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

Integrated Disciplines (Complex Systems)

Title of Project : Dynamical, thermodynamical and cloud-microphysical studies of violent wind and heavy rain-producing tropical cyclones: Quantitative improvement of intensity estimations/forecasts

Kazuhisa Tsuboki
(Nagoya University, Institute for Space-Earth Environmental Research, Professor)

Research Project Number : 16H06311 Researcher Number : 90222140
Research Area : Social/Safety system science, Natural disaster/Disaster prevention science
Keyword : Meteorological disasters, Natural disaster prevention, typhoon, aircraft observation

【Purpose and Background of the Research】

Typhoons are the most devastating weather system. Violent wind and heavy rainfall associated with a typhoon cause huge disaster in East Asia including Japan. In 2013, Supertyphoon Haiyan struck the Philippines caused a very high storm surge and more than 7000 people were killed. In 2015, two typhoons approached the main islands of Japan and severe flood occurred in the northern Kanto region. Moreover, many researches have projected increase of typhoon intensity with the climate change. However, the historical data of typhoon include large uncertainty. In particular, intensity data of the most intense typhoons have larger error after the US aircraft reconnaissance of typhoon was terminated in 1987. Addressing the problem of the typhoon intensity is the main objective of the present study. We perform aircraft observation of typhoon to improve intensity estimation, and also in-situ observation of thermodynamical and cloud-microphysical processes of typhoons to improve numerical model. According to the observational results, intensity estimations and forecasts will be improved.

【Research Methods】

As shown in Fig. 1, we will perform aircraft observations of typhoons. Using dropsondes from the aircraft, temperature, humidity, pressure, and wind are measured in the surrounding region of the typhoon center. The dropsonde data are assimilated to the numerical cloud-resolving model which has been developed in Nagoya University and we make efforts to realize accurate estimations and forecasts of the typhoon intensity as well as typhoon track. Furthermore, we will utilize a ground-based balloon with microscope camera, X-band precipitation radar, Ka-band cloud radar, aerosol sonde, and drone to observed typhoon and associated clouds and precipitation. After the test flight in 2016, typhoon observations will be made for the next 4 years; 2017-2020. The main target area of observation is the south of Okinawa where a typhoon turns.

【Expected Research Achievements and Scientific Significance】

This research will advance aircraft observation technique of typhoon in Japan. The aircraft observation will be the breakthrough to improve typhoon intensity estimations. Assimilation of the aircraft observation data to the cloud-resolving model will improve intensity estimations and forecasts of typhoons. This is the first step for the future advanced aircraft observation and will contribute to prevention or reduction of typhoon disasters.

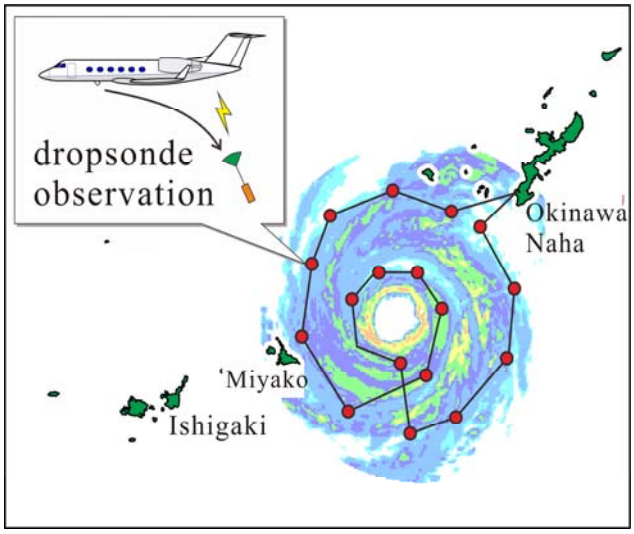

Figure 1 Flight plan for dropsonde observation. Closed circles are positions of dropsonde launch.

【Publications Relevant to the Project】

Tsuboki, K., M. K. Yoshioka, T. Shinoda, M. Kato, S. Kanada, and A. Kitoh (2015), Future increase of supertyphoon intensity associated with climate change, *Geophys. Res. Lett.*, **42**, 646–652, doi:10.1002/2014GL061793.

【Term of Project】 FY2016-2020

【Budget Allocation】 136,600 Thousand Yen

【Homepage Address】

http://www.rain.hyarc.nagoya-u.ac.jp/~tsuboki/kibanS/index_kibanS_eng.html