P2.3

A STUDY OF QINGHAI-XIZANG PLATEAU LEE WAVE RAINSTORM

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In some terrential rains course of the middle and upper reaches of the Changjiang River, at 12 hours before the terrential rain proceses happened, there is not a trough above Sichuan basin in 500hpa.When the terrential rain is going to happen,the small trough appeared suddenly above Sichuan basin in 500hpa. This type of rainstorm is not only difficult to predict, but also difficult to find the real reason which produce the torrential rain in analyse afterwards, it's a kind of difficult torrential rain in fact. Analyse and research this kind of torrential rain course is very meaningful to real torrential rain prediction . Now at example of July 3-6 1983 torrential rain happened in middle and upper reaches of the Changjiang River, discuss the prediction problems of torrential rain.

1. The type of 500hpa lee wave

The torrential rain course in the middle and upper reaches area of the Changjiang River for July 3-6, 1983, was consist of two torrentials rains. The first torrential rain is from 22 o'clock third day to 17 oclock forth day ; The second is from 5 o'clock fifth day to 17 o'clock sixth day. We can find out from Fig 1 and picture Fig 2 , before two torrential rain course begin , 500 hPa in the upper reache area of the Changjiang River, has no low value system, the torrential rain situation is not very obvious, so it's difficult to make torrential rain prediction . But we can see from fig 1 and fig 2 , from Sichuan Basin to Qinghai-Tibet plateau southern side, There are large stretch of southwest air current areas. After 12 hours, a small-scale low troughs has appeared in Sichuan Basin. Obviously, the torrential rain was caused by this low trough . So the question lies in being clarified the natures of low trough and predict it.

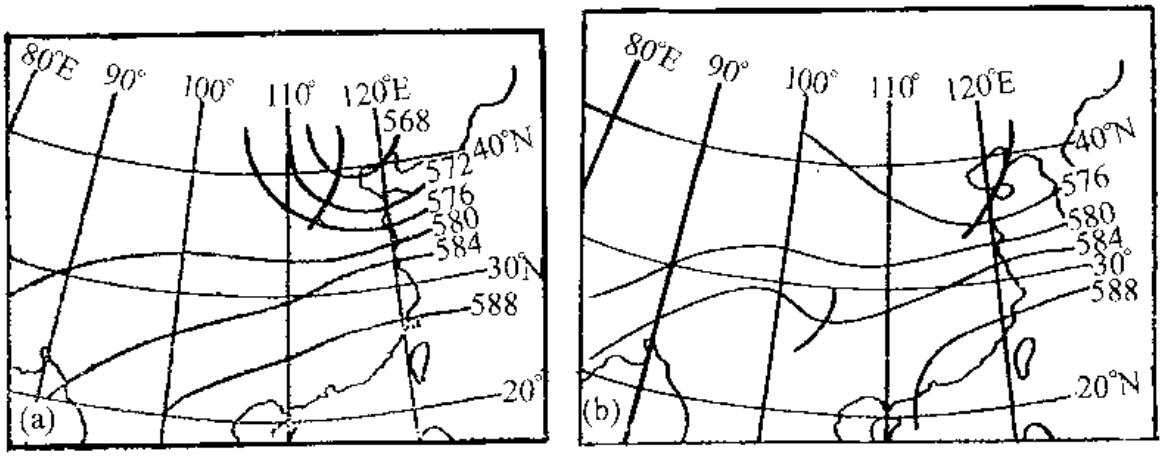

Fig1 1983 . 7 .3 .20:00(a) and 4 .08:00(b)

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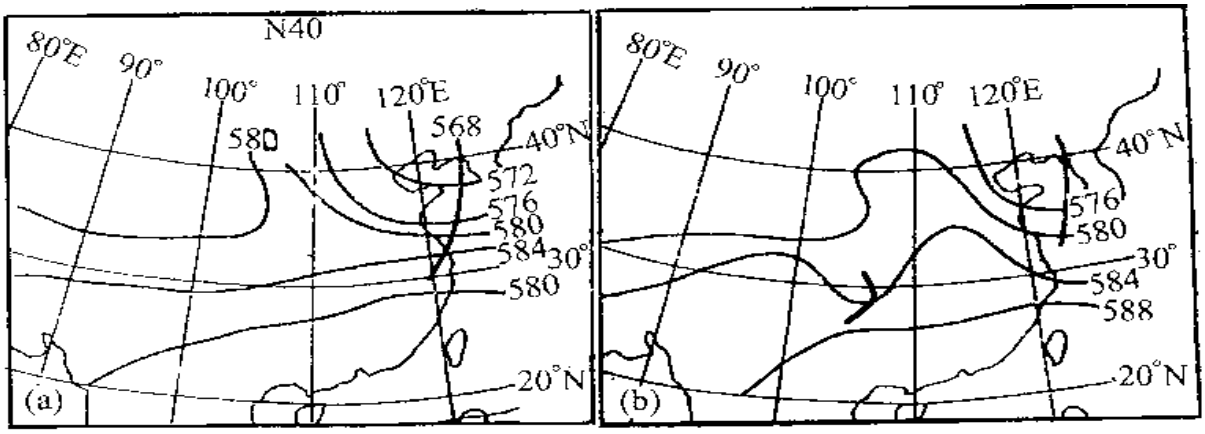

Fig2 1983 . 7 . 4 .20:00(a) and 5 .08:00 500hpa

1.1. An environmental condition helping the small trough to produce

(1)Topography. We know, in the east of Qinghai-Tibet Plateau, the Hengduan mountain lies across west of the basin , Form a natural protective barrier. The highest peak of Hengduan mountain is higher than 5000m, with great drop between Sichuan Basin. Above-mentioned low troughs were just produced under the topographical condition.

(2)The air current. From fig1 and fig2 We can see at 20 o'clock third day and 20 o'clock forth day, vast area of middle-south of Qinghai-Tibet Plateau (35°N) exist an area of W-SW air stream. At 8 o'clock third day, the centre of largest wind speed is in Lijiang, the largest wind speed reaches 18 m/s; at 20 o'clock third day, wind speed center moves to Xichang (the mountain ridge), its value is 20 m/s; At 8 o'clock forth day , the largest wind speed centre moves to Enshi (behind the mountain), its value slightly reduces, it is 16 m/s. At 20 o'clock forth day, another largest wind speed center appeared also in Xichang, the value is 20 m/s. At 08 o'clock fifth day, this centre moves to Enshi. Not only the little trough of Sichuan Basin appeared just at 08 o'clock forth day and 08 o'clock fifth day, when largest wind speed center passed the Hengduan mountain, but also from ground to 500 hPa, before little trough appeared (20 o'clocks third day and 20 o'clock forth day), It is W-SW air current between the higher and lower level. This phenomenon and little troughs didn't appear at the other time (see 1 form).

Form 1. 7, 3-6 1983 wind in Lijiang station

day		3	3	4	4	5	5	6	6
time		08	20	08	20	08	20	08	20
Ground	Wind direction	sw	w	w	sw	E	w	sw	ssw
	Wind speed	2	6	6	4	4	8	4	6
700hpa	Wind direction	Nw	sw	sw	sw	sw	Nw		sw
	Wind speed	8	8	8	6	8	10		8
500hpa	Wind direction	w	w	Nw	sw	w	w	w	Nw
	Wind speed	18	12	12	12	8	8	6	4

(3) stability of stratification. During the 2nd July to 5th July, the atmospheres of 1000-500hpa, appeared stable stratification at 20 o'clock first day in front of the mountain(Tengchong), and at 08 o'clock third day in the mountain ridge(Xichang). The layer of knots became stable at 20 o'clock the third day behind the mountain (Chongqing). The steady layer spread eastward with the strong wind centre, see fig3. Therefore, the small trough in Sichuan Basin happens under the condition that the atmosphere is stability in front of and behind the mountain. Further analysis shows that the stability stratification formed, because upper layer temperature is increased and lower layer temperature is reduced. In front of the mountain, at 20 oclock 1st day, (stratification began stable) the temperature is increased in 500-700hpa and temperature of ground is reduced, see fig 4(a). In the mountain ridge, the temperature in 500hpa is increased and it induced from the ground to 700hpa at 08:00 3rd, (stratification began stability), see fig 4(b). At 20:00 3rd,(stratification began stability) the temperature is increased from 500-700hpa and it induced from 850hpa to ground in behind of the mountain, see fig4(c). Hence temperature-difference between upper and lower become little, stratification becomes steady. It can see that the temperature-rise is earlier in 500hpa than in 700hpa from fig4(c),and the air temperature on the ground reduced is earlier than in 850hpa. Just this time, the small trough appeared in 500hpa above Sichuan Basin. These environmental conditions are just helpful of forming lee wave.

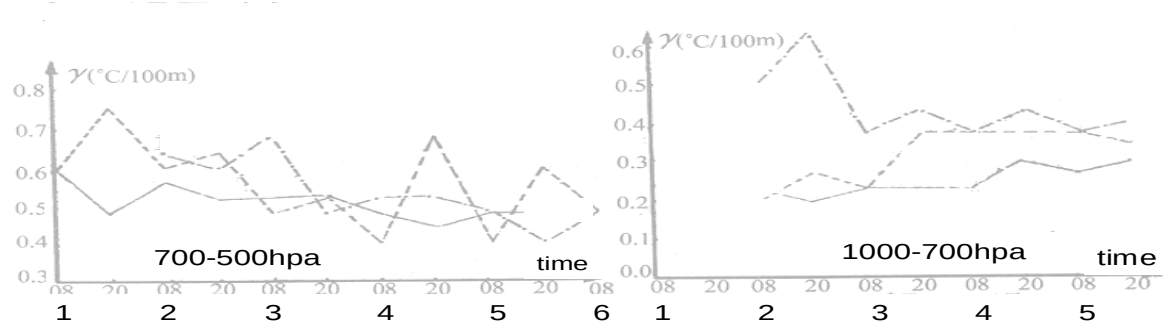

Fig3 1983 .7 .1-6. Degree of stratification stability. Tengchun(front of the mountain. solid line) Xichang(ridge of the mountain. Deshed line) Chongqing(behind of the mountain. Dot desh line)

1.2 Fundamental feature of small trough in 500hpa above Sichuan Basin

(1) Time scale less than 12hours;

(2)The space scale is about 500 km, equal of north and south distance belong meso-α scale;

(3)This trough is moved slowly, present the quasi-stationary state;

(4)These smalls troughs appear when the centre of wind speed of W-SW air current moved behind mountain, and exist or die with the size and existance of w-sw air current in front of the mountains;

(5)These troughs is warm.

These characteristics are in accordance with the basic characteristic of lee wave.

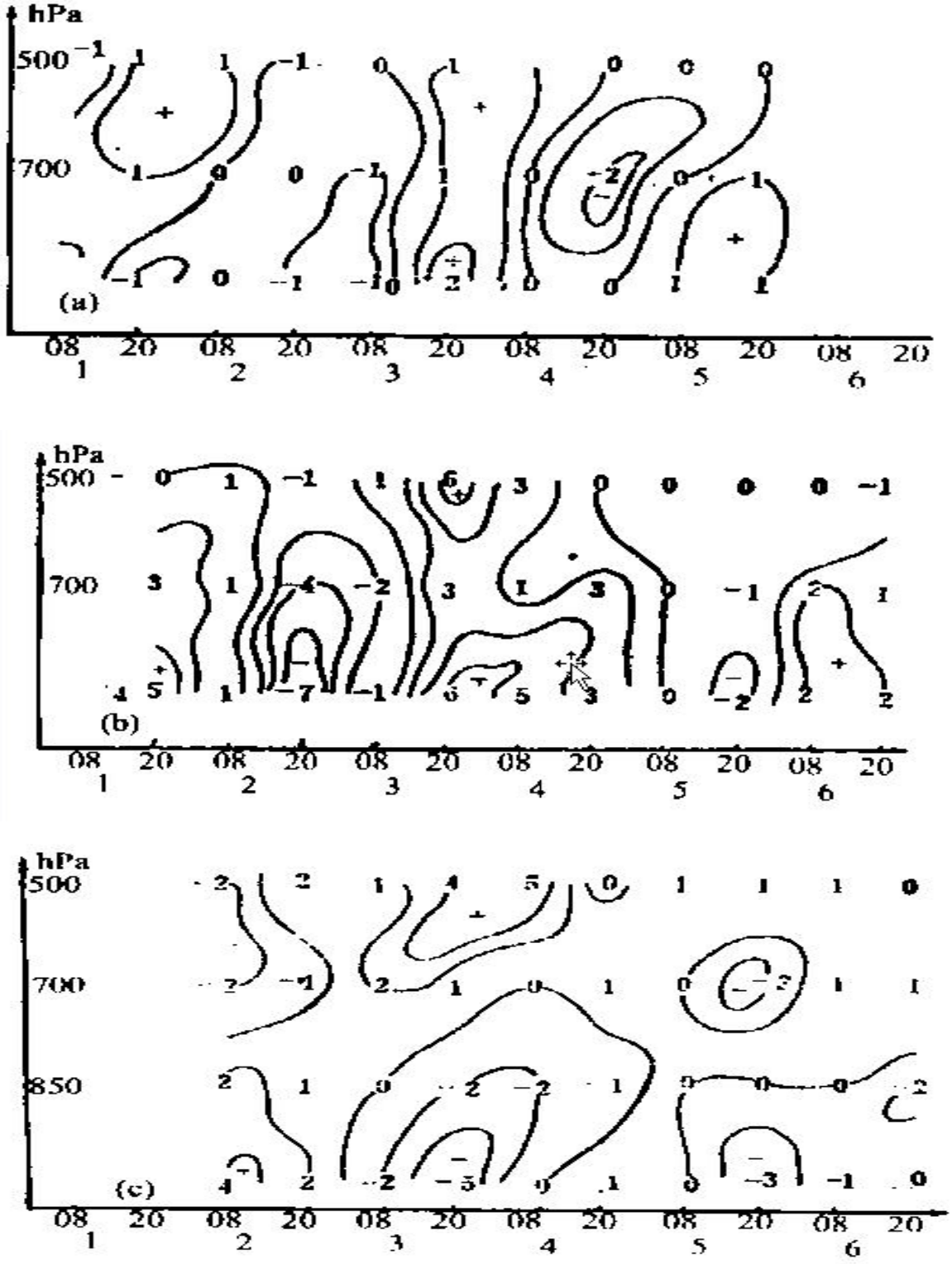

Fig4 7,1-6,1983 24our temperature-difference
Tenchueng(a) Xichang(b) Chongqin(c)

1.3 The analysis of precipitation course

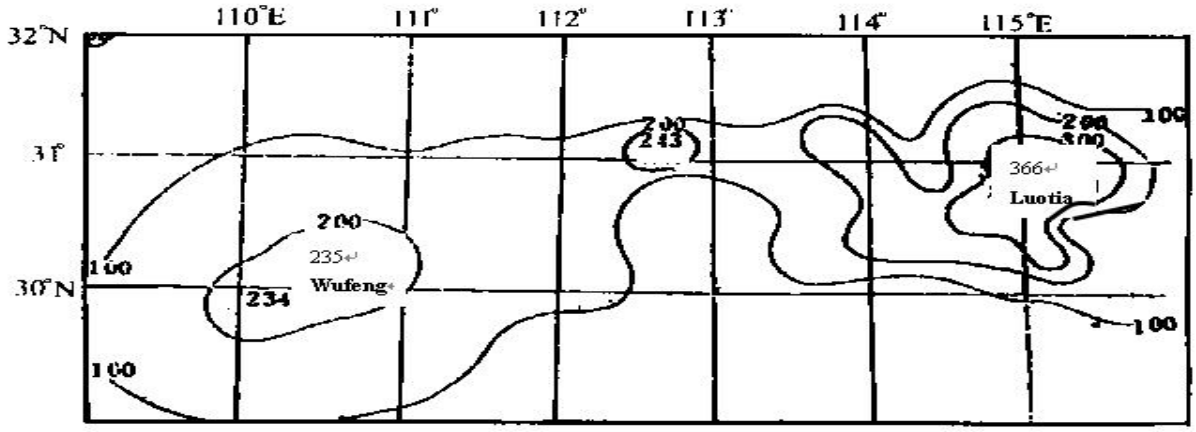

Fig5 7,3-6 1983 total precipitaion content(mm)

(1)The precipitation centre. There are two strong precipitation centres. One is Wufeng, the other is in Luotian, (see fig5).

These two centres are in correspondence with the two wave troughs of lee;

(2) Precipitations of two centres exists seesaw structure.

Form 2. 7,4-6,1983, precipitation content(mm)

during	20:00,4_{th} to 08:00 5_{th}	08:00,5_{th} to 08:00 6_{th}	08:00,6_{th} to 17:00 6_{th}
Wufeng	0.3	95.1	8.3
Luotia	134.1	5.1	30.6

2. Genesis and development of lower eddy in lower layer. Becurse the lee trough in 500hpa appeared, field of pressure of lower atmosphere layer is influenced obviously. At 08 o'clock the 4th day the negative allohypsic center of the 700hpa and 850hpa appeared in the waves troughs. It makes meso-α scale low eddy in Yibin(850hpa) developed simultaneous, there is a meso-β scale cyclogenesis in Hankou(850hpa).

3.Prediction of lee interrential rain following is inportant:

(1) topograph. abruptness of mountain is large;

(2) wind speed more than 12m/s;

(3)air temperature in 500hpa rises suddenly;

(4)stratification is stability. γ <0.3c/100m(in front of mountain), γ <0.4c/100m(in ridge of mountain), γ <0.5c/100m(in behind of mountain). γ is lapse rate of temperature.

4. summary. main result in this paper is in the following:

(1) some terrential rain in middle and upper reachs of Changjiang river are caused by the lee trough in Qinghai-Tibet Pleteau.

(2) This lee trough appeaerance is sudden. It can be a lee wave.

(3). The lee wave can cause meso-β scale low eddy.

(4).Precipitation of two centre in lee rainstorm exists seesaw phenomenon.