Development of a new dropsonde system for typhoon aircraft observation in the T-PARCII project

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Accurate data of typhoon intensity are indispensable for both scientific research and operational forecast of typhoon. However, uncertainty of the intensity estimation of typhoon became large after the US aircraft reconnaissance in the western North Pacific was terminated in 1987. In particular, the error of intensity estimation is significant for very intense typhoons. To improve this problem, the T-PARCII (Tropical cyclone-Pacific Asian Research Campaign for Improvement of Intensity estimations/forecasts) project performs an in-situ observation of typhoon. The most basic and important facility for the in-situ observation using aircraft is a dropsonde system. For an effective observation of typhoon, a multi-channel dropsonde receiver and easy-to-use dropsonde are necessary. In the T-PARCII project, Nagoya University and Meisei Electric Co., Ltd. developed a four-channel dropsonde receiver and new dropsonde. The receiver is composed of two independent receiving parts to minimize troubles in aircraft observation. Each part has two channels and works independently each other. The newly developed dropsonde is very light and is launched without parachute which often causes a trouble in launching from an aircraft. The terminal fall-speed is approximately 13 m/s in the lower atmosphere. The dropsonde measures air temperature, pressure, relative humidity, wind speed, and wind direction. A test flight of the newly developed dropsonde system was performed on July 27, 2017 to the north of the Noto Peninsula, Japan. We launched eight dropsondes from the Gulf Stream II aircraft at a height of 40,000 ft with a straight and spiral flight patterns. All the eight dropsondes were successfully launched from the jet aircraft. We generated a trouble of one of the receivers in receiving a dropsonde signal and found that the other receiver worked correctly regardless of the trouble. We tested spiral and straight types of antenna of the dropsonde to receive GPS signal and found that the straight type is more efficient. Temperature, humidity and pressure data were successfully observed by all the seven dropsondes with small missing data. Wind data were mostly observed when the straight antenna of GPS was used. We are still improving temperature sensor to increase its response. Since the dropsonde is disposable, we are developing a dropsonde using materials which minimize the load to the environment. The dropsonde system is used for aircraft observations in the T-PARCII project as well as other observation project.

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