Forecasting flash floods an hour in advance

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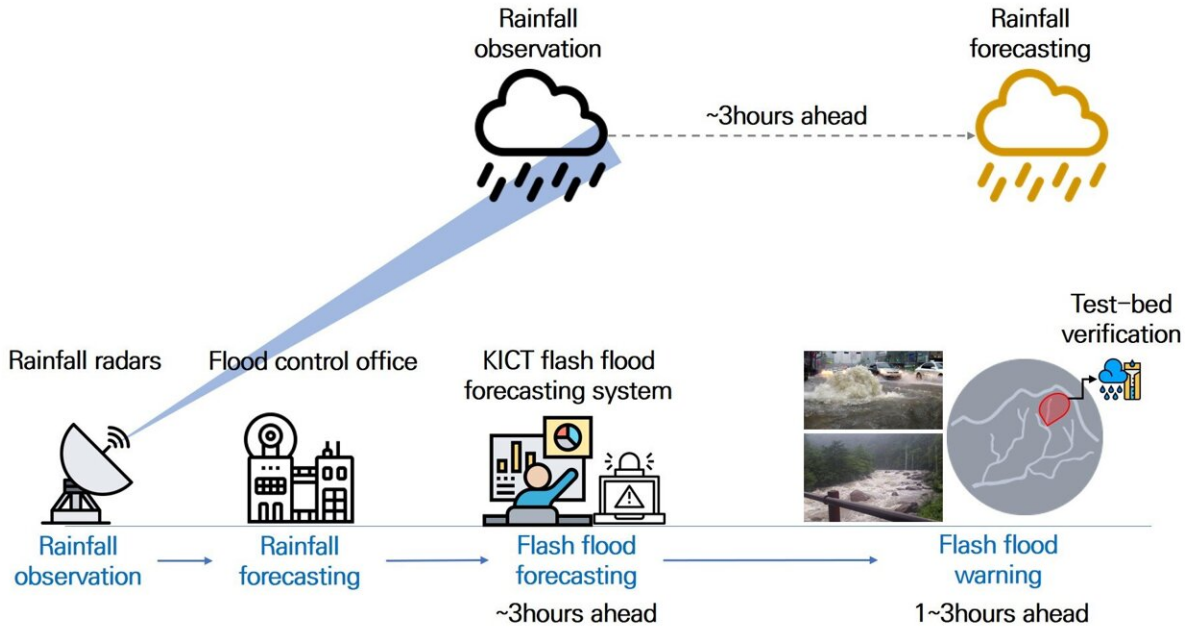


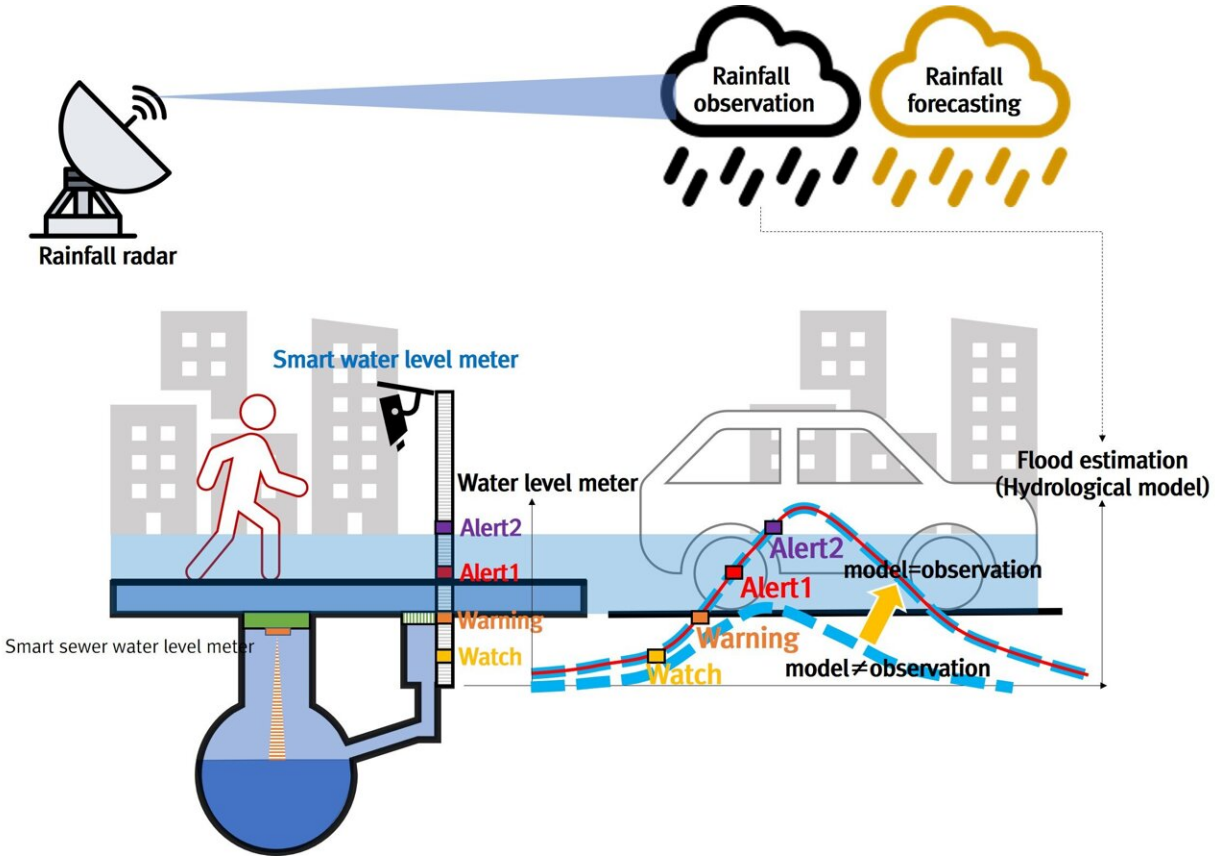
Procedure for flash flood forecasting using rainfall radar data and KICT flash flood forecasting system. Credit: Korea Institute of Civil Engineering and Building Technology

Korea has recently seen a surge in localized torrential rain and floods due to global warming. Frequent flash floods are hard to forecast and, when forecast, the accuracy is low. This often leads to major disasters that take hundreds of lives, as seen in Germany and China (Henan) in July 2021. Floods are one of the deadliest types of natural disasters, but climate change has made the forecasting of them even more challenging.

Researchers at the Korea Institute of Civil Engineering and Building Technology (KICT) have developed a system that can forecast flash floods one hour in advance.

A flash flood is caused by a rapid rise of water flowing into adjacent streams or rivers because of intense rainfall concentrated in small areas and occurs in a fairly short period of time. In low-lying urban areas such as Gangnam in Seoul and in mountainous areas, the speeds of water surge and flow are much faster than in other areas with the same amounts of rainfall. The current heavy rain alert (forecasting based on a certain level of rainfall) is a far cry from actual, perceived risk of flooding. It falls far short of efficiently communicating the risk of flash floods that abruptly hit cities, mountainous areas, or regions along small rivers.

The research team at the KICT, led by Dr. Hwang Seokhwan, developed a system for these regions that forecasts abrupt flash floods based on the rainfall radar data from the Ministry of Environment with regional flood characteristics taken into account. This system will begin to provide forecasting services by the Korean government this year.



shows how to set the level of urban flood risk standards and verify the standards. Credit: Korea Institute of Civil Engineering and Building Technology

The flash flood forecasting system extracts local factors that determine the depth of flooding and the extent of flood damage in different regions and conditions based on the information about the damage from previous floods and specific characteristics of regional floods. With these, the system derives its own equations of the characteristics and uses them to predict the risks of flash floods in areas that do not have any flood damage information.

More specifically, it transfers the hydrological characteristics of the areas with measurements to those without measurements to provide

accurate forecasting data about the risk of a flash flood to cities as well as islands and mountainous areas. This is the first system of its kind for forecasting floods.

These technical features enable fast and accurate calculation of flash flood risks in any region, including cities, mountains, and islands. This, in turn, enables accurate forecasting of a flash flood coming an hour later in just a few minutes. During a four-year period of pilot operation from 2019 to 2022, the system proved its effectiveness by accurately forecasting the major flash floods in all areas of Korea about an hour in advance. Its success rate in forecasting flash floods was an impressive 90.3% for 31 heavy rainfall events during the public verification in 2019.

Dr. Hwang said, "No matter how accurate a forecasting is, its forecast does not have any value as information if it does not come soon enough. This forecasting system is expected to significantly reduce the casualties and property damage caused by flash floods as their coming can be predicted at least one hour in advance."

The technology, developed by the KICT, will be transferred to the Flood Control Office of the Ministry of Environment and be applied to issuance of flood alerts first in Seoul in the 2023 rainy season.

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