remote sensing

MDPI

In Situ Aircraft Measurements of CO_2 and CH_4: Mapping Spatio-Temporal Variations over Western Korea in High-Resolutions

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Table S1. The instrumentation installed on a Korean Meteorological Administration (KMA) research aircraft based on the Beechcraft King Air 350.

Figure S1. Photo of a Nafion membrane installed chamber box (**a**) without and (**b**) with a silica gel dryer; it was designed for Korean Meteorological Administration (KMA) research aircraft King Air 350 cavity ring-down spectroscopy (CRDS) measurements.

Figure S2. Cavity ring-down spectroscopy (CRDS) reported water vapor concentration ranges (%) for whole climate change monitoring (CM) missions for 2019.

Figure S3. The CO_2 dry mole fractions (DMF) corresponding to NOAA standard gas at DMF of 467.78 ppm for CO_2 with gradually decreasing inlet pressure ranges of 280–1000 hPa.

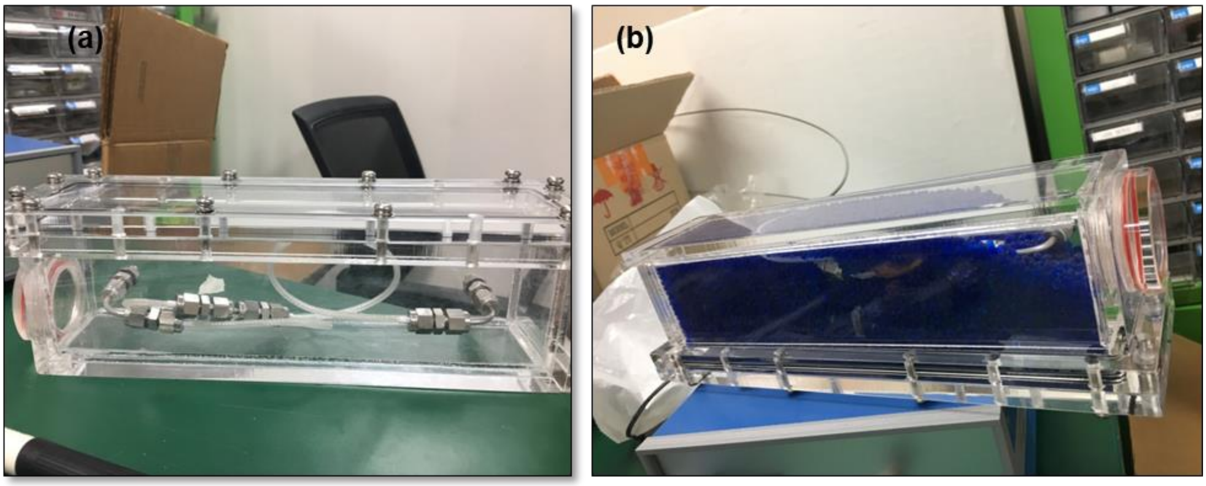
Figure S4. Regression slope (RS) between △CO and △CO_2 along the flight route and flying altitude above mean sea level (AMSL), the dotted line shows the ECMWF ERA5 derived boundary layer height (BLH) at longitude 126.5–127°E and UTC time (0300–0700). However, the BLH on the CM.2 mission was calculated with the King Air aircraft observed potential temperature difference and relative humidity (RH) because the ECMWF-derived BLH seems to be largely underestimated.

Figure S5. Spatiotemporal distributions of CO for all climate change monitoring (CM) missions. The figure depicts CO concentrations measured within the boundary layer are averaged at the latitude bins of 0.075° (approximately 5-km spatial resolution) and temporally interpolated with the aircraft sampled time (all the aircraft sample times denoted by CM.1 through CM.9 are provided in Table 4).

Table S1. The instrumentation installed on Korean meteorological Administration (KMA) research aircraft based on Beechcraft King Air 350.

No.	Instrumentations	Measured Parameters
1	CRDS	CO_2, CH_4, CO, H_2O
2	NOx analyzer	NO, NO_2
3	NOy analyzer	NOy
4	SO_2 Analyzer	Sulfur dioxide (SO_2)
5	O_3 analyzer	Ozone (O_3)
6	Sky-optical particle counter (OPC)	Particle concentrations in 32 channels over a range of 0.25~32 μm
7	Nephelometer	Light-scattering coefficient of aerosols particles in three wavelengths (450, 550, 770 nm)
8	Single particle soot photometer (SP2)	Black carbon mass, number, and sizes

9	Advanced Volume-Assured Pressure Support (AVAPS) II Dropsonde Receiving Systems	Pressure, temperature, relative humidity, horizontal wind
10	Atmospheric Gamma-Ray Spectrometer (RSX-3	Gamma ray
11	Camera (AVS-860)	Image of atmosphere, surface, ocean
12	Stepped Frequency Microwave Radiometer (SFMR)	Ocean surface wind so on
13	G-Band Water Vapor Radiometer (GVR)	Water vapor and liquid water concentration
14	Fuselage (ejectable) flare racks for seeding	102 ejectable silver iodide (AgI)
15	Wing (Burn-In-Place) flare racks for seeding	24 burn-in-place hygroscopic flares (CaCl2, Agl)
16	Cloud condensation nuclei counter (CCN-200)	Sing-particle light scattering (for activated nuclei)
17	Cloud combination probe (CCP)	Particle (size range: 12.5 μm–1.55 mm and 2–50 μm) Liquid water content (0~5 g/m^3)
18	Precipitation imaging probe (PIP)	Particle (size range:100 μm–6.2 mm); Particle images
19	Multi-element water content system (WCM-2000)	Water amount
20	Aircraft-Integrated Meteorological Measurement System (AIMMS-20)	Temperature, Relative Humidity, pressure, Three-dimensional wind, latitude, longitude, altitude, speed, etc.
21	M300	Data acquisition system
22	Total Temperature sensor	Temperature
23	Dew Point Hygrometer	Dew point temperature
24	Icing detector	Presence of ice
25	External air inlet system	Iso-kinetic inlet for aerosol and gas inlet



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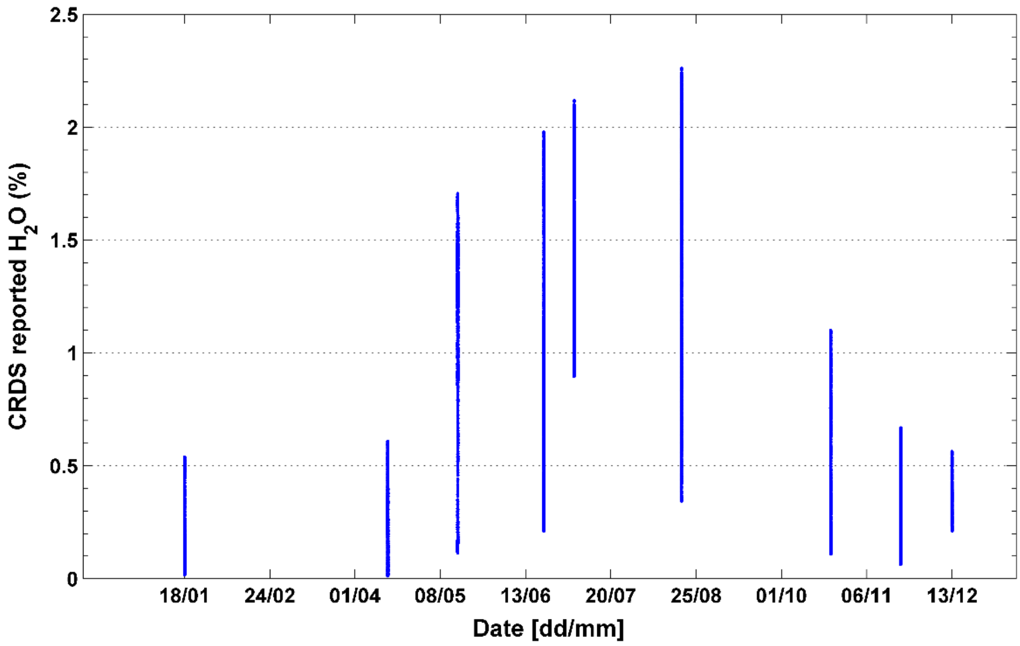

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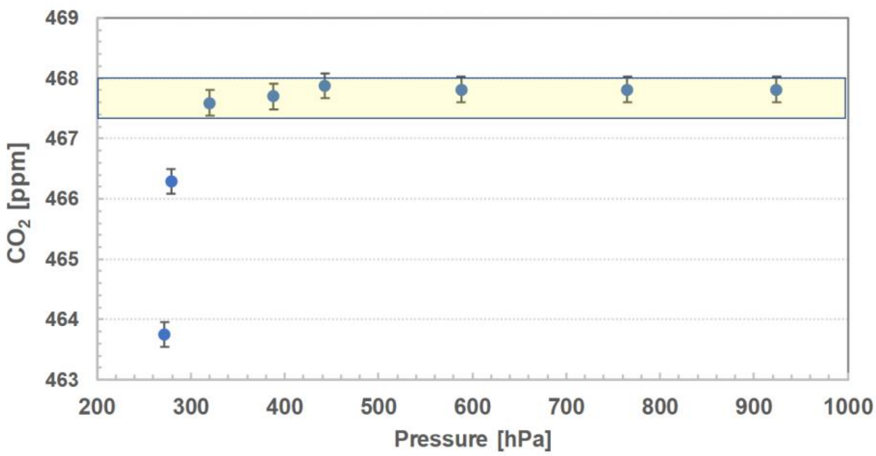

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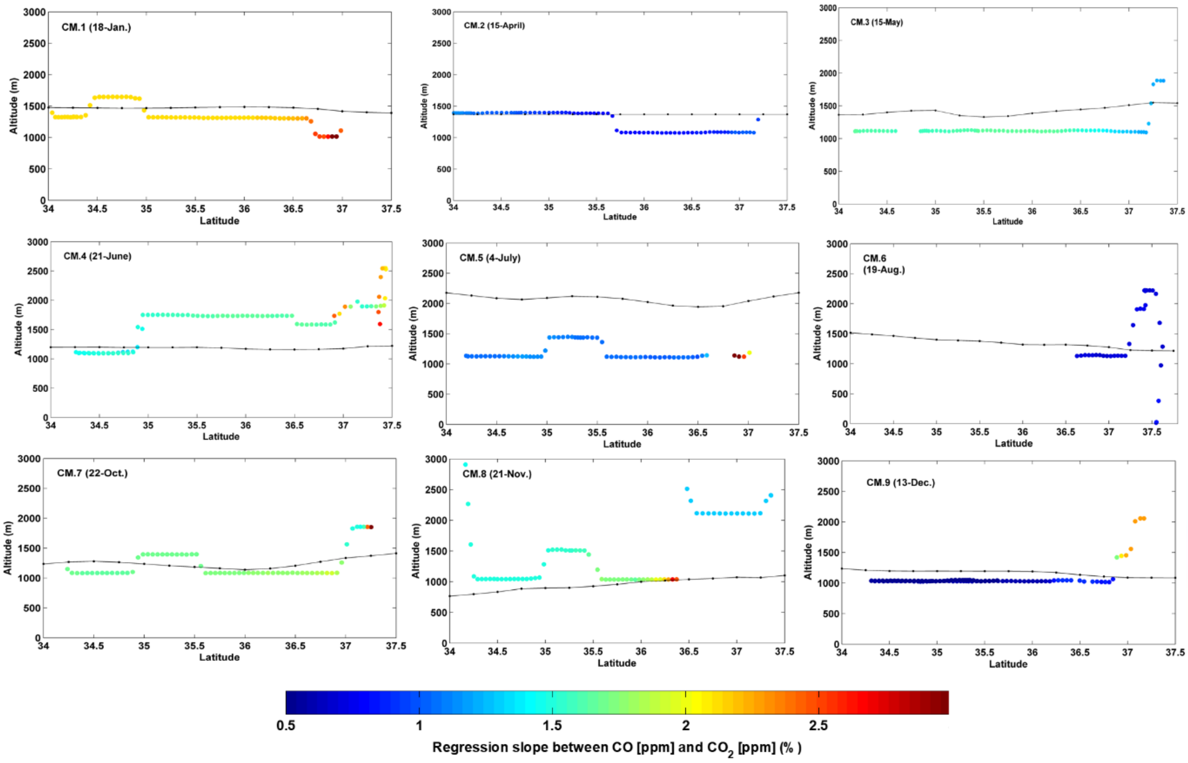

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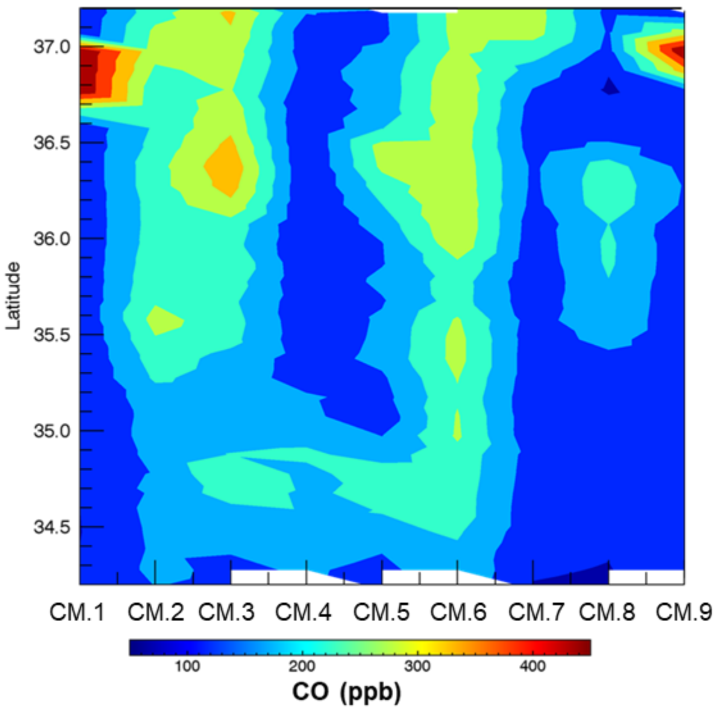

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