

11-year statistics for in-situ CO₂ data obtained in airliner project of CONTRAIL

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Since 2005, we have conducted an observation program using the passenger aircraft of the Japan Airlines named Comprehensive Observation Network for TRace gases by AirLiner (CONTRAIL). We report change history of measurement conditions, quality control processes and spatiotemporal distributions of the Continuous CO₂ Measuring Equipment (CME) data in the past 11 years. CME has obtained about 8-million in-situ CO₂ data from more than 14000 flights between Japan and Europe, Australia, North America, or Asia. The initial CME operations had several problems such as pump stops during the flights, shortage of standard gases, and insufficient performance of dehumidification. To deal with these operation problems, we have optimized the pump operation conditions, the calibration intervals of standard gases, and use of perma pure dryer, as well as modification of the additional observational aircraft. Accordingly, more stable in-flight observations have been achieved without decreased accuracy of the measurements; number of measurement flights with valid CO₂ data was dramatically increased from only 29 and 572 in 2005 and 2006, respectively, to more than 1000 flights in each year since 2010. Geographical coverage of the CME data has been also changed depending on operation of the aircraft. For example, we have many observations along the flights to/from Europe from 2006 to March 2014 but less since April 2014, and ample flights over India in 2010, 2011, and 2014 but sparse in other years. We need to consider such non-uniform data distributions in time in analyzing seasonal or inter-annual changes of CO₂.