【Grant-in-Aid for Scientific Research (S)】

Advanced field observation of the Seeder-Feeder heavy rain mechanism and comprehensive research for water disaster mitigation

PI's Photo		
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	Project Information	Project Number : 24H12345　　Project Period (FY) : 2024-2028 Keywords : Seeder-feeder mechanism, rainscope, polarimetric radar, phased array radar

Purpose and Background of the Research

●Outline of the Research

Typhoon Hagibis of 2019 caused so much rain that it broke Japan's daily rainfall record, and it is still fresh in our memories that many people were killed. This heavy rain is said to be caused by the Seeder-Feeder mechanism. The Seeder-Feeder mechanism is a mechanism in which rain from the upper layer captures cloud particles as it passes through the clouds at the lower layer, increasing the intensity of the rain. It also affects localized torrential rains. There has been a lot of research on the Seeder-Feeder mechanism, but most of it has been based on meteorological Doppler radar and model research at the time. No research has ever been done before, focusing on the behavior of clouds and precipitation particles, and attempting to understand the formation process of heavy rain from on-site observations.

In this research, we will focus on the Seeder-Feeder mechanism that causes heavy rain and in addition to the observation methods that our research team has accumulated so far, we will use newly developed cloud and precipitation particle imaging sondes and phased array polarized precipitation radar. We will clarify this mechanism through cutting-edge field observations that incorporate new observation techniques that did not exist 10 years ago.

Through this, we will not only elucidate the mechanism of heavy rainfall, but also create a method for estimating high-precision surface precipitation using radar, and make a breakthrough in the major restructuring of the active radar observation network of the Ministry of Land, Infrastructure, Transport and Tourism.

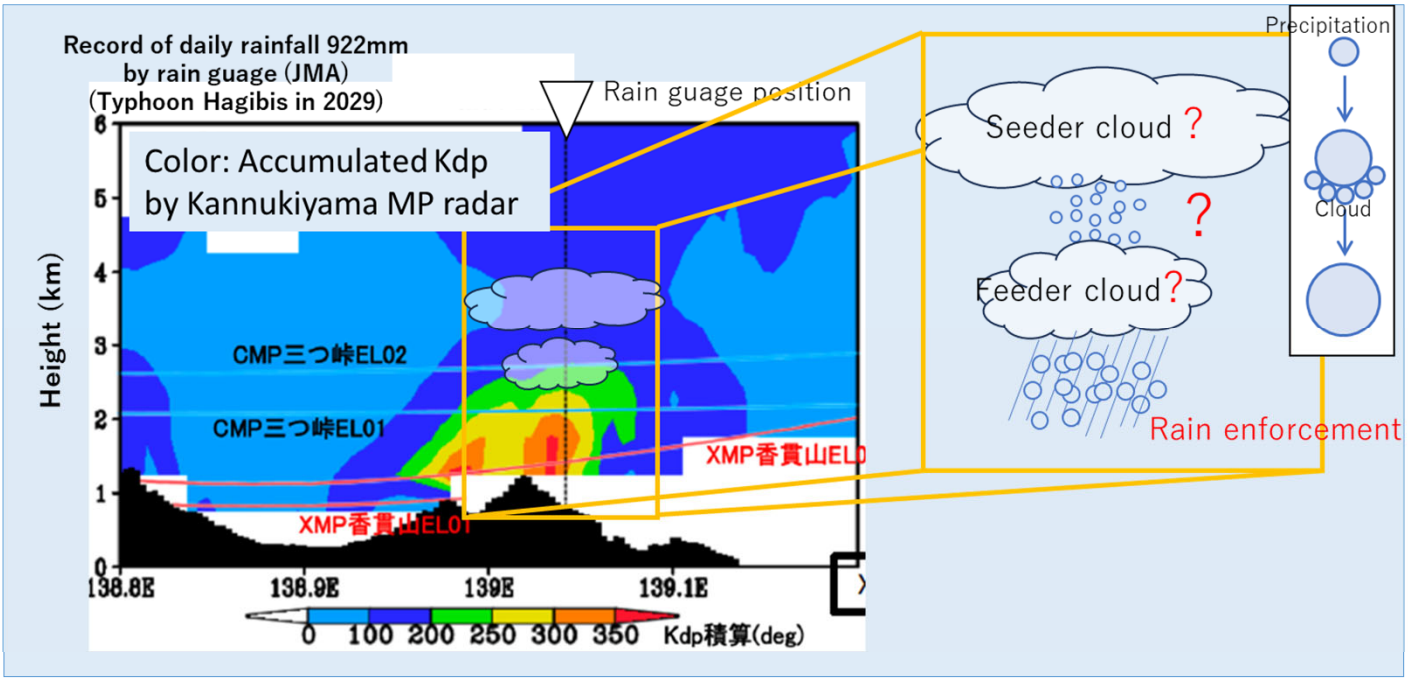

Fig.1 Background of this research: rainfall enforcement by seeder-feeder mechanism.

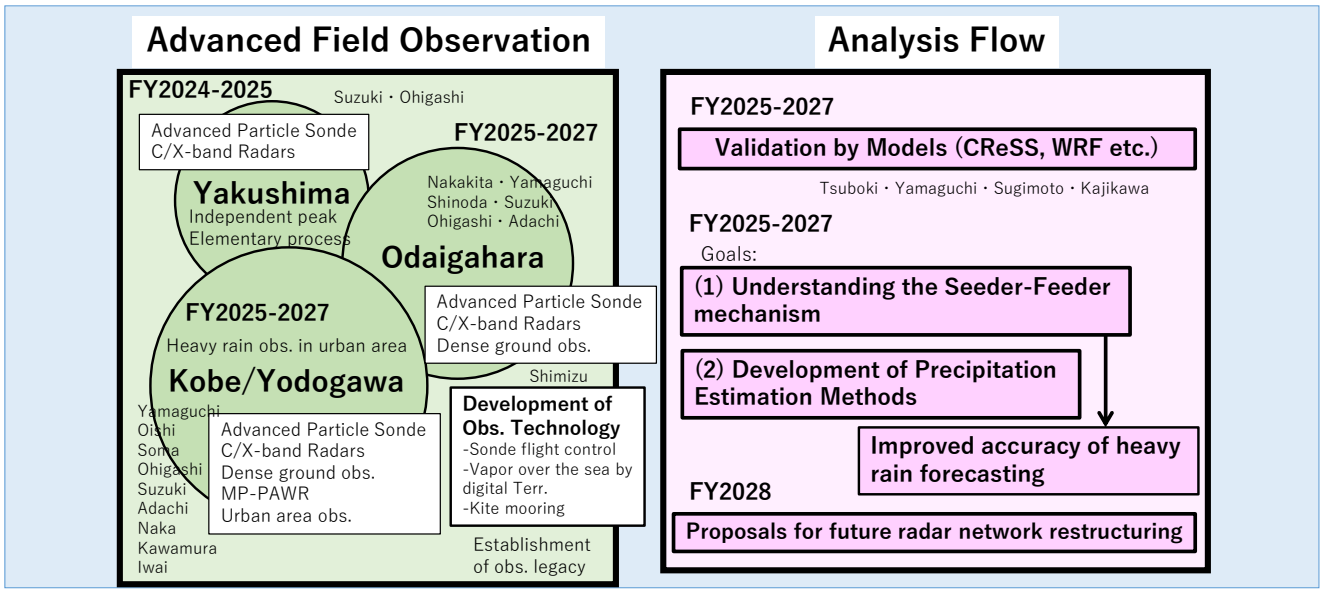

Fig.2 Framework of the research.

Expected Research Achievements

● **Direct observation of cloud and precipitation particles using camera-equipped sondes and synchronous observation using cutting-edge radar** This is the first time that we have ever directly observed precipitation particles falling from the sky and how they fall and capture cloud particles in the lower layers, and we will do this. At the same time, we will use the latest cloud/precipitation radar that can observe the size and shape of precipitation particles to observe their behavior with high resolution and high temporal resolution. By doing so, we will be able to observe in detail how precipitation particles from the sky supplement cloud particles in the lower layers, and we will be able to observe in detail how precipitation particles from the sky supplement cloud particles at lower levels, and we will be able to improve modeling of the capture rate of cloud particles necessary to improve atmospheric physics numerical models and estimate surface precipitation from radar observations.

Fig.3 Latest particle sonde and cloud/precipitation radars

● **Contributions to river management**
Elucidation and modeling of the Seeder-Feeder mechanism not only improves the accuracy of observing and predicting the total amount of rainfall for each river outflow, which is very important for river management. It will greatly contribute to predicting flow rates and will greatly contribute to flood control.

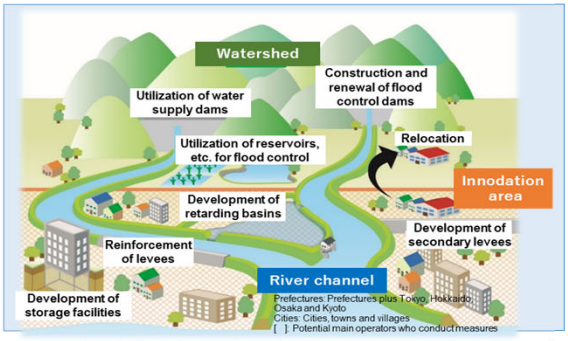

Fig.4 Sustainable river basin management by all.

Homepage Address, etc.	https://hmd.dpri.kyoto-u.ac.jp/seederfeeder/