EMS Annual Meeting Abstracts
Vol. 15, EMS2018-23, 2018

Application of Time-Lagged Cloud-Resolving Ensemble Quantitative Precipitation Forecasts in Taiwan for Typhoon Morakot (2009)

Chung-Chieh Wang and Shin-Hau Chen
National Taiwan Normal University, Earth Sciences, Taipei, Taiwan (cwang@ntnu.edu.tw)

In this study, the performance of time-lagged ensemble quantitative precipitation forecasts (QPFs) for typhoons in Taiwan, with a cloud-resolving grid spacing of 2.5 km, a large domain of 1860 $\times$ 1360 km^2, and an extended range of 8 days, is discussed. Previous evaluation for six typhoons in 2012-2013 shows that on average, the system produced a decent QPF at the longest range at day 5.7, providing much extended lead time, especially for slow-moving storms that pose higher threats. In addition, since forecast uncertainty (reflected in spread) reduces with lead time, the system is well suited to provide a wide range of rainfall scenarios in Taiwan at longer lead times, each highly realistic for the associated track, for advanced preparation for the worst-case scenario. Later on as the typhoon approaches and the predicted tracks converge (toward the best track) as the uncertainty reduces, the authorities can make adjustments toward the scenario of increasing likelihood. This strategy fits well our conventional wisdom to "hope for the best, but prepare for the worst" when facing natural hazards. Overall, the system compares favorably in usefulness to a typical 24-member ensemble (5-km grid size, 750 $\times$ 900 km^2, 3-day forecasts) currently in operation using comparable computational resources.

As the most devastating typhoon in the past 50 years, Typhoon Morakot (2009) is selected here to further examine the usefulness of the QPFs by this 2.5-km ensemble system running 4 times a day. The main findings are as the following. First, the large track errors at longer range prevent decent QPFs until after about 1200 UTC 5-0000 UTC 6 August 2009, so the ensemble evolved toward the worse-case, which eventually happened, and this event represents a very difficult case to forecast well. Second, nevertheless, from QPFs made since 0000 UTC 6 August, up to about 70% of lagged members produced rainfall amount $>$1500 mm in 48 h, with a lead time up to about 2 days before the most rainy 24 h started in southern Taiwan (the area with the highest rainfall amount). Thus, highly realistic QPFs and probabilities (at short range) with enough lead time for action, similar in quality to those from high-resolution multi-member ensemble but at a much less computational cost, are possible using the time-lagged approach, even for this very difficult event.