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The Structure and Evolution of Oceanic Bow Echoes off the southern coast of Taiwan in the Mei-yu Season

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Bow echoes are longer-lived and larger-scale convective windstorm and usually occur in the mid-latitude continental area during spring and summer seasons. They are most easily identified by their characteristic bow-shaped pattern of high reflectivity on radar images, with kinematic features which include a strong leading-line updraft, cold outflow accompanied by rear inflow jet and a weak-reflectivity region behind the apex of the bow echo (Burgess and Smull, 1990; Atkins et al., 2004). On 7 June 2003, an eastward propagating mesoscale convective system was captured by the Taiwan Doppler weather radar network after initiating in the northern South China Sea and exhibited similar patterns to bow echoes.

Radar reflectivity collected by Kenting radar characterized its bend-shaped convective line in the leading edge and widespread stratiform precipitation in the rear area. The system lasted more than 7 hours. Moreover, between the convective rainband and the stratiform cloud there was a region of weak echo. The maximum Doppler velocity in the rear of convective line went up to 30 m/s as a rear inflow jet (RIJ) embedded in the stratiform area. An apparent Doppler velocity gradient was associated with the convective line, revealing the remarkable shearing along the convective line. Also, it was obvious that a negative-positive velocity couplet occurred within the apex of the convective line and was comparable with the mesoscale convective vortex (MCV). Dual Doppler wind field synthesized from Kenting and Green Island radars reconfirmed that the intense westerly flow constructed the RIJ with wind speed over 30 m/s. A noteworthy fact is that the flow pattern behind the northern end of convective line seemed to be diffluent rather than rotated, indicating the lack of a dominant cyclonic vortex. The vertical wind field showed an apparent updraft in front of the convective line, and a subsidence behind the convective line and within the RIJ (Figure 1).

Keywords: Bow echoes, Mesoscale convective vortex, Dual Doppler analysis

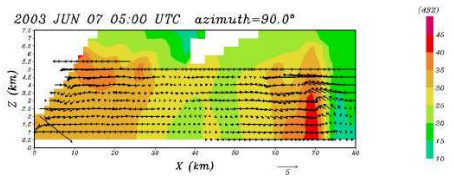

Figure 1: The vertical cross section of a bow echo in reflectivity (dBZ) and wind field (m/s) relative to the convective system at 0500 UTC on 7 June 2003.

References

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