

A promising new observation in the AsiaPEX – an unmanned aerial vehicle observation of evolution in the lower boundary layer in the morning

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A decay process of morning temperature inversion was observed with an unmanned aerial vehicle (UAV) borne thermometer. We will introduce this UAV observation as a promising new observational tool, to be considered in the AsiaPEX.

1. Introduction

UAVs are portable mother ships for meteorological measurement tools and can perform frequent observations of the lower atmospheric boundary layer which varies on a short time scale and a small spatial scale. Despite the limits to a flight height and a takeoff location, there is an advantage over conventional methods, including radiosondes and moored balloons in terms of portability and frequency of observation. In this presentation, we will introduce an observational example on decay of morning temperature inversion and development of static instability in the lower boundary layer.

2. Data

MATRICE M210 RTK by DJI was employed as a mother ship of thermometer and hygrometer developed by Weather Information & Communications Service. We have continuously made observational UAV-flights in Tokyo Metropolitan University, allowed by East Japan civil aviation bureau from February 2019. We used one-morning observation from 7:00 to 9:20 AM (JST) on 18th Feb. 2019, in the analysis in this presentation.

3. Results

The observation date, 18 Feb. 2019, was a fine and calm day with nocturnal radiative cooling. In the first flight around 7:00, lower temperature than 2.0°C was observed around the 1005-hPa level, against higher temperature about 3.5°C around the 990-hPa level. Even in consideration of sensor response to the ambient air, it can be said that we could observe a temperature inversion. This temperature inversion gradually decayed and almost vanished around 8:30. Faster warming near the ground continued in 2.5-hour observation period, consequently, static instability could be seen around 9:20. Relative humidity became lower as the temperature increased, however, its vertical structure was unclearly recognized.