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3D Reconstruction of Typhoon and Thunderstorm Cloud Top Using Airborne Camera

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Typhoons are extreme weather phenomena that inflict damages and casualties around globe. These phenomena are difficult to study because of their chaotic behaviour but the capacity to measure their intensity can help mitigate the hazards that they bring. In the past, several attempts have been done to relate typhoon's intensity with the structural evolution of its eye. This suggests the possible relation between the typhoon intensity with typhoon eye altitude. In this research, we visualize Typhoon Trami's structure by reconstructing the three-dimensional model inside its eye and analyze the information of its cloud top altitude. An experiment was conducted under the SATREPS/ULAT project (SATREPS: Science and Technology Research Partnership for Sustainable Development, ULAT: Understanding Lightning and Thunderstorm) where images of Typhoon Trami were taken from an aircraft last September 26, 2018. Aircraft images were used to reconstruct the 3D model inside the typhoon eye because they provide closer views of the typhoon than that of geostationary satellite images, making it easier to reconstruct a 3D model. The 3D reconstruction generated covers 43 km region of the typhoon eye at 20.2 m/pixel spatial resolution. Three cross-sections of the 3D model were analyzed, and the resulting altitude distribution was compared with the cloud-top altitude estimated by mapping the brightness temperature of the Himawari Thermal Infrared Band 13 with cloud-top height as measured by NOAA sonde data. From the 3D model, the altitude distribution ranges from 5.3 km to 14.3 km which corresponds with the altitude estimated from the brightness temperature of 6.5 km to 14.3 km. However, regions of altitude difference can also be observed between the two methods. This study shows that a three-dimensional model could be a good mode of typhoon visualization as it shows a more detailed typhoon structure such

as the stairstep structures that was detected at some regions within the typhoon eye. This research was supported by SATREPS, funded by Japan Science and Technology Agency (JST) / Japan International Cooperation Agency (JICA).