Estimation of BG CO2 concentration from CRDS measurements at AMY site in South Korea using Quality Assurance Flagging Codes

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Since November 2011, KMA has been operating the CRDS (Cavity Ring Down Spectrometer) instrument, manufactured by Picarro inc., USA, at Anmyeondo (AMY) site for measuring background carbon-dioxide. The AMY site was designated as a regional WMO GAW site in 1998, and has the longest history of atmosphere watch elements in Korea. As for the CO2, the AMY site started its measurement using NDIR instrument in 1999 at first, then replacing it with the CRDS in 2011.

Beginning this year, the AMY site makes it routine to record the operational status for every measurement instruments in operation using flagging codes in an effort to ensure the activities in quality assurance and quality check of the measured raw data. The flagging codes for the CRDS are consisted of following 7 categories: flag 0 for well mixed air sample and good operating conditions, flag 1 for influence of local high concentration source but good operating conditions, flag 2 for possible influence from dehumidifier, flag 3 for suspected instrument malfunction and data quality, flag 4 for raw data loss from instrument malfunction, flag 5 for instrument correction, and flag 6 for data loss from other causes other than the instrument malfunction. Figure 1a illustrates probability densities for each of the 7 codes for the CRDS raw data from 2012 through 2016.

In a retrospective way the past 5-year CRDS raw data, from 2012 through 2016, were flagged with above-mentioned codes on purpose to assess and make comparison of the existing methodology to estimate background CO2 concentration in Korea. Here, we assume that the CRDS raw data flagged with the flag 0 are representative of well mixed background air conditions, while those with the flag 1 representing the local pollutant air. Those annual and monthly mean concentrations for each of the past 5 years were obtained from the simple arithmetic average using only those raw data with flag 0. Figure 1b shows the annual mean concentrations, making comparison among the 5 years.

In the upcoming meeting the detailed feature of the results will be presented, making comparison of the above simple arithmetic average with those of statistical signal processing method that has been used at KMA.
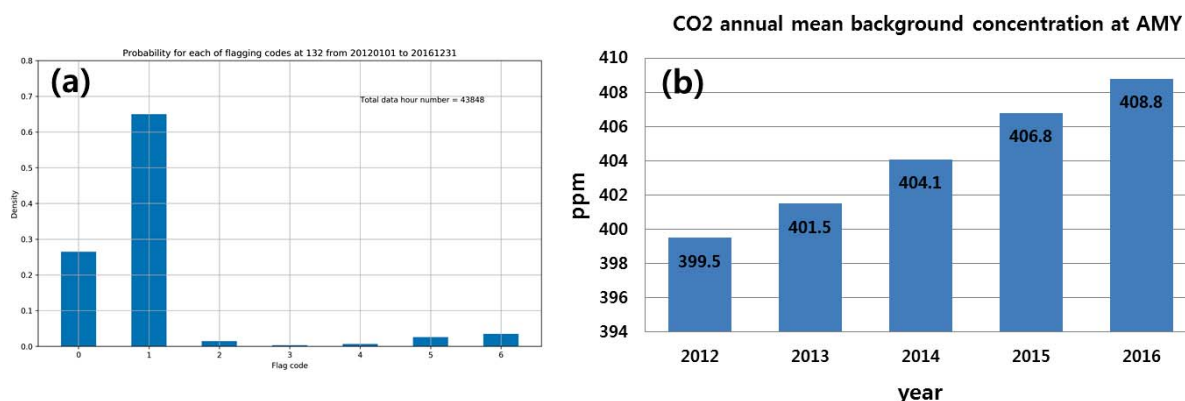

Fig. 1. (a) Probability density for each of flagging codes of the CRDS raw data from 2012 through 2016, (b) Annual mean CO2 background concentrations at AMY site obtained from simple arithmetic average of those raw data with flag code 0 only.