



Aircraft observation for atmospheric researches with atmospheric research aircraft in Korea: introduction to the aircraft and observation data

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Since January 2018, the atmospheric research aircraft (King Air 350HW), which has been operated by the National Institute of Meteorological Sciences (NIMS), Korea Meteorological Administration (KMA) have successfully finished the first year of operation for atmospheric observations and experiments in Korea. It has flown 106 times and 352 hours in total over the Korean Peninsula. The major purposes of the aircraft are summarized as; 1) preceding observation of severe weather such as heavy snow and rain and typhoon, 2) monitoring of air quality including aerosols 3) monitoring of greenhouse gases, and 4) observation of microphysical properties of clouds related to cloud seeding.

To satisfy the research purpose, the aircraft has equipped 25 atmospheric research instruments including a data acquisition and real-time visualization system, which has made it possible to synchronize measurement times and acquire one data file at once from all instruments. Essentially, the basic meteorological parameters such as temperature, humidity, pressure, and wind are measured at a high temporal resolution (up to 20 Hz) as well as the 3-dimensional coordinates and true air speed of the aircraft. Depending on the previously described purpose, the aircraft equipped with the research instruments produces 1) vertical profiles of atmospheric parameters over the seas including rain rate and sea surface wind speed, 2) physical, optical properties of aerosols and concentrations of reactive gases like NO_x , NO_y , SO_2 , and O_3 , 3) concentrations of greenhouse gases such as CO_2 and CH_4 , and 4) number concentrations and images of cloud and precipitation particles, including cloud condensation nuclei, and liquid water. Every flight measurement data is transferred to the web-based data processing and displaying system. The system processes data to produce Level 1 from raw data using the Airborne Data Processing and Analysis (ADPAA) software and achieves quality controls to generate the Level 2 data. The aircraft produces a lot of observation data by two to three times flights a week, therefore this system is useful to provide the post-processed and quality controlled data to the users who have their own purposes.

Through the first year of operation, we have built up the experiences on aircraft-based atmospheric observations related to the instrumental operation and calibration. Especially, all measurements have been analyzed to verify the data qualities, measurement principles, and meteorological properties with respect to the flight condition. Moreover, comparable measurements from different instruments have been examined to prove the accuracy and precision of the instruments. With those efforts, it is expected that the aircraft support the atmospheric research with experienced and reliable data in order to extend our understanding and knowledge on the atmospheric phenomena, mechanism on the mid-altitude.