Article ID: 1006-8775(2002) 01-0075-10

ON THE RELATIONSHIP BETWEEN PRECIPITATION ANOMALIES IN THE FIRST RAINING SEASON (APRIL-JUNE) IN SOUTHERN CHINA AND SST OVER OFFSHORE WATERS IN CHINA

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ABSTRACT: Precipitation anomalies in the first raining season of southern China were analyzed, with the suggestion that there are obvious interannual variation of peak values. In the raining season, the general tendency of precipitation is not obvious and the anomalous oscillation is multi-scale. Corresponding to years of more or less precipitation in the raining season, there are sharply opposite distribution across the nation in the simultaneous periods. In addition, by studying the distribution of correlation between anomalous precipitation in southern China in the first raining season and SSTA over offshore waters of China in the preceding period (June ~ August of the previous year), a sensitive zone of waters has been found that has steady effect on the precipitation of southern China in the season. Discussions are also made of the sensitive period, its simultaneous SSTA and subsequent anomalous circulation field in relation to precipitation anomalies and simultaneous circulation field in the first raining season of southern China. In the last part of the work, relationship between the SSTA in the sensitive zone and global SSTA is analyzed. A possible mechanism by which SSTA in offshore Chinese waters affects the precipitation anomalies in the first raining season of southern China is put forward.

Key words: precipitation anomalies; first raining season of southern China; circulation characteristics; sensitive sea waters; SSTA

CLC number: P426.62 **Document code:** A

1 INTRODUCTION

Southern China is one of the regions that receive the most precipitation in the country. The rain mainly occurs in May ~ July (May ~ September in coastal area). Starting at an earlier time, the raining season brings about much more precipitation to the region when it comes to May. Heavy rains are frequent in May and June, causing floods and great damage from time to time. Most of the flooded areas include the middle and lower reaches of the Pearl River and northern Guangxi. Flooding disasters, varying in degree of severity, occur almost annually in some parts of the areas, over the past dozens of years. Significantly heavier floods appeared in four years (1959, 1962, 1968 and 1973), about once every seven years[1]. It can then be seen how important it is to study the precipitation anomalies in the first raining season of southern China. Meanwhile, attention has been shifted to the study of offshore wasters in China as there is fuller availability of relevant data, which is also reflected on the statistic facts revealed. Most of the selected waters are, however, concentrated in areas from the Indian Ocean to the South China Sea. Wu et al[2]. states that precipitation in China is more subject to sea temperature in neighboring waters than in those farther away. As early as in the starting years of the 1990's, Wang et al[3-4]. observed that with the same distribution of sea temperature anomalies in the western Pacific warm pool, opposite patterns of precipitation could occurred in the valley of Changjiang and Huaihe Rivers

Received date: 2001-05-28; **revised date:** 2002-04-16

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in China. She attributes it to the situation of various distribution of offshore SSTA in China and argues that the anomaly of sea temperature, though moderate in size and magnitude and small in the amount of sensible heat caused by it, is an important factor in triggering climatic anomalies. It is the aim of the current paper to discuss the variation patterns of the offshore sea temperature in China and its effect on the precipitation in the first raining season in southern China so as to provide the effort of disaster prevention and reduction over the raining season with foundations of some useful value[5].

First of all, the climatic characteristics of the precipitation anomalies during the first raining season of southern China are analyzed. Then, national precipitation distribution, anomalies of the geopotential height and divergence and anomalous flow field at 850 hPa are studied by comparison for simultaneous periods in wet and less wet raining seasons. A sensitive zone of waters has been identified that has steady effect on the precipitation in the region. The composite/comparison method is used to study these characteristics in the cold water year and latter period of the warm water year (i.e. April ~ June in the following year). The data used in the work are monthly mean precipitation at 160 weather stations across the country (January 1951 ~ December 1998), reanalyzed output of NCEP/NCAR of the United States (1958 ~ 1994) at monthly mean geopotential fields of 100 hPa and 500 hPa and wind fields at 100 hPa, 500 hPa and 850 hPa (with a horizontal resolution of 2.5°×2.5°) and gridpoint values of global monthly mean sea temperature (1950 ~ 1993) from the British Meteorological Office (with grid intervals of 1°×1°). In addition, 16 weather stations across southern China were selected as the representing points in the work. Mainly, the methods are linear fitting, filtering, wavelet, running mean with equal weight, comparison and composite study (which has passed the *t* test and is above some degree of significance).

2 BASIC CHARACTERISTICS OF PRECIPITATION ANOMALIES IN APRIL~JUNE

2.1 *Seasonal variations of precipitation*

Anomaly of Category III (48 years)

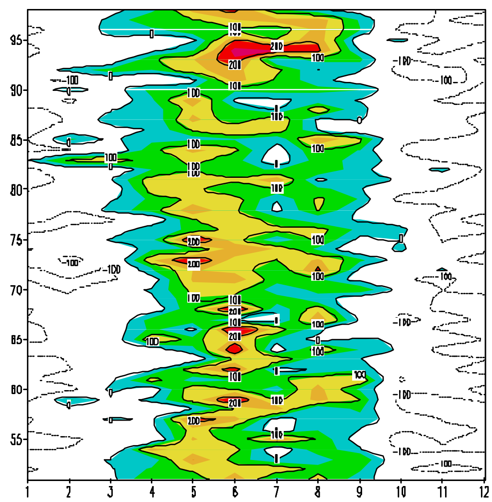

Fig.1 Interannual variation of seasonal changes in precipitation in southern China.

For the understanding of the interannual characteristics of the seasonal variation of the precipitation, we have defined an " anomaly of Category III ". It is the difference between the yearly and monthly mean and the multi-year mean. Such time sequence can express seasonal changes and their difference from year to year. For this category of anomaly, the yearly and monthly distribution is presented by the abscissa of month and the ordinate of year (Fig.1). It shows obvious interannual variation of the months in which there is peak precipitation and the onset date and duration of the raining season. The peaks usually occur in June in the 1960's and 1990's but in May in the 1970's and 1980's.

To understand the seasonal distribution of strong precipitation anomalies in the first raining season of southern China, the interannual-seasonal variations of the anomaly in Category I are analyzed on the yearly and monthly basis. The anomaly is the difference between the monthly mean of a particular month and multi-year mean of the month. It contains the mixed variations on the interannual and seasonal scales. Here, absolute values of the anomaly in Category I that are larger than or equal to 50 mm will be treated as an anomalous event. By a statistical study of both positive and negative events appearing monthly over the 48 years, one can have an illustrative analysis of the seasonal characteristics of well-defined events of precipitation anomalies (Fig.2). It shows significant seasonal variation of the event in the region. The positive anomalous event concentrates in April ~ August, mostly in July. There are also quite a number of negative anomalous event of precipitation in April ~ September, mostly in August. The event is not found in just a few months. In general, the positive and negative anomalous events are relatively significant from April to September in southern China and also quite frequent from April to June (in the first raining season), which tends to cause drought or floods.

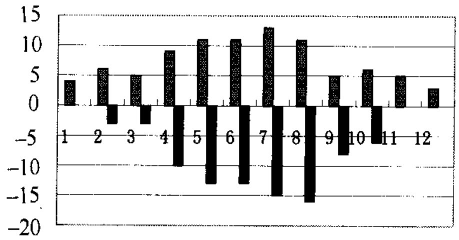

Fig.2 Interannual-seasonal variation frequency of Category I precipitation anomaly for the 48 years in southern China

2.2 *Interannual trends and variations of precipitation*

To understand the tendency of precipitation and stage variation features, we have studied the curves of Category I anomalies and corresponding 1-year filtering for the precipitation in the season (April ~ June) from 1951 to 1998 (See Fig.3, in which the year is presented on the abscissa and standardized anomalies on the ordinate). It is clearly seen that precipitation varies insignificantly on the whole, though with five periods of more or less amount over the 48 years. It is noted that precipitation increased in the 1970's, decreased in 1985 but then increased again in 1992.

2.3 *Periodic characteristics of precipitation in the first raining season*

The MORLET wavelet method is used to study the characteristics of the periodic distribution of precipitation in southern China over the 48 years (See Fig.4 in which the year is presented on the abscissa and the wavelet coefficients on the ordinate). It is obvious that the precipitation anomalies are marked by periods of 2 ~ 4 years, 5 years, 6 ~ 8 years, 10 ~ 12 years and 22 ~ 24 years, respectively. The 2 ~ 4 year period dominates the 1970's, as shown in Fig.3. The 6 ~ 8 year period is a dominating one from early 1970's to the middle and late 1980's but the 5-year period takes over beginning from the 1990's.

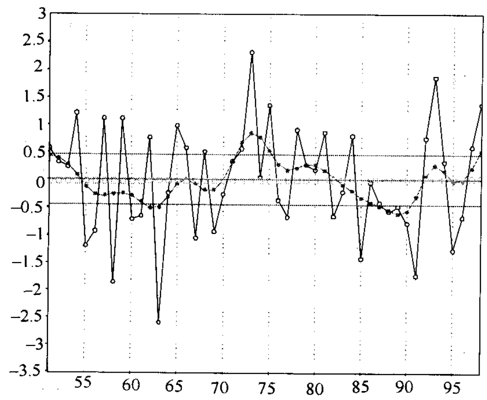

Fig.3 Category I precipitation anomaly in April ~ June from 1951 to 1998 shown as the tendency curve (□-□), 11-year filtering curve (●-●) and interannual standardization curve (O-O).

3 CIRCULATION CHARACTERISTICS OF WET AND LESS WET YEARS IN THE FIRAT RAINING SEASON OF SOUTHERN CHINA

To understand the circulation characteristics of the wet and less wet years in the first raining season of southern China, categorization is made using 45% of the mean square deviation (Fig.3) to define 18 wet years, 13 normal years and 17 less wet years (Tab.1).

Tab.1 Wet and less wet years in the first raining season of southern China

Wet years	1951, 1954, 1957, 1959, 1962, 1965, 1966, 1968, 1972, 1973, 1975, 1978, 1981, 1984, 1992, 1993, 1997, 1998
Less wet years	1955, 1956, 1958, 1960, 1961, 1963, 1967, 1969, 1977, 1982, 1985, 1988, 1989, 1990, 1991, 1995, 1996

3.1 *Distribution of national precipitation in wet and less wet years simultaneous with the first raining season of southern China*

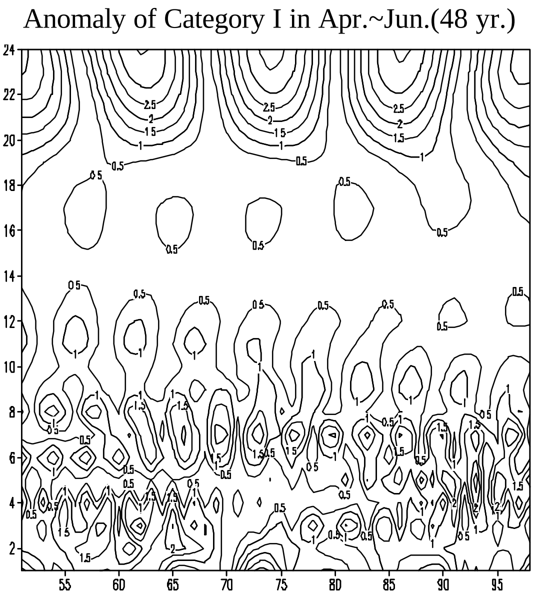

Fig.4 Wavelet analysis of Category I precipitation anomaly in the 48 years of the first raining season of southern China (1951-1998).

It is known from the results of composite comparison of national precipitation in the simultaneous wet and less wet years (figure omitted) that for years in which the southern China's first raining season is wet, there is less rain in most of the area north of the Changjiang River, much less in the Huaihe River basin between the Changjiang and Yellow Rivers but slightly more in northwestern China, Inner Mongolia and part of northeastern China; for years in which the season is less wet, there is generally an opposite distribution of national precipitation in the simultaneous periods, with most of the region north of the Changjiang River having more rain and northwestern China, Inner Mongolia and part of northeastern China having a little less.

3.2 *Characteristics of composite geopotential anomaly fields in wet and less wet years simultaneous with the first raining season of southern China*

In the 100-hPa composite geopotential anomaly fields simultaneous with wet years of the first raining season of southern China (figure omitted), negative geopotential anomalies cover the Eurasian continent in the Northern Hemisphere and most of the maritime regions, or, the region in which the South Asia high is dominating is lower throughout the whole layer near 30°N. It is therefore unfavorable for the intensification of the South Asia high. The consequence is that there is more rain in southern China but relatively less rain in the middle and lower reaches of the Chanjiang River. In the 100-hPa composite geopotential anomaly fields simultaneous with less wet years of the first raining season of southern China (Figure omitted), however, the situation is just the opposite. Positive geopotential anomalies dominate the Eurasian continent in the Northern Hemisphere and most of the maritime regions, or, the region in which the South Asia high is controlling is higher throughout the whole layer near 30°N. It is therefore favorable for the intensification of the South Asia high. The result is that there is less rain in southern China but relatively more rain in the middle and lower reaches of the Chanjiang River.

Similarly, the 500-hPa composite geopotential anomalies (figure omitted) simultaneous with wet and less wet years can also be used to study the anomalous characteristics of the circulation systems at the level in association with precipitation anomalies in the first raining season of southern China. The study shows that the negative geopotential anomaly is dominant over the mid-low latitude continent and the ocean, unfavorable for the westward and northward movement of the subtropical high to lead to a wet raining season in southern China but less wet span in the middle and lower reaches of the Changjiang River. It is just the opposite in a less wet year when positive geopotential anomaly is dominating over middle and lower latitude oceans, favorable for the westward and northward progression of the subtropical high to cause less rain in southern China but more rain in the middle and lower reaches of the Changjiang River.

3.3 *Characteristics of composite divergence anomaly fields in wet and less wet years simultaneous with the first raining season of southern China*

From the divergence field of composite anomalies at 100 hPa, 500 hPa and 850 hPa in the wet (less wet) years (figure omitted), we know that there are favorable (unfavorable) circulation for precipitation anomalies at all levels over southern China. In wet years, the 850 hPa is controlled by a zone of strong anomalous convergence, the 500 hPa is by a zone of weak anomalous convergence with weak anomalous divergence in some parts of region, and the 100 hPa is by a zone of strong anomalous divergence. The anomalies are such in the circulation system of the region that they are favorable for ascending motion and precipitation. In less wet years, however, the 850 hPa is dominated by a zone of strong anomalous divergence, the 500 hPa is by a zone of anomalous divergence and the 100 hPa is by a zone of anomalous convergence. The anomalies are such in the circulation system of the region that they are favorable for descending motion but unfavorable for precipitation.

3.4 *Characteristics of composite anomalous fields in wet and less wet years simultaneous with the first raining season of southern China*

From the 850-hPa composite anomalous fields in wet years (figure omitted), we know that there is a strong anti-cyclonic anomalous circulation over tropical oceans south of 22.5°N, which is favorable for the transport of maritime warm and humid air currents towards southern China and the precipitation there. It is just the opposite in the 850-hPa composite anomalous fields in wet years (figure omitted) in that there is a strong cyclonic anomalous circulation over tropical oceans south of 22.5°N, which is weakening the transport of maritime warm and humid air currents towards southern China and unfavorable for the precipitation there.

4 SENSITIVE WATERS AND PERIODS OF TIME

4.1 *Sensitive waters*

For the isolation of key waters of sea temperature that well relates SSTA offshore China with precipitation in the first raining season of southern China, the percentage of precipitation anomalies is used to calculate the coefficient of its correlation with monthly SSTA in individual months from the preceding April to the current March on various gridpoints in China's offshore waters. A steady negative correlation zone is then located in the tropical western Pacific. Then correlated waters with the absolute value of monthly correlation coefficient above 0.39 are picked for retrieval of the correlation with the percentage of precipitation anomalies in the first raining season of southern China. As what is discovered, the northern warm pool in the western Pacific (132.5°E ~ 141.5°E, 10.5°N ~ 13.5°N) is well correlated in preceding July with the precipitation in the raining season (figure omitted) by a coefficient of –0.51, which is over the significance level of 0.05. This zone of waters is called the western zone, which is a key in studying the precipitation in the first raining season.

4.2 *Sensitive periods of time*

4.2.1 PESISTENCE OF SSTA IN THE WESTERN ZONE

Studying the coefficient of auto-correlation between the current July and monthly SSTA a year ahead or behind it (Fig.5), we find that the monthly SSTA is all positively correlated. Particularly, there is persistent, significant positive correlation between the SSTA from the current March to the following April and that in July (at the 0.05 significance level). It is then believed that the SSTA in the western zone is strong in persistence.

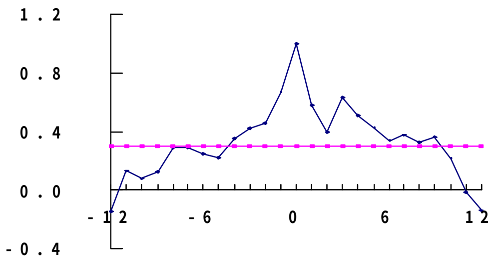

Fig.5 Time-lag auto-correlation coefficient curve for July in the western zone. The Straight line means the –0.05 confidence level; "–" means leading and "+" lagging, in the abscissa; the correlation coefficient is shown in the ordinate

4.2.2 SELECTION OF OPTIMAL CORRELATED PERIODS OF TIME BETWEEN SSTA IN WESTERN ZONE AND PRECIPITATION ANOMALIES IN THE FIRST RAINING SEASON OF SOUTHERN CHINA

It is clear from Fig.5 that the SSTA in the preceding July is well correlated with that in the preceding April, May, June and August. It is based on the fact that the coefficients of correlation between the percentage of precipitation anomalies in the raining season and the monthly SSTA in April, May, June, July and August and running monthly SSTA are calculated (Tab.2). Next is a description of how the running month is taken in Tab.2. When the coefficient of the correlation between the running monthly SSTA in June ~ August and the percentage of precipitation anomalies in the raining season is sought, June is taken crosswise and August lengthways. The point of intersecting is what the coefficient is found (–0.4563). It is seen from Tab.2 that the preceding July, preceding June ~ August and preceding June, July and August are the three periods of time with the best correlation. Comparing with some indexes (omitted), we selected the preceding June, July and August as the optimal periods of correlation.

Tab.2 Coefficients of correlation between the percentage of precipitation anomalies in the raining season and the monthly SSTA in April, May, June, July and August and running monthly SSTA

month	April	May	June	July	August
April	-0.2666	-0.3071	-0.3285	-0.3971	-0.4232
May		-0.3124	-0.3339	-0.4168	-0.4423
June			-0.3078	-0.4316	-0.4563
July				-0.5091	-0.4892
August					-0.3608

5 NEGATIVE CORRELATION BETWEEN SSTA IN COLD/WARM WATER YEAR ON THE WESTERN ZONE AND PRECIPITATION IN SOUTHERN CHINA

To learn more about the trend of negative correlation between the SSTA and precipitation in southern China, we first make a 11-year running mean of the percentage of precipitation anomalies and the SSTA in the western zone in the preceding months (June ~ August) for a 44-year duration in southern China (Fig.6). It reveals significant negative correlation in the 1950's, 1970's and 1980's. Then, the criterion of 0.08°C is used to isolate 16 cold water years and 16 warm water years from the June-August SSTA in the western zone. By composite treatment of national precipitation anomalies in the April ~ June periods subsequent to the cold and warm water years, we know that precipitation is significantly more in southern China but relatively less in the Changjiang River basin, in cold water years; it is significantly less in southern China but relatively more in the Changjiang River basin, in warm water years. The change of rainfall is obviously clear within the province of Guangdong, which is consistent with national precipitation distribution in periods simultaneous with wet and less wet raining season in southern China. It is now clear that the zone of waters selected is indeed in negative correlation with precipitation in southern China.

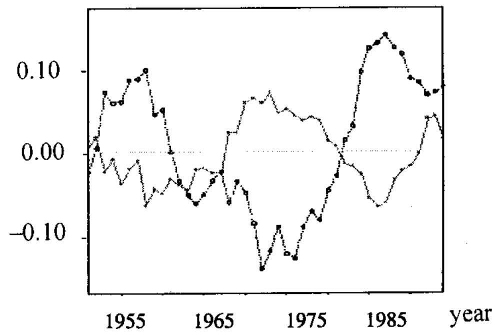

Fig.6 11-year running mean curve of the percentage of precipitation anomalies for the 44 years (1951-1994) in the first raining season of southern China (blackened line) and 11-year running mean curve of SSTA of the western zone in preceding June ~ August.

6 STUDY ON THE MECHANISM OF THE EFFECT OF SSTA IN THE WESTERN ZONE ON THE PRECIPITATION IN SOUTHERN CHINA

It is inevitable that precipitation anomalies caused by preceding SST in the western zone will result in the anomaly of the general circulation system on the whole, including the region of southern China. Now that we have learned of the circulation anomalies in simultaneous periods with the anomalous precipitation years in the first raining season of southern China, next will be a discussion of how the general circulation will evolve as a result of SSTA in both warm and cold water years in the western zone, i.e. what the characteristics of the circulation are in April ~ June in the subsequent years of warm or cold water events.

6.1 *Characteristics of circulation anomalies*

6.1.1 ANOMALOUS FIELDS OF COMPOSITE GEOPOTENTIAL HEIGHT IN APRIL ~ JUNE SUBSEQUENT TO WARM OR COLD WATER YEARS IN THE WESTERN ZONE

It is known from the anomalous field of composite geopotential height at 100 hPa in April ~ June subsequent to the warm or cold water years in the western zone (figure omitted) that there are significant out-of-phase characteristics in areas controlled by the South Asia high near 30°N. During the cold water years, the geopotential anomaly is negative in the middle-and lower-latitude continent and the oceans in the Northern Hemisphere, i.e. the region in which the South Asia high is dominating is lower throughout the whole layer near 30°N. It is therefore favorable for more precipitation in southern China but relatively less rain in the middle and lower reaches of the Chanjiang River. The situation is just the opposite in warm water years. Positive geopotential anomalies dominate the Eurasian continent in the Northern Hemisphere and the oceans, i.e. the region in which the South Asia high is controlling is higher throughout the whole layer near 30°N. It is there favorable for less precipitation in southern China but relatively more precipitation in the middle and lower reaches of the Chanjiang River.

Similarly, It is known from the anomalous field of composite geopotential height at 500 hPa in April ~ June subsequent to the warm or cold water years in the western zone (figure omitted) that there are significant out-of-phase characteristics. During the cold water years, the geopotential anomaly is negative in most of the middle-and lower- latitude oceans, being therefore unfavorable for the westward and northward advancement of the subtropical high and causing more precipitation in the first raining season in southern China but relatively less rain in the middle and lower reaches of the Chanjiang River. The situation is just the opposite in warm water years. Positive geopotential anomalies dominate most of the middle-and lower- latitude continent and oceans, being therefore favorable for the westward and northward advancement of the subtropical high and causing less precipitation in southern China but relatively more rain in the middle and lower reaches of the Chanjiang River.

By comparing the subsequent years and the current years in relation to the warm or cold events, we know that the April ~ June geopotential anomalous fields in periods subsequent to SSTA in the western zone are basically consistent with those in periods simultaneous with the precipitation anomalies in southern China's first raining season.

6.1.2 CHARACTERISTICS OF MEAN ANOMALOUS FIELDS OF COMPOSITE DIVERGENCE IN APRIL ~ JUNE SUBSEQUENT TO WARM OR COLD WATER YEARS IN THE WESTERN ZONE

Examining the anomalous fields of composite divergence at 100 hPa, 500 hPa and 850 hPa in April ~ June subsequent to cold (warm) water years in the western zone (figure omitted), we can find similar features to those simultaneous with precipitation anomalies of wet (less wet) years in the first raining season of the southern China. They clearly show the background circulation anomalies favorable (unfavorable) for precipitation, which are formed on upper (lower) levels in southern China in April ~ June. In the cold water years in southern China, the 850 hPa is controlled by a zone of strong anomalous convergence, the 500 hPa is by a zone of weak anomalous convergence with weak anomalous divergence in some parts of the region, and the 100 hPa is by a zone of anomalous divergence. The anomalies are such in the circulation system of the region that they are favorable for ascending motion and precipitation. In the warm water years, however, the 850 hPa is dominated by a zone of strong anomalous divergence, the 500 hPa is a zone of anomalous divergence and the 100 hPa is by a zone of anomalous convergence. The anomalies are such in the circulation system of the region that they are favorable for descending motion but unfavorable for precipitation. For more understanding of the source of moisture and low-level characteristics, the flow fields of 850-hPa composite anomalies are additionally analyzed in April ~ June following the cold or warm water years in the western zone.

6.1.3 CHARACTERISTICS OF COMPOSITE ANOMALOUS FIELDS IN APRIL ~ JUNE SUBSEQUENT TO WARM OR COLD WATER YEARS IN THE WESTERN ZONE

From the flow field of 850-hPa composite anomalies in April ~ June subsequent to the cold water in the western zone (figure omitted), we know that there is a strong anti-cyclonic anomalous circulation over the tropical ocean south of 25°N. It is a favorable factor for the transportation to southern China of warm and humid air current from tropical ocean and the precipitation in southern China. From the flow field of 850-hPa composite anomalies in April ~ June subsequent to the warm water in the western zone (figure omitted), we know that in contrast there is a deep cyclonic anomalous circulation over the tropical ocean south of 25°N. It is a unfavorable factor for the transportation to southern China of warm and humid air current from tropical ocean and the precipitation in southern China. The situation is similar to the flow fields of composite anomalies at 850 hPa in April ~ June simultaneous with the wet and less wet raining seasons in southern China.

6.2 *Relationship of SSTA between the western zone and global waters*

Does the SSTA in the western zone has anything to do with other waters? To make clear the issue, we have done a composite analysis of global SSTA on a monthly basis from June to the following March in both warm and cold water years. Take the case of July as illustration. It is found that the SSTA is mainly of positive anomalous distribution across the globe but a few isolated locations in the current July of warm water years (Fig.7a) while extensive positive anomalies are present in the Indian and Atlantic Oceans. It is interesting to find that significant out-of-phase anomalies exist between the northeastern Pacific / Nino 3 & 4 near 40°N and the tropical western Pacific where the western zone is located. In the cold water years, the SSTA in most of the global waters is dominated by negative anomalous distribution (Fig.7b) while strong positive anomalies prevail near 40°N in northern Pacific and Nino 3 & 4, which is generally opposite to the phase in warm water years. For both warm and cold water years, most of the distribution of SSTA can last from June to the following March, in the preceding period (figure omitted).

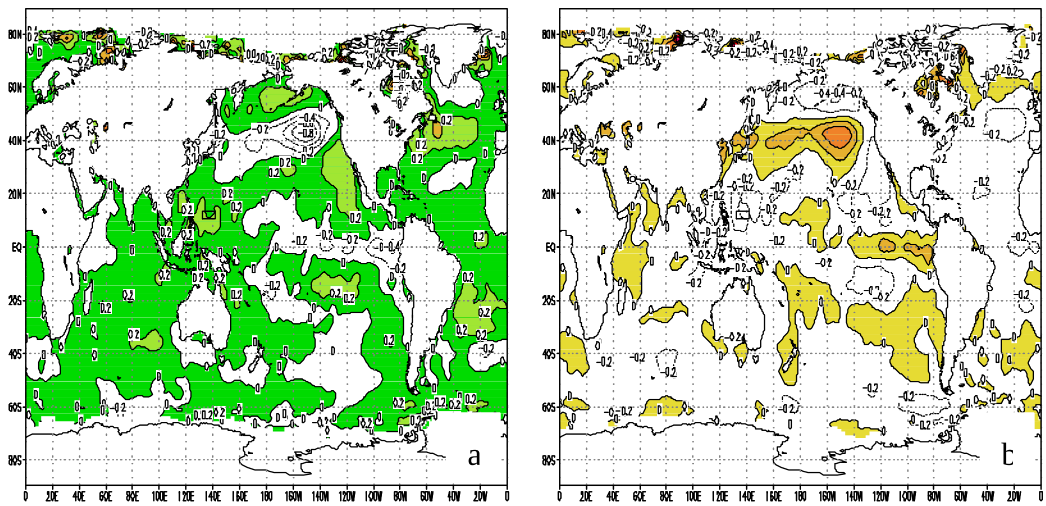

Fig.7 Distribution of composite global SSTA in the preceding July of the warm water years (a) and cold water years (b) in the western zone.

Small as it is, the western zone is in phase with the globe in terms of SSTA in addition to its out-of-phase teleconnection with northern Pacific Ocean and Nino 3 & 4 waters. More study shows that northern Pacific near 40°N and Nino 3 & 4 are anticorrelated with the western zone only in discontinuous months. It is therefore reasonable to think that the western zone is a region that is sensitive to the precipitation in the first raining season of southern China, as offshore waters is the right region on which we should focus more in our study of the effect on precipitation in China.

7 CONCLUDING REMARKS

a. There are significant interannual variations in the month of peak values, onset and duration of the raining season in southern China. The peaks usually occur in June for the 1990's and 1960's but in May for the 1970's and 1980's. The precipitation anomalies vary with large frequency and easily cause droughts or floods. Nevertheless, the general tendency of precipitation is not as significant as before over the past few dozens of years in southern China. There are five well-defined climatic sections of precipitation over the 48 years of interest. Multi-scale oscillations are found with the precipitation anomalies, which are 2 ~ 4 year, 5 year, 6 ~ 8 year, 10 ~ 12 year and 22 ~ 24 year.

b. In the simultaneous periods of wet and less wet years of the first raining season in southern China, generally opposite distributions are found in national precipitation. In periods simultaneous to the wet years of the southern China raining season, the South Asia high is weak at 100 hPa and the subtropical high moves northward at a later date at 500 hPa. It is just the opposite in the less wet years of the raining season.

c. In the wet years of the raining season, an anomalous convergence zone is at the lower levels and an anomalous divergence zone at the upper levels, favoring the updraft and precipitation. In the meantime, there is a strong anti-cyclonic anomalous circulation at 850 hPa over the tropical waters south of 22.5°N, which favors the transportation of oceanic warm and humid air current to southern China. It is just the opposite in the less wet years.

d. Near the warm pool of the western Pacific in offshore waters of China, a negative correlation zone has been in the region (132.5°E ~ 141.5°E，10.5°N ~ 13.5°N) that steadily affects the precipitation in the first raining season of southern China, mostly during June ~ August in the preceding year.

e. For April ~ June subsequent to the cold or warm water years, the anomalous fields of 100 hPa and 500 hPa composite geopotential height and divergence and the flow fields of 850 hPa composite anomalies have characteristics similar to those with the wet or less wet years. It is therefore determined that the cold and warm water years affect the precipitation in the first raining season of southern China. Detailed affecting mechanisms are to be revealed through numerical modeling.

Acknowledgements: Mr. CAO Chao-xiong, who works at the Guangzhou Institute of Tropical and Oceanic Meteorology, has translated the paper into English.

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