Monitoring of typhoon and thunderstorms using micro-satellites and ground-based lightning networks

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We are conducting new project for development of extreme weather, including typhoons and individual thunderstorms, monitoring and alert system in the Philippines in 2017-2021 under international cooperation between Japan, Philippines and other SE-Asian countries supported by JST, JICA and other funds. It has been reported that lightning activity could be a enhanced prior to the typhoon intensity by one or two days. In this project, we make use of two new technologies, that is, the lightning activity estimated by the ground-based lightning networks with 12 sites for VLF radio wave measurement in nation-wide of Philippines and with 50 sites for electrostatic field measurement distributed in Metro Manila together with infrasound sensor and automated weather station, and the 3 dimensional capturing of thunderstorms by the on-demand operation of 50-kg micro-satellites, including the first Philippine-developed micro-satellite, DIWATA-1. We plan to establish a new methodology to obtain very detail semi-real time information of typhoons and thunderstorm activities that cannot be achieved only with conventional observational equipments. Based on these new observations together with advanced radar measurements and drop/radio sondes campaigns, we will try to construct the cutting-edge observation system to monitor the development of typhoons and thunderstorms, which may greatly contribute to the prediction of disasters and the public alerting system.

By the end of March 2017 we started the test observation for lightning at Quezon city, Philippines, Palau and Guam, forming the network for typoons. We also succeeded in making 3-D cloud structure with telescope and wide angle spectral camera onboard DIWATA-1, achieving high resolution of ten to several meters. Now we are establishing the real-time target pointing operation with micro-satellites based on the last-minute lightning data measured by ground networks. Adding to DIWATA-1, three more our satellites, namely, RISESAT, MicroDragon and DIWATA-2 with advanced cameras will be used in 2018-2019. In the last September, drop sonde campaign using airplane in the east side of Philippines were carried out under collaboration with Nagoya University team. Here we introduce the results of 3-D cloud modeling using images taken by satellite, preliminary lightning analysis using ground networks, and the first results of the drop-sonde campaign for Typhoon Trami, adding to the outline of the project.