

Enhancement of transient cyclones and anticyclones due to Mountains on the Korean Peninsula

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Mountains on the Korean Peninsula are known to intensify cyclones that form and develop over the Sea of Japan during winter. This study focuses on the strengthening of atmospheric baroclinicity due to mountains, aiming to elucidate the mechanism by which transient disturbance activity, including both cyclones and anticyclones, is enhanced. Understanding the influence of terrain on disturbance activity is important for comprehending the climate around the Sea of Japan and the daily weather patterns in Japan.

The influence of mountains was evaluated through elevation modification experiments using the Weather Research and Forecasting (WRF)-ARW model. Furthermore, by separating the variables obtained from WRF into background and disturbance fields using a 7-day moving average, the mountain influence was separated into effects on transient disturbances and effects on the larger-scale background field.

The analysis revealed that mountains enhance vertical wind shear of zonal winds in the background field and decrease static stability. Furthermore, it was found that they strengthen the meridional temperature gradient and form a dipole-like geopotential height distribution. It was also confirmed that mountains enhance the poleward heat flux and kinetic energy in the disturbance field.

Based on the above results, we conclude that the mountains on the Korean Peninsula block the inflow of cold air from the continent to the Sea of Japan driven by the northwest monsoon. This action enhances the background baroclinicity over the Sea of Japan through both vertical wind shear and meridional temperature gradient. Furthermore, by reducing static stability, it intensifies transient disturbance activity.

Keywords: Japan Sea, Transient high/low, Model, Elevation modification