THE CLIMATIC SUMMARIES OF THE WESTERN PACIFIC TYPHOONS DURING 1945-1973 (I)

P I N - T S E C H A N G
(張 簪 澤)
Department of Atmospheric Sciences
Chinese Culture University

ABSTRACT

Climatic summaries of typhoon trajectories, landfall locations, and pressure changes are presented for two areas in the western pacific Ocean. These summaries were extracted from "best track" geographical positions and central pressure tabulations of typhoons that occurred between 1945 and 1973. Typhoons that passed within 700 n.mi. of Guam or east of the Philippines were segregated by "10-day" periods from July 21 through October 31. Maps with the track lines of these storms for each "10-day" peeriod are presented. Statistics of typhoon movement, pressure, elapsed time, speed, and distance traveled are in tabular form for "10-day", monthly, and seasonal periods for 14 classifications of inland and continental coast segments.

1. INTRODUCTION

The tracks of typhoons that occured over 29 years in two regions of the Pacific have been examined. From this study, typhoon landfall and pressure statistics for these storms were determined. The regions, the oceanic area within 700 n.mi. of Guam region was further divided into four subcategories. These were obtained by halfing the primary region and adding a second circle within a 470 n.mi. radius of Guam. The geographical area covered by these four subcategories is also shown in figure 1.

To see the effect of typhoons on selected areas of the Asian continent and the islands of the western North Pacific, the coastline was divided into 13 segments, or landfall areas (7 island and 6 continental), that include the adjacent oceanic waters out to 50 n.mi.

(fig. 1). A 14th category was defined for those storms that did not make landfall on the Asian coast or islands.

2. DATA SOURCE

Climatic typhoon data for the western Pacific Ocean from 1945 through 1973 were obtained from the Environmental Data Service, NOAA. This data base contained the "best typhoon as determined by the Joint track" geographical positions of the Typhoon Warning Center, Guam. Positions of the storm were tabulated at 6-hourly intervals from the time the typhoon was named as a tropical storm until it dissipated, or changed to a cold core cyclone. Atmospheric pressure values of the storm center recorded every 6 hours are also included in the data base.

3. TIME SEGREGATION OF THE DATA

It is known that some aspects of typhoon tracks and intensity vary with the time of year. To minimize such seasonal effects, the data base of 377 typhoons of the western Pacific Ocean was divided into 10 periods of 10 or 11 days, with the first period beginning on July 21 and the last ending on October 31.

4. STORM TRACK MAPS

For a first look at the data, storm track lines of all typhoons that passed through or formed within the two regions for each "10-day" period were plotted on Mercator projection maps shown in Figures 2a through 2j.

An examination of these maps indicates that there are preferred coastal sections where typhoons make landfall. From late July to early August, there appear to be two preferred sea lanes that the typhoons follow. One of these lanes originates in the southern Guam area and extends through the Philippine Islands westward into southern China. The other lane has a more northwestward orientation and passes into the Ryukyu Islands into southern Japan. By mid-August, the two lanes appear to have moved northward. The southern lane traverses the Taiwan area, while the other more dispersed lane passes over the island of Honshu, Japan.

Early September, storm tracks seem to have a more diffuse pattern, and no preferred sea lane for typhoons is obvious. In mid-September, however, two basic sea lanes tend to reappear. Again, the southern-most one passes north of the Philippine Islands; the other one seems to curve northward, east of Japan. In the whole month of October, the two basic sea lanes seem follow the same pattern as in September.

5. CATALOGING THE DATA

The shoreline intersected by all storms that passed through either region was divided into 13 segments. Several quantities computed and tabulated from the storm data base by the "10-day" period for each coastal seg-

ment, as well as for storms that made no landfall, are:

(1) Number of storms
(2) Average pressure of storms leaving the study area
(3) Average pressure of storm landfall
(4) Average minimum pressure
(5) Elapsed time from the study area to landfall
(6) Average actual distance traveled by the storms from the study area to landfall
(7) Average computed direct distance from the study area to landfall
(8) Average computed actual speed of the storms

Note that storms which pass over an island coastal section may also make landfall affecting several continental sections.

Tabulations of the number of storms from the Guam area that intersected the coastal segments are shown by the "10-day" periods in table 1. (Tables 1 through 22 are in sequence.) The totals show trends in landfall preference for sections 1, 2, 4, 5, and 11, as well as a preference for no landfall. A total of 170 storms passed through the Guam area during the base period. Of these, 67 (39%) never made landfall. Early in the season, typhoons from the Guam regions followed the more northerly track to the Ryukyus. This track shifted toward southern Japan by mid-August, becoming more diffuse through September. In October, the center of activity of the southern lane returned to the Philippines. From mid-September to the end of October, the development of the northern lane east of Japan was clear.

Similar tabulations of the number of storms are shown for the Philippine Island region in table 2. In this case only 14 (11%) of the 127 storms failed to make landfall. The predominant sections for landfall of these typhoons are 1, 2, 3, 9, 10, and 11. As the season progresses, in late July and early August the southern lane shows up in the percentage of storms striking sections 1 and 2. By the end of August, section 2 is receiving nearly half of all storms from the Philippine region. The preferred track is difficult to find during September, but shifts once more to section 1 in October. The number of storms in the Philippine region that do not make landfall is also greatest in late October.

The number of storms that passed through the southwestern half of the Guam area is shown in table 3. Nearly half of the 82 storms from this subregion passed through sections 1 and 2, with exactly half making landfall on the continental sections 9, 10 and 11. This demonstrates a tendency for typhoons in the southwestern portion of the Guam region to head west along the southern storm lane. In late October, however, a majority of the storms in this group failed to make landfall by following the preferred northern sea lane.

Storms from the northeastern half of the Guam region, counted in table 4,

also show some interesting trends. The preferred landfall sections are 4 and 5, while over half of the 109 typhoons make no landfall. The cyclic migration of the northern storm lane is clearly seen in the number of storms intersecting coastal sections 4 and 5. The July and early August storms tend to strike section 4; the mid-August storms more often affect section 5. By mid-October, however, no storm from the northeastern half of Guam makes landfall.

We have further subdivided the Guam area by placing a circle of 470 n.mi. radius around Guam. Typhoons that passed through the two resulting regions are grouped by section of landfall and the "10-day" period in tables 5 and 6. Table 5 lists storms in the southwestern half of the circle. One-fourth of these storms passed through section 1. Nearly one-third of the storms listed in table 5 failed to intersect a coastal section, mainly in October. Typhoons from the northeastern half of the small circle are categorized in table 6. Half of the storms in this class failed to make landfall. Sections 4 and 5 are most frequently struck by the remaining half.

Tables 7 through 13 deal with parameters of storms passing through the Guam area. Table 7 lists the average pressures of all storms as they leave the large circle around Guam. The average presures of these storms at landfall are shown in table 8. When the mean pressures at both points for each coastal section over the whole season are compared, a trend for storms to deepen before striking sections 1 through 4 becomes evident. Typhoons striking section 5 have a tendency to be filling, as do those striking all continental coastal sections. The tendency to fill before striking sections 7 through 13 could be due, at least in part, to the effect of landfall at the island coastal segments.

Average minimum pressures of storms from the Guam area are presented by "10-day" periods in table 9. Means for each coastal section show a range of 40 mb, with the extremes occurring in small samples. Storms striking island sections 1, 2, and 3 have lower average minimum pressures than those striking sections 4 and 5. Continental sections 9 through 12, which receive storms from the southern sea lane, also have lower average minimum pressures than those sections further north. Storms that fail to make landfall have the highest average minimum presures, discounting the very small samples in section 6 and 7. The variation of average minimum pressure by the "10-day" periods is much less. The higher values tend to fall in periods dominated by storms that do not pass any coastal segments.

The minimum times for storms from the Guam region to make landfall are shown in table 10a. One storm took only 30 hours to make landfall at coastal section 5. Several other storms required only about 40 hours to strike

this section as well as other coastal sections. The minimum time to reach a continental section was 60 hours.

The average time necessary for a storm to pass from the study area to a coastal section is in table 10b. Landfall at island sections occurred more rapidly than at continental sections because of the distances involved. Roughly 70 hours were spent by storms moving from the Guam area to an island coast. Storms took between 60 and 90 hours to make landfall on a continental coast.

Tables 11 and 12 show the distance storms traveled from the Guam area to the point of landfall. In table 11 the straight line distance between the two points was calculated. The average actual distances storms covered are in table 12. The storm track line of the typhoon is most erratic when the difference between the two is greatest. The differences for storms from this area were never larger than 20%.

Values of average actual speed were computed from the values of average actual distance and average elapsed time. These speed values are found in table 13. It can be seen from the table that storms that took the southern sea lane through sections 1 and 2 moved at nearly the same speed. On the northern track, storms that struck sections 3 and 4 seemed to travel more slowly than those striking section 5. All typhoons striking the continental coast progressed at roughly the same speed. Those storms that entered section 12 did so from section 11; this might explain the somewhat lower speeds there.

Tables14 through 20 deal with parameters of storms from the region east of the Philippine Islands.

The average pressures of typhoons leaving the Philippine study area, compiled in table 14, and average pressures at the point of landfall, contained in table 15, are compared to show changes in pressure. The trend seen earlier, for Guam storms to deepen before landfall at coastal sections 1, 2 and 3, is seen for storms from this region only in coastal sections 3 and 4. In all other cases the storms fill, slightly for sections 1 and 2, more for the other sections.

Table 16 shows the average minimum pressures of storms from the Philippine Islands region. The spread of mean values for each section is only 23 mb, with the extremes again in small samples. A possible pattern emerges when the means of each time period are examined. Late July and early August storms, as well as those in October, seem to have slightly lower minimum pressures. However, the data is biased by four very deep typhoons.

The minimum times for storms from the Philippine Islands region to make landfall are shown in table 17a. Several storms only took 6 hours or less to strike coastal sections because the region was near the coast. Only 12 hours were required by one storm to strike the continental coast.

Average elapsed times from the Philippine Islands area to the 13 coastal segments are listed in table 17b. Because of the proximity of this area to land, elapsed time to sections 1, 2, and 3 only averaged between 16 and 18 hours. The time required for landfall at sections 4 and 5 and the continental sections was considerably greater.

The average direct and actual distances a storm covered as it moved from the area east of the Philippines to a coastal section are shown in tables 18 and 19 respectively. The difference between average actual and direct distances never exceeded 14%.

Finally, computed values for average actual speeds of storms from the Philippine Islands area are in table 20. The variation of the mean actual speed by coastal section points to the possibility that storms that follow the southern sea lane move faster than those to the north. An examination of the mean actual speed for each time period reinforces this idea. The average for late July, late September and late October, when all storms follow the southern sea lane through sections 1 and 2, are higher than when one or more typhoons take a more northerly course.

A summary of averages for Guam storms is shown in table 21. A similar collection of values for storms passing through the Philippine Islands region is available in table 22.

Storms occurring from July 21 to October 31 during 1945 to 1973 which struck the Ryukyu Islands or Japan, can be divided into two basic groups: those that passed through the study regions with typhoon intensity, and those that did not. Of the 68 storms making landfall in the Ryukyu, 45 (66%) filled the former criteria. Another 14 passed through the area as tropical storms. Only 9 storms met the latter criteria by not passing through the study regions. For the 29 years of record, only 37 storms struck the Japanese coast. Twenty-six (70%) of these were in the study area. Over one-half of the remaining storms did not pass through the study area at all.

Storms that were in the study region deepened more between the point of origin and landfall than storms that were not. The average pressure change for Ryukyu storms was 33.0 mb for typhoons in the former category and 18.1 mb for those in the latter. For Japan storms, these figures were 28.5 mb and 19.4 mb respectively.

6. summary and conclusion

6.1 Storm in the Study Regions

1. Between July 21 and October 31 from 1945 to 1973, there were 377 typhoons and 53 tropical storms in the western Pacific.

2. A total of 241 typhoons (64%) passed through either of the study regions during the period examined.

3. The average number of storms per year, passing through either region, is

8.3. This differs from the figure Mallinger (1972) found because of a difference in selection criteria and data sample. The actual distribution of storms per year is shown in figure 3. As Hawkins and Imbembo (1973) noted, there has been a trend towards fewer storms in recent years.

6.2 Guam Storms

1. A total of 170 typhoons passed through the Guam area between July 21 and October 31 from 1945 to 1973.

2. Of this total, 40% did not make landfall of the Asian continent or adjacent islands.

3. Storms from the northeastern half of the Guam area failed to strike land more than 50% of the time.

4. More than 50% of the storms that passed on the northeastern side and within 470 n.mi. of Guam did not make landfall and only 33% struck either the Ryukyu Islands or southern Japan.

5. Only 6% of the October storms that passed through the northeastern half of the Guam circle affected any coastal region.

6. Generally, storms with tracks south of the island of Okinawa tended to deepen before landfall, while those to the north had a tendency to fill.

7. Westward moving storms had lower average minimum pressures than storms moving northwesterly. Storms that curved away from the populated coastal regions without making landfall had the highest average minimum pressures.

8. Approximately 70 hours elapsed between storm departure from the study area and landfall on the island chains. More than 100 hours passed before landfall on the mainland of Asia.

9. Storms striking the Ryukyu Islands moved about 12% slower than those striking to the north or south.

6.3 Philippine Storms

1. In the period of interest, 127 typhoons passed through the Philippine Islands area.

2. The number of storms reached a maximum in late August through mid-September.

3. More than 65% of the storms made landfall in the Philippines or Taiwan. Fifty percent of all storms continued onto the coast of China.

4. Storms early and late in the season had slightly lower average minimum pressures than those in mid-season.

5. Storms south of the island of Okinawa tended to move faster than those to the north.

9. REFERENCES

Hawking, H.F. and S.M. Imbembo (1973): Seeding opportunities for Project STORMFURY in the Western Pacific (1964-1973) and eastern Pacific (1969-1973). Project STORMFURY 1973 Annual Report, U.S. Department of Commerce, NOAA,NHEML, Coral Gables, Florida, Section 4.

Mallinger, W.D. (1972): Typhoon seeding eligibility in the western North Pacific. Project STORMFURY Annual Repaort, U.S. Department of Navy and U.S. Department of Commerce,

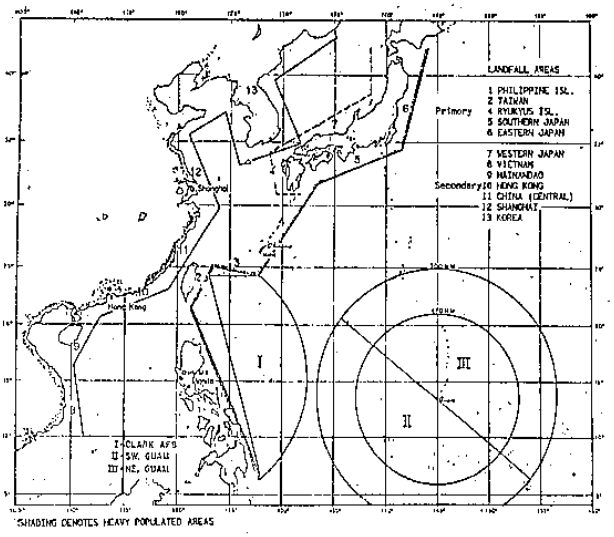

Figure 1. Typhoon study areas and selected coastal shorelines.

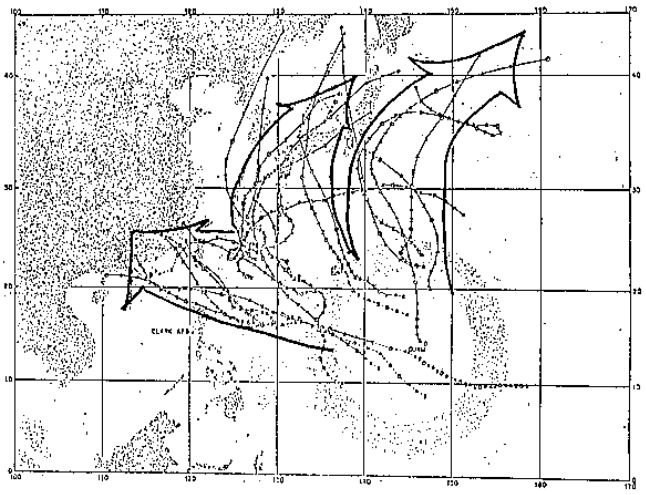

Figure 2c. Typhoon tracks lines traversing the study areas from August 11 to 20, 1945-19743.

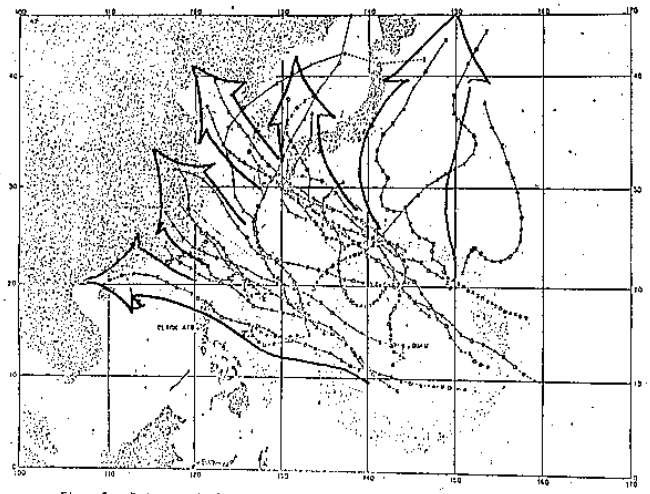

Figure 2a. Typhoon tracks lines traversing the study areas from July 21 to 31, 1945-1973.

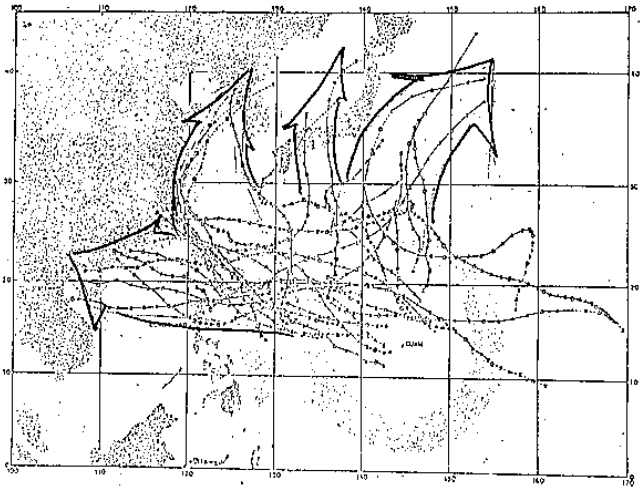

Figure 2d. Typhoon tracks lines traversing the study areas from August 21 to 31, 1945-1973.

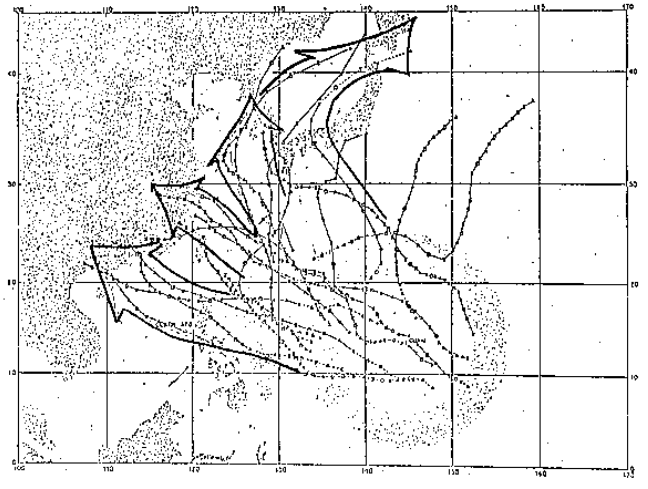

Figure 2b. Typhoon tracks lines traversing the study areas from August 1 to 10, 1954-1973.

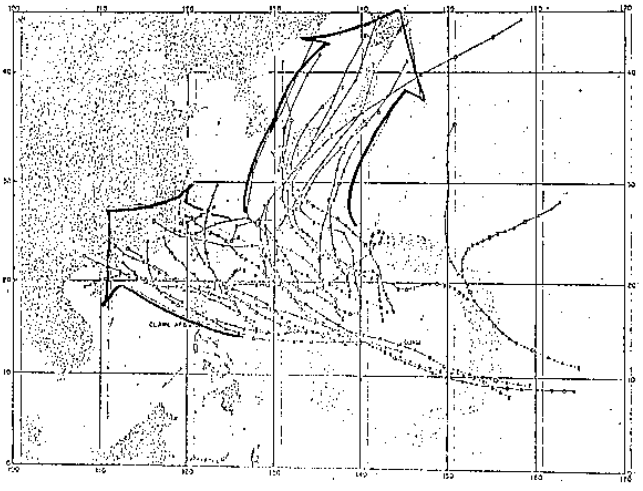

Figure 2e. Typhoon tracks olnes traversing the study areas form September 1 to 10, 1945-1973.

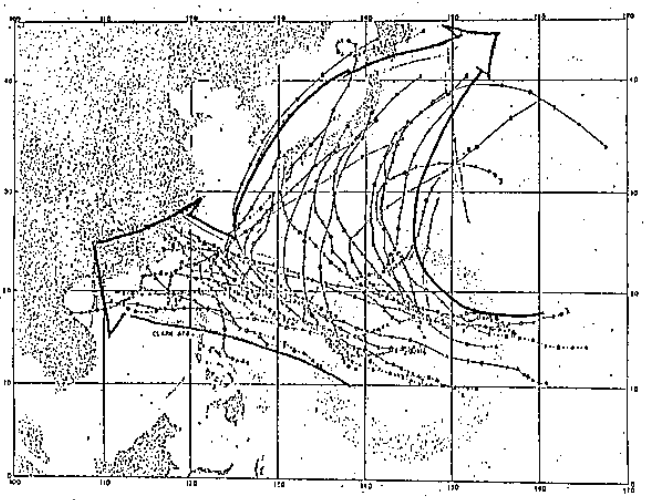

Figure 2f. Typhoon tracks lines traversing the study areas from September 11 to 20, 1945-1973.

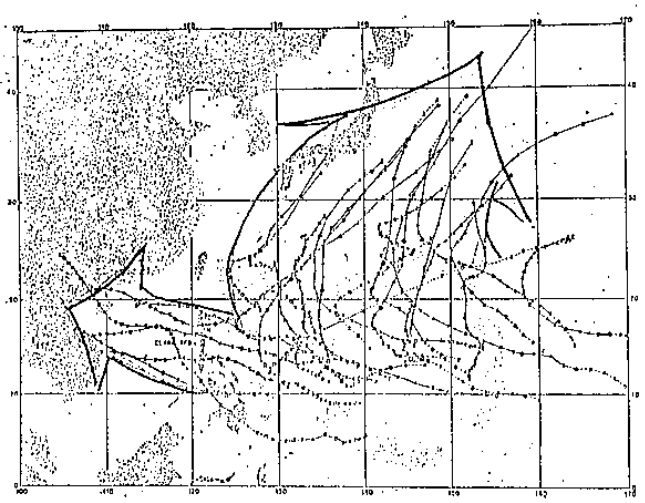

Figure 2i. Typhoon tracks lines traversing the study areas from October 11 to 20, 1945-1973.

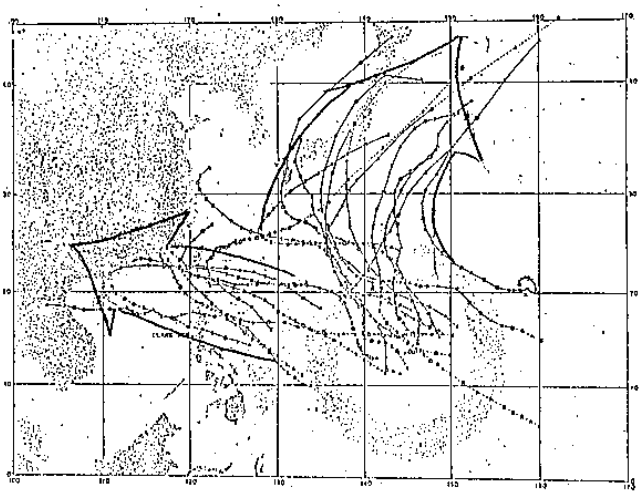

Figure 2g. Typhoon tracks lines traversing the study areas from September 21 to 30, 1945-1973.

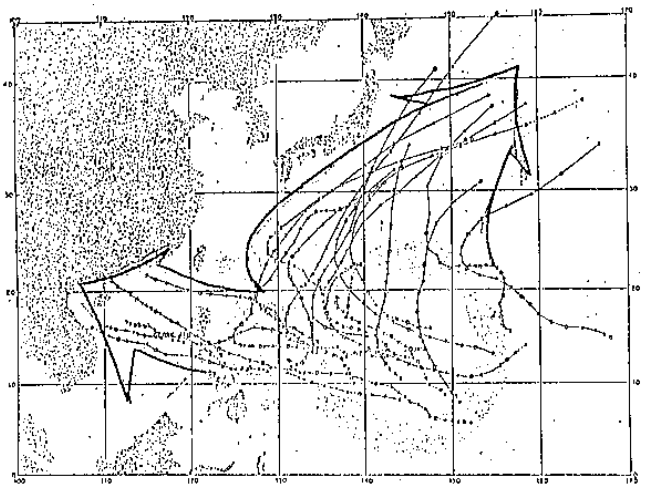

Figure 2j. Typhoon tracks lines traversing the study areas from October 21 to 31, 1945-1973.

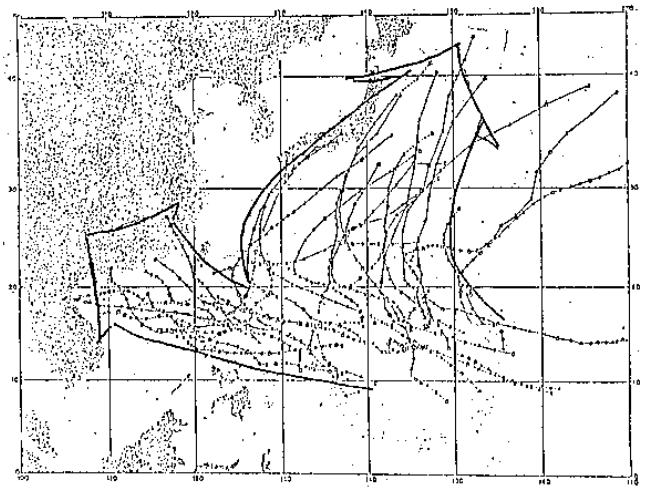

Figure 2h. Typhoon tracks lines traversing the study areas from October 1 to 10, 1945-1973.

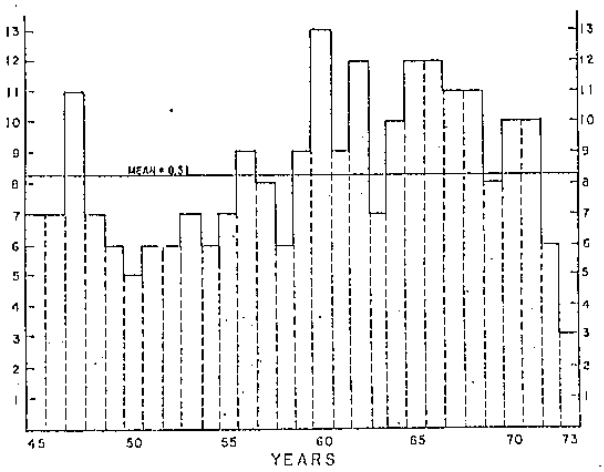

Figure 3. Distribution of typhoons through the study areas.

Table 1. Number of storms From the Guam Area That Intersect 13 Asian Costal Sectionss

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall	Total Guam storms
July 21-31	2	2	1	6	1	1	-	-	-	2	3	1	2	3	16
Aug. 1-10	2	3	2	2	2	-	-	-	1	3	5	-	1	2	13
11-20	1	1	-	2	5	-	1	-	1	-	1	-	2	2	11
21-31	2	4	1	2	1	-	-	-	-	3	5	2	-	6	16
Sept. 1-10	3	3	-	6	5	-	-	-	1	3	3	-	1	2	19
11-20	1	4	4	1	5	-	-	-	1	-	3	-	-	7	22
21-30	1	2	-	4	3	-	-	-	-	2	2	1	-	6	16
Oct. 1-10	5	-	3	-	2	-	-	-	3	1	1	-	-	11	21
11-20	5	-	-	-	-	-	-	2	2	-	-	-	-	16	21
21-31	3	-	-	-	-	-	-	1	1	-	-	-	-	12	15
Total	25	19	11	23	24	1	1	3	10	14	23	4	6	67	170

Table 2. Number of Storms From the Philippine Islands Area That Intersect 13 Asian Coastal Segments

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall	Philippine storms
July 21-31	2	4	3	-	-	-	-	-	-	2	4	2	1	1	10
Aug. 1-10	4	3	1	3	-	-	-	-	2	3	4	-	-	1	12
11-20	3	4	3	2	-	-	-	-	1	4	4	-	1	-	12
21-31	6	9	1	1	1	-	-	-	2	5	9	4	2	1	19
Sept. 1-10	7	-	-	3	2	-	-	-	2	6	5	1	-	1	13
11-20	5	7	6	-	-	-	-	-	3	3	6	-	-	-	18
21-30	5	4	-	-	-	-	-	-	2	5	1	-	-	-	9
Oct. 1-10	9	-	3	1	-	-	-	-	5	3	1	-	-	1	14
11-20	5	-	1	-	-	-	-	2	2	-	-	-	-	4	10
21-31	5	-	-	-	-	-	-	1	2	-	-	-	-	5	10
Total	15	31	18	10	3	0	0	3	21	31	34	7	4	14	127

Table 3. Number of Storms That Passed Through the Southwestern Half of the Guam Area

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall	Total each period
July 21-31	2	2	-	-	1	-	-	-	-	2	2	-	-	-	5
Aug. 1-10	2	3	2	1	1	-	-	-	1	3	5	-	1	-	9
11-20	1	1	-	2	-	-	-	-	1	-	1	-	1	-	4
21-31	2	3	1	-	-	-	-	-	-	2	4	2	-	2	8
Sept. 1-10	3	3	-	3	3	-	-	-	1	3	3	-	1	-	12
11-20	1	2	4	-	3	-	-	-	1	-	1	-	-	-	10
21-30	1	1	-	-	-	-	-	-	-	2	1	-	-	1	3
Oct. 1-10	4	-	3	-	1	-	-	-	3	1	1	-	-	2	10
11-20	5	-	-	-	-	-	-	2	2	-	-	-	-	5	10
21-31	3	-	-	-	-	-	-	1	1	-	-	-	-	8	11
Total	24	15	10	6	9	0	0	3	10	13	18	2	3	18	82

Table 4. Number of Storms That Passed Through the Northeastern Half of the Guam Area

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall	Total each period
July 21-31	-	-	1	6	1	1	-	-	-	-	1	1	2	3	12
Aug. 1-10	-	1	1	2	1	-	-	-	-	1	2	-	1	2	7
11-20	-	-	-	-	5	-	1	-	-	-	-	-	1	2	7
21-31	1	2	-	2	1	-	-	-	-	2	2	1	-	6	12
Sept. 1-10	1	-	-	5	3	-	-	-	-	1	-	-	1	2	11
11-20	-	3	-	1	2	-	-	-	-	-	2	-	-	7	13
21-30	-	-	-	4	3	-	-	-	-	-	1	1	-	6	13
Oct 1-10	1	-	-	-	1	-	-	-	-	-	-	-	-	10	12
11-20	-	-	-	-	-	-	-	-	-	-	-	-	-	13	13
21-31	-	-	-	-	-	-	-	-	-	-	-	-	-	9	9
Total	3	6	2	20	17	1	0	0	0	4	8	3	5	60	109

Table 5. Number of storms in the Southwestern Half of the Guam Area That Passed Within 470 n.mi. of Guam

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall	Total each period
July 21-31	2	2	-	-	1	-	-	-	-	2	2	-	-	-	5
Aug. 1-10	1	1	1	1	-	-	-	-	-	1	2	-	1	-	4
11-20	1	-	-	1	-	-	-	-	1	-	-	-	-	-	2
21-31	1	2	1	-	-	-	-	-	-	-	4	1	-	2	6
Sept. 1-10	2	1	-	2	1	-	-	-	-	2	1	-	-	-	6
11-20	-	1	2	-	3	-	-	-	-	-	-	-	-	-	6
21-30	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Oct. 1-10	2	-	2	-	-	-	-	-	2	-	-	-	-	2	6
11-20	1		-	-	-	-	-	-	1	-	-	-	-	3	4
21-31	2	-	-	-	-	-	-	1	1	-	-	-	-	6	8
Total	12	7	6	4	5	0	0	1	5	5	9	1	1	14	48

Table 6. Number of Storms From the Northeastern Half of the Gham Area That Passed Within 470 n.mi. of guam

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall	Total each period
July 21-31	-	-	1	3	-	-	-	-	-	-	1	1	1	1	5
Aug. 1-10	-	1	1	2	-	-	-	-	-	1	2	-	1	1	5
11-20	-	-	-	-	2	-	-	-	-	-	-	-	-	2	4
21-31	1	2	-	1	1	-	-	-	-	2	1	1	-	3	8
Sept. 1-10	1	-	-	3	1	-	-	-	-	1	-	-	-	-	5
11-20	-	3	-	1	2	-	-	-	-	-	2	-	-	5	11
21-30	-	-	-	3	3	-	-	-	-	-	1	1	-	4	10
Oct. 1-10	1	-	-	-	1	-	-	-	-	-	-	-	-	6	8
11-20	-	-	-	-	-	-	-	-	-	-	-	-	-	8	8
21-31	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4
Total	3	6	2	13	10	0	0	0	0	4	6	3	2	34	68

Table 7. Average Pressure (mb) of Storms as Thery Were Leaving the guam Area

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfal
July 21-31	939.5	982.5	929.0	972.5	941.0	969.0	-	-	-	939.5	964.7	929.0	929.0	967.3
Aug. 1-10	981.0	971.3	957.5	920.5	984.0	-	-	-	987.0	962.3	965.8	-	908.0	979.5
11-20	912.0	980.0	-	976.0	968.0	-	968.0	-	912.0	-	980.0	-	966.0	957.0
21-31	959.0	942.5	933.0	978.0	962.0	-	-	-	-	952.7	949.2	939.0	-	956.3
Sept. 1-10	953.3	984.3	-	946.8	975.6	-	-	-	987.0	952.3	984.3	-	954.0	973.0
11-20	996.0	936.0	969.3	915.0	946.6	-	-	-	996.0	-	933.3	-	-	960.4
21-30	980.0	991.0	-	948.0	954.3	-	-	-	-	986.0	954.5	919.0	-	966.7
Oct. 1-10	975.8	-	982.3	-	949.0	-	-	-	966.7	983.0	983.0	-	-	941.6
11-20	965.2	-	-	-	-	-	-	981.0	945.0	-	-	-	-	964.9
21-31	956.0	-	-	-	-	-	-	935.0	951.0	-	-	-	-	965.7
Mean	963.2	963.6	963.7	955.3	961.8	969.0	968.0	965.67	962.3	959.7	960.6	931.5	952.3	959.52

Table 8. Average Pressure (mb) of Storms From the Guam Area at Landfall

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall
July 21-31	912.5	953.5	921.0	971.8	967.0	977.0	-	-	-	978.0	959.0	956.0	990.5	NA
Aug. 1-10	941.5	952.7	930.0	943.4	977.5	-	-	-	979.0	989.0	968.0	-	985.0	NA
11-20	896.0	940.0	-	938.5	973.6	-	988.0	-	972.0	-	975.0	-	986.5	NA
21-31	972.5	944.0	918.0	951.5	977.0	-	-	-	-	976.0	958.4	984.0	-	NA
Sept. 1-10	955.7	938.3	-	954.3	967.4	-	-	-	964.0	959.3	948.0	-	970.0	NA
11-20	1000.0	961.0	942.8	940.0	963.6	-	-	-	1006.0	-	976.7	-	-	NA
21-30	957.0	975.0	-	957.2	966.3	-	-	-	-	976.5	963.0	964.0	-	NA
Oct. 1-10	956.4	-	952.3	-	971.0	-	-	-	980.7	980.0	mssg	-	-	NA
11-20	951.0	-	-	-	-	-	-	981.5	971.5	-	-	-	-	NA
21-31	944.7	-	-	-	-	-	-	994.0	982.0	-	-	-	-	NA
Mean	949.79	952.1	938.83	956.15	969.28	977.0	988.0	985.7	978.8	975.85	962.9	972.0	984.8	NA

Table 9. Average Minimum Pressure of Storme From the Guam Area (mb)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall	Mean for each storms
July 21-31	907.5	944.5	913.0	962.3	924.0	960.0	-	-	-	907.5	934.0	913.0	955.5	959.0	941.4
Aug. 1-10	932.5	944.3	907.5	914.0	962.0	-	-	-	935.0	921.0	929.6	-	901.0	975.0	933.1
11-20	891.0	912.0	-	925.5	957.2	-	962.0	-	891.0	-	912.0	-	934.0	937.0	934.2
21-31	957.5	912,8	918.0	945.5	948.0	-	-	-	-	944.3	918.0	926.5	-	936.8	928.5
Sept. 1-10	941.3	931.7	-	936.5	941.8	-	-	-	954.0	923.7	931.7	-	928.0	953.5	937.1
11-20	990.0	925.3	931.2	907.0	923.6	-	-	-	990.0	-	921.3	-	-	943.4	934.6
21-30	954.0	972.5	-	933.8	946.3	-	-	-	-	968.0	941.0	919.0	-	946.3	947.0
Oct. 1-10	925.6	-	936.3	-	926.5	-	-	-	922.0	877.0	mssg	-	-	931.8	927.4
11-20	933.8	-	-	-	-	-	-	929.0	931.0	-	-	-	-	948.0	942.3
21-31	909.3	-	-	-	-	-	-	914.0	912.0	-	-	-	-	949.6	938.8
Mean	931.2	933.0	925.4	939.9	941.9	960.0	962.0	924.0	931.0	928.2	927.0	921.3	934.7	944.5	

Table 10a. Minimum Elapsed Time From the Guam Area To Landfall (hours)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall
July 21-31	48	48	60	42	90	90	-	-	-	84	60	90	96	-
Aug. 1-10	48	48	42	66	36	162	114	-	132	84	60	-	204	-
11-20	48	78	-	48	36	-	126	-	84	-	102	-	120	-
21-31	66	48	78	126	66	-	-	-	-	90	60	138	-	-
Sept. 1-10	42	66	-	36	60	-	-	-	114	84	78	-	126	-
11-20	60	60	54	54	42	-	-	-	120	-	132	-	-	-
21-30	54	78	-	54	30	-	-	-	-	72	84	108	-	-
Oct. 1-10	48	-	54	78	42	-	-	-	108	162	180	-	-	-
11-20	48	-	-	-	-	-	-	156	108	-	-	-	-	-
21-31	36	-	-	-	-	-	-	108	138	-	-	-	-	-
Lowest	36	48	42	36	30	90	117	108	84	72	60	90	96	

Table 10b. Average Elapsed Time From the Guam Area to Landfall (hours)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall
July 21-31	54.0	54.0	60.0	61.0	90.0	90.0	-	-	-	99.0	72.0	90.0	120.0	NA
Aug. 1-10	51.0	82.0	75.0	75.0	48.0	-	-	-	132.0	106.0	97.0	-	204.0	NA
11-20	48.0	78.0	-	57.0	56.40	-	126.0	-	84.0	-	102.0	-	123.0	NA
21-31	69.0	78.0	78.0	144.0	66.0	-	-	-		130.0	114.0	138.0	-	NA
Sept. 1-10	52.0	78.0	-	54.0	99.6	-	-	-	114.0	84.0	96.0	-	126.0	NA
11-20	60.0	73.5	82.0	54.0	57.6	-	-	-	120.0	-	94.0	-	-	NA
21-30	54.0	72.0	-	75.0	38.0	-	-	-	-	75.0	87.0	108.0	-	NA
Oct. 1-10	68.4	-	84.0	-	60.0	-	-	-	140.0	162.0	180.0	-	-	NA
11-20	68.4	-	-	-	-	-	-	192.0	120.0	-	-	-	-	NA
21-31	66.0	-	-	-	-	-	-	108.0	138.0	-	-	-	-	NA
Mean	61.9	74.5	79.1	69.3	64.75	90.0	126.0	164.0	124.8	105.0	118.5	118.5	136.0	NA

Table 11. Average Direct Distance Traveled By Guam Area Storms To Point of Landfall (n.mi.)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall
July 21-31	626.1	813.7	607.9	631.7	616.2	683.0	-	-	-	1075.3	949.3	982.7	1242.4	NA
Aug. 1-10	623.0	796.9	814.9	587.0	784.0	-	-	-	1430.0	1116.4	983.4	-	1231.7	NA
11-20	758.8	696.7	-	554.3	684.5	-	1591.1	-	1300.7	-	906.2	-	1335.5	NA
21-31	667.4	779.7	620.4	742.4	602.3	-	-	-	-	1160.0	954.9	1016.3	-	NA
Sept. 1-10	706.1	757.2	-	563.3	813.4	-	-	-	1234.7	1136.1	918.3	-	1440.2	NA
11-20	672.7	772.3	676.0	527.4	823.0	-	-	-	1300.5	-	930.6	-	-	NA
21-30	773.7	796.5	-	659.8	772.7	-	-	-	-	983.5	895.8	975.9	-	NA
Oct. 1-10	690.2	-	618.0	-	785.5	-	-	-	1322.3	1108.8	1240.0	-	-	NA
11-20	604.0	-	-	-	-	-	-	1589.2	1299.4	-	-	-	-	NA
21-31	611.7	-	-	-	-	-	-	1459.1	1397.9	-	-	-	-	NA
Mean	658.5	778.8	674.1	613.2	761.7	683.0	1591.1	1545.8	1322.9	1104.6	957.6	997.8	1304.6	NA

Table 12. Average Actual Distance Traveled By Guam Area Storms to Point of Landfall (n.mi.)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall
July 21-31	640.6	839.8	642.5	664.1	672.9	852.3	-	-	-	1117.5	1002.2	1079.5	1346.3	NA
Aug. 1-10	631.3	832.0	854.8	643.5	831.3	-	-	-	1480.6	1209.3	1050.3	-	1586.3	NA
11-20	769.8	733.3	-	593.5	723.0	-	1717.4	-	1329.1	-	968.4	-	1477.0	NA
21-31	727.9	841.4	656.6	1038.0	661.8	-	-	-	-	1276.0	1107.6	1233.8	-	NA
Sept. 1-10	721.6	797.3	-	598.7	987.4	-	-	-	1280.3	1192.4	1004.8	-	1688.1	NA
11-20	703.7	792.3	790.9	546.0	877.5	-	-	-	1402.6	-	960.7	-	-	NA
21-30	781.9	816.3	-	700.2	908.2	-	-	-	-	1010.8	949.0	1054.6	-	NA
Oct. 1-10	726.9	-	737.6	-	828.0	-	-	-	1442.3	1313.4	1463.1	-	-	NA
11-20	643.2	-	-	-	-	-	-	1734.5	1342.0	-	-	-	-	NA
21-31	652.0	-	-	-	-	-	-	1498.0	1441.8	-	-	-	-	NA
Mean	689.1	814.1	762.2	672.8	834.2	852.3	1717.4	1655.7	1394.5	1185.9	1044.4	1150.4	1488.5	NA

Table 13. Average Computed Actual Speed of Guam Ares Storm (Knots)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall	Mean each period
July 21-31	11.86	15.55	10.89	9.22	7.48	9.47	-	-	-	11.29	13.92	11.99	11.22	NA	11.27
Aug. 1-10	12.38	10.14	11.40	8.58	17.32	-	-	-	11.22	11.41	10.81	-	7.83	NA	10.34
11-20	16.04	9.40	-	10.41	12.82	-	13.63	-	15.82	-	9.49	-	12.01	NA	12.38
21-31	10.55	10.79	8.42	7.21	10.02	-	-	-	-	9.82	9.72	8.94	-	NA	9.65
Sept. 1-10	13.88	10.22	-	11.09	9.91	-	-	-	11.23	12.42	10.47	-	13.40	NA	11.28
11-20	11.73	10.78	9.59	10.11	15.23	-	-	-	11.69	-	10.22	-	-	NA	11.67
21-30	14.48	11.34	-	9.34	21.29	-	-	-	-	13.48	10.91	9.76	-	NA	13.00
Oct. 1-10	10.63	-	8.78	-	13.08	-	-	-	10.30	8.11	8.13	-	-	NA	10.28
11-20	9.40	-	-	-	-	-	-	9.03	11.18	-	-	-	-	NA	9.71
21-31	9.88	-	-	-	-	-	-	13.87	13.35	-	-	-	-	NA	11.37
Mean	11.33	11.08	9.71	9.64	13.89	9.47	13.63	10.65	10.49	11.33	10.69	9.91	11.28	NA	

Table 14. Average Pressure of Storms as They Were Leaving the Philippine Islands Area (mb)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall
July 21-31	912.5	954.2	957.3	-	-	-	-	-	-	912.5	929.0	913.5	963.0	997.0
Aug. 1-10	959.0	962.3	931.0	973.0	-	-	-	-	962.0	946.3	954.5	-	-	999.0
11-20	954.7	963.2	976.3	954.5	-	-	-	-	894.0	978.0	963.2	-	987.0	-
21-31	972.3	953.6	929.0	972.0	983.0	-	-	-	981.0	972.2	975.0	953.8	973.5	986.0
Sept. 1-10	957.0	949.7	-	954.3	957.0	-	-	-	980.5	942.0	958.2	986.0	-	989.0
11-20	981.4	960.6	960.2	-	-	-	-	-	975.3	971.7	967.5	-	-	-
21-31	960.4	974.2	-	-	-	-	-	-	974.0	962.4	964.0	-	-	-
Oct. 1-10	963.2	-	952.0	998.0	-	-	-	-	968.4	945.7	884.0	-	-	970.0
11-20	961.4	-	985.0	-	-	-	-	961.0	960.0	-	-	-	-	966.5
21-31	951.6	-	-	-	-	-	-	937.0	954.0	-	-	-	-	950.8
Mean	960.8	957.7	959.1	966.1	965.7	-	-	953.0	965.9	956.5	959.0	946.9	974.3	968.6

Table 15. Average Pressure of Storms From the Philippine Islands Area at Landfall (mb)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall
July 21-31	912.5	947.8	950.7	-	-	-	-	-	-	978.0	957.7	973.5	985.0	NA
Aug. 1-10	963.0	952.7	927.0	968.7	-	-	-	-	982.5	972.7	968.7	-	-	NA
11-20	944.3	967.8	975.0	955.0	-	-	-	-	972.0	984.0	985.3	-	985.0	NA
21-31	976.0	963.0	918.0	945.0	983.0	-	-	-	962.0	977.6	951.8	986.5	990.0	NA
Sept. 1-10	958.0	949.2	-	952.7	972.5	-	-	-	967.0	968.2	963.8	1003.0	-	NA
11-20	978.4	965.7	965.5	-	-	-	-	-	972.0	987.3	976.3	-	-	NA
21-30	962.8	978.8	-	-	-	-	-	-	993.0	987.0	972.0	-	-	NA
Oct. 1-10	966.2	-	952.5	997.0	-	-	-	-	985.0	982.7	mssg	-	-	NA
11-20	959.2	-	983.0	-	-	-	-	972.0	971.5	-	-	-	-	NA
21-31	962.8	-	-	-	-	-	-	994.0	982.0	-	-	-	-	NA
Mean	962.4	961.7	955.6	961.6	976.0	-	-	979.3	977.6	979.1	965.5	985.1	987.5	NA

Table 16. Average Minimum Pressure of Storms From the Philippine Isands Area (mb)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall	Mean each period
July 21-31	907.5	940.8	947.3	-	-	-	-	-	-	907.5	927.5	910.5	942.0	991.0	931.5
Aug. 1-10	957.5	944.3	894.0	962.0	-	-	-	-	955.0	923.0	931.8	-	-	991.0	944.8
11-20	942.7	957.0	973.3	947.0	-	-	-	-	891.0	966.3	957.0	-	971.0	-	955.7
21-31	965.3	944.2	918.0	945.0	968.0	-	-	-	961.0	956.0	944.2	945.0	956.0	980.0	951.0
Sept. 1-10	950.6	940.8	-	944.7	927.5	-	-	-	961.0	933.3	948.0	968.0	-	985.0	945.8
11-20	975.0	941.6	941.7	-	-	-	-	-	957.3	966.3	940.5	-	-	-	951.0
21-30	956.8	972.0	-	-	-	-	-	-	974.0	957.6	963.0	-	-	-	963.0
Oct. 1-10	949.0	-	936.3	987.0	-	-	-	-	-	-	877.0	-	-	955.0	944.6
11-20	943.8	-	983.0	-	-	-	-	944.5	931.0	-	-	-	-	940.3	943.9
21-31	941.0	-	-	-	-	-	-	914.0	938.5	-	-	-	-	940.4	938.3
Mean	951.8	947.6	945.3	941.0	941.0	-	-	934.3	950.2	947.0	940.8	938.4	956.3	954.7	

Table 17 . Average Elapsed Time From the Philippine Islands Area to Landfall (hrs)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall
July 21-31	18.0	16.5	18.0	-	-	-	-	-	-	63.0	25.5	45.0	84.0	NA
Aug. 1-10	13.5	20.0	30.0	28.0	-	-	-	-	81.0	72.0	39.0	-	-	NA
11-20	18.0	18.0	10.0	42.0	-	-	-	-	48.0	55.5	33.0	-	144.0	NA
21-31	17.0	17.3	36.0	78.0	78.0	-	-	-	54.0	61.2	33.3	72.0	138.0	NA
Sept. 1-10	21.4	21.0	-	18.0	99.0	-	-	-	72.0	60.0	42.0	84.0	-	NA
11-20	20.4	7.7	14.0	-	-	-	-	-	112.0	36.0	40.0	-	-	NA
21-30	16.8	19.5	-	-	-	-	-	-	75.0	43.2	24.0	-	-	NA
Oct. 1-10	16.7	-	6.0	6.0	-	-	-	-	96.0	80.0	108.0	-	-	NA
11-20	27.6	-	6.0	-	-	-	-	84.0	81.0	-	-	-	-	NA
21-31	10.8	-	-	-	-	-	-	84.0	111.0	-	-	-	-	NA
Mean	18.1	16.2	16.9	50.0	78.0	-	-	84.0	86.3	57.9	37.4	66.0	126.0	NA

Table 18. Average Direct Distance Traveled by Philippine Islands Area Storme to Point of Landfall (n.mi.)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall
July 21-31	206.1	157.3	165.9	-	-	-	-	-	-	664.7	315.6	480.2	1309.5	NA
Aug. 1-10	185.6	166.7	349.5	237.8	-	-	-	-	1030.8	682.1	374.9	-	-	NA
11-20	174.8	239.8	57.4	165.2	-	-	-	-	737.0	585.1	402.8	-	967.6	NA
21-31	189.5	182.1	240.0	577.1	568.8	-	-	-	805.6	559.0	339.1	644.7	1183.3	NA
Sept. 1-10	201.8	202.2	-	253.6	857.5	-	-	-	772.4	606.4	416.9	792.9	-	NA
11-20	239.7	99.9	110.1	-	-	-	-	-	871.4	458.3	325.7	-	-	NA
21-30	201.7	246.3	-	-	-	-	-	-	891.3	474.7	376.0	-	-	NA
Oct. 1-10	159.8	-	60.1	140.6	-	-	-	-	919.3	670.9	850.9	-	-	NA
11-20	248.6	-	75.0	-	-	-	-	1051.1	865.6	-	-	-	-	NA
21-31	135.2	-	-	-	-	-	-	1075.0	1006.2	-	-	-	-	NA
Mean	192.02	177.73	120.85	252.23	761.23	-	-	1059.07	891.30	577.76	373.26	618.87	1160.93	NA

Table 19. Average Actual Distance Traveled by Philippine Islands Area Storms to Point of Landfall(n.mi.)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfal
July 21-31	208.4	182.3	168.9	-	-	-	-	-	-	685.3	320.6	502.6	1365.4	NA
Aug. 1-10	185.9	168.9	360.8	250.2	-	-	-	-	1078.7	735.7	389.4	-	-	NA
11-20	176,6	248.9	58.1	262.3	-	-	-	-	747.7	619,3	424.4	-	1211.7	NA
21-31	192.9	191.6	254.5	665.5	706.1	-	-	-	795.2	596.2	347.0	710.3	1314.7	NA
Sept. 1-10	204.9	206.8	-	275.9	972.6	-	-	-	789.7	639.6	472.8	872.5	-	NA
11-20	244.0	99.9	129.9	-	-	-	-	-	995.0	473.7	346.0	-	-	NA
21-30	203.9	260.6	-	-	-	-	-	-	922.2	485.2	406.0	-	-	NA
Oct. 1-10	162.5	-	60.1	140.6	-	-	-	-	979.9	720.5	910.0	-	-	NA
11-20	267,7	-	75.0	-	-	-	-	1078.5	889.2	-	-	-	-	NA
21-31	135.3	-	-	-	-	-	-	1100.8	1038.4	-	-	-	-	NA
Mean	196.06	186.81	124.58	290.9	883.77	-	-	1085.93	938.49	606.56	401.77	674.13	1301.6	NA

Table 20. Average Computed Actual Speed of Storm From the Philippine Islands Area to Landfall (knots)

Time period	Sections: 1	2	3	4	5	6	7	8	9	10	11	12	13	No landfall	Mean each period
July 21-31	11.58	11.05	9.38	-	-	-	-	-	-	10.88	12.57	11.17	16.25	NA	11.45
Aug. 1-10	13.77	8.45	12.03	8.94	-	-	-	-	13.32	10.22	9.98	-	-	NA	10.81
11-20	9.81	13.83	5.81	6.25	-	-	-	-	15.58	11.16	12.86	-	-	NA	10.78
21-31	11.35	11.08	7.07	8.53	9.05	-	-	-	14.73	9.74	10.42	9.87	9.53	NA	10.57
Sept. 1-10	9.57	9.85	-	15.33	9.82	-	-	-	10.97	10.66	11.82	10.39	-	NA	10.98
11-20	11.96	12.97	9.28	-	-	-	-	-	8.88	13.16	8.65	-	-	NA	10.81
21-30	12.14	13.36	-	-	-	-	-	-	12.30	11.23	16.92	-	-	NA	12.46
Oct. 1-10	9.73	-	10.02	23.43	-	-	-	-	10.21	9.01	8.43	-	-	NA	10.84
11-20	9.70	-	12.5	-	-	-	-	12.84	10.98	-	-	-	-	NA	10.86
21-31	12.58	-	-	-	-	-	-	13.10	9.35	-	-	-	-	NA	11.84
Mean	11.02	12.01	9.05	11.73	9.56	-	-	12.93	11.27	10.72	10.93	10.32	11.77	NA	

Table 21. Summary of Parameters of Storms That Passed Through the Ghaм Area

Guamstorms	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
No. Storms	25	19	11	23	24	1	1	3	10	14	23	4	6	67	170
% of all	14.7%	11.2%	6.5%	13.5%	14.1%	.6%	.6%	1.8%	5.9%	8.2%	13.5%	2.4%	3.5%	39.4%	100%
No./yr	.9	.7	.4	.8	.7	.04	.04	.1	.3	.5	.8	.1	.2	2.3	5.9
P leaving	963.2	963.6	963.7	955.3	961.8	969.0	968.0	965.7	962.3	959.7	960.6	931.5	952.3	960.7	
σ	(29.11)	(31.4)	(23.31)	(30.22)	(28.89)	---	---	(31.6)	(33.2)	(26.28)	(29.05)	(9.31)	(24.90)	mssg	
P arriving	949.8	952.1	938.8	956.2	969.8	977.0	988.0	985.7	978.8	975.9	962.9	972.0	984.0	---	
σ	(27.83)	(20.63)	(20.10)	(21.33)	(17.09)	---	---	(7.9	(13.4)	(22.01)	(20.5)	(13.29)	(7.06)	---	
ΔP	-13.4	-11.5	-24.9	+.9	+7.5	+8.0	+20.0	+20.0	+16.5	+16.2	+2.3	+40.5	+31.6	---	
P min	931.2	933.0	925.4	939.3	941.9	960.0	962.0	924.0	931.0	928.2	927.0	921.3	934.7	943.97	
σ	(32.10)	(28.18)	(23.08)	(28.22)	(29.04)	---	---	(10.2)	(32.9)	(30.35)	(25.46)	(8.26)	(27.14)	mssg	
T min	36	48	42	36	30	90	114	108	84	72	60	90	96	---	
T elapsed	61.9	74.5	79.1	69.3	64.75	90.0	126.0	164.0	124.8	105.0	99.9	118.5	136.0	---	
σ	(19.10)	(20.27)	(27.29)	(29.01)	(30.15)	---	---	(49.32)	(22.89)	(30.57)	(36.08)	(20.51)	(33.53)	---	
Disst D	658.5	778.8	674.1	613.2	761.7	683.0	1591.1	1545.8	1322.9	1104.6	957.6	997.8	1304.6	---	
σ	(120.19)	(56.65)	(143.74)	(89.6)	(129.34)	---	---	(153.9)	(65.45)	(122.84)	(128.13)	(24.35)	(90.28)	---	
Dist A	689.1	814.1	762.2	672.8	834.2	852.3	1717.4	1655.7	1394.5	1185.9	1044.4	1150.4	1488.5	---	
σ	(128.75)	(60.53)	(182.37)	(167.11)	(176.07)	---	---	(249.63)	(70.83)	(136.66)	(210.91)	(107.06)	(130.19)	---	
Speed	11.3	11.1	9.7	9.6	13.9	9.5	13.6	10.7	10.5	11.3	10.7	9.9	11.3	---	

Table 22. Summery of Parameters of Storms That Passed Through the Philippine Islands Area

Philippine storms	1	2	3	4	5	6	7	8	9	10	11	No land fall	Total
No. Storms	51	35	18	10	3	3	21	31	34	7	4	14	131
% of all	38.9%	26.7%	13.7%	7.6%	2.3%	2.3%	16.0%	23.7%	26.0%	5.3%	3.1%	10.7%	100%
No./yr	1.8	1.2	.6%	.3	.1	.1	.7	1.1	1.2	.2	.1	.5	4.5
P leaving	960.8	957.7	959.1	966.1	965.7	953.0	966.0	956.5	952.9	946.9	974.2	968.8	
σ	(30.5)	(26.4)	(26.8)	(26.8)	(19.1)	(25.2)	(27.8)	(31.3)	(30.9)	(27.3)	(8.6)	(22.8)	
P arriving	962.4	961.7	955.6	961.6	971.7	979.3	977.6	979.1	971.8	985.1	987.5	---	
σ	(26.4)	(22.2)	(24.8)	(23.8)	(6.2)	(10.7)	(14.0)	(12.7)	---	(19.6)	(5.5)	---	
ΔP	+1.6	+4.0	-3.5	-4.5	+6.0	+26.3	+11.6	+22.6	+18.9	+38.2	+13.3	---	
P min	951.8	947.5	945.3	954.6	941.0	934.3	949.1	945.7	940.8	938.4	956.3	954.6	
σ	(33.9)	(29.2)	(29.6)	(27.3)	(19.3)	(24.6)	(29.7)	(30.3)	(32.3)	(24.4)	(12.9)	(22.0)	
T min	6	6	6	6	48	72	48	12	18	36	84	---	
T elapsed	18.1	16.3	14.3	30.6	92.0	84.0	86.3	57.9	37.4	66.0	126.0	---	
σ	(10.8)	(11.0)	(14.7)	(26.5)	(42.0)	(9.8)	(28.9)	(25.1)	(24.4)	(19.2)	(29.7)	---	
Disst D	196.1	186.4	129.5	291.0	883.7	1085.9	937.1	609.1	394.6	674.1	1301.6	---	
σ	(81.8)	(101.1)	(129.2)	(190.5)	(189.8)	(37.9)	(117.8)	(172.3)	(186.0)	(125.2)	(74.4)	---	
Dist A	192.0	177.7	120.8	252.2	761.3	1059.1	889.1	577.8	373.2	618.9	1160.9	---	
σ	(71.6)	(92.9)	(112.6)	(156.5)	(148.9)	(34.5)	(92.5)	(158.3)	(159.1)	(109.2)	(129.0)	---	
Speed	10.83	11.44	9.05	9.51	9.61	12.93	10.86	10.52	10.55	10.21	10.33	---	

1945-1973西太平洋颱風諸元之統計研究(Ⅰ)

中國文化大學 大氣科學系

張霈澤

摘 要

本研究是將西太平洋中兩個颱風源地內,1945至1973年間,所發生之各個颱風之軌跡路徑,登陸地點,及中心氣壓變化等,加以歸納並作成統計表.本文所採用之資料,是自1945至1973年間,所有颱風最佳路徑之地理位置(經,緯度)及中心氣壓值之記錄表.歸納之方法是以關島及菲律賓以東,兩地為中心,以700浬為半徑作圓.由此二圓內出發之所有颱風加以時段化,即自七月二十一日至十月三十一日,每十日為一期而將之分為十個時段.因此,吾人可得十個十日期之颱風路徑集合圖.此外,本研究亦將各颱風路徑之抵達終站,劃分為十四個登陸區段,並按此十四個抵達區段,分別統計各十日期時段內之颱風數,平均中心氣壓,平均經歷時間,平均移速,及全程距離等之各項統計表.