Recent Modifications of Tropical Cyclone Bogus Data in the JMA Global and Meso-scale Data Assimilation Systems

Akira Okagaki[1], Hiroshi Sako[2]
Numerical Prediction Division, Japan Meteorological Agency

In JMA's global and meso-scale NWP systems, a typhoon-bogus scheme is applied to initialization for tropical cyclones (TCs) over the western North Pacific. In this scheme, a typical TC structure is generated based on real-time TC analysis at RSMC Tokyo, and pseudo-observation data (i.e., bogus data) extracted from this structure are deployed around the TC. The bogus data are assimilated in each NWP system.

Introduction of a bogus data adjustment function

In recent years, the accuracy of the first-guess fields in the operational analysis has been improved by the introduction of new satellite data and a sophisticated data assimilation system. This has reduced the relative accuracy of the bogus data to first-guess fields, and the assimilation of too many bogus data could impair the accuracy of analysis. To deal with this issue, a bogus data adjustment function has been introduced. With this function, the number of bogus data can be adjusted according to the distance from the TC's central position in the TC analysis to the one in the first guess. In many cases, the number of bogus data is greatly reduced compared with before, and these data are deployed only in the vicinity of the TC center.

Experiments and Results

For the global NWP system, data assimilation and forecast experiments were conducted prior to actual operation. The level of TC track prediction error was clearly reduced as a result of using the improved typhoon-bogus scheme (Figure 1). The new scheme was incorporated into the operational global NWP system in April 2010.

Introduction into the meso-scale NWP system

An almost-identical scheme was incorporated into the operational meso-scale NWP system in September 2010. One additional change for the meso-scale system is the timing of bogus data generation. Previously, these data were prepared for the start of the assimilation window (at a point three hours before the analysis time). In the new scheme, the data are prepared for the end of the assimilation window (at the analysis time). This allows the system to use the latest TC analysis data. However, since the meso-scale data assimilation process is started only 50 minutes after the analysis time, the real-time TC analysis data sometimes cannot be delivered in time. Any data delivered late will be used in the next data assimilation process at three hours later. TC track forecast error in experiments using this new scheme

[1] E-mail: a-okagaki@met.kishou.go.jp
[2] E-mail: h-sakou@met.kishou.go.jp

was reduced (Figure 2).

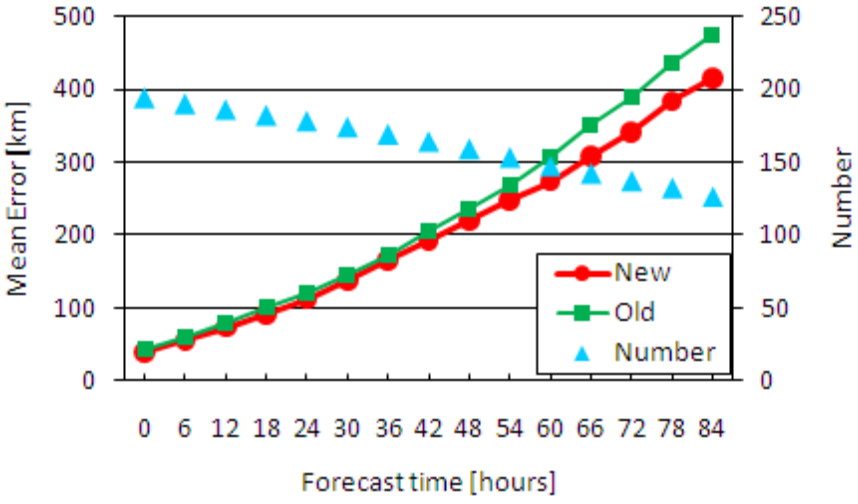

Figure 1. Mean track forecast errors (km) for TCs in RSMC Tokyo's area of responsibility from 25 September to 25 October, 2009, according to the global NWP system. The red line shows errors of TC track prediction with the improved typhoon-bogus scheme, and the green line shows those with the old one. The level of error is clearly lower with the improved scheme. The blue triangles denote the number of verification samples.

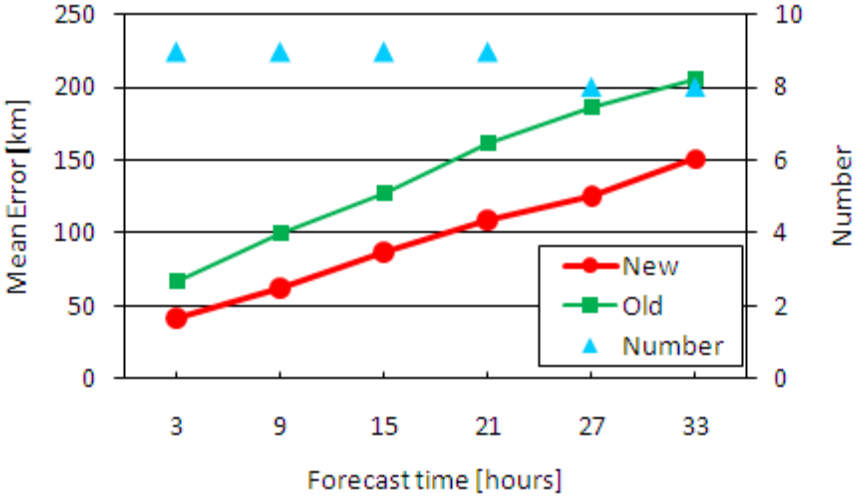

Figure 2. As Figure 1, but for meso-scale NWP system. The target typhoon is Typhoon KROVANH (T0911) and the study period is from 28–30 August, 2009.