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Behavior of cold outflow and gust front during a torrential rain occurred in central Tokyo on August 5, 2008

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A center of torrential rain that occurred around noon on August 5, 2008 was located in the vicinity of the boundary of Shinjuku and Bunkyo Wards (109 mm hour⁻¹ was recorded by rain gauge observation). The torrential rain area stagnated there after it headed eastward from the central part of Shinjuku Ward, and brought intense rainfall of ~20 mm (10 min)⁻¹ for about 40 minutes. Marked cold outflows from the torrential rain area were observed both westward and southeastward. The westward cold outflow of which wind velocity was ~3 m s⁻¹ expanded gradually and converged with northerly wind, then another intense rainfall area was formed in the western part of Tokyo wards area. On the other hand, the cold outflow toward the southeast (~7 m s⁻¹) hardly expanded, and a gust front with a large temperature gradient stagnated along the areas of Kanda-Kasumigaseki-Roppongi. According to wind measurements (25 m, 107 m, and 250 m above ground) at the Tokyo Tower near the gust front, though the northwesterly wind that corresponded to the cold outflow was observed in the lower layer, the southeasterly wind from Tokyo Bay toward the intense rainfall area was admitted in the higher layer. It is possible that the stagnation of the gust front in the vicinity of the torrential rain area contributed to stagnate and maintain the torrential rain area through the continuous lifting of the southeasterly wind at the same place. As the gust front stagnated around the overcrowded areas of high-rise buildings such as Kasumigaseki, it should be necessary to examine the effect of large urban canopy on cold outflow and gust front.

Keywords: torrential rain, central Tokyo, cold outflow, gust front, urban canopy