**Data Treatment**

Zero data are removed and analysed off-line (average and standard deviation, see earlier comments). The calibration data is also removed (inf data, filter using sensitivity column). Sometimes not all the data is flagged as inf so needs to be checked. The database is checked for any other potential problems to the data.

During a power cut the logger records noise and so a very small signal (~ \*\*) is observed. This is not a background so does not need to be subtracted from the main data. Comparisons can always be made with the ad logged data if in doubt.

If the instrument has been off for any time it is allowed a two hour warm-up period and this data is removed.

If the instrument experiences a large change (> 5%?) in sensitivity during a calibration (perhaps as a result of a water droplet finding its way into the instrument), this is seen in a sudden drop in concentration. Once the instrument has been calibrated again the data recovers. The data for this period is usually removed or else the appropriate calibration data is applied (interpolated points?).

How should we apply sensitivity data in the automatic processing??

1. Use instrument/daq factory calculated concentration
2. Use averaged sensitivity for the month
3. Linearly interpolate sensitivity for the month and apply
4. Linearly interpolate annual sensitivity and apply.

The raw counts that are generated are a point measurement and not an average of the minute data, so to recalculate the concentration data you just have to take the instrument calculated concentration and multiply by the old sensitivity, then divide by the new sensitivity. However this doesn’t help the smoothing and jumps in data. For that you also need to adjust the zero data at times as well…..

The Aerolaser instrument is not well insulated therefore is affected by sudden changes in temperature. Data when the laboratory temperature has changed rapidly (limits?) between calibrations needs to be either removed or adjusted using calibration data which has been collected when the lab temperature is stable.

Considering the treatment of outliers, data <40ppbV and >200ppbV are removed before submission to database. A concentration of 250 ppbv may indicate lab air leak.

Treatment of spikes?? Label as reduced quality data?

**Table of flags**

|  |  |  |  |
| --- | --- | --- | --- |
| **Flag** | **Parameter** | **Comments** | **Relevant File** |
| FAULT |  |  | Daily\_minute\_yymmdd\_hhmmss |
| PO | Power cut | Data is removed for the first 2 hours after a power cut | Daily\_minute\_yymmdd\_ hhmmss |
| OUTLIER | Data < 40 ppb or >200 ppb | Remove outlier data | Daily\_minute\_yymmdd\_ hhmmss |
| SPIKE | Spikes?? | 3 x Std deviations from mean?? Need to play with this… | Daily\_minute\_yymmdd\_ hhmmss |
| SENS | Sens <5 counts/ppb | Sensitivity of the instrument | Daily\_minute\_yymmdd\_ hhmmss |
| VSENS | Sensitivity changed by x % between calibrations | In this case, need to adjust the sensitivity applied to the calibration (use previous). | Daily\_minute\_yymmdd\_ hhmmss |
| BKG | Background < \*\*\* |  | Daily\_minute\_yymmdd\_ hhmmss |
| ZERO | When the external zero trap is in-line | This is not yet automated so if possible pick up from the data itself. We want to perform some analysis on the zero data (see offline notes). | Daily\_minute\_yymmdd\_ hhmmss |
| INTZERO | Is the external zero < 2% of internal zero | Indicates that the internal zero material (used for the calibration) needs to be replaced and data may need to be adjusted. |  |
| EXTZERO | Is the external zero >5% of internal zero | Replace packing material in external trap-no adjustment to data needed. |  |
| SDZERO | Standard deviation σ > 2 ppbV | Standard deviation of zero data | Daily\_minute\_yymmdd\_ hhmmss |
| CALIB | Calibration | Inf in the sensitivity column. | Daily\_minute\_yymmdd\_ hhmmss |
| Parameter file…… |  |  |  |
| CALPress |  |  | co\_parameters\_yymmdd\_ hhmmss |
| LAMP flow |  |  | co\_parameters\_yymmdd\_ hhmmss |
| MONO press |  |  | co\_parameters\_yymmdd\_ hhmmss |
| CELL press |  |  | co\_parameters\_yymmdd\_ hhmmss |
| LAMP Temp |  |  | co\_parameters\_yymmdd\_ hhmmss |
| MONO temp |  |  | co\_parameters\_yymmdd\_ hhmmss |
|  |  |  |  |

NB. The o3\_parameters file updates every 5 minutes and is overwritten when it gets to a certain number of lines.

The co\_parameters file updates every 5 minutes and a new file is created every week.

A new daily\_minute file is created every day; the time in filename is when the file was created.

**Flagging notes**

Currently all of these flags are replaced with “3” invalid or missing data and the data is replaced with “9999”.

If data is particularly noisy it has in the past been flagged as 1 “reduced quality data”. Increased noise may be due to high humidity effects causing moisture in the lines (or because of other issues) but in all cases of reduced quality data the reasons for it are thoroughly investigated and the problem is solved quickly.

**Offline extra calculations from carbon monoxide data**

Calculate precision data from √ ((background/sensitivity) ^2 + (standard deviation of zero data) ^2) and feed out.

Use data obtained from zero to calculate Average and standard deviation for month and feed out. This is then used to adjust the data :- (Concentration in the calibration standard (ppb)/ (Concentration in calibration standard (ppb)+zero (ppb))

Near real time hourly averaged data is submitted daily to MACC (Monitoring Atmospheric Composition and Climate: [www.gmes-atmosphere.eu](http://www.gmes-atmosphere.eu)) as part of the European GMES (Global Monitoring for Environment and Security) programme and the ACTRIS (Aerosols, Clouds, and Trace Gases Research Infrastructure Network: <http://www.actris.net/>) project. There is a link directly to the CVAO website.

Minute data is submitted to the British Atmospheric Data Centre (BADC) on a monthly basis. For GAW submission (WDCGG), the data is averaged hourly, daily and monthly to an external time-step: - 00:00 to 01:00, 01/01/2007 00:00 to 02/01/2007 00:00, and 01/01/2007 00:00 to 01/02/2007 00:00.

The website is updated with current data at regular occasions.

**References**

An improved fast response vacuum-UV resonance fluorescence CO instrument. C. Gerbig et al., 1999, Journal of Geophysical Research, 104, D1, 1699-1704.

Guidelines for the measurement of atmospheric carbon monoxide, WMO GAW Report No.192, July 2010.