

microDOAS Real Time Viewing

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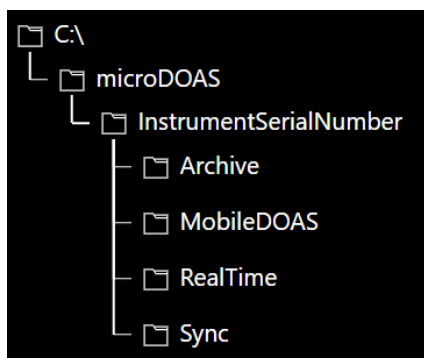
Introduction

The purpose of this software is to allow users to view the approximate overhead SO₂ column density derived from microDOAS measurements in close to real time. This requires the measured skylight data to be transferred to a viewing device shortly after acquisition. There, a rough spectral analysis can be performed and the results displayed. This is accomplished using two separate programs.

- **SyncMicroDOAS** manages data transfer from the instrument to a Windows tablet or computer
- **MobileDOAS** analyzes incoming data and displays the results

Installation

- The MobileDOAS software is only available for Windows operating systems. Therefore, the device used for viewing must run Windows.
- Data transfer is facilitated by calls to the WinSCP dynamic linked libraries. WinSCP must therefore be installed on the data viewing device first. WinSCP is available for free download from <https://winscp.net/eng/index.php>
- Next, copy the microDOAS software to the device. It is available from the NOVAC website at <https://novac-community.org/software>. The following directory tree is recommended:



- **Archive** contains an archive of spectral data that has been transferred to the viewing device. Note that, as only the most current data are synchronized while running the software, the archive will typically not contain a complete copy of all data on the microDOAS instrument.
 - **MobileDOAS** contains the MobileDOAS software used for data analysis and visualization. Note that only some specific versions of MobileDOAS have been found to work with the microDOAS data format. **The recommended version is 20200615.**
 - **RealTime** contains spectral data coming in from the instrument in real time.
 - **Sync** contains the software used for transferring the data from the microDOAS instrument to the viewing device.
- Although the MobileDOAS software will not be communicating with the spectrometer over a USB connection, the Ocean Optics OmniDriver is still required to be installed on the system for the software to function properly. A copy of OmniDriver (version 2.37) is included in the MobileDOAS directory. Start the program to install it on the system. Keep all the default settings during the installation process. Once the software has been installed, reboot the computer.
 - In order for MobileDOAS to perform a valid analysis on the incoming data, the MobileDOAS configuration must be customized to match the spectrometer inside the microDOAS. This is done by opening MobileDOAS and navigating to *Configuration* → *Operation Setting*. In the Spectrometer tab, select Directory Polling. In the *Evaluation* tab, insert the appropriate fit references and fit settings. In the *Directory* tab, configure the software to watch the **RealTime** directory for incoming spectra, and fill out other fields as required.
 - Next, the data transfer settings and data paths may need to be adjusted. Navigate to the **Sync** directory and open **SyncMicroDOAS_vX.X.ps1** in a text editor. All variables that may need to be adjusted are in the 'CUSTOMIZATION' section at the top of the script. To find your instrument's *SshHostKeyFingerprint*, login to the instrument using WinSCP, then navigate to *Tabs* → *Server/Protocol Information*. Copy the MD5 host key fingerprint and past it into the ps1 file. It should start with *ssh-ed25519 255xx:xx:xx...*
 - Finally, in the **Sync** directory, open **SyncMicroDOAS.bat** in a text editor. Check to make sure that the indicated path matches the location of the ps1 file and that the filename represents the desired version of the ps1 file (e.g., v2.0).

- Optionally, you can now place shortcuts to **SyncMicroDOAS.bat** and **MobileDOAS_20200615.exe** on the desktop, as these are the two programs that will be needed to view the microDOAS data.

Operation

Once the software has been installed and configured, viewing the microDOAS data should be very simple.

- Power up the microDOAS and wait for the ACQ LED to begin single-blinking. If the LED is double-blinking, this means that the incident radiation is too low and the instrument has entered dark mode. Move the instrument so that it is facing the sky.
- Connect the viewing device to the microDOAS. This can be done either by WiFi or ethernet cable. In both cases, the viewing device must first be assigned a static IP address on the same network as the microDOAS (i.e., same first 3 numbers of the IP address, but different last number). If a dedicated tablet is available, it is recommended to pre-configure this device to connect automatically to the BeagleBoneBlack inside the microDOAS. Typically, the IP address of the microDOAS is either 192.168.8.1 (WiFi) or 192.168.7.2 (Ethernet). The WiFi password is *BeagleBone*. Detailed instructions for connecting to the microDOAS are included in the instrument manual.
- Once connected, run the SyncMicroDOAS.bat file, e.g. by double-clicking on the shortcut on the desktop. This will start syncing data to the viewing device. A terminal window will open and show the status of file transfers, as well as any errors that may occur.
- Finally, run the MobileDOAS software, e.g. from the desktop shortcut. Clicking on the green arrow at the top left corner of the screen will start the data analysis and real time view.

Application notes

The microDOAS creates a new data directory each time it is switched on or rebooted. (Reboots sometimes occur automatically if an error is encountered or the acquisition software crashes.) These data directories are located in /media/doas/DATA on the embedded computer. In order to avoid excessive overhead during data synchronization,

only files from the latest data directory are fetched for viewing. Also, especially for poor network connections, it is possible that not all spectra are downloaded, even from the most current data directory, as downloading the latest data is always prioritized over older data.

Similarly, the data analysis and visualization in MobileDOAS will typically not display all recorded data, but only the latest results. Depending on the speed of the computer used for analysis, the analysis may take longer than the time for acquiring a single data point, and therefore only every other measurement may be displayed, or every third point, etc. If the display appears to freeze for 10s of seconds at a time, this may be related to an insufficiently fast WiFi connection. If possible, move the display system closer to the instrument.

Due to these limitations, it is highly recommended that all data are downloaded from the microDOAS after the measurements have been completed, and a re-analysis is performed on the complete dataset, ideally using the mDOAS software.