

The Vortex Moving toward Taiwan and the Influence of the Central Mountain Range

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Abstract

Surface friction is important to a vortex moving toward Taiwan but was ignored in several previous studies. The change of the potential vorticity comes from friction in the shallow water equation, hence, it was applied to study the westbound vortex influenced by the Central Mountain Range (CMR) blocking and surface friction, which is defined as friction coefficient multiplied by the square of topographic elevation. For small surface friction, the simulated vortex first deflects southward, then rebounds north due to the effect of channel flow, as previous studies.

With Taiwan topography without friction, the movement of vortex is not affected by the CMR due to the conservation of potential vorticity. With moderate or large surface friction, when the vortex approaching Taiwan, it deforms and creates two wind maxima, one due to effect of channel flow, another east of the vortex, because the slowdown vortex is pushed by the mean easterly flow behind. Meanwhile, the vortex and two wind maxima rotate cyclonically. Hence, the vortex can deflect north or south, or form a loop, depends on strength and location of the wind maxima. If circulation of the vortex moves around the northern tip of Taiwan, it can induce a significant secondary vortex on the lee side. On the other hand, the secondary vortex, triggered by the flow passing over the CMR, is weak. This paper may provide an explanation on deflection of the vortex approaching Taiwan, which may be difficult to sort out in a more complicated atmospheric model.