

Synoptic systems and the widespread - heavy rains in Middle area of Vietnam

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Abstract

Vietnam is a country in the monsoon activity area. In winter the cold air can give their affect up to southern part of Vietnam. In summer the south – west monsoon impact will be observed over southern and middle area. When monsoon system will interact with other synoptic system for example typhoon, tropical depression, ITCZ est.... the weather in this area in most of the cases will be especially affected. Heavy rainfall or very heavy rainfall have been recorded, sometimes it reached to the historical disaster. Base on the analyzing of synoptic situations, their affected area and the resulted quantitative daily rainfall during period of 1993 - 2002, the precipitation variation could be noticed and must be considered during forecasting service and as some special characteristic of monsoon activity in Vietnam.

1. Introduction

The network of rain-gauge stations in Vietnam is not dense enough, therefore using rainfall data measured by weather radar is necessary for a very-short range prediction of widespread heavy rain and for studying the flood phenomena in Vietnam, especially in the Middle part of the country where the flood event is offen very serious due to the small, short, sloped rivers with narrow flat area along the coast line. Most of the Middle part of Vietnam is on the eastern side of Truong Son high mountain ridge. To get quantitative data for studying the process of a widespread-heavy rain in time and space, weather radar is required to operate in a special schedule. The variation of quantity of rainfall depends on the synoptic systems, which caused the widespread-heavy rains. Base on the data, gathered during last 10 years, we can find the most affected synoptic situations on precipitation phenomena in this area.

2. Distribution widespread heavy rains in Middle (1993-2002)

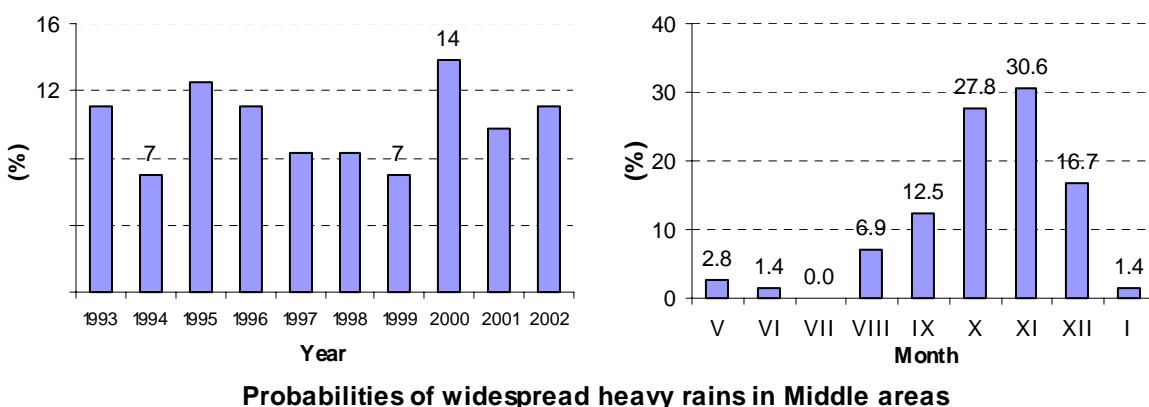


Fig. 1: Probabilities of widespread heavy rains in middle areas.

Table 1: Number of widespread-heavy rainfall events in Middle part of Vietnam (1993-2002)

Month	V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	Sum
1993					1	3	2	2					8
1994		1			1	2		1					5
1995					3	3	3						9
1996				1	1	2	3	1					8
1997					2	2	1	1					6
1998						1	4	1					6
1999						1	2	2					5
2000	1			1		2	3	2	1				10
2001	1			2		1	1	2					7
2002				1	1	3	3						8
Sum	2	1	0	5	9	20	22	12	1	0	0	0	72

During the period of 1993-2002, there are strong variations in distribution of widespread-heavy rains. Annual distribution widespread-heavy rains are not equally. Highest probabilities of widespread-heavy rains fall in 1994, 1999 and lowest is in 2000. Mostly they concentrate from August to December every year (maximum probability is in December). Rarely there are widespread-heavy rains in the period from January to July, even there is not in February, March, April, July.

3. Synoptic systems cause widespread heavy rains in Middle part of Vietnam

There are 72 large-heavy rains happened in Middle areas in 10 years (1993-2002). Nine primary synoptic systems (independent type or combine type) cause that rains are found as follows:

- 1/ Typhoon + Cold Air (14%)
- 2/ Tropical Low Pressure + ITCZ (13%)
- 3/ Tropical Low Pressure + Cold Air (8%)
- 4/ Cold Air + Eastern wind streams (8%)
- 5/ Tropical Low Pressure (7%)
- 6/ Cold Air (5.5%)
- 7/ Tropical Low Pressure + ITCZ + Cold Air (4%)
- 8/ ITCZ + Cold Air (4%)
- 9/ ITCZ + South Western Monsoon (4%)

In addition, there are also 19 other synoptic systems can bring large-heavy rains to study areas, however, occurred probabilities are very low. Although appearance is only 2 times in 10 years for the system of Cold Air + North Eastern Monsoon, Tropical Low Pressure+ South Western Wind Convergence, Typhoon and Typhoon +ITCZ, is only 1 time in 10years for remain systems, their influences are very serious. Typical example as the famous rain occurred in 1-6/XI/1999 in Trung Bo with rainfall of 1000mm, reached to more than 2000mm at somewhere, its damage was strongest in many last decades. This rain was caused by synoptic system of ITCZ + Cold Air + Eastern wind streams.

Cold Air have very important role in combining with other synoptic systems cause large-heavy rains in Middle areas, its number of appearance times in 72 rains in 10 years is 40.

Table 2: Nine primary synoptic systems cause widespread heavy rains in Middle areas in 10 years (1993-2002).

Year	Number of occurred days	Month	Rainfall (24h) from-to (mm)	Year	Number of occurred days	Month	Rainfall (24h) from-to (mm)
1/ Typhoon + Cold Air (14%)				4/ Cold Air + Eastern wind streams (8%)			
1993	2	11	300-500	1994	3	10	100-300
1993	2	12	50-100	2000	3	11	100-150
1995	3	10	200-450	2000	3	11	200-300
1995	2	11	100-350	2000	2	11	150-250
1995	5	11	100-150	2000	2	12	80-100
1997	3	9	150-300	2001	3	12	60-100
1997	3	11	100-250	5/ Tropical Low Pressure (7%)			
1998	3	11	100-200	1994	2	6	50-100
1998	3	12	250-400	1994	3	10	50-100
2001	4	11	150-250	1995	2	9	100-100
2/ Tropical Low Pressure + ITCZ (13%)				1996	5	10	100-100
1993	2	9	200-400	1997	2	10	30-50
1993	3	10	150-250	6/ Cold Air (5.5%)			
1995	5	9	100-200	1995	2	11	100-150
1995	5	9	200-350	1996	4	11	100-250
1996	10	8	200-350	1997	4	12	100-100
1996	7	9	100-300	2000	5	1	100-200
1999	6	12	200-250	7/ Tropical Low Pressure + ITCZ + Cold Air (4%)			
2000	1	5	50-100	1993	5	10	300-500
2000	3	12	70-90	1993	6	10	200-300
3/ Tropical Low Pressure + Cold Air (8%)				1997	3	9	150-300
1993	3	12	50-100	8/ ITCZ + Cold Air (4%)			
1996	5	10	50-100	1993	5	11	200-400
1997	5	10	100-300	1995	4	10	300-600
1998	3	10	250-350	1999	6	12	300-800
1998	6	11	300-400	9/ ITCZ + South Western Monsoon (4%)			
2001	3	12	80-100	1996	4	12	100-150
				2001	4	8	50-100
				2001	4	8	150-200

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