

# Synoptic patterns causing heavy rain in the first period of summer monsoon in the North Viet Nam

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# Main content

1. The large heavy rain spells in the North
2. Synoptic patterns causing heavy rain in the first period of SM in the North VN
3. Contribution of synoptic patterns for heavy rainfall processes in the beginning of SM in the North Vietnam

# 1. The large heavy rain spells in the North

## + The large heavy rain convention:

Days with more than one – third meteorological stations in the area with faire, heavy and very heavy rainfall follow the criterion:

*Faire rain:*  $25 \leq R \leq 50\text{mm}/24\text{h}$ ;

*Heavy rain:*  $50 \leq R \leq 100\text{mm}/24\text{h}$ ;

*Very heavy rain:*  $R > 100\text{mm}/24\text{h}$

**+ *Domain and Time scope:***

The north (From Thanh Hoa province northwards): including the regions with relative homogeneous about rainfall conditions.

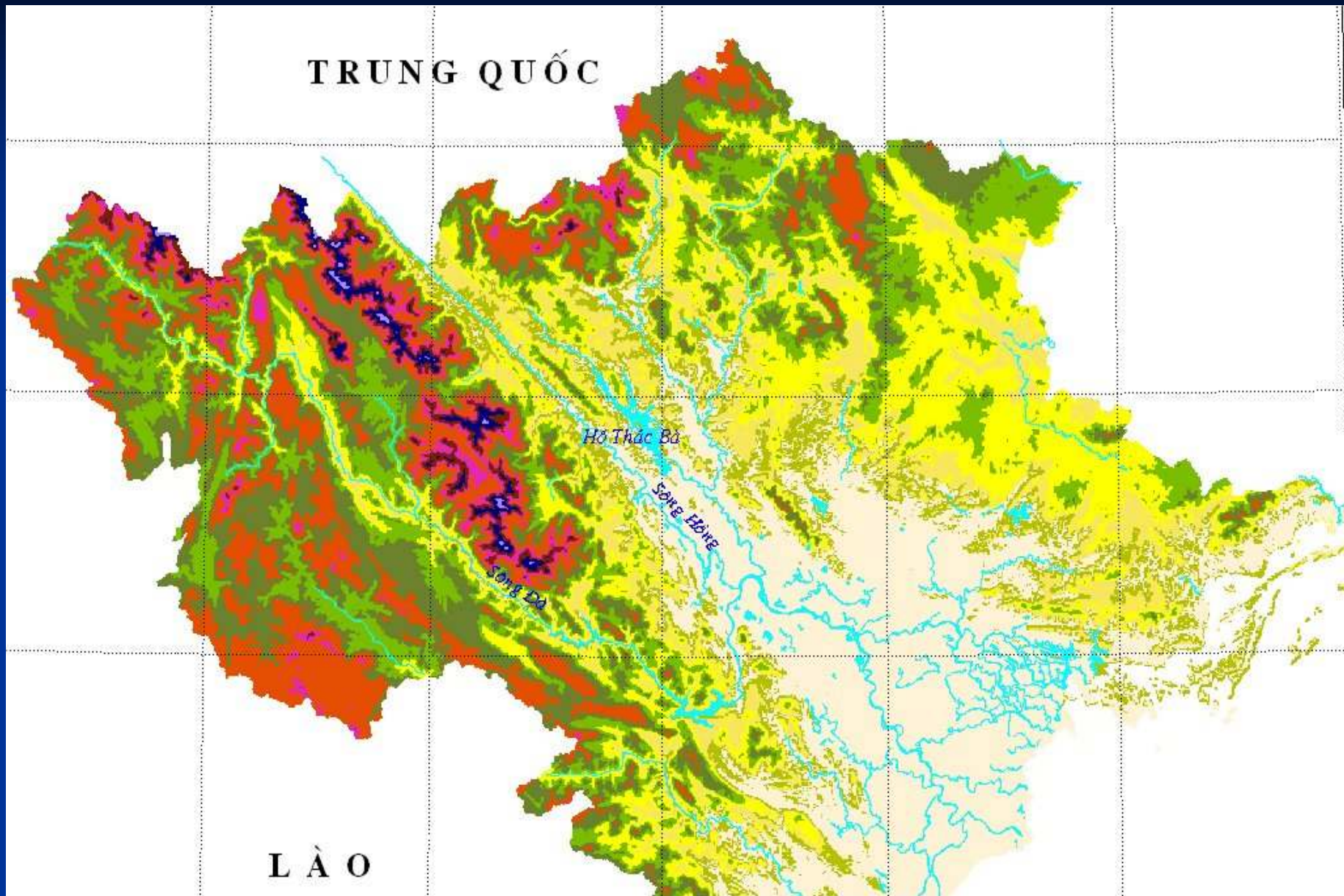
**The Northwest:** including Lai Chau, Son La provinces, a west part Hoang Lien Son mountain chain which belong to Lao Cai and Yen Bai provinces.

**The Middle:** Including Ha Giang, Tuyen Quang, Cao Bang, Lang Son, Bac Can provinces, and the maiming part of Lao Cai, Yen Bai which is in the east of Hoang Lien Son mountain chain.

**The North East:** Including Quang Ninh, Hai Phong, Bac Giang, Bac Ninh provinces.

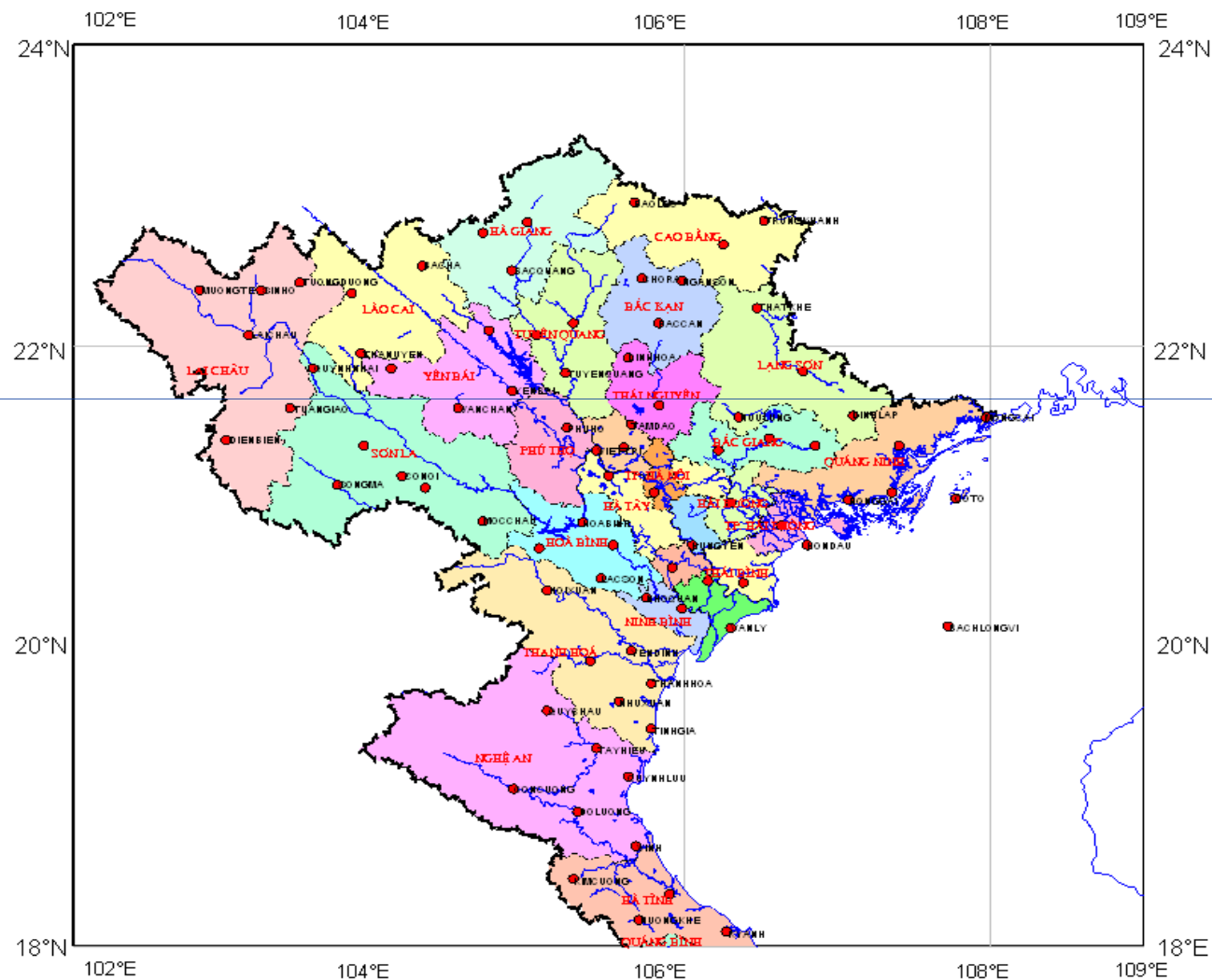
**The North Delta:** Including Ha Noi, Hung Yen, Hai Duong, Thai Binh, Nam Định, Ninh Binh, Thanh Hoa, Ha Nam, Hoa Binh, Vinh Phuc và Phu Tho provinces.

TRUNG QUỐC



LÀO

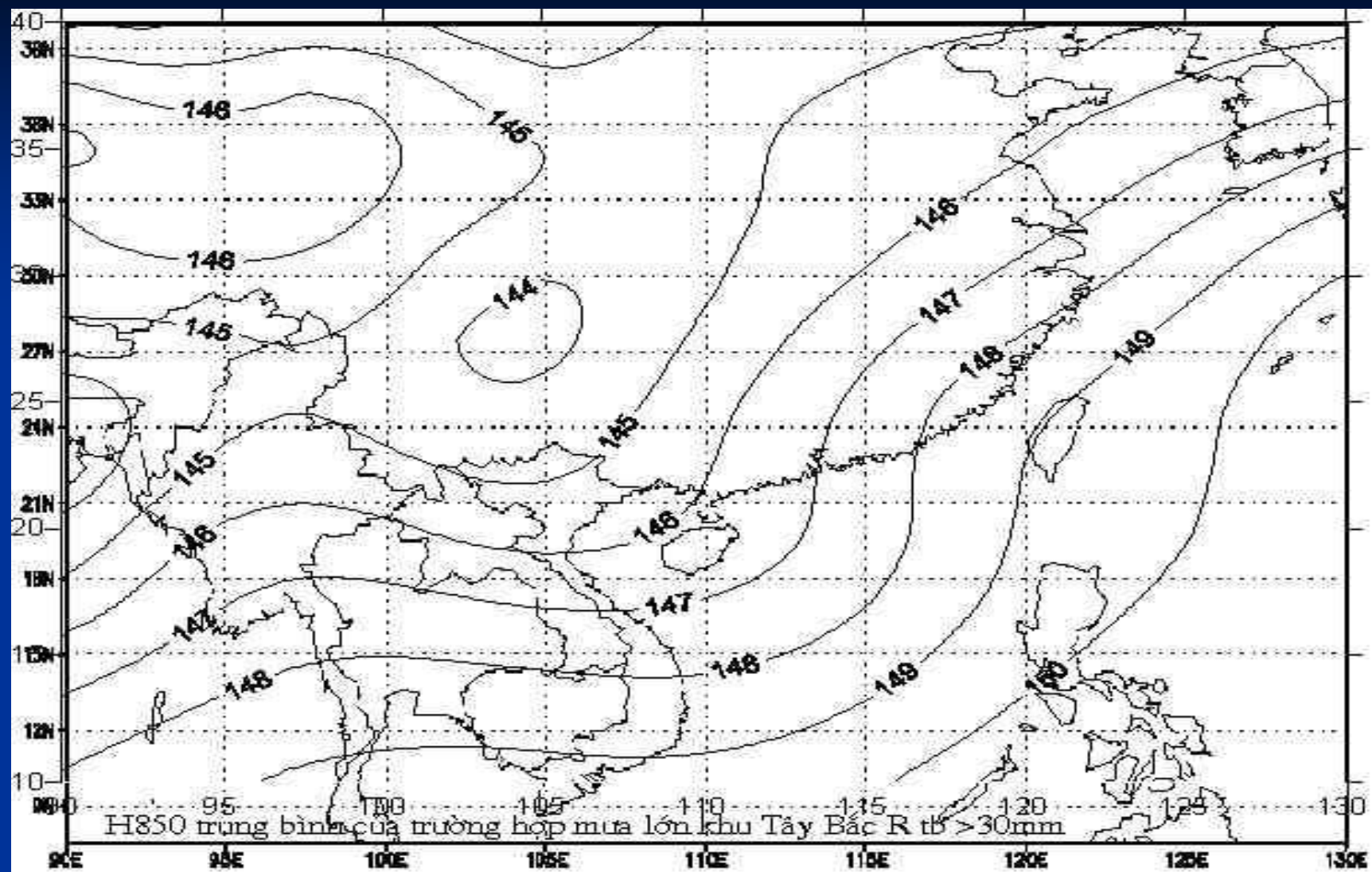
# Fig. 1. Meteorological Station network



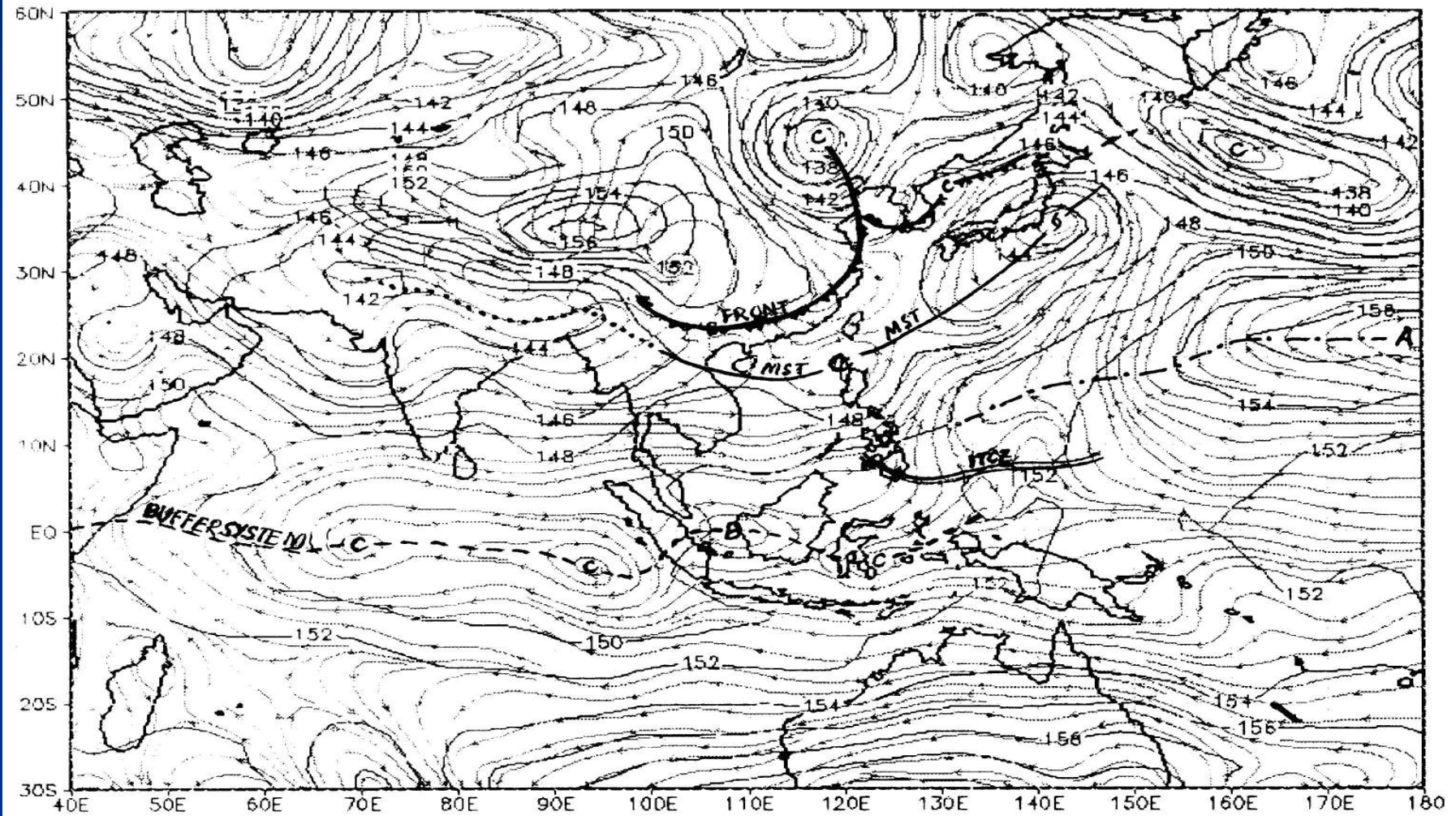
## 2. Synoptic patterns causing heavy rain in the first period of SM in the North VN

### *2.1 A cold front and its combination with other patterns*

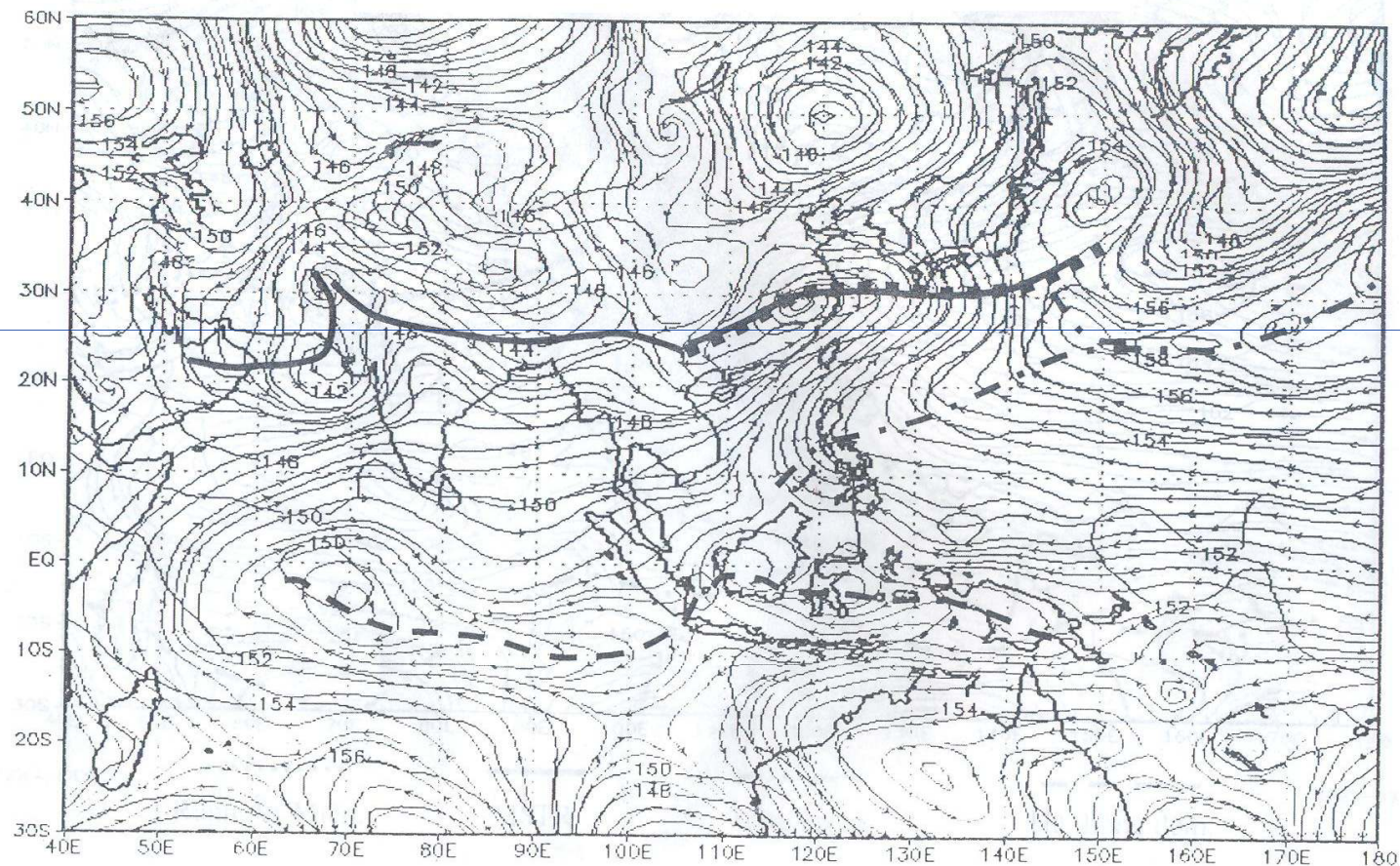
- *A cold front (1-100mm)*
- *A cold front combines with monsoon trough (10-170mm)*
- *A cold front combines with a tone of subtropical high-pressure (3-70mm)*
- *A cold front combines with a tropical cyclone (1-72mm)*
- *A cold front combines with monsoon trough and subtropical high-pressure (2-100mm)*



# Streamline on 850 hPa 18 May, 2000

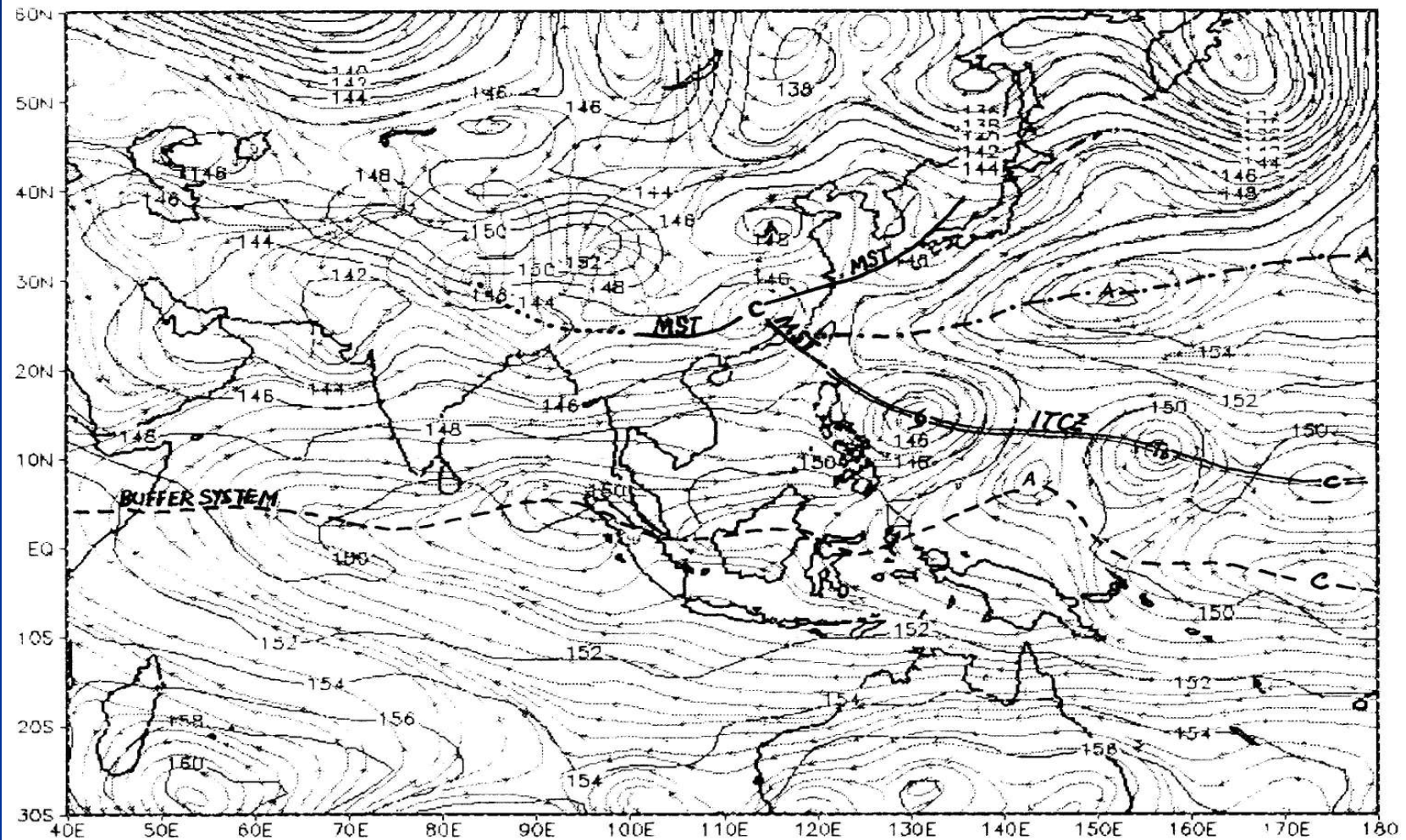


# Streamline on 850 hPa 9 Jun, 1996

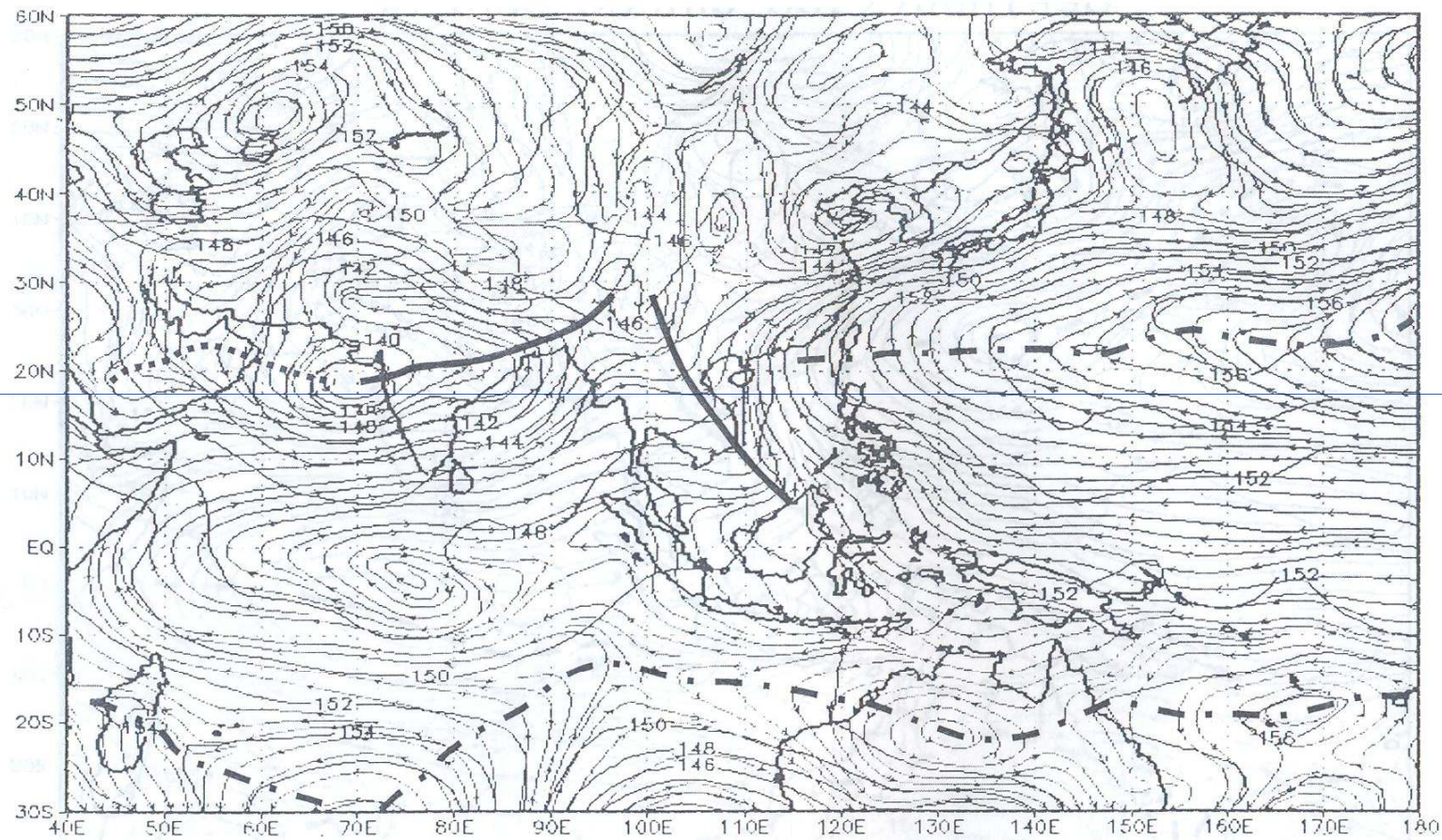


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# Streamline on 850 hPa 23 Jun, 1997



## Streamline on 850 hPa 17 Jun, 1998



## *2.2. A tropical Cyclone and its combination with other patterns.*

- A tropical cyclone (6-200mm)*
- A tropical cyclone combines with monsoon trough (3-80mm)*
- A tropical cyclone combines with subtropical high-pressure (3-100mm)*
- Tropical cyclone combines with subtropical high-pressure and ITCZ (1-120mm)*

### *2.3. A monsoon trough and its combination with different patterns*

- Monsoon trough (3-50mm)*
- A monsoon trough combines with subtropical high-pressure (2-100mm)*
- . Monsoon trough combines with ITCZ (2-100mm)*

## *2.4. Subtropical high-pressure and its combination with different patterns*

- Subtropical high-pressure (4-200mm)*
- Subtropical high-pressure combined with ITCZ (2-170mm)*

## 2.5. *Intertropical Convergence Zone* and *Intertropical Convergence Zone* combined with different patterns

- *Intertropical Convergence Zone* (5-300mm)

### 3. Contribution of synoptic patterns for heavy rainfall processes in the beginning of SM in the North VN

1. In the beginning of the SM, heavy rainfall spells in the North of Vietnam resulting from the contribution of MT, TC, subtropical high-pressure, ITCZ and cold front
2. Their frequency is as in order: monsoon trough (11), tropical cyclone (6), ITCZ (5), subtropical high-pressure (4) and cold front (1).

3. The 2 system combination caused the heaviest rainfall was cold front and monsoon trough (10). Almost cases did not cause heavy rainfall all over the North of Vietnam (only in the mountain regions)
4. Pattern combined 3 systems occurred only 3 cases: cold front with MT and subtropical high-pressure (2 times) and TC with subtropical high-pressure and ITCZ (one time).

5. ITCZ is still weak compared with different patterns in terms of causing heavy rainfall frequencies and seem that heavy rainfall area caused by TC in the North of Vietnam is less than caused by other

6. In the North of Vietnam,

TC is the pattern of highest causing heavy rainfall

ITCZ and subtropical high-pressure is less than other

Cold front probably causing heavy rainfall is considerable when it combines with MT.

**Thank you!**