

A New Weather Radar that Can Forecast Downpours 30 Minutes Before

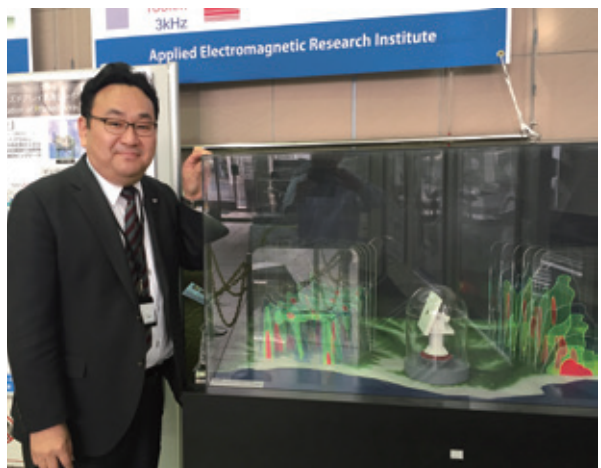
A new radar that can forecast rapid weather changes has been developed. The radar is expected to be useful in our daily lives, for the management of events such as the Tokyo Olympics and Paralympics in 2020, as well as for disaster prevention and mitigation.

TAKASHI SASAKI

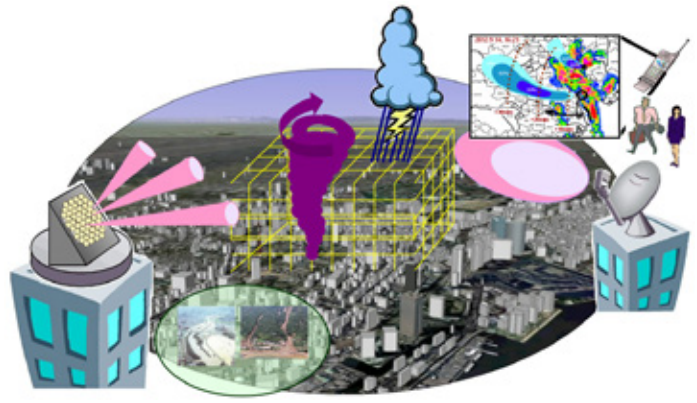
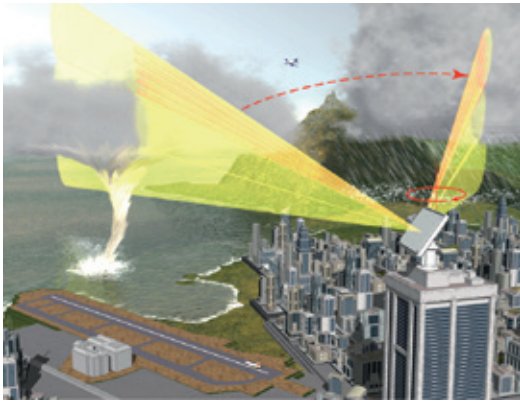
ISOLATED heavy rainfall and localized torrential rainfall, known in Japan as “guerrilla rainstorms,” and unpredictable rapid weather changes, including rapidly developing low atmospheric pressure, have been a major problem in recent years. Rapid weather changes bringing isolated heavy rainfall and gusts of wind sometimes cause unexpected flooding and landslide disasters.

A multi-parameter phased array weather radar (MP-PAWR) has been brought into use for the first time in the world to observe such sudden weather phenomena with high precision. Research and development of the MP-PAWR has been led by scientists at the Remote Sensing Laboratory of the National Institute of Information and Communications Technology (NICT).

The Laboratory’s Director, Dr. Katsuhiro Nakagawa,



Dr. Katsuhiro Nakagawa, Director of NICT’s Remote Sensing Laboratory
Photo: Takashi Sasaki



Illustrations showing the MP-PAWR radar and its weather forecasting capabilities (left) close to an airport and (right) in an urban environment
Figures: Courtesy of National Institute of Information and Communications Technology (NICT)

explains the background to the development.

“A weather radar is the most effective means to observe rainfall. But a conventional weather radar that rotates parabolic antennae mechanically could not detect locally and rapidly developing cumulonimbus in the early stage of ‘guerrilla rainstorms.’ You need to change the angle of the antennae to observe the whole picture of cumulonimbus that develops high in the sky and you need at least five minutes. On the other hand, cumulonimbus develops rapidly in about ten minutes. For this reason, we began development of a weather radar that could rapidly observe cumulonimbus in three dimensions.”

The first thing that Dr. Nakagawa and his colleagues developed was PAWR. Because this radar conducts observations at broad angles of elevation simultaneously, in one rotation it can conduct three-dimensional observations that conventional parabolic antennae could only conduct by rotating as many as dozens of times. PAWR takes less than 30 seconds to observe an area 60 kilometers in radius and 14 kilometers in height and can capture cumulonimbus that develop rapidly almost in real time. At the time, conventional radars with polarized observation functions were also still necessary to observe a wide range of rainfall types with high precision.

In 2017, they developed MP-PAWR, which has multiple functions. The novel weather radar was developed as part of the “Enhancement of Societal Resiliency against Natural Disasters” program, one of the Cross-ministerial Strategic Innovation Promotion Programs (SIP) promoted by the Cabinet Office, and

has been installed at Saitama University.

Dr. Nakagawa says, “A conventional weather radar just enabled us to observe the lower part of rain clouds intermittently. But the practical realization of MP-PAWR has enabled us to continuously observe the whole picture of rain clouds and the state of rainfall. Now we can detect ‘guerrilla rainstorms’ early by quickly capturing ‘localized torrential rainfall in the making’ that is generated in the sky.”

According to Dr. Nakagawa, high-precision weather information provided by MP-PAWR will be highly effective for preventing disasters, such as by providing vital information for water-related disaster mitigation, including river patrols, sandbagging at-risk areas, and issuing evacuation orders to residents, and will provide many benefits in our daily lives.

Dr. Nakagawa points out the possibilities of MP-PAWR, explaining, “Observing things close to your daily lives, MP-PAWR will make it easier for you to bring in the laundry before sudden heavy rainfall and to call off outdoor activities more quickly. In addition, the ability to predict sudden changes in weather will make outdoor events, such as sports competitions and firework displays, safer and more comfortable. Currently, we are considering the uses of the weather information provided by MP-PAWR for the smooth management of the Tokyo Olympics and Paralympics in 2020. A range of Japanese state-of-the-art technologies will be utilized for the coming Olympic Games. The Olympics will be a perfect opportunity for us to demonstrate Japan’s advanced weather technologies to the world.”