

Development of an inexpensive and small balloon observation device, and its application in observing the Earth's upper atmosphere

*Taku Takada¹, Yui Sasaoka¹, Shiya Ueta¹, Ken T. Murata², Hidehiko Suzuki³

1. National Institute of Technology, Kochi College, 2. National Institute of Information and Communications Technology, 3. Meiji University

In this presentation we will outline the development of an inexpensive and small balloon observation device and its use in observing the Earth's atmosphere, from the troposphere to the stratosphere. By enclosing helium in a rubber balloon used for meteorological observation, it is possible to make the observation device fly in a region extending beyond the troposphere to the stratosphere. We have been developing balloon observation devices and carrying out balloon-based observation experiments with students since 2014. In 2018, we aimed to develop an observation system capable of monitoring the flight path of the balloon devices, by installing three to four ground stations (including mobile stations) and using communication equipment based on Long Range (LoRa) modulation of the 920 MHz band. We conducted experiments with LoRa communication equipment with a line-of-sight of up to 28 km, which confirmed that communication via LoRa modulation can be successfully applied in balloon monitoring. Furthermore, we are currently developing a balloon detachment system and, by separating the balloon near the designated altitude, we can shorten the distance traveled in the horizontal direction and lengthen the observation time at the optimum altitude. In the current balloon observation system, we aim to develop its use for various atmospheric observations, mainly for classifying the following three observation sequences: (1) when reaching the stratosphere (about 25 km altitude), the balloon bursts and deploys a parachute; (2) when reaching an altitude of about 15 km, when air density becomes sufficiently low, the balloon detaches and deploys a parachute, (3) when reaching an altitude of between 7 and 10 km, after completely passing through the tropospheric cloud layer, the balloon detaches and deploys a parachute. We hope to develop a balloon observation system suitable for use with various observation targets.

Keywords: Balloon observation, small balloon, upper atmosphere, stratosphere, troposphere, LoRa communication