

## ACCLIP2022 KMA KingAir Aircraft Observations Readme

This is the read me file for the Korean Meteorological Administration (KMA) King Air observations during ACCLIP 2022 campaign including the CO<sub>2</sub>, CH<sub>4</sub>, CO, GPS position data and meteorological data such as temperature, relative humidity, barometric pressure.

### 1. Authors:

#### **Shanlan Li (Lead and corresponding Author)**

Senior Researcher / Ph.D.

Climate Research Department, National Institute of Meteorological Administration (NIMS), Seogwipo, Jeju-do 63568, Republic of Korea.

TEL: 064-780-6647; FAX: 064-738-9072

Email: [sunranlee@korea.kr](mailto:sunranlee@korea.kr); [sunranlee18@gmail.com](mailto:sunranlee18@gmail.com); ORCID: 000-0001-6789-0229

#### **Sang-Won Joo (co-author)**

Climate Research Department, National Institute of Meteorological Administration (NIMS), Seogwipo, Jeju-do 63568, Republic of Korea.

Email: [swjoo@kma.go.kr](mailto:swjoo@kma.go.kr)

#### **Jeong Eun Kim (co-author)**

Climate Research Department, National Institute of Meteorological Administration (NIMS), Seogwipo, Jeju-do 63568, Republic of Korea.

Email: [narci76@korea.kr](mailto:narci76@korea.kr)

#### **Haeyoung Lee (co-author)**

Climate Research Department, National Institute of Meteorological Administration (NIMS), Seogwipo, Jeju-do 63568, Republic of Korea.

Email: [leehy80@korea.kr](mailto:leehy80@korea.kr)

#### **Tae-young Goo (co-author)**

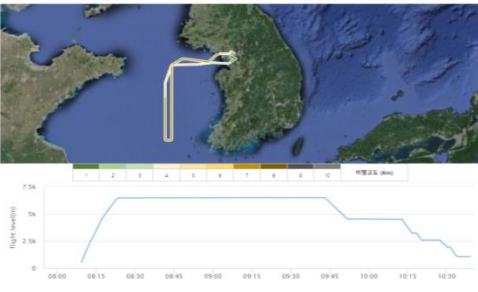
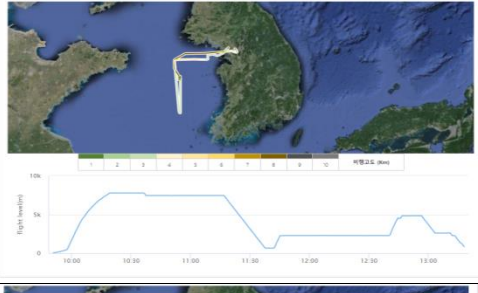
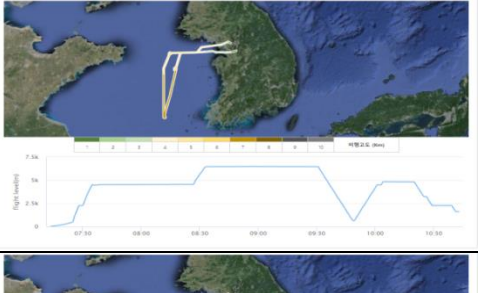
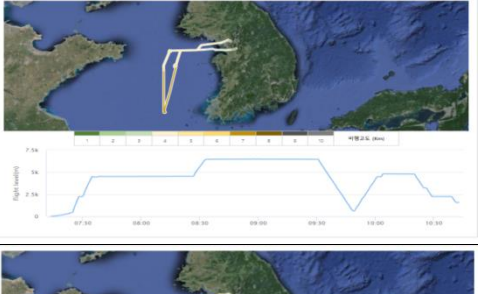
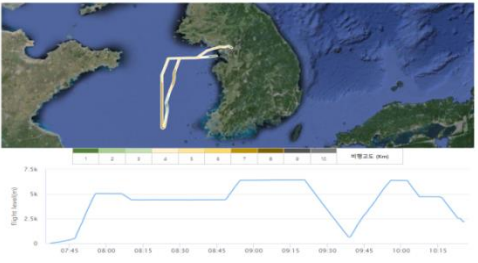
Observation Research Department, National Institute of Meteorological Administration (NIMS), Seogwipo, Jeju-do 63568, Republic of Korea.

Email: [gooty@korea.kr](mailto:gooty@korea.kr)

### 2. Data Set Description

The all of the data providing for ACCLIP were measured based on Korean Meteorological Administration (KMA) King Air research aircraft platform that is modified by Weather Modification Incorporated (Fargo, ND, USA). It has a ceiling of 9.6 km, speed range of 70-120 m/s, with maximum flight time of 4.5 hours with the maximum payload. The total of five one-day flight observations was included in the EOL filed data. This is preliminary data and we will release the Quality controlled data within six months. Data will be provided as text file with column name, and the flight information details were shown in Table 1.

**Table 1. The flight information details for KMA King Air observations during 2022 ACCLIP campaign**

| Flight mission name | Take-off and landing time (UTC)     | Locations (Typical Flight route) (Mainly covered 34°N~38°N; 124~128°E)               | Data Set name (CRDS and AIMMS data)                                 |
|---------------------|-------------------------------------|--|---|
| KA-RF01             | 2022-08-03 23:08 ~ 2022-08-04 01:45 |    | KA-RF01-202208032308.txt<br><br>KA-RF01-202208032308-AIMMS.txt      |
| KA-RF02             | 2022-08-06 00:56 ~ 2022-08-06 04:23 |    | KA-RF02-202208060056-CRDS.txt<br><br>KA-RF02-202208060056-AIMMS.txt |
| KA-RF03             | 2022-08-16 01:30 ~ 2022-08-16 04:09 |   | KA-RF03-202208160130-CRDS.txt<br><br>KA-RF03-202208160130-AIMMS.txt |
| KA-RF04             | 2022-08-18 22:32 ~ 2022-08-19 01:39 |  | KA-RF04-202208182232-CRDS.txt<br><br>KA-RF04-202208182232-AIMMS.txt |
| KA-RF05             | 2022-08-25 22:46 ~ 2022-08-26 01:40 |  | KA-RF05-202208252246-CRDS.txt<br><br>KA-RF05-202208252246-AIMMS.txt |

### 3. Instrument Description

The CO<sub>2</sub>, CH<sub>4</sub> and CO measurements employed a commercial analyzer developed by Picarro Inc. (CRDS, model G2401m, Santa Clara, CA, USA). The temperature, ambient pressure and relative humidity were measured by AIMMS-20 (Aircraft-Integrated Meteorological Measurement System). The altitude and position information were also provided by GPS phase module of AIMMS-20 systems. The specifications of the CRDS and AIMMS-20 were shown in Table 2.

**Table 2. The Specifications for KMA King Air payload of Picarro CRDS G2401m and AIMMS-20.**

| Instrument  | Measurements        | Specifications             | Frequency |
|---|---------------------|----------------------------|-----------|
| Picarro CRDS G2401m<br>(Cavity Ring-Down spectroscopy)              | CO <sub>2</sub>     | < 0.2 ppm over 300 seconds | 1 second  |
|   | CH <sub>4</sub>     | < 2 ppb over 300 seconds   |           |
|   | CO                  | < 30 ppb over 300 seconds  |           |
| AIMMS-20<br>(Aircraft-Integrated Meteorological Measurement System) | Temperature         | 0.01                       | 1 second  |
|   | Relative Humidity   | 2%                         |           |
|   | Barometric Pressure | 100 hPa ± 0.05%            |           |
|   | GPS (Lat, Lon, Alt) | -                          |           |

#### 4. Data Collection and Processing

The aircraft data were recorded and collected by M300 data acquisition systems for the individual instruments with a time resolution of 1second. The Picarro CRDS was calibrated more regularly and frequently (two-month intervals) in our laboratory, with a series of three World Meteorological Organization (WMO) scale standard sample tanks for CO<sub>2</sub> (374.06, 419.45, and 467.78 ppm) and CH<sub>4</sub> (1756.7, 1901.4, 2325.8 ppb), two for CO (311.1 and 89.7 ppb) from NOAA/ESRL, with full coverage of the observed range of ambient air. Since CO levels are low in the troposphere, zero gas has been included to adapt to the three points linear calibrations. The total measurement uncertainties were calculated by combination of the CRDS instrumentation precision, water vapor correction errors, and the errors in the cavity pressure sensitivity. The detailed for data quality control and quality assurance refer the Li et al. (2020).

#### 5. Data Format

Product identifier: **KA-RF**

Example filename for the KAM King Air product:

**KA-RF04-202208182232-CRDS.txt**

KA is the King Air, RF## is the flight mission number during ACCLIP campaign, 202208182232 is take-off time as YYMMDDhhmm format (UTC). CRDS is the measurement instrument name of Cavity Ring-down Spectroscopy. The data file contains the Year, month, day, hour, minute, second, CO<sub>2</sub>\_dry (ppm, water vapor corrected by manufacture provided correction parameter), CH<sub>4</sub>\_dry (ppb, water vapor corrected), CO (ppb), H<sub>2</sub>O (%), CRDS instrument reported water as percentage)

**KA-RF04-202208182232-AIMMS.txt**

AIMMS is the aircraft Integrated meteorological measurement system mounted on KMA King Air aircraft. The data file contains the Year, month, day, hour, minute, second, latitude, longitude, altitude (m), Temperature (C), Relative humidity (%), Barometric Pressure (hPa). The all of the missing data were flagged as 999999.9999.

#### 6. References

- Li et al., 2020:** In-situ aircraft measurements of CO<sub>2</sub> and CH<sub>4</sub>: Mapping spatio-temporal variations across Korea in high-resolution, Remote Sensing, 2020, 12(8). (2020-9-16). <https://doi.org/10.3390/rs12183093>
- Li et al., 2022:** Analysis of source distribution of high carbon monoxide events using airborne and surface observations in Korea, 2022, 289. (2022-11-15). <https://doi.org/10.1016/j.atmosenv.2022.119316>.
- Li et al., 2019:** Airborne in-situ Measurement of CO<sub>2</sub> and CH<sub>4</sub> in Korea: Case study of vertical distribution measured at Anmyeon-do in winter, Atmosphere, 2019, 29(5) (in Korean with English abstract). <https://doi.org/10.14191/Atmos.2019.29.5.511>
- Li et al., 2022:** Analysis of CH<sub>4</sub> source distributions based on CH<sub>4</sub>-C<sub>2</sub>H<sub>6</sub>-CO correlation from KMA aircraft regular observation in 2019 and KORUS-AQ campaign in 2016 over South Korea, Journal of Korean Society for Atmospheric Environment, 38(1) (in Korean with English abstract) [doi.org/10.5572/KOSAE.2022.38.1.74](https://doi.org/10.5572/KOSAE.2022.38.1.74)