

# Numerical Simulation of Local Circulation Characteristics in the Taipei Basin and Yilan Region under Weak Northeast Monsoon Conditions

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From September to October, Taiwan was controlled by the continental cold high-pressure, and the environmental wind field was dominated by the northeast monsoon. When the latitude of the continental cold high-pressure center was higher and gradually moves eastward to the sea, the environmental wind field in northern Taiwan was mostly weak northeasterly or easterly winds introduced by continental high-pressure peripheral circulation; as such an environmental wind field occurred, even though the distance between the Taipei Basin and the Yilan area of northern Taiwan were similar, the local wind fields were quite different, and even because of the impact of terrain, heavy rainfall occurred in the Yilan area (24-hour cumulative rainfall exceeds 200 mm) or more. In order to understand the relationship between the environmental wind field (weak northeast monsoon), local circulation, and complex terrain effects, this study applied the WRF (Weather Research and Forecasting Model) model, with a four-layer nested grid, the innermost layer with a height of 500 m spatial resolution, simulating the change of local circulation in the Taipei Basin and Yilan under the northeast monsoon on October 25, 2022.

It was found that the wind field in the Taipei Basin was a weak northeasterly wind that day, but due to the influence of the terrain, a local circulation would occur in the afternoon, and the wind field would gradually change to an easterly or southeasterly easterly wind. With such airflow characteristics, there is no continuous precipitation in Taipei, and the weather tends to be stable. However, when the wind field of the same environment passes through the Lanyang Plain, it is affected by the terrain effect, and the area where the wind field convergence zone is formed in the Lanyang Plain has Nimbostratus and indirect precipitation. The reason why the Lanyang Plain has completely different weather phenomena from the Taipei Basin under the same environmental wind field is mainly because the near-surface wind field gradually changes to southwest or northwest wind below 975 hPa. In addition, a northwest-southeast trending wind direction convergence zone is formed in the vicinity of Sansing. As the terrain blocking and local circulation become more obvious, the wind direction gradually turns to westerly and goes out to ocean.

Keywords: Northeast monsoon, local circulation, Taipei Basin, convergence zone, terrain effect, Lanyang Plain