Analysis of the Multiscale Weather Scenario on the August 8 Seoul Flood Event in 2022

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Abstract

The State of the Climate in Asia 2020 provides an overview of land and ocean temperatures, precipitation, glacier retreat, shrinking sea ice, sea level rise and severe weather. One of the key messages is precipitation. The East Asian and South Asian summer monsoons were both unusually active, This, combined with frequent tropical cyclones, caused floods and landslides, leading to loss of life and displacement in many countries (IPCC, 2021b). From the long-term investigation, Seoul typically averages 348 mm (13.7 inches) of rain in August – the wettest month of the year there. However, in August 2022, several locations recorded this much rainfall in just one day, especially on 8 August, the one day rainfall amount in the Dongjak District of Seoul reached 381.5 mm, much higher than the record of 354.7 mm in 1920. Also, the peak hourly precipitation in the Dongjak District surpassed 141.5 mm at one point, the highest rate since authorities began keeping records in 1907. Therefore, Korean authorities have warned of the risk of flash floods and landslides. Parts of Japan also saw downpours on Monday night of 8 August, with some regions of Hokkaido reporting flooding. Authorities have warned of the risk of flash floods and landslides (Bae and Yeung, 2022).

This study tries to focus on the synoptic scale analysis, including the source of moisture, thermodynamic structures and dynamic mechanisms. Also, the possible mesoscale analysis will apply to understand the detailed structures and related dynamics. Summaries of the Seoul's heavy rainfall event investigation tell:

(1) The quasi-stationary frontal system crossing the Korean Peninsula was a key mechanism triggering the heavy rainfall.
(2) The tropical cyclonic system in South China Sea supplied sufficient warm and moist air along the NW Pacific high pressure edge onto the Korean Peninsula.
(3) The vertical displacement with low-level convergence and high-level divergence favored the development of the frontal system which brought heavy precipitation over the Seoul area.
(4) The coupling between low-level jet and upper-lever jet made the frontal system more organized.
(5) Applying the principle of proportionality between the upward peak motions in synoptic and mesoscale modes learned from the Typhoon Matmo(2014) case (Hor et al., 2022), the estimated maximum of updrafts in the meso-α scale might reach 8 m/s inside the quasi-stationary frontal case.

Key words: Korean Peninsula, stationary frontal system, updrafts, flash floods and landslides.