Processing executable tool

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www.italy-croatia.eu/soundscape

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Partners Involved	IOF, BWI, ARPA-FVG, CETACEA
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Summary

Abstract

This document shortly describes the processing executable tool

1 Introduction

The main objective of the project is to create a cross-border technical, scientific and institutional cooperation to face together the challenge of assessing the impact of underwater environmental noise on the marine fauna and in general on the Northern Adriatic Sea ecosystem. At this stage, in fact, there are no extensive data on underwater noise in the area and the knowledge on noise pollution and its impact on biodiversity is very limited.

Therefore, according to the project work plan, the network of the underwater noise monitoring stations will be set up in the Northern Adriatic Sea (Activity 3.2). The continuous underwater noise produced by anthropogenic activities such as marine traffic (both commercial and recreational) and hydrocarbon exploitation will be monitored. The monitoring results will be used to fill the knowledge gap about underwater noise levels in the Northern Adriatic Sea but also to support setting up and validating the soundscape model (Activity 5.2).

2 Underwater Noise Processing Tool

To achieve objectives of the project mentioned earlier, the underwater noise data collected by the network of underwater noise monitoring stations will have to be processed by the same processing executable tool that has been developed by the University of Gdansk together with CNR.

Concerning the processing itself the tool follows the steps described in the STORY OF THE DATA:

Table 1. The story of the data from the recovery to the processing results.

The story of the data			
STEP number		Description	Responsible
1		Recovery of the instrument and write the recovery sheet (metadata)	for each station responsible
2		Check the GPS position	"
3		CTD cast (include time and position)	"
4		Pistohone check	"

5		Extract SD card	"
6		2 Copies of SD card	"
7		upload LEG data (raw data and CTD data calibrationfile and metadata) to the platform	"
8		Check both calibration files	KUBA software
9		Check time of start and stop recording	
10		Check the number of files vs duration of measurements	"
11		Check the number of samples inside each file	"
12		Delete data before deployment and after recovery (delete first four hours before recovery and 4 hours after deplyment)	"
13		Check for zeros and non valid data	
14		Check clock	
15		Check for clipping and saturation	
16		Porduce the spectrogram and mp3 or wav for the one hour record and alert partners via email for the checks	"
17		Check for unexpected noise 10 times randomly one hour spectrogram (i.e. mooring noise)	
18		Start routine again and LEG checked	
19		Calculation of 1 s SPL with standard algorithm	
20		Check of the minum levels comparing to the electronic noise	
21		Compare the levels with the levels of the previous data with the levels of the bigining of this dataset	
22		Compare the maximum level with the maximum level achievable by the device (saturation) 5dB	
23		Delete all the wrong data tracking the deleting	
24		Check the CTD cast with the oceanographic data of the modelling	
25		Calculation of 20 s SPL	
26		Deliver to Quonops the processed	
27		Send the log of all this to the owner of the data	

Since the processing tool uses the metadata from the *Deployment* and *Recovery datasheets* defined in deliverable D-3.2.2 Recommendations for the underwater noise monitoring procedure, we here define all the variables to be used by the processing tool.

The tool operates on the server of CNR in Venice, but an executable will be created to be used also locally by the partners.

N.B. All metadata should be included in the web interface also if there is no information. If information is not available none should be selected.

Time information must be correctly compiled otherwise the processing tool will not work. The correct sequence is shown in Figure 1, according to the definitions given below.

The Web App and standalone tool will be updated with new features and bug corrections.

DEFINITIONS

Ensemble: it is a dataset collected after one deployment in one station composed by the raw data together with all metadata (filled *Deployment* and *Recovery datasheets*), and CTD, calibration files.

Start recording time: this time sets when the recorder is switched on.

Stop recording time: this time sets when the recorder is switched off.

Deployment time: this time is the end of the physical deployment (for example when the divers finish to attach the rig).

Recovering time: this time is the start of the physical recovery.

Leg start time: this time sets the start of the useful data recorded for the processing.

Leg end time: this time sets the end of the useful data recorded for the processing.

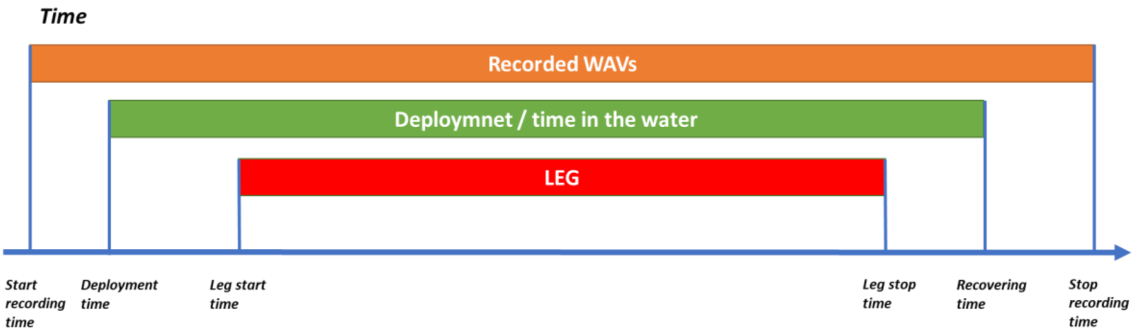
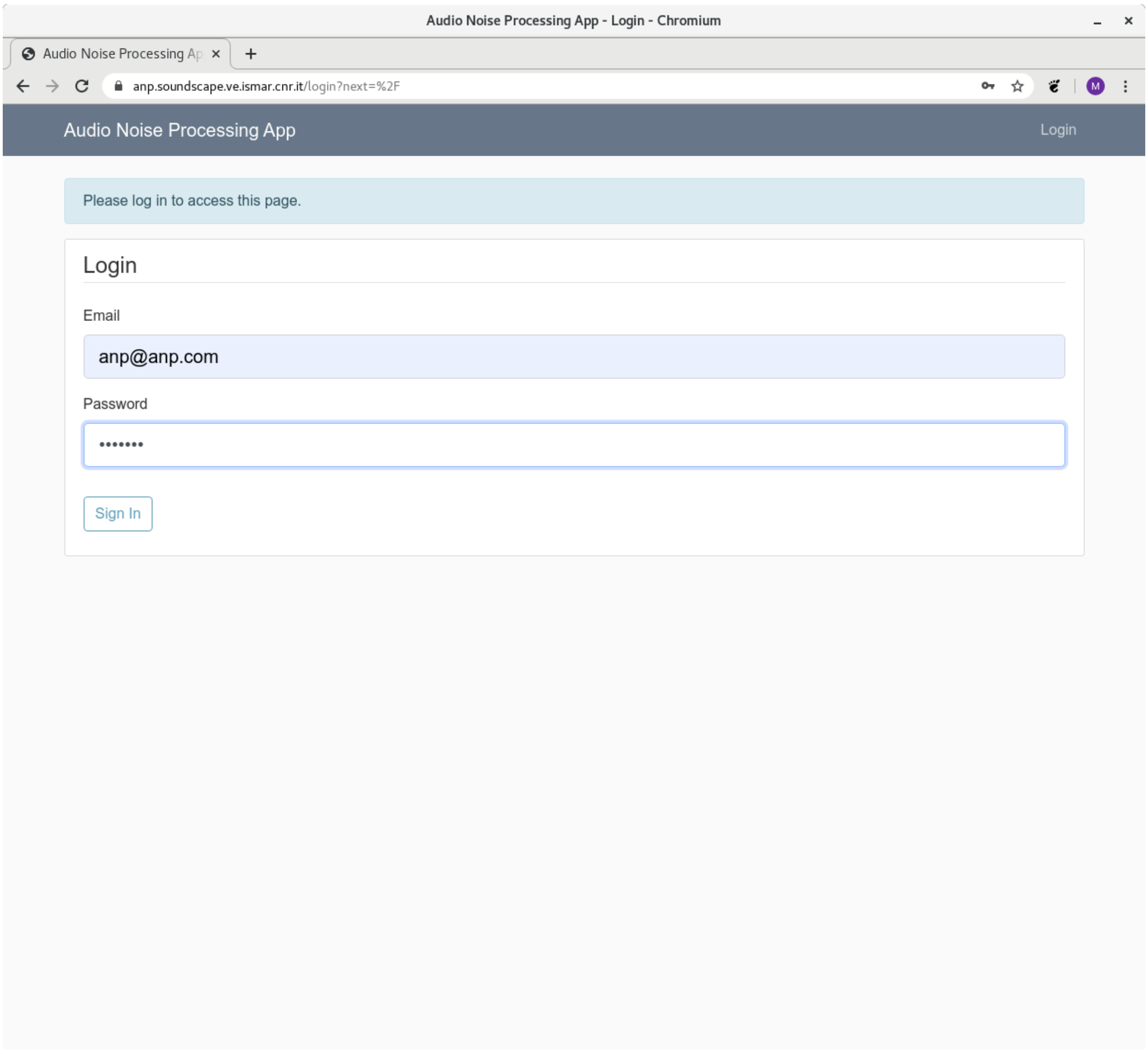


Figure 1. Operations timeline.

3 Audio noise processing app

The web processing tool is available at this address: http://anp.soundscape.ve.ismar.cnr.it. The first step is to log in using own username and password,

Figure 2. Username and password can be obtained sending an email to jakub.zdroik@gmail.com.


Audio Noise Processing App - Login - Chromium
Audio Noise Processing Ap
anp.soundscape.ve.ismar.cnr.it/login?next=%2F
Audio Noise Processing App
Login

Please log in to access this page.

Login

Email

anp@anp.com

Password

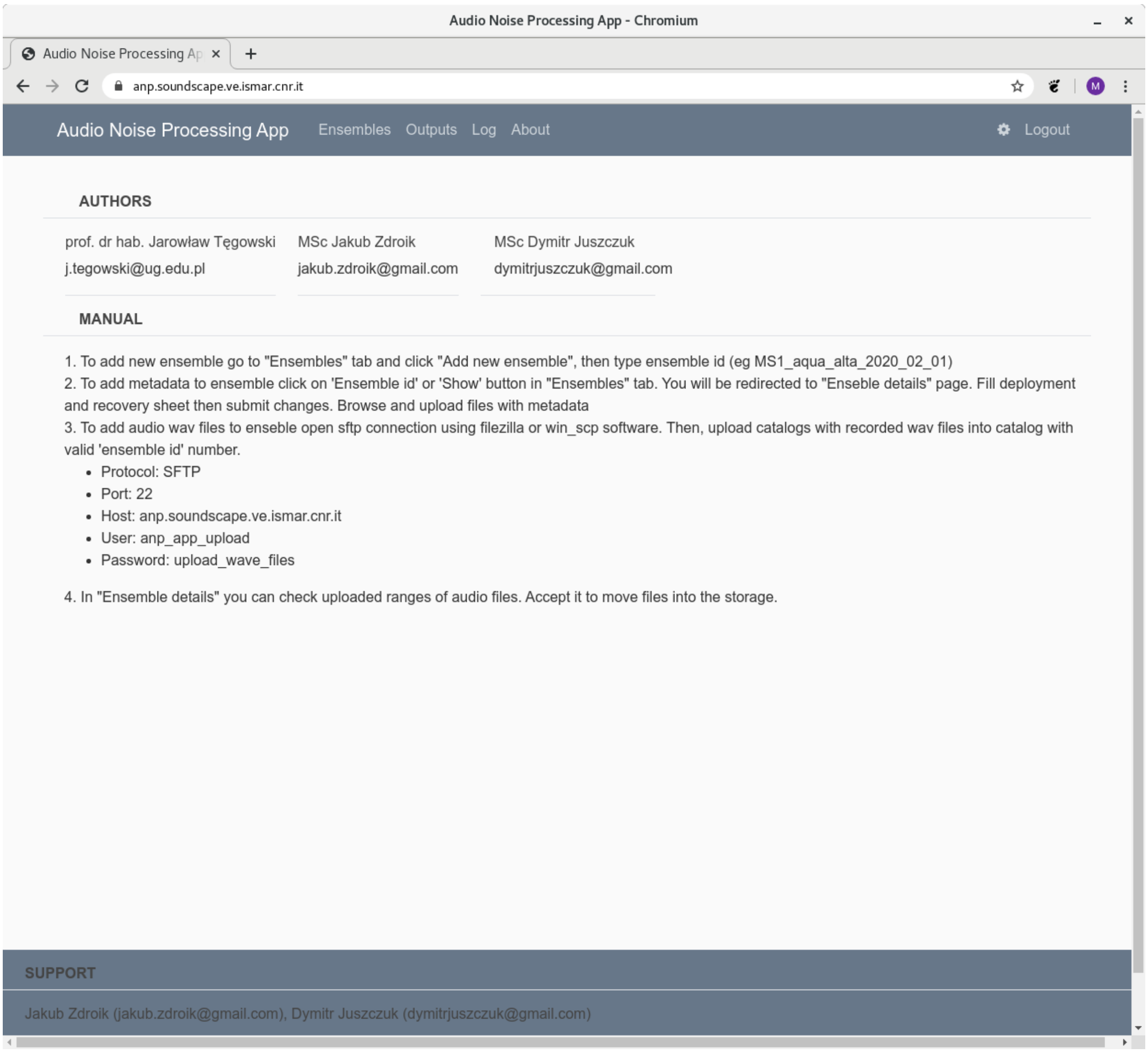
•••••••

Figure 2. Processing tool login page.

Once logged in, a welcome page appears (see Figure 3). Here there are a concise manual and some useful information that can be used in the next steps. Particularly one should note that an open sftp connection must be used to upload wav files. This can be done with anftp software like Filezilla or win_scp using the connection parameters shown inTable 2.

Table 2. Open sftp connection parameters.

Protocol	SFTP
Port	22
Host	anp.soundscape.ve.ismar.cnr.it
User	anp_app_upload
Password	upload_wave_files


Audio Noise Processing App - Chromium
Audio Noise Processing Ap
anp.soundscape.ve.ismar.cnr.it
Audio Noise Processing App
Ensembles
Outputs
Log
About
Logout

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dymitrjuszczuk@gmail.com

MANUAL

1. To add new ensemble go to "Ensembles" tab and click "Add new ensemble", then type ensemble id (eg MS1_aqua_alta_2020_02_01)
2. To add metadata to ensemble click on 'Ensemble id' or 'Show' button in "Ensembles" tab. You will be redirected to "Enseble details" page. Fill deployment and recovery sheet then submit changes. Browse and upload files with metadata
3. To add audio wav files to enseble open sftp connection using filezilla or win_scp software. Then, upload catalogs with recorded wav files into catalog with valid 'ensemble id' number.
   - Protocol: SFTP
   - Port: 22
   - Host: anp.soundscape.ve.ismar.cnr.it
   - User: anp_app_upload
   - Password: upload_wave_files
4. In "Ensemble details" you can check uploaded ranges of audio files. Accept it to move files into the storage.

SUPPORT

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Figure 3. Welcome page.

3.1 Ensembles creating and editing

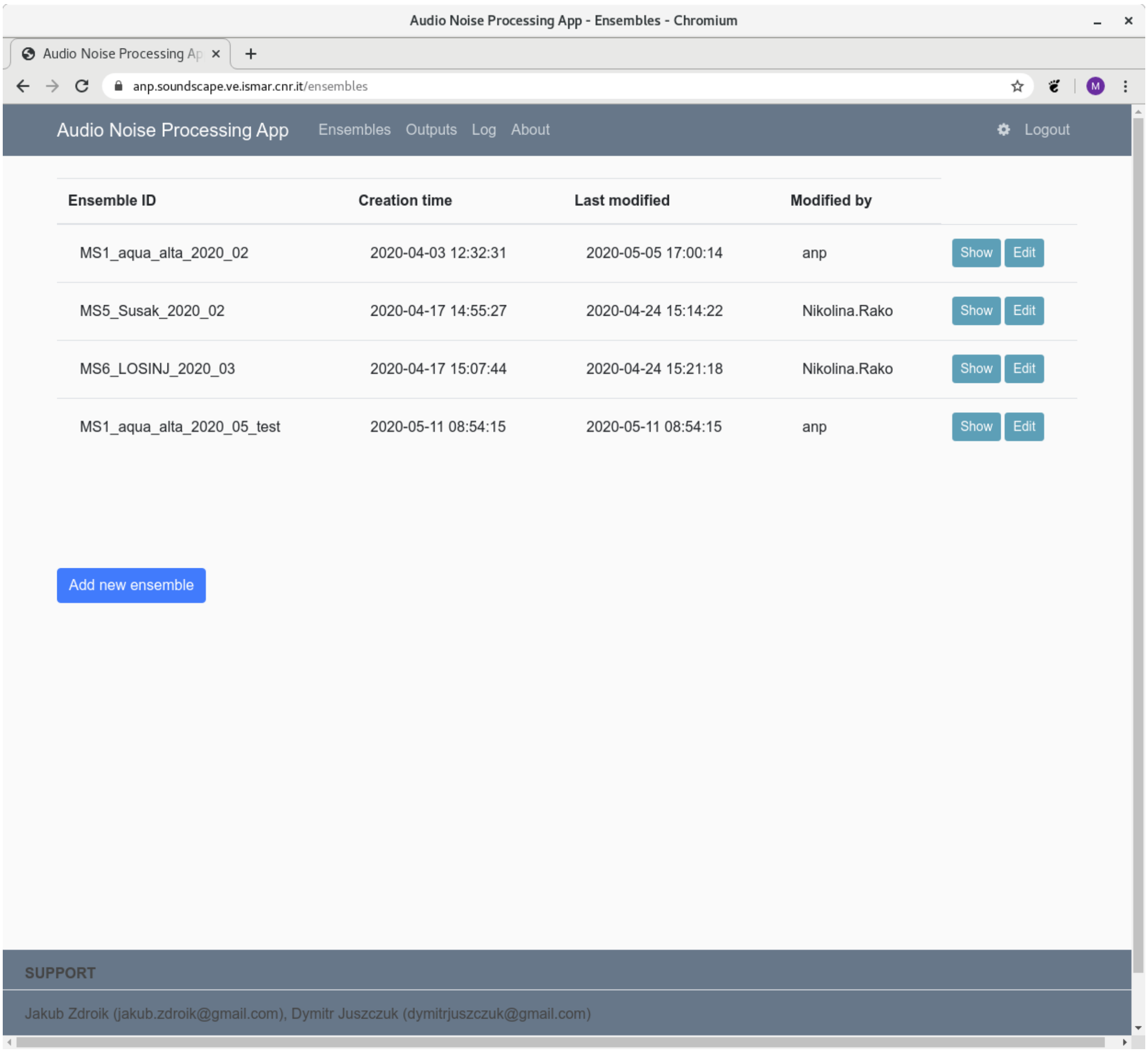
Clicking on “ensembles” on the upper bar one opens the ensembles window where there is the list of existing ensembles. Here there is the possibility to show or edit them pushing the “Show” or “Edit” buttons. It is also possible to create a new ensembleusing the “Add new ensemble” button (Figure 4).

Pressing this button starts the ensemble creation procedure. The user is asked to define the ensemble name (Figure 5). The right format of the name is “location_name_YYYY_MM” where locations and names are shown inTable 3 and YYYY and MM represent the year and the month of the deployment. If necessary, to distinguish different ensembles, an extra field can be added to the name: for example, the suffix “_DD” that represents the day of the deployment.

To help the users, the correct connections of Location and Name are also shown in the “Select location ID:” field (Figure 5).

Table 3.Ensemble name: usable Location and name.

Location	**Name**
MS1	Aqua-Alta
MS2	Azalea
MS3	Ancona
MS4	Paloma
MS5	Susak
MS6	Lošinj
MS7	Žirje
MS8	Split
MS9	Ivana



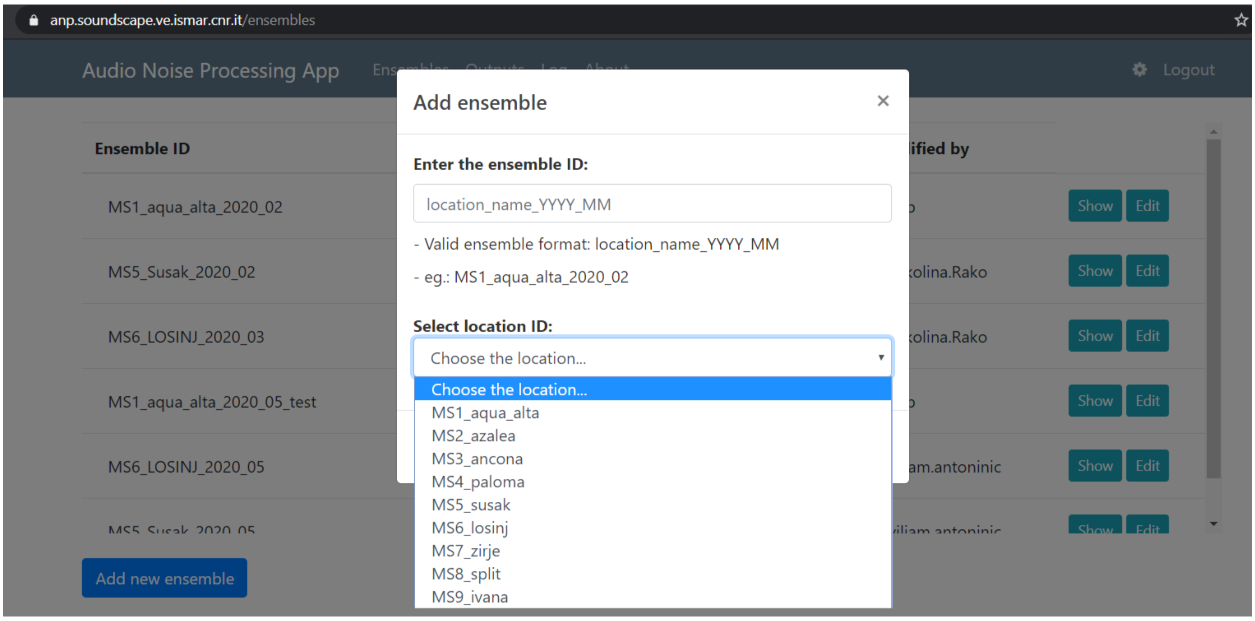
Audio Noise Processing App - Ensembles - Chromium
Audio Noise Processing Ap
anp.soundscape.ve.ismar.cnr.it/ensembles
Audio Noise Processing App
Ensembles
Outputs
Log
About
Logout
Show
Edit
Add new ensemble

Ensemble ID	Creation time	Last modified	Modified by
MS1_aqua_alta_2020_02	2020-04-03 12:32:31	2020-05-05 17:00:14	anp
MS5_Susak_2020_02	2020-04-17 14:55:27	2020-04-24 15:14:22	Nikolina.Rako
MS6_LOSINJ_2020_03	2020-04-17 15:07:44	2020-04-24 15:21:18	Nikolina.Rako
MS1_aqua_alta_2020_05_test	2020-05-11 08:54:15	2020-05-11 08:54:15	anp

SUPPORT

Jakub Zdroik (jakub.zdroik@gmail.com), Dymitr Juszczuk (dymitrjuszczuk@gmail.com)

Figure 4. Ensembles window.


anp.soundscape.ve.ismar.cnr.it/ensembles
Audio Noise Processing App
Logout
Show
Edit
Add new ensemble
×

Add ensemble

Enter the ensemble ID:

location_name_YYYY_MM

- Valid ensemble format: location_name_YYYY_MM

- eg.: MS1_aqua_alta_2020_02

Select location ID:

Choose the location...

Choose the location...
MS1_aqua_alta
MS2_azalea
MS3_ancona
MS4_paloma
MS5_susak
MS6_losinj
MS7_zirje
MS8_split
MS9_ivana

Ensemble ID
MS1_aqua_alta_2020_02
MS5_Susak_2020_02
MS6_LOSINJ_2020_03
MS1_aqua_alta_2020_05_test
MS6_LOSINJ_2020_05
MS5_Susak_2020_05

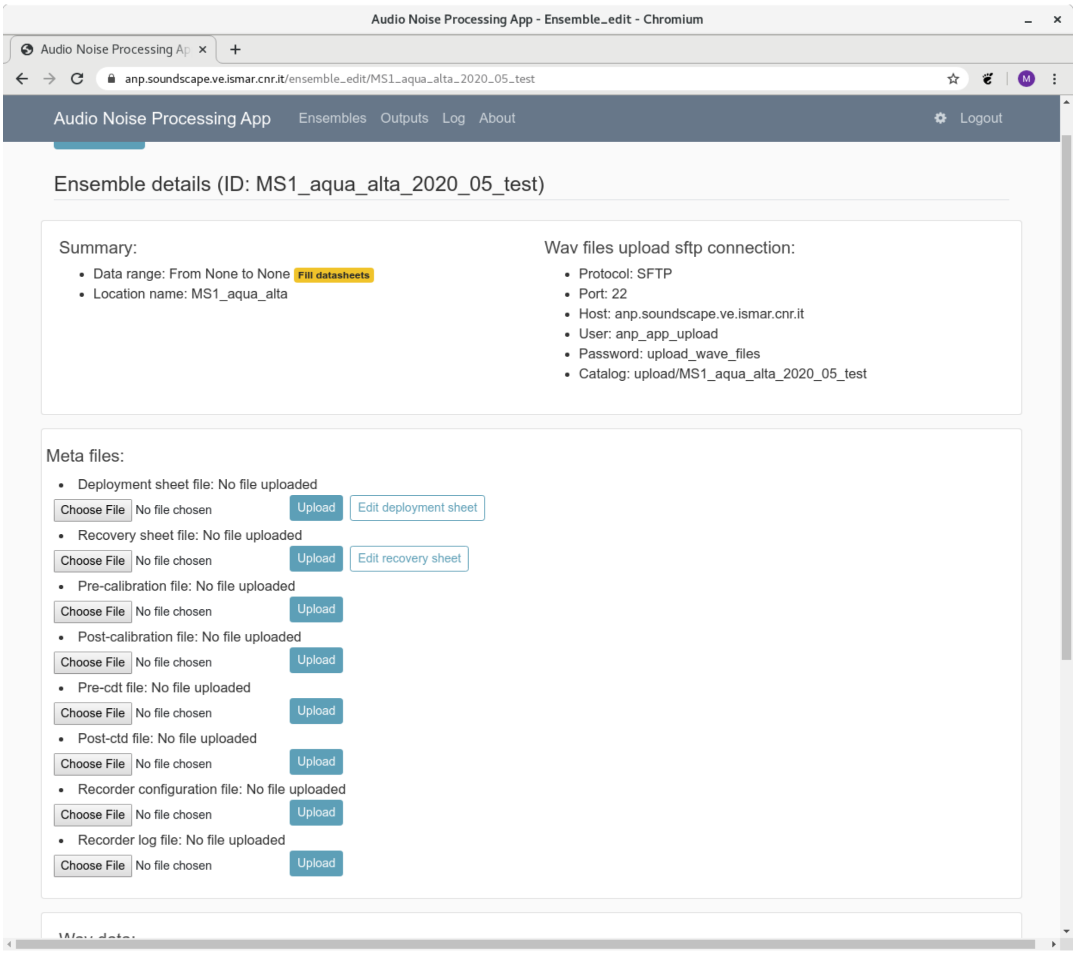
Figure 5. Add ensemble: defining name.

When a new ensemble is created, or when the “Edit” button is pressed for an already existing one, the ensemble editing window is called (Figure 6). Here the user should provide both metadata and wav files. Metadata are particularly important because their information are needed to properly process the sound data.

So, these following files are supposed to be updated by the user, clicking for each one first the corresponding “Choose File” and then the “Upload” buttons:

- **Deployment sheet file**: a pdf with the scan of the deployment sheet as in *D-3.2.2 Recommendations for the underwater noise monitoring procedure*;
- **Recovery sheet file**: a pdf with the scan of the recovery sheet as in *D-3.2.2 Recommendations for the underwater noise monitoring procedure*;
- **Pre-calibration file**: the wav file recorded using the pistonphone before the deployment;
- **Post-calibration file**: the wav file recorded using the pistonphone after the recovery;
- **Pre-CTD file**: CTD data collected before the deployment. It can be both cnv and ascfile;
- **Post-CTD file**: CTD data collected after the recovery. It can be both cnv and ascfile;
- **Recorder configuration file**: the xml configuration file of the hydrophone used during the recording;
- **Recorder log file**: the log file downloaded from the hydrophone after the deployment.

Some examples of these files are shown in the appendix,Figure 27, Figure 28, Figure 29, Figure 28, Figure 29.


Audio Noise Processing App - Ensemble_edit - Chromium
Audio Noise Processing Ap
anp.soundscape.ve.ismar.cnr.it/ensemble_edit/MS1_aqua_alta_2020_05_test
Audio Noise Processing App
Ensembles
Outputs
Log
About
Logout
Fill datasheets
Choose File
Upload
Edit deployment sheet
Edit recovery sheet

Ensemble details (ID: MS1_aqua_alta_2020_05_test)

Summary:

- Data range: From None to None
- Location name: MS1_aqua_alta

Wav files upload sftp connection:

- Protocol: SFTP
- Port: 22
- Host: anp.soundscape.ve.ismar.cnr.it
- User: anp_app_upload
- Password: upload_wave_files
- Catalog: upload/MS1_aqua_alta_2020_05_test

Meta files:

- Deployment sheet file: No file uploaded
  No file chosen
- Recovery sheet file: No file uploaded
  No file chosen
- Pre-calibration file: No file uploaded
  No file chosen
- Post-calibration file: No file uploaded
  No file chosen
- Pre-cdt file: No file uploaded
  No file chosen
- Post-ctd file: No file uploaded
  No file chosen
- Recorder configuration file: No file uploaded
  No file chosen
- Recorder log file: No file uploaded
  No file chosen

Figure 6. Ensemble editing window.

The deployment and recovery sheet files uploaded by the users will be filed. In this way the description of field operations will be always available. Anyway, because the processing tools require some of this information, also to produce netcdf files, the user must inputthem. It can be done clicking the “Edit deployment sheet” and “Edit recovery sheet” buttons.

Start/Stop recording time, Deployment/Recovery time, Start/End of leg time must be inputted according to definitions and Figure 1.

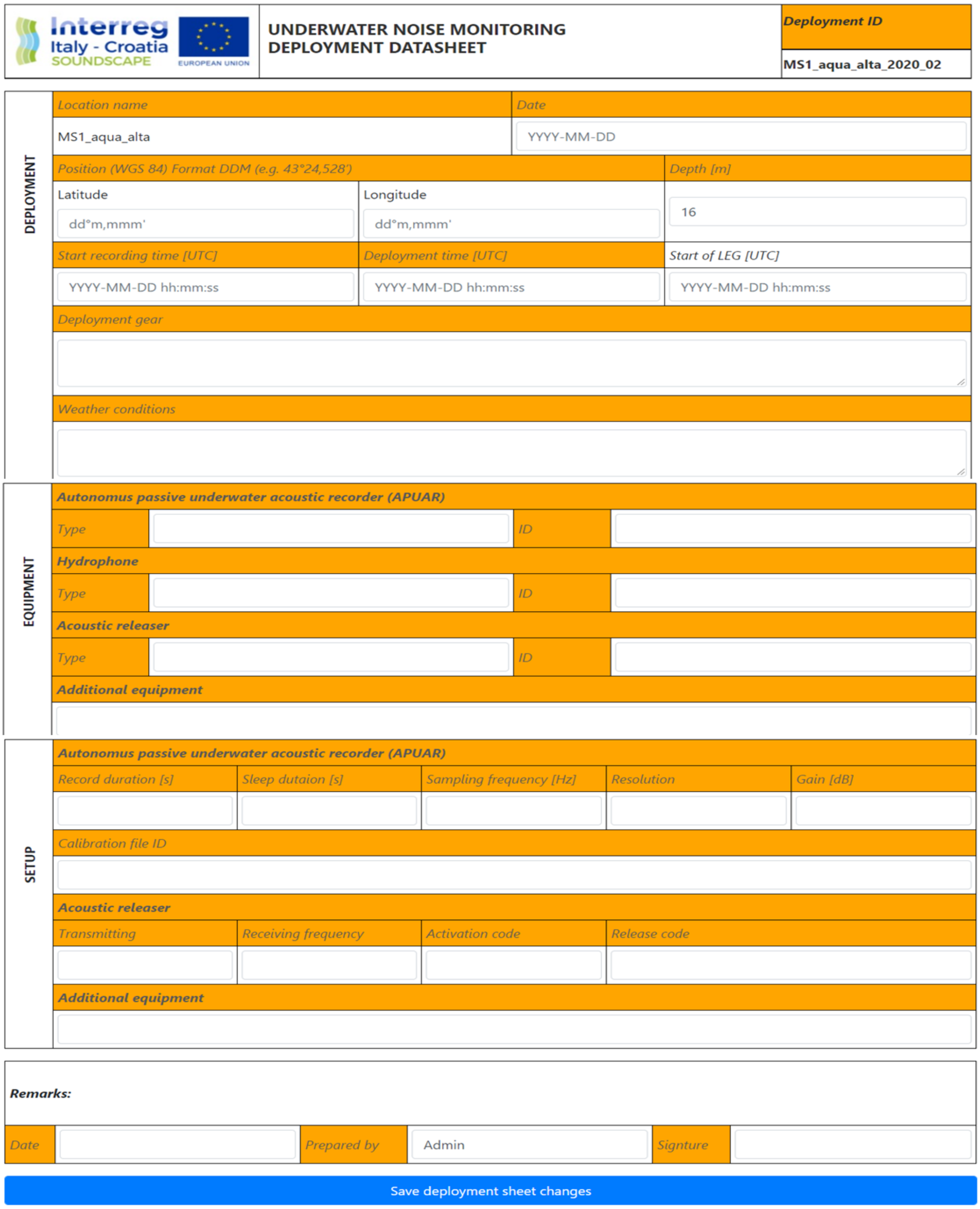
The deployment sheet editor, shown in Figure 7, requires these fields to be filled (“none” should be used If information is not available):

- **Deployment ID**: the ensemble name;
- **Location name**: the same used in ensemble name;
- **Date**: the date of the deployment;
- **Latitude, Longitude and Depth**: the station coordinates and depth;
- **Start recording time**: this time sets when the recorder is switched on (UTC);
- **Deployment time**: the time when the deployment operation ended (UTC);
- **Start of leg**: the start of the useful data recorded for the processing (UTC);
- **Deployment gear**: any tools used for the deployment;
- **Weather condition**: weather and see conditions;
- **Autonomus passive underwater acoustic recorder (APUAR) – Type**: manufacturing company (e.g.DevelogicSono.Vault);
- **Autonomus passive underwater acoustic recorder (APUAR) – ID**: the hydrophone serial number;
- **Hydrophone – Type**: type of hydrophone (e.g. Neptune sonar D/60);
- **Hydrophone – ID**: hydrophone serial number;
- **Acoustic releaser – Type**: the acoustic releaser used;
- **Acoustic releaser – ID**: the acoustic releaser serial number;
- **Record duration**: the duration of record cycle if duty cycle is used;
- **Sleep duration**: the duration of sleep cycle if duty cycle is used;
- **Sampling frequency**: the sampling rare in Hz (e.g. 48000);
- **Resolution**: the dynamic range in bit (e.g. 16 bit);
- **Gain**: it is the gain setting (e.g. 6);
- **Calibration file id**: The name of the Pre-calibration file;
- **Acoustic releaser – Transmitting**: transmitting frequency in Hz;
- **Acoustic releaser – Receiving**: receiving frequency in Hz;
- **Acoustic releaser – Activation code**: its unique activation code;
- **Acoustic releaser – Release code**: its unique releaser code;
- **Additional equipment**: any other equipment used for the deployment;
- **Remarks**: any useful notes;
- **Date**: date of when this sheet is filled.

The recovery sheet editor, shown in Figure 8, requires these fields to be filled (“none” should be used If information is not available):

- **Deployment ID**: the ensemble name;
- **Location name**: the same used in ensemble name;
- **Date**: the date of the recovery;
- **Latitude, Longitude and Depth**: the station coordinates and depth;
- **End of leg**: the end of the useful data recorded for the processing (UTC);
- **Recovering time**: the start of the physical recovery (UTC);

- **Stop recording time**: the time when the recorder is switched off (UTC);
- **Weather condition**: weather and see conditions;
- **Autonomus passive underwater acoustic recorder (APUAR) status and condition**: APUAR status after recovery;
- **APUAR’s memory status**: amount of memory usedby any sd cards in GB;
- **Hydrophone status and condition**: hydrophone status after recovery;
- **Acoustic releaser status and condition**: acoustic releaser status after recovery;
- **Deployment rig parts status and condition**: deployment rig parts status after recovery;
- **Calibration file id**: The name of the Post-calibration file;
- **Remarks**: any useful notes;
- **Date**: date of when this sheet is filled.



Interreg Italy - Croatia SOUNDSCAPE EUROPEAN UNION UNDERWATER NOISE MONITORING DEPLOYMENT DATASHEET	*Deployment ID* MS1_aqua_alta_2020_02

DEPLOYMENT

Location name		*Date*
MS1_aqua_alta		YYYY-MM-DD
Position (WGS 84) Format DDM (e.g. 43°24,528')		*Depth [m]*
Latitude dd°m,mmm'	Longitude dd°m,mmm'	16
Start recording time [UTC]	*Deployment time [UTC]*	*Start of LEG [UTC]*
YYYY-MM-DD hh:mm:ss	YYYY-MM-DD hh:mm:ss	YYYY-MM-DD hh:mm:ss
Deployment gear		
Weather conditions		

EQUIPMENT

Autonomus passive underwater acoustic recorder (APUAR)			
Type		*ID*	
Hydrophone			
Type		*ID*	
Acoustic releaser			
Type		*ID*	
Additional equipment			

SETUP

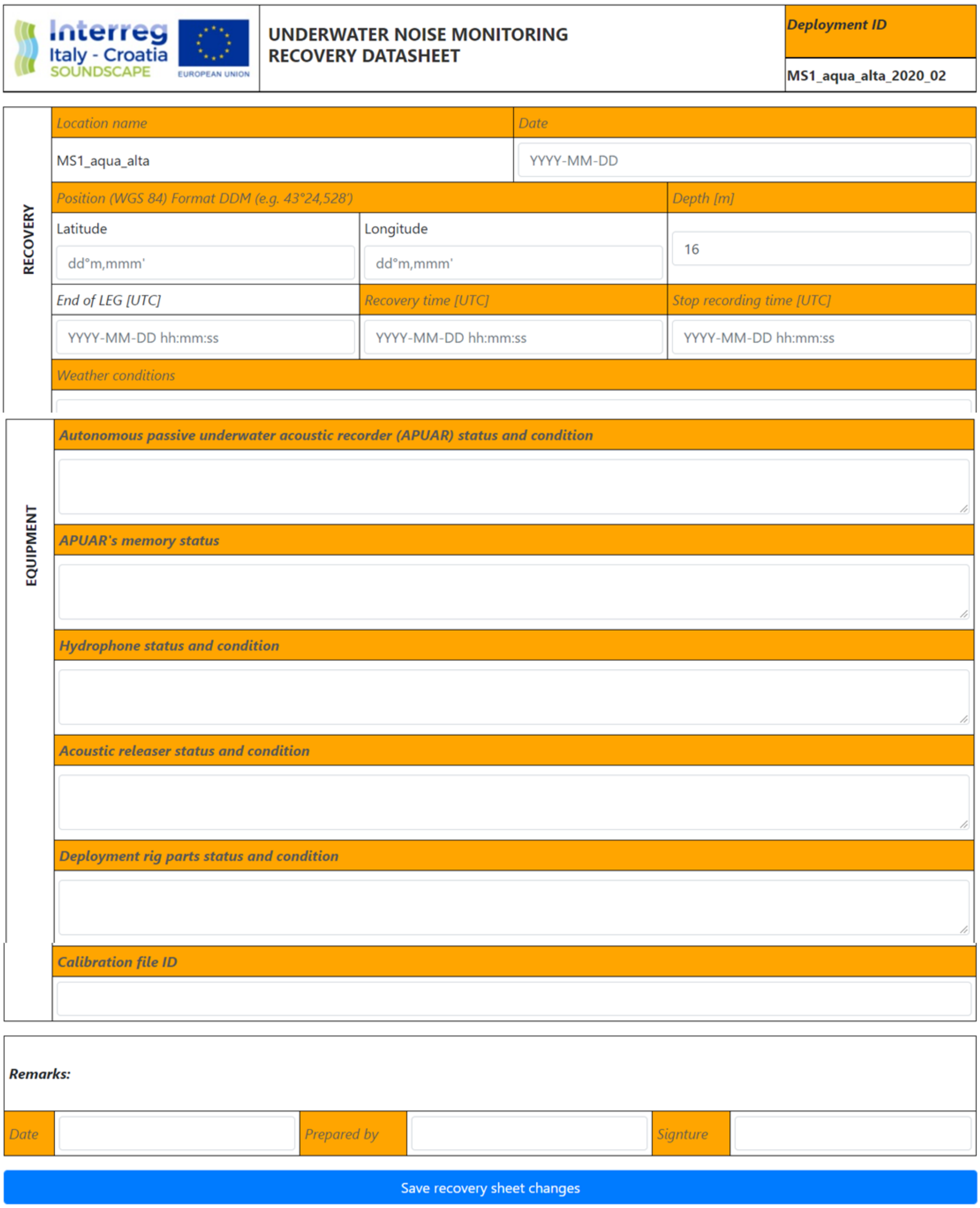
Autonomus passive underwater acoustic recorder (APUAR)				
Record duration [s]	*Sleep dutaion [s]*	*Sampling frequency [Hz]*	*Resolution*	*Gain [dB]*
Calibration file ID				
Acoustic releaser				
Transmitting	*Receiving frequency*	*Activation code*	*Release code*	
Additional equipment				

Remarks:

Date		*Prepared by*	Admin	*Signture*	

Save deployment sheet changes

Figure 7. Deployment sheet editor.



UNDERWATER NOISE MONITORING
RECOVERY DATASHEET

Deployment ID
MS1_aqua_alta_2020_02

RECOVERY

Location name	Date
MS1_aqua_alta	YYYY-MM-DD

Position (WGS 84) Format DDM (e.g. 43°24,528')		Depth [m]
Latitude	Longitude	
dd°m,mmm'	dd°m,mmm'	16
End of LEG [UTC]	Recovery time [UTC]	Stop recording time [UTC]
YYYY-MM-DD hh:mm:ss	YYYY-MM-DD hh:mm:ss	YYYY-MM-DD hh:mm:ss

Weather conditions

EQUIPMENT

Autonomous passive underwater acoustic recorder (APUAR) status and condition

APUAR's memory status

Hydrophone status and condition

Acoustic releaser status and condition

Deployment rig parts status and condition

Calibration file ID

Remarks:

Date		Prepared by		Signture	

Figure 8. Recovery sheet editor.

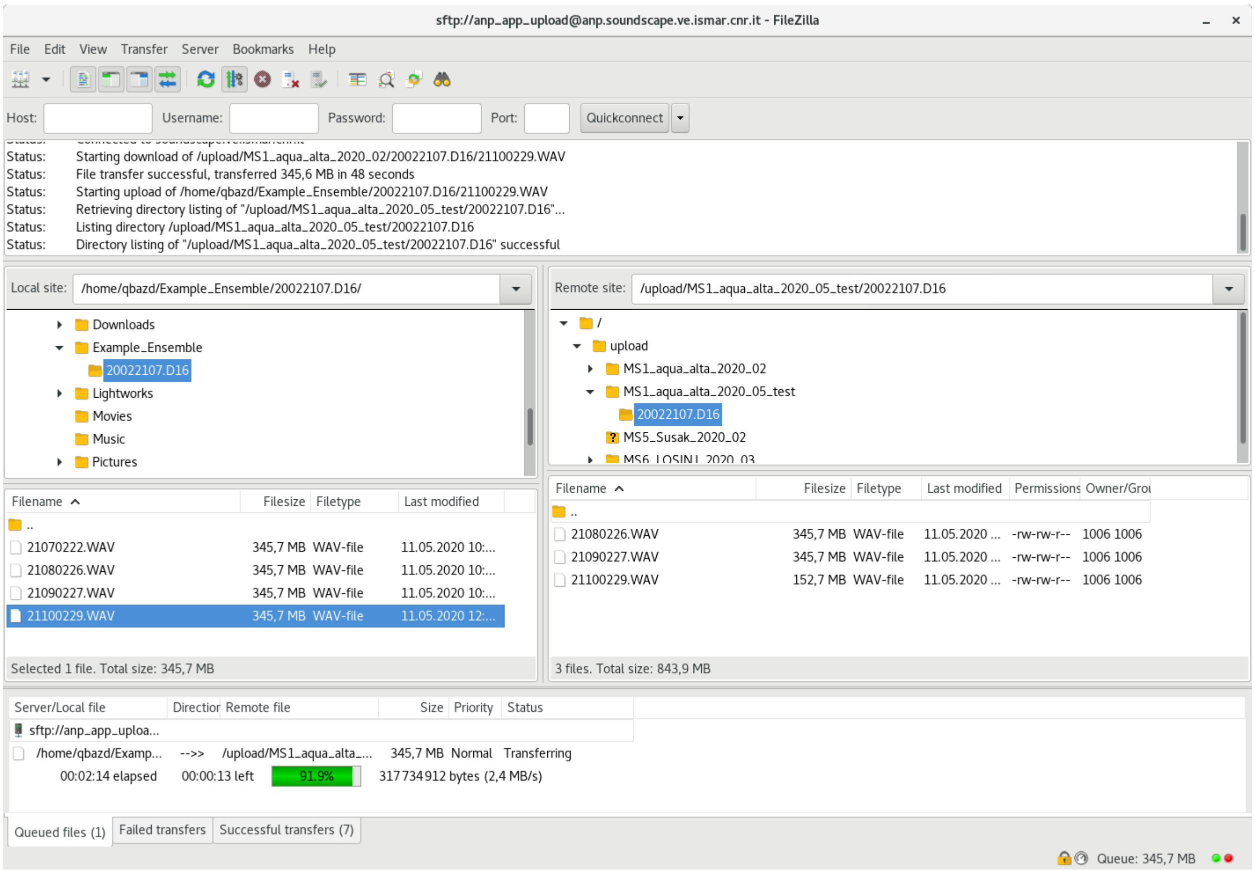
After typing this information, next step is the upload of the wav files.

This operation requires an external ftp software. The user can use, for example Filezilla or win_scp. After opening this external software, the user needs tocreate a sftp connection with the parameters shown in Table 2. In this waythe user can upload files from local to remote sites.Figure 9 shows an example using Filezilla.

The remote folders is /upload/*ensemble_name/* where "ensemble_name" is the same name the user has assigned to the ensemble.

It is better to upload the whole folders rather than the single files. The local folders should reproduce the sd structure. As shown in Figure 9, the whole folder 20022107.D16 is uploaded.

This folder is a temporary one and it will be deleted at the end of the importing operation, when files will be moved to permanent storage.



sftp://anp_app_upload@anp.soundscape.ve.ismar.cnr.it - FileZilla

Host: Username: Password: Port:

```
Status:     Starting download of /upload/MS1_aqua_alta_2020_02/20022107.D16/21100229.WAV
Status:     File transfer successful, transferred 345,6 MB in 48 seconds
Status:     Starting upload of /home/qbazd/Example_Ensemble/20022107.D16/21100229.WAV
Status:     Retrieving directory listing of "/upload/MS1_aqua_alta_2020_05_test/20022107.D16"...
Status:     Listing directory /upload/MS1_aqua_alta_2020_05_test/20022107.D16
Status:     Directory listing of "/upload/MS1_aqua_alta_2020_05_test/20022107.D16" successful
```

Local site: /home/qbazd/Example_Ensemble/20022107.D16/

```
Downloads
Example_Ensemble
    20022107.D16
Lightworks
Movies
Music
Pictures
```

Filename	Filesize	Filetype	Last modified
..			
21070222.WAV	345,7 MB	WAV-file	11.05.2020 10:...
21080226.WAV	345,7 MB	WAV-file	11.05.2020 10:...
21090227.WAV	345,7 MB	WAV-file	11.05.2020 10:...
21100229.WAV	345,7 MB	WAV-file	11.05.2020 12:...

Selected 1 file. Total size: 345,7 MB

Remote site: /upload/MS1_aqua_alta_2020_05_test/20022107.D16

```
/
  upload
    MS1_aqua_alta_2020_02
    MS1_aqua_alta_2020_05_test
      20022107.D16
    MS5_Susak_2020_02
    MS6_LOSINJ_2020_03
```

Filename	Filesize	Filetype	Last modified	Permissions	Owner/Grou
..					
21080226.WAV	345,7 MB	WAV-file	11.05.2020 ...	-rw-rw-r--	1006 1006
21090227.WAV	345,7 MB	WAV-file	11.05.2020 ...	-rw-rw-r--	1006 1006
21100229.WAV	152,7 MB	WAV-file	11.05.2020 ...	-rw-rw-r--	1006 1006

3 files. Total size: 843,9 MB

Server/Local file	Directior	Remote file	Size	Priority	Status
sftp://anp_app_uploa...					
/home/qbazd/Examp...	-->>	/upload/MS1_aqua_alta_....	345,7 MB	Normal	Transferring
00:02:14 elapsed	00:00:13 left	91.9%	317 734 912 bytes (2,4 MB/s)		

Queued files (1) | Failed transfers | Successful transfers (7)

Queue: 345,7 MB

Figure 9. Uploading wav files with an external software.

When a file is fully uploaded, the tool automatically checks its integrity and consistence. If no errors happen, the file is shown in a list with some information: start time, length, gap to next file. Leg and recorded wav range are also summarized (Figure 10). Otherwise, a warning message highlights that the file is corrupt. It is not considered for further processing.

If the files satisfy all the requirements, the user can accept them and move them to the permanent storage.

A message will advise that this operation was successfully done (Figure 11).

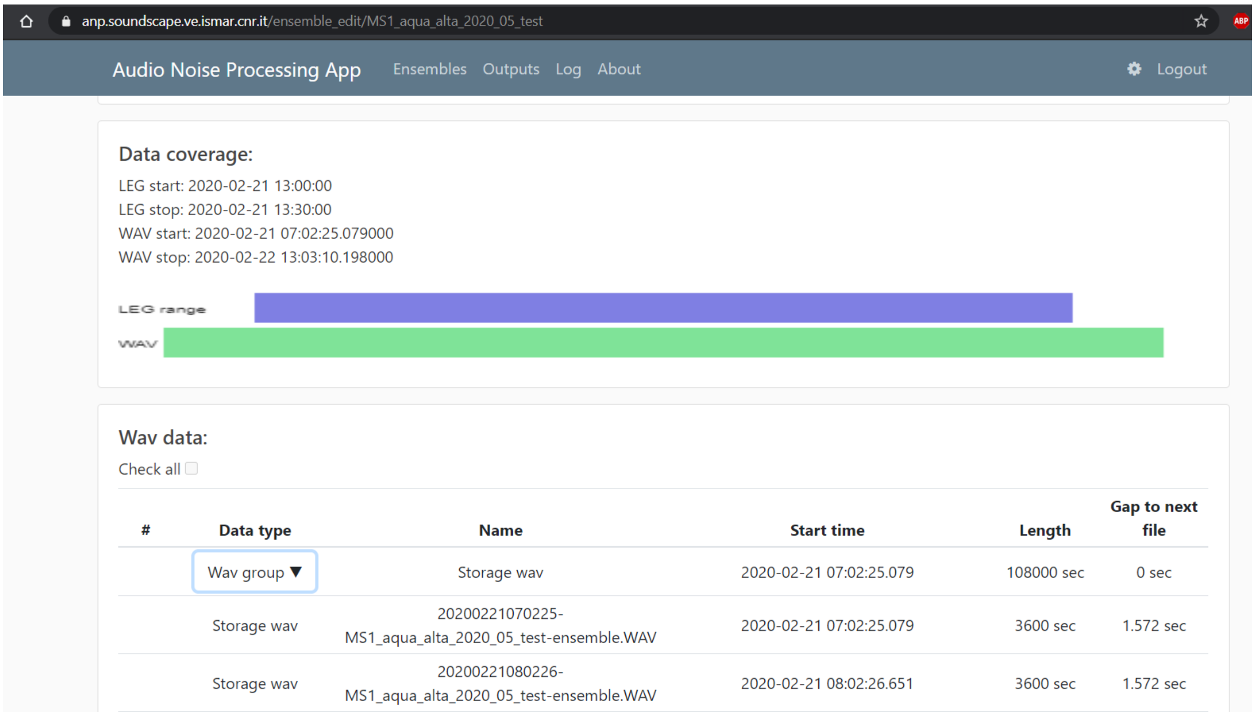
Moreover, the tool is capable of automatically correcting some issues related to metadata of wav files generated by SonoVault Recorder.

It may happen that a wrong start timestamp of wav file is printed, with a yyy-mm-dd hh:mm:ss.ttt format instead of the correct yyyy-mm-dd hh:mm:ss.ttt, eg: 020-06-01 00:00:00.422 instead of 2020-06-01 00:00:00.422. So, if date is in the wrong format: "yyy-mm-dd hh:mm:ss.ttt", then "2" is added at the beginning to make it compliant.

In addition, there are files that contain non-ASCII characters in the Ensemble ID field in metadata. Because non-ASCII characters may produce a malfunction, if present, they are stripped.

These corrections do not affect or modify the wav input files but only concern the processing operation.

A file can be always removed from the storage. Inside the ensemble editing window the user can select the files to be removed and press the “Remove from storage” button (Figure 12).


anp.soundscape.ve.ismar.cnr.it/ensemble_edit/MS1_aqua_alta_2020_05_test
Audio Noise Processing App
Ensembles
Outputs
Log
About
Logout
LEG range
WAV

Data coverage:

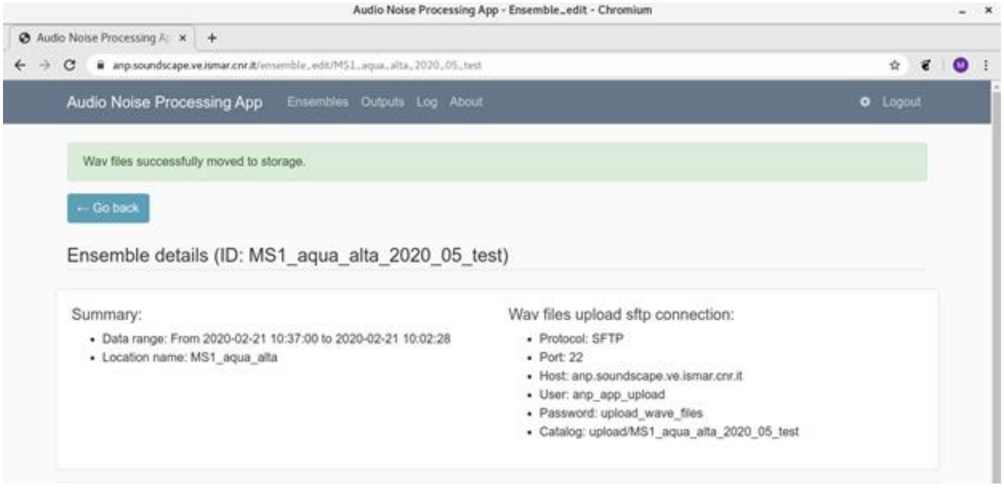
LEG start: 2020-02-21 13:00:00
LEG stop: 2020-02-21 13:30:00
WAV start: 2020-02-21 07:02:25.079000
WAV stop: 2020-02-22 13:03:10.198000

Wav data:

Check all □

#	Data type	Name	Start time	Length	Gap to next file
	Wav group ▼	Storage wav	2020-02-21 07:02:25.079	108000 sec	0 sec
	Storage wav	20200221070225-MS1_aqua_alta_2020_05_test-ensemble.WAV	2020-02-21 07:02:25.079	3600 sec	1.572 sec
	Storage wav	20200221080226-MS1_aqua_alta_2020_05_test-ensemble.WAV	2020-02-21 08:02:26.651	3600 sec	1.572 sec

Figure 10. Automatic checking wav files integrity.


Audio Noise Processing App - Ensemble_edit - Chromium
Audio Noise Processing A
anp.soundscape.ve.ismar.cnr.it/ensemble_edit/MS1_aqua_alta_2020_05_test
Audio Noise Processing App
Ensembles
Outputs
Log
About
Logout
← Go back

Wav files successfully moved to storage.

Ensemble details (ID: MS1_aqua_alta_2020_05_test)

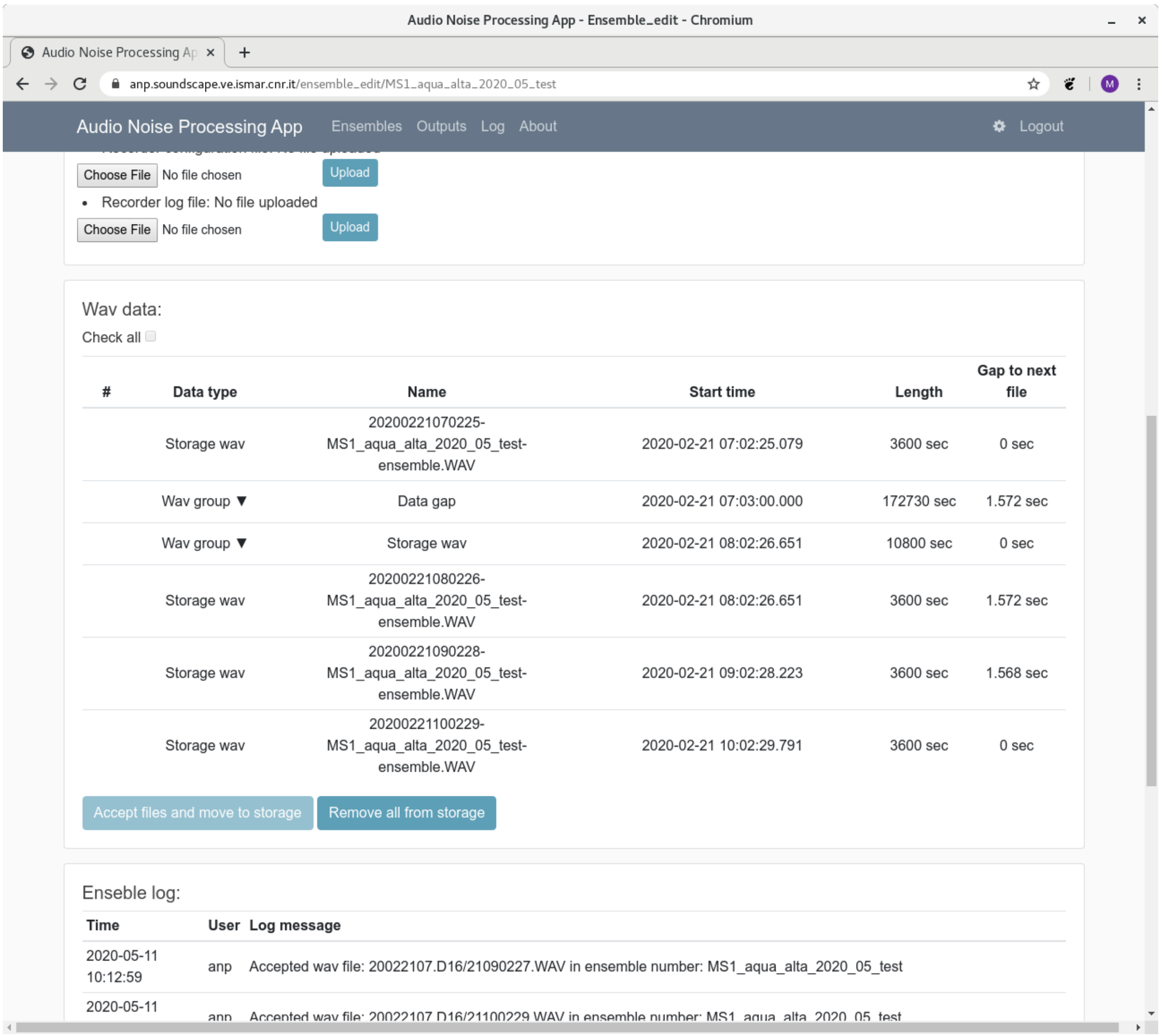
Summary:

- Data range: From 2020-02-21 10:37:00 to 2020-02-21 10:02:28
- Location name: MS1_aqua_alta

Wav files upload sftp connection:

- Protocol: SFTP
- Port: 22
- Host: anp.soundscape.ve.ismar.cnr.it
- User: anp_app_upload
- Password: upload_wave_files
- Catalog: upload/MS1_aqua_alta_2020_05_test

Figure 11. End of upload operation.



Audio Noise Processing App - Ensemble_edit - Chromium
Audio Noise Processing Ap
anp.soundscape.ve.ismar.cnr.it/ensemble_edit/MS1_aqua_alta_2020_05_test
Audio Noise Processing App
Ensembles
Outputs
Log
About
Logout

Choose File No file chosen Upload

- Recorder log file: No file uploaded

Choose File No file chosen Upload

Wav data:

Check all □

#	Data type	Name	Start time	Length	Gap to next file
	Storage wav	20200221070225-MS1_aqua_alta_2020_05_test-ensemble.WAV	2020-02-21 07:02:25.079	3600 sec	0 sec
	Wav group ▼	Data gap	2020-02-21 07:03:00.000	172730 sec	1.572 sec
	Wav group ▼	Storage wav	2020-02-21 08:02:26.651	10800 sec	0 sec
	Storage wav	20200221080226-MS1_aqua_alta_2020_05_test-ensemble.WAV	2020-02-21 08:02:26.651	3600 sec	1.572 sec
	Storage wav	20200221090228-MS1_aqua_alta_2020_05_test-ensemble.WAV	2020-02-21 09:02:28.223	3600 sec	1.568 sec
	Storage wav	20200221100229-MS1_aqua_alta_2020_05_test-ensemble.WAV	2020-02-21 10:02:29.791	3600 sec	0 sec

Enseble log:

Time	User	Log message
2020-05-11 10:12:59	anp	Accepted wav file: 20022107.D16/21090227.WAV in ensemble number: MS1_aqua_alta_2020_05_test
2020-05-11	anp	Accepted wav file: 20022107.D16/21100229.WAV in ensemble number: MS1_aqua_alta_2020_05_test

Figure 12. Remove files from storage.

3.2 Ensembles Processing

Once all the data has been uploaded, users can start the ensemble building process pressing the "build ensemble" button. This can be done under the "ensemble → edit" tab (Figure 13, Figure 14 and Figure 15).

The results are available under the “Outputs” tab. Here, for each processed ensemble, users can choose whether to list all the outputs or to list the outputs related to the first 24 hours from the start date and time. The start date/time can be easily defined by the users (Figure 16 and Figure 17).

Partial results are available even if the processing is still on going.

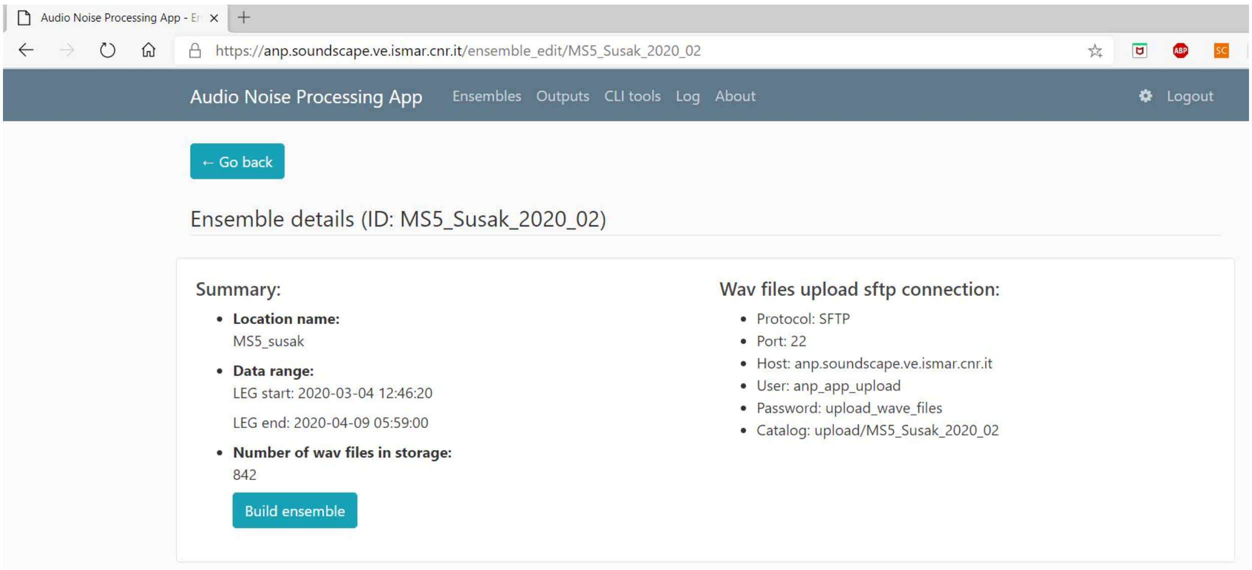
The output files can then be downloaded (Figure 17): they are two kinds of 1 hour length csv files with respectively 1 second and 20 second average values of the sound pressure levels (SPL) in the 1/3 octave bands centered at 63 Hz, 125 Hz, 250 Hz and 4000 Hz.

An example of a csv output file is shown in Figure 30. User can therefore visualize the data, e.g. see Figure 31. Next versions of the Audio Noise Processing App will have the capability of automatically allowing data visualization.

Anyway, all the output files are available on anp.soundscape.ve.ismar.cnr.it server:

/storage/AudioNoiseProcessingApp/output/spl_bias_20/<ensebmle_id>/

User must access with their own username and password.


Audio Noise Processing App - E
https://anp.soundscape.ve.ismar.cnr.it/ensemble_edit/MS5_Susak_2020_02
Audio Noise Processing App
Ensembles
Outputs
CLI tools
Log
About
Logout
← Go back

Ensemble details (ID: MS5_Susak_2020_02)

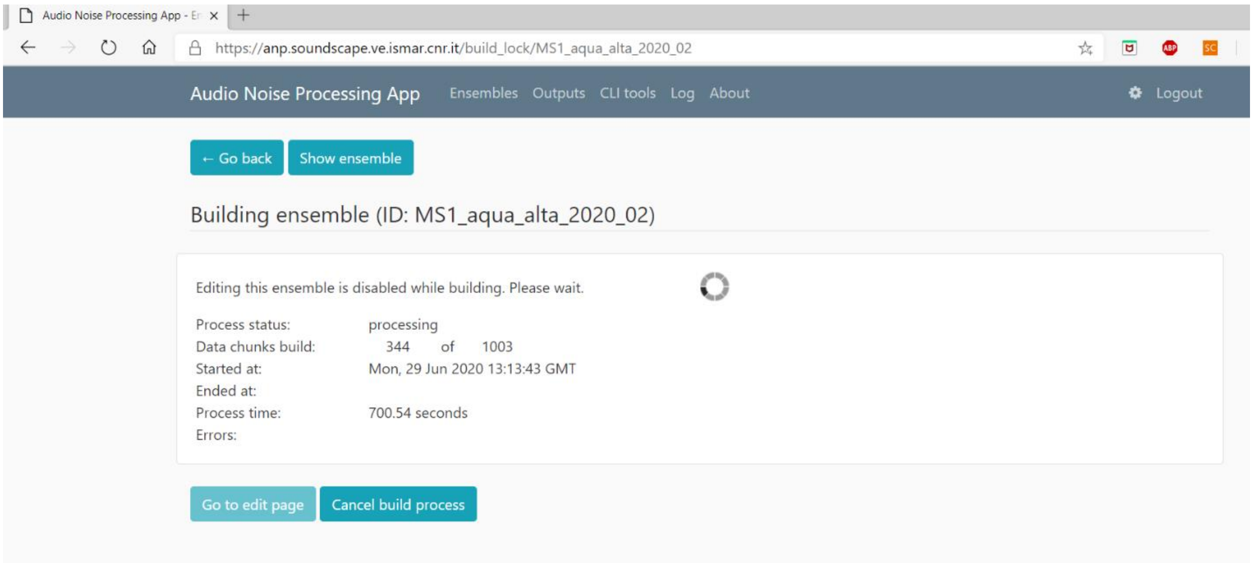
Summary:

- **Location name:**
  MS5_susak
- **Data range:**
  LEG start: 2020-03-04 12:46:20
  LEG end: 2020-04-09 05:59:00
- **Number of wav files in storage:**
  842

Wav files upload sftp connection:

- Protocol: SFTP
- Port: 22
- Host: anp.soundscape.ve.ismar.cnr.it
- User: anp_app_upload
- Password: upload_wave_files
- Catalog: upload/MS5_Susak_2020_02

Figure 13. Build ensemble: start of processing.

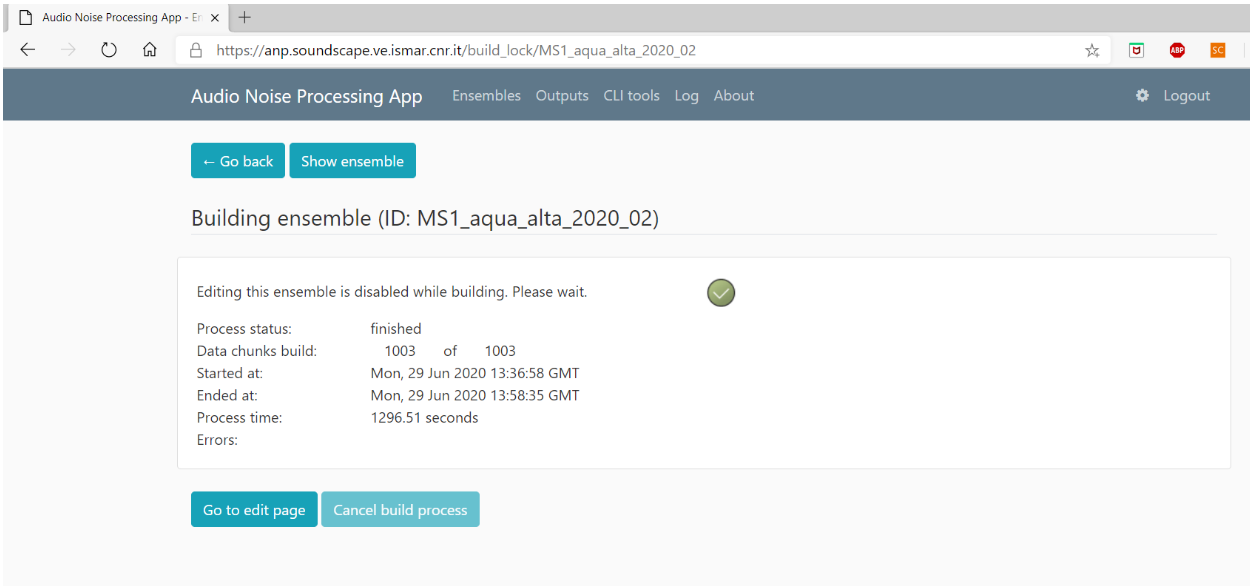

Audio Noise Processing App - E
https://anp.soundscape.ve.ismar.cnr.it/build_lock/MS1_aqua_alta_2020_02
Audio Noise Processing App
Ensembles
Outputs
CLI tools
Log
About
Logout
← Go back
Show ensemble
Go to edit page
Cancel build process

Building ensemble (ID: MS1_aqua_alta_2020_02)

Editing this ensemble is disabled while building. Please wait.

```
Process status:        processing
Data chunks build:       344    of    1003
Started at:            Mon, 29 Jun 2020 13:13:43 GMT
Ended at:
Process time:          700.54 seconds
Errors:
```

Figure 14. Build ensemble: on going processing.


Audio Noise Processing App - E
https://anp.soundscape.ve.ismar.cnr.it/build_lock/MS1_aqua_alta_2020_02
Audio Noise Processing App
Ensembles
Outputs
CLI tools
Log
About
Logout
← Go back
Show ensemble
Go to edit page
Cancel build process

Building ensemble (ID: MS1_aqua_alta_2020_02)

Editing this ensemble is disabled while building. Please wait.

```
Process status:        finished
Data chunks build:       1003    of    1003
Started at:            Mon, 29 Jun 2020 13:36:58 GMT
Ended at:              Mon, 29 Jun 2020 13:58:35 GMT
Process time:          1296.51 seconds
Errors:
```

Figure 15. Build ensemble: end of processing.

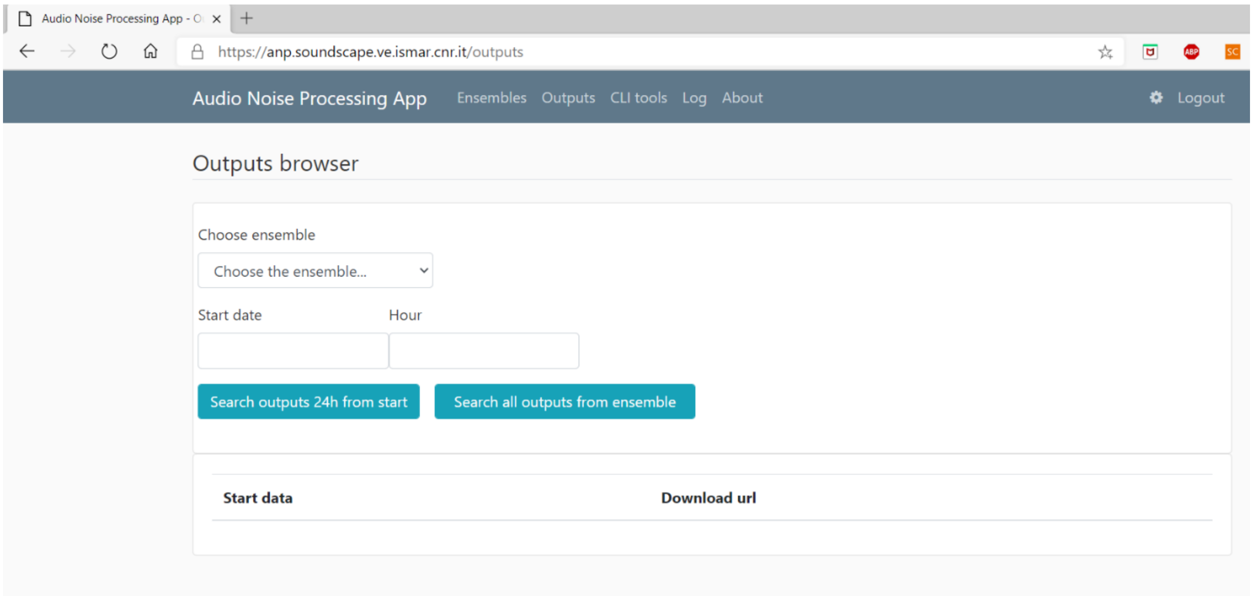
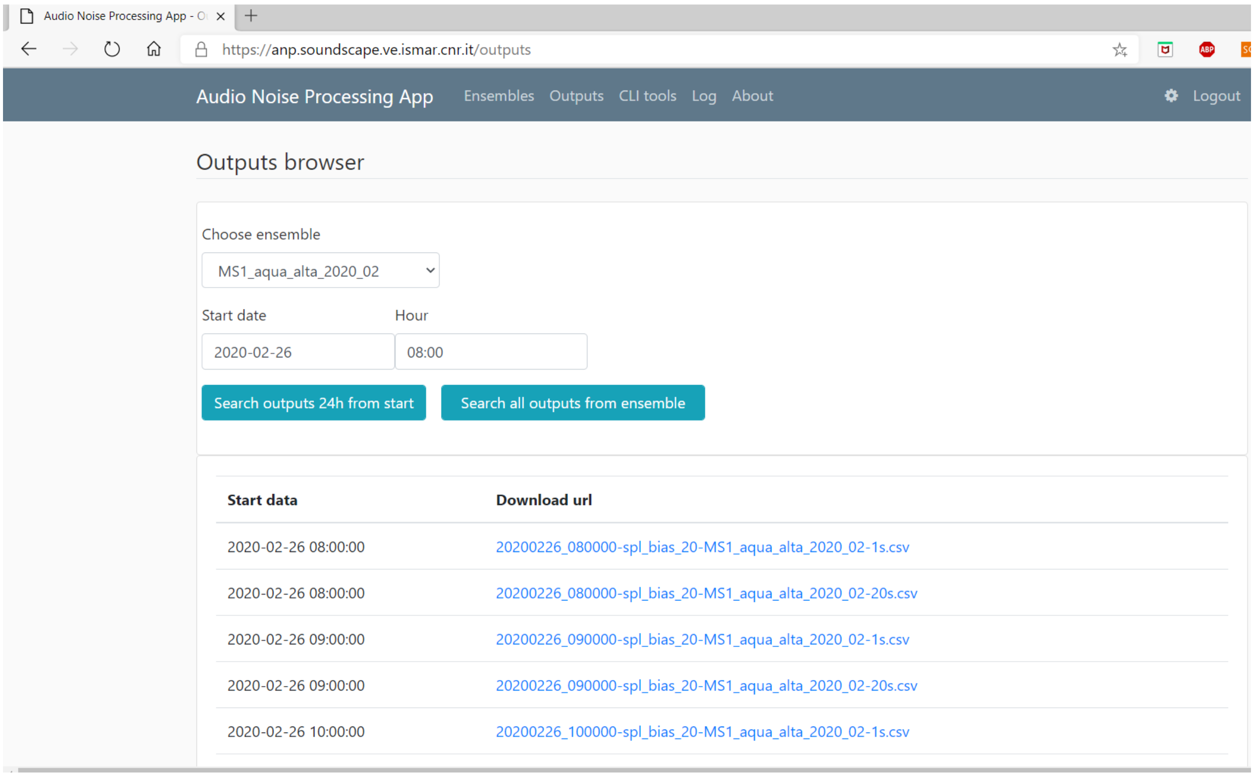

Audio Noise Processing App - O
https://anp.soundscape.ve.ismar.cnr.it/outputs
Audio Noise Processing App
Ensembles
Outputs
CLI tools
Log
About
Logout
Outputs browser
Choose ensemble
Choose the ensemble...
Start date
Hour
Search outputs 24h from start
Search all outputs from ensemble
Start data
Download url

Figure 16. Results selection.


Audio Noise Processing App - O
https://anp.soundscape.ve.ismar.cnr.it/outputs
Audio Noise Processing App
Ensembles
Outputs
CLI tools
Log
About
Logout
Outputs browser
Search outputs 24h from start
Search all outputs from ensemble

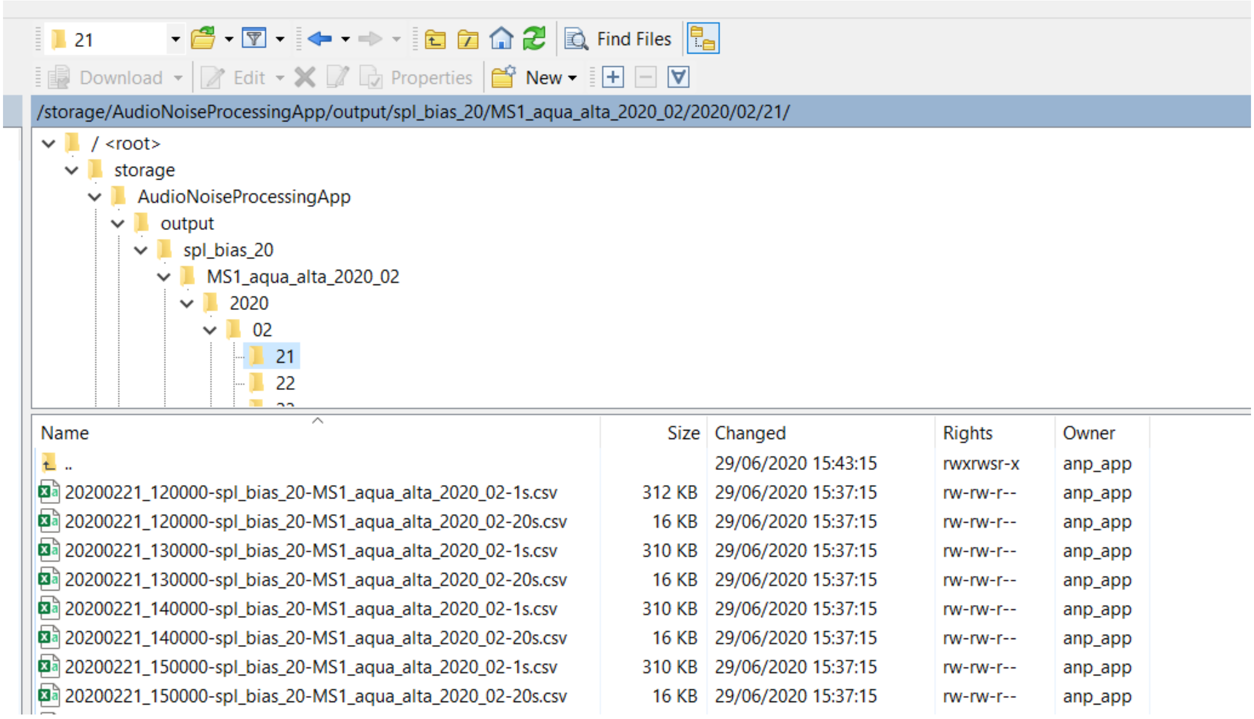
Choose ensemble: MS1_aqua_alta_2020_02

Start date: 2020-02-26

Hour: 08:00

Start data	Download url
2020-02-26 08:00:00	20200226_080000-spl_bias_20-MS1_aqua_alta_2020_02-1s.csv
2020-02-26 08:00:00	20200226_080000-spl_bias_20-MS1_aqua_alta_2020_02-20s.csv
2020-02-26 09:00:00	20200226_090000-spl_bias_20-MS1_aqua_alta_2020_02-1s.csv
2020-02-26 09:00:00	20200226_090000-spl_bias_20-MS1_aqua_alta_2020_02-20s.csv
2020-02-26 10:00:00	20200226_100000-spl_bias_20-MS1_aqua_alta_2020_02-1s.csv

Figure 17. Results selection.



/storage/AudioNoiseProcessingApp/output/spl_bias_20/MS1_aqua_alta_2020_02/2020/02/21/

```
/ <root>
  storage
    AudioNoiseProcessingApp
      output
        spl_bias_20
          MS1_aqua_alta_2020_02
            2020
              02
                21
                22
```

Name	Size	Changed	Rights	Owner
..		29/06/2020 15:43:15	rwxrwsr-x	anp_app
20200221_120000-spl_bias_20-MS1_aqua_alta_2020_02-1s.csv	312 KB	29/06/2020 15:37:15	rw-rw-r--	anp_app
20200221_120000-spl_bias_20-MS1_aqua_alta_2020_02-20s.csv	16 KB	29/06/2020 15:37:15	rw-rw-r--	anp_app
20200221_130000-spl_bias_20-MS1_aqua_alta_2020_02-1s.csv	310 KB	29/06/2020 15:37:15	rw-rw-r--	anp_app
20200221_130000-spl_bias_20-MS1_aqua_alta_2020_02-20s.csv	16 KB	29/06/2020 15:37:15	rw-rw-r--	anp_app
20200221_140000-spl_bias_20-MS1_aqua_alta_2020_02-1s.csv	310 KB	29/06/2020 15:37:15	rw-rw-r--	anp_app
20200221_140000-spl_bias_20-MS1_aqua_alta_2020_02-20s.csv	16 KB	29/06/2020 15:37:15	rw-rw-r--	anp_app
20200221_150000-spl_bias_20-MS1_aqua_alta_2020_02-1s.csv	310 KB	29/06/2020 15:37:15	rw-rw-r--	anp_app
20200221_150000-spl_bias_20-MS1_aqua_alta_2020_02-20s.csv	16 KB	29/06/2020 15:37:15	rw-rw-r--	anp_app

Figure 18. Outputs available on anp.soundscape.ve.ismar.cnr.it server.

4 Soundcape Tool

Parallel to the web application a stand-alone application was developed. It allows users to process wav files locally with their own computers. Wav files are processed in the same way with both the web application and the stand-alone application.

The stand-alone application consists in two tools, **soundscape_spl.py and develogic_check_wavs.py**, written in Python. This programming languagewaschosen for manyreasons:

- it is Open Source (see https://opensource.org/ for the Open Source Definition);
- it can be used in many operating systems;
- there are lot of documentations;
- there is a huge Community that support it.

Information can be found at https://www.python.org/.

Users must not have deep experience in programming: routines can be launched by command line in a console.

4.1 Python Installation

The app requires Python installed and working in the pc.

If not already done, Python can be downloaded at https://www.python.org/downloads/. Here users must select the proper version according to their operating system. Please, note that version 3.7 or higher is required to run properly the application.

For detailed information about download and installation, see the website https://wiki.python.org/moin/BeginnersGuide/Download. More resources are available on https://www.python.org/doc/.

Note that administrator privileges may be requested to install Python.

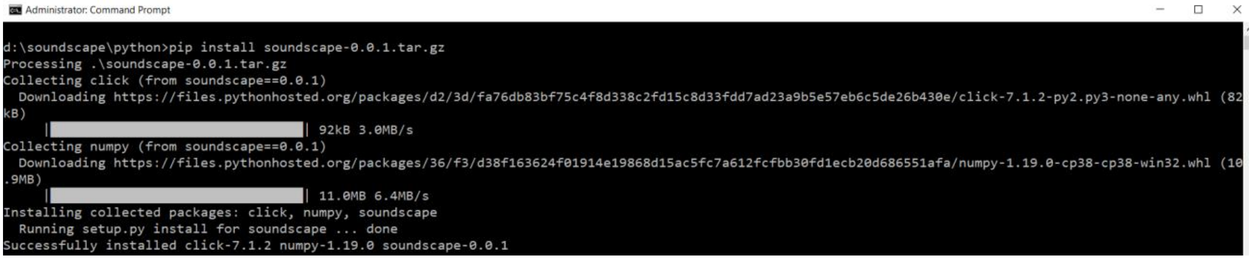
4.2 Soundscape_spl.py and develogic_check_wavs.pyinstallation

Python code can be downloaded using anp_app_upload user (see Table 2) from soundscape server under the directory "tools": the package is soundscape-x.y.z.tar.gz, where x, y, and z define version number. Users should download the last version available.Last versions have bug corrections and/or new features.

Once downloaded, from the console, type the following command to install the package:

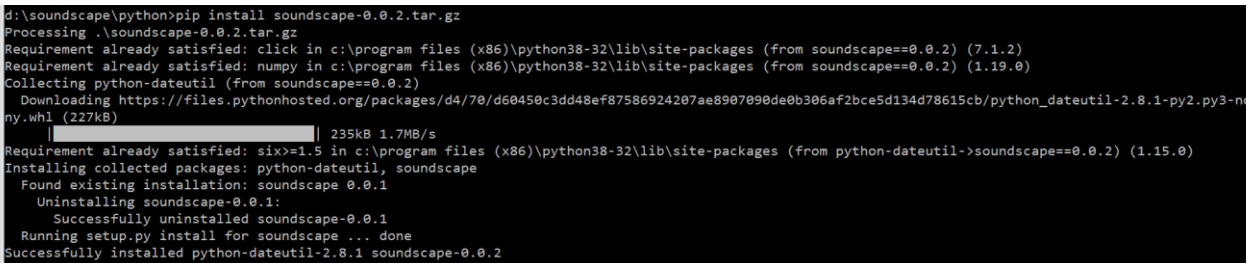
>pip install soundscape-x.y.z.tar.gz

This command installs the package (Figure 19) or, if an older version is already installed, it updates it (Figure 20). It may request administrator privileges depending on the operating system.



```
d:\soundscape\python>pip install soundscape-0.0.1.tar.gz
Processing .\soundscape-0.0.1.tar.gz
Collecting click (from soundscape==0.0.1)
  Downloading https://files.pythonhosted.org/packages/d2/3d/fa76db83bf75c4f8d338c2fd15c8d33fdd7ad23a9b5e57eb6c5de26b430e/click-7.1.2-py2.py3-none-any.whl (82
kB)
     |████████████████████████████████| 92kB 3.0MB/s
Collecting numpy (from soundscape==0.0.1)
  Downloading https://files.pythonhosted.org/packages/36/f3/d38f163624f01914e19868d15ac5fc7a612fcfbb30fd1ecb20d686551afa/numpy-1.19.0-cp38-cp38-win32.whl (10
.9MB)
     |████████████████████████████████| 11.0MB 6.4MB/s
Installing collected packages: click, numpy, soundscape
  Running setup.py install for soundscape ... done
Successfully installed click-7.1.2 numpy-1.19.0 soundscape-0.0.1
```

Figure 19. Installation of Soundscape package.



```
d:\soundscape\python>pip install soundscape-0.0.2.tar.gz
Processing .\soundscape-0.0.2.tar.gz
Requirement already satisfied: click in c:\program files (x86)\python38-32\lib\site-packages (from soundscape==0.0.2) (7.1.2)
Requirement already satisfied: numpy in c:\program files (x86)\python38-32\lib\site-packages (from soundscape==0.0.2) (1.19.0)
Collecting python-dateutil (from soundscape==0.0.2)
  Downloading https://files.pythonhosted.org/packages/d4/70/d60450c3dd48ef87586924207ae8907090de0b306af2bce5d134d78615cb/python_dateutil-2.8.1-py2.py3-n
ny.whl (227kB)
     |████████████████████████████████| 235kB 1.7MB/s
Requirement already satisfied: six>=1.5 in c:\program files (x86)\python38-32\lib\site-packages (from python-dateutil->soundscape==0.0.2) (1.15.0)
Installing collected packages: python-dateutil, soundscape
  Found existing installation: soundscape 0.0.1
    Uninstalling soundscape-0.0.1:
      Successfully uninstalled soundscape-0.0.1
  Running setup.py install for soundscape ... done
Successfully installed python-dateutil-2.8.1 soundscape-0.0.2
```

Figure 20. Update of Soundscape package.

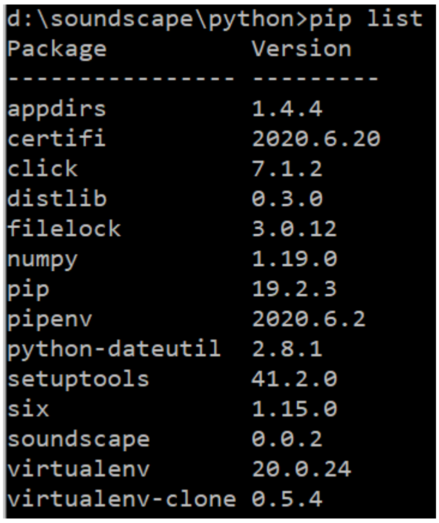
Type:

>soundscape_spl.py --help

to check if the installation procedure finished properly. No error messages should appear (seeFigure 23).

Also, the soundscape package should be visible in the pip packages list like soundscape x.y.z, according to the version number (see Figure 21):

>pip list



```
d:\soundscape\python>pip list
Package          Version
---------------- ---------
appdirs          1.4.4
certifi          2020.6.20
click            7.1.2
distlib          0.3.0
filelock         3.0.12
numpy            1.19.0
pip              19.2.3
pipenv           2020.6.2
python-dateutil  2.8.1
setuptools       41.2.0
six              1.15.0
soundscape       0.0.2
virtualenv       20.0.24
virtualenv-clone 0.5.4
```

Figure 21. List of pip packages with soundscape package.

4.3 Soundscape_spl.py

The Soundscape_spl Tool is a command line tool. It can be called through a console from any directory.

The default mode to invoke soundscape_spl tool is to type:

>**soundscape_spl.py my_file.WAV**

This command returns some information on screen, such as input metadata (Figure 22), and two csv file output with respectively 1 second and 20 second average values of the sound pressure levels (SPL) in the 1/3 octave bands centered at 63 Hz, 125 Hz, 250 Hz and 4000 Hz. An example of a csv output file is shown in Figure 30. User can therefore visualize the data, e.g. see Figure 31. Next versions of the Audio Noise Processing App will have the capability of automatically allowing data visualization.

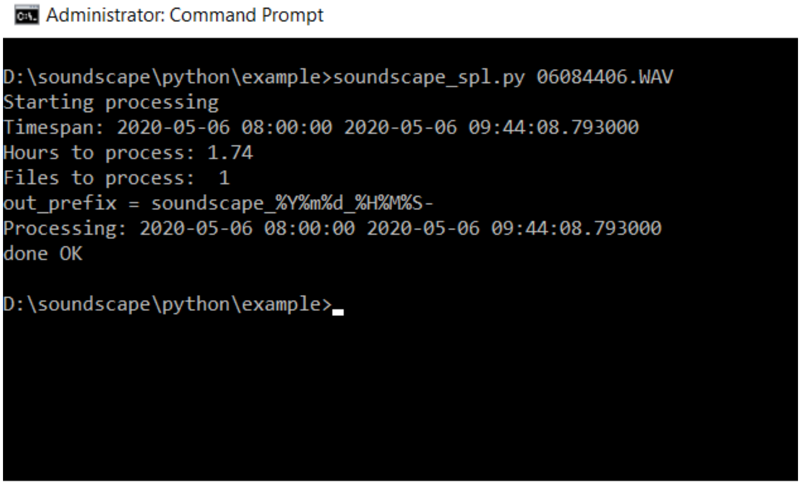
my_file.WAV must be in the same directory from where the command is launched, otherwise user must supply the whole path.

Input files can be also processed recursively:

>**soundscape_spl.py my_file_1.WAV my_file_2.WAV**

It is also possible to process all the wav files that are in the directory using the “*” character:

>**soundscape_spl.py *.WAV**



```
D:\soundscape\python\example>soundscape_spl.py 06084406.WAV
Starting processing
Timespan: 2020-05-06 08:00:00 2020-05-06 09:44:08.793000
Hours to process: 1.74
Files to process:  1
out_prefix = soundscape_%Y%m%d_%H%M%S-
Processing: 2020-05-06 08:00:00 2020-05-06 09:44:08.793000
done OK

D:\soundscape\python\example>_
```

Figure 22. Execution of Soundscape tool.

In the same way as the web app, see page 13, the tool is capable of automatically correcting some issues related to metadata of wav files generated by SonoVault Recorder.

More options can be set when users run the soundscape_spl.py. They can be shown invoking the help (Figure 23):

>**soundscape_spl.py --help**

Options:

--version return the app version:

soundscape_spl.py --version

-o, -- out_prefix allows to specify a path where to save the outputs (default is the same folder from where the command is launched):

soundscape_spl.py -o d:/soundscape/python/example/out/ my_file.WAV

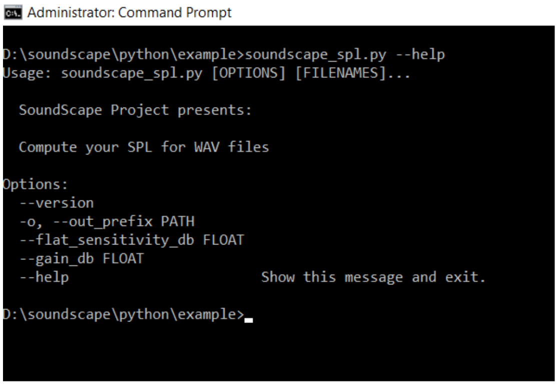
soundscape_spl.py --out_prefix d:/soundscape/python/example/out/ my_file.WAV

--flat_sensitivity_db allows to modify the sensitivity of the recorder:

soundscape_spl.py --flat_sensitivity_db 10 my_file.WAV

--gain_db allows to set the gain:

soundscape_spl.py --gain_db 10 my_file.WAV



Administrator: Command Prompt

```
D:\soundscape\python\example>soundscape_spl.py --help
Usage: soundscape_spl.py [OPTIONS] [FILENAMES]...

  SoundScape Project presents:

  Compute your SPL for WAV files

Options:
  --version
  -o, --out_prefix PATH
  --flat_sensitivity_db FLOAT
  --gain_db FLOAT
  --help                         Show this message and exit.

D:\soundscape\python\example>
```

Figure 23. Soundscape tool help option.

Together with the tool, users can download a test wav files andoutput test files. They are in folders named “example_x.y.z”, according to the toolversion, under “tool” directory.

Running soundscape_spl.py with these input files must return the very same outputs. It is a way to check that soundscape_spl.py has been properly installed and is correctly working.

4.4 Develogic_check_wavs.py

Since version 0.0.6, the develogic_check_wavs.py tool is introduced. It allows to check the integrity of wav files.

It can be used in the following way, letting the user to check one, many or all the wav files inside the directory:

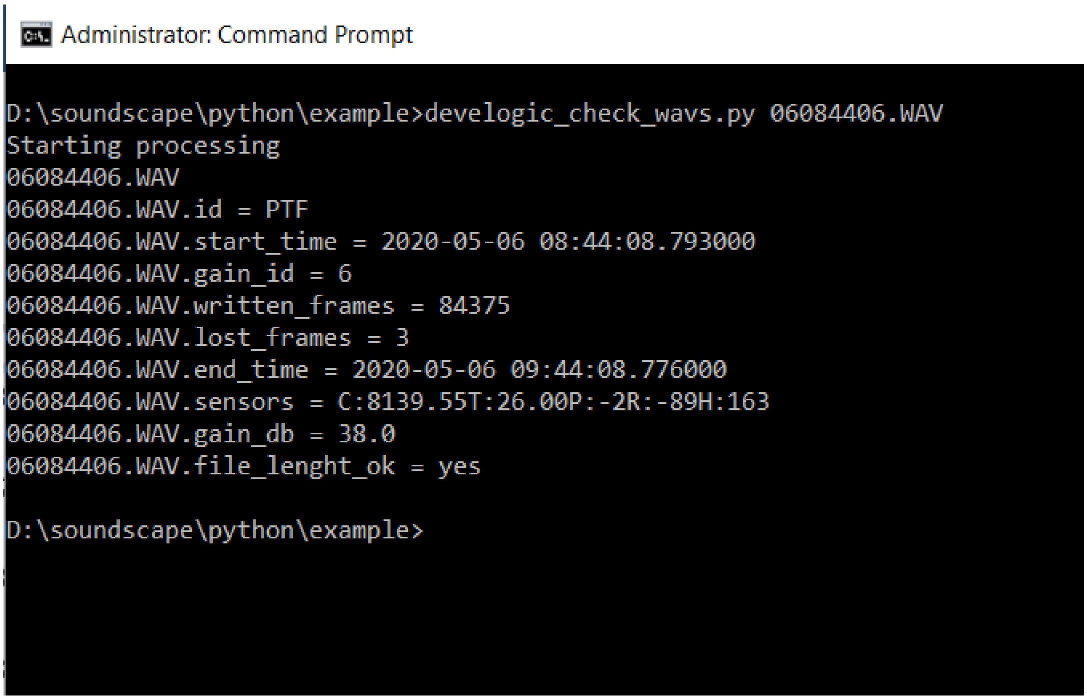
>**develogic_check_wavs.pymy_file.WAV**

>**develogic_check_wavs.py my_file_1.WAVmy_file_n.WAV**

>**develogic_check_wavs.py*.WAV**

It returns wav files metadata and a “length of file” status check, Figure 24.

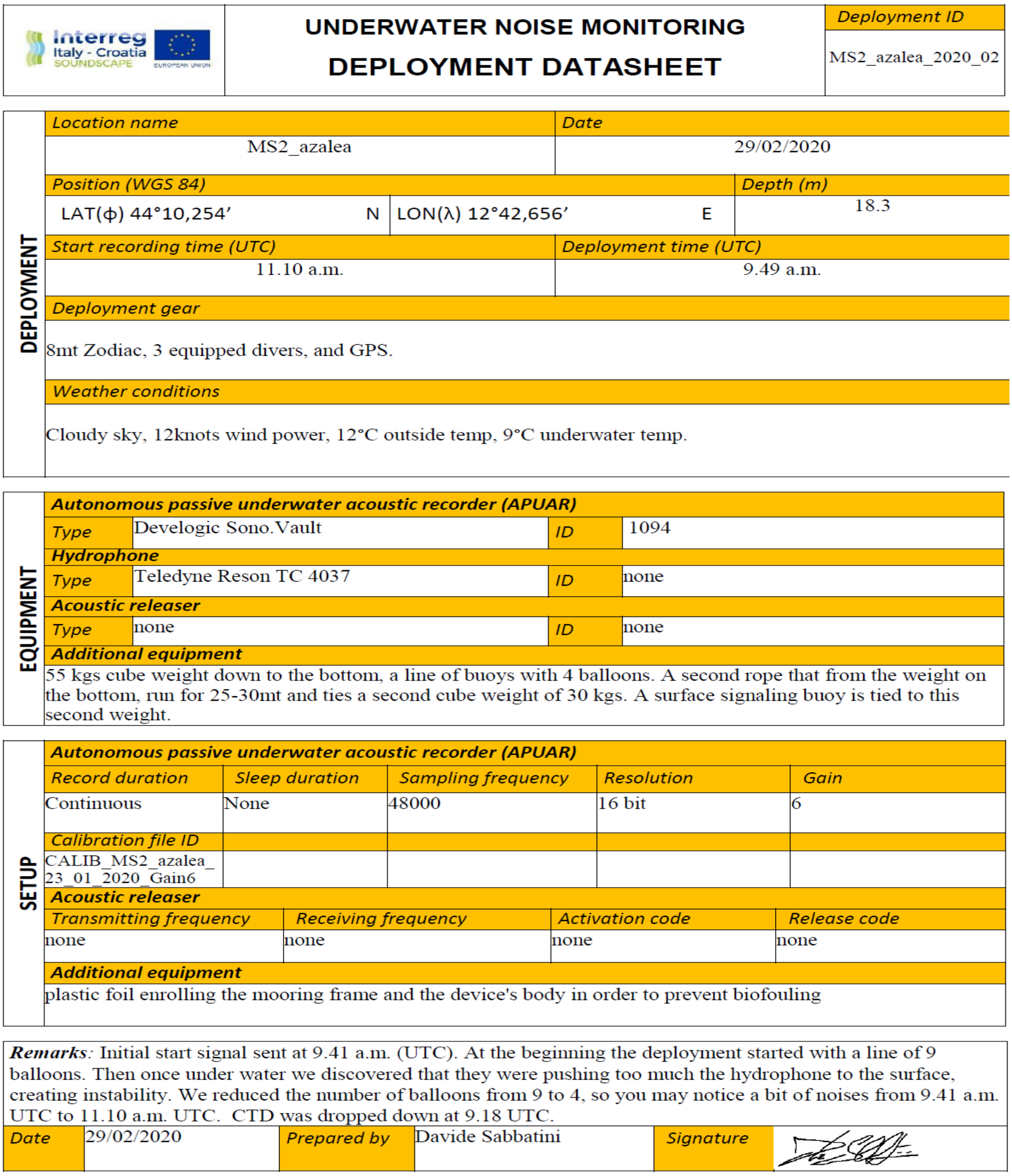
This tool does not modify or correct the wav input files.



```
D:\soundscape\python\example>develogic_check_wavs.py 06084406.WAV
Starting processing
06084406.WAV
06084406.WAV.id = PTF
06084406.WAV.start_time = 2020-05-06 08:44:08.793000
06084406.WAV.gain_id = 6
06084406.WAV.written_frames = 84375
06084406.WAV.lost_frames = 3
06084406.WAV.end_time = 2020-05-06 09:44:08.776000
06084406.WAV.sensors = C:8139.55T:26.00P:-2R:-89H:163
06084406.WAV.gain_db = 38.0
06084406.WAV.file_lenght_ok = yes

D:\soundscape\python\example>
```

Figure 24. Execution of develogic_check_wavs.py tool.

5 Appendix



	UNDERWATER NOISE MONITORING DEPLOYMENT DATASHEET	Deployment ID MS2_azalea_2020_02

DEPLOYMENT	Location name		Date	
	MS2_azalea		29/02/2020	
	Position (WGS 84)			Depth (m)
	LAT(ϕ) 44°10,254' N	LON(λ) 12°42,656' E		18.3
	Start recording time (UTC)		Deployment time (UTC)	
	11.10 a.m.		9.49 a.m.	
	Deployment gear			
	8mt Zodiac, 3 equipped divers, and GPS.			
	Weather conditions			
	Cloudy sky, 12knots wind power, 12°C outside temp, 9°C underwater temp.			

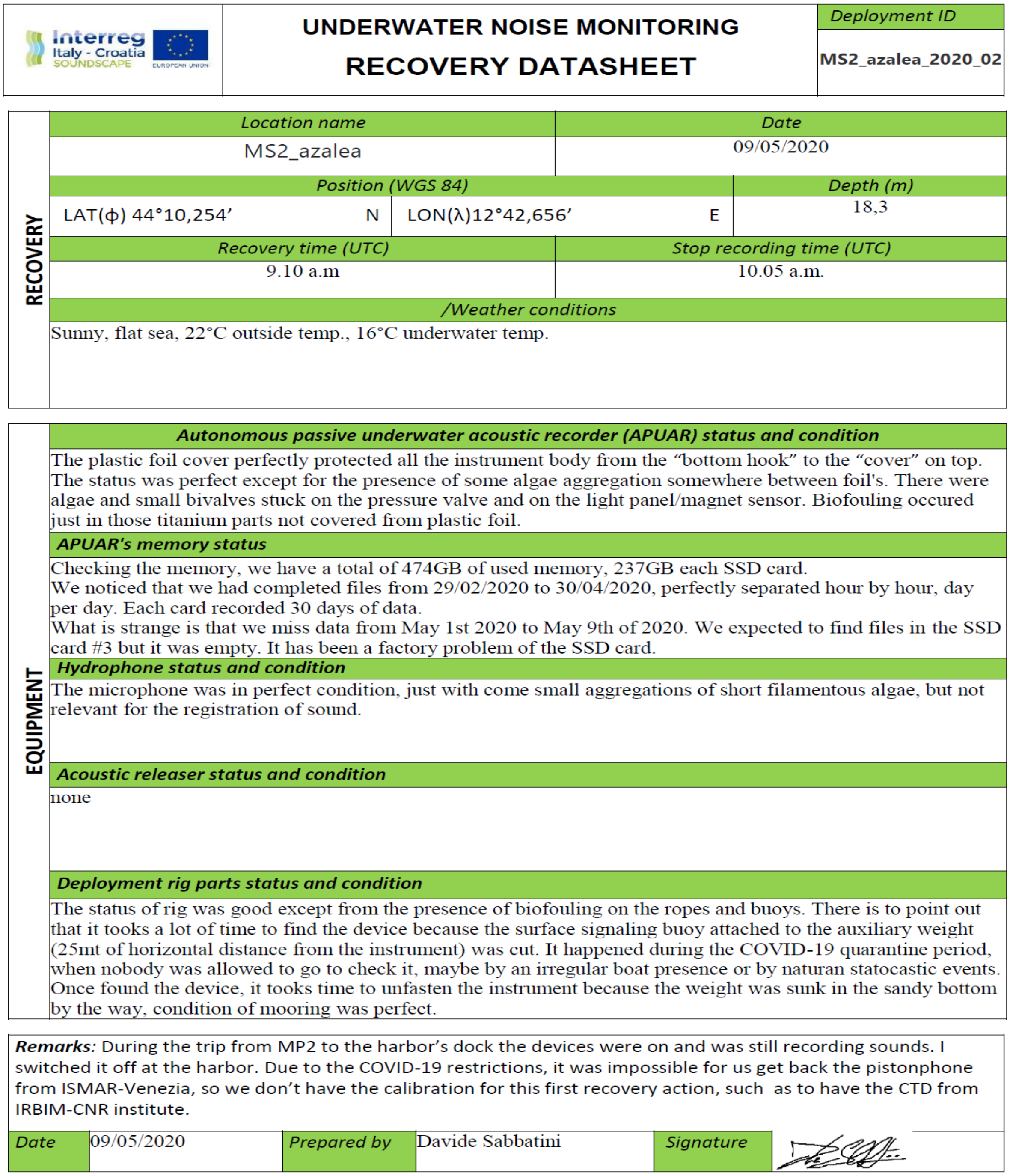
EQUIPMENT	Autonomous passive underwater acoustic recorder (APUAR)			
	Type	Develogic Sono.Vault	ID	1094
	Hydrophone			
	Type	Teledyne Reson TC 4037	ID	none
	Acoustic releaser			
	Type	none	ID	none
	Additional equipment			
	55 kgs cube weight down to the bottom, a line of buoys with 4 balloons. A second rope that from the weight on the bottom, run for 25-30mt and ties a second cube weight of 30 kgs. A surface signaling buoy is tied to this second weight.			

SETUP	Autonomous passive underwater acoustic recorder (APUAR)				
	Record duration	Sleep duration	Sampling frequency	Resolution	Gain
	Continuous	None	48000	16 bit	6
	Calibration file ID				
	CALIB_MS2_azalea_23_01_2020_Gain6				
	Acoustic releaser				
	Transmitting frequency	Receiving frequency	Activation code	Release code	
	none	none	none	none	
	Additional equipment				
	plastic foil enrolling the mooring frame and the device's body in order to prevent biofouling				

***Remarks**:* Initial start signal sent at 9.41 a.m. (UTC). At the beginning the deployment started with a line of 9 balloons. Then once under water we discovered that they were pushing too much the hydrophone to the surface, creating instability. We reduced the number of balloons from 9 to 4, so you may notice a bit of noises from 9.41 a.m. UTC to 11.10 a.m. UTC. CTD was dropped down at 9.18 UTC.

Date	29/02/2020	Prepared by	Davide Sabbatini	Signature	

Figure 25. Scan of the deployment sheet as in D-3.2.2 "Recommendations for the underwater noise monitoring procedure".



Interreg Italy - Croatia SOUNDSCAPE EUROPEAN UNION	**UNDERWATER NOISE MONITORING** **RECOVERY DATASHEET**	*Deployment ID* **MS2_azalea_2020_02**

RECOVERY

Location name		*Date*	
MS2_azalea		09/05/2020	
Position (WGS 84)			*Depth (m)*
LAT(ϕ) 44°10,254' N	LON(λ)12°42,656' E		18,3
Recovery time (UTC)		*Stop recording time (UTC)*	
9.10 a.m		10.05 a.m.	

/Weather conditions

Sunny, flat sea, 22°C outside temp., 16°C underwater temp.

EQUIPMENT

Autonomous passive underwater acoustic recorder (APUAR) status and condition

The plastic foil cover perfectly protected all the instrument body from the "bottom hook" to the "cover" on top. The status was perfect except for the presence of some algae aggregation somewhere between foil's. There were algae and small bivalves stuck on the pressure valve and on the light panel/magnet sensor. Biofouling occured just in those titanium parts not covered from plastic foil.

APUAR's memory status

Checking the memory, we have a total of 474GB of used memory, 237GB each SSD card.
We noticed that we had completed files from 29/02/2020 to 30/04/2020, perfectly separated hour by hour, day per day. Each card recorded 30 days of data.
What is strange is that we miss data from May 1st 2020 to May 9th of 2020. We expected to find files in the SSD card #3 but it was empty. It has been a factory problem of the SSD card.

Hydrophone status and condition

The microphone was in perfect condition, just with come small aggregations of short filamentous algae, but not relevant for the registration of sound.

Acoustic releaser status and condition

none

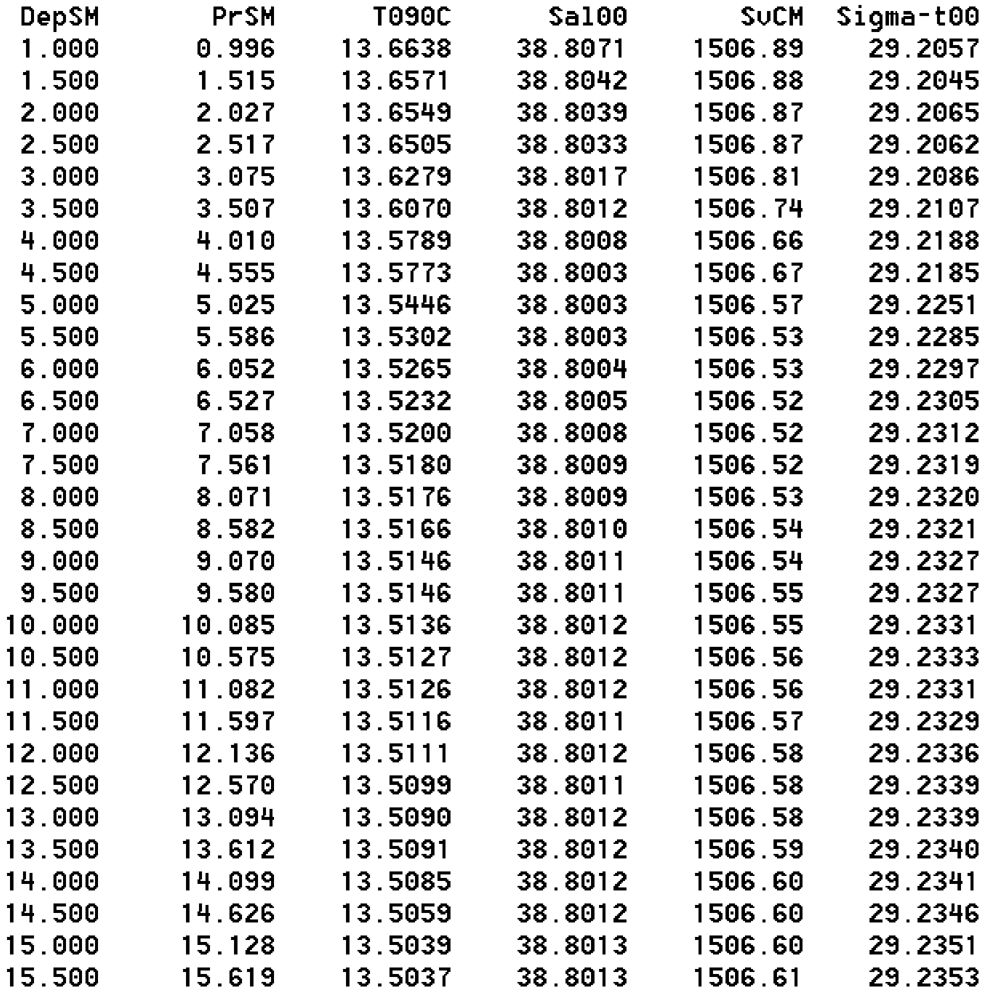
Deployment rig parts status and condition

The status of rig was good except from the presence of biofouling on the ropes and buoys. There is to point out that it tooks a lot of time to find the device because the surface signaling buoy attached to the auxiliary weight (25mt of horizontal distance from the instrument) was cut. It happened during the COVID-19 quarantine period, when nobody was allowed to go to check it, maybe by an irregular boat presence or by naturan statocastic events. Once found the device, it tooks time to unfasten the instrument because the weight was sunk in the sandy bottom by the way, condition of mooring was perfect.

Remarks: During the trip from MP2 to the harbor's dock the devices were on and was still recording sounds. I switched it off at the harbor. Due to the COVID-19 restrictions, it was impossible for us get back the pistonphone from ISMAR-Venezia, so we don't have the calibration for this first recovery action, such as to have the CTD from IRBIM-CNR institute.

Date	09/05/2020	*Prepared by*	Davide Sabbatini	*Signature*	

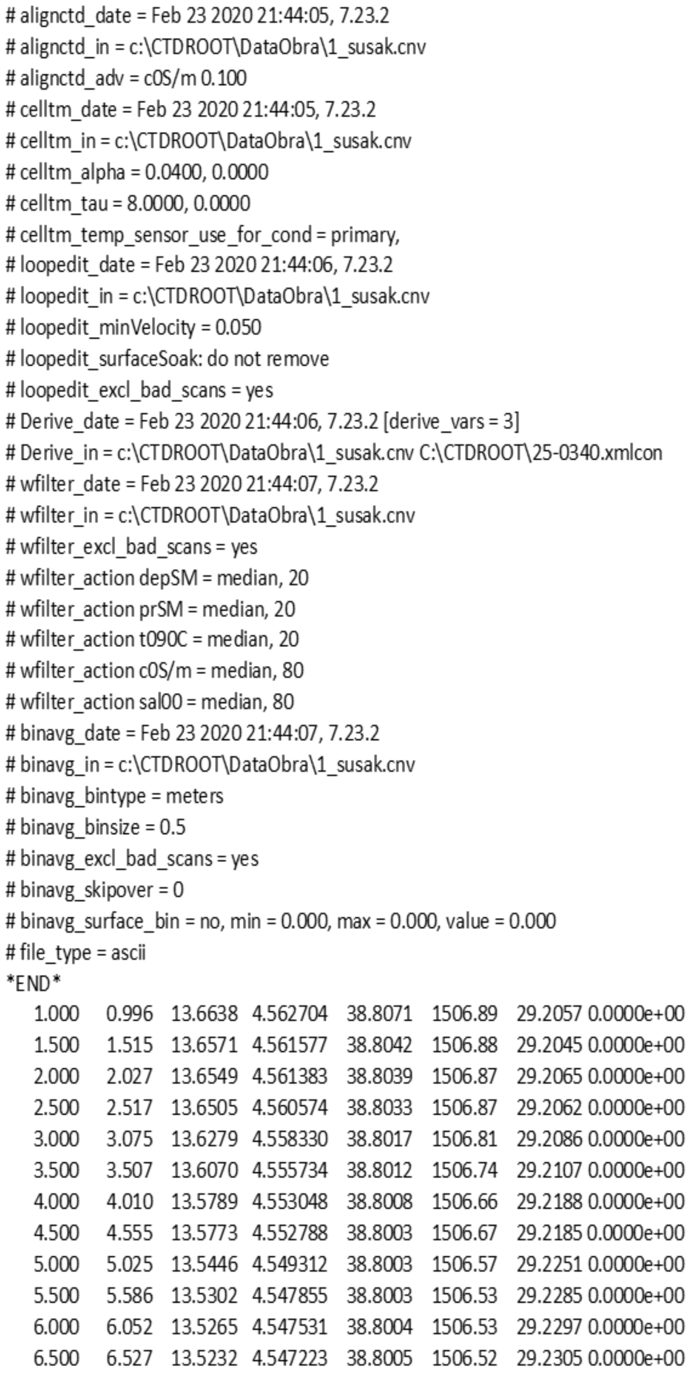
Figure 26. Scan of the recovery sheet as in D-3.2.2 "Recommendations for the underwater noise monitoring procedure".



```
   DepSM       PrSM      T090C      Sal00       SvCM  Sigma-t00
   1.000      0.996    13.6638    38.8071    1506.89    29.2057
   1.500      1.515    13.6571    38.8042    1506.88    29.2045
   2.000      2.027    13.6549    38.8039    1506.87    29.2065
   2.500      2.517    13.6505    38.8033    1506.87    29.2062
   3.000      3.075    13.6279    38.8017    1506.81    29.2086
   3.500      3.507    13.6070    38.8012    1506.74    29.2107
   4.000      4.010    13.5789    38.8008    1506.66    29.2188
   4.500      4.555    13.5773    38.8003    1506.67    29.2185
   5.000      5.025    13.5446    38.8003    1506.57    29.2251
   5.500      5.586    13.5302    38.8003    1506.53    29.2285
   6.000      6.052    13.5265    38.8004    1506.53    29.2297
   6.500      6.527    13.5232    38.8005    1506.52    29.2305
   7.000      7.058    13.5200    38.8008    1506.52    29.2312
   7.500      7.561    13.5180    38.8009    1506.52    29.2319
   8.000      8.071    13.5176    38.8009    1506.53    29.2320
   8.500      8.582    13.5166    38.8010    1506.54    29.2321
   9.000      9.070    13.5146    38.8011    1506.54    29.2327
   9.500      9.580    13.5146    38.8011    1506.55    29.2327
  10.000     10.085    13.5136    38.8012    1506.55    29.2331
  10.500     10.575    13.5127    38.8012    1506.56    29.2333
  11.000     11.082    13.5126    38.8012    1506.56    29.2331
  11.500     11.597    13.5116    38.8011    1506.57    29.2329
  12.000     12.136    13.5111    38.8012    1506.58    29.2336
  12.500     12.570    13.5099    38.8011    1506.58    29.2339
  13.000     13.094    13.5090    38.8012    1506.58    29.2339
  13.500     13.612    13.5091    38.8012    1506.59    29.2340
  14.000     14.099    13.5085    38.8012    1506.60    29.2341
  14.500     14.626    13.5059    38.8012    1506.60    29.2346
  15.000     15.128    13.5039    38.8013    1506.60    29.2351
  15.500     15.619    13.5037    38.8013    1506.61    29.2353
```

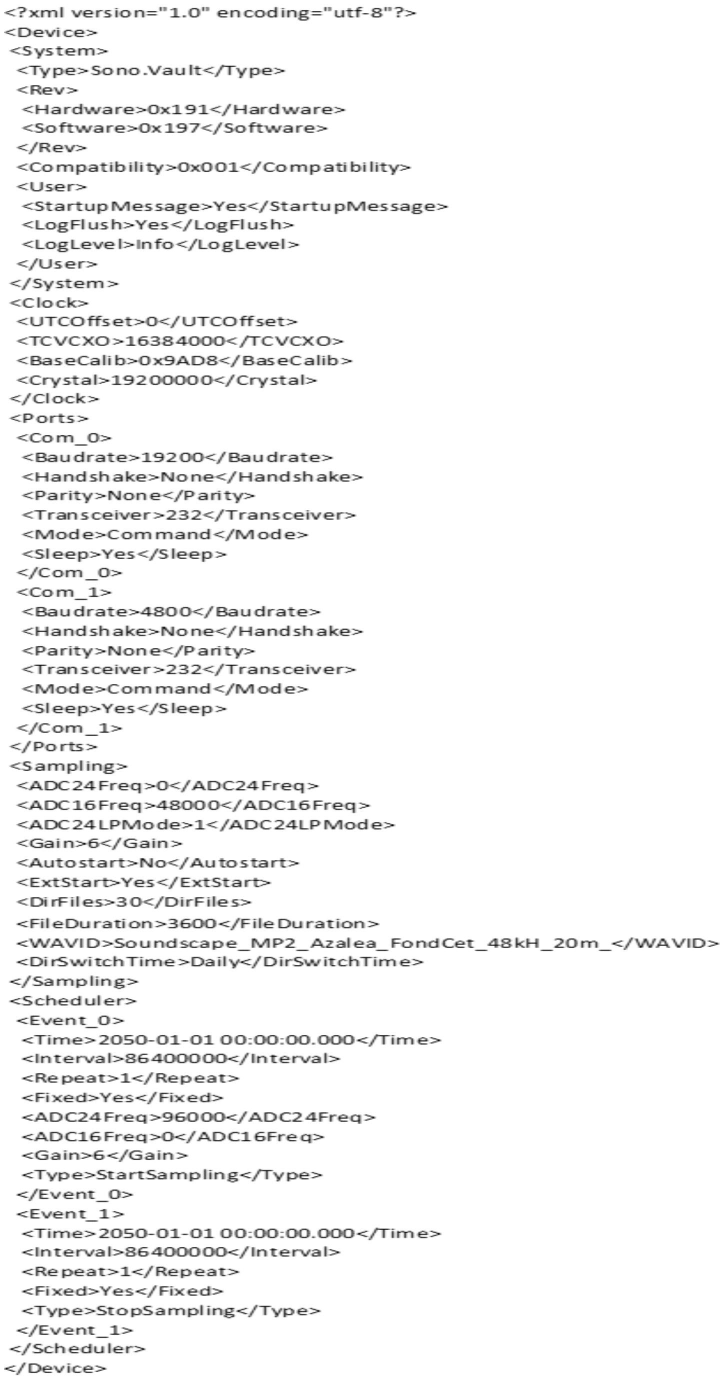
Figure 27. Format of CTD ASCii file.

```
* Sea-Bird SBE25 Data File:
* FileName = C:\CTDROOT\DataObra\SUSAK.hex
* Software Version 1.59
* Temperature SN = 4295
* Conductivity SN = 2753
* System UpLoad Time = Feb 22 2020 13:11:35
* ds
* SBE 25 CTD  V 4.1a SN 340   02/22/20  13:10:50.094
* external pressure sensor, range = 508 psia,  tcval = -63
* xtal = 9437345   clk = 32768.866   vmain = 13.5   iop = 158   vlith = 5.4
* ncasts = 1   samples = 2393   free = 1045689   lwait = 0 msec
*
* CTD configuration:
* number of scans averaged = 1,  data stored at 8 scans per second
* real time data transmitted at 1 scans per second
* minimum conductivity frequency for pump turn on = 4000
* battery type = ALKALINE
*
* 0 external voltages sampled
*

* S>
* dh
* cast 0  02/22 12:27:25  smpls 0 to 2392  nv = 0  avg = 1  stp = switch of

* S>
# nquan = 8
# nvalues = 39
# units = specified
# name 0 = depSM: Depth [salt water, m], lat = 43.00
# name 1 = prSM: Pressure, Strain Gauge [db]
# name 2 = t090C: Temperature [ITS-90, deg C]
# name 3 = c0S/m: Conductivity [S/m]
# name 4 = sal00: Salinity, Practical [PSU]
# name 5 = svCM: Sound Velocity [Chen-Millero, m/s]
# name 6 = sigma-t00: Density [sigma-t, kg/m^3 ]
# name 7 = flag: flag
# span 0 =      1.000,     20.000
# span 1 =      0.996,     20.173
# span 2 =    13.4987,    13.6638
# span 3 =   4.545324,   4.562704
# span 4 =    38.8003,    38.8071
# span 5 =    1506.52,    1506.89
# span 6 =    29.2045,    29.2364
# span 7 = 0.0000e+00, 0.0000e+00
# interval = meters: 0.5
# start_time = Feb 22 2020 12:27:25 [Instrument's time stamp, header]
# bad_flag = -9.990e-29
# <Sensors count="3" >
#   <sensor Channel="1" >
#     <!-- Frequency 0, Temperature -->
#     <TemperatureSensor SensorID="55" >
#       <SerialNumber>4295</SerialNumber>
#       <CalibrationDate>03-Jul-19</CalibrationDate>
#       <UseG_J>1</UseG_J>
#       <A>0.00000000e+000</A>
#       <B>0.00000000e+000</B>
#       <C>0.00000000e+000</C>
#       <D>0.00000000e+000</D>
#       <F0_Old>0.000</F0_Old>
#       <G>4.30602279e-003</G>
#      <H>6.27196022e-004</H>
#      <I>1.88387461e-005</I>
#      <J>1.16828353e-006</J>
#      <F0>1000.000</F0>
#      <Slope>1.00000000</Slope>
#      <Offset>0.0000</Offset>
#    </TemperatureSensor>
#  </sensor>
#  <sensor Channel="2" >
#    <!-- Frequency 1, Conductivity -->
#    <ConductivitySensor SensorID="3" >
#      <SerialNumber>2753</SerialNumber>
#      <CalibrationDate>17-Jul-19</CalibrationDate>
#      <UseG_J>1</UseG_J>
#      <!-- Cell const and series R are applicable only for wide range sensors. -->
#      <SeriesR>0.0000</SeriesR>
#      <CellConst>2000.0000</CellConst>
#      <ConductivityType>0</ConductivityType>
#      <Coefficients equation="0" >
#        <A>0.00000000e+000</A>
#        <B>0.00000000e+000</B>
#        <C>0.00000000e+000</C>
#        <D>0.00000000e+000</D>
#        <M>0.0</M>
#        <CPcor>-9.57000000e-008</CPcor>
#      </Coefficients>
#      <Coefficients equation="1" >
#        <G>-1.06167418e+001</G>
#        <H>1.48354631e+000</H>
#        <I>-1.09261844e-003</I>
#        <J>1.58581447e-004</J>
#        <CPcor>-9.57000000e-008</CPcor>
#        <CTcor>3.2500e-006</CTcor>
#        <!-- WBOTC not applicable unless ConductivityType = 1. -->
#        <WBOTC>0.00000000e+000</WBOTC>
#      </Coefficients>
#      <Slope>1.00000000</Slope>
#      <Offset>0.00000</Offset>
#    </ConductivitySensor>
#  </sensor>
#  <sensor Channel="3" >
#    <!-- Pressure voltage, Pressure, Strain Gauge -->
#    <PressureSensor SensorID="49" >
#      <SerialNumber>0505</SerialNumber>
#      <CalibrationDate>31-Jul-19</CalibrationDate>
#      <A0>3.178598e+002</A0>
#      <A1>-8.822971e-002</A1>
#      <A2>-4.922155e-009</A2>
#      <Offset>0.00000</Offset>
#    </PressureSensor>
#  </sensor>
# </Sensors>
# datcnv_date = Feb 23 2020 21:44:03, 7.23.2 [datcnv_vars = 4]
# datcnv_in = c:\CTDROOT\DataObra\1_susak.hex C:\CTDROOT\25-0340.xmlcon
# datcnv_skipover = 600
# filter_date = Feb 23 2020 21:44:04, 7.23.2
# filter_in = c:\CTDROOT\DataObra\1_susak.cnv
# filter_low_pass_tc_A = 0.100
# filter_low_pass_tc_B = 0.500
# filter_low_pass_A_vars = depSM t090C c0S/m
# filter_low_pass_B_vars = prSM
```



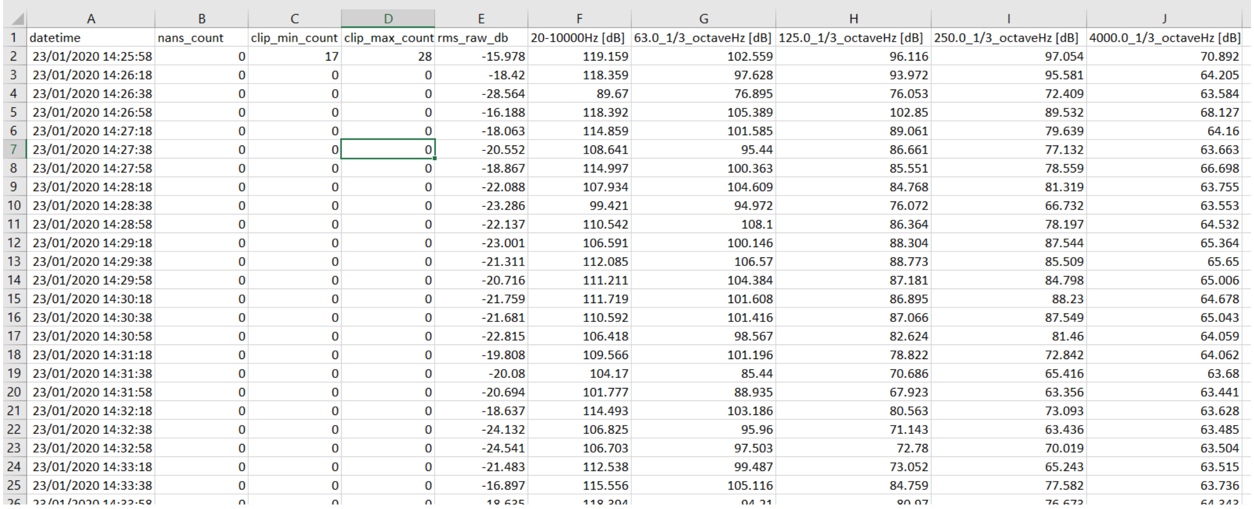
```
# alignctd_date = Feb 23 2020 21:44:05, 7.23.2
# alignctd_in = c:\CTDROOT\DataObra\1_susak.cnv
# alignctd_adv = c0S/m 0.100
# celltm_date = Feb 23 2020 21:44:05, 7.23.2
# celltm_in = c:\CTDROOT\DataObra\1_susak.cnv
# celltm_alpha = 0.0400, 0.0000
# celltm_tau = 8.0000, 0.0000
# celltm_temp_sensor_use_for_cond = primary,
# loopedit_date = Feb 23 2020 21:44:06, 7.23.2
# loopedit_in = c:\CTDROOT\DataObra\1_susak.cnv
# loopedit_minVelocity = 0.050
# loopedit_surfaceSoak: do not remove
# loopedit_excl_bad_scans = yes
# Derive_date = Feb 23 2020 21:44:06, 7.23.2 [derive_vars = 3]
# Derive_in = c:\CTDROOT\DataObra\1_susak.cnv C:\CTDROOT\25-0340.xmlcon
# wfilter_date = Feb 23 2020 21:44:07, 7.23.2
# wfilter_in = c:\CTDROOT\DataObra\1_susak.cnv
# wfilter_excl_bad_scans = yes
# wfilter_action depSM = median, 20
# wfilter_action prSM = median, 20
# wfilter_action t090C = median, 20
# wfilter_action c0S/m = median, 80
# wfilter_action sal00 = median, 80
# binavg_date = Feb 23 2020 21:44:07, 7.23.2
# binavg_in = c:\CTDROOT\DataObra\1_susak.cnv
# binavg_bintype = meters
# binavg_binsize = 0.5
# binavg_excl_bad_scans = yes
# binavg_skipover = 0
# binavg_surface_bin = no, min = 0.000, max = 0.000, value = 0.000
# file_type = ascii
*END*
    1.000    0.996   13.6638  4.562704   38.8071   1506.89   29.2057 0.0000e+00
    1.500    1.515   13.6571  4.561577   38.8042   1506.88   29.2045 0.0000e+00
    2.000    2.027   13.6549  4.561383   38.8039   1506.87   29.2065 0.0000e+00
    2.500    2.517   13.6505  4.560574   38.8033   1506.87   29.2062 0.0000e+00
    3.000    3.075   13.6279  4.558330   38.8017   1506.81   29.2086 0.0000e+00
    3.500    3.507   13.6070  4.555734   38.8012   1506.74   29.2107 0.0000e+00
    4.000    4.010   13.5789  4.553048   38.8008   1506.66   29.2188 0.0000e+00
    4.500    4.555   13.5773  4.552788   38.8003   1506.67   29.2185 0.0000e+00
    5.000    5.025   13.5446  4.549312   38.8003   1506.57   29.2251 0.0000e+00
    5.500    5.586   13.5302  4.547855   38.8003   1506.53   29.2285 0.0000e+00
    6.000    6.052   13.5265  4.547531   38.8004   1506.53   29.2297 0.0000e+00
    6.500    6.527   13.5232  4.547223   38.8005   1506.52   29.2305 0.0000e+00
```

Figure 28.Format of CTD cnv file.



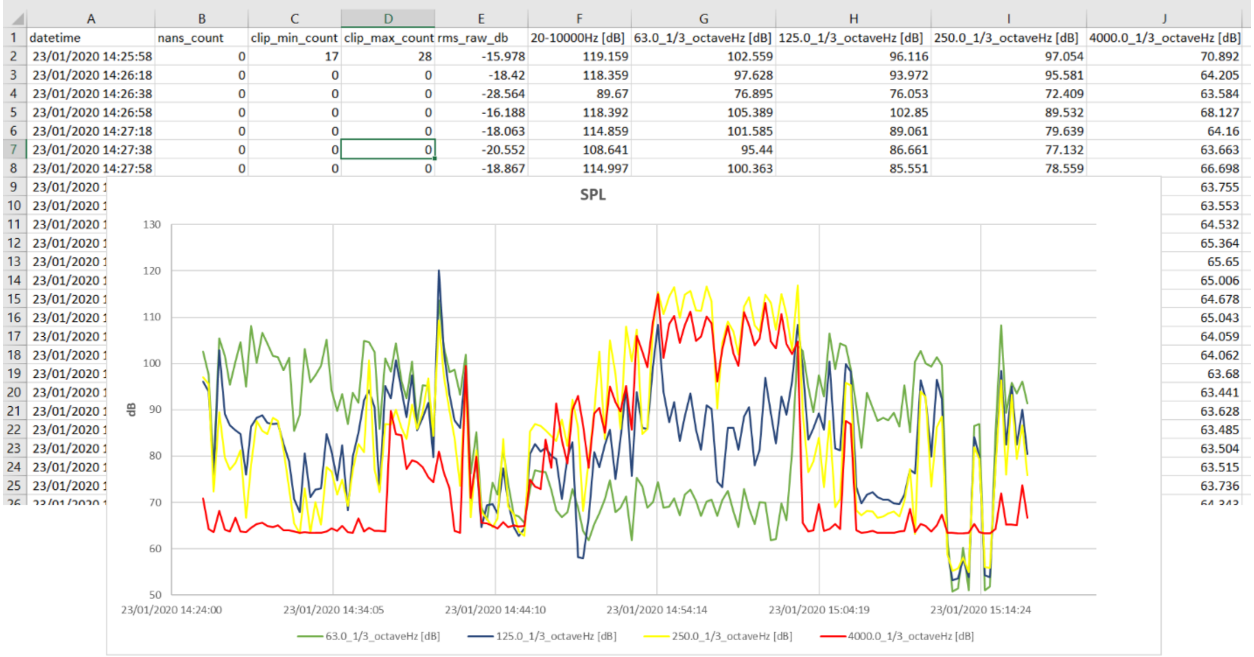
```xml
<?xml version="1.0" encoding="utf-8"?>
<Device>
 <System>
  <Type>Sono.Vault</Type>
  <Rev>
   <Hardware>0x191</Hardware>
   <Software>0x197</Software>
  </Rev>
  <Compatibility>0x001</Compatibility>
  <User>
   <StartupMessage>Yes</StartupMessage>
   <LogFlush>Yes</LogFlush>
   <LogLevel>Info</LogLevel>
  </User>
 </System>
 <Clock>
  <UTCOffset>0</UTCOffset>
  <TCVCXO>16384000</TCVCXO>
  <BaseCalib>0x9AD8</BaseCalib>
  <Crystal>19200000</Crystal>
 </Clock>
 <Ports>
  <Com_0>
   <Baudrate>19200</Baudrate>
   <Handshake>None</Handshake>
   <Parity>None</Parity>
   <Transceiver>232</Transceiver>
   <Mode>Command</Mode>
   <Sleep>Yes</Sleep>
  </Com_0>
  <Com_1>
   <Baudrate>4800</Baudrate>
   <Handshake>None</Handshake>
   <Parity>None</Parity>
   <Transceiver>232</Transceiver>
   <Mode>Command</Mode>
   <Sleep>Yes</Sleep>
  </Com_1>
 </Ports>
 <Sampling>
  <ADC24Freq>0</ADC24Freq>
  <ADC16Freq>48000</ADC16Freq>
  <ADC24LPMode>1</ADC24LPMode>
  <Gain>6</Gain>
  <Autostart>No</Autostart>
  <ExtStart>Yes</ExtStart>
  <DirFiles>30</DirFiles>
  <FileDuration>3600</FileDuration>
  <WAVID>Soundscape_MP2_Azalea_FondCet_48kH_20m_</WAVID>
  <DirSwitchTime>Daily</DirSwitchTime>
 </Sampling>
 <Scheduler>
  <Event_0>
   <Time>2050-01-01 00:00:00.000</Time>
   <Interval>86400000</Interval>
   <Repeat>1</Repeat>
   <Fixed>Yes</Fixed>
   <ADC24Freq>96000</ADC24Freq>
   <ADC16Freq>0</ADC16Freq>
   <Gain>6</Gain>
   <Type>StartSampling</Type>
  </Event_0>
  <Event_1>
   <Time>2050-01-01 00:00:00.000</Time>
   <Interval>86400000</Interval>
   <Repeat>1</Repeat>
   <Fixed>Yes</Fixed>
   <Type>StopSampling</Type>
  </Event_1>
 </Scheduler>
</Device>
```

Figure 29. Format of xml recorder configuration file.



	A	B	C	D	E	F	G	H	I	J
1	datetime	nans_count	clip_min_count	clip_max_count	rms_raw_db	20-10000Hz [dB]	63.0_1/3_octaveHz [dB]	125.0_1/3_octaveHz [dB]	250.0_1/3_octaveHz [dB]	4000.0_1/3_octaveHz [dB]
2	23/01/2020 14:25:58	0	17	28	-15.978	119.159	102.559	96.116	97.054	70.892
3	23/01/2020 14:26:18	0	0	0	-18.42	118.359	97.628	93.972	95.581	64.205
4	23/01/2020 14:26:38	0	0	0	-28.564	89.67	76.895	76.053	72.409	63.584
5	23/01/2020 14:26:58	0	0	0	-16.188	118.392	105.389	102.85	89.532	68.127
6	23/01/2020 14:27:18	0	0	0	-18.063	114.859	101.585	89.061	79.639	64.16
7	23/01/2020 14:27:38	0	0	0	-20.552	108.641	95.44	86.661	77.132	63.663
8	23/01/2020 14:27:58	0	0	0	-18.867	114.997	100.363	85.551	78.559	66.698
9	23/01/2020 14:28:18	0	0	0	-22.088	107.934	104.609	84.768	81.319	63.755
10	23/01/2020 14:28:38	0	0	0	-23.286	99.421	94.972	76.072	66.732	63.553
11	23/01/2020 14:28:58	0	0	0	-22.137	110.542	108.1	86.364	78.197	64.532
12	23/01/2020 14:29:18	0	0	0	-23.001	106.591	100.146	88.304	87.544	65.364
13	23/01/2020 14:29:38	0	0	0	-21.311	112.085	106.57	88.773	85.509	65.65
14	23/01/2020 14:29:58	0	0	0	-20.716	111.211	104.384	87.181	84.798	65.006
15	23/01/2020 14:30:18	0	0	0	-21.759	111.719	101.608	86.895	88.23	64.678
16	23/01/2020 14:30:38	0	0	0	-21.681	110.592	101.416	87.066	87.549	65.043
17	23/01/2020 14:30:58	0	0	0	-22.815	106.418	98.567	82.624	81.46	64.059
18	23/01/2020 14:31:18	0	0	0	-19.808	109.566	101.196	78.822	72.842	64.062
19	23/01/2020 14:31:38	0	0	0	-20.08	104.17	85.44	70.686	65.416	63.68
20	23/01/2020 14:31:58	0	0	0	-20.694	101.777	88.935	67.923	63.356	63.441
21	23/01/2020 14:32:18	0	0	0	-18.637	114.493	103.186	80.563	73.093	63.628
22	23/01/2020 14:32:38	0	0	0	-24.132	106.825	95.96	71.143	63.436	63.485
23	23/01/2020 14:32:58	0	0	0	-24.541	106.703	97.503	72.78	70.019	63.504
24	23/01/2020 14:33:18	0	0	0	-21.483	112.538	99.487	73.052	65.243	63.515
25	23/01/2020 14:33:38	0	0	0	-16.897	115.556	105.116	84.759	77.582	63.736
26	23/01/2020 14:33:58	0	0	0	-18.635	118.394	94.21	80.97	76.673	64.343

Figure 30. Example of a csv output file.



	A	B	C	D	E	F	G	H	I	J
1	datetime	nans_count	clip_min_count	clip_max_count	rms_raw_db	20-10000Hz [dB]	63.0_1/3_octaveHz [dB]	125.0_1/3_octaveHz [dB]	250.0_1/3_octaveHz [dB]	4000.0_1/3_octaveHz [dB]
2	23/01/2020 14:25:58	0	17	28	-15.978	119.159	102.559	96.116	97.054	70.892
3	23/01/2020 14:26:18	0	0	0	-18.42	118.359	97.628	93.972	95.581	64.205
4	23/01/2020 14:26:38	0	0	0	-28.564	89.67	76.895	76.053	72.409	63.584
5	23/01/2020 14:26:58	0	0	0	-16.188	118.392	105.389	102.85	89.532	68.127
6	23/01/2020 14:27:18	0	0	0	-18.063	114.859	101.585	89.061	79.639	64.16
7	23/01/2020 14:27:38	0	0	0	-20.552	108.641	95.44	86.661	77.132	63.663
8	23/01/2020 14:27:58	0	0	0	-18.867	114.997	100.363	85.551	78.559	66.698
9	23/01/2020 1									63.755
10	23/01/2020 1									63.553
11	23/01/2020 1									64.532
12	23/01/2020 1									65.364
13	23/01/2020 1									65.65
14	23/01/2020 1									65.006
15	23/01/2020 1									64.678
16	23/01/2020 1									65.043
17	23/01/2020 1									64.059
18	23/01/2020 1									64.062
19	23/01/2020 1									63.68
20	23/01/2020 1									63.441
21	23/01/2020 1									63.628
22	23/01/2020 1									63.485
23	23/01/2020 1									63.504
24	23/01/2020 1									63.515
25	23/01/2020 1									63.736

Figure 31. Example of data visualization. Automatic data visualization will be added in next App updates.