Wu, Y.-J., Y.-C. Liou, Y.-C. Lo, S.-L. Tai, S.-F. Chang, and J. Sun, 2021: Precipitation processes of a thunderstorm occurred on 19 August 2014 in northern Taiwan documented by using a high resolution 4DVar data assimilation system. *J. Meteor. Soc. Japan*, **99.** 1023–1044.
doi:10.2151/jmsj.2021-049

Plain Language Summary: The evolution of a heavy rainfall event occurred on 19 August 2014 in northern Taiwan is investigated with observed data and analyses from a newly-developed 4DVar data assimilation system named IBM_VDRAS. This event possesses different precipitating processes and track from those frequently observed in that region. The kinematic, thermodynamic, and microphysical fields of the convective cells are analyzed in details to explain the mechanisms which help to maintain the structure of the convective system and lead to heavy precipitation.

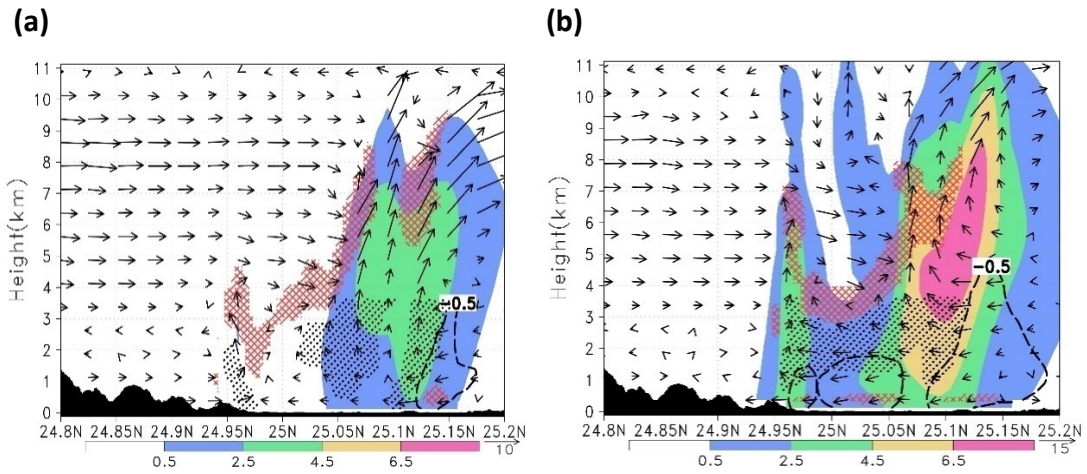

Fig. 1 IBM_VDRAS simulations of the wind vectors, rainwater mixing ratio q_r (color shading), downward motion at -0.5 m s^{-1} (broken contour), convergence of water vapor flux (red hatched), and wind convergence (black hatched) over a north-south-oriented vertical cross section at (a) 10 min; (b) 30 min after 15:32 LST. The q_r field intensifies with time. The area with descending flow expands southward with time. The low-level outflow wind from this merged cell in the north blows toward the south. When the flow reaches the mountain and is blocked, a low-level convergence zone is generated, triggering updraft and a new convective cell near 24.95 N (Fig. 1b). The new convective cell grows to an altitude about 6.5 km, where the persistent southerly wind can be found. Water vapor convergence is identified from the new cell in the south to the merged cell in the north, indicating that the local circulation in Taipei Basin supports the transport of water vapor northward and helps to maintain the merged cell.

Highlights:

- The mechanisms leading to this event and its maintenance involve the interactions among sea breeze, cold air outflow, cell merging, and terrain. A correct description of the interactions among these factors in a numerical model is a key to the improvement of the forecast.
- Sensitivity experiments of quantitative precipitation forecast (QPF) show that the terrains prevent the location of major rainfall from shifting outside of Taipei Basin.
- By assimilating surface data, the model can better predict the position of the rainfall.