



# InSite-Lite Seismic Processor: User Operations Manual

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ISO 9001:2015

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Applied Seismology Consulting Ltd. is an ISO 9001:2015 certified company and operates a Quality Management System that provides quality assurance of our products and management procedures.

### **Acknowledgments**

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InSite-Lite is the free version of ASC's InSite Seismic Processor. This version has limited functionality. Functions only available only for users of the full version of InSite show a '\$' symbol. Contact us at [asc-info@appliedseismology.co.uk](mailto:asc-info@appliedseismology.co.uk) for information about how to upgrade to the full version.

InSite is an integrated data acquisition, management, processing, visualization and interpretation software developed for seismological studies. InSite provides a solution for all seismology applications, ranging in scale from acoustic emissions in the laboratory, through microseismics around mining and petroleum fields, up to regional-scale earthquakes.

The following sections present a summary on how to install and work with an example project in InSite-Lite. The help menu in InSite Lite cover all the functions in InSite. You can also find further tutorials and demonstration videos in the 'Support' section of our website [appliedseismology.co.uk](http://appliedseismology.co.uk).

## 1. Step 1 InSite-Lite Installation

After downloading the installation file, please follow the following steps:

- executing it will launch the dialog shown in Figure 1. Click Next to continue
- The second screen (Figure 2) in the installation dialog shows the terms and conditions of use of InSite-Lite. Scroll down to read the full terms and click 'I agree' to continue. By continuing with the installation, the user agrees with ASC's terms and conditions.
- The next screen shows the Privacy Policy (Figure 3). Click Next to continue with the installation. By clicking 'Next' the user accepts CopyMinder's Privacy Policy.
- The next step checks the installation of the prerequisite VC 2010 C++ (Figure 4). Click Next to proceed.
- Select the PC users with access to InSite-Lite (Figure 5). Click 'Next' to proceed.
- Choose the installation folder (Figure 6). By default, InSite-Lite is installed in 'C:\Program Files\ASC\InSite-Lite'. Click 'Install' to proceed.
- After Licence key installed a confirmation screen is reached (Figure 8). Click 'Next' to finalise installation.
- Once installation is completed a confirmation screen is shown (Figure 9). Click 'Finish' to exit the installation.

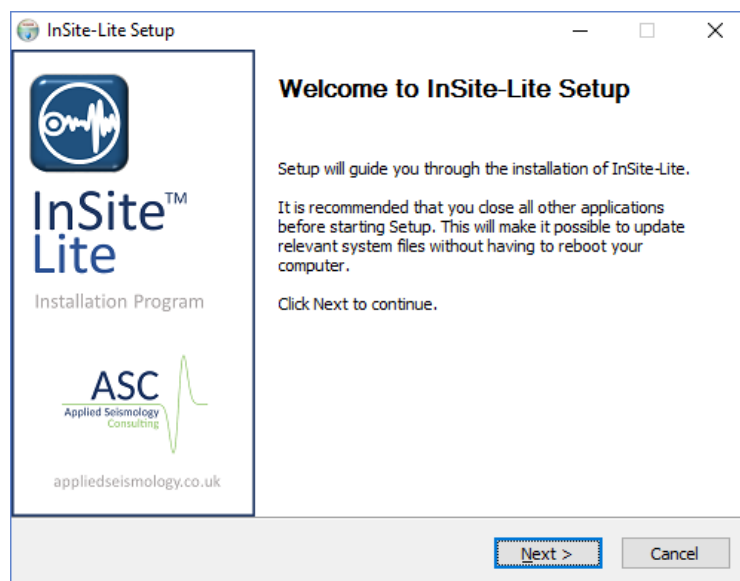


Figure 1: InSite-Lite setup program. Welcome screen

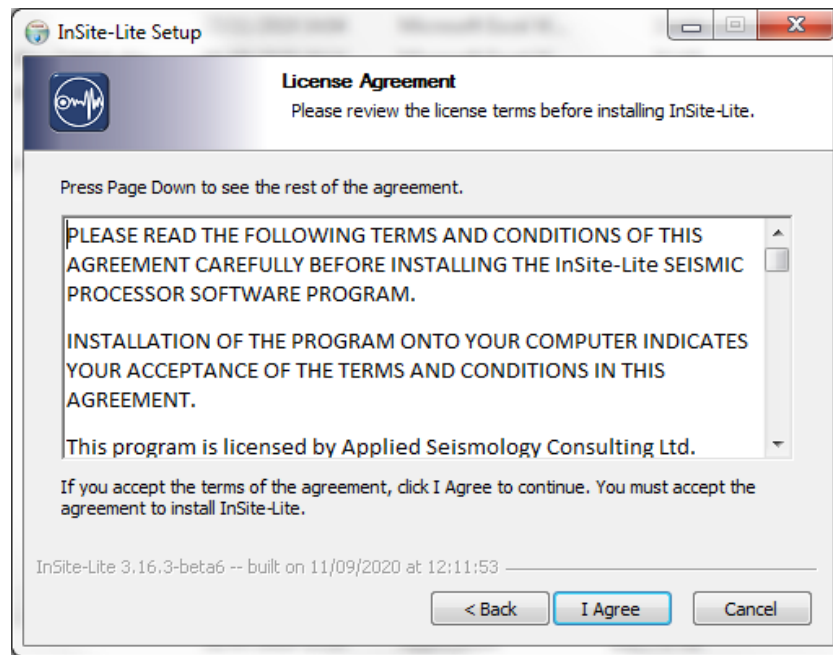


Figure 2: InSite-Lite setup program. Licence Agreement.

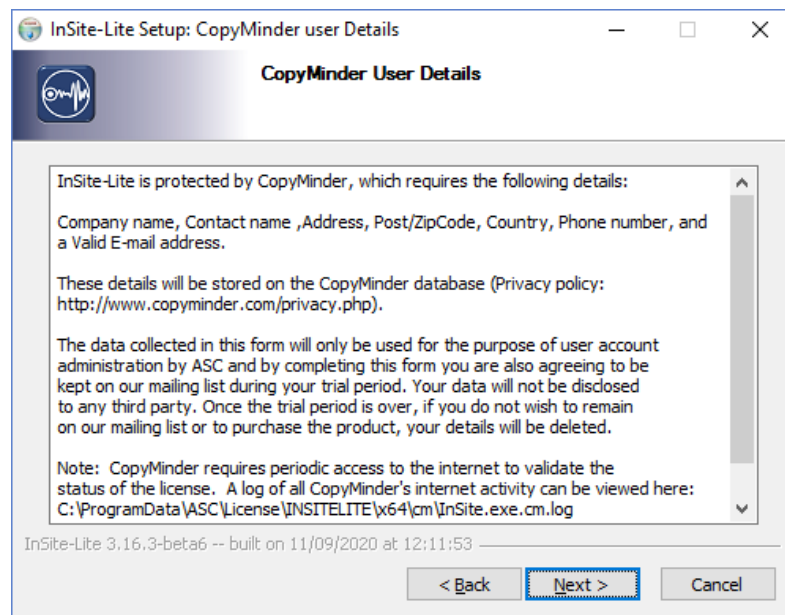


Figure 3: InSite-Lite setup program. CopyMinder Privacy Policy.

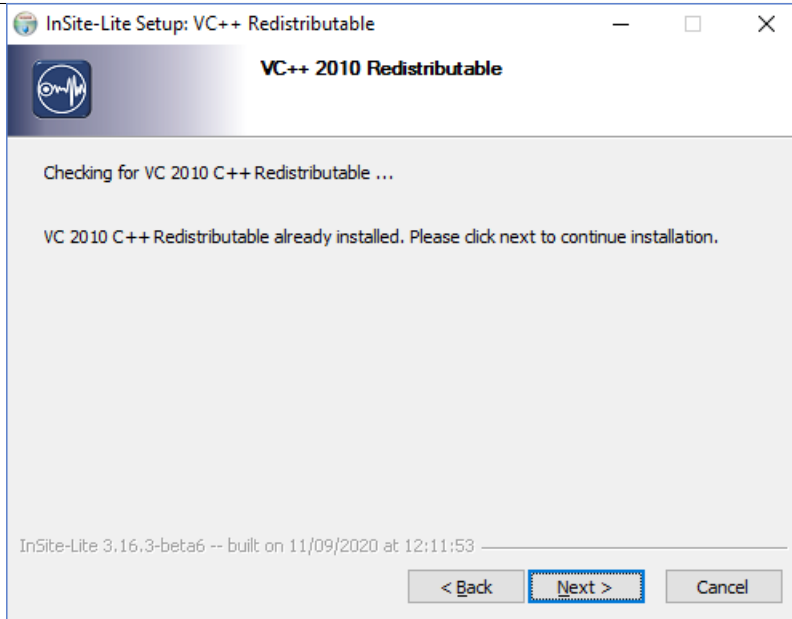


Figure 4: InSite-Lite setup program. Installation of VC 2010 C++ Redistributable pack.

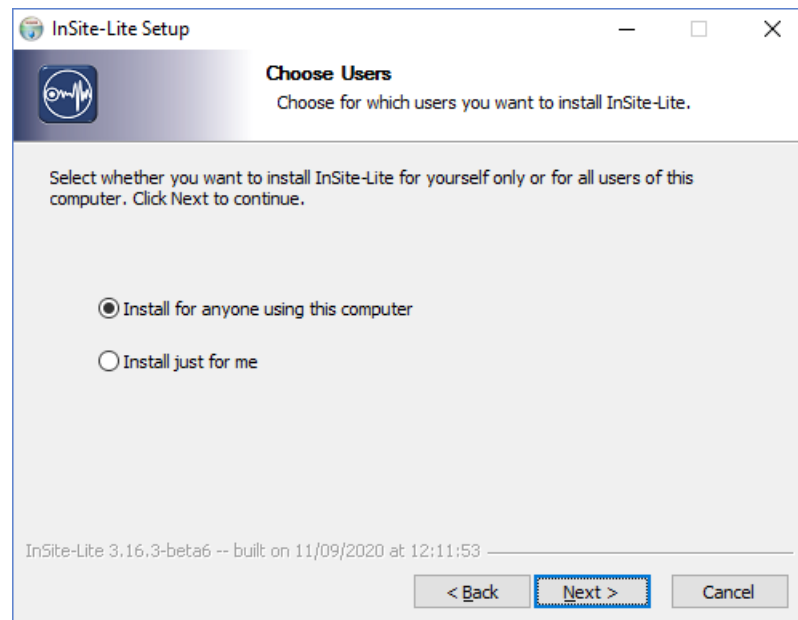


Figure 5: InSite-Lite setup program. User access configuration.

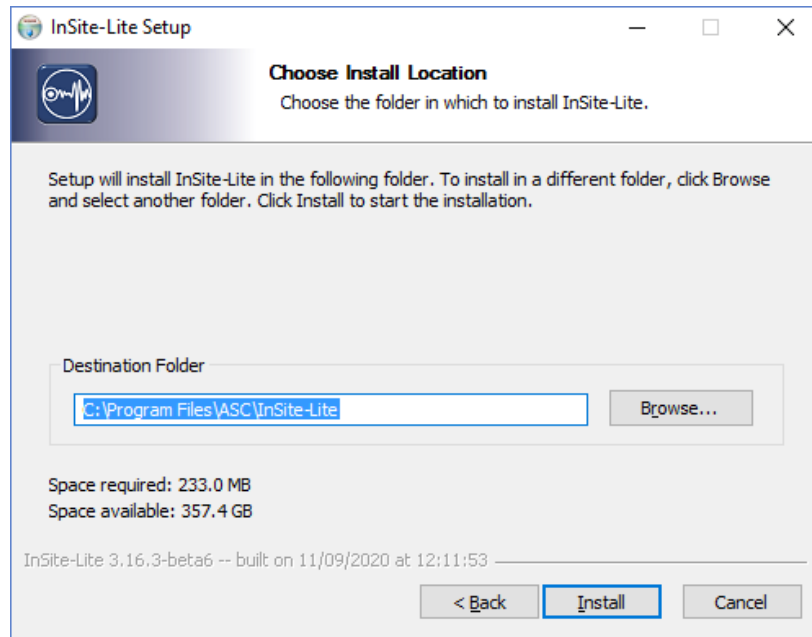


Figure 6: InSite-Lite setup program. Program installation folder.

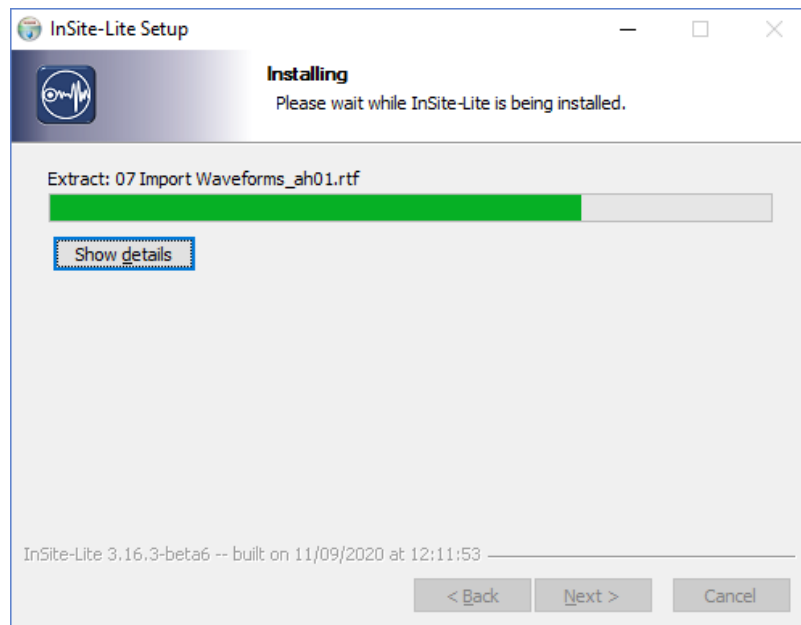


Figure 7: InSite-Lite setup program. Progress update.



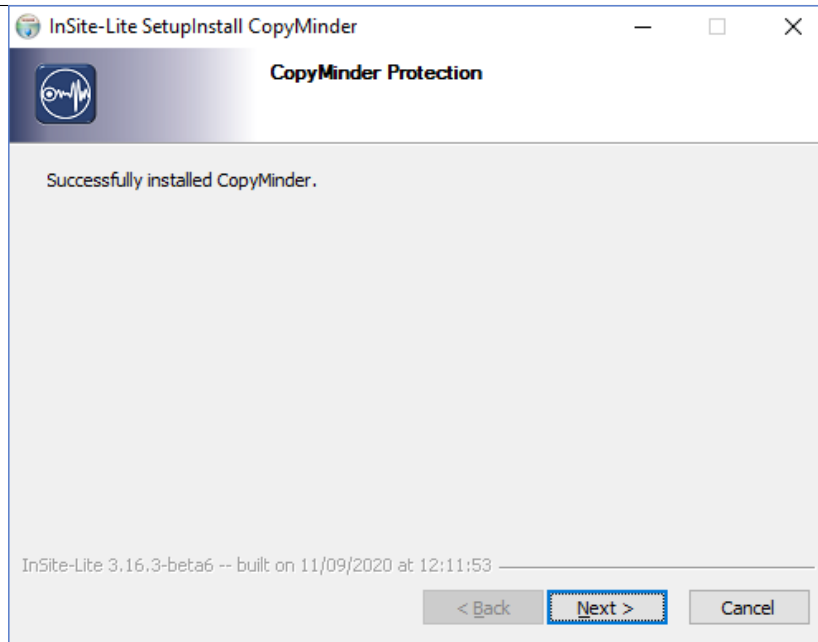


Figure 8: InSite-Lite setup program. Installation of program key.

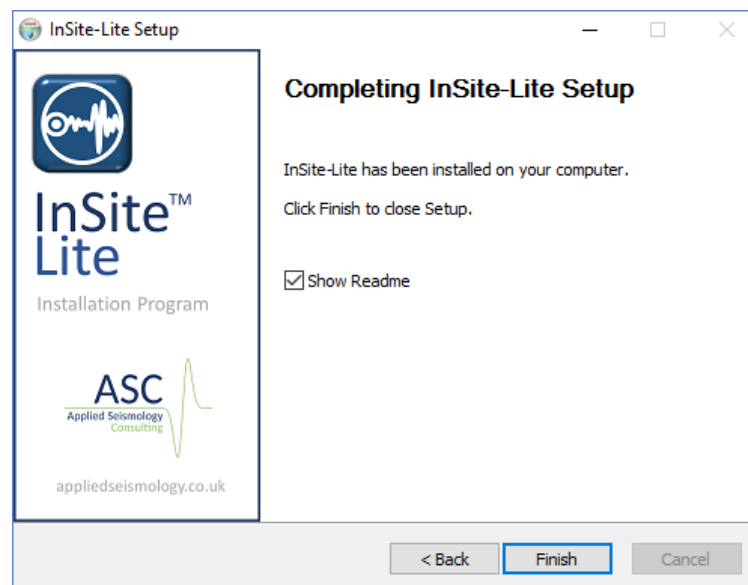


Figure 9: InSite-Lite setup program. Installation completed.

## 2. Step 2 InSite-Lite Licence Activation

On first execution of InSite-Lite, the software licence key will be activated. Please ensure the PC is connected to the Internet. To activate the licence, proceed through the following steps:

- On first execution, a dialog is launched to select the type of licence (Figure 10). Select 'Configure as a trial' if you do not have a licence code. This option will activate the licence for a trial period of 90 days.
- A window will confirm the selection (Figure 11). Click 'OK' to proceed with licence registration.
- Enter user's details to register and activate the licence (Figure 12). Click 'OK' to submit your details.
- A verification email is sent to registered user (Figure 13). Click on the link to verify your registration.
- Once user's details are verified, a confirmation page will confirm licence activation (Figure 14)
- PLEASE NOTE: You can select 'Configure as a standalone program' (Figure 15) only if you have been provided with a licence code. If you want to select this option, contact ASC support team at [asc-info@appliedseismology.co.uk](mailto:asc-info@appliedseismology.co.uk).

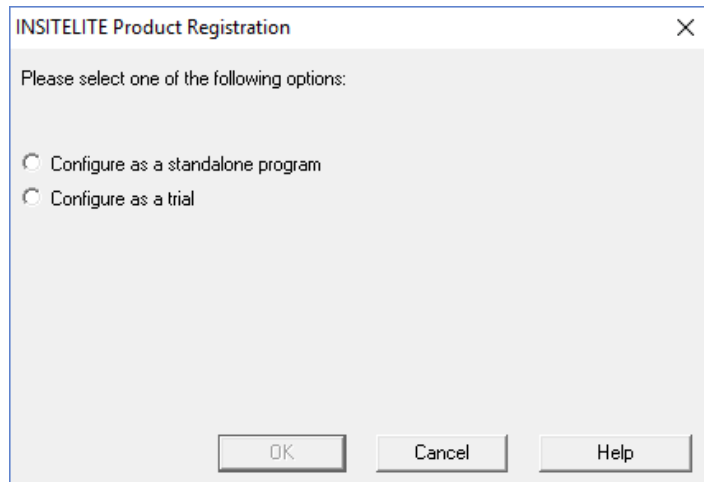


Figure 10: InSite-Lite. First execution.

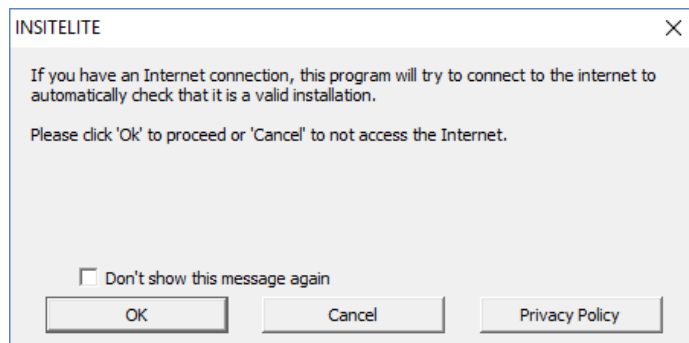


Figure 11: InSite-Lite. First execution information.

The screenshot shows a "Product Registration" dialog box with a question mark icon and a close button (X) in the top right corner. The main text reads: "To complete the registration of this product, please fill out the form below. Items marked with a \* are compulsory. Only information regarding the registration of this product will be sent over the Internet. This information will be securely stored by Microcosm and will not be distributed to anybody other than the Software Developer and Microcosm. If you would like to see Microcosm's security policy then please click the button below". Below this text, there are several input fields with labels and asterisks indicating they are compulsory: "Company Name \*", "Contact Name \*", "House Name/Number \*", "Street Name \*", "Town/City \*", "County/State", "Post/Zip Code \*", "Country \*", "Telephone No.", and "Email Address \*". The "Country" field is a dropdown menu. At the bottom, there are three buttons: "OK", "Cancel", and "Privacy Policy".

Figure 12: InSite-Lite. User registration for activation.

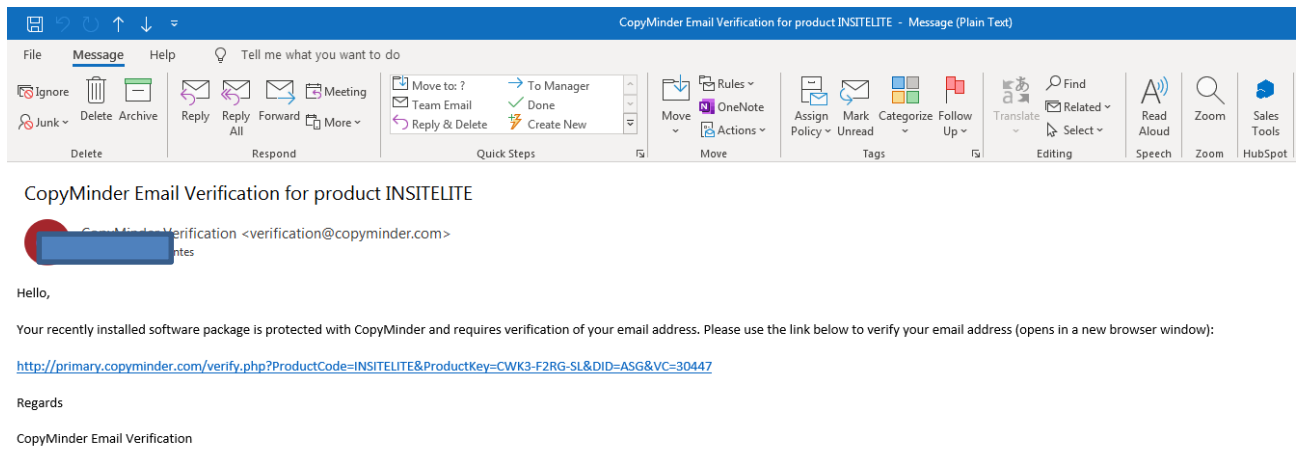


Figure 13: InSite-Lite. User verification email.

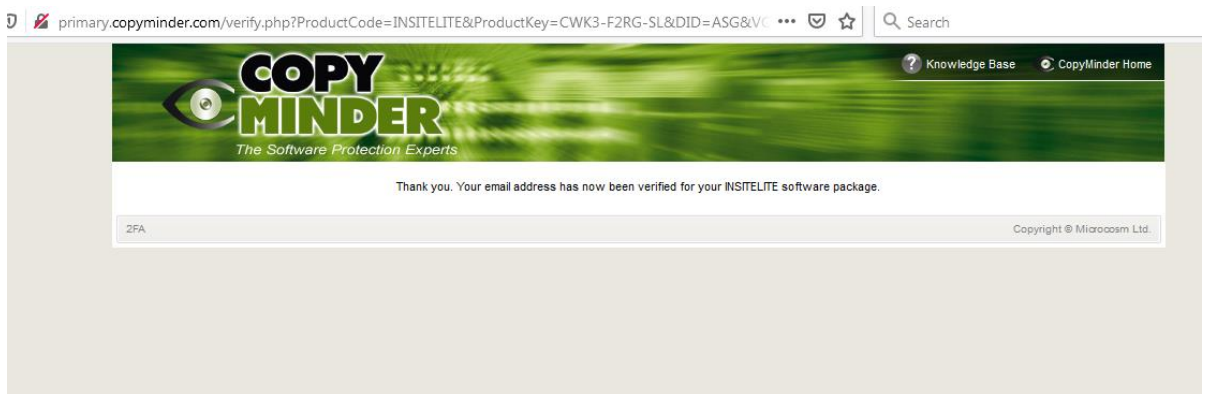


Figure 14: InSite-Lite. Licence activation confirmation.

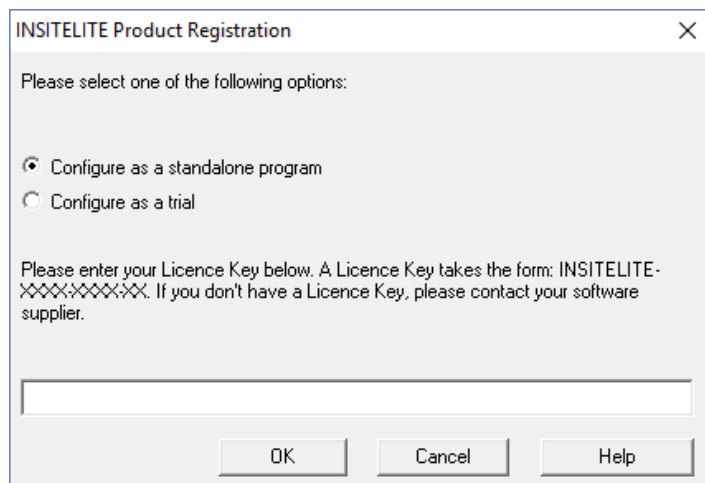


Figure 15: InSite-Lite. First execution option if you have been provided a Licence Key. PLEASE NOTE, this option is only available by contacting ASC at [asc-info@appliedseismology.co.uk](mailto:asc-info@appliedseismology.co.uk)

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## 3. Step 3 Project Setup

Installation of InSite-Lite includes an example project to familiarise with the use of the software. Please copy and paste the tutorial folder in the installation path, `C:\Program Files\ASC\Insite-Lite\Quick Start Tutorial`, to a folder where you can read and write. Please follow through this tutorial in the following order using the data and PCF (project file) file provided.

The first step when working on a project in InSite is the import or creation of a sensor array with channel numbers matching those in the harvested or imported seismic waveform data files.

In this example, the .pcf file is already set with the correct sensor array and this step can be skip. The following details are for information only and working on a fresh project.

1. In InSite's 'Data Visualiser' click 'Project->Edit Default Arrays-> Receivers'. Alternatively, the same Dialog can be called clicking on



*Figure 16: Array Input and Edit Button*

in the main toolbar in Data Visualiser

2. the array can be imported from a ready-made .sen or .csv file (examples included in the folder `C:\Program Files\ASC\Insite-Lite\Examples`) following the format described in later sections by clicking `Import from File`. Alternatively, each sensor can be manually added by clicking `Add` and completing the properties menu.
-

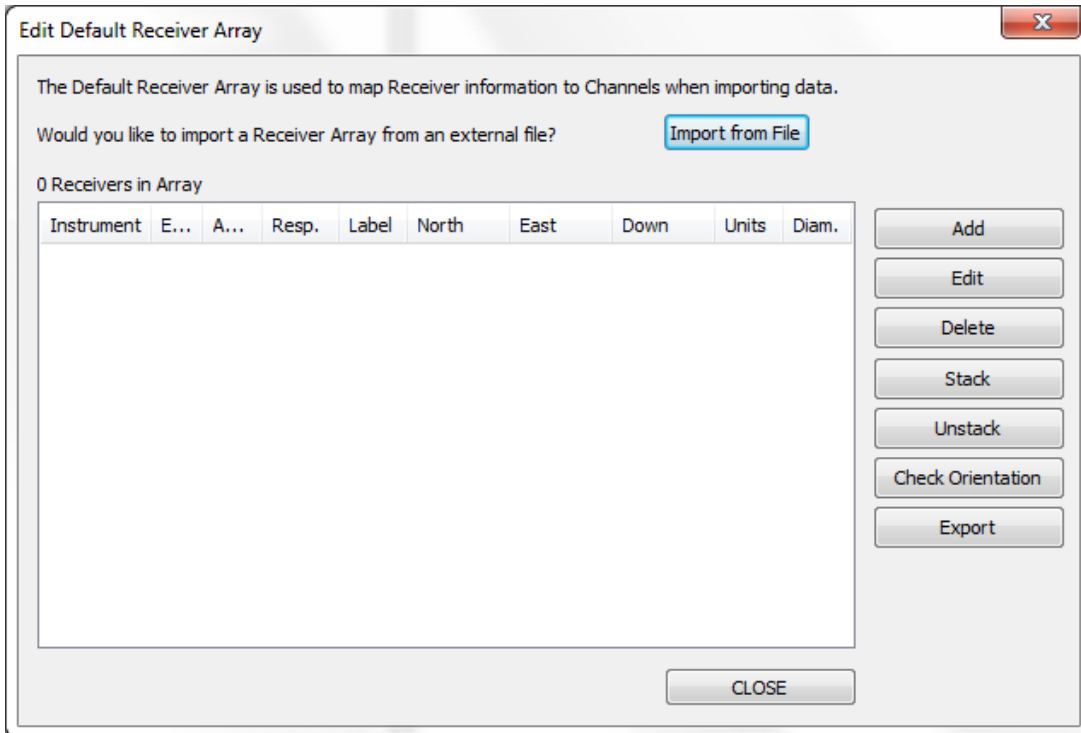


Figure 17: Array Input and Edit Dialog

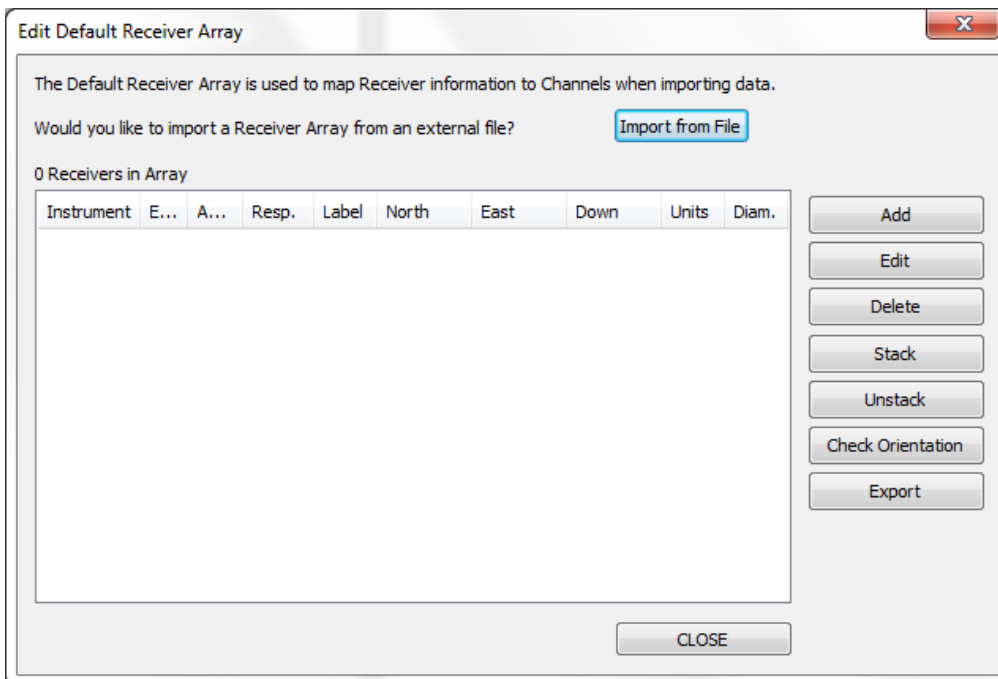


Figure 18: Array Input and Edit Dialog

## 4. Step 4 Data Import

InSite-Lite can import a variety of data formats.

In this step, we just import triggered SEGY format data. Notice that the tutorial SEGY data are triggered event data.

1. Create an empty folder ESF under the same directory as the SEGY folder.
2. Click 'Project -> Import and Manage Data...' Make sure the Import Directory and the ESF Storage Directory are set correct (see figure below)
3. Select the root of the file tree and click ->Import->, all .sgy files will be imported to InSite and stored as ESF files in the specified ESF folder.

Note: there are 50 events imported into InSite-Lite

4. Right-click on any one event and select `View Waveforms`. You will notice that some first arrivals were already picked. The free version of InSite-Lite does not have automatic first arrival picking. In the next step, we will manually pick or re-pick the first arrivals and locate events using homogeneous model.
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## 5. Step 5 Microseismic Waveform Processing

Once we have setup the monitoring array and imported waveforms, we are ready to process microseismic events.

InSite provides 3 ways of processing:

- Automatic processing or batch processing: the procedures are defined in the auto-processor by users (available in the full version of InSite).
- Online processing: process the data while triggering. In online processing, procedures are not specified by users and determined by the type of data automatically (available in the full version of InSite).
- Manual processing: each step of processing is conducted by users. In this step, we will introduce the automatic processing and manual processing.

Adjusting processing parameters:

- Right-click on one event that was not located successfully. In the example shown below, event 5 is not located.

103 Events Loaded from Component 2002112517

| Type   | Num... | Date        | Time             | LocalTime        | Label        | Enabl... | North   | East     | Down    | Un... | LMag    | Wavefor... | DB | N... | N... | N... | N... | N... | N... |
|--------|--------|-------------|------------------|------------------|--------------|----------|---------|----------|---------|-------|---------|------------|----|------|------|------|------|------|------|
| Eve... | 0001   | 25-11-20... | 17:19:58.0094990 | 17:19:58.0094990 | f_004508.rcd | ✓        | -       | -        | -       | -     | -       | ✓          | ✗  | 27   | 24   | -    | -    | -    | -    |
| Eve... | 0002   | 25-11-20... | 17:20:00.0809990 | 17:20:00.0809990 | f_004508.rcd | ✓        | -6.0537 | -102.756 | 12678.9 | 1.00  | 0.0570  | ✓          | ✗  | 33   | 33   | 15   | 8    | 8    | -    |
| Eve... | 0003   | 25-11-20... | 17:20:07.1939990 | 17:20:07.1939990 | f_004510.rcd | ✓        | -       | -        | -       | -     | -       | ✓          | ✗  | 33   | 21   | -    | -    | -    | -    |
| Eve... | 0004   | 25-11-20... | 17:20:10.0022491 | 17:20:10.0022491 | f_004511.rcd | ✓        | 12.608  | 175.141  | 13126.3 | 1.00  | 0.0116  | ✓          | ✗  | 30   | 30   | 11   | 6    | 3    | -    |
| Eve... | 0005   | 25-11-20... | 17:20:11.5137490 | 17:20:11.5137490 | f_004511.rcd | ✓        | -       | -        | -       | -     | -       | ✓          | ✗  | 36   | 15   | -    | -    | -    | -    |
| Eve... | 0006   | 25-11-20... | 17:20:12.3402490 | 17:20:12.3402490 | f_004511.rcd | ✓        | -       | -        | -       | -     | -       | ✓          | ✗  | 27   | 27   | -    | -    | -    | -    |
| Eve... | 0007   | 25-11-20... | 17:20:32.0795000 | 17:20:32.0795000 | f_004516.rcd | ✓        | -       | -        | -       | -     | -       | ✓          | ✗  | 33   | 24   | -    | -    | -    | -    |
| Eve... | 0008   | 25-11-20... | 17:20:57.5332500 | 17:20:57.5332500 | f_004522.rcd | ✓        | -       | -        | -       | -     | -       | ✓          | ✗  | 33   | 27   | -    | -    | -    | -    |
| Eve... | 0009   | 25-11-20... | 17:20:58.0860000 | 17:20:58.0860000 | f_004522.rcd | ✓        | -59.331 | -91.081  | 12650.0 | 1.00  | -0.0... | ✓          | ✗  | 36   | 33   | 16   | 8    | 3    | -    |
| Eve... | 0010   | 25-11-20... | 17:20:59.7432500 | 17:20:59.7432500 | f_004523.rcd | ✓        | -       | -        | -       | -     | -       | ✓          | ✗  | 33   | 18   | -    | -    | -    | -    |
| Eve... | 0011   | 25-11-20... | 17:20:59.9360000 | 17:20:59.9360000 | f_004523.rcd | ✓        | -30.906 | -157.970 | 12706.5 | 1.00  | 0.203   | ✓          | ✗  | 36   | 21   | 18   | 11   | 7    | -    |

Figure 19: Some events are not located in the triggering and online processing step

- The reason is that the auto-picking algorithm failed to pick the P-wave arrival. See the figure below.

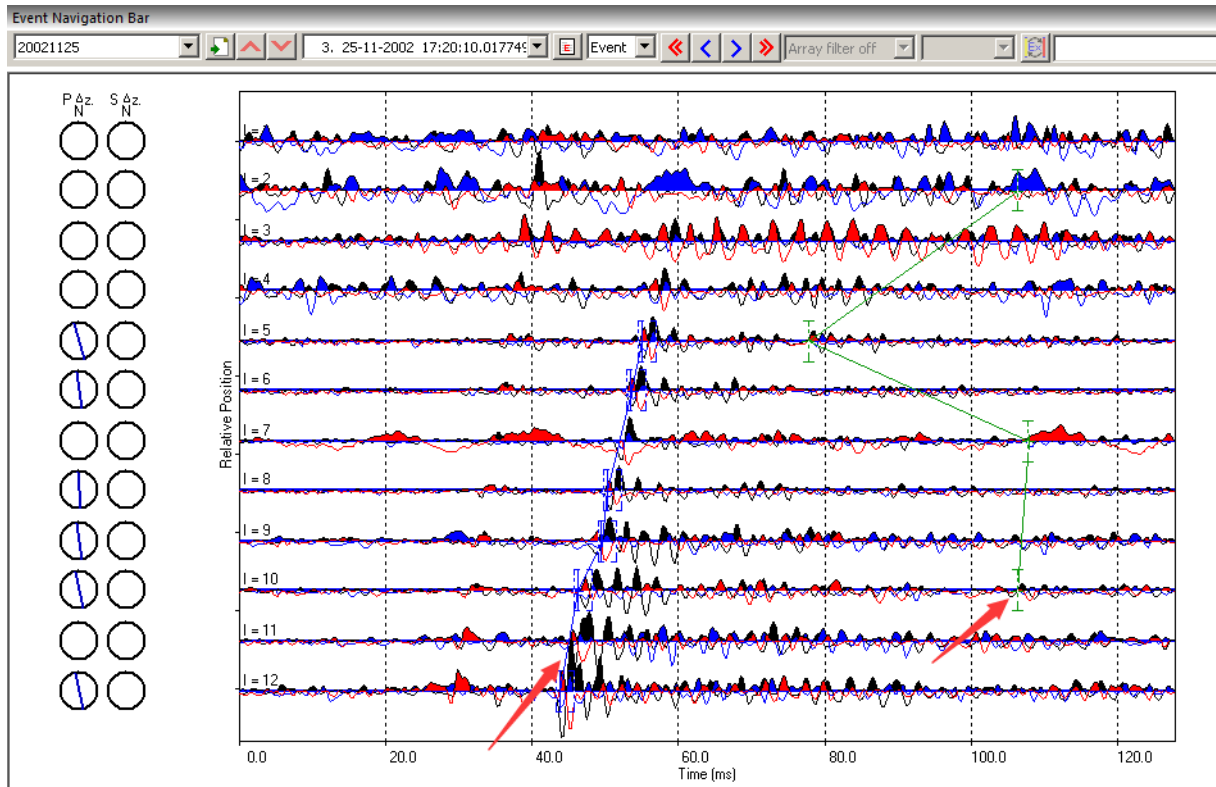
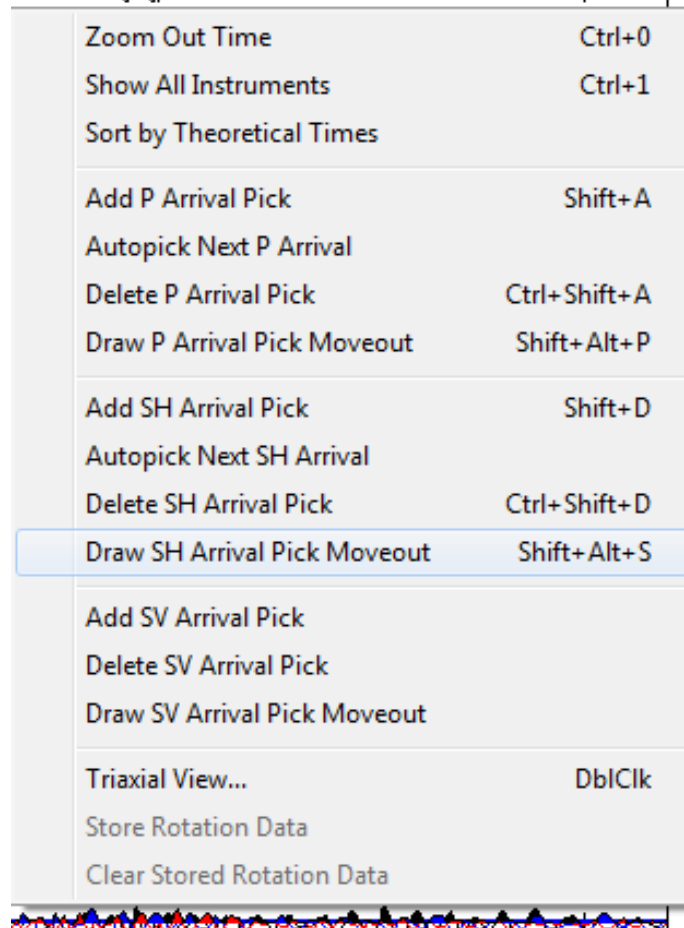


Figure 20: Incorrect pick



To adjust the first arrivals, users could either use Draw P Arrival Pick Moveout or Draw S Arrival Pick Moveout or Add P Arrival Pick or Add S Arrival Pick to manually adjust the first arrivals. Shortcuts Shift + A and Shift + D are used frequently.



|                              |              |
|------------------------------|--------------|
| Zoom Out Time                | Ctrl+0       |
| Show All Instruments         | Ctrl+1       |
| Sort by Theoretical Times    |              |
| Add P Arrival Pick           | Shift+A      |
| Autopick Next P Arrival      |              |
| Delete P Arrival Pick        | Ctrl+Shift+A |
| Draw P Arrival Pick Moveout  | Shift+Alt+P  |
| Add SH Arrival Pick          | Shift+D      |
| Autopick Next SH Arrival     |              |
| Delete SH Arrival Pick       | Ctrl+Shift+D |
| Draw SH Arrival Pick Moveout | Shift+Alt+S  |
| Add SV Arrival Pick          |              |
| Delete SV Arrival Pick       |              |
| Draw SV Arrival Pick Moveout |              |
| Triaxial View...             | DbIClk       |
| Store Rotation Data          |              |
| Clear Stored Rotation Data   |              |

Figure 21: Manual pick

- Click the location button to relocate the event. This event is thus relocated manually. You may want to repeat this procedure for all other events. Tips: you can repick all first arrivals only without click the locate button. The full version of InSite includes an autoprocessor to batch processing all events.
- Other parameters can also be adjusted. For example, the source vector time window, auto-picking parameters, or parameters in locater.
- This step gives you some flavour about how tedious the processing can be. Advanced locating method such as source scan has been developed to automate this process to a certain degree. However, at the end of the day it is the sole responsibility of the processor to ensure the quality and the reliability of the processing outcome.

## 6. Step 6 3D Visualiser

InSite provides comprehensive 3D visualisation to assist interpretation of fracture propagation. See Location Visualiser for details. In this tutorial we will explore two functions including displaying events by different colour and size scales and play events as a function of time.

Display events by different colour and size scales

- Enter the 3D visualiser and click **Properties**. In the tab of **Events**, display the event by **sphere** symbol type, and colour scale by **time** and size scale by **signal-to-noise ratio** (see figure below). Now you will be able to tell when and where a good quality event is located. For automatic processing, this is a good trick to emphasize good quality events to reveal major failure zones.

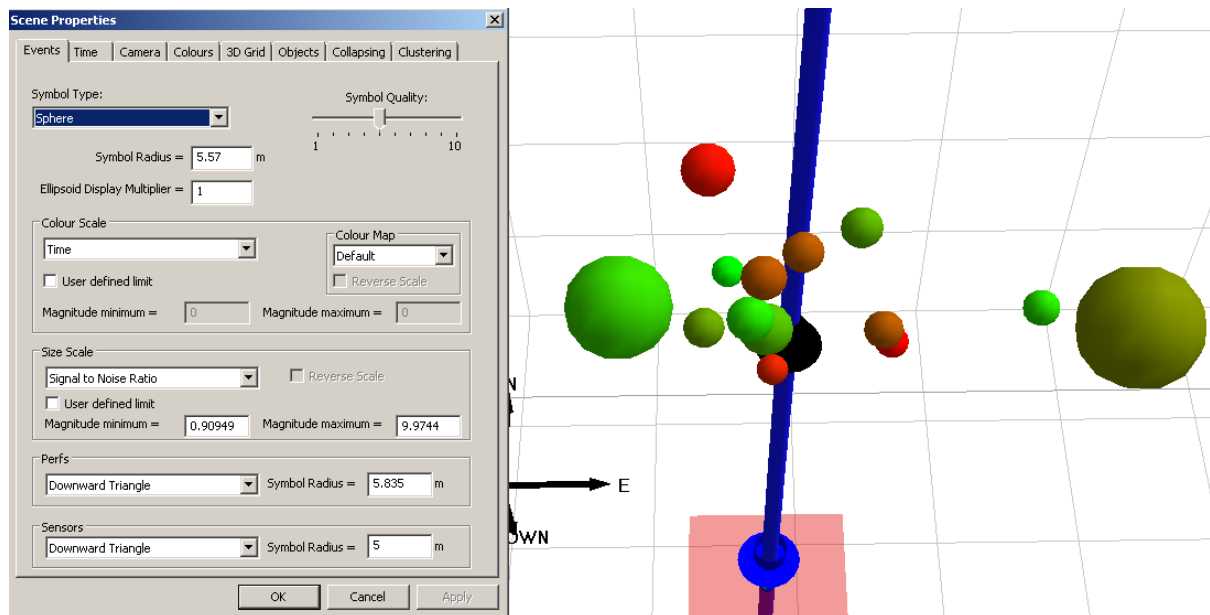


Figure 22: 3D visualiser

- Now switch to the **Time** tab and set the parameters following the figure below. Click **OK**.

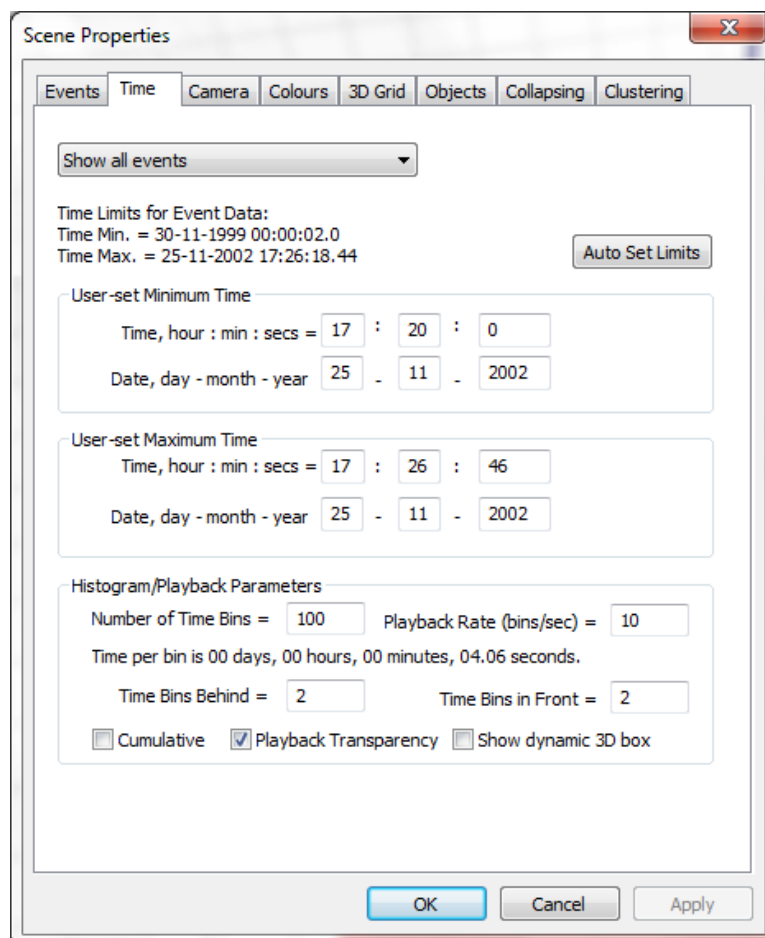


Figure 23: Set parameters to play events by time

- Click **Play Events** button to start. The events will appear on screen as a function of time. The historical events will be displayed in transparent mode and the active events are in solid mode. This is a very useful tool to understand the time and space patterns of the microseismicity.

A few other functions that are worth of mentioning include (see figure below):

1. **Treatment Curves:** you can import engineering data such as those from hydraulic fracture treatment, e.g. well head pressure, proppant concentration, etc. Those parameters can be displayed as a 2D chart (Step 7 Parameter analysis and 2D charting see "2D charts") and also be used to scale or colour events.
2. **Uncertainty:** Since v3.15, you can evaluate the uncertainty using Bayesian Posterior probability by giving the uncertainty in arrival time, velocity model and source polarization.
3. **Calculate stimulated volume:** two ways of calculating the rock volume stimulated by fractures, one is to fit a box to the event cloud and the other is by tightly fitting an isosurface.
4. **Array Analysis:** this function can be used to quantify the sensitivity and the location accuracy of the employed acquisition geometry. This information can be used to assist interpretation of microseismic cloud.

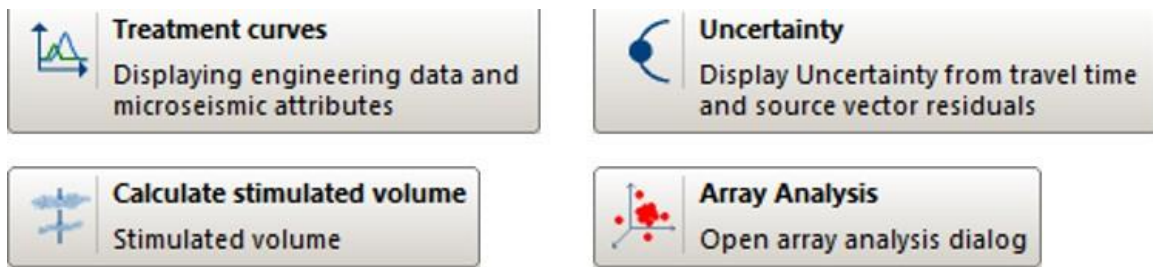


Figure 24: Additional functions available for interpretation

## 7. Step 7 Data and results Export

By this time, you have exported 3D visualisation figures and 2D charts for display purpose. In this section, you will export quantitative information such as waveform and event catalogue for further data processing. InSite support a variety of data format such as ASCII format like ATF and binary format like SEGY, SEGD, SEED/miniSEED etc.

Export waveform

- To export waveform for one event, enter `Waveform-Moveout` by clicking the global button and make sure `View->Export Bar` has been selected.
- Click `ATF` to export the displayed waveform to a file in ASCII format. In the same folder as the ESF file, you will find a number of ATF files each corresponding to one channel.
- Clicking `MSEED` will export the waveform in miniSEED format. In the same folder as the ESF file, you will find a new file with same file name as the ESF file but ends with `.miniseed`.

Note: This way is to export the observed waveform to the corresponding file format. If waveform is filtered, or rotated to P-SH-SV coordinate, the processed waveform will be stored instead of the original raw file. To export raw waveform or processed waveform, you can use the auto-processor. See `AutoProcessing` for details.

Export Catalogue

Microseismic catalogue can be exported with different level of details. Make sure you are in `Data Visualiser`; the drop-down menu from `Export` shows different ways of exporting catalogue information. See the `Export` sub-menu for details.

- `Export CSV Event Data File` is the most common function. It exports parameters such as time, location, magnitude etc for each event. Please export a file and review the content in it. You can open CSV file by EXCEL.
- `Export CSV Instrument Data File` has more details than Event Data file. Each pair of source and receiver is stored in one row and the additional information include picked and theoretical arrival time, ray polarization, etc.