

The Shear Resonance Mechanism For Very-Large-Scale Motions In Typhoon

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This is the first study to investigate very-large-scale motions (VLSMs) in a typhoon. A mature typhoon can be divided into three main parts, the eye, the eyewall, and the outer region. And the spectrum characteristics may be different for the three parts of a typhoon, while the same form is still used in engineering applications. In the current study, we conducted field measurements to analyze the characteristics of the wind velocity spectrum of the eye, eyewall, and outer region of a typhoon. For the outer and eye regions, the characteristic of the wind velocity spectrum is the same as the monsoon. For the eyewall region, a -1 subrange (k^{-1} , k is wavenumber) occurs at the wind velocity spectrum, and the vortex structure size even reaches 32.1δ , which illustrates that VLSMs exist in this region. Furthermore, we found that the -1 subrange of the wind velocity spectrum has a positive correlation with Reynolds shear stress. The phenomena established in the present study were validated by an established theory that states that flow should satisfy two conditions simultaneously for a -1 subrange: strong resonance between average and turbulent motions and a large wind velocity gradient. It may be that this theory is a possible original mechanism for VLSMs. Finally, we confirmed this mechanism with a flat plate shear flow field-measured test.