CHARACTERISTICS OF SEASONAL VARIATION OF RAINFALL OVER THE TIBETAN PLATEAU DURING SUMMER 1998 AND ITS IMPACT ON EAST ASIAN WEATHER*

LI Wei (李 薇) and *CHEN Longxun* (陈隆勋)

Chinese Academy of Meteorological Sciences, Beijing 100081

Received October 15, 1999; revised January 17, 2001

ABSTRACT

The seasonal variation of rainy season over the Tibetan Plateau in summer 1998 is analyzed by using daily observational rainfall data for Lhasa from 1955 to 1996, and rainfall data at 70 stations from January to August of 1998 over the Tibetan Plateau (TP) and adjacent regions, as well as TBB data from May to August of 1998. The onset date of rainy season for Lhasa is climatologically 6 June. Among the analyzed years, the earliest onset date is 6 May, while the latest may delay to 2 July. The obvious inter-decadal variation can be found in the series of onset date. The onset date of summer 1998 over middle TP (onset date of Lhasa) is 24 June, which is relatively later than the normal case.

The onset for rainy season of 1998 started over southeast and northeast parts of TP and then propagated westward and northward. The convection over east and west parts of TP shows that there is a quasi 12—15 day oscillation. In June, the convection over middle and lower reaches of Yangtze River is formed by the westward propagation of convection over subtropical western Pacific, while in July, it is formed by the eastward propagation of convection over TP.

Besides, it is also found that there exists good negative and obvious advance and lag correlation between the convection over the middle and western TP and that over the subtropical western Pacific and southern China. Therefore it can be inferred that a feedback zonal circulation with a quasi two-three week oscillation exists between the ascending region of TP and descending region of subtropical western Pacific, i.e. the convection over TP may affect the subtropical high over western Pacific and vice versa.

Key words: ORS (onset of rainy season), monsoon, Tibetan Plateau (TP), TBB, quasi two-three week oscillation

I. INTRODUCTION

To the surrounding free atmosphere, the Tibetan Plateau (TP) is a special underlying surface. It interacts with the surrounding atmosphere as a heat source/sink. Meanwhile its function as a heat source/sink shows evident characteristics of diurnal and seasonal variations. The existence of TP not only enhances the complexity of monsoon phenomena

* The paper is supported by the key project B of the State Ministry of Science and Technology "Observations and Theoretical Study of the Physical Process and Land-air Interaction over the Qinghai-Xizang (Tibetan) Plateau and Its Impact on the Global Climate and Severe Weather in China".

over the plain area of East Asia but also makes the monsoon over the plateau have particular characteristics. The advance and withdrawal of monsoon have close relationships to the onset and ending of rainy season. The study of seasonal variation in the rainy season roughly reflects the advance and withdrawal of monsoon over TP, and the impact of the seasonal variation over TP on the East Asia summer monsoon can be further studied.

According to the classical definition, the radical reason of monsoon phenomena is the thermodynamic difference between land and sea. For the existence of the huge TP reaching to the middle troposphere, the thermodynamic difference between the Plateau and surrounding free atmosphere consequentially brings about seasonal thermodynamic difference and finally forms a seasonal variation over TP similar to that of land-sea monsoon phenomena. The atmosphere over TP is a heat sink to the free atmosphere at the same altitude in winter whereas a relative heat source in summer. Reflecting in the climate temperature-pressure field over TP from January to December, there exist two kinds of primarily opposite temperature-pressure fields in winter and summer. During the period from November to next March, low level of the Plateau is controlled by a cold high as is called winter pattern; while during the period from June to September it is controlled by a strong warm low as called summer pattern; in April, May and October it is intermediate pattern, the characteristics of winter pattern are particularly obvious in April and October and more characteristics of summer pattern are shown in May. All the above characteristics of seasonal variation in the low level pressure field over the plateau region coincide with a kind of corresponding flow pattern, thus causing the seasonal variation of wind field which is called as monsoon phenomena over TP. The monsoon phenomenon over TP is more evident over the hinterland than that over border areas. Dai (1990) defined the rainy season by a relative pentad rainfall coefficient which shows that the earliest onset of the rainy season over TP started over its south part, and the rainy season started over the low reaches of Yalung Zangbo River Basin and Zayu Station in early March, meanwhile the latest onset started over the northwestern plateau in late June. Zhang and Yao (1984) defined the rainy season over TP by the modified relative rainfall coefficient and indicated that the rainy season over TP advanced from southeast to northwest and from border to hinterland. There was 131-day difference between the earliest (Zayu , on 4 March) and latest onset (Gar in western plateau, on 13 July). Chen (1984) defined the onset date of rainy season over TP in 1979 by a uniform method and indicated that the onset date of rainy season over TP in 1979 was 19 June. The earliest onset date over the southeastern TP was 8 June. The onset advanced from south to north and from east to west (except for a few stations). There were about 20 days from the earliest to the latest onset. Zhou and Jia La (1997) also studied the onset and break of the rainy season over TP. They defined onset of rainy season (ORS) over TP by another relative rainfall coefficient different from that by Dai (1990) and indicated that the earliest onset of the rainy season started over the southeastern TP in late April and early May. The latest onset started over Ngari region in early July, which was almost seven pentads later than the southeastern. ORS advanced slowly from east to west two months later.

The Asian summer monsoon was abnormal in 1998 and the Yangtze River Basin suffered from severe flooding. To discuss the relationship between the seasonal variation of the rainy season over TP and the flooding over the Yangtze River Basin, it is necessary to take TP as a separate cell to study the seasonal variation over there and its impact on the downstream regions.

II. DATASET AND DEFINITION OF THE RAINY SEASON ONSET

Daily rainfall data for Lhasa from January 1955 to December 1996 and the rainfall data from January to August of 1998 at 70 stations over TP and adjacent areas are used to define ORS over TP in the work. The climatological onset date of rainy season for Lhasa and onset date of rainy season over TP in summer 1998 are defined by using the "relative rainfall coefficient". The method is described as follows:

$$C_N = \left(\frac{R(N)}{N} \Big/ \frac{R(365)}{365} \right),$$

C_N denotes the ratio of mean daily rainfall during the calculated period (N days) to annual mean daily rainfall. If the coefficients C_5, C_{10}, C_{15} are all greater than 1.5 after a medium rain (daily rainfall $\geqslant 5.0$ mm), then the date when medium rain occurred is defined as rainy season onset date, where

$$C_5 = \left(\frac{R(5)}{5} \Big/ \frac{R(365)}{365} \right),$$

$$C_{10} = \left(\frac{R(10)}{10} \Big/ \frac{R(365)}{365} \right),$$

$$C_{15} = \left(\frac{R(15)}{15} \Big/ \frac{R(365)}{365} \right).$$

Due to the limitation of rainfall data of 1998 (only from January to August), after many times of tests, we found that the result would coincide with the distribution of real precipitation if selecting C_5, C_{10} and $C_{15} \geqslant 0.8$, while the onset dates of rainy season over few stations are modified by selecting C_5, C_{10} and $C_{15} \geqslant 1.0$. The method is more convenient to be used to define ORS over TP and the result is more continuous and well consistent with the real rainfall data.

III. CLIMATOLOGICAL ONSET DATE OF LHASA STATION AND CHARACTERISTICS OF DISTRIBUTION OF THE RAINY SEASON ONSET OVER TP IN 1998

ORS is one of the characteristics of the seasonal transition, and an important phenomenon indicating the onset of the summer monsoon over TP. Dai (1990), Zhang and Yao (1984) defined the rainy season over TP and gave the distribution chart (not shown) of the onset date of rainy season. Averagely ORS over the regions of TP expands from southeast to northwest, i.e. the rainy season over east part is earlier than that over west part and south part earlier than north part. The earliest onset occurred over Zayu located in southeastern plateau in March. But the rainfall is likely caused by Indian westerly trough in late winter and early summer for at that time the tropical monsoon has not arrived yet. ORS for Nyingchi started in mid April and for Lhasa in early June, then in the following two to three weeks from onset of Lhasa, it expanded westward from Lhasa to Shiquanhe of west Tibet. There are more than two months between ORS over the east and west parts. To compare the onset date of rainy season for Lhasa of 1998 with the climatological onset, we defined the onset dates of rainy season for Lhasa from 1955 to 1996 by the relative rainfall coefficient (Table 1).

Table 1. Onset Dates of Rainy Season for Lhasa

Year	Onset	Year	Onset	Year	Onset	Year	Onset	Year	Onset
		1960	6 June	1970	23 June	1980	19 May	1990	24 May
		1961	30 June	1971	14 May	1981	25 May	1991	15 June
		1962	24 May	1972	15 June	1982	9 June	1992	16 May
		1963	25 May	1973	12 June	1983	6 May	1993	5 June
		1964	28 June	1974	19 June	1984	9 June	1994	18 May
1955	5 June	1965	13 June	1975	27 June	1985	2 June	1995	12 June
1956	9 June	1966	16 June	1976	2 June	1986	14 May	1996	14 May
1957	22 June	1967	10 June	1977	21 May	1987	2 June	1997	12 June
1958	18 June	1968	lack data	1978	15 May	1988	2 July	1998	24 June
1959	30 May	1969	19 June	1979	17 June	1989	27 June		
				climatological onset		6 June			

It is shown from the table that the climatological onset date of rainy season for Lhasa is 6 June. The earliest onset date is 6 May in 1983 while the latest one is 2 July in 1988. We can see that there exists obvious inter-decadal variation among ORS. During 1950s to 1960s the onset mostly started in mid-June while it became earlier from 1980s.

In comparison of the climatological rainfall for Lhasa with that of 1998 (as in Fig. 1), the rainfall of summer 1998 is much stronger than climatological one, but the onset date of rainy season for Lhasa is 24 June which is almost three weeks later than the normal case. Figure 2 shows the distribution of ORS over TP in 1998 by the relative rainfall coefficient. It shows that the earliest onset over TP in 1998 started near Mount. Hengduan to southeast of TP and Nagaland of India in early April, but the rain belt did not propagate to west immediately after the onset; another earliest onset started over northeastern TP in early May, the rain belt did not move westward either. However both of them promptly propagated to western TP until 50 days (the second dekad of June) after the onset. This means that the rainy season over the middle and western TP is formed by the rapid movement of the convection propagating from the southeastern and northwestern TP in two directions in mid and late June. The convection moved westward to Shiquanhe which is located in the westmost TP till the end of August. Hence we separate the rainy season over TP into two phases — the prophase rainy season before mid June and the anaphase rainy season afterwards. The former is likely caused by Indian westerly trough and the latter is the result of tropical summer monsoon.

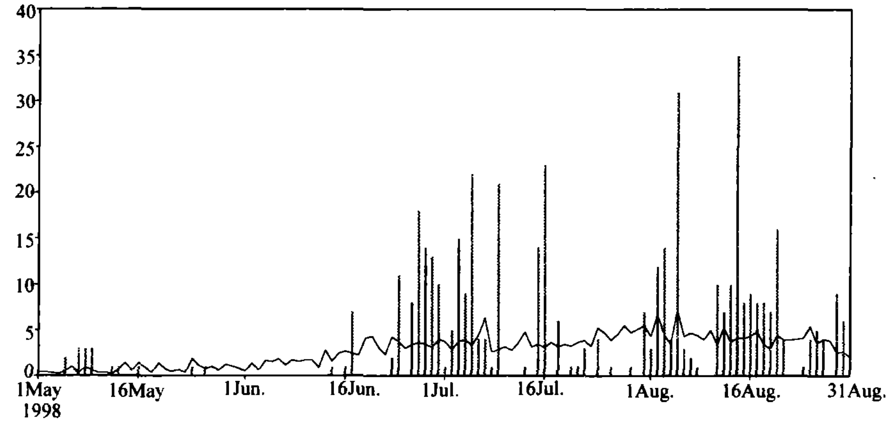

Fig. 1. Comparison of rainfall (mm) for Lhasa in 1998 (verticals) with climatological rainfall (curve).

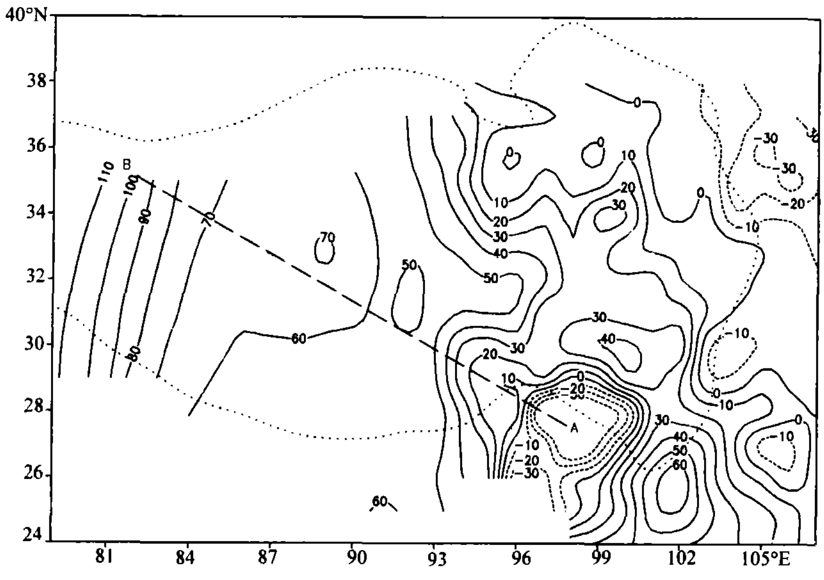

Fig. 2. Distribution of the onset date of rainy season over the Tibetan Plateau in 1998 (numbers at contours denote days from 1 May).

IV. CHARACTERISTICS OF PROPAGATION OF THE CONVECTION OVER TP BEFORE AND AFTER ORS REVEALED BY TBB/GMS

To study the propagation of the convection over TP in NW-SE direction before and after ORS, let us see the evolution of TBB (Equivalent Black Body Temperature) in Fig. 3 along AB line in Fig. 2. Value of TBB is a good index of convection. The lower TBB shows the deep convection. and shows that except for the time during 6—12 May, 22—24 May and late May some weak convection occurred over the western and middle TP, the convection over the whole plateau was very weak at all time. But by 16 June, deep convection occurred over the plateau and moved to 90°E from east part then progressed

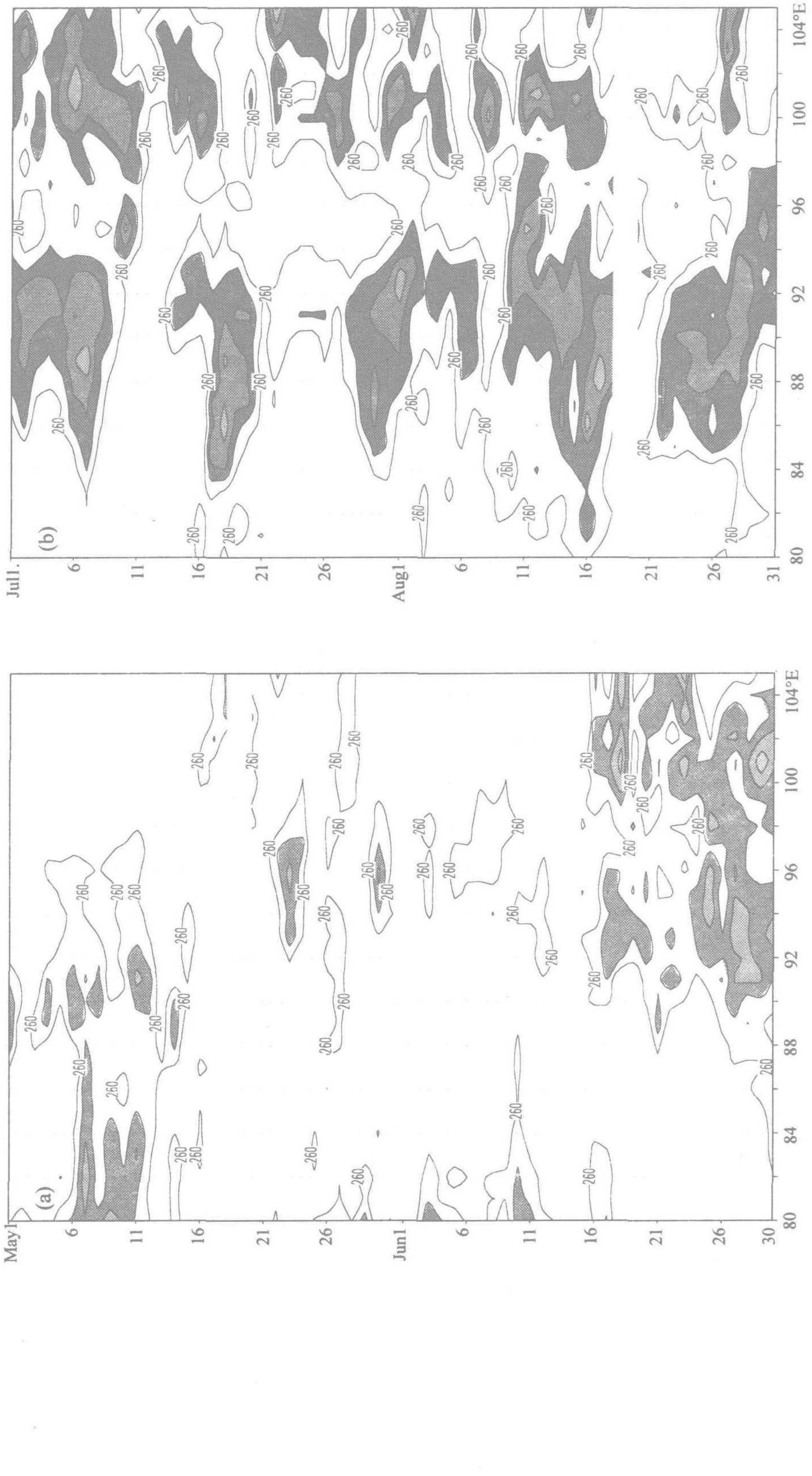

Fig.3. Time-longitude cross section of TBB along AB line in Fig.2 for (a) May–June, (b) July–August. Shading area denotes TBB value less than 250 K.

westward quickly. Afterwards the regions in west of 94°E and east of 99°E were in the rainy season while those between 94°E and 99°E were in break period of the rainy season in most time of July and August.

To clearly understand the evolution of the convection over TP before and after ORS. we also performed the distribution of pentad mean TBB over TP from the third pentad before ORS to the second pentad after ORS and the difference of TBB between two continuous pentads (Figs. 4 and 5). It shows that in the third pentad before ORS the convective region occurred over the southern plateau near 90°E. In the second pentad before ORS there occurred another convective region over the eastern plateau and the southern convective region intensified over its local region. By the first pentad before ORS (19 June to 23 June). the two convective regions progressed northward and westward to the plateau synchronously. East part of contour 255 K in east of 90°E over the plateau reached to 32°N. and west part of it reached to 30°N. In addition. two convective centers occurred in 94°E. 30°N and 99—100°E. 26—31°N with their values less than 250 K. In the pentad of ORS. the eastern convective region intensified over the local region too and the initial convective region over the middle part of the plateau expanded northwestward. Contour of 255 K moves northward to 30—31°N and westward to 85°E. while its center was still located near 90°E. By the first pentad after ORS (19 June — 3 July). the eastern convective center still maintained while the western center intensified to 240 K in 86—91°E. According to the radiosonde data for Lhasa of summer 1998. the height of the air temperature of 240 K occurred in the level of 11 km above sea level. Thus it reveals that the height of convective cloud top over the region averagely reached to 11 km. That is to say. the convection was relatively deep one. 255 K contour also progressed northward to 31°N from 30°N. By the second pentad after ORS. many changes took place in the convective region. Three convective centers occurred over the whole plateau. i. e. over west part (87°E). over middle part (90—94°E) and over east part (99—102°E). The north border of 255 K contour over the eastern plateau promptly moved from 32°N to 36°N. while that over the western plateau moved from 90°E. 34°N to 81°E. 30°N. From the expanding of TBB over TP before and after ORS. it indicates that the characteristics of the expanding of the convective region over the plateau are very different between east part and west part. The convective region over the east part intensified on itself. It only intensified toward the center of plateau and expanded northward rapidly in the first pentad after ORS and the second pentad. while that over the west part was mainly formed by the expanding of the convective region over the middle plateau before ORS and finally formed the convective center over west and east parts of plateau. This kind of characteristic variation is well consistent with yearly mean (Chen et al. 1999). i. e. ORS over the western plateau is mainly formed by the northward propagation of the rainy season over the middle plateau. It is consistent with the characteristics of the propagation of the rainy season by analysis of rainfall data in Fig. 2. Figure 5 denotes the distribution of the departure of TBB between two continuous pentads. we can see that the most changes occurred in the time from the second pentad to the first pentad before ORS (as in Fig. 5b). two intensified convective centers occurred over the plateau. After ORS. the convection intensified firstly over west part (as in Fig. 5d) and then over east part (as in Fig. 5e).

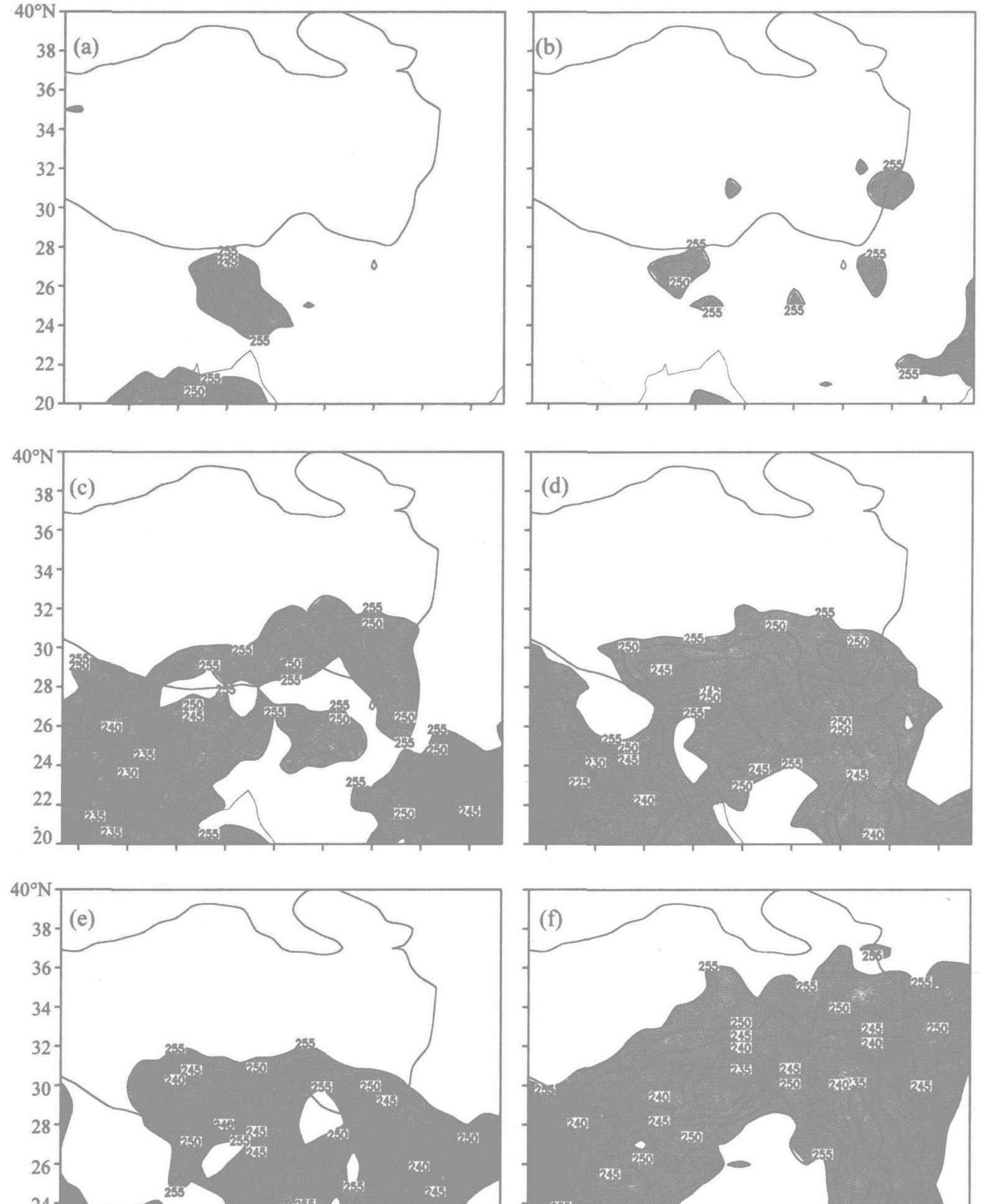

Fig. 4. Distribution of pentad mean TBB over TP during the rainy season of 1998: (a) the third pentad (9—13 June) before ORS, (b) the second pentad (14—18 June) before ORS, (c) the first pentad (19—23 June) before ORS, (d) ORS (24—28 June), (e) the first pentad (29 June—3 July) after ORS, and (f) the second pentad (4—8 July) after ORS.

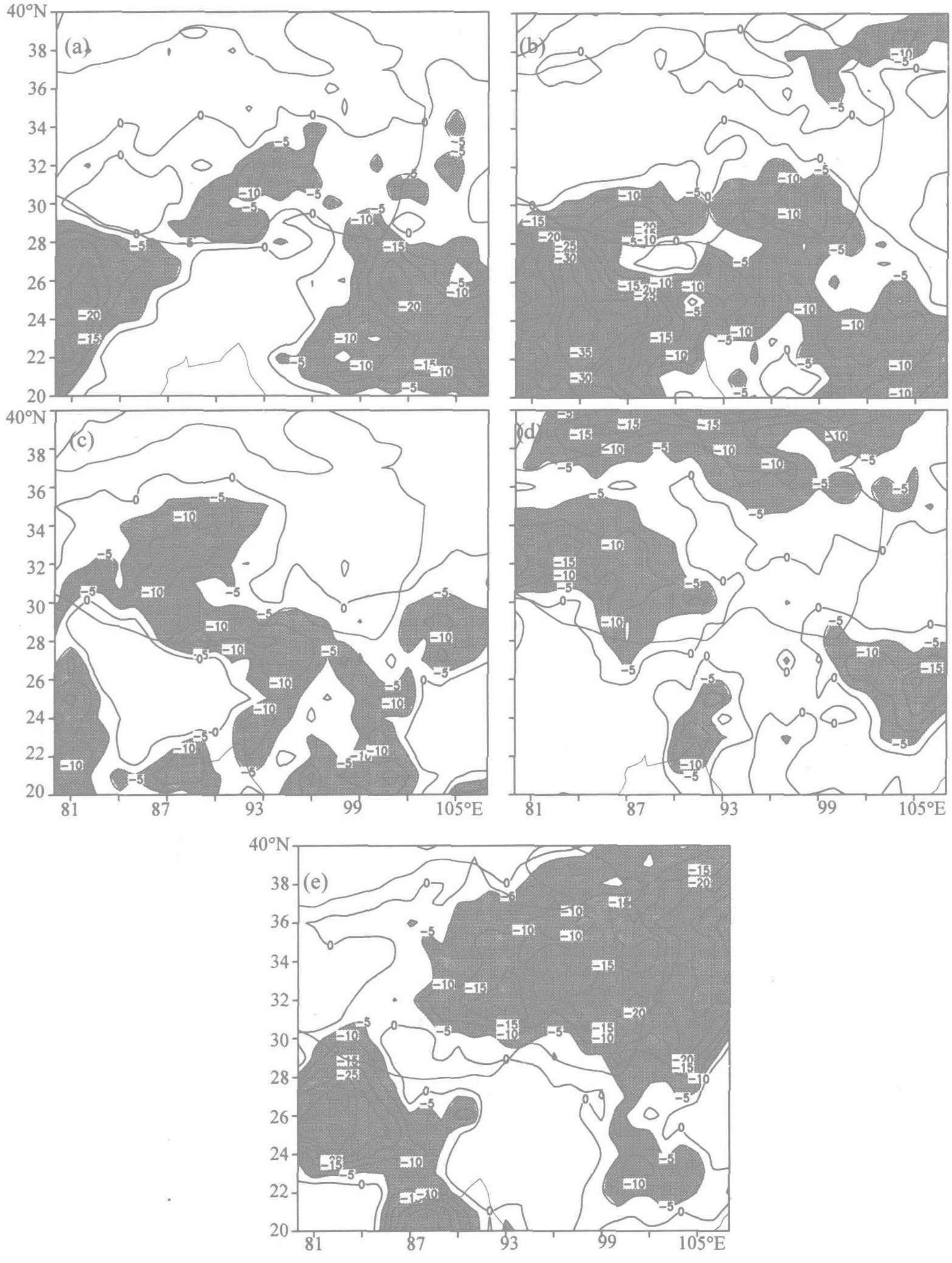

Fig. 5. Difference of TBB between two continuous pentads in summer 1998: (a) the second minus third pentad before ORS. (b) the first minus second pentad before ORS. (c) the onset minus the first pentad before ORS. (d) the first pentad after ORS minus the onset pentad. and (e) the second minus first pentad after ORS.

The above analysis shows that the characteristics and mechanism of the intensification of the convection over the west and east parts of TP are very different.

V. IMPACT OF THE CONVECTION OVER TP ON THE CONVECTION ACTIVITY OVER EAST ASIA

Data from satellite remote sensing are very useful to determine the characteristics of ORS in virtue of its continuous and uniform distribution. Therefore we performed the time-longitude cross section of TBB along 30°N (Fig. 6). In accordance with the radiosonde data of summer 1998, the average altitudes of 260 K, 250 K and 240 K over 30°N are 7.6 km, 9.7 km and 11 km respectively. Generally, the cloud is taken as deeper than medium convection once the cloud top height reaches to 8 km. thus we take it as the standard to determine the convective region. In Fig. 6, shading area denotes TBB value less than 250 K, indicating that the convection has reached some intensity. Figure 6 shows several significative facts: (1) There exists evidently quasi 12—15 day oscillation in TBB over middle and western TP. From the distribution of power spectral density of TBB over middle and western TP (30°N, 86°E), it is found that only 12—15 day period reached significance level; (2) TBB over the middle and eastern plateau has been steadily less than 250 K only since 21 June (shading area in Fig. 6) and expanded to west part since 26 June. This is consistent with the result shown in Fig. 2; (3) In June, the low TBB belt over middle and lower reaches of Yangtze River was obviously formed by the westward propagation of low TBB belt over subtropical western Pacific, while in July, continuous low TBB center developed over TP and propagated eastward to the middle and lower reaches of Yangtze River. Especially after 16 July, the low TBB center propagated eastward to West Pacific at all times, by about 21 July, heavy rainfall occurred over the middle and lower reaches of Yangtze River. The six times of low TBB center occurring over TP after 26 July only propagated eastward to west of 110°E and caused the heavy rainfall over the middle and upper reaches of Yangtze River. To discuss the evolution of the convection over the eastern TP in meridional direction during the seasonal transition period, we performed the time-latitude cross section of TBB along 99°E (Fig. 7). It shows from Fig. 2 that over the east part of TP along 99°E. the rainy season has started over most regions in south of 29°N early in April, however over the regions near 30°N the rainy season mostly started on 10 June. Seen from Fig. 7, during the period from 1 May to 16 May, convection maintained over 30—40°N. Since 22 May, the convection near 25°N rapidly expanded and propagated northward. By 31 May, it reached to 35°N. From 1 June to 11 June, the convective region retreated southward and reached to 30°N by 11 June. After three days of break, the convection occurred again over TP of 25—35°N. The convection over the plateau region near 30°N occurred about four times of break, respectively during the time from 12 to 14 June, 11 to 18 July, 26 to 29 July and 16 to 24 August. Each time of break was less than 8 days, suggesting that the convection over the region was steady. We can also see from the figure that, in the normal case, the mean north border of convection over TP is located near 35°N in July and August, while near 37.5°N in mid summer. The convection over south of the border is more obvious than that over north, because the latter is controlled by the westerly belt all the year round.

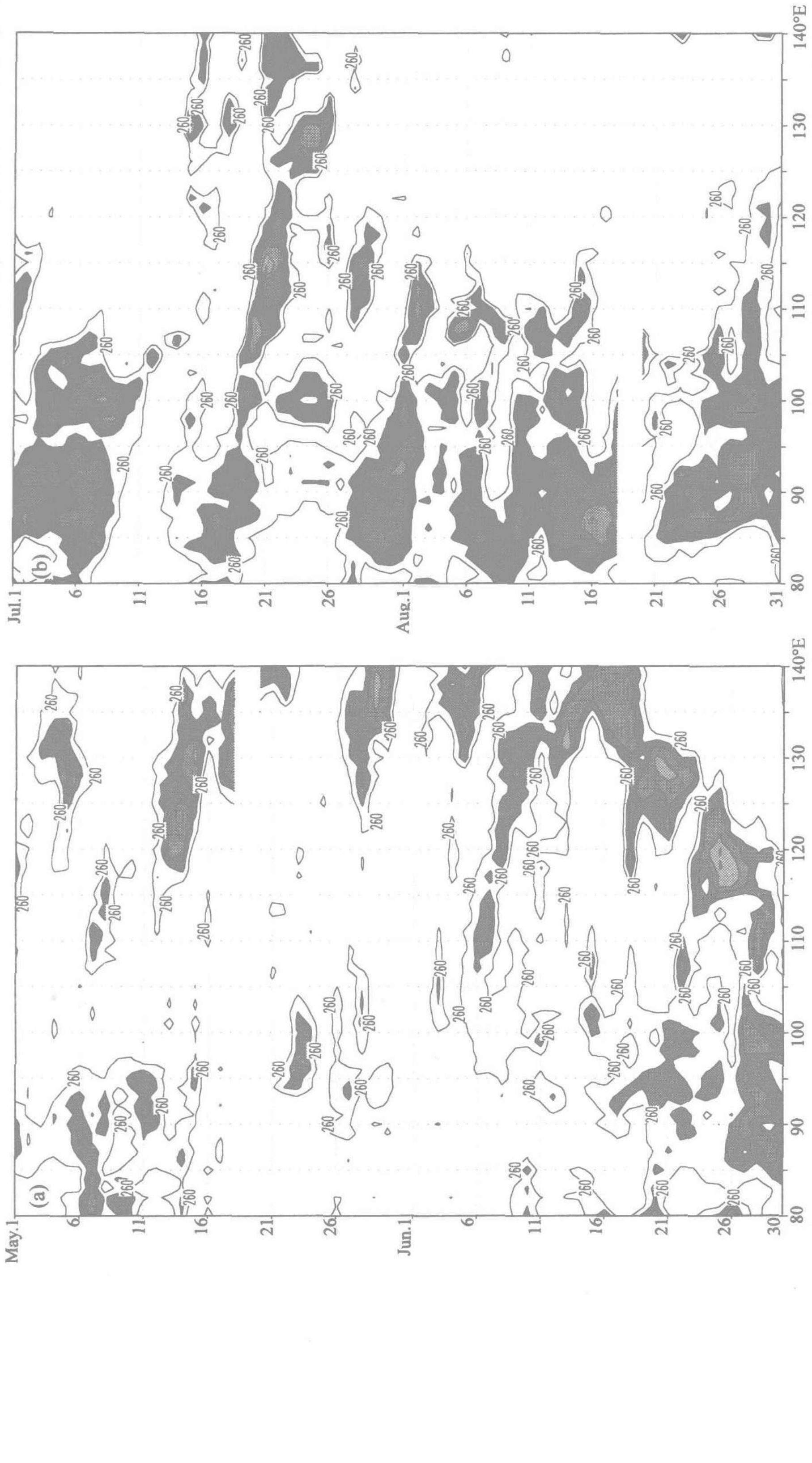

Fig.6. Time-longitude cross section along 30°N for (a). May–June and (b). July–August (shading area denotes TBB value less than 250K).

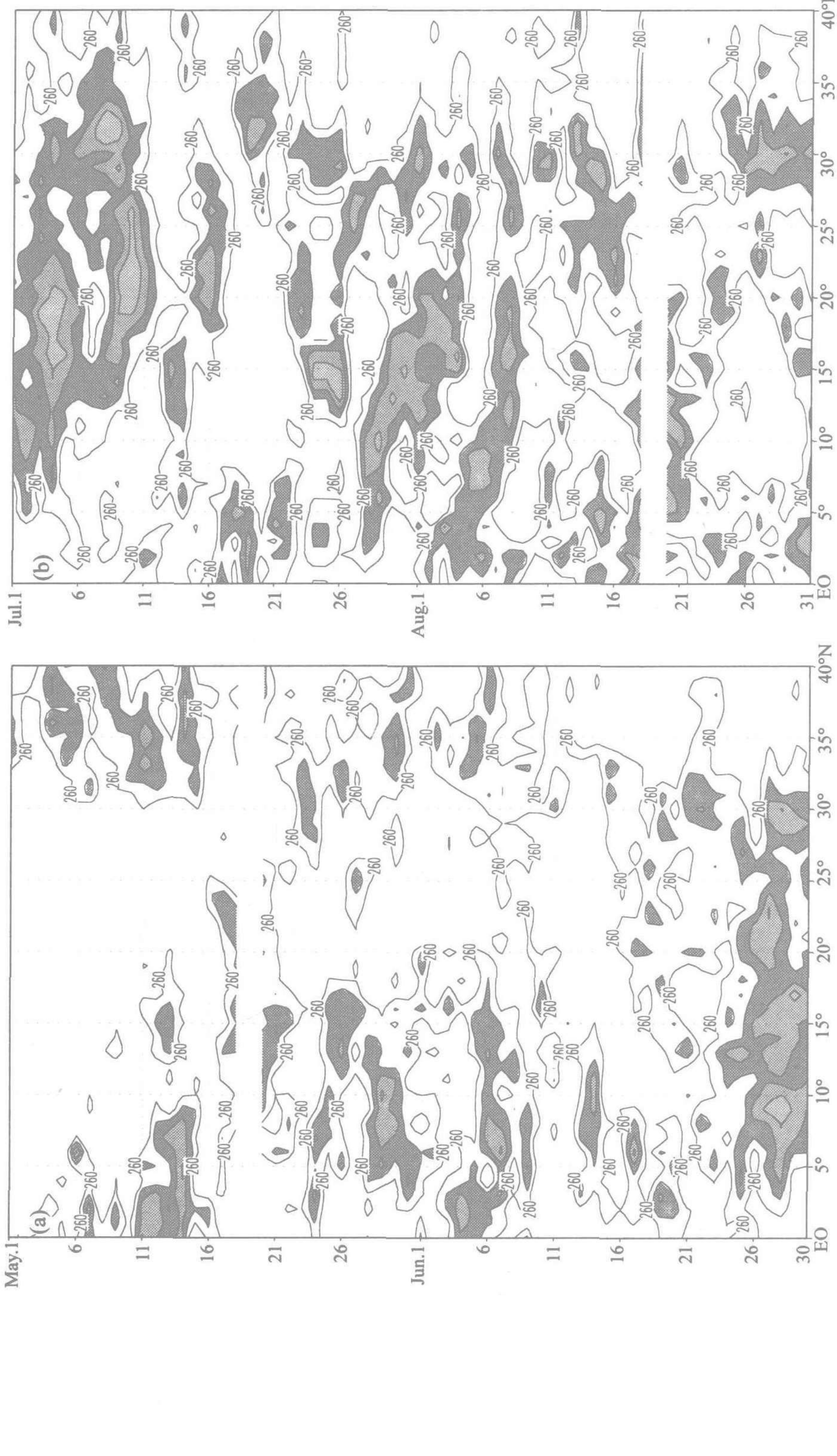

Fig.7. Time-latitude cross section of TBB along 99°E for (a) May—June and (b) July—August (shading area denotes TBB value less than 250K).

VI. INTERACTION BETWEEN THE CONVECTION OVER TP AND THE SUBTROPICAL HIGH OVER WEST PACIFIC

Seen from Fig. 6, during some time TBB over the west part of TP along 30°N has a good negative correlation with that over the West Pacific region (east of 120°E): during the period from 6 May to 11 May, deep convection was located over the region near west of 86°E, while the West Pacific region east of 120°E had scarce cloud sky; from 7 June to 9 June, convection occurred over the region of West Pacific east of 120°E when TP had scarce cloud sky; from 13 June to 16 June, deep convection occurred over the region east of 120°E, while the convection over the plateau weaken. Similar phenomena also took place in July and August: during the time from 1 to 6 July, from 27 to 1 August, from 6 to 17 August, most convective region maintained over the western Plateau. However during this period there was no convection over the West Pacific; during the time from 21 to 26 July, convection occurred over the West Pacific, while the region over the western plateau had clear sky. During the above period, when TBB over the western TP deepened, TBB over the West Pacific region weakened, and vice versa. This means that there exists a zonal circulation between TP and subtropical region of West Pacific. This is very important. Besides, in comparison of Fig. 6 with the variation of ridge line of West Pacific subtropical high in summer 1998 and TBB over the middle and western TP (Fig. 8), we can find that most of the convection over TP occurred in the period when the ridge line of subtropical high over West Pacific moved to 25°N and its north. In 1998, deep convection began to occur over the middle and western TP since 26 June while the ridge line of West

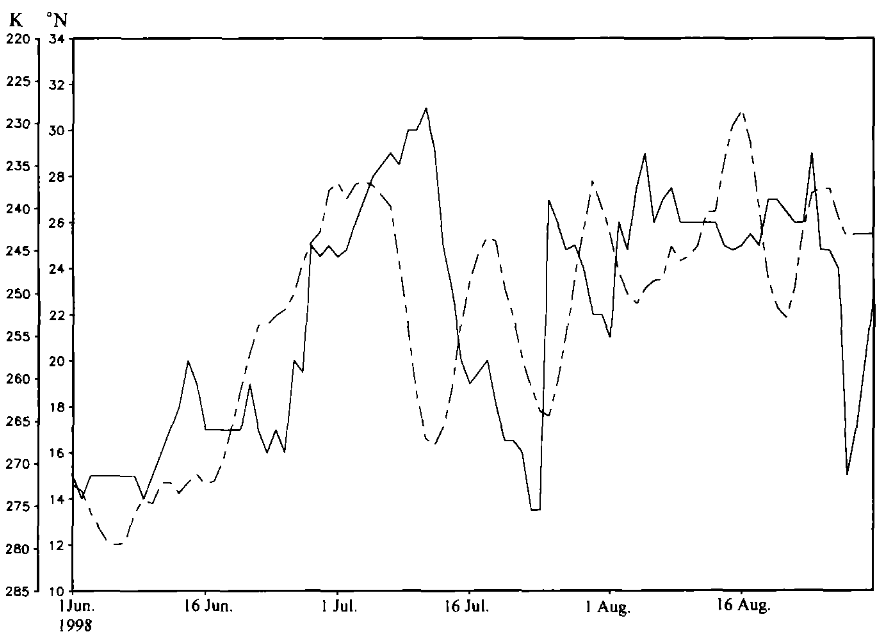

Fig. 8. Time series of positions of 110—130°E subtropical high (solid line) and TBB over middle and western Tibetan Plateau (dashed line).

Pacific subtropical high moved northward to 25°N since 28 June. The convection over the middle and western TP disappeared on 9 July, the ridge line of West Pacific subtropical high retreated southward from 31°N and reached to 13°N on 25 July. During the period of southward retreat the ridge line of subtropical high reached to 25°N on 14 July, medium convection occurred over the middle and west parts of TP near 15 July. During other time the region over TP had weak convection. After 27 July, the convection over the middle and western plateau intensified meanwhile the ridge line of subtropical high moved northward to 25°N, afterwards, during August it maintained in 25°N. At the same time over the middle and western plateau maintained deep convection. From the above discussion we can infer that the appearance of deep convection over TP is prone to the maintenance of the ridge line of the subtropical high over West Pacific near 25°N. On the contrary, when the region in middle and western TP of 30°N has weak or no convection over it the West Pacific subtropical high either moves northward or retreats southward. But during the period when subtropical high moves northward, the convective region could occur over the West Pacific region of 30°N (low TBB value). Therefore the appearance and intensification of the convection over middle and western TP of 30°N can be taken as an index which shows the West Pacific subtropical high's arrival to 25°N. The weakness of the convection over the plateau region shows usually the pattern of the southward retreat (if no convection in 30°N) or northward movement and arrival to 30°N of subtropical high. Shown from Fig. 6 that in summer 1998 (especially in July), the convection over the plateau near 90°E could propagate eastward to 120°E. In addition, when deep convection occurs over the middle and western TP, the region of West Pacific has scarce cloud. On the contrary, once the convection occurs over the subtropical western Pacific the region over TP has weak convection. There may exist negative correlation between the convection over TP and that over the subtropical western Pacific. In order to testify the relationship between the two regions, we performsed the distribution of the coefficient of TBB between the western TP (30°N, 86°E) and other regions during the period from June to August of 1998 (Fig. 9). In the concurrent correlation phase (Fig. 9c), TBB over the western TP has a good negative correlation with that over the region of subtropical western Pacific in 17—35° N, 105—140°E. This means that once the convection over the middle and western TP is deep (weak), the convection over the region of subtropical western Pacific is weak (deep), i. e. there exists a zonal correlative region at this latitude. We can see that the negative correlative region extends westward to South China from West Pacific. A small area of —0. 5 is located over South China. The negative correlation over TP and subtropical West Pacific maintains more than nine days. But since the third day (Fig. 9e), the negative correlation is more evidently reflected as the negative center over the West Pacific intensifies and moves westward gradually and reaches to the mainland (26°N, 116°E) by the ninth day. While in the advance correlation phase (Figs. 9a, 9b and 9c), although there is a negative correlative region over the subtropical western Pacific, the correlative center intensifies gradually in 30°N, 135°E which is different from the characteristics of westward movement in lag correlation phase. This means that the subsidence over subtropical high of West Pacific in 135°E intensifies first, then induces the intensification of the convection over the western TP. Afterwards, it induces the

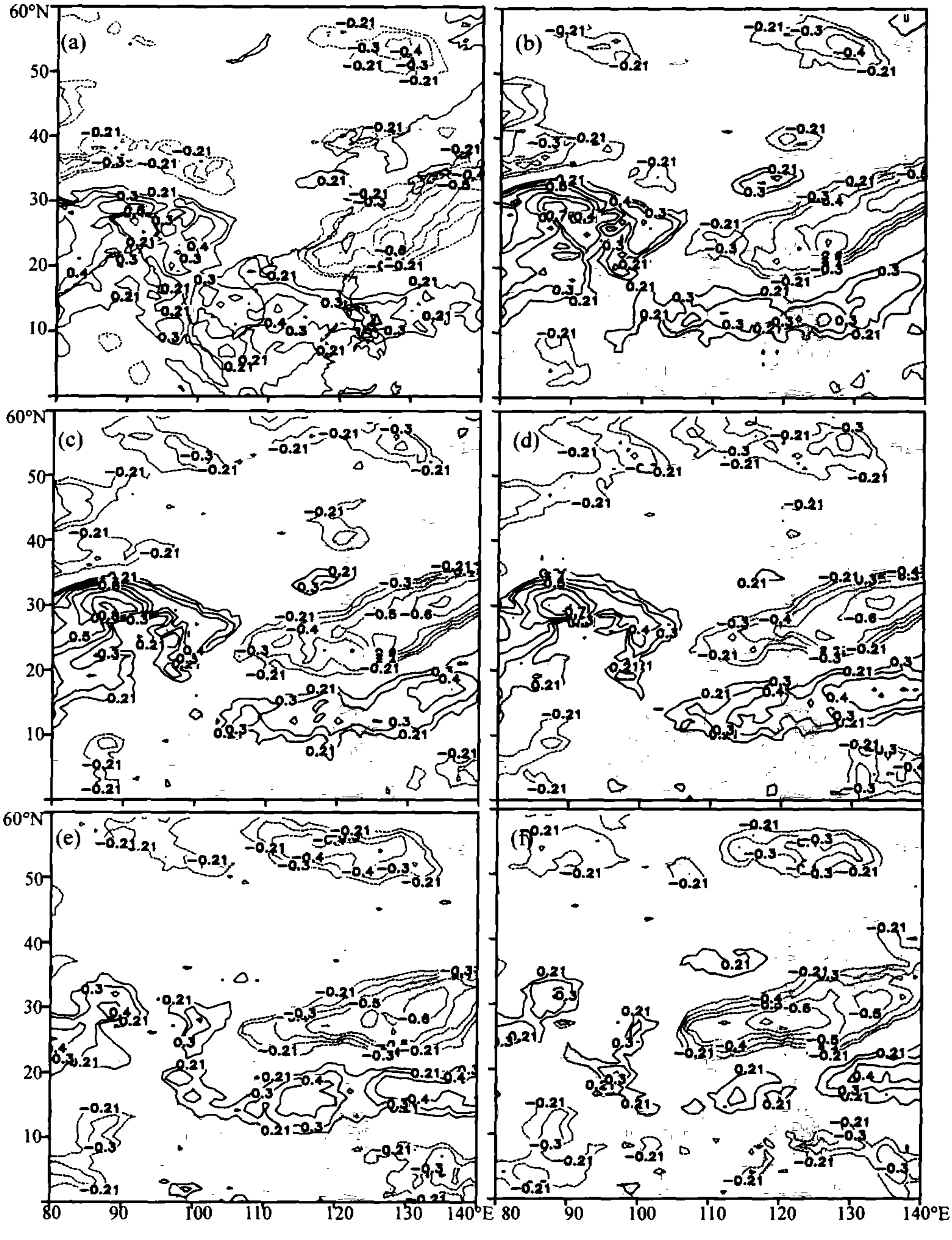

Fig. 9. Advance and lag correlation of TBB between Tibetan Plateau and other regions: (a) 6 days other regions leading TP, (b) 3 days other regions leading TP, (c) concurrent correlation, (d) 3 days TP leading other regions, (e) 6 days TP leading other regions, and (f) 9 days TP leading other regions (±0.21 has reached 0.05 confidence level, solid line denotes positive correlation, dash line denotes negative).

southwestward movement of subsidence over subtropical high. 9 days later. Yangtze River Basin becomes a strong subsidence region. Besides, the convection over the western TP has a good positive correlation with that over the region of Indochina Peninsula — South China Sea—tropical West Pacific. The strongest positive correlation occurs over the South China Sea—West Pacific in the third to sixth day after the reference day. Meanwhile the convection over TP has not obvious correlation with that over the Bay of Bengal except in the ninth day after the reference day.

The above analysis shows that: (1) the intensification of the subsidence over the subtropical West Pacific could induce the intensification of the convection over the western TP, while the intensification of the convection over the western TP could in reverse induce the southwestward movement of the subsidence over the subtropics. The south of Yangtze River will be affected 9 days after: (2) The convection over the western TP has a good positive correlation with that over the region of Indochina Peninsula—South China Sea—tropical West Pacific. The strongest positive correlation occurs in the sixth day after the reference day; (3) The convection over TP has not obvious correlation with that over the Bay of Bengal except in the ninth day after the reference day. Therefore we obtain the following conclusions: (1) The convection over the western TP is related to the intensification of the subsidence over subtropical high over West Pacific in 30°N. besides, it is possibly related to the subsidence over Arabian Sea rather than to the convective action over the Bay of Bengal. (2) The intensification of the convection over the western TP could make the subsidence region over the subtropics extend southwestward to South China Sea and intensify the convection over the South China Sea and tropical West Pacific. So it can be inferred that: there exists an interactionable zonal circulation between the convective region over the western TP and that over the subtropical West Pacific and they can interact with each other.

VII. CONCLUSIONS

Based on the above discussions, we may draw the following conclusions:

(1) The onset date of the rainy season for Lhasa in 1998 is 24 June which is about 3 weeks later than normal case. Seen from the distribution of ORS over TP, the rainy season starts first over the northeastern and southwestern TP and propagates northwestward.

(2) The characteristics and the mechanism of convection intensification over TP are different between east and west parts. The convection over east part of TP intensifies and develops in the local position, while the one over west part is formed by the convection propagating from the mid TP.

(3) There exits a quasi 12—15 day oscillation in the convection over mid and western plateau; the convection has extended to middle and western Plateau from east part at end of June and early July; the convective region over Yangtze River Basin in June propagates from the West Pacific subtropical regions while in July propagates from TP.

(4) TBB over TP has a good negative correlation with that over the subtropical region of West Pacific and has advance and lag feedbacks to each other. This means that the convection over TP and that over the subtropics are out-of phase. A zonal circulation

exists between the ascending (descending) over TP and descending (ascending) over West Pacific subtropical region. They interact with each other and have the characteristics of quasi two—three week oscillation. Analysis on the correlation between the convection over western plateau and the movement of the subtropical high over West Pacific shows that the convection over western plateau along 30°N develops to be strongest when the ridge line of subtropical high is located in 25°N. while the convection over the western plateau weakens. the subtropical high moves either to south or north. Besides. the intensification of the subsidence in 135°E. 30°N is prone to the intensification of the convection over the western plateau. while the intensification of the convection over the western TP is prone to the southeastward movement of the subsidence over the region as well. South of Yangtze River Basin will become subsidence region after 9 days.

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