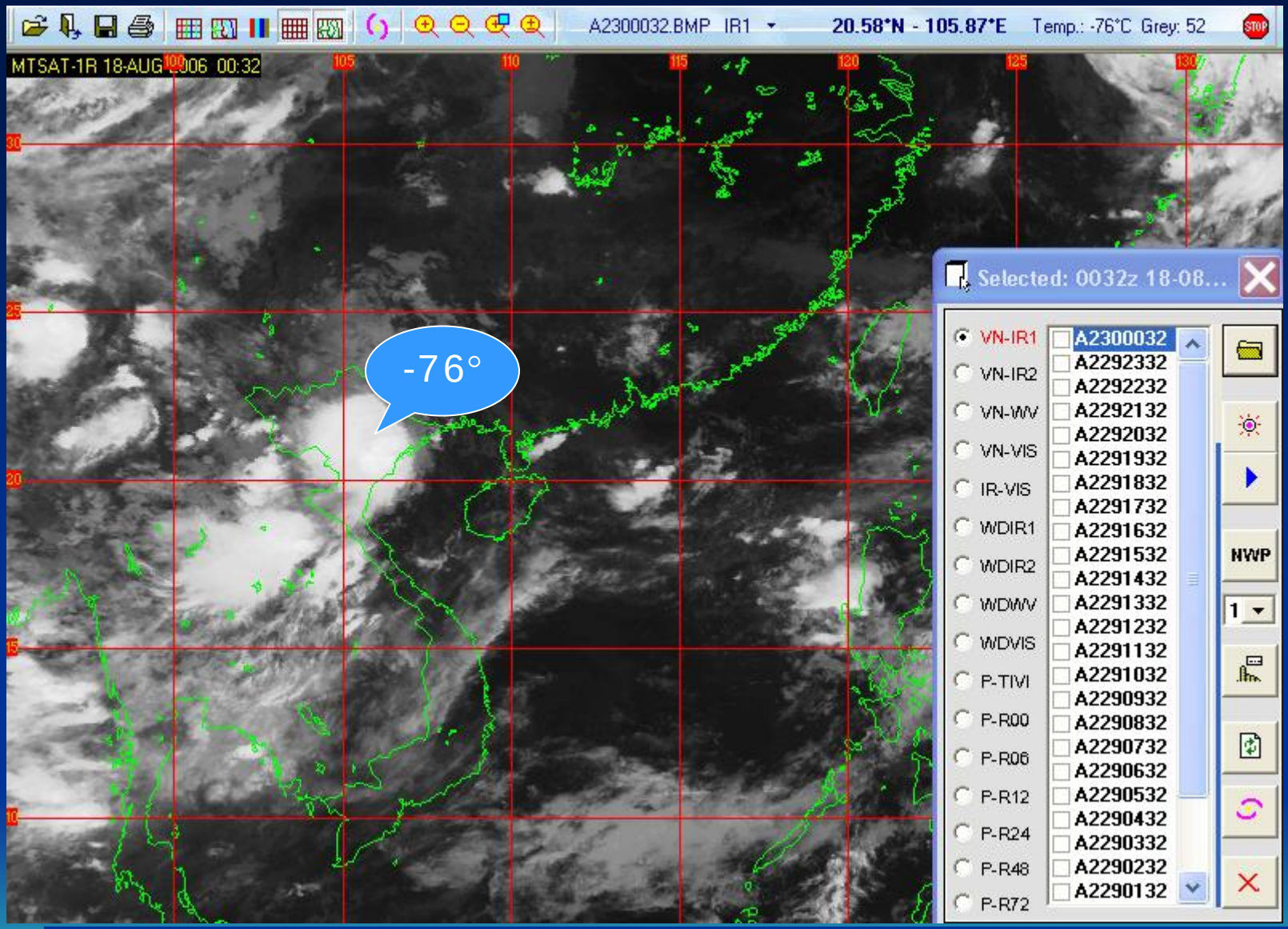



**Fig 11: Cloud picture (IR1) captured from MTSAT**

**at 0030 UTC 18 AUG 2006**

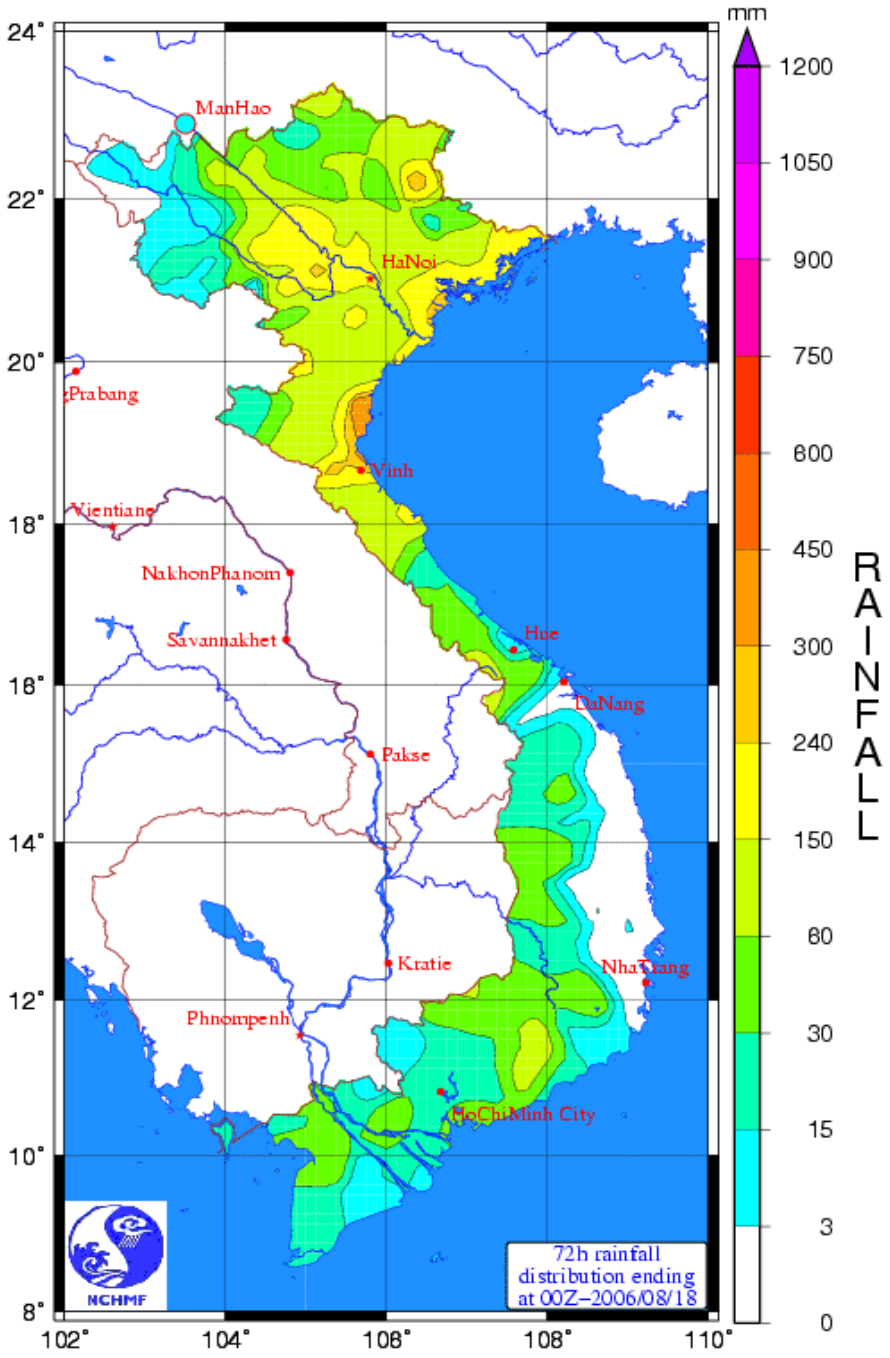



**Fig 12: Rainfall Observation (from 00UTC 15/08 to 00UTC 18/08/06):**

**Cua Ong 171**

**Bai chay 189**

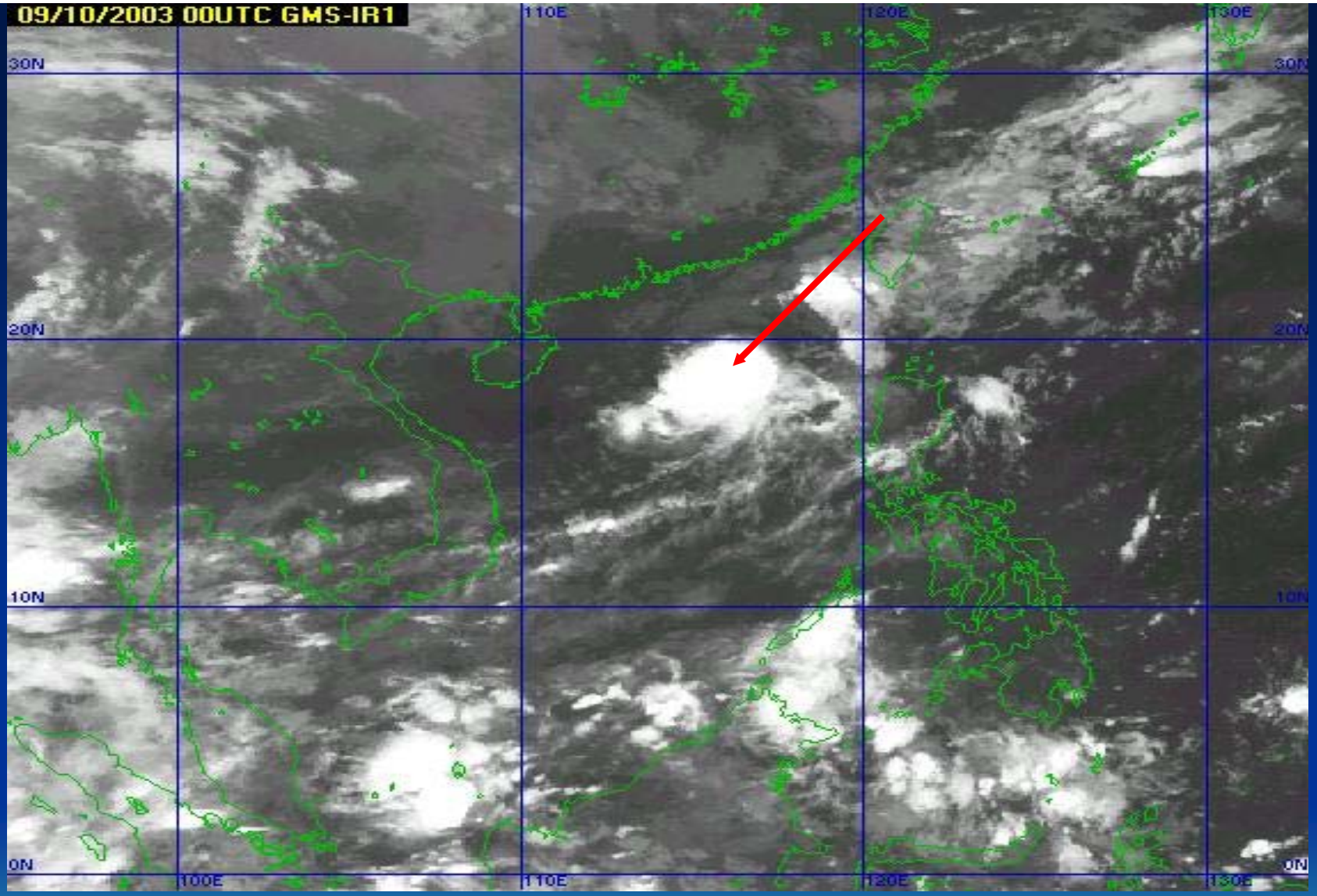
**Ha Noi 132**

**Mong cai : 237**

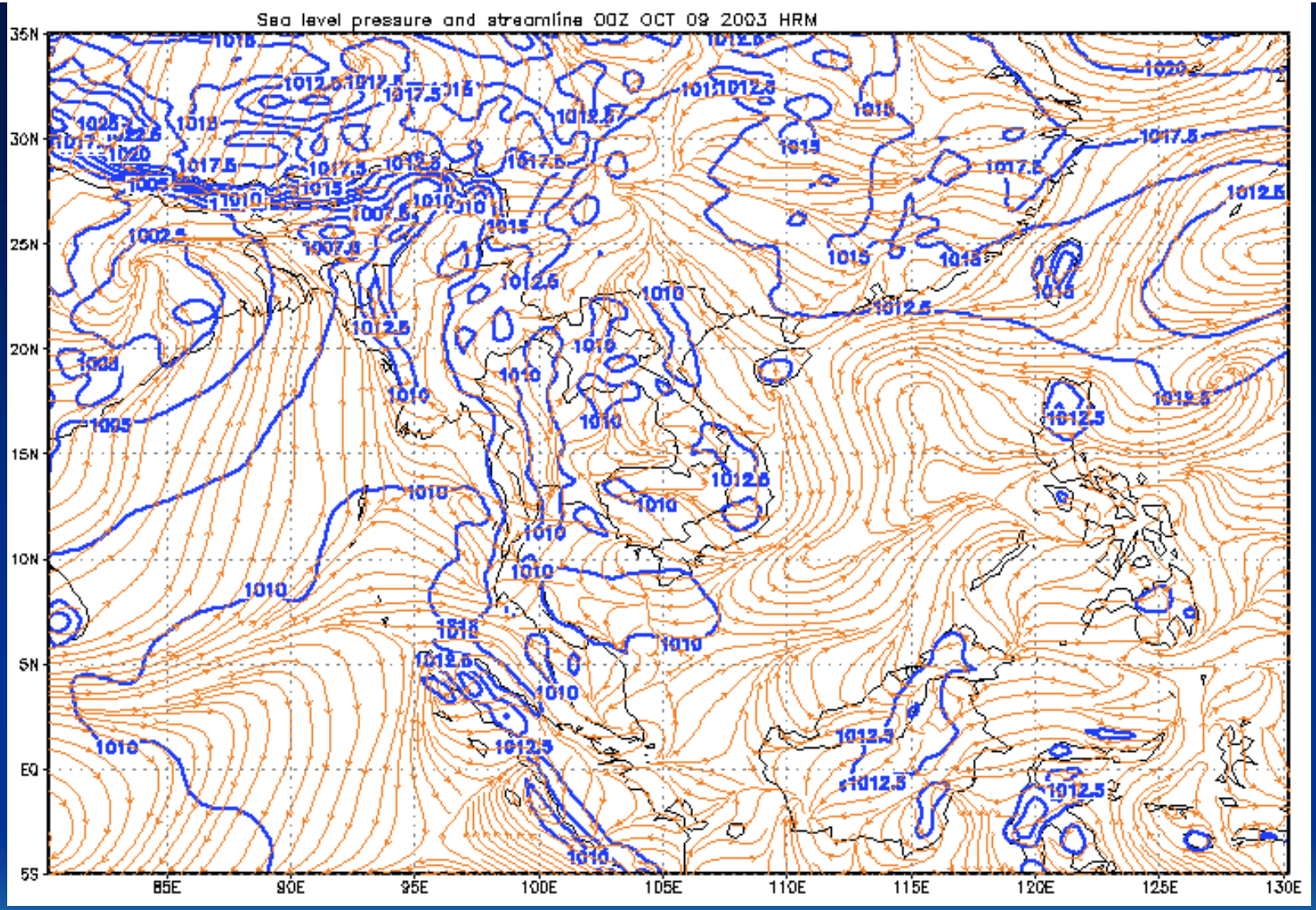
**Yen Bai: 212**

**Son Tay:226**

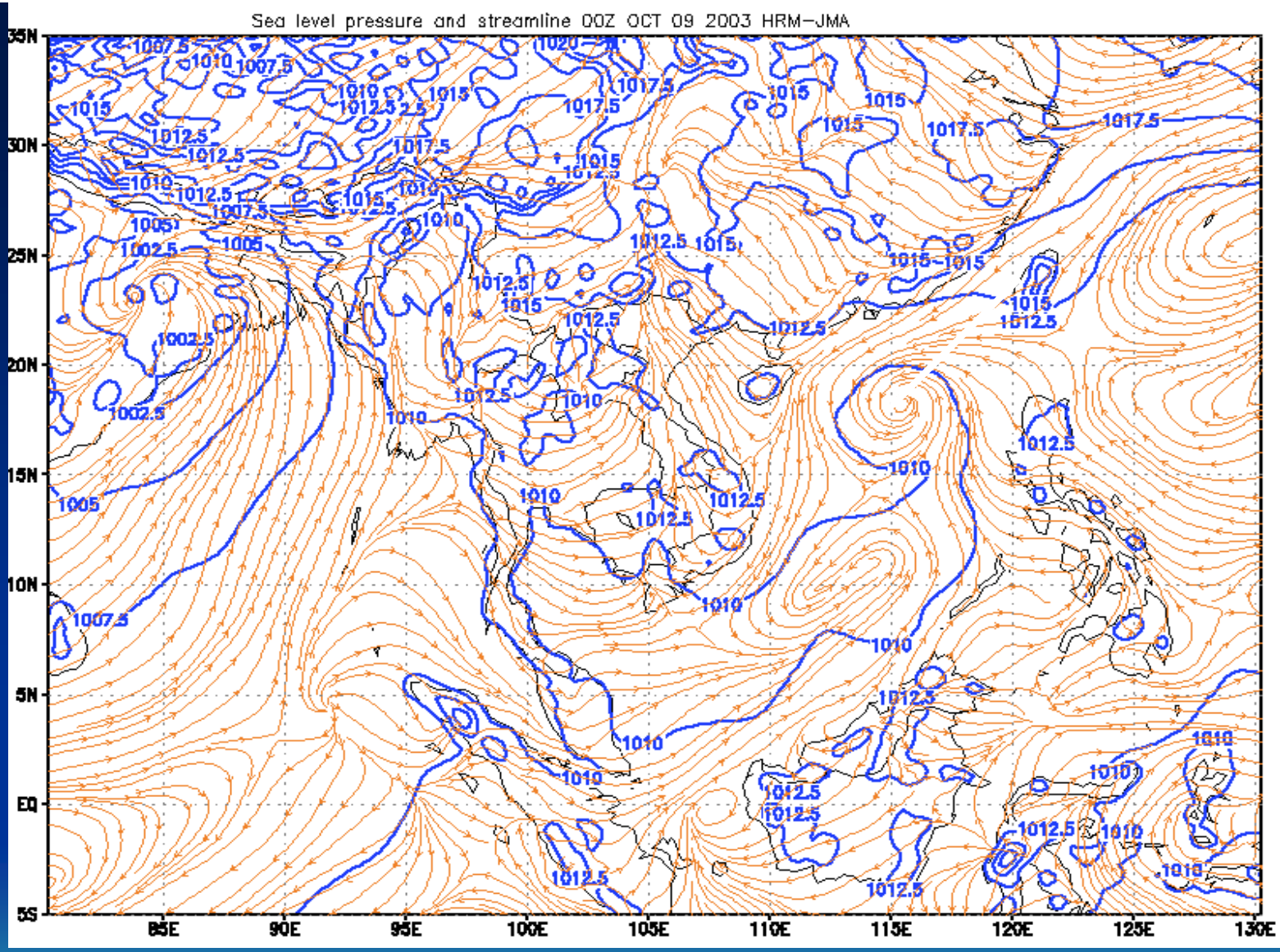
**Thai Binh : 274**



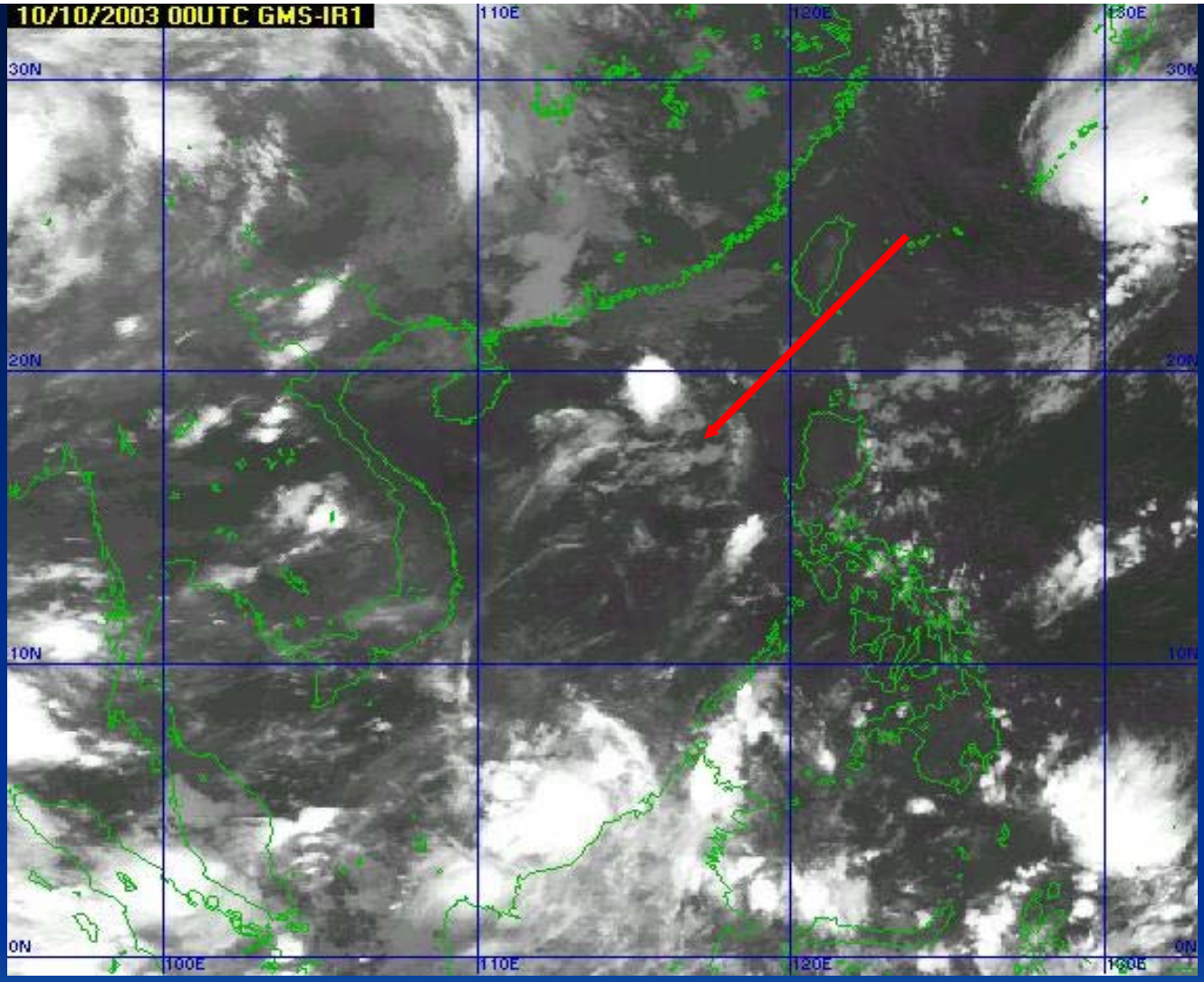

Cloud image IR-1 from GOES-9 at 00UTC 9/10/2003



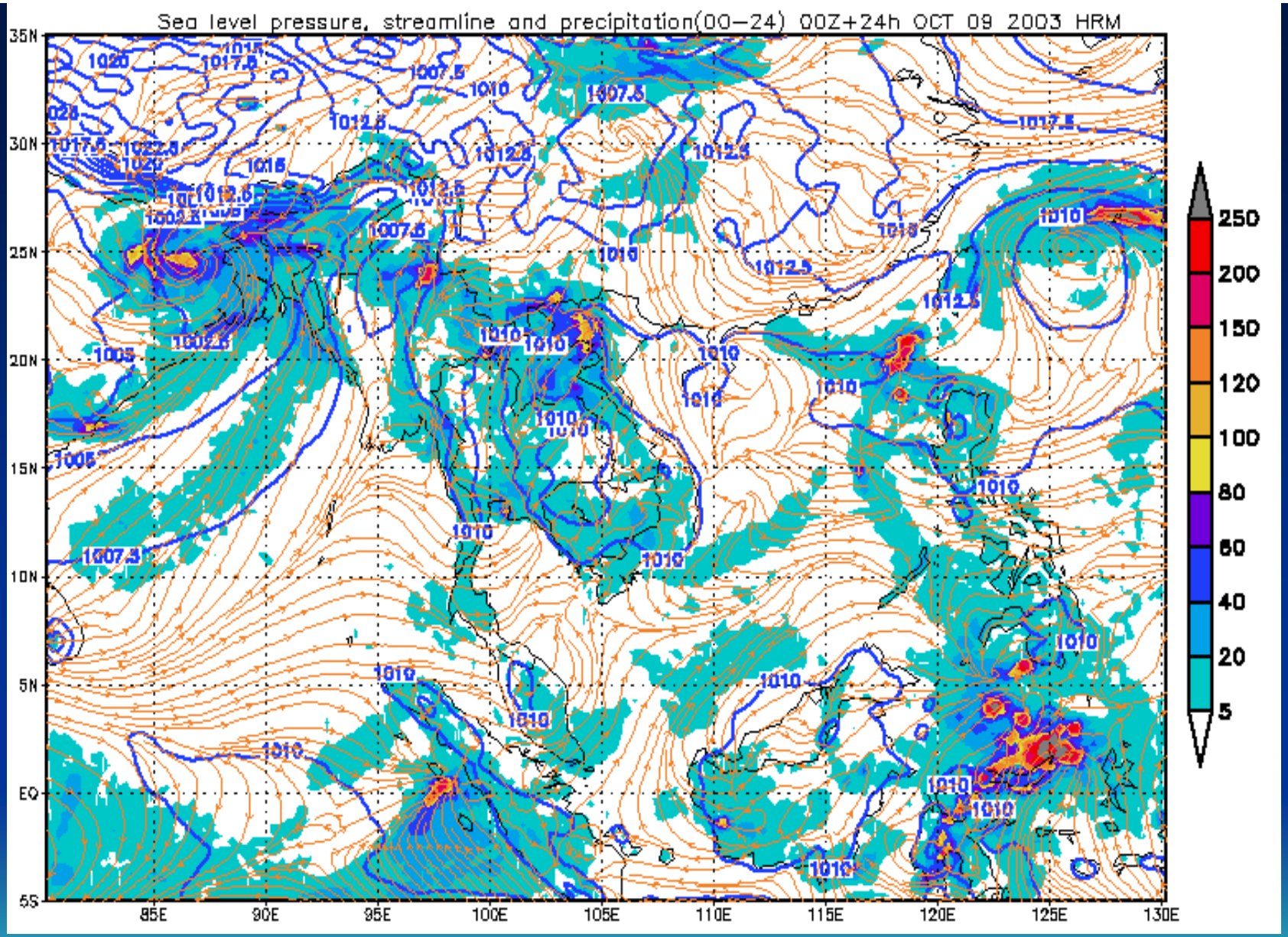

**Surface pressure, streamline (initial data GME) at 00 UTC 9/10/2003**



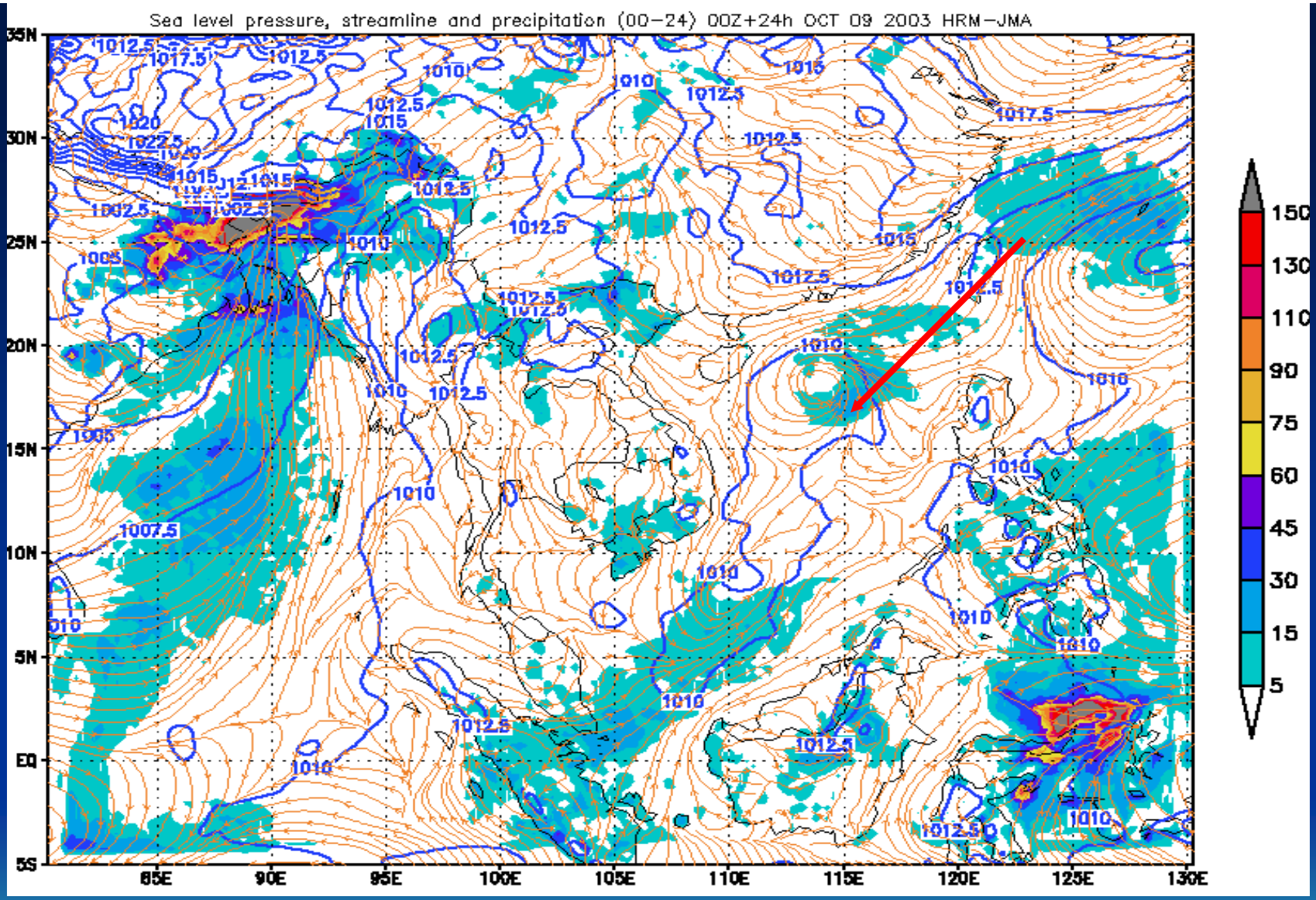

**Surface pressure, streamline (initial data GME+GSM) at 00UTC 9/10/2003**




**Cloud image IR-1 from GOES-9 at 00UTC 10/10/2003**




**Surface pressure, streamline and accumulated rainfall +24h (initial data GME) at 00 UTC 9/10/2003**

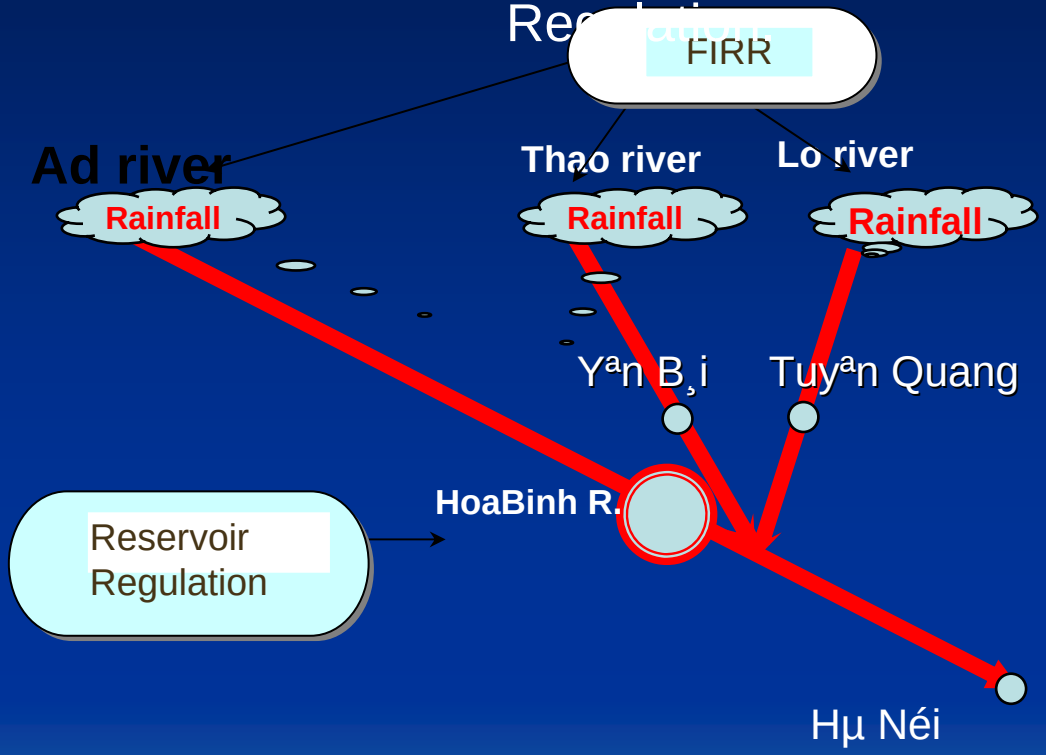



**Surface pressure, streamline and accumulated rainfall +24h (initial data GME+GSM) at 00 UTC 9/10/2003**

# 3.2. Hydrological Forecast

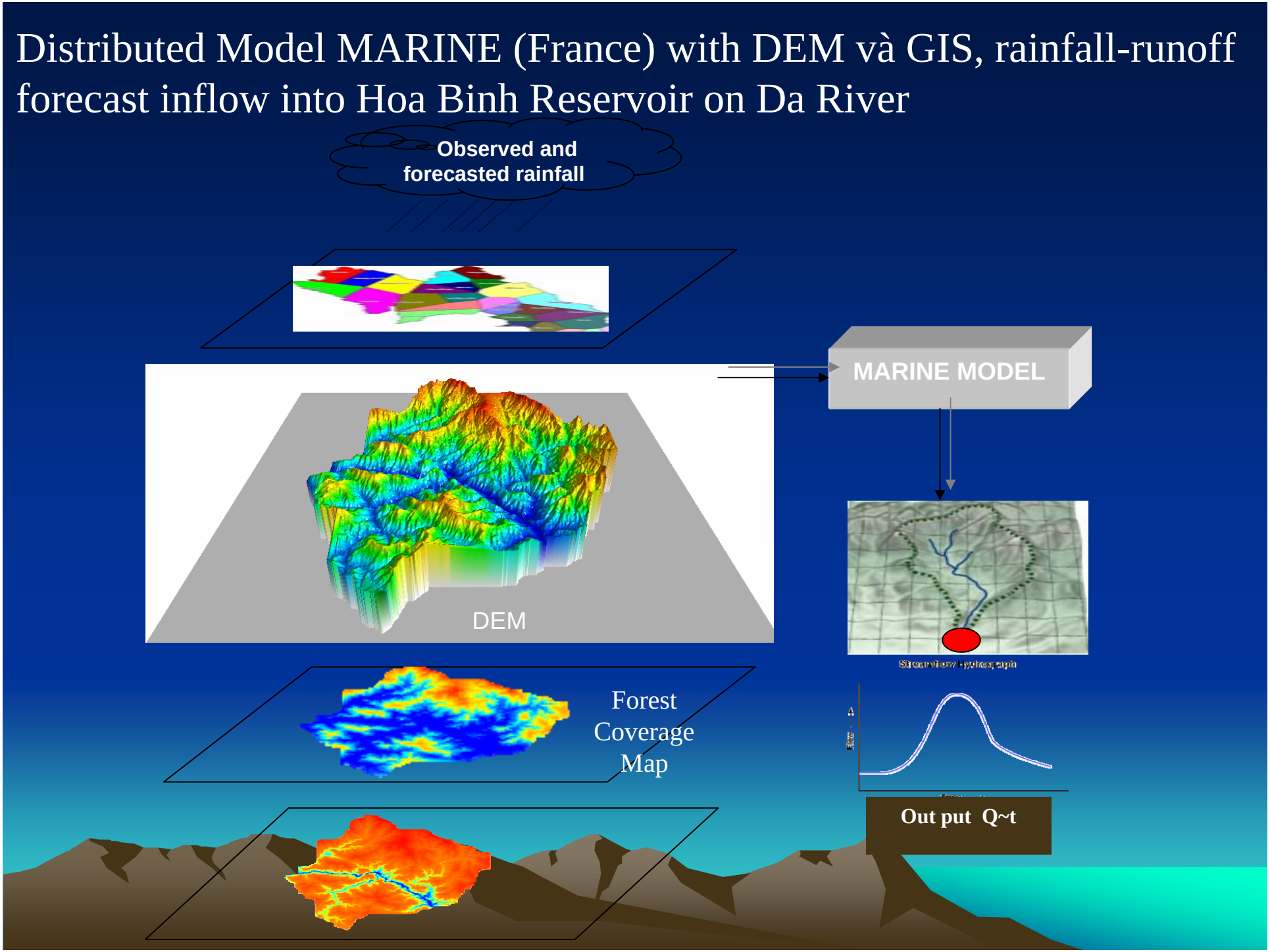
**Hydrologic Model FIRR using 4 combined methods:**

Unit Hydrograph, Duhamel Integral, Kinematic Wave vµ Reservoir Regulation

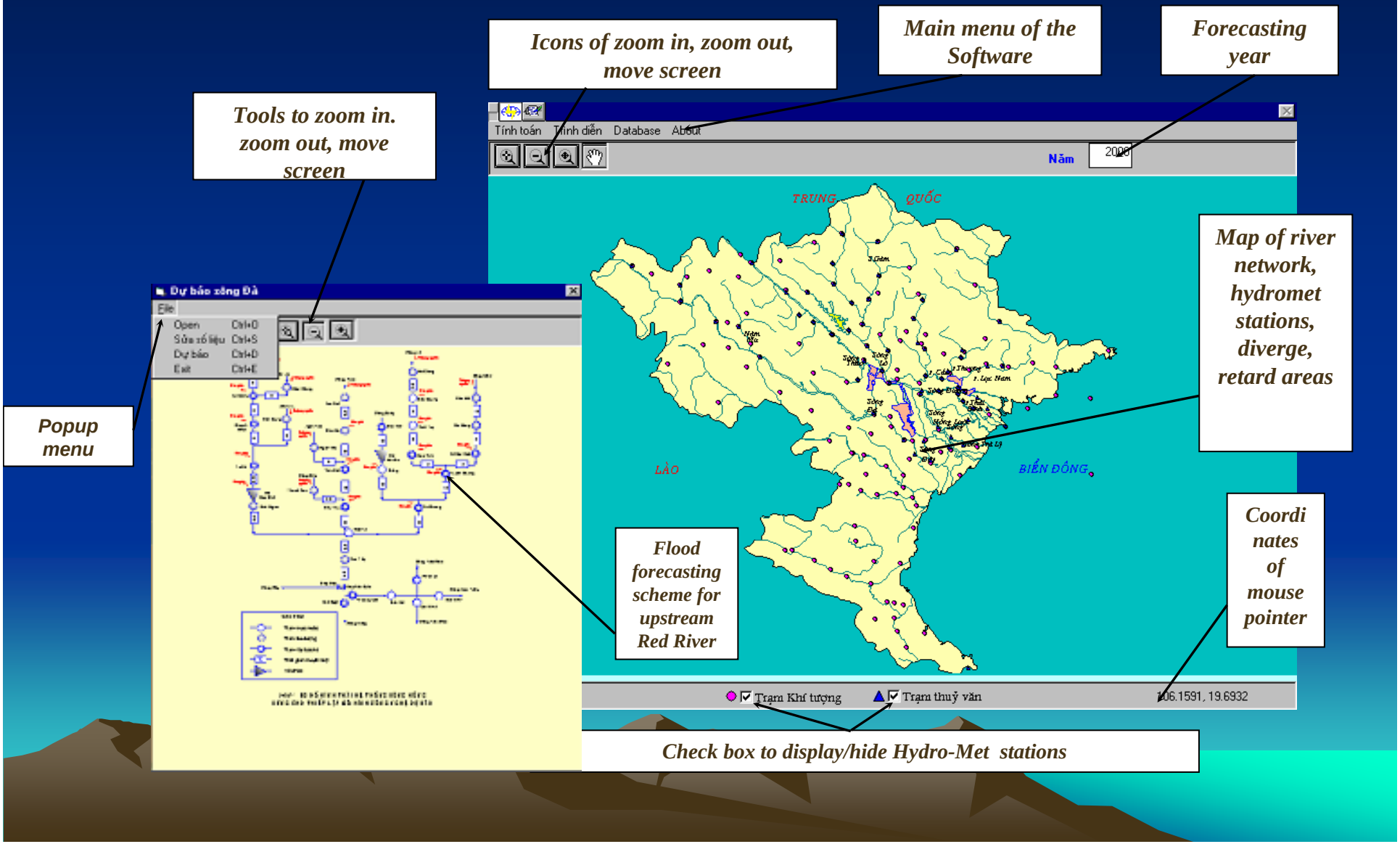



Inflow forecast into Hoa Binh Reservoir on Da River; flow at YenBai on Thao River, at TuyenQuang on Lo River and HoaBinh reservoir regulation.

# Distributed Model MARINE (France) with DEM và GIS, rainfall-runoff forecast inflow into Hoa Binh Reservoir on Da River



# Short-term flood forecasting software for the Red River system with lead time 6 – 48hours; using rainfall-runoff, related water level/discharges methods, SSARR model and step multi-regression



# 4. The application of CTS model to forecast storm surge in Vietnam Coastal Zone

-Used of CTS model to simulate the storm surge to every storm hit to Vietnam Coastal from 2000 to now.

- Some results of storm surge forecasts for 4 storms: Kaemi (8/2000), Wukong (9/2000), Vicente (6/2005) and Jelawat (6/2006).

**Table 1: The calculated storm surge at locations (KAEMI)**

| Province | Location | Hanoi Time (Hr/D/M/Y) | Storm surge (cm) |
|---|---|---|---|
| Ha Tinh | Cua Sot | 18/22/08/2000 | 74 |
| | Cua Nhuong | 15/22/082000 | 74 |
| Quang Binh | Cua Ron | 17/22/08/2000 | 68 |
| | Cua Gianh | 18/22/08/2000 | 70 |
| | Nhat Le | 18/22/08/2000 | 69 |

## Table 2: Comparison of calculated and observed maximum storm surge value of Typhoon KAEMI, 2000

| Location | Observed (cm) | Calculated (cm) | Error | |
|---|---|---|---|---|
| | | | Δcm | δ% |
| Cua Ron | 64 | 68 | 4 | 6 |
| Nhat Le | 71 | 69 | -2 | 3 |
| Cua Viet | 75 | 69 | -6 | 9 |
| Mean | | | $\|\Delta\| = 4$ cm | $\delta$ 6 % |

The calculated and observed storm surge is show in figures 3, 4 and in tables 2, 3 and 4. The development of the water elevation at Hondau station during storm surge is show in figure 5.

## Table 3: Comparison of calculated and observed storm surge of Typhoon Wukoong, 2000

| Location | Observed (cm) | Calculated (cm) | Error | |
|---|---|---|---|---|
| | | | Δcm | δ% |
| Cua Hoi | 124 | 146 | 22 | 15 |
| Cua Sot | 132 | 128 | -4 | 3 |
| Vung Ang | 81 | 83 | 2 | 2 |
| Cua Nhuong | 139 | 101 | -38 | 38 |
| Mean | | | \|Δ\| = 17 cm | δ= 15% |

## Table 4: Comparison of calculated and observed maximum storm surge value of Typhoon VICENTE, 2005

| Location | Observed (cm) | Calculated (cm) | Error | |
|---|---|---|---|---|
| | | | Δcm | δ% |
| Hon Dau | 100 | 111 | 11 | 10 |
| Ba Lat | 132 | 118 | -14 | 12 |
| Cua Hoi | 135 | 145 | 10 | 7 |
| Lach Quen | 138 | 164 | 26 | 17 |
| Cua Lo | 132 | 166 | 34 | 20 |
| Mean | | | \|Δ\| = 19 cm | δ= 13% |

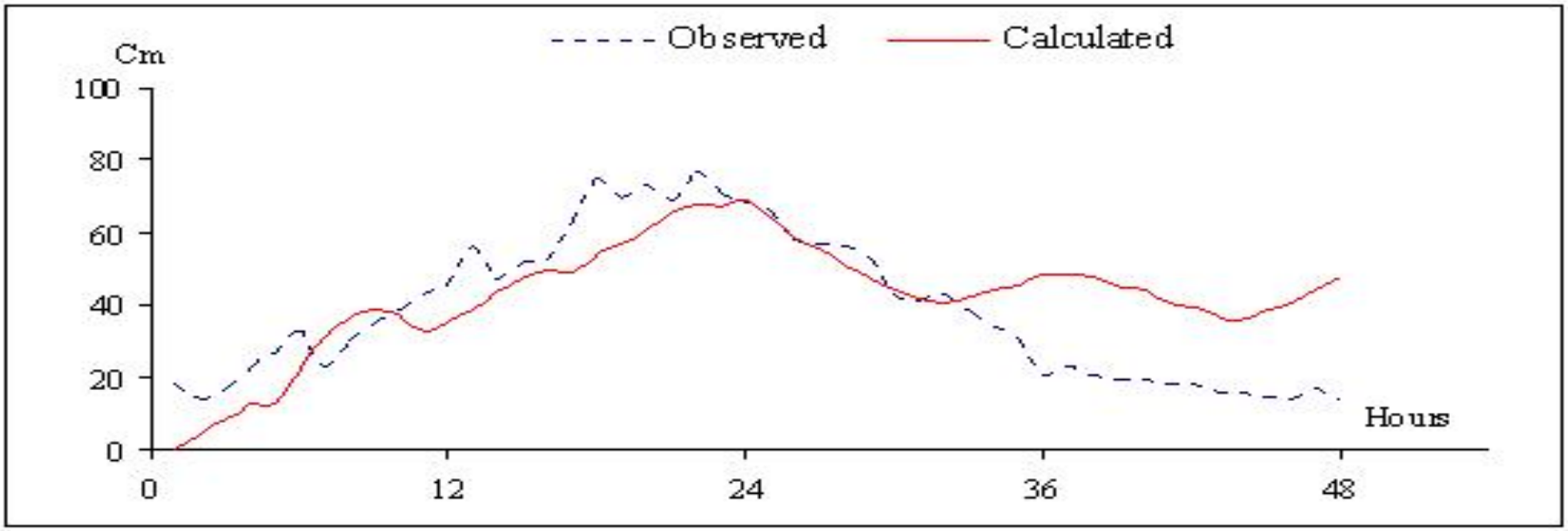



Figure 3: The water elevation at CuaViet Station during typhoon KAEMI

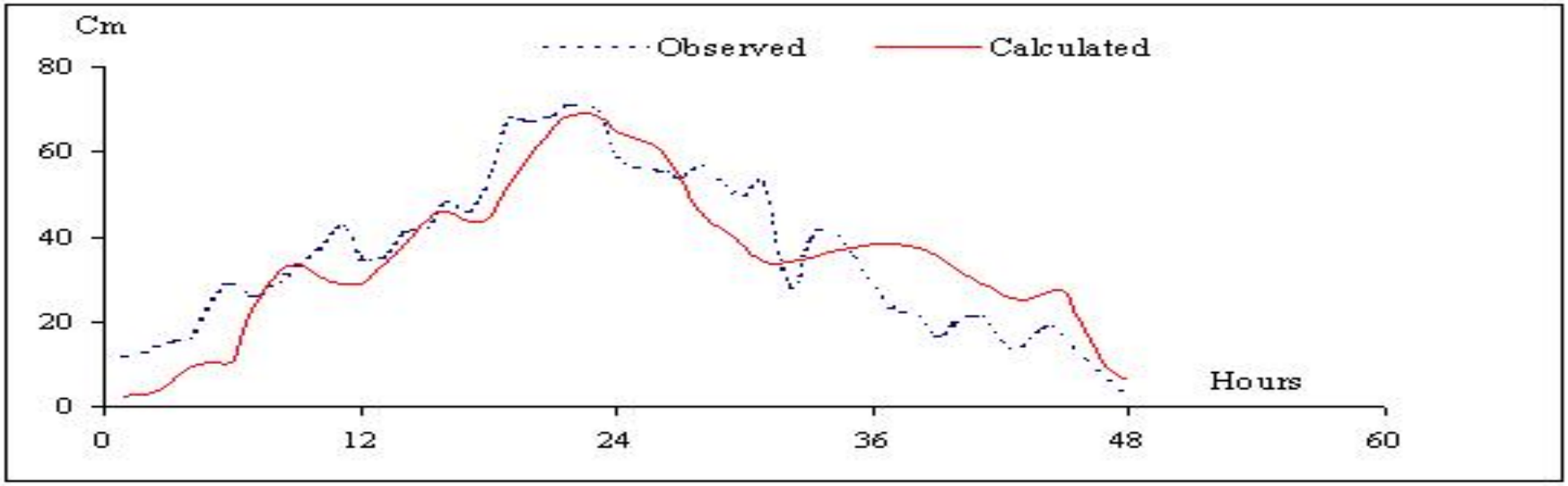



Figure 4: The water elevation at NhatLe Station during typhoon KAEMI

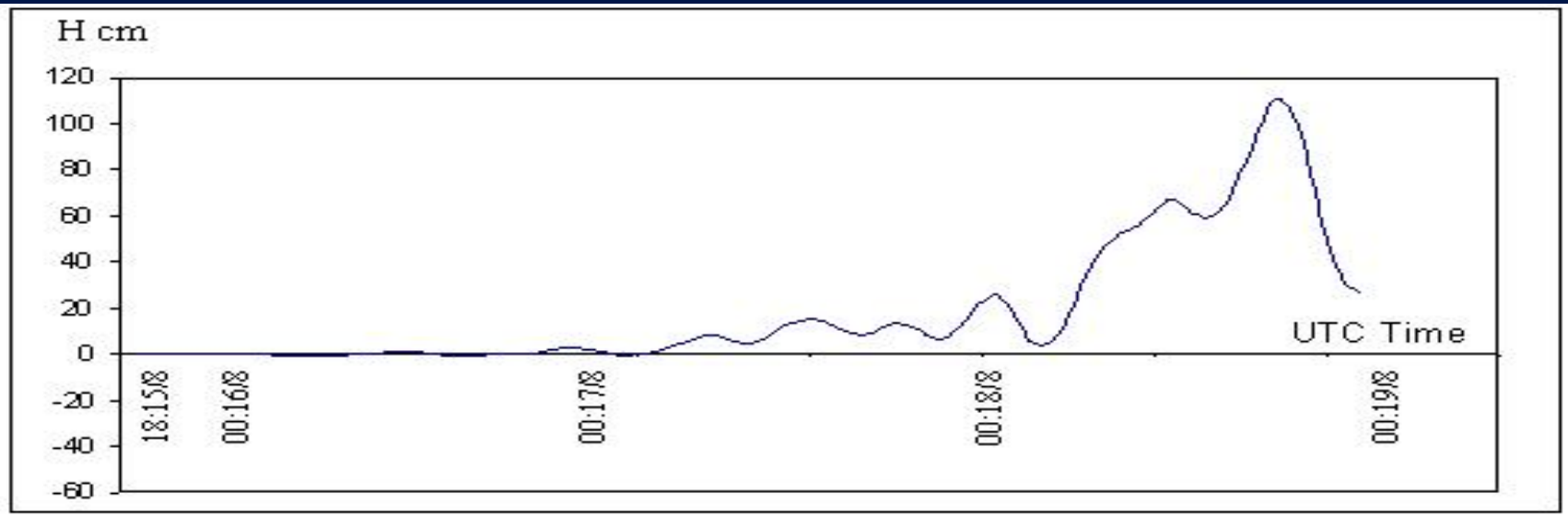



Figure 5: Calculated storm surge elevation at Hondau station during typhoon VICENTE

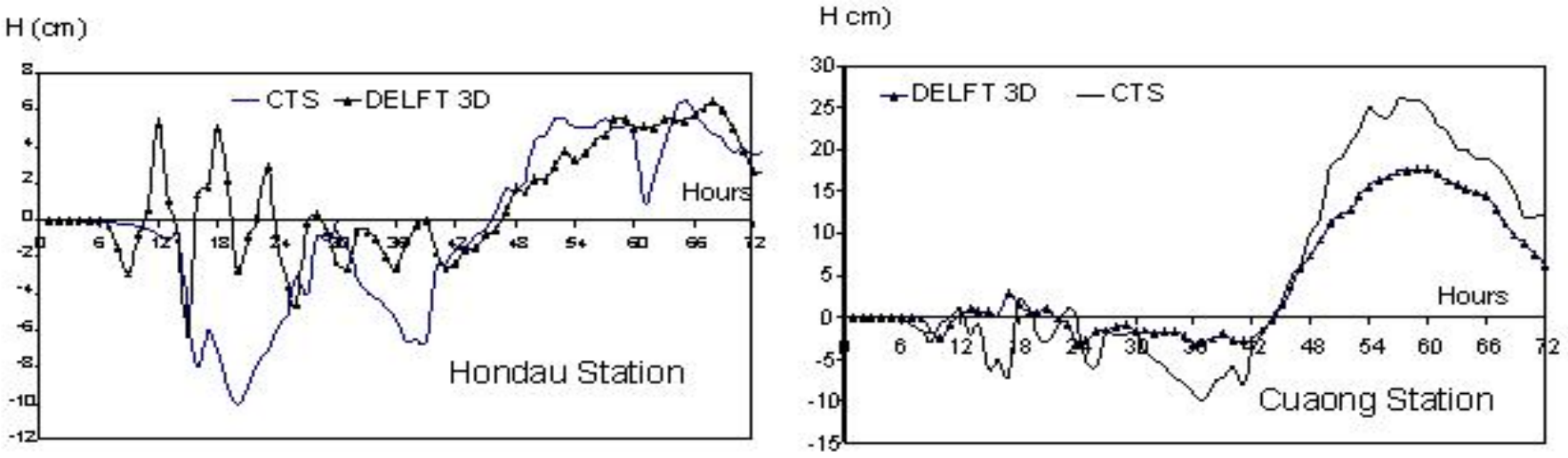



Figure 6: The water elevation at Hondau and Cuaong station during typhoon JELAWAT

# 5. Contribution to AMY

- Participate the IOP:
  - Synoptic 8obs/day surface stations
  - 6 weather radar stations: hourly observation
  - Upper – air radiosounding stations: 2obs/day
  - 8 PILOT stations: 1 obs/day
  - Research vessel: 2 campaigns/year
  - Daily output of the operational forecasting HRM

# 6. Collaboration in MAHASRI

1. Implementation of the technical transfer models, the software for the remote sensing data processing.
2. Data assimilation.
3. To improve the operational numerical models in NHMS of Vietnam
4. To improve HM forecasts, especially the forecasts of weather disturbances, particularly heavy rainfall events.
5. Capacity building

***Thank you very much for your attention!***