Numerical analyses and simulations of the easterly-related weather phenomena on the east coast of Korea

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The east coast of Korea has complex terrain with a narrow coastal area surrounded by the East Sea/Sea of Japan and a steep and long mountain range, and often experiences hazardous weather phenomena. Heavy snowfall and rainfall occur frequently in this region, in association with barrier jets parallel to the mountain range, cold air damming, and intensification of instability, mostly due to the prevailing easterly winds. Depending on the distribution of the atmospheric pressure systems around Korea, the degree and intensity of the easterly winds are different and hence exert different impacts on the weather systems over the inland and coastal areas. This implies that classification of the easterly-related weather patterns should be also accounted for. In order to improve the forecast skill of such weather systems, it is essential to study the characteristics of occurrence and inland incursion of the easterly winds. In this study, we perform high-resolution numerical simulations for selected easterly wind cases using the Weather Research and Forecasting (WRF) model, and carry out the synoptic- and/or meso-scale analyses on the pattern and structure of some selected easterly-related hazardous weather systems. In addition, we identify the spatial characteristics of important weather elements, such as pressure, precipitation and temperature, for the selected easterly cases in Korea via the geostatistical analyses, such as autocorrelogram, semi-variogram, Moran's I, general G, etc., by utilizing the ERA5 dataset. Through this study, we can understand the occurrence and development mechanisms, the pattern and structure characteristics, and the spatiotemporal features of the easterly-related weather systems.