

THESIS INFORMATION ON
NEW SCIENTIFIC CONTRIBUTION, THEORETICAL STUDY

1. **Dissertation title:** The effects of topography and cold surges on structure of tropical cyclones over Vietnam coastal regions

Code: 9440222

Major: Meteorology and Climatology

2. **PhD Candidate:** Nguyen Binh Phong

Scientific advisors: Assoc. Prof. Dr. Nguyen Van Thang

Dr. Nguyen Van Hiep

Institution: Vietnam Institute of Meteorology, Hydrology, and Climate Change.

3. **Introduction:**

Vietnam locates in the region of the Pacific Northwest hurricane zone with about 30 tropical cyclones per year, accounting for 38% of the global tropical cyclones. One of the efforts to reduce the damages on property and people due to tropical cyclones is to predict the typhoon track and intensity with relatively high accuracy. Currently, the numerical models for weather and typhoon forecasting purposes have been applied in operation and research in Vietnam. In addition, Vietnam also consulted the operational products of major centers in the world. However, the typhoon forecast quality of the models sometimes does not meet the actual requirements due to the large error in track prediction. As the typhoon approaches the shore, forecasting the typhoon track is more complicated due to the interaction between the typhoon and the topography as well as the weather patterns. Depending on the speed of movement, intensity and topography's type that the typhoon passes through, the area affected by the typhoon will have different structure of meteorological fields, especially precipitation and wind. Beside the topography, cold surge (KKL) also has significant effects on typhoon's structure and intensity, especially in strong or intensification events. Because of the above reasons, the topic "The effects of topography and cold surges on structure of tropical cyclones over vietnam coastal regions " was chosen to study

the typhoon's track, structure, especially, the structure of precipitation and winds when tropical cyclones are affected by cold surge and Vietnam's topography.

The thesis has built a system of 04 experiments increasing and decreasing topography elevation and initialization programs to improve the quality of the initial field, then used the best initialization scheme to study the structural simulation of tropical cyclones under interaction with cold surge. Topography experiments were carried out with 05 tropical cyclones operating under the influence of winter monsoon. The research results showed that the topography has a clear impact on the structure of meteorological fields in the typhoon, the track and intensity as well.

The results show that the strong winds are concentrated to the east and north of the typhoon center in the case of integrating all 18 selected tropical cyclones because this part has little friction with the topography. A decrease in the western wind speed of the typhoon eyewall due to the effect of topographical friction is most pronounced when typhoon makes a landfall. In the case of integrated cyclones not affected by the cold surge, the strong wind area is also concentrated to the east and north of the typhoon center and the weak wind speed area is in the southwest where it is adjacent to the topography. The clear difference is shown when tropical cyclones affected by cold surge. It can be seen that gas particles with relatively high momentum in cold surge contribute to wind speed enhancement (possibly leading to an increase in maximum wind speed in tropical cyclones) in the northern and northwestern eyewall of the cyclone.

4. Scientific contributions of the Thesis:

- Clarifying the mechanism and influence of Vietnam's topography on the structure of the cloud fields, the wind, the distribution of rainfall and the deviation of the track when the TC nears the shore and landfalls;

- Clarifying the mechanism and influence of cold surge on the structure of the cloud field, the distribution of rainfall and strong winds in tropical cyclones on the East Sea of Vietnam.

The first scientific advisor



Assoc. Prof. Dr. Nguyen Van Thang

The second scientific advisor



Dr. Nguyen Van Hiep

PhD. student



Nguyen Binh Phong