

Discussion on the Turning Probability of the Typhoons Affecting Taiwan

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This research examines the factors that influence typhoon turning by reviewing literature and applying everyday reasoning. We collected typhoon data that hit Taiwan from 2002 to 2022 from the typhoon database, and analyzed the proportion of typhoon turning and its direction during the period of maximum turning angle.

1. Research motivation & purpose

The research looks at why typhoons turn and aims to understand the characteristics and laws of typhoon turning to improve typhoon forecasts in Taiwan. The author investigates the causes and fundamental aspects of typhoon turning, provides data on the percentage of typhoons that hit Taiwan and turn, and examines the steering path of typhoons during peak steering angles.

Typhoons are most prevalent in the western Pacific Ocean. The primary variables influencing the typhoon's path include the Pacific subtropical high pressure, the Fujiwhara effect, the channeling effect, and the induced low.

2. Literature Research

3. Research Methods & Introduction

The research utilized the Central Meteorological Administration's typhoon database covering nearly 20 years of data. Relevant information about typhoons hitting Taiwan was gathered and analyzed using Excel and quantitative statistics. The typhoon turning definition was based on the change in the direction of typhoon movement per unit time, with threshold angles of 30 and 90 degrees. The research process involved reviewing literature, creating statistical tables, generating charts, and performing statistical analysis.

4. Research Data & Results & Discussion

1. Turning ratio of typhoons hitting Taiwan :

- There are 84% of the typhoons becomes a light typhoon and turns more than 30 degrees in a single day.
- There are 17% of the typhoons becomes a light typhoon and turns more than 90 degrees in a single day.

2. Steering Direction of Typhoons During Maximum Steering Angle :

- For all typhoons that hit Taiwan : 57% turn right, 41% turn left, 2% special.
- Typhoon turning greater than 90 degrees : 60% turn right.

Conclusion

1. Subtropical high is the main factor among the variables that affect typhoon's turn, as indicated by literature research.
2. In Taiwan, 58 typhoons made landfall between 2002 and 2022, with an average turning angle of around 61.26 degrees. Among them, Typhoon Parma had the highest turning angle of 180 degrees, while Typhoon Wutip had the lowest.
3. In the past 20 years, typhoons have a high chance of turning more than 30 degrees in one day. If the turning angle is over 90 degrees, the chance is much lower.
4. This research shows that during the period with the largest steering angle, more typhoons tend to turn right than left. Among typhoons with a steering angle greater than 90 degrees, 60% turned right during the period of maximum steering angle, which can be helpful in predicting future typhoons.

Future Work

1. This study focuses on the typhoon's turning direction at the maximum turning angle. Future research should also investigate the typhoon's turning direction during formation and cessation to improve typhoon track predictions.
2. This research didn't calculate the factors affecting a typhoon's turn, like the subtropical high. Future research could investigate and calculate the proportion of factors influencing a typhoon's turn to enhance the study's uniqueness and reference value.