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Performance of Unified Model heavy rainfall forecasts over the Korean peninsula depending on rain types

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Previous studies indicated that heavy rainfall (>10 mm/h) over the Korean peninsula is characterized by two rain types; cold-type vs. warm-type, which are featured by strong updraft, high cloud top altitude, and large amount of ice crystal, vs. lower cloud top height and more of liquid water. In this study, for evaluating UM heavy rainfall forecasts for different rain types over the Korean peninsula, heavy rain events occurred over the Korean Peninsula during the summer of 2012-2016 period were classified into two types (i.e. cold-type vs. warm-type), by using AWS (Automated Weather Station) rain gage data and IMPACT·LDAR II (Improved Accuracy from Combined Technology·Lightning Detection And Range II) lightening data. By doing that, 78 cold-type cases and 164 warm-type cases were noted

Using classified heavy rain cases, we first evaluated the performance of UM rainfall forecasts for each rain type against AWS rain gage data. For the comparison, UM rainfall and AWS rain gage data were collocated at area mean grid of 0.25˚ x 0.25˚ over the peninsula. The calculated threat score, false alarm ratio and probability of detection values indicate that UM forecasts better for the warm-type rainfall, in comparison to the performance for cold-type rainfall. Quantitative evaluation of UM rainfall forecast also shows that warm-type UM rainfall forecasts are better than cold-type forecasts, partly because of severe underestimate of cold-type rainfall. It is thought that such underestimates are partly due to the current UM model capability which may not properly simulate short-living smaller-scale cold type rain system, due to the coarser spatial and temporal resolutions. On the other hand, considering that the warm-type is closely linked to the large-scale synoptic forcing, it is not surprising to find that the same UM model better forecasts the warm-type heavy rainfall.