



# **Audit of Management of Weather Forecast and Earthquake Notification Systems**

**Disclosed on August 22, 2017**

## **1. Audit Background**

From March 20 to April 20, 2017, the Board of Audit and Inspection (BAI) of Korea conducted an audit on the operation and the management conditions of 8 institutions, including the Korea Meteorological Administration (KMA). The audit was conducted to inspect its operations, find possible problems, and to make recommendations.

## **2. Audit Findings**

### **2.1 Inappropriate operation of Numerical Weather Prediction (NWP) model**

The KMA announces weather forecasts based on the NWP<sup>1</sup> model by inputting into the model weather data collected from satellites and radar.

In June, 2010, Chollian Satellite 1, also known as Communication, Ocean and Meteorological Satellite 1 (COMS-1), was launched and operated to collect satellite observation data regarding atmospheric conditions surrounding the Korean peninsula and to be used for the NWP model. However, the applicable technologies for utilization of the collected satellite data were not properly developed, and as such, the local forecast model, which predicts atmospheric conditions around the Korean peninsula in detail, could not utilize the satellite data at all.

\* Regarding the development of application technologies, such as how to utilize the observation data for the NWP, no development plan had been established for the weather observation equipment to be loaded in the Chollian Satellite 2, scheduled to be launched in May 2018.

In addition, the NWP model utilized observation data transmitted from 20 foreign satellites. However, 24 out of 902 files (2.7%) were unable to be utilized due to delays in reception by not using dedicated circuits, but slower general lines.

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<sup>1</sup> NWP model is software for predicting future atmospheric conditions through mathematical calculation. It consists of ① local forecast model, which predicts the weather on the Korean peninsula, ② regional forecast model, which covers the weather on East Asian region and ③ Global forecast model for the world.

## **2.2 Wind shear warnings were not issued at military airports for civilian aviation**

The KMA announces wind shear<sup>2</sup> warnings for private airports, including Incheon International Airport, for the safe takeoff and landing of aircrafts.

According to the *Enforcement Decree of the Weather Act*, the KMA is required to issue a warning when the wind shear, which can affect the safe operation of aircrafts, occurs or is expected to occur.

Taking into consideration that military airports also operate equipments, such as ‘wind profilers’ or ‘airport weather observation equipment,’ the KMA could announce the wind shear warnings in cooperation with the Navy or the Air Force that manage the airports.

However, the KMA issued a warning only for Gimhae Airport (1 among 8 military airports), which accommodated civilian flights from August 2007. For the rest of the 7 military airports, no alerts were made, hampering the safety of aviation.

## **2.3 Inappropriate conditions for earthquake early warning**

The KMA adopted the **Earthquake Early Warning (EEW) system\*** in January 2015. If the magnitude of an earthquake over 5.0 is expected, an earthquake early warning should be issued immediately.

\*Earthquake P waves (6km/s) propagate twice as fast as S waves (3km/s). If the P waves arrive, the KMA immediately issues a warning to maximize the golden hour and to minimize any damages.

In order to ensure information reliability and reduce misinformation, the conditions of issuing warnings were set to “detect P-wave more than 20 times in at least 15 observation stations” and “when it lasts more than 20 seconds.” However, the three early warnings issued in 2016 took up to 26.7 seconds on average.

Contrary to this, overseas cases, including Japan, placed great emphasis on promptness by collecting information from at least 2-6 observation stations to effectively issue an early warning.

\*In the case of Japan, 7 early warnings in 2016 took place within 7.2 seconds on average.

If the conditions, “P-wave more than 20 times in at least 15 observation stations” and “last more than 20 seconds,” are replaced with “detection in the 8 observation stations,” the time for issuing an early warning in Korea can be decreased by 12 to 17 seconds without a significant difference in the probability of misinformation.

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<sup>2</sup> Wind shear refers to a drastic change in wind speed or direction over a relatively short distance in the atmosphere.

### **3. Recommendations**

The BAI recommended that the KMA develop the application technologies of satellite observation data to utilize the satellite data of the Chollian Satellite for numerical weather prediction. In addition, the BAI requested the head of the KMA to make sure there will be no delays in collecting observation data from new foreign satellites in the future so that the inability to use the received data for numerical weather prediction does not occur again.

The BAI notified the head of the KMA to prepare necessary measures to issue wind shear warnings to the rest of the 7 military airports where civilian aircrafts land and take off.

Finally, the BAI requested the head of the KMA to reset the conditions for issuing an earthquake early warning to strengthen the effectiveness of the Earthquake Early Warning system.