



## **tropical cyclone risk analysis: a decisive role of its track**

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The tracks of 85 tropical cyclones (TCs) that made landfall to South Korea for the period 1979-2010 are classified into four clusters by using a fuzzy c-means clustering method. The four clusters are characterized by 1) east-short, 2) east-long, 3) west-long, and 4) west-short based on the moving routes around Korean peninsula. We conducted risk comparison analysis for these four clusters regarding their hazards, exposure, and damages. Here, hazard parameters are calculated from two different sources independently, one from the best-track data (BT) and the other from the 60 weather stations over the country (WS). The results show distinct characteristics of the four clusters in terms of the hazard parameters and economic losses (EL), suggesting that there is a clear track-dependency in the overall TC risk. It is appeared that whether there occurred an “effective collision” overweighs the intensity of the TC per se. The EL ranking did not agree with the BT parameters (maximum wind speed, central pressure, or storm radius), but matches to WS parameter (especially, daily accumulated rainfall and TC-influenced period). The west-approaching TCs (i.e. west-long and west-short clusters) generally recorded larger EL than the east-approaching TCs (i.e. east-short and east-long clusters), although the east-long clusters are the strongest in BT point of view. This can be explained through the spatial distribution of the WS parameters and the regional EL maps corresponding to it. West-approaching TCs accompanied heavy rainfall on the southern regions with the helps of the topographic effect on their tracks, and of the extended stay on the Korean Peninsula in their extratropical transition, that were not allowed to the east-approaching TCs. On the other hand, some regions had EL that are not directly proportional to the hazards, and this is partly attributed to spatial disparity in wealth and vulnerability. Correlation analysis also revealed the importance of rainfall; daily accumulated rainfall is the most-correlated with EL among all BT and WS hazard parameters for all clusters except the east-short. The least-correlated hazard parameter is the storm radius which showed significant correlations with EL for only the short clusters. In conclusion, this study suggests that TC track is essential in determining the way it brings damage on South Korea. Thus, it is suggested that the damage warning and adaptation policy need to be different for different TC tracks although South Korea is relatively small compared to average TC size.