Appendix 1: Calculation of the Air Quality Index

Step 1:

Following the eco-environmental standards issued by the Chinese government, we calculate the $IAQI_p$ of each pollutant item P as follows.

$$IAQI_p = \frac{IAQI_{Hi} - IAQI_{Lo}}{BP_{Hi} - BP_{Lo}}(C_p - BP_{Lo}) + IAQI_{Lo} \qquad (1)$$

$IAQI_p$ = sub-index AQI of the pollutant item P;

C_p = mass concentration of the pollutant item P;

$BP_{Hi(lo)}$ = high (low) value of the pollutant concentration limit close to C_p;

$IAQI_{Hi(lo)}$ = air quality sub-index corresponding to BP_{Lo} and BP_{Hi}, respectively.

Among them, BP_{Hi}, BP_{lo}, $IAQI_{Lo}$, and $IAQI_{Hi}$ are constants, which can be found on the website of State Environmental Protection Administration: http://www.mee.gov.cn/ywgz/fgbz/bz/bzwb/jcffbz/201203/t20120302_224166.shtml.

For example, if the detected SO_2 (24h) concentration is 500ug/m^3, the corresponding value of each variable is found on the website (i.e., IAQI$_{Hi}$=200, IAQI$_{Lo}$=150, BP$_{Hi}$=800, BP$_{Lo}$=475). The calculation process is as follows:

$$IAQI_{SO_2} = \frac{200-150}{800-475} * (500 - 475) + 150 = 154 (Round\ Numbers)$$

Step 2:

After calculating the sub-index AQI of each pollutant item, we choose the largest value as the final AQI index.

$$AQI = max\{IAQI_1, IAQI_2, IAQI_3, \cdots, IAQI_n\} \qquad (2)$$