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A Study of a Heavy Rainfall Event in the Central Part of Korea in a Situation of a Synoptic Scale Ridge over the Korean Peninsula

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Observational and numerical studies have been carried out to explain the heavy rainfall event over Seoul metropolitan area and Gyeonggi province on June 29 2011. The characteristic features for this heavy rainfall event is convergence produced by the association of low-level mesoscale trough above the Yellow sea in a situation of a synoptic scale ridge over the Korean peninsula. Maximum of 234mm rainfall was recorded in one day, and most of the rainfall occurred in 12 hours.

The major cause of this event is the formation of convergence zone. Abrupt wind direction change created by south-westerly low-level jet at the windward side and northerly or south-easterly wind caused by synoptic scale ridge at the lee side of the rainfall region produce horizontal wind shear in the middle of the mesoscale pressure trough. Also, wind speed difference at the exit of the low-level jet is another cause of the convergence.

The low-level jet forms around the East China Sea. Land-sea heat capacity difference causes the increase of meridional temperature gradient around the coast line of the East China Sea during the daytime and induces the meridional pressure gradient increase. Therefore, low-level jet strengthens at the area where the meridional pressure gradient is strong. This low-level jet moves along the western flank of Western Pacific Subtropical High (WPSH) and impacts on Korean Peninsula.

Formation of the synoptic scale ridge seems to be associated with WPSH and the strong low pressure system at the northeast of Korean Peninsula. The strong cyclone suppresses the northern flank of the WPSH, and relatively high pressure forms at the windward and lee side of the pressure low. Orographic effect plays an important role in intensifying pressure ridge over the Korean Peninsula.

Numerical studies have been carried out to understand the effect of the condensation latent heat, land-sea heat capacity difference, and the orography by using WRF model. Topography sensitivity simulation shows that the North Korean orography strengthens the synoptic scale ridge. Mesoscale trough is not simulated when microphysics parameterization is neglected. Therefore, condensational latent heat induces the formation of the low-level mesoscale trough. Weaker low-level jet is simulated when the sensible heat flux is neglected, and the main reason for this result seems to be the land-sea heat capacity difference around the East China Sea. Three sensitivity simulations show significant decrease in rainfall compare to the control simulation.