

INDES

Product User Manual - Oil spill detection

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List of tables and figures

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List of Contents

1. Purpose..... 1

2. Processing..... 1

2.1. Input data 1

2.2. Method..... 2

 2.2.1. Areas of interest 2

 2.2.2. method 3

 2.2.2.1. Step 1: detection of all suspicious slicks 3

 2.2.2.2. Step 2: Discrimination of look-alikes 4

 2.2.2.3. Step-3: Classification of possible oil spills 4

 2.2.2.4. Step-4: Annotation of possible oil spills 4

 2.2.2.5. Oil Spill Detection Report 5

3. Description of the product specification 6

3.1. Product general content and specifications 7

3.2. Nomenclature of files 7

3.3. Acknowledgments 8

4. Data format..... 8

5. How to download a product 8

5.1. Registration 8

5.2. Access Services 8

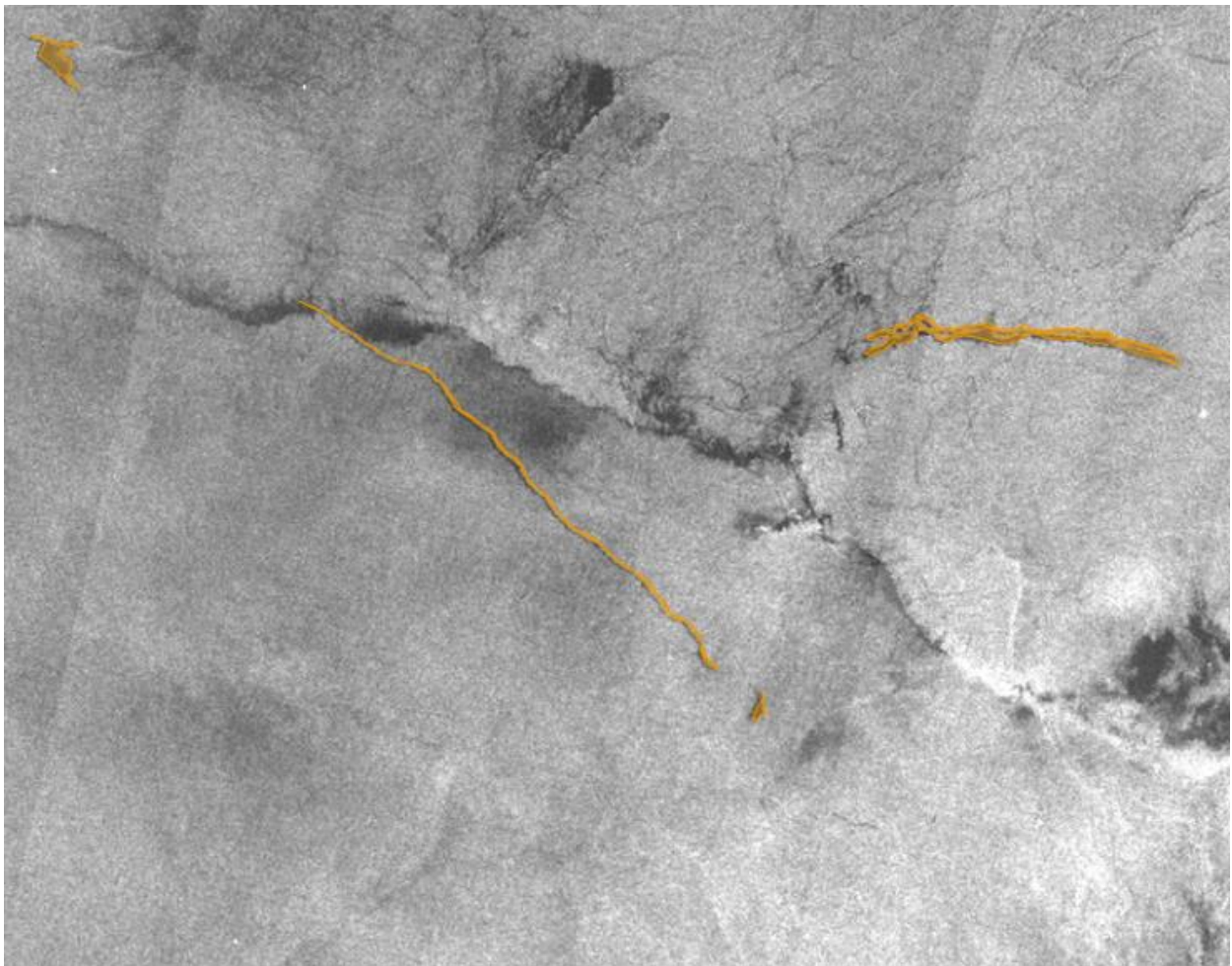


1. PURPOSE

This document presents the information needed by users for the **Oil spill detection** products provided in the frame of the Indeso project.

This document is organized as follows:

- Chapter 2; processing: input data and method applied.
- Chapter 3; the product description, with the different files provided, the nomenclature
- Chapter 4; the file format
- Chapter 5; how to download products.



2. PROCESSING

2.1. INPUT DATA

Images are taken from Radarsat-2 satellite.

2.2. METHOD

Thanks to their very wide area coverage, radar satellites can provide a cost efficient means for monitoring and surveillance purposes in the field of detecting ship-source oil pollution. Oil spills have to be detected and located in a short time, during night and day and independently of the weather conditions. This concept has been largely developed in Europe for the last years, from the early Roses and MarCoast GMES project to the surveillance of the Mozambique Channel for World Bank users performed in 2011 by CLS and to the fully operational CleanSeaNet service provided by CLS to EMSA, a satellite based monitoring system for marine oil spill surveillance in European waters. In the frame of CleanSeaNet, CLS provides since 2011 rapid delivery of oil spill alert information and radar derived products (detected ships and high resolution wind).

The oil reports are made available through a web browser (Maestro web) for authorized users only, using a username and a password.

2.2.1. AREAS OF INTEREST

For oil spill monitoring, 6 areas of interest (AOI) have been identified, with two priority levels:

Name	Priority	Area size
Eastern Malacca strait	Primary	100km x 500km
Western Malacca strait	Secondary	100km x 500km
Timor sea	Primary	360km x 470km
Java sea	Secondary	300km x 300km
Natuna	Secondary	750km x 400km
Makassar strait	Primary	960km x 390km

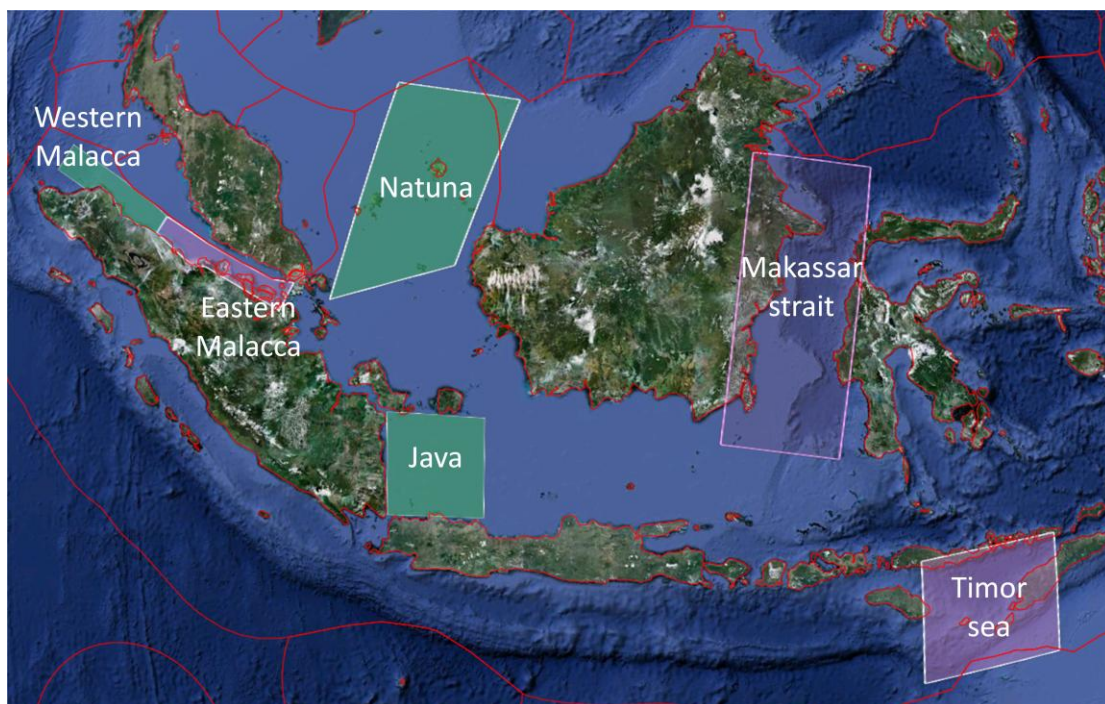


Figure 1 Location of the AOI for oil spill monitoring application

2.2.2. METHOD

The oil spill detection process is a semi-automated process that requires supervision from the Radar Analyst and uses the SARTool Oil module of SARTool application.

SARTool is designed by a CLS team of radar experts. SARTool has proven high level of performance to detect sharp features of interest in the radar scene, and produce user-friendly reports for end users. SARTool, including all the software and accompanying documentation, is provided under the terms and conditions of SARTool License. SARTool name is a registered Trademark.

The figure below shows the flowchart representing the detection and analysis process of oil spills.

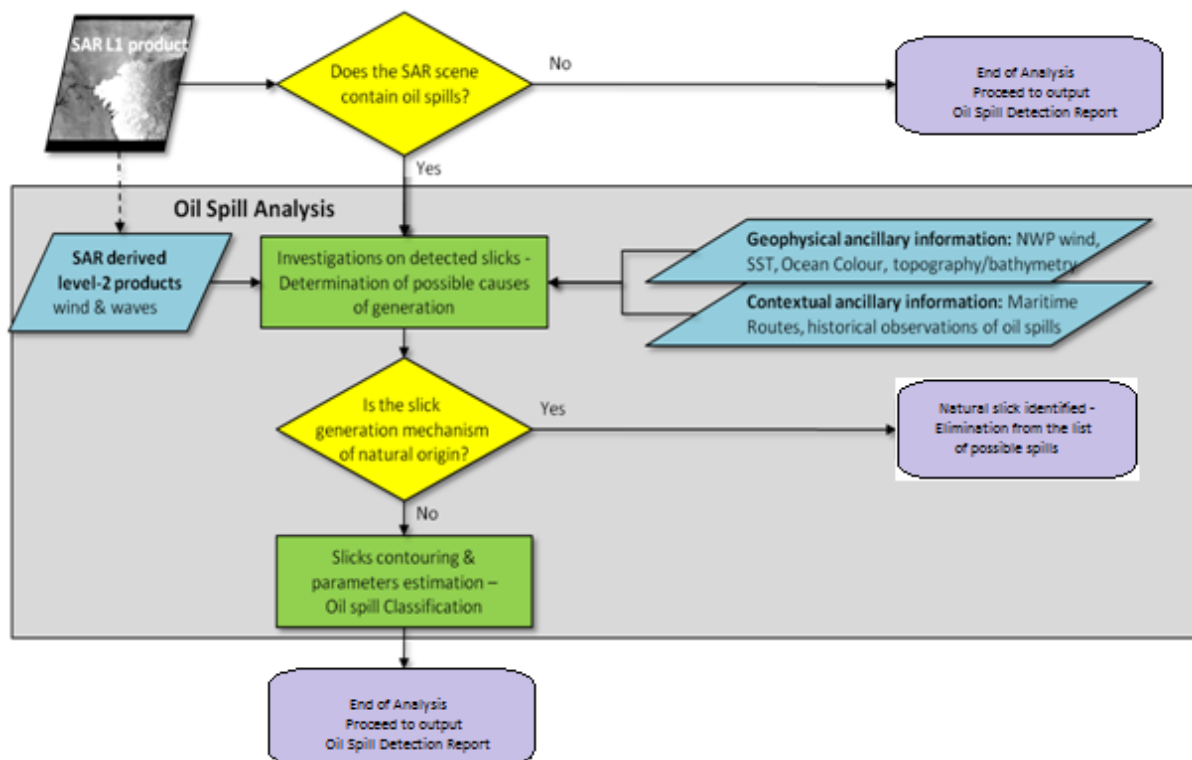


Figure 2 - Flowchart representing the oil spill detection methodology

The detection process basically relies on 4 steps:

- **Step 1:** detection of all suspicious slicks
- **Step 2:** discrimination of look-alikes
- **Step 3:** classification of possible oil spills
- **Step 4:** annotation of possible oil spills

2.2.2.1. STEP 1: DETECTION OF ALL SUSPICIOUS SLICKS

SARTool software enables the analysis of SAR level-1 products using the full resolution capacity and the best dynamic range of pixel, regardless of processing level (complex or detected).

The primary task of the Radar Analyst will consist in visually inspecting the entire SAR image in order to identify all suspicious slicks.

This visual inspection is performed directly on the SAR image with its native geometry and projection (path oriented product). The task of the Radar Analysts is assisted by over plotting ancillary

information on the SAR image (traffic separation schemes, position of previously detected slicks ...).

If no suspicious slicks are detected on the SAR image, then the analysis is completed and no Oil Spill Detection Report is generated.

2.2.2.2. STEP 2: DISCRIMINATION OF LOOK-ALIKES

An important contribution from the operators in charge of analysing SAR images is to make the best use of the available ancillary information in order to assess in the most efficient manner the situation at sea as captured by the SAR sensor.

Taking full advantage of the ancillary information (in particular Wind product), the Analysts will then attempt to discriminate all detected suspicious slicks that can at no doubt be identified as being of natural origin. These suspicious slicks will not be reported to end-user. Such slicks, usually referred to as look-alikes, are typically caused by:

- low wind situations of wind sheltering effect,
- wave-current interactions that dampen the short gravity waves (e.g. oceanic front)
- rain cells
- cold upwelling areas
- algae blooms or suspended matters

If all suspicious slicks detected on the SAR image can be identified as look-alikes without ambiguity at this end of step 2, then the analysis is completed and no Oil Spill Detection Report are generated.

2.2.2.3. STEP-3: CLASSIFICATION OF POSSIBLE OIL SPILLS

All detected slicks, the source of which could be identified as being of natural origin, and the remaining slicks will be classified in one of the two classes:

- **OIL_SPILL:** this class contains all the possible spills whose parameters values or a combination of them are sufficient to conclude they are most probably oil.
 - The confidence of end-users in this level of classification should be such that they should be able to mobilize means of verification without hesitation.
 - The classification criteria should ensure that the false alarm rate (resp. confirmation rate) is kept significantly lower (resp. higher) than for LOOK_ALIKE.
- **LOOK_ALIKE:** This class will eventually contain all remaining possible spills that could not be assigned to OIL_SPILL. On the other hand and despite their long experience, Radar Analysts were not able to reject these slicks for being clearly identified as look-alikes.
 - End-users should understand this decision as a form of uncertainty higher than for OIL_SPILL. The opportunity to conduct on-site verification could then depend on the proximity of surveillance means

The classification process will not be described here.

The Radar Analyst will then proceed to annotate each detected Oil_Spill or Look_Alike elements.

2.2.2.4. STEP-4: ANNOTATION OF POSSIBLE OIL SPILLS

The SARTool GUI is used to navigate in the SAR product easily (scroll and zoom with mouse wheel button). To simplify the analysis, the product is always displayed in a north oriented view. The contrast clipping can be modifying dynamically and the full resolution data are automatically loaded after a zoom factor to see an oil spill with a maximum of details.



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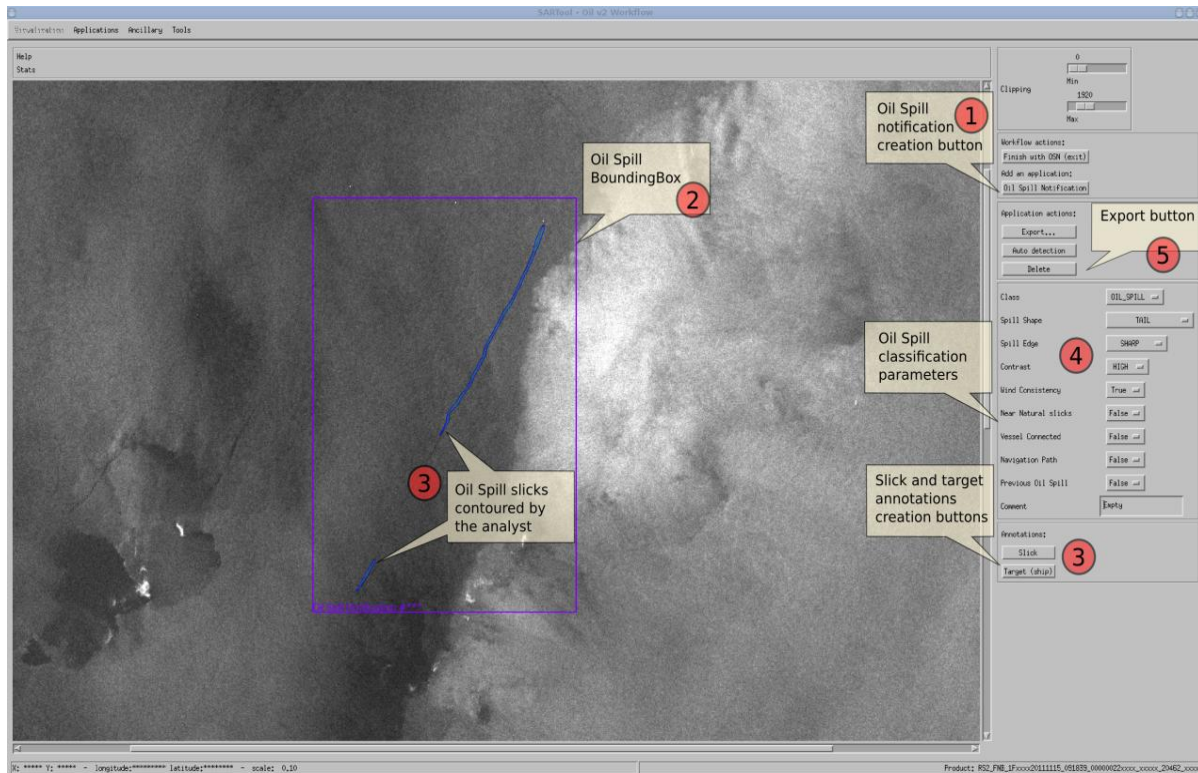


Figure 3: Example of annotation of oil spill using SARTool GUI

The GUI is also used by the Radar Analyst to create as many Oil Spill Detection Reports as necessary, each Report representing a specific pollution and composed of one to many slicks.

To create an Oil Spill Detection Report, the Radar Analyst has to:

1. Create an oil spill notification
2. Draw the region of interest around the pollution
3. Draw a polygon for each slicks that compose the pollution (two slicks in this example)
4. Classify the oil spill with parameters
5. Export the report

2.2.2.5. OIL SPILL DETECTION REPORT

After the Oil Spill Detection Report is created by the Radar Analyst, it is indexed by Maestro module and made available on the CIS Web Interface in Oil Spill Monitoring session.

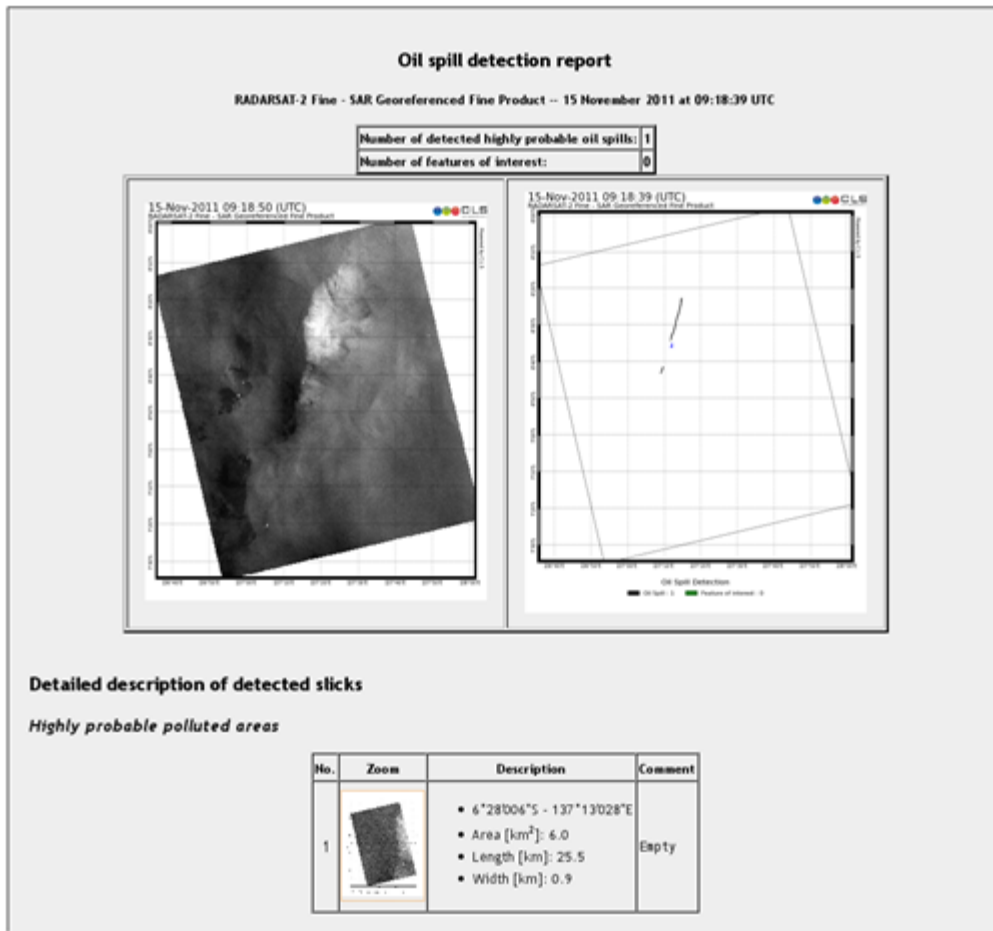


Figure 4- Oil Spill Detection Report

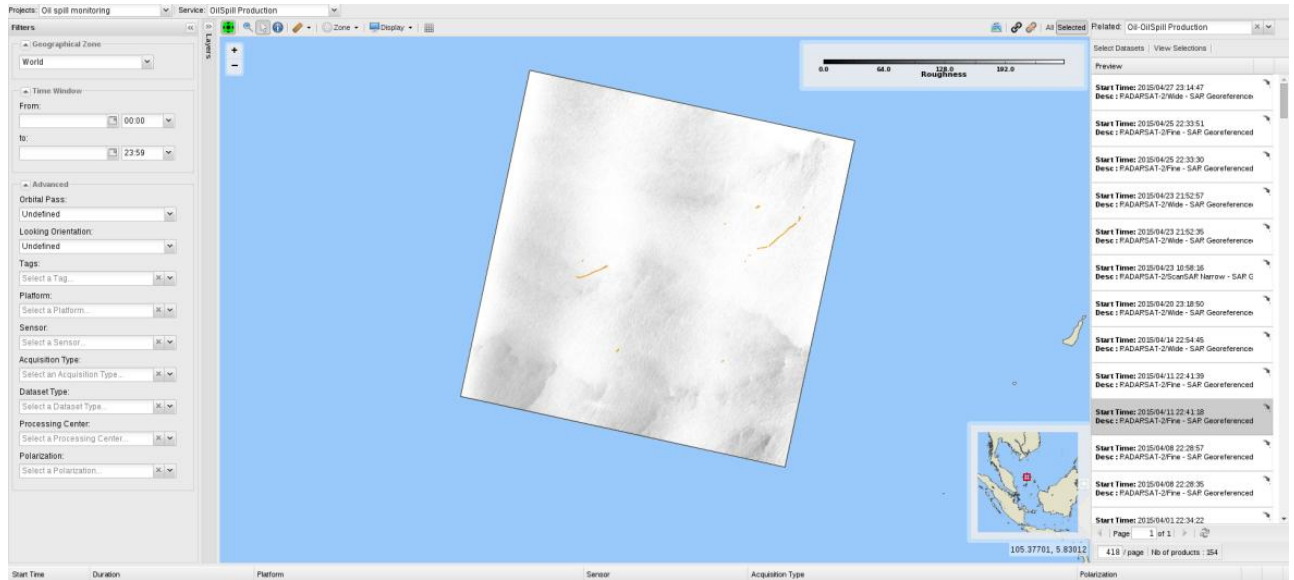
The following products are available within the oil spill report:

- PNG of SAR derived high resolution wind field
- PNG map of detected echoes
- PNG of sea surface roughness
- Full resolution Quicklooks of each oil spill

3. DESCRIPTION OF THE PRODUCT SPECIFICATION

The product is available via the "Oil Spill monitoring" page on the Maestro web interface.

The selection can be done by date, time, and technical parameters.



3.1. PRODUCT GENERAL CONTENT AND SPECIFICATIONS

Each Indeso product includes a series of related datasets. Those datasets are delivered with different names (see nomenclature), contents and format (below).

Note that the products and datasets available for a given user depend on the user profile.

Dataset Name	Dataset time coverage	Production frequency	Geographical coverage	Spatial Resolution	File format
Oil spill detection report	time coverage of the dataset	on demand	spatial coverage of the dataset	discrete (50 or 100m)	GML (xsd clsOils) / Shapefile (less information in this format)

Table 1: Oil spill datasets

OilSpill product content:

ID	Processing	Start Time	End Time	Area	Classification	Width	Length	Product_Ref	OP_Comment
46	IN-DESO	2010/10/11 10:26:25	2010/10/11 10:27:41	0.902650 636379	OIL_SPILL	0.4328 46066 479	3.20727 355184	RS2_SNB_1FSCLS20101011_102658_00000043 xS	Empty

3.2. NOMENCLATURE OF FILES

Depending on their format, the files are delivered under the following names :

Shapefile :

OilSpill_Production_sarproducts_date.dbf



OilSpill_Production_sarproducts_date.shp

OilSpill_Production_sarproducts_date.shx

KMZ :

OilSpill_Production_sarproducts_date.kmz

3.3. ACKNOWLEDGMENTS

Original INDESO Products - or Value Added Products or Derivative Works developed from INDESO Products including pictures - shall include the following credit conspicuously displayed and written in full:

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"© INDESO, 2013, a system implemented by CLS for Balitbang KP, all rights reserved".

4. DATA FORMAT

The product is available on Maestro INDESO website in two formats:

- Shapefile (geospatial vector data format for geographic information system (GIS) software)
- KMZ (KML is an XML notation for expressing geographic annotation and visualization within Internet-based, two-dimensional maps and three-dimensional Earth browsers, KMZ files are zipped KML files).

5. HOW TO DOWNLOAD A PRODUCT

5.1. REGISTRATION

To access data, registration is required. During registration process, the user shall accept using licenses for the use of INDESO products and services.

License shall include:

- Data use conditions,
- Legal and contractual clauses

5.2. ACCESS SERVICES

Different services enable registered users to access the data. Depending on the dataset, not all of them are relevant.

Data Type	Dataset Name	File format	Discover	View	Get
Radar	Oil spill detection report	KMZ/Shapefile	Yes	Yes	Yes