A Case Study on Development Mechanisms of Mesoscale Convective Systems accompanied with the Chang-Ma Front

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To understand the development mechanisms of heavy rainfall on 9-10 July 2007 over Korean peninsula, mesoscale convective systems (MCSs) accompanied with the Chang-ma front at two different regions were investigated. The sub-synoptic conditions were analyzed using JMA MANAL (meso-scale analysis) reanalysis data, weather charts, and MTSAT IR data. To analyze the wind field inside the precipitation systems, multi-Doppler radar analysis was carried out. During the case period, the surface low intensified and moved toward the northeastward along the Chang-ma front. A low-level warm front gradually formed with an east-west orientation, and the cold front near the low pressure was aligned from northeast to southwest.

In Case 1, the convective systems (meso-α scale) were embedded within an area of stratiform clouds to the north of the warm front. These systems developed when a strong southerly and southwesterly low-level jet (LLJ) formed and advected warm and moist air northward. The warm air was uplifted along the warm frontal surface. The development of low-level warm front increased horizontal wind shear. In addition, the wind shear (below 4 km) played an important role of generating new convective cell at the back side of convective cell. In Case 2, each of convective cells (meso-β scale) moved along the line ahead of cold front within the prefrontal warm sector. Convective cells initiated due to low-level convergence within the southwesterly LLJ. The enhanced low pressure induced southeasterly ageostrophic wind and intensified southwesterly LLJ at the ahead of cold front. Wind variations between ageostrophic wind and LLJ led to the convergence.

Keywords : MCSs, Changma front, LLJ, Convergence, Wind shear