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EVOLUTIONS STUDIES AUTOMATED OPTICAL SENSOR REGISTRATION MONITORING TOOL

Software User Manual

Deliverable D14

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ABSTRACT:

This Software User Manual describes the steps involved to estimate shifts with the OSMON Package and how to visualize the results with the Reporting & Analysis Tool.

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DOCUMENT CHANGE LOG

Issue/ Revision	Date	Modification	Modified pages	Observations
1.0	06.07.2020	All new	All	NA
1.1	08.09.2020	Revised Webtool description, renamed processing script to estimateShifts	All	Include EUMETSAT RIDs.1.E dated 12.08.2020

TABLE OF CONTENT

APPLICAPLE AND REFERENCE DOCUMENTS

[RD-1]	ENVEO IT, (2020), Evolution Studies - Automated Optical Sensor Registration Monitoring Tool. Software Installation Manual Deliverable D13 ENVEO-OSMON_D13.SIM_1/0

Note: If not provided, the reference applies to the latest released Issue/Revision/Version

ACRONYMS

AVHRR ..... *Advanced Very High Resolution Radiometer*
DW ..... *Data Window*
GCP..... *Ground Control Point*
MetOp ..... *Meteorological Operational Satellite*
MROI ..... *Medium Resolution Optical Imager*
NIR ..... *Near Infrared*
OLCI..... *Ocean and Land Colour Instrument*
OLI..... *Operational Land Imager*
SIM..... *Software Installation Manual*
SLSTR..... *Sea and Land Surface Temperature Radiometer*
SUM ..... *Software User Manual*
SWIR..... *Shortwave Infrared*
TIR ..... *Thermal Infrared*
TIRS ..... *Thermal Infrared Sensor*
VIS ..... *Visible*

DEFINITION OF TERMS

GCP	**In the OSMON project the term Ground Control Point (GCP) refers to an image template covering a prominent feature on the Earth Surface, which can be identified in medium resolution optical images. GCP image templates are extracted from VIS, NIR, SWIR, TIR spectral bands of Landsat-8 OLI and TIRS data. The geographic location of a GCP is exactly specified by the geographic map projection, ellipsoid and local datum, corner coordinates and pixel spacing in Easting and Northing direction.**
MROI	Medium Resolution Optical Imagers is used as a general name of medium resolution optical satellites such as Sentinel-3 SLSTR, Sentinel-3 OLCI and MetOp/AVHRR.
MROI-DW	This term is used for MROI-satellite data covering the same area as the corresponding GCP.MROI-DW are raster files in the same map projection, ellipsoid and local datum, corner coordinates and pixel spacing in Easting and Northing direction. To achieve the same pixel spacing as GCP, oversampling of the native resolution of the MROI data is applied.

1. INTRODUCTION

This Software User Manual describes the steps involved to estimate shifts with the OSMON Package and how to visualize the results with the Reporting & Analysis Tool.

2. OSMON PROCESSING

The OSMON processing app is designed as a command line utility. The setup and configuration of the package is described in [RD-1]. After the initialisation and ingestion of the reference products the shift estimation of the MROI products is executed by calling the **estimateShifts** subcommand. It requires at least one MROI product as input.

```
python3 manage.py estimateShifts <path>/AVHR_xxx_1B_M01_2017*
```

If multiple MROI products are given, they are processed one after the other. For continuous monitoring in near-real-time, a cronjob which invokes the command **estimateShifts** can be set up.

Level 1b products of the following sensors are supported:

- Landsat-8 OLI/TIRS
- MetOP AVHRR3
- Sentinel-3 OLCI
- Sentinel-3 SLSTR

Shift estimates for the provided MROI products are stored in the OSMON database.

3. OSMON WEBTOOL

To display the matching output generated by the CoreModule, access the Reporting and Analysis Tool via a web browser. The following sections describe the login procedure and the content and functionality of each tab accessible from the home page (Figure 1).

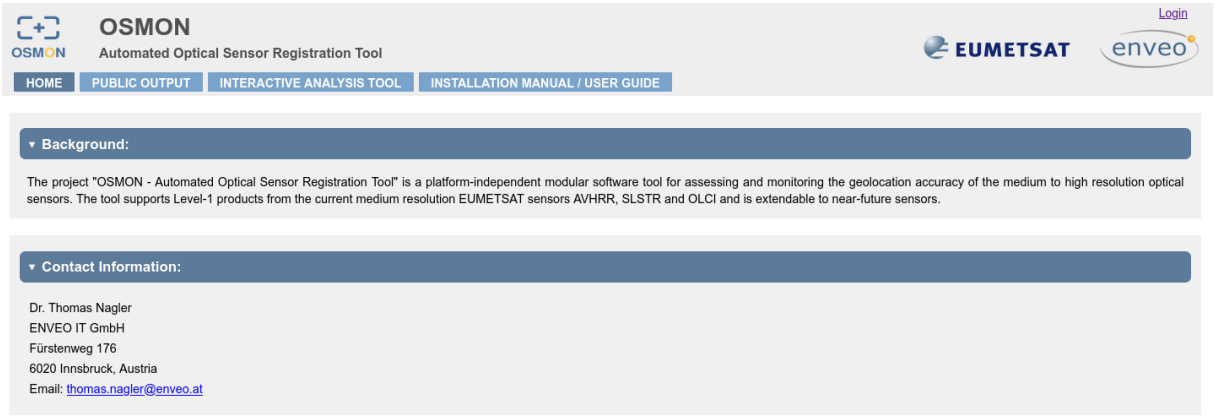

Figure 1: Home page of the OSMON Reporting and Analysis tool

3.1. Login

The OSMON user management enables the storage of user-defined filter settings, the creation of reports and the setting of alarms.

In order to log in to the OSMON Webtool, a user needs to be created. The creation of an admin user is described in [RD-1]. The admin user can log in to the OSMON Webtool with his username and password as described below. In addition, the admin user can create new users in the Django admin page on the OSMON domain. The access of the admin page is described in [RD-1]. The admin user can create a new user by clicking on the ***Add*** button next to the user in the Authentication and Authorization administration (Figure 2).

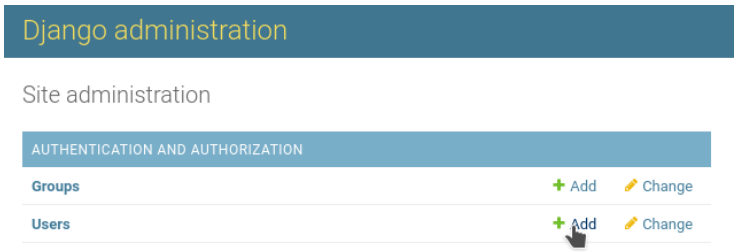

Figure 2: Django admin page for the creation of a new user, step 1.

Thereafter a username and a password can be specified, and confirmed with a click on the ***SAVE*** button (Figure 3). Afterwards, additional specifications like first and last name, email address, the status as active user, staff user or superuser as well as the assignment to user groups and the setting of user permissions can be set.

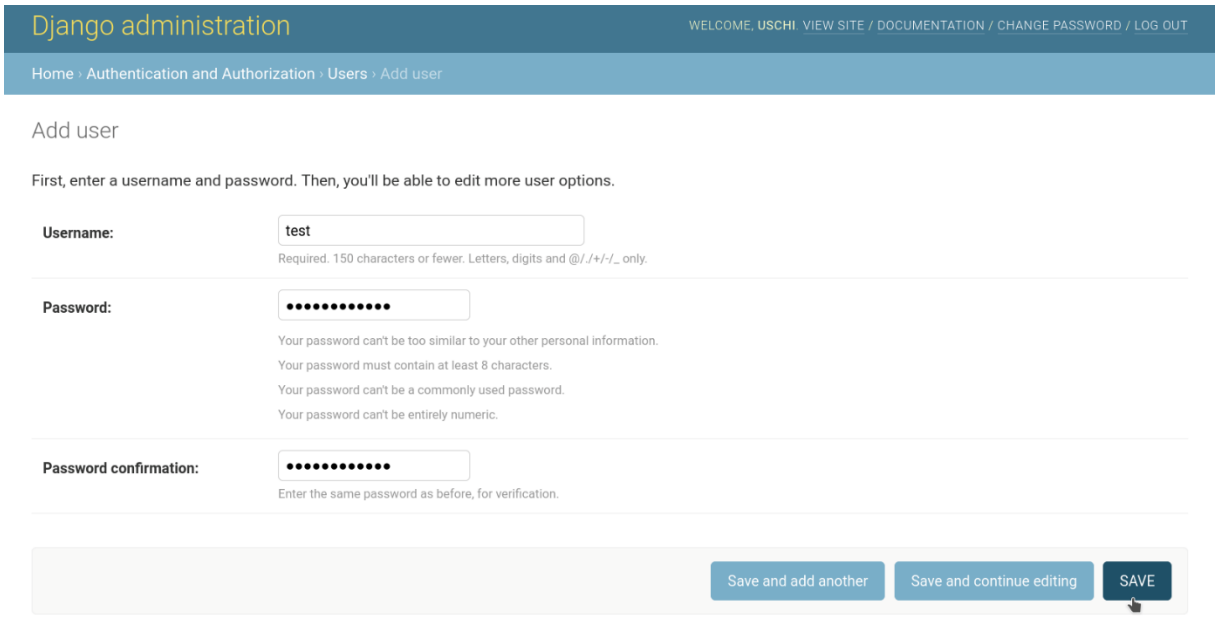

Figure 3: Django admin page for the creation of a new user, step 2.

Once a user has been created, he can log in on the OSMON Webtool with a click on the ***Login*** button at the top right corner of the homepage (see Figure 1) with his Username and Password (Figure 4).

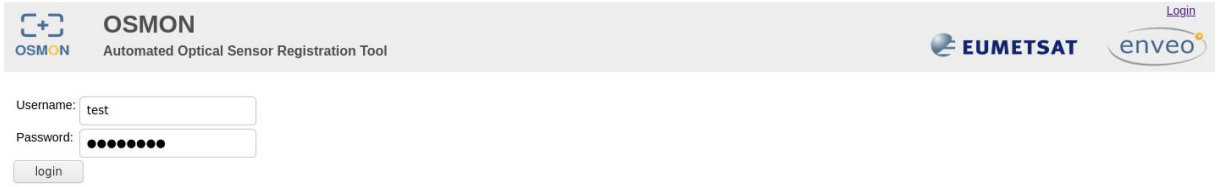

Figure 4: OSMON login page.

After logging in, the username is shown at the top right corner of the OSMON Webtool next to a ***My Settings*** button and a ***Logout*** button. Furthermore, the additional tab User Defined Output appears in the navigation bar (Figure 5).

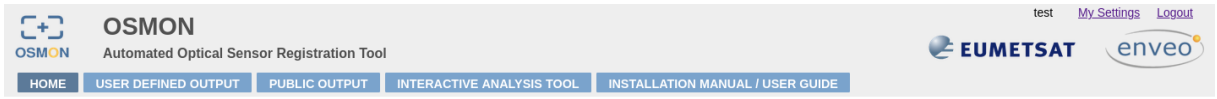

Figure 5: OSMON navigation bar for logged in user.

With a click on the ***My Settings*** button, a logged in user can view, create, edit and delete user sets for displaying in the tab ***User Defined Output*** or in PDF reports (Figure 6).

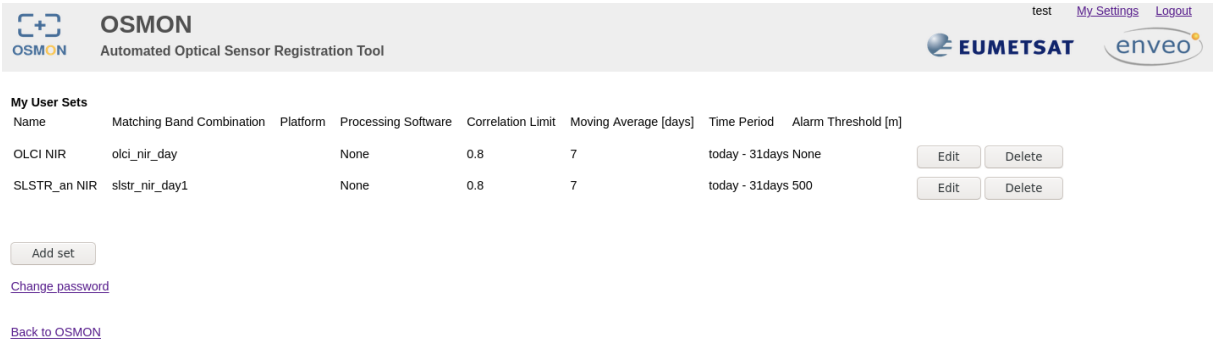

Figure 6: OSMON user settings.

With a click on the ***Add set*** button, a new user set can be created with the definition of a name, a matching band combination and, optionally, a platform (Figure 7).

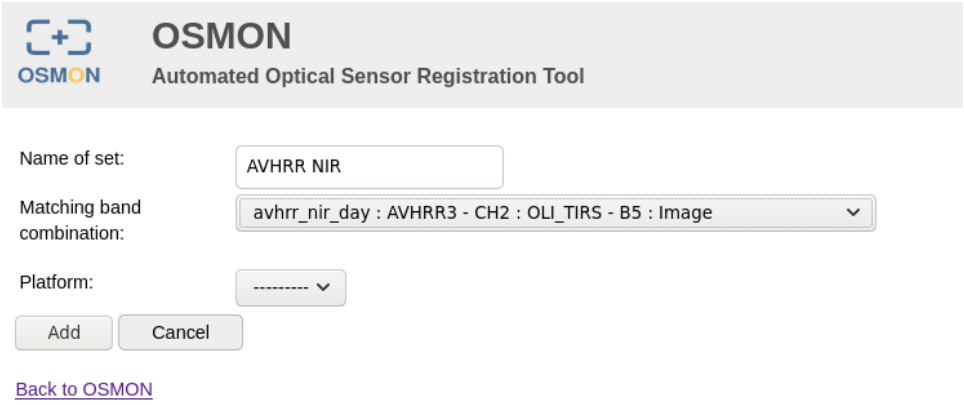

Figure 7: Creation of a new user set.

An existing user set can be edited with a click on the ***Edit*** button and deleted with a click on the ***Delete*** button next to the user set (see Figure 6). By editing a user set, the processing software, a correlation limit, a time span for the moving average, a time span backwards from the current date, a threshold of the daily mean shift magnitude for alarms, and a subset of plots can be specified (Figure 8).

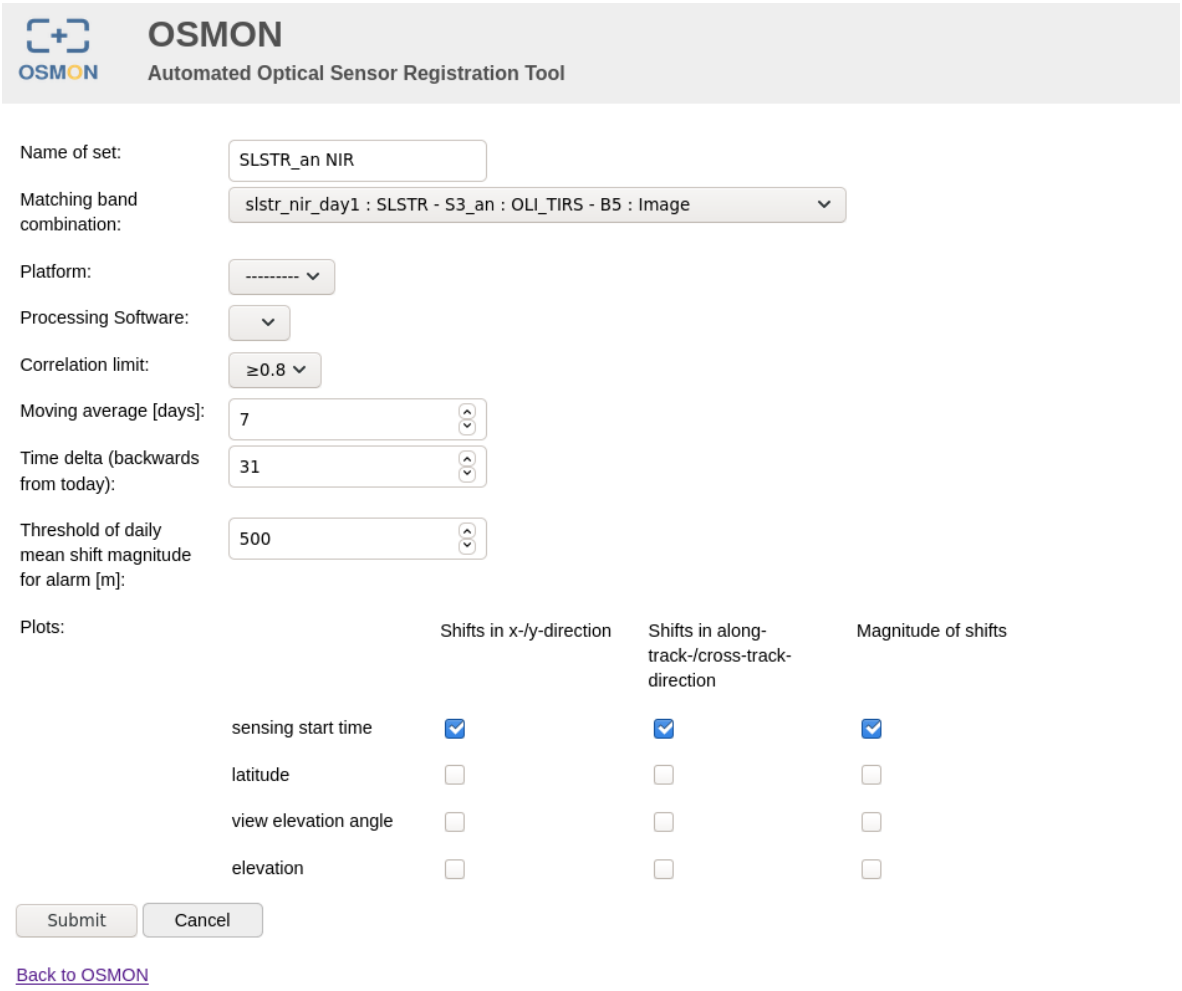

Figure 8: Editing an existing user set.

The following plots are available to display the shift estimates :

- Timeseries in x-/y-direction (true Easting/Northing)
- Timeseries in along-track-/cross-track-direction
- Timeseries of the shift magnitude
- Estimated shifts in x-/y-direction (true Easting/Northing) per latitude
- Estimated shifts in along-track-/cross-track-direction per latitude
- Estimated magnitude of shifts per latitude
- Estimated shifts in x-/y-direction (true Easting/Northing) per view elevation angle
- Estimated shifts in along-track-/cross-track-direction per view elevation angle
- Estimated magnitude of shifts per view elevation angle
- Estimated shifts in x-/y-direction (true Easting/Northing) per elevation with respect to WGS84 ellipsoid
- Estimated shifts in along-track-/cross-track-direction per elevation with respect to WGS84 ellipsoid
- Estimated magnitude of shifts per elevation with respect to WGS84 ellipsoid

With a click on the button ***Back to OSMON***, the user is redirected to the OSMON Home.

3.2. Home

Basic OSMON description and contact information.

3.3. User Defined Output

A logged in user can display his configured user sets in the tab ***User Defined Output***.

For each user set, a list of all alarms is shown in the beginning if any alarms exist in the database. (For the ingestion of alarms to the database, see Section 3.8.) Un-accepted alarms are displayed in bold. The user can click on an un-accepted alarm in order to accept it, which sets the field *accepted* to True in the database. Alternatively, a click on the button ***Accept all*** sets the field *accepted* to True for all alarms for the given user set. If there are any un-accepted alarms for a given user set, a red point is shown next to the heading, whereas a green point indicates either no un-accepted alarms or no alarms at all. Figure 9 shows an example of a list of alarms for a defined user set.

Figure 9: List of alarms for a specific user set. Bold lines indicate un-accepted alarms. The red point indicates the existence of un-accepted alarms for this user set.

After the list of alarms, the button ***Save to CSV*** enables the export of the single data points to a csv file. After some general information on the user set specifications and some numbers on the calculated shifts, an overview of the daily mean of the estimated shifts in x- and y-direction is provided (Figure 10). After that, the plots defined for the given user set are shown.

By pressing the ***Print PDF*** button, a PDF report with the same information and plots is created.

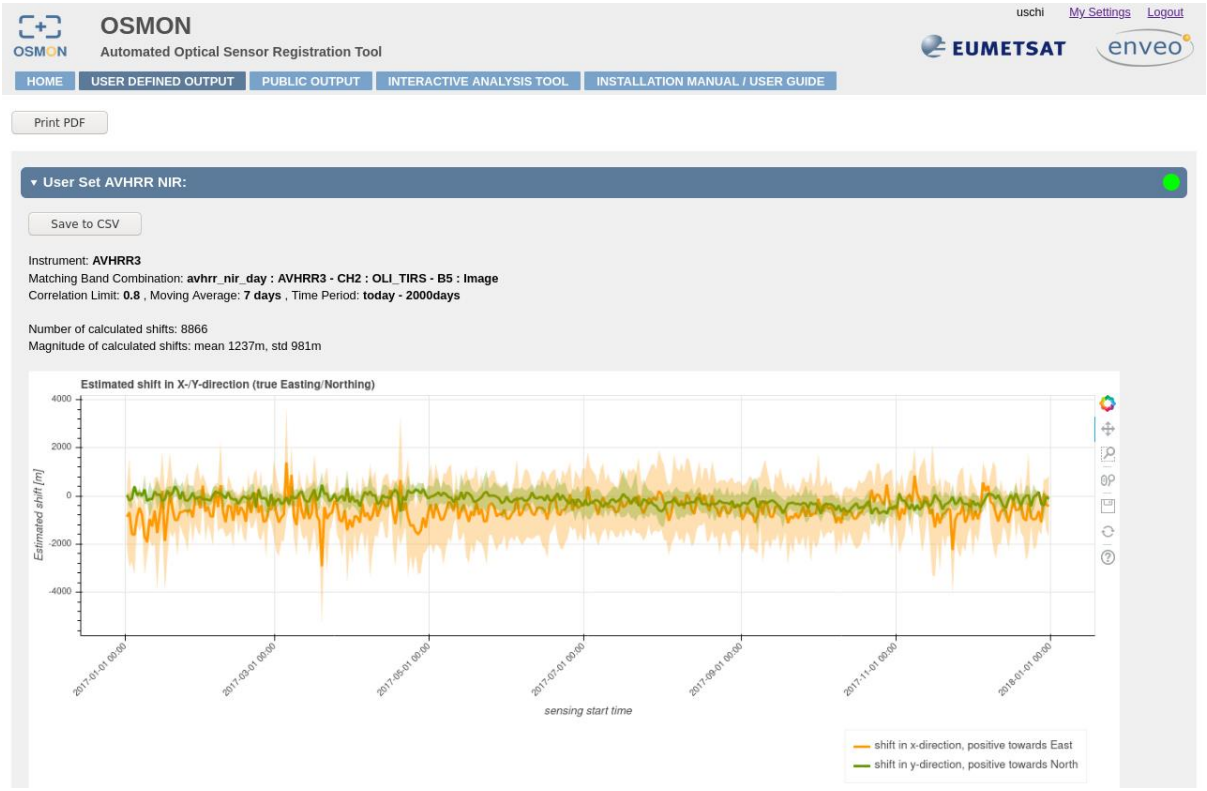

Figure 10: Reporting tool providing an overview on available shift estimates per sensor.

3.4. Public Output

A public user can be created by the admin with the username PUBLIC_USER which is defined in the Webtool configuration file Webtool/apps.py. A person who logs in with this username can create user sets in the same way as other logged in users (see Section 3.1). However, the output of these user sets is publicly available at the tab ***Public Output***, which has similar structure and possibilities as the tab ***User Defined Output*** (Section 3.3).

3.5. Interactive Analysis Tool

The Interactive Analysis Tool (Figure 11) enables a detailed investigation of the matching results. The shifts can be filtered by:

- **Start date** of the time series
- **End date** of the time series
- **Band combination**
- **Platform**
- **Processing Software** of the level 1-b product generation
- **Processing Environment** of the level 1-b product generation
- **Correlation limit** to reject matches with lower correlation coefficients
- **GCP**
- **Moving average** specifies the number of days to compute the displayed moving average

- **e**: Additional Django filter expression

For comparison of different products, processing versions, etc. it is possible to add a panel. The table next to the selection form provides a quick overview on the number of ingested products.

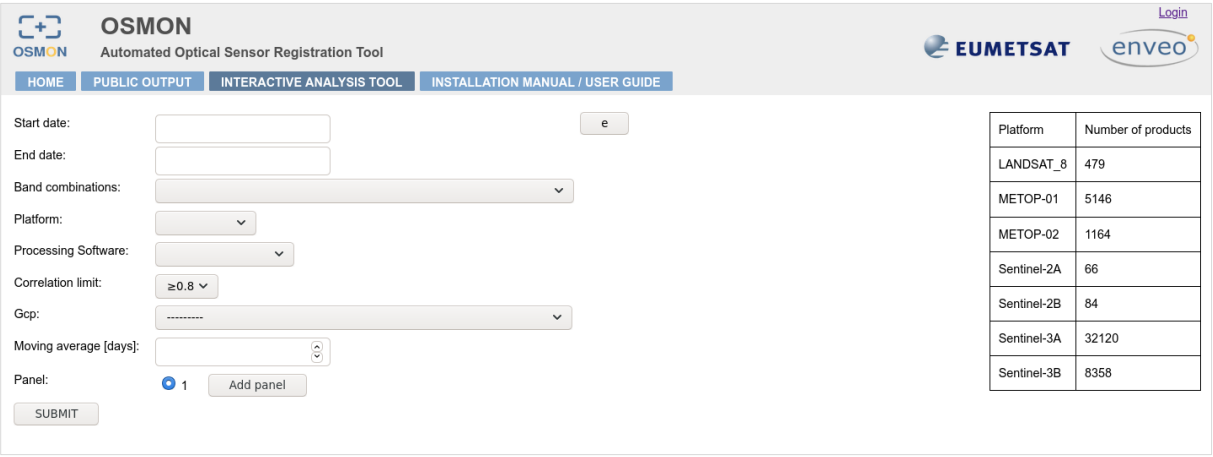

Figure 11: Filter and selection interface of the Interactive Analysis tool.

With the selection of the band combination, the reference and EO sensor are selected as well as the bands. If configured, thresholds of the sun elevation angle for the differentiation of day and night, and thresholds of the cloud coverage can be selected with the band combination. In addition, the selection of the SLSTR nadir or oblique view is also covered by the band combination.

With a click on the ***SUBMIT*** button, the tables and plots for the selected shifts are displayed. The toolbar on the bottom right of each plot enables panning and zooming as well as saving the graph as PNG file (Figure 12).

Figure 12: Toolbar of OSMON plots for panning, zooming, hovering, tapping and saving figures.

If the mouse is hovered over single data points, a quicklook is displayed in the lower right corner of the screen together with information on the data point (Figure 13). A click on a single data point opens the respective quicklook in a new tab.

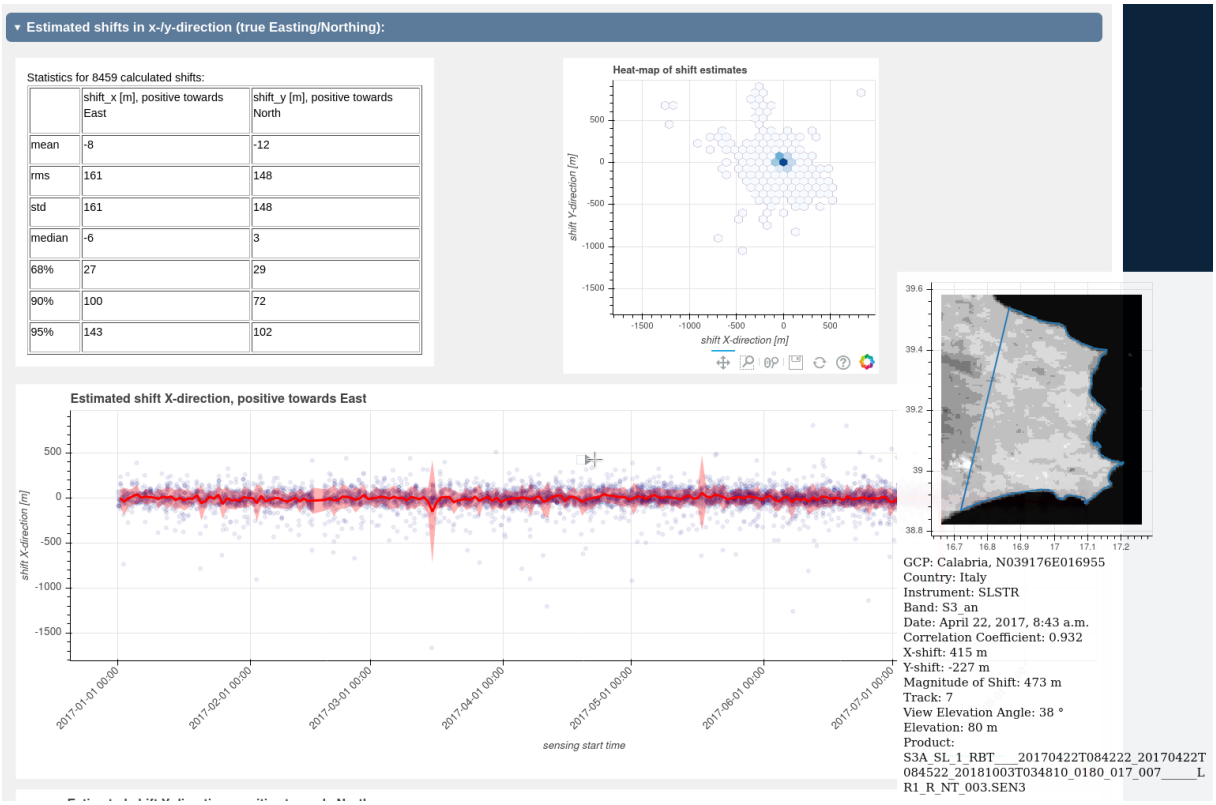

Figure 13: Results for selection of SLSTR (S3_an) from January to August 2017, as displayed in the Interactive Analysis Tool. The window at the bottom right shows the quicklook and information of a hovered data point.

A click on the ***Add panel*** button duplicates the current selections to an additional panel. The results for the additional panel will be displayed next to the previous panel (Figure 14).

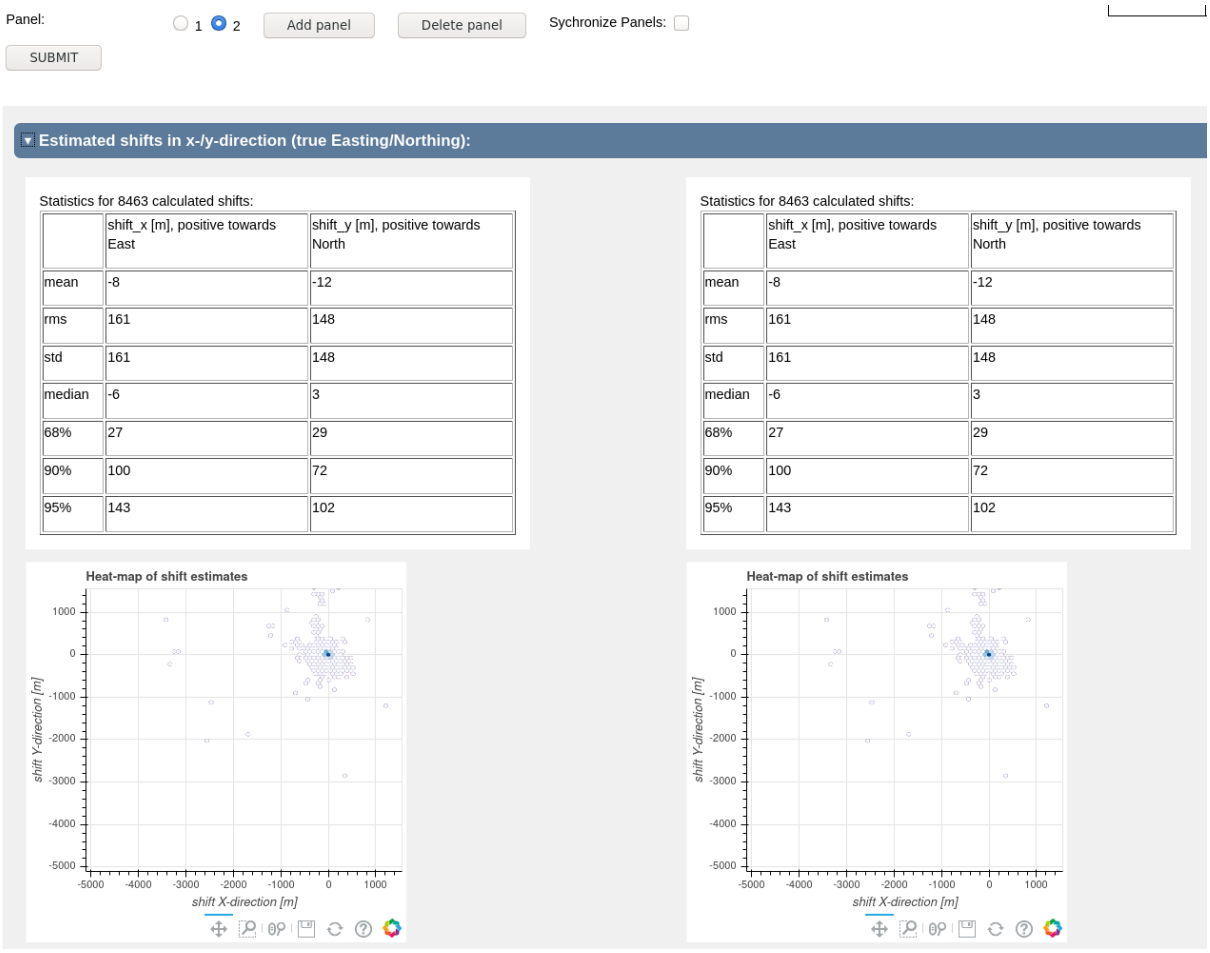

Figure 14: Example of two-panel view.

If multiple panels have been created, the filter selections can be individually adapted for the selected panel. If the ***Synchronize Panels*** button is active, the selections which will be changed after activating this button will be valid for all panels, and the axes limits will be synchronized between the panels. With a click on the ***Delete panel*** button, the selected panel will be deleted.

3.6. Installation Manual / User Guide

This tab links to the Software Installation Manual (SIM), Software User Manual (SUM) and the source code documentation generated with the sphinx documentation generator.

3.7. Command line Report

Optionally, the pdf reports can be generated from the command line calling:

```
manage.py createReport --username USERNAME --filename FILENAME
```

where USERNAME is the username whose user sets define the data which are plotted to the report and FILENAME is the name of the output pdf file.

Optionally, specific user sets for the defined user can be selected with

```
manage.py createReport --username USERNAME --filename FILENAME --usersets
"USERSET1","USERSET2"
```

where USERSET1 and USERSET2 are the names of the usersets.

Optionally, the time span of the product acquisition times for the results to be written to the report can be specified with

```
manage.py createReport --username USERNAME --filename FILENAME --start_date
YYYYMMDD --end_date YYYYMMDD
```

If *start_date* and *end_date* are not given, the time spans that are specified in the given user sets are used.

3.8. Command line Alarm

As stated in Section 3.1, a threshold for the daily mean of the shift magnitude (in meters) can be configured for each user set. The management command ***checkAlarm*** checks whether the mean of the shift magnitude for a given date and a given user set is above the configured threshold. The command is executed with

```
manage.py checkAlarm --username USERNAME
```

Where USERNAME is the username for whose user sets the alarms will be checked. Optionally, specific user sets for the given user can be selected with

```
manage.py checkAlarm --username USERNAME --usersets "USERSET1","USERSET2"
```

where USERSET1 and USERSET2 are the names of the user sets.

A specific date can be given with

```
manage.py checkAlarm --username USERNAME --date YYYYMMDD
```

If no date given, the script is performed for the day before the current date from 0:00 to 0:00 UTC.

If the mean of the shift magnitude for a given date exceeds the threshold defined in the user set, the date is written to the database together with the mean shift magnitude, a time stamp of the insert date and the Boolean field *accepted* set to False. The database entry of each alarm relates to the respective user set.

A list of all alarms for each user set is shown at the web surface at the tabs ***User Defined Output*** (see Section 3.3) and ***Public Output***, respectively.