

Observations

Cells containing the observations below were excluded from the file All Typhoons.xls in order to create the file QC All Typhoons.xls.

- When the latitude or longitude of the fix could not be read. Example: lon – x.3.
- When there was no data other than the name of the storm.
- When there is no record of time and fix.
- When the speed of the storm could not be read. Example: Speed of storm – 10.?.
- When the mission was said to be aborted.
- When the storm was not found or there was no evidence of closed circulation.
- When the only information available was the unit, remarks, and number of observations.
- When the only information available was in the remarks.
- When no eye was observed.

Typhoons Excluded from File All Typhoons.xls

1947

Barbara – lon: x.3.

Anna – No data.

Tc Donna – No data.

Tc Eillen – No data.

Tc Faith – No data.

Tc Joyce – No data.

Tc Beatrice – No data.

1949

Allyn – fix # 12 – Speed of storm 10.?.

1950

Grace – fix # 3 – Mission aborted.

Helene – fix # 1 – No time and no latitude and longitude data.

Ida – fix # 1, 2 – No time and no latitude and longitude data.

June – fix # 5 – Mission aborted.

Marie – fix # 14, 15, 18 – Mission aborted.

Salome – no time, no fix, only remarks that it is a tropical storm.

Missatha – no time, no fix, only remarks that it is a tropical storm.

Nancy – no time, no fix, only remarks that it is a tropical storm.

Anita – no time, no fix, only remarks. Remarks says Anita is the same as Ruby.

Delilah – Remarks indicates no recon.

Fran – No data.

1951

Iris – fix # 11 – Mission aborted.

Iris – fix # 22, 23 – No eye.

Louise – fix # 3 – Mission aborted.

Marge – fix # 25 – No eye.

Pat – fix # 2, 3, 4 – No data.

Amy – fix # 25 – No eye.

Babs – fix # 1 – No eye.

Amy – fix # 5 – No eye.

1953

Ophelia – fix # 2 – Mission aborted.

Viola – fix # 2 – Storm not found.

Alice – fix # 1 – Mission aborted.

Cora – fix # 2 – No evidence of closed circulation.

Doris – fix # 7 – No data.

Judy – fix # 15 – No data besides remarks.

1954

Flossie – fix # 5 – No data besides unit, remarks, number of obs., and turbulence.

Flossie – fix # 8 – Remarks indicates this was the final flight. Only unit, number of obs., and turbulence reported.

Ida – fix # 5 – No data besides unit.

June – fix # 1, 2 – Remarks says no fix.

Lorna – fix # 1, 2 – Remarks says no fix.

Marie – fix # 1, 2 – Mission aborted. Only turbulence data reported.

Marie – fix # 9 – Only units and number of obs. data.

Marie – fix # 12 – Only unit, turbulence, and number of obs. data.

Marie – fix # 16 – Remark indicates it was unable to find fix.

Nancy – fix # 6 – No data.

Nancy – fix # 9 – No data besides unit.

Nancy – fix # 11, 14, 15, 16 – No data. Remarks indicate that crew has not yet returned.

Olga – fix # 5 – No data besides turbulence and number of obs.

Pamela – fix # 1, 2 – No data besides remarks.

Pamela – fix # 10 – Mission aborted twice.

Pamela – fix # 30 – No data besides unit.

Ruby – fix # 19 – No data besides turbulence, unit, and number of obs.

Sally – fix # 1, 2, 14 – Mission aborted.

Sally – fix # 30 – No data besides unit and number of obs.

1955

Georgia – fix # 1 – No data.

Kate – fix # 1 – No data.

Marge – fix # 1 – No data.

1956

Olive – fix # 8 – No data.

Thelma – fix # 21 – Remarks says it is a map analysis position.

1961

Olga – fix # 1 – Only data available is flight level.

Abbreviations and Definitions

The following identify and clarify the definition of certain words that appear in the file QC All Typhoons.xls .

Column A – **Typhoon:** The name of the Typhoon.

Column B – **Year:** The year in which the corresponding Typhoon was observed.

Column C – **Typhoon #:** Lists the order, in numbers, which the Typhoon was observed during its corresponding year.

Column D – **Month:** The month which the Typhoon was observed during the corresponding year.

Column E – **Fix:** The number of the aircraft fix made for the corresponding Typhoon.

Column F – **Time of Fix (Z):** The time of the aircraft fix for the corresponding Typhoon in UTC. The format of the time is: DDHHMM.

Column G – **Lat:** The latitude of the fix.

Column H – **Lon:** The longitude of the fix.

Column I – **SFC Pressure (mb):** The surface pressure in millibars (mb) recorded at the fix location.

Column J – **Flight Level:** The altitude of the aircraft during the time of the fix. Flight levels during earlier years are in feet, whereas later years are measured in meters and millibars.

Column K – **Level Unit:** Identifies whether the flight level was measure in feet (ft), meters (m), or millibar (mb).

Column L – **Flight Level (meter):** The altitude of the aircraft during the time of the fix in meters.

Column M – **Min 700 mb Height (m and ft):** Minimum 700 mb height observed in meters and feet. Height reported in feet before the year of 1963. Height reported in meter starting in 1963. A few measurements were made at the 500mb level. Please observe the flight level in order to determine the validity of the height.

Column N – **Min 700 mb Height (m):** Minimum 700 mb height in meter.

Column O – **Estimated Max Sfc Winds:** Maximum observed surface winds in knots.

Column P – **Sfc Level Wind Bearing:** The direction of the wind at the surface measure from the aircraft track or direction.

Column Q – **Sfc Level Wind Range:** The range of the wind at surface level. Assumed to be in miles.

Column R – **Sfc Wind Quadrant:** The quadrant which the surface wind is observed.

Column S – **Flight Level Winds (Knots):** Maximum observed flight level winds in knots. For the years 1946, 1947, 1948, and 1949 the wind speed was denoted as wind speed near the center. In putting together the spread sheet it was assumed that wind speed near the center is comparable to what is described as flight level wind in later reports.

Column T – **Flight Wind Quadrant:** The quadrant which the flight level wind is observed.

Column U – **Flight Level Wind Direction:** The direction of the wind on the surface measured from true North.

Column V – **Flight Level Wind Bearing:** The direction of the flight level wind measured from the aircraft track or direction.

Column W – **Flight Level Wind Range:** The range of the wind at flight level. Assumed to be in miles.

Column X – **Speed of Storm (knots):** The velocity the storm is traveling during the time of the fix in knots.

Column Y – **Direction of Storm:** The direction of the storm. Note that in 1947 Typhoon Kathleen shows a value of 920 for fix 6.

Column Z – **Fix Positioned By:** The method used to position the fix.

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|--------------------------------|------------------------------------|---------------------------|
| • a – Analysis | • g – Pilotage | • r – Radar |
| • c – Circumnavigation | • h – Lowest 700mb height | • rd – Radio |
| • cel – Cel | • l – LORAN | • s – Sun lines |
| • d – Dead reckoning | • p – Weather plane | • sf – Surface winds |
| • e – Estimation/Extrapolation | • pr – Pressure | • t – Triangulation |
| • f – Landfall | • pr w – Pressure and wind pattern | • v – Visual |
| | | • w – Wind stream/pattern |

Column AA – **Unit:** The unit that made the fix. If it contains four numbers it represents the number of the aircraft.

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| • 54 – 54 WRS | • 56 – 56WRS | • 315 – 315 th Air Division |
| • 512 – 512 th Air Division | • 514 – 514 th Air Division | • vw1 – vw-1 Early Warning Squadron |
| • vw3 – vw-3 | • vj1 – vj-1 | • usaf – U.S Air Force |
| • usn – U.S. Navy | | |

Column AB – **Method:** The method used to make the fix.

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|-------------------|---------------------|-------------------|
| • a – Altimeter | • dr – Direct | • n – Negative |
| • acft – Aircraft | • ds – Descent | • p - Penetration |
| • as – Ascent | • e – Extrapolation | • r – Radar |
| • d – Dropsonde | • l – Low level | • s – Spiral |

Column AC – **Confidence:** Confidence of the fix.

- 1 – Poor
- 2 – Fair
- 3 – Good
- 4 – Very good/Accurate
- 5 – Excellent
- 6 – No error/Perfect

Column AD – **Accuracy:** Center determination and estimated accuracy of the fix in nautical miles.

- p – Positive
- l – Poor
- f – Fair
- u – Unknown

Column AE – **Nav Accuracy:** Navigational (OMEGA and LORAN) fix position accuracy in nautical miles.

Column AF – **Met Accuracy:** Meteorological (by the ARWO) fix position accuracy in nautical miles.

Column AG – **Eye Shape:** Geometrical representation of the eye based on the aircraft radar representation.

Column AH – **Eye Diameter (NM):** The diameter of the eye in nautical miles.

Column AI – **Rad2:** The second radius of the eye if other than circular in nautical miles.

Column AJ – **Inner:** The diameter of the inner wall clouds of the eye in nautical miles.

Column AK – **Outer:** The diameter of the outer wall clouds of the eye in nautical miles.

Column AL – **Orientation/Quadrant:** The orientation or quadrant the eye is located. Note the values of 600 and 400 during Typhoon Viola in 1978.

Column AM – **Temp:** The temperature of the eye, at flight level, in Celsius. Starting in 1959, as described in the ATCR, when flight level is near the 700mb level, the 700mb temperature/dew point is recorded in place of the actual flight level data.

Column AN – **SST:** The sea surface temperature in Celsius.

Column AO – **Dew Pt:** The dew point temperature of the eye, at flight level, in Celsius. Dew point temperature records start in 1959. As described in the ATCR, when flight level is near the 700mb level, the 700mb temperature/dew point is recorded in place of the actual flight level data.

Column AP – **Temp Outside Eye:** The temperature outside of the eye of the Typhoon in Celsius. Temperature outside of the eye of the Typhoon starts to being recorded in 1958.

Column AQ – **Remarks:** Any unusual and interesting characteristic of the Typhoon at the time of the fix, or aircraft information.

Column AR – **Computed JTWC Slp (mb)**: The minimum sea level pressure in millibars computed by the Joint Typhoon Warning Center (JTWC). The computed sea level pressure only appears in the year of 1963.

Column AS – **Degree of Turbulence** – The degree of turbulence encountered during flight.

- Nil – Nil
- lgt – Light
- mdt – Moderate
- sev – Severe
- ext – Extreme
- hvy – Heavy
- ocnl – Occasional

Column AT – **Quadrant**: The quadrant where turbulence was encountered during flight.

Column AU – **State of Sea**: The state in which the sea was observed.

- 1 – Calm/Smooth
- 2 – High
- 3 – Very High
- 4 – Rough
- 5 – Very Rough
- 6 – Phenomenal

Column AV – **Open Sector**: Believed to be the open sector of the Typhoon where no clouds were observed. Only observed in 1950. Not defined in report.

Column AW – **Quad with Max Weather**: Believed to be the quadrant where most rain/hail/winds/turbulence were observed. Only observed in 1950. Not defined in report.

Column AX – **Number of Obs Taken**: The number of observations made by the reconnaissance aircraft.

Column AY – **Level Entered Eye**: The altitude which the aircraft entered the eye of the Typhoon. Observed from 1951 to 1954.

Column AZ – **Level Departed Eye**: The altitude which the aircraft left the eye of the Typhoon. Observed from 1951 to 1954.

Column BA – **Predominant Cloud Type**: The most often observed cloud type during flight. Coded based on WMO classification. Observed only in 1950.

Columns BC through CG – **Radius of xx Knot Winds (Q)**: The radius of a certain velocity wind, xx, in knots and its quadrant, Q.

Remarks

- 1945** Fixes found on files AA88905, AA88906, AA88907, and AA88908. However no pressure and no storm names were included on the charts where the information is available.
- 1946** Aircraft fixes found on file AA94520 but not all observations specify if fix was made by aircraft.
- 1947** Aircraft fixes found on file AA94520 but not all observations specify if fix was made by aircraft. Fixes obtained from weather bulletins.
- 1948** Fixes from November and December found on microfilm. Fixes from January to July found on file AA94520.
- 1949** Fixes extracted from the "Life History of Typhoon" paragraphs. No flight chart found.
- 1950** Fixes extracted from Individual Tropical Cyclone Data Sheets from boxes AA94515 and AA94516.
- 1951** Fixes extracted from Individual Tropical Cyclone Data Sheets. Available from the 1951 Annual Typhoon Report.
- 1952** Fixes not found.
- 1953** Fixes extracted from Individual Tropical Cyclone Data Sheets from box AA94515.
- 1954** Fixes extracted from Individual Tropical Cyclone Data Sheets from box AA94515.
- 1955** Very few fixes found. Found detailed info in box AA94515 for the first two Typhoons of the year. More fixes found on reconnaissance storm track maps. Only fixes found in box AA94515 used.
- 1956** Fixes extracted from Reconnaissance Aircraft fix charts. Available in the 1956 Annual Typhoon Report and microfilm.
- 1957** Fixes extracted from Reconnaissance Aircraft fix charts found on microfilm AF00273.
- 1958** Fixes found and extracted from copies of the original Reconnaissance Aircraft fix charts found on microfilms AE51035, AE30576 from August to December, AE30574 from January to July, and AF00273 from January to September.
- 1959 – 1965** Fixes extracted from Annual Typhoon Reports available at the Joint Typhoon Warning Center webpage.

Analysis

A simple Z-score was performed, in conjunction with a scatter plot of the estimated max surface winds, flight level wind, surface pressure, and minimum 700mb height, in order to observe any outliers. Visual investigation of the plots for outliers yields values that are confirmed by the z-score as outliers. It is not possible however to assure the method works since there is a large quantity of data from different time periods and weather conditions. Outliers were identified as numbers which the difference between the original value and the mean of the data are greater than two standard deviations. Equation 1 shows the z-score equation used.

$$z = \frac{|x-y|}{s} \quad (1)$$

Where: x is a data point

y is the mean of the data

s is the standard deviation based on the entire population

An easy way to identify values that are considered outliers according to equation 1 is by using an IF statement in Microsoft Excel. The statement, = IF(ABS(x – y)>2*s, “Outlier”, “Normal” was used for such purposed for the parameters mentioned above.

Although outliers can be identified in this manner, it is possible to observe from the graphs a relationship between the surface pressure and the surface and flight level winds, as expected, reducing the reliability of the z-score in finding outliers. Therefore, the z-score can be used to support values that are easily observed on the graphs.

The correlation between surface wind and surface pressure, surface wind and flight level wind, and flight level wind and pressure was analyzed with a simple Pearson correlation coefficient, correl, in Microsoft Excel. These coefficients are, -0.71, 0.77, and -0.84 respectively, displaying what is expected.