Typhoon Intensity Estimation Using Satellite Image Edge Detection Technology

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Taiwan is located in the Northwest Pacific Ocean where typhoons occur most frequently in the world. There are about 20 typhoons in the Northwest Pacific Ocean every summer, and 15~25% of them will invade Taiwan and bring rainfall. Therefore, typhoons often bring abundant precipitation to Taiwan and are also one of Taiwan's important sources of water resources. In this study, an objective index was proposed to determine the intensity of typhoons, which was achieved using an image edge processing technique to examine meaningful discontinuity characteristics and thereby calculate the gradient of brightness temperature in satellite infrared images. By taking the typhoon center as a reference point, the angle between the position vector and the gradient vector was defined as the deviation angle. Following this definition, the probability density and standard deviation of the deviation angle may be derived, and a non-dimensional typhoon intensity index (TI) will be established. Using 1519 Himawari-8 AHI images and the TI detection algorithm, the 10 western North Pacific strong typhoons were analyzed. Out results show that we have a good relationship between the TI and typhoon intensity. Moreover, TI can show the different between the rapid and slow intensification stage. Therefore, the TI can become a potentially effective indicator to predict changes in typhoon intensity.

Keywords: typhoon intensity, image edge detection, satellite image