Orographic Influences on Typhoon Tracks in the Vicinity of Taiwan
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Motivation
- Taiwan's position in the Pacific Ocean subjects itself to the passage of 3 to 4 tropical cyclones (TCs) each year. The climatology suggests that Taiwan Island sits in the common pathway where most of the TCs passed through over the western North Pacific Ocean.
- Taiwan's Central Mountain Range (CMR), and the island's geographical orientation provide a unique environment for the TC interaction.
- The terrain effects on TC tracks can be applied to other geographical locations with steep mountains which are also prone to TCs.

Objective
Use the RADAR data to observe tropical cyclone tracks, to understand why a tropical cyclone may either steer around or cross over Taiwan Island, to observe and understand what influences orographic effects have on typhoon tracks, and to observe other meteorological phenomena as a result of Taiwan terrain.

Methodology
- Froude Number $F_r = \frac{U}{\sqrt{g h}}$.
- Brunt–Väisälä Frequency: $N = \sqrt{\frac{g}{\rho} \frac{\partial \rho}{\partial z}}$.
- Steering flow: $U$ is the TC's propagation speed, $V_{\text{max}}$ is the TC's maximum sustained wind speed.
- RADAR data quality control software: RadKit.
- RADAR data study of Typhoon Maria (2015).
- RADAR data study of Typhoon Fanapi (2010).

Typhoon Track climatology shows the most common paths of typhoons which moved across or around Taiwan Island. Typhoon Maria (2018) had a track of Category 1 type, while Typhoon Fanapi (2010) had a track of Category 3 type.
- Track: can be affected by the TC's propagation speed; higher propagation speeds tend to facilitate a more straightforward path over the ocean environment.
- Typhoon Maria (2018) tracked to the north of Taiwan, eventually making landfall on mainland China. Maria moved around the northern tip of the island because of both the terrain effect and the slower propagation speed while crossing the northern tip of Taiwan.
- Typhoon Fanapi (2010) made landfall on Taiwan, interacting with the CMR as it moved across the island. The overall kinetic energy of the storm was strong enough to overtake the terrain.

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References