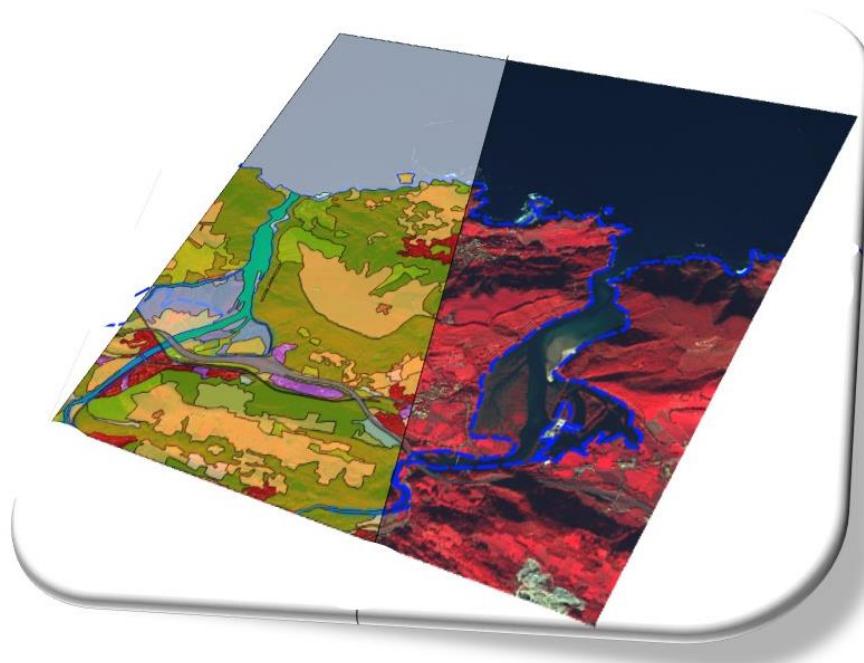




European Environment Agency



**SPECIFIC CONTRACTS No 3436/R0-COPERNICUS/EEA.57850 and No 3436/R0-COPERNICUS/EEA.58088 implementing Framework service contract No EEA/DIS/R0/18/008**

**Production of Very High Resolution Land Cover/Land Use dataset for coastal zones of the reference years 2012 and 2018**

## **D3.2 – Final Delivery Report**

**(Referred to 100% of the AOI)**

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Checked by:	Claudio La Mantia	10/02/2021
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## Document History

<b>List of reviews</b>			
<b>Version</b>	<b>Author</b>	<b>Date</b>	<b>Note</b>
v0	CZ Production Team	10/02/2021	First release

## Table of Contents

<b>1 Introduction.....</b>	<b>5</b>
1.1 Purpose and scope .....	5
1.2 Applicable documents .....	5
1.3 Reference documents .....	5
<b>2 Product specifications .....</b>	<b>6</b>
2.1 Nomenclature .....	8
2.2 Overview of mapped area.....	11
2.2.1 Summary statistics.....	12
2.3 Keynotes of used source files .....	15
2.4 Keynotes about the production process .....	15
2.4.1 Integration of existing Copernicus Hot Spot mapping products .....	16
2.4.2 Integration of CLC water classes.....	17
2.4.3 Different water levels in VHR2012 and VHR2018.....	17
<b>3 Quantitative assessment of LCLU delivered data .....</b>	<b>18</b>
3.1 Accuracy Assessment.....	18
3.2 Sampling Design .....	18
3.3 Response Design.....	18
3.4 Internal validation results .....	18
<b>4 Delivered files .....</b>	<b>22</b>
4.1 LCLU maps .....	22
4.2 Reference points interpreted .....	23
4.3 Metadata.....	23
4.4 PSIL.....	24
<b>Appendix A: Re-coding table from 4<sup>th</sup> to 5<sup>th</sup> class level.....</b>	<b>25</b>

## List of Figures

Figure 1: Spatial distribution of the area mapped.....	11
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## List of Tables

Table 1: Coastal Zones Land Cover and Land Use status map 2012 .....	6
Table 2: Coastal Zones Land Cover and Land Use status map 2018 .....	7
Table 3: Coastal Zones Land Cover and Land Use change map 2012-2018.....	8
Table 4: Detailed CZ LC/LU classes and cross reference to MAES Level 2 .....	9
Table 5: CZ LC/LU class spatial distribution for the mapped area.....	12
Table 6: Handling of the errors inside the geometric skeleton .....	16
Table 7: Overall Accuracies for Status 2012 and Status 2018.....	19
Table 8: Overall Accuracies for Change 2012-2018. ....	19
Table 9: Producer's and User's Accuracies for Change 2012-2018. ....	20
Table 10: Producer's and User's Accuracies for Status 2012 and Status 2018 Level 1 classes.....	20
Table 11: Producer's and User's Accuracies for Status 2012 and Status 2018 Level 5 classes.....	21
Table 12: attribute fields in the three datasets .....	22
Table 13: Attribute table of the reference points shapefile.....	23
Table 14: Attribute table of the PSIL shapefiles .....	24

## List of Acronyms

Acronym	
<b>AOI</b>	Area Of Interest
<b>CLC</b>	CORINE Land Cover
<b>CORDA</b>	Copernicus Reference Data Access
<b>DB</b>	DataBase
<b>DU</b>	Delivery Unit
<b>DWH</b>	Data WareHouse
<b>EEA</b>	European Environment Agency
<b>EO</b>	Earth Observation
<b>ETRS89</b>	European Terrestrial Reference System 1989
<b>EU</b>	European Union
<b>Geo DB</b>	Geographic Data Base
<b>INSPIRE</b>	Infrastructure for Spatial Information in Europe
<b>ISO</b>	International Organization for Standardization
<b>LAEA</b>	Lambert azimuthal equal-area projection
<b>LC/LU</b>	Land Cover /Land Use
<b>LUCAS</b>	Land Use and Coverage Area frame Survey
<b>MAES</b>	Mapping and Assessment of Ecosystems and their Services
<b>MMU</b>	Minimum Mapping Unit
<b>MMW</b>	Minimum Mapping Width
<b>N2K</b>	Natura2000
<b>OSM</b>	OpenStreetMap
<b>PSIL</b>	Parent Scene Identification Layer
<b>RZ</b>	Riparian Zones
<b>UA</b>	Urban Atlas
<b>SC</b>	Service Contract
<b>VHR</b>	Very High Resolution

## 1 Introduction

### 1.1 Purpose and scope

This document represents the Internal final QC/QA Delivery Report referring to the Coastal Zones products covering the 100% of the AOI to be mapped within the framework of the SPECIFIC CONTRACTS No 3436/R0-COPERNICUS/EEA.57850 and No 3436/R0-COPERNICUS/EEA.58088, both implementing Framework service contract No EEA/DIS/R0/18/008 – Production of Very High Resolution Land Cover/Land Use dataset for coastal zones of the reference years 2012 and 2018.

This Delivery Report includes the following key information about the final delivery:

- Product specifications (including keynotes about the production process and used source files)
- Quantitative assessment of LCLU delivered data
- Delivered files

### 1.2 Applicable documents

Ref.	Title
[AD.1]	Tender Specifications “EEA/DIS/R0/18/008 Framework service contract for Copernicus Local Land Monitoring Services – Production of Very High Resolution Land Cover/Land Use dataset for coastal zones of the reference years 2012 and 2018”
[AD.2]	Proposal responding to EEA’s Invitation for Tender (pkz008-429-1.0_EEA_LC_Coastal_Zone_Technical_Proposal)
[AD.3]	Framework Service Contract EEA/DIS/R0/18/008
[AD.4]	SPECIFIC CONTRACT No 3436/R0-COPERNICUS/EEA.57850
[AD.5]	SPECIFIC CONTRACT No 3436/R0-COPERNICUS/EEA.58088

### 1.3 Reference documents

Ref.	Title
[RD.1]	Footprints for VHR2012 data (pkz048-47-1.0 – D4.1)
[RD.2]	Assessment report on the availability of VHR2012 data (pkz048-37-1.1 – D4.2)
[RD.3]	Preliminary Coastal Zones AOI 2018 (pkz048-43-1.0 – D5.1)
[RD.4]	Final Coastal Zones AOI 2018 (pkz048-65-1.2 - D5.2)
[RD.5]	Final mapping guidelines (pkz048-66-v2 – D6.2)
[RD.6]	<a href="https://github.com/eea/copernicus_quality_tools/wiki/Coastal-Zones-2012#vectornaming">https://github.com/eea/copernicus_quality_tools/wiki/Coastal-Zones-2012#vectornaming</a>
[RD.7]	<a href="https://github.com/eea/copernicus_quality_tools/wiki/Coastal-Zones-2018#vectornaming">https://github.com/eea/copernicus_quality_tools/wiki/Coastal-Zones-2018#vectornaming</a>
[RD.8]	<a href="https://github.com/eea/copernicus_quality_tools/wiki/Coastal-Zones-Change-2012-2018#vectornaming">https://github.com/eea/copernicus_quality_tools/wiki/Coastal-Zones-Change-2012-2018#vectornaming</a>
[RD.9]	Data Warehouse phase 2 DAP v2.5 <a href="https://spacedata.copernicus.eu/documents/12833/14545/DAP+Document+++current/c2449218-3ed9-434a-b32c-edfb95b9362">https://spacedata.copernicus.eu/documents/12833/14545/DAP+Document+++current/c2449218-3ed9-434a-b32c-edfb95b9362</a>
[RD.10]	GMES Space Component Data Access Portfolio: Data Warehouse 2011-2014 <a href="https://spacedata.copernicus.eu/documents/12833/14553/DAP_Document_DWH_V2.8_27122013.pdf">https://spacedata.copernicus.eu/documents/12833/14553/DAP_Document_DWH_V2.8_27122013.pdf</a>

## 2 Product specifications

The Coastal Zones products provide a detailed Land Cover/Land Use dataset for the coastal zones of the EEA39. The mapped coastal zones are delimited by the CLC boundaries on the seaward side and include an adapted 10 km wide strip on landward side, including specific areas under clear coastal influence or being clearly relevant for coastal zones even if reaching further than 10 km landwards.

The CZ LC/LU product includes three complementary layers:

1. LC/LU status map for the reference year 2012.
2. LC/LU status map for the reference year 2018.
3. LC/LU change map 2012-2018 derived from and fully consistent with 1) and 2) to characterize the evolution of the coastal zones over time.

Product specifications of each layer are described in the following three tables.

*Table 1: Coastal Zones Land Cover and Land Use status map 2012*

Coastal Zones Land Cover and Land Use status map 2012	
<b>Product Title / Content</b>	<b>Product Short Name</b>
Coastal Zones Land Cover and Land Use status map 2012	
<b>Product Definition</b>	
The LCLU status map provides a detailed Land Cover and Land Use map of the coastal land zone within EEA39, for a specific reference year, based on VHR satellite imagery and coastal zones nomenclature.	
<b>Input Data Sources</b>	
1)Coastal Zones AOI (adapted buffer of EU-Hydro dataset) 2)Image data:  <i>Products:</i> <ul style="list-style-type: none"><li>• DWH_MG2b_CORE_03</li><li>• D2_MG2b_NARA_011b</li><li>• D2_MG2b_LOLA_011b</li><li>• VHR_IMAGE_2015</li></ul> <i>Missions:</i> <ul style="list-style-type: none"><li>• SPOT-5 (2.5m)</li><li>• SPOT-6 (1.5m/4.0m)</li><li>• SPOT-7 (4.0m)</li><li>• Pléiades (2.0m)</li><li>• WorldView-2 (2.0m)</li></ul> 3)Additional data: CLC 2012/2018; Urban Atlas 2012/2018; GIO HR Layers; DWH_MG2_CORE_01 Coverage 2 (RapidEye, 5m); National orthophoto WMS, Google Earth, Bing Maps; Numerous additional reference and in-situ data sources.	
<b>Methodology</b>	
Mixture of automatic classification routines and visual interpretation of VHR satellite data implementing tailored Coastal Zones nomenclature.	
<b>Geographic Coverage</b>	
Customized 10 km landwards buffer Coastal land zone and 25 km seawards buffer including territorial waters within EEA39.	
<b>Projection</b>	
ETRS89 Lambert Azimuthal Equal Area (LAEA) (EPSG 3035)	
<b>Temporal Reference</b>	
Reference year 2012 (products of the reference year 2012 are produced based on 2011-2014 reference data)	
<b>Geometric Resolution / Equivalent Scale</b>	
1:10.000	
<b>Nomenclature</b>	
71 thematic classes	
<b>Minimum Mapping Unit</b>	
0.5 ha	
<b>Minimum Mapping Length</b>	
N/A	
<b>Minimum Mapping Width</b>	
10 m	

<b>Thematic/Positional Product Accuracy</b>
≥ 80 % for class specific user and produced accuracies
≥ 85 % overall accuracy
Positional accuracy: RMSE ≤ 5m

*Table 2: Coastal Zones Land Cover and Land Use status map 2018*

<b>Coastal Zones Land Cover and Land Use status map 2018</b>					
<b>Product Title / Content</b>	<b>Product Short Name</b>				
Coastal Zones Land Cover and Land Use status map 2018	CZ_LCLU_2018				
<b>Product Definition</b>					
The LCLU status map provides a detailed Land Cover and Land Use map of the coastal land zone within EEA39, for a specific reference year, based on VHR satellite imagery and coastal zones nomenclature.					
<b>Input Data Sources</b>					
<p>1) Coastal Zones AOI (adapted buffer of EU-Hydro dataset)</p> <p>2) Image data:</p> <table> <tr> <td><i>Products:</i></td><td><i>Missions:</i></td></tr> <tr> <td> <ul style="list-style-type: none"> <li>VHR_IMAGE_2018</li> </ul> </td><td> <ul style="list-style-type: none"> <li>SPOT-6 (1.5m/4.0m)</li> <li>SPOT-7 (4.0m)</li> <li>Pléiades (2.0m)</li> <li>WorldView-2 (2.0m)</li> <li>SuperView-1 (2.0m)</li> <li>KOMPSat (2.0m)</li> <li>Planet Dove (4.0m)</li> <li>Deimos-2 (4.0m)</li> <li>TripleSat-1 (4.0m)</li> </ul> </td></tr> </table> <p>3) Additional data:</p> <p>CLC 2012/2018; Urban Atlas 2012/2018; GIO HR Layers; National orthophoto WMS, Google Earth, Bing Maps; Numerous additional reference and in-situ data sources.</p>		<i>Products:</i>	<i>Missions:</i>	<ul style="list-style-type: none"> <li>VHR_IMAGE_2018</li> </ul>	<ul style="list-style-type: none"> <li>SPOT-6 (1.5m/4.0m)</li> <li>SPOT-7 (4.0m)</li> <li>Pléiades (2.0m)</li> <li>WorldView-2 (2.0m)</li> <li>SuperView-1 (2.0m)</li> <li>KOMPSat (2.0m)</li> <li>Planet Dove (4.0m)</li> <li>Deimos-2 (4.0m)</li> <li>TripleSat-1 (4.0m)</li> </ul>
<i>Products:</i>	<i>Missions:</i>				
<ul style="list-style-type: none"> <li>VHR_IMAGE_2018</li> </ul>	<ul style="list-style-type: none"> <li>SPOT-6 (1.5m/4.0m)</li> <li>SPOT-7 (4.0m)</li> <li>Pléiades (2.0m)</li> <li>WorldView-2 (2.0m)</li> <li>SuperView-1 (2.0m)</li> <li>KOMPSat (2.0m)</li> <li>Planet Dove (4.0m)</li> <li>Deimos-2 (4.0m)</li> <li>TripleSat-1 (4.0m)</li> </ul>				
<b>Methodology</b>					
Produced by merging LCLU status 2012 and LCLU change map in a GIS environment.					
<b>Geographic Coverage</b>					
Customized 10 km landwards buffer Coastal land zone and 25 km seawards buffer including territorial waters within EEA39.					
<b>Projection</b>					
ETRS89 Lambert Azimuthal Equal Area (LAEA) (EPSG 3035)					
<b>Temporal Reference</b>					
Reference year 2018 (products of the reference year 2018 are produced based on 2017-2019 reference data)					
<b>Geometric Resolution / Equivalent Scale</b>					
1:10.000	71 thematic classes				
<b>Minimum Mapping Unit</b>	<b>Minimum Mapping Length</b>	<b>Minimum Mapping Width</b>			
0.5 ha	N/A	10 m			
<b>Thematic/Positional Product Accuracy</b>					
<p>≥ 80 % for class specific user and produced accuracies</p> <p>≥ 85 % overall accuracy</p> <p>Positional accuracy: RMSE ≤ 5m</p>					

Table 3: Coastal Zones Land Cover and Land Use change map 2012-2018

Coastal Zones Land Cover and Land Use change map 2012-2018		
Product Title / Content	Product Short Name	
Coastal Zones Land Cover and Land Use change map 2012-2018	CZ_LCLU change_2012_2018	
Product Definition		
The LCLU change map provides a detailed Land Cover and Land Use change map of the coastal land zone within EEA39, between two specific reference years, based on VHR satellite imagery and coastal zones nomenclature.		
Input Data Sources		
<b>1) Coastal Zones AOI (adapted buffer of EU-Hydro dataset)</b> <b>2) Image data:</b> <i>Products:</i> <ul style="list-style-type: none"> <li>• DWH_MG2b_CORE_03</li> <li>• D2_MG2b_NARA_011b</li> <li>• D2_MG2b_LOLA_011b</li> <li>• VHR_IMAGE_2015</li> <li>• VHR_IMAGE_2018</li> </ul> <i>Missions:</i> <ul style="list-style-type: none"> <li>• SPOT-5 (2.5m)</li> <li>• SPOT-6 (1.5m/4.0m)</li> <li>• SPOT-7 (4.0m)</li> <li>• Pléiades (2.0m)</li> <li>• WorldView-2 (2.0m)</li> <li>• SuperView-1 (2.0m)</li> <li>• KOMPSat (2.0m)</li> <li>• Planet Dove (4.0m)</li> <li>• Deimos-2 (4.0m)</li> <li>• TripleSat-1 (4.0m)</li> </ul> <b>3) Additional data:</b> CLC 2012/2018; Urban Atlas 2012/2018; GIO HR Layers; National orthophoto WMS, Google Earth, Bing Maps; Numerous additional reference and in-situ data sources.		
Methodology		
Mixture of automatic classification routines and visual interpretation of VHR satellite data implementing tailored Coastal Zones nomenclature.		
Geographic Coverage		
Customized 10 km landwards buffer Coastal land zone and 25 km seawards buffer including territorial waters within EEA39.		
Projection		
ETRS89 Lambert Azimuthal Equal Area (LAEA) (EPSG 3035)		
Temporal Reference		
Based on very high resolution (VHR) satellite imagery of the reference years 2012 and 2018		
Geometric Resolution / Equivalent Scale		
1:10.000	71 thematic classes	
Minimum Mapping Unit	Minimum Mapping Length	Minimum Mapping Width
0.5 ha	N/A	10 m
Thematic/Positional Product Accuracy		
$\geq 80\%$ for class specific user and produced accuracies $\geq 85\%$ overall accuracy Positional accuracy: RMSE $\leq 5\text{m}$		

## 2.1 Nomenclature

The Coastal Zones LC/LU layer differentiates 71 thematic LC/LU classes. In line with the other thematic hotspot products, the CZ nomenclature is designed to address the MAES classes at level 2.0.

Table 4 describes the CZ nomenclature and how CZ classes shall be aggregated to map MAES at level 2. More details about the CZ nomenclature can be found in [RD.5].

Table 4: Detailed CZ LC/LU classes and cross reference to MAES Level 2

Level 1	Level 2	Level 3	Level 4	Level 5	Ecosystem types level 2 (MAES)
1 Urban	1.1 Urban fabric, industrial, commercial, public, military and private units	1.1.1 Urban fabric (predominantly public and private units)	1.1.1.1 Continuous urban fabric (IMD ≥80%)		Urban
			1.1.1.2 Dense urban fabric (IMD ≥30-80%)		
			1.1.1.3 Low density fabric (IMD <30%)		
		1.1.2 Industrial, commercial, public and military units	1.1.2.1 Industrial, commercial, public and military units (other)		
			1.1.2.2 Nuclear energy plants and associated land		
	1.2 Transport infrastructure	1.2.1 Road networks and associated land			
		1.2.2 Railways and associated land			
		1.2.3 Port areas and associated land	1.2.3.1 Cargo port		
			1.2.3.2 Passenger port		
			1.2.3.3 Fishing port		
	1.3 Mineral extraction, dump and construction sites, land without current use	1.3.1 Mineral extraction, dump and construction sites	1.2.3.4 Naval port		
			1.2.3.5 Marinas		
			1.2.3.6 Local multi-functional harbours		
	1.4 Green urban, sports and leisure facilities	1.2.3.7 Shipyards			
		1.2.4 Airports and associated land			
2 Cropland	2.1 Arable land	2.1.1 Arable irrigated and non-irrigated land			Cropland
		2.1.2 Greenhouses			
	2.2 Permanent crops	2.2.1 Vineyards, fruit trees and berry plantations			
		2.2.2 Olive groves			
	2.3 Heterogeneous agricultural area	2.3.1 Annual crops associated with permanent crops			
		2.3.2 Complex cultivation patterns			
		2.3.3 Land principally occupied by agriculture with significant areas of natural vegetation			
		2.3.4 Agro-forestry			
3 Woodland and forest	3.1 Broadleaved forest	3.1.1 Natural & semi-natural broadleaved forest			Woodland and forest
		3.1.2 Highly artificial broadleaved plantations			
	3.2 Coniferous forest	3.2.1 Natural & semi-natural coniferous forest			
		3.2.2 Highly artificial coniferous plantations			
	3.3 Mixed forest	3.3.1 Natural & semi-natural mixed forest			
		3.3.2 Highly artificial mixed plantations			
	3.4 Transitional woodland and scrub				
4 Grassland	3.5 Lines of trees and scrub				Grassland
	3.6 Damaged forest				
	4.1 Managed grassland	4.2.1 Semi-natural grassland			
	4.2 Natural & semi-natural grassland				

		4.2.2 Alpine and sub-alpine natural grassland			
5 Heathland and scrub	5.1 Heathland and moorland 5.2 Alpine scrub land 5.3 Sclerophyllous scrubs				Heathland and shrub
6 Open spaces with little or no vegetation	6.1 Sparsely vegetated areas  6.2 Beaches, dunes, river banks  6.3 Bare rocks, burnt areas, glaciers and perpetual snow	6.1.1 Sparse vegetation on sands  6.1.2 Sparse vegetation on rocks  6.2.1 Beaches and dunes  6.2.2 River banks  6.3.1 Bare rocks, outcrops, cliffs  6.3.2 Burnt areas (except burnt forest)  6.3.3 Glaciers and perpetual snow	6.2.1.1 Beaches  6.2.1.2 Dunes  6.3.1.1 Bare rocks and outcrops  6.3.1.2 Coastal cliffs	6.2.1.1.1 Sandy beaches  6.2.1.1.2 Shingle beaches	Sparsely vegetated land
7 Wetland	7.1 Inland wetlands  7.2 Coastal wetlands	7.1.1 Inland marshes  7.1.2 Peat bogs  7.2.1 Salt marshes  7.2.2 Salines  7.2.3 Intertidal flats	7.1.2.1 Exploited peat bogs  7.1.2.2 Unexploited peat bogs		Wetlands
8 Water	8.1 Water courses  8.2 Lakes and reservoirs  8.3 Transitional waters  8.4 Sea and ocean	8.1.1 Natural & semi-natural water courses  8.1.2 Highly modified water courses and canals  8.1.3 Seasonally connected water courses (oxbows)  8.2.1 Natural lakes  8.2.2 Reservoirs  8.2.3 Aquaculture ponds  8.2.4 Standing water bodies of extractive industrial sites  8.3.1 Lagoons  8.3.2 Estuaries  8.3.3 Marine inlets and fjords  8.4.1 Open sea  8.4.2 Coastal waters		Marine inlets and transitional waters	Rivers and lakes  Marine inlets and transitional waters  Open ocean Coastal

A recoding rule table from 4th to 5th class level has been agreed with EEA and applied to all the CZ mapping products in order to maximize coherence between CZ and N2k nomenclatures (See Appendix A). For the same reason, compared to the previous deliveries, in this final delivery the LC/LU classes 8.3.2.0 – “Marine inlets and fjords” and 8.3.3.0 – “Estuaries” have been switched (in the previous deliveries the LC/U class 8.3.2.0 was “Estuaries” and the LC/LU class 8.3.3.0 was “Marine inlets and fjords”).

## 2.2 Overview of mapped area

The entire mapped area (100% of the AOI) totals 2.229.478 km<sup>2</sup>, including the marine and ocean LCLU classes: 84100 - Open sea and 84200 - Coastal waters.

In terms of only land mapped area<sup>1</sup> the size of the AOI is: 723.518 km<sup>2</sup> (for status layer 2018).

Compared to the 719.844,2 km<sup>2</sup> defined in SC2 + SC3 (and spatially defined in [RD.4]), the final AOI includes additional 3.673 km<sup>2</sup>. The additional km<sup>2</sup> originates from a more detailed mapping of the *LCLU class 72300 - Intertidal flats* and, to a minimal extent, from a further refining of the coastline which, in some cases, has been corrected to improve the overlap with the VHR images.

More in detail, *Class 72300 - Intertidal flats*, initially extracted from the CLC map, was furtherly refined through photointerpretation of the VHR images by including additional intertidal flats that were not included in the CLC map due to the different (lower) MMU of the latter.

Figure 1 illustrates the spatial distribution of the total area mapped.

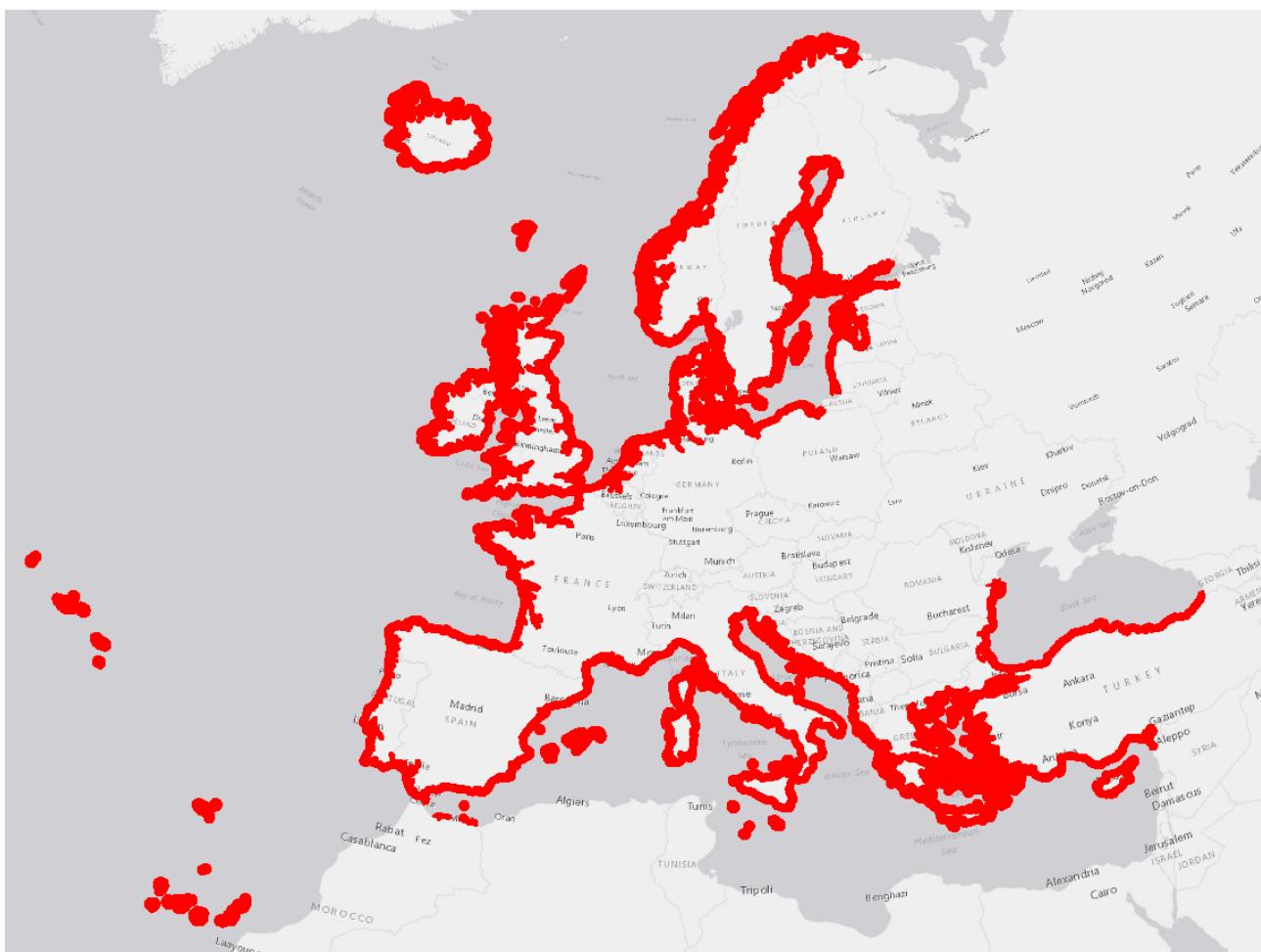


Figure 1: Spatial distribution of the area mapped.

<sup>1</sup> i.e. excluding marine and ocean LCLU classes: 83200 - Estuaries, 83300 - Marine inlets and fjords, 84100 - Open sea and 84200 - Coastal waters

## 2.2.1 Summary statistics

The summary statistics on the CZ LC/LU class spatial distribution for the mapped area is reported in Table 5. The change area covers just ~1,5% of the total land surface of the mapped area.

Table 5: CZ LC/LU class spatial distribution for the mapped area.

Class code	Class names	Status map 2012			Status layer 2018			Change layer 2012-2018		
		Counts	Area (km <sup>2</sup> )	Area (%)	Counts	Area (km <sup>2</sup> )	Area (%)	Area gain (km <sup>2</sup> )	Area loss (km <sup>2</sup> )	Diff (km <sup>2</sup> )
11110	Continuous urban fabric (IM,D ≥ 80%)	27762	3246,65	0,15%	27873	3258,51	0,15%	13,42	1,55	11,86
11120	Dense urban fabric (IM,D ≥ 30-80%)	161366	18827,99	0,84%	161707	19084,97	0,86%	264,94	7,96	256,98
11130	Low density urban fabric (IM,D < 30%)	553987	13767,87	0,62%	556971	13943,46	0,63%	182,48	6,90	175,58
11210	Industrial, commercial, public and military units (other)	376863	11314,42	0,51%	385050	11862,07	0,53%	586,14	38,49	547,64
11220	Nuclear energy plants and associated land	41	16,72	>0,01%	50	18,74	>0,01%	2,02		2,02
12100	Road networks and associated land	7736	4695,29	0,21%	7817	4789,97	0,21%	97,68	3,00	94,68
12200	Railways and associated land	3092	705,27	0,03%	3141	713,83	0,03%	9,11	0,55	8,55
12310	Cargo port	1794	546,25	0,02%	1811	571,25	0,03%	27,31	2,32	24,99
12320	Passenger port	504	23,34	>0,01%	513	24,94	>0,01%	1,62	0,02	1,59
12330	Fishing port	1480	29,51	>0,01%	1518	30,56	>0,01%	1,08	0,02	1,05
12340	Naval port	116	31,88	>0,01%	116	32,23	>0,01%	0,34		0,34
12350	Marinas	3506	145,88	0,01%	3559	149,34	0,01%	3,62	0,16	3,46
12360	Local multi-functional harbours	1285	35,54	>0,01%	1293	35,98	>0,01%	0,60	0,16	0,44
12370	Shipyards	402	40,54	>0,01%	409	41,80	>0,01%	1,32	0,06	1,27
12400	Airports and associated land	751	908,50	0,04%	759	912,90	0,04%	8,56	4,17	4,39
13110	Mineral extraction sites	14767	1449,72	0,07%	14881	1510,91	0,07%	164,41	103,23	61,19
13120	Dump sites	2013	117,60	0,01%	2055	117,57	0,01%	7,81	7,84	-0,03
13130	Construction sites	14015	602,97	0,03%	10930	540,62	0,02%	393,42	455,76	-62,34
13200	Land without current use	30742	840,84	0,04%	29031	788,19	0,04%	82,13	134,78	-52,65
14000	Green urban, sports and leisure facilities	101860	5827,75	0,26%	103091	5896,32	0,26%	100,40	31,83	68,57
21100	Arable irrigated and non-irrigated land	335945	122755,66	5,51%	338372	122217,06	5,48%	353,05	891,65	-538,61

21200	Greenhouses	28913	1549,81	0,07%	30257	1703,81	0,08%	202,90	48,90	154,00
22100	Vineyards, fruit trees and berry plantations	111145	15598,94	0,70%	112828	15728,69	0,71%	298,29	168,55	129,75
22200	Olive groves	108815	15297,06	0,69%	109494	15283,00	0,69%	41,30	55,35	-14,05
23100	Annual crops associated with permanent crops	4444	480,82	0,02%	4466	479,17	0,02%	1,30	2,94	-1,65
23200	Complex cultivation patterns	38258	3494,51	0,16%	38368	3487,52	0,16%	4,94	11,93	-6,99
23300	Land principally occupied by agriculture with significant areas of natural vegetation	23949	2854,33	0,13%	24042	2851,10	0,13%	4,55	7,78	-3,23
23400	Agro-forestry (Mediterranean Areas)	2743	1048,79	0,05%	2747	1044,44	0,05%	2,30	6,66	-4,35
31100	Natural & semi-natural broadleaved forest	426043	74640,42	3,35%	428992	74527,39	3,34%	470,67	583,71	-113,04
31200	Highly artificial broadleaved plantations	15290	6172,99	0,28%	15525	6118,50	0,27%	55,74	110,24	-54,50
32100	Natural & semi-natural coniferous forest	244012	76659,29	3,44%	253200	74109,04	3,32%	1299,62	3849,86	-2550,25
32200	Highly artificial coniferous plantations	4441	586,41	0,03%	4806	661,02	0,03%	109,87	35,26	74,61
33100	Natural & semi-natural mixed forest	101368	19043,31	0,85%	102973	18897,99	0,85%	273,64	418,96	-145,32
33200	Highly artificial mixed plantations	393	44,07	>0,01%	453	46,92	>0,01%	5,32	2,47	2,85
34000	Transitional woodland and scrub	171587	12240,05	0,55%	194055	14594,22	0,65%	4659,75	2305,58	2354,17
35000	Lines of trees and scrub	11844	241,67	0,01%	11866	245,75	0,01%	4,91	0,83	4,08
36000	Damaged forest	266	53,84	>0,01%	668	325,50	0,01%	322,92	51,25	271,67
41000	Managed grassland	276578	56337,34	2,53%	277341	56130,94	2,52%	84,91	291,31	-206,40
42100	Semi-natural grassland	362745	35404,02	1,59%	364138	35253,64	1,58%	366,50	516,88	-150,38
42200	Alpine and sub-alpine natural grassland	56	2,41	>0,01%	72	2,86	>0,01%	0,61	0,16	0,45
51000	Heathland and moorland	132860	44469,98	1,99%	133002	44395,65	1,99%	20,90	95,24	-74,33
52000	Alpine scrub land	1024	55,05	>0,01%	1026	55,37	>0,01%	0,38	0,07	0,32
53000	Sclerophyllous scrubs	110991	38964,49	1,75%	111758	38558,07	1,73%	124,68	531,10	-406,42
61100	Sparse vegetation on sands	7061	926,12	0,04%	7142	926,09	0,04%	6,07	6,10	-0,03
61200	Sparse vegetation on rocks	211328	44344,88	1,99%	211545	44378,01	1,99%	62,73	29,60	33,14
62111	Sandy beach	11675	1118,98	0,05%	11708	1131,68	0,05%	21,40	8,71	12,69
62112	Shingle beach	2477	106,09	>0,01%	2470	106,33	>0,01%	0,89	0,64	0,24

62120	Dunes	1458	527,47	0,02%	1464	527,25	0,02%	0,55	0,76	-0,21
62200	River banks	11843	973,52	0,04%	11968	953,47	0,04%	33,24	53,29	-20,05
63110	Bare rocks and outcrops	31194	15086,22	0,68%	31260	15092,21	0,68%	9,93	3,95	5,99
63120	Coastal cliffs	30377	1409,62	0,06%	30355	1406,98	0,06%	0,26	2,90	-2,64
63200	Burnt areas (except burnt forest)	448	129,50	0,01%	540	183,74	0,01%	177,52	123,28	54,24
63300	Glaciers and perpetual snow	3133	1148,63	0,05%	3133	1142,30	0,05%	0,22	6,54	-6,33
71100	Inland marshes	40724	5698,52	0,26%	40835	5702,56	0,26%	22,04	18,00	4,04
71210	Exploited peat bog	3119	1183,07	0,05%	3142	1186,63	0,05%	6,09	2,53	3,56
71220	Unexploited peat bog	63443	18937,96	0,85%	63489	18921,81	0,85%	0,78	16,93	-16,15
72100	Salt marshes	32063	5228,60	0,23%	32109	5221,32	0,23%	9,27	16,55	-7,28
72200	Salines	1087	707,59	0,03%	1093	710,03	0,03%	6,64	4,20	2,44
72300	Intertidal flats	7112	12142,34	0,54%	7123	12148,68	0,54%	9,81	3,48	6,33
81100	Natural & semi-natural water courses	19219	3428,76	0,15%	19274	3463,89	0,16%	59,76	24,63	35,13
81200	Highly modified water courses and canals	7553	722,79	0,03%	7668	739,05	0,03%	18,03	1,77	16,26
81300	Seasonally connected water courses (oxbows)	475	27,91	>0,01%	490	28,42	>0,01%	0,62	0,11	0,50
82100	Natural lakes	107399	12479,63	0,56%	107576	12501,30	0,56%	31,10	9,43	21,67
82200	Reservoirs	7200	168,08	0,01%	7586	187,84	0,01%	22,02	2,26	19,76
82300	Aquaculture ponds	681	126,33	0,01%	696	127,31	0,01%	1,33	0,35	0,98
82400	Standing water bodies of extractive industrial sites	1589	63,50	>0,01%	1752	72,41	>0,01%	13,26	4,35	8,91
83100	Lagoons	2959	5619,55	0,25%	2966	5617,08	0,25%	3,01	5,48	-2,48
83200	Estuaries	597	3367,10	0,15%	601	3360,57	0,15%	0,41	6,94	-6,53
83300	Marine inlets and fjords	701	28829,98	1,29%	711	28806,84	1,29%	0,15	23,28	-23,14
84100	Open sea	250	1267898,72	56,87%	249	1267898,70	56,87%		0,02	-0,02
84200	Coastal waters	803	205906,74	9,24%	812	205893,70	9,24%	28,46	41,50	-13,04
	<b>SUM</b>	<b>4.425.760</b>	<b>2.229.478,03</b>	<b>100%</b>	<b>4.482.781</b>	<b>2.229.478,03</b>	<b>100%</b>	<b>11203,05</b>	<b>11203,05</b>	

## 2.3 Keynotes of used source files

The primary data source used for the mapping activities are the VHR datasets available in the ESA Data WareHouse. More in detail, in the areas covered by this delivery, the VHR2012 dataset is composed mainly by SPOT 5 data with a very small percentage of SPOT 6 data, while the VHR2018 dataset is composed by Pleiades and SPOT 7 data with minor percentages of PlanetScope and Deimos data.

In general, the data quality allows to meet the map specifications with minor issues in some areas where lower resolution images were available. In such cases the correct interpretation of the images has been supported by using available ancillary data.

In case of more than one image was available on a particular area, the interpretation was based on a defined hierarchy of the images: for the Status layer 2012 the images acquired in 2012 were first used, then the images acquired in 2013 and then in 2011 as last option. For Status layer 2018 the images acquired in 2018 were first used, than those acquired in 2017 since no images acquired in 2019 were available.

If more than one image was available in the same year on a particular area, than the hierarchy of the images dates was the following: Sep, Aug, Jul, Jun, May, Oct, Dec, Nov, Apr, Mar, Feb, Jan. For the day of the month the hierarchy was eventually in the reverse order from the last day to the first of the month.

Reference information of the satellite images used for the production of each LCLU map is included in the Parent Scene Identification Layer (PSIL, section 4.4).

In some cases, due to the complexity of the landscape and/or the resolution of the input VHR data, some ancillary data have been used to support the thematic interpretation while the objects delineation was always performed on the VHR satellite data.

The used ancillary data are:

- Microsoft Bing Maps.
- Google Earth satellite images.
- Map of the Nature System of Italy (partial)<sup>2</sup>.
- Pan-European High Resolution Layers<sup>3</sup>.

## 2.4 Keynotes about the production process

The methodology implemented for the production of the Coastal Zone LC/LU map, due to the very detailed thematic specifications, is mainly founded on visual interpretation and delineation from remotely sensed Very High Resolution (VHR) images.

The visual interpretation is supported by a geometric skeleton derived by the integration of the already existing Copernicus Hot Spot mapping products such as Riparian Zones, Natura 2000 and Urban Atlas plus Open Street Map (in particular road and railway features) that have been used to the highest possible extent in order to avoid duplication of work.

The geometric skeleton and the VHR2012 are the basis data for the Coastal Zones LC/LU interpretation of the reference year 2012.

The change detection layer is created starting from the LC/LU 2012 status layer and applying a visual change interpretation and delineation based on the VHR satellite imagery of the reference years 2012 and 2018.

The status map 2018 layer is finally derived through the automatic integration of the status map 2012 and the change layer in a GIS environment.

<sup>2</sup> [http://www.isprambiente.gov.it/en/environmental-services/map-of-the-nature-system?set\\_language=en](http://www.isprambiente.gov.it/en/environmental-services/map-of-the-nature-system?set_language=en)

<sup>3</sup> <https://land.copernicus.eu/pan-european/high-resolution-layers>

## 2.4.1 Integration of existing Copernicus Hot Spot mapping products

The geometric skeleton for Coastal Zones is derived by the following main input data:

- Natura 2000 & Riparian Zones
- Corine Land Cover (just selected classes)
- Urban Atlas (just selected classes & no direct integration)
- Open Street Maps (roads & railways)

Most of the input data have a similar nomenclature and mostly the same specifications as CZ (Minimum Mapping Unit = 0,5ha; Minimum Mapping Width = 10m, no spikes/acute angles, etc.). But still some of the input data can contain errors which are integrated also in the skeleton. These errors result due to:

- different degrees of application of the specifications
- different quality checks tools and methods (improvements of methods from first products to latest products, etc.)
- different thematic interpretations
- The specifications of Urban Atlas differ from CZ: some processing steps are needed to transform UA to input data for the skeleton. These processing steps can result in some artefacts, which produce MMW errors, spikes, etc.

The existing Copernicus Hot Spot mapping products (N2K, RZ, CLC) integrated in the skeleton are final and approved products (although containing some minor errors, e.g. MMW errors).

The integration of all input data into the skeleton also transfers the errors into the skeleton. Due to the combination of all data also some new errors on the border of the input data can be generated.

Ideally all errors in the CZ mapping should be resolved, but:

- 1) some errors are introduced by the input data (that contain errors) that are already officially accepted
- 2) some errors are introduced due to the skeleton generation (input data integration process) and the new mapping

Because some of the input data are already accepted by EEA and in the best-case errorless products could be expected for the integration into the skeleton, these errors are not corrected in the CZ products. Just the errors introduced in the CZ mapping due to the skeleton generation and the new mapping are resolved.

Handling of the different error types are described in the following Table 6.

*Table 6: Handling of the errors inside the geometric skeleton*

Handling of the errors inside the geometric skeleton		
Type	Description	Adopted solution
<b>Border errors between input data</b>	Errors resulting of different classes of the input data on the same locations (different mapping or different granularity of nomenclature)	<ul style="list-style-type: none"> <li>• All errors are resolved</li> <li>• Adjacent polygons on the border with different codes are manually recoded to the correct class</li> <li>• The boundary of the skeleton is not visible in the final product</li> </ul>
<b>Thematic errors</b>	Errors of wrong classification of the input datasets	<p>Errors are corrected if:</p> <ul style="list-style-type: none"> <li>• the wrong classification affects the class on the first code level (e.g. Cropland instead of woodland)</li> <li>• the wrong classification affects change situations (the wrong classes are corrected to be able to represent the changes properly)</li> </ul>

<b>Geometric errors</b>	Geometric/topological errors which violate the CZ specifications (MMU, MMW, spikes, etc.):	<ul style="list-style-type: none"> <li>Errors due the pre-processing of input data to transform them into input data for the skeleton are corrected</li> <li>Errors resulting of the input data of N2K, RZ and CLC will not be corrected (errors directly taken from the input data to the skeleton)</li> </ul>
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#### 2.4.2 Integration of CLC water classes

In order to take into account CZ Users feedback for amending seawards the final AOI, the “4.2.3 - Intertidal flats” thematic class from Corine Land Cover has been extracted and included in the final CZ product.

In addition, in order to close small gaps in the seawards and to homogenize the AOI in the whole EEA39, all sea and ocean gaps have been closed. For this reason the “5.2.3 Sea and ocean” thematic class from Corine Land Cover has been used and included in the final CZ product. The adopted solution improves the initial definition of a 1 km landwards buffer and makes the cartographic representation of the final product more aesthetically pleasing.

#### 2.4.3 Different water levels in VHR2012 and VHR2018

For the scope of the Coastal Zones LC/LU production, the EU-Hydro coastline (updated on February 20, 2019 and amended through a comparison with the image data available from VHR-2018) is used as starting point. Only different water levels due to erosion/accretion of this coastline are mapped as changes in the change layer.

Different water body levels in VHR2012 and VHR2018 due to tide or temporal flooded areas are not considered as LC/LU changes. The reference year 2012 is used as basis for the LC/LU mapping and the water level of 2012 is delineated. If temporal fluctuations of water level between 2012 and 2018 without any real permanent change are detected, the water level change is not mapped and a comment is added to the class polygon.

### 3 Quantitative assessment of LCLU delivered data

The following section describes the internal accuracy assessment procedures and results of the LC/LU mapping referred to the final delivery (100% of the final AOI).

#### 3.1 Accuracy Assessment

A well-proven thematic accuracy assessment was performed to evaluate the accuracy (overall accuracy, user's and producer's accuracy) of the Coastal Zones LC/LU status product of 2012, the status product of 2018 and the change layer (2012-2018). In order to understand the procedure of the internal accuracy assessment performed by the service providers, the applied sampling and response design is briefly described in this report. At the end of the report the results of the internal accuracy assessment for this intermediate delivery are presented. The validation shows that the consortium has delivered high quality products.

#### 3.2 Sampling Design

For the Coastal Zones thematic accuracy assessment of the status layer 2012, the status layer 2018 and change layer 2012-2018, a stratified random point sampling scheme, in which all areas have a known non-zero probability of sampling, was selected. The first level strata of the sampling scheme are the Delivery Units (3 deliveries with an area distribution of 15,1%, 34,9% and 50,0%) and the second level strata are all LC/LU classes on Level 5 that have been mapped within a Delivery Unit, while taking into account the area sizes of the respective LC/LU class occurrence. To sufficiently cover changes and potential changes in the validation, additional sample points were added in areas mapped as changes (commission stratum) and areas prone to changes (omission stratum).

#### 3.3 Response Design

For the internal validation of the Coastal Zones status 2012 layer, status 2018 layer and change layer 2012-2018, reference labels down to class level 5 were inferred by visual interpretation of the selected sample points. This step was performed by independent, well-trained operators, who were not involved in the production itself, using the Very High-Resolution (VHR) satellite data or higher quality data if available and applicable (e.g. Google Earth, Bing Maps, national orthophoto WMS). When re-interpreting the LC/LU sample point, the response design had to respect the latest product specifications with Coastal Zones LC/LU nomenclature guidelines ([RD.5]). A blind validation (without seeing the mapped classes) was performed on Level 1, a validation using a plausibility approach was used for level 5 (validator have information on the mapped class and need to decide if it is plausible and correct).

#### 3.4 Internal validation results

The internal validation comprises the estimation of the overall weighted thematic accuracy of the status layer of 2012, status layer of 2018 and change layer 2012-2018. In order to maintain full statistical rigor and representativeness and account for unequal inclusion probabilities and the relative occurrence of classes, area related weights were applied, according to the area ratio for each class compared to the overall area.

The area weighting was adapted for the marine classes (8.4 Sea and ocean: 8.4.1 Open sea & 8.4.2 Coastal waters). The large area of these classes (>66% of the total Area of Interest) would distort the validation, since the weighting factor of them would overestimate the influence of these two classes. The area reaching 1 km from the coastline seawards was chosen as reference area for these classes, as this was the original Area of Interest. Using this approach, the validation kept its statistical soundness, but increased its validity and significance.

In total 60.001 sample points were evaluated for the full delivery of the Coastal Zones product. Every LC/LU class and every region should be represented sufficiently.

The validation assessment includes the Overall Accuracy, Producer's Accuracies and User's Accuracies for Status 2012, Status 2018 and for the Change 2012-2018. The assessments are made for Level 1 (blind

validation) and Level 5 (plausibility validation). On Table 7**Error! Reference source not found.** the Overall Accuracy for Status 2012 and Status 2018 is presented, on Table 10**Error! Reference source not found.** and Table 11**Error! Reference source not found.** the Producer's and User's Accuracies of the 8 Level 1 classes and the 71 Level 5 classes respectively. Accuracy metrics of the change layer 2012-2018 are demonstrated on Table 8**Error! Reference source not found.** (Overall Accuracy of the change layer 2012-2018) and on Table 9**Error! Reference source not found.** (Producer's and User's Accuracies of the changes).

The Overall Accuracy for the plausibility validation on Level 5 is 97,90 % for Status 2012 and 97,70 % for Status 2018. For the blind validation on Level 1 these values are slightly higher, 98,27 % for Status 2012 and 98,24 % for Status 2018. All these values exceed the required Overall Accuracies of 85 %.

*Table 7: Overall Accuracies for Status 2012 and Status 2018.*

		Status 2012		Status 2018	
		Overall Accuracy	Confidence Interval	Overall Accuracy	Confidence Interval
Level 5	plausibility validation	97.90%	0.0015	97.70%	0.0016
Level 1	blind validation	98.27%	0.0013	98.24%	0.0013

For the change layer 2012-2018 an Overall Accuracy of 99,61 % on Level 5 (with aggregation of the changes on level 1), 99,44 % on Level 5 (with aggregation of the changes on level 5), and 99,61 % on Level 1 is reached. These values are high, because they state that 99,61 % of the area is correctly mapped as change or non-change. The change area covers just ~1,64 % of the total land surface of the Area of Interest.

*Table 8: Overall Accuracies for Change 2012-2018.*

		Change 2012-2018	
		Overall Accuracy	Confidence Interval
Level 5	plausibility validation / aggregation level 1	99.606%	0.000545
Level 5	plausibility validation / aggregation level 5	99.437%	0.000795
Level 1	blind validation	99.608%	0.000543

The changes possess a Producer's Accuracy of 92,94 % and a User's Accuracy of 93,26 % (Validation on Level 5 with aggregation of the changes on level 5) This means, >92 % of the real LC/LU changes were detected correctly and >93 % of the mapped changes are real LC/LU changes (see Table 9**Error! Reference source not found.**).

*Table 9: Producer's and User's Accuracies for Change 2012-2018.*

		Change 2012-2018	
		Producer's Accuracy	User's Accuracy
Changes	92.935%	93.252%	
	97.851%	99.723%	

The Producer's and User's Accuracy for Status 2012 and Status 2018 for the blind validation of Level 1 classes all achieve the required 80 %.

*Table 10: Producer's and User's Accuracies for Status 2012 and Status 2018 Level 1 classes.*

Class	2012		2018	
	Producer's Accuracy	User's Accuracy	Producer's Accuracy	User's Accuracy
1	97.39%	98.66%	96.69%	98.60%
2	97.67%	98.20%	97.09%	98.12%
3	98.68%	98.18%	98.08%	98.65%
4	94.91%	96.96%	92.08%	96.34%
5	91.20%	96.76%	88.17%	95.96%
6	94.70%	98.15%	91.72%	98.32%
7	97.08%	98.41%	87.75%	98.37%
8	98.31%	99.50%	93.56%	99.48%

Also, the Producer's and User's Accuracies of the 71 classes on Level 5 were estimated. Most of the classes exceed the 80 % in the Producer's and User's Accuracy. Some rare classes have slightly lower accuracy values (see Table 11 Error! Reference source not found.).

Table 11: Producer's and User's Accuracies for Status 2012 and Status 2018 Level 5 classes.

Class	2012		2018		Class	2012		2018	
	Producer's Accuracy	User's Accuracy	Producer's Accuracy	User's Accuracy		Producer's Accuracy	User's Accuracy	Producer's Accuracy	User's Accuracy
11110	99.88%	90.52%	96.21%	90.57%	35000	99.13%	94.24%	90.34%	94.24%
11120	91.65%	98.06%	89.70%	98.23%	36000	88.55%	83.84%	96.90%	79.96%
11130	86.69%	98.11%	94.00%	98.11%	41000	97.28%	98.14%	95.74%	97.72%
11210	96.52%	97.97%	94.67%	97.99%	42100	91.62%	94.35%	91.49%	93.69%
11220	76.39%	90.50%	100.00%	90.50%	42200	94.50%	26.34%	67.32%	27.65%
12100	98.51%	98.38%	95.65%	98.90%	51000	99.11%	97.36%	89.76%	97.20%
12200	83.05%	99.70%	100.00%	99.71%	52000	97.61%	86.68%	100.00%	81.55%
12310	95.37%	92.24%	90.29%	92.33%	53000	99.95%	96.14%	91.07%	95.71%
12320	87.31%	91.04%	96.48%	90.56%	61100	98.83%	86.55%	98.22%	87.38%
12330	94.45%	90.59%	81.71%	91.12%	61200	96.02%	97.97%	76.68%	97.83%
12340	96.77%	91.76%	67.70%	91.76%	62111	97.44%	98.48%	88.92%	97.87%
12350	94.81%	87.86%	95.54%	94.04%	62112	83.82%	88.57%	78.55%	88.48%
12360	67.10%	77.36%	94.77%	77.42%	62120	51.18%	98.70%	89.13%	98.75%
12370	97.45%	85.24%	98.35%	85.56%	62200	95.88%	92.25%	90.40%	90.06%
12400	100.00%	99.40%	89.63%	99.40%	63110	99.75%	98.08%	93.45%	97.87%
13110	91.48%	96.65%	92.82%	93.68%	63120	98.02%	97.29%	69.65%	97.26%
13120	93.97%	76.19%	68.78%	73.83%	63200	91.21%	93.87%	100.00%	77.57%
13130	92.59%	95.20%	87.20%	88.64%	63300	96.51%	97.88%	89.32%	97.73%
13200	95.60%	89.43%	90.41%	88.04%	71100	92.93%	95.03%	79.74%	94.98%
14000	70.95%	96.48%	91.71%	96.63%	71210	92.43%	96.36%	78.65%	96.20%
21100	63.11%	99.18%	95.93%	98.90%	71220	98.77%	97.92%	86.73%	97.91%
21200	93.99%	94.89%	94.38%	97.48%	72100	90.64%	98.05%	91.36%	98.20%
22100	96.16%	96.73%	92.23%	96.59%	72200	98.09%	99.54%	99.12%	99.54%
22200	95.06%	96.42%	88.29%	96.06%	72300	88.56%	97.19%	79.61%	97.20%
23100	93.15%	83.38%	93.58%	83.72%	81100	96.86%	98.45%	96.74%	98.24%
23200	92.86%	84.03%	74.17%	83.94%	81200	97.56%	98.90%	86.81%	98.85%
23300	90.38%	86.37%	90.74%	86.28%	81300	100.00%	98.40%	91.27%	98.35%
23400	83.30%	89.88%	97.37%	89.80%	82100	99.65%	99.42%	82.27%	99.15%
31100	99.38%	97.94%	97.18%	97.62%	82200	68.75%	89.53%	91.49%	89.93%
31200	95.80%	99.04%	88.12%	98.99%	82300	86.41%	98.02%	97.61%	98.10%
32100	98.38%	99.44%	97.63%	98.84%	82400	92.29%	90.28%	87.55%	90.47%
32200	94.81%	71.68%	80.16%	86.46%	83100	93.36%	97.51%	96.91%	97.52%
33100	98.15%	98.68%	97.41%	98.47%	83200	97.61%	98.13%	85.44%	98.19%
33200	92.90%	38.10%	90.84%	38.64%	83300	95.77%	95.99%	98.89%	95.98%
34000	90.92%	94.71%	90.80%	94.74%	84100	100.00%	100.00%	99.95%	100.00%
					84200	96.88%	99.65%	96.48%	99.64%

The validation estimates presented above express minimum quality values of the products delivered as the products have been further revised before delivery in order to correct the most important errors resulting from the internal validation process.

## 4 Delivered files

### 4.1 LCLU maps

According to the rules defined in [RD.6],[RD.7] and [RD.8], the data are delivered in three different zip files:

- **CZ\_2012\_DU004\_3035\_V1\_0.zip** (includes the status map 2012)
- **CZ\_2018\_DU004\_3035\_V1\_0.zip** (includes the status map 2018)
- **CZ\_Change\_2012\_2018\_DU004\_3035\_V1\_0.zip** (includes the change map 2012-2018)

Each zip file includes the LCLU maps in Geopackage format as well as the metadata file in a separate folder as required in [RD.6],[RD.7] and [RD.8]. The name of the geopackage is the same of the zip file.

The attributes fields of each of the three layers are reported in Table 12.

*Table 12: attribute fields in the three datasets*

Status map 2012	Status maps 2018	Change map 2012-2018
<b>ID</b>	ID	ID
<b>DU</b>	DU	DU
<b>CODE_1_12</b>	CODE_1_18	CODE_1_12
<b>CODE_2_12</b>	CODE_2_18	CODE_2_12
<b>CODE_3_12</b>	CODE_3_18	CODE_3_12
<b>CODE_4_12</b>	CODE_4_18	CODE_4_12
<b>CODE_5_12</b>	CODE_5_18	CODE_5_18
<b>COMMENT_12</b>	COMMENT_18	CODE_1_18
<b>NODATA_12</b>	NODATA_18	CODE_2_18
<b>AREA_HA</b>	AREA_HA	CODE_3_18
<b>Shape_Length</b>	Shape_Length	CODE_4_18
<b>Shape_Area</b>	Shape_Area	CODE_5_18
		COMMENT
		NODATA_12
		NODATA_18
		CHANGECODE
		AREA_HA
		Shape_Length
		Shape_Area

Where:

- “ID”: unique feature identifier.
- “DU”: coastal zones delivery unit ID.
- “CODE\_1\_12”: LCLU class code level 1, 2012.
- “CODE\_2\_12”: LCLU class code level 2, 2012.
- “CODE\_3\_12”: LCLU class code level 3, 2012.
- “CODE\_4\_12”: LCLU class code level 4, 2012.
- “CODE\_5\_12”: LCLU class code level 5, 2012.
- “CODE\_1\_18”: LCLU class code level 1, 2018.
- “CODE\_2\_18”: LCLU class code level 2, 2018.

- “CODE \_3\_18”: LCLU class code level 3, 2018.
- “CODE \_4\_18”: LCLU class code level 4, 2018.
- “CODE \_5\_18”: LCLU class code level 5, 2018.
- “NODATA\_12”: indicator that polygon was not mapped in 2012 (0 or 1).
- “NODATA\_18”: indicator that polygon was not mapped in 2018 (0 or 1).
- “COMMENT\_12”: MMU or MMW exception and different water level comment.
- “COMMENT\_18”: MMU or MMW exception and different water level comment.
- “COMMENT”: area size exception comment.
- “CHANGECODE”: “CODE\_4\_12”\_“CODE\_4\_18” e.g. “2110\_1111”.
- “AREA\_HA”: “real”, area of polygon in hectares.
- “Shape\_Length”: the perimeter of the feature.
- “Shape\_Area”: the area of the polygon expressed in m<sup>2</sup>.

## 4.2 Reference points interpreted

Reference points interpreted for the product level delivery report are also included in the delivery. The points are delivered in shapefile format included in a zip file. This file collects the validation points used in delivery 1 (15,4% of AOI), delivery 2 (34,6% of AOI) and delivery 3 (50% of AOI), for a total of 60.001 points.

The map validation process has been the same for each single delivery. Since a re-coding to 5<sup>th</sup> level class of the nomenclature has been agreed with EEA during the project (only re-coding not introducing further classification improvement), the validation has been always performed at class level 4 and then the results have been presented at level 5 according to the recoding table agreed with EEA (Appendix A).

Reference points, provided as shapefile named “CZ\_DEL04\_validation\_points.zip”, do not consider the 5<sup>th</sup> level class of the nomenclature. The shapefile has the following attribute table listed in Table 13.

*Table 13: Attribute table of the reference points shapefile.*

Name	Description
<b>Id</b>	Id of the point
<b>CODE_4_12</b>	Class of the polygon underneath the point at the 4 <sup>th</sup> level of the status map 2012
<b>CODE_4_18</b>	Class of the polygon underneath the point at the 4 <sup>th</sup> level of the status map 2018
<b>Val_4_12</b>	Validator class attribution at 4 <sup>th</sup> level for status map 2012 (plausibility approach)
<b>Val_4_18</b>	Validator class attribution at 4 <sup>th</sup> level for status map 2018 (plausibility approach)
<b>Val_1_12</b>	Validator class attribution at 1 <sup>st</sup> level for status map 2012 (blind approach)
<b>Val_1_18</b>	Validator class attribution at 1 <sup>st</sup> level for status map 2018 (blind approach)

The spatial reference system for all data is: ETRS89 ETRS-LAEA equal-area projection (EPSG: 3035).

## 4.3 Metadata

Metadata are provided together with the products as INSPIRE-compliant XML files according to the EEA Metadata Standard for Geographic Information (EEA-MSGI). EEA-MSGI has been developed by EEA to meet needs and demands for inter-operability of metadata. EEA’s standard for metadata is a profile of the ISO 19115 standard for geographic metadata and contains more elements than the minimum required to comply the INSPIRE metadata regulation.

Detailed conceptual specifications on EEA-MSGI and other relevant information on metadata can be found at: <http://www.eionet.europa.eu/gis>.

#### 4.4 PSIL

The Parent Scene Identification Layer (PSIL) is an auxiliary vector file included in the delivery containing spatially explicit reference information of the satellite images used for the production of each LCLU map.

The PSIL includes two files:

- “CZ\_DEL04\_PSIL\_2012.zip” related to the images used for the status map 2012
- “CZ\_DEL04\_PSIL\_2018.zip” related to the images used for the status map 2018

Each zip file includes a vector polygon file in ESRI Shapefile format projected in ETRS89 Lambert Azimuthal Equal Area (EPSG: 3035). The shapefiles define the VHR images used in production for each point of the maps. The attribute table of each shapefile is described in Table 14.

*Table 14: Attribute table of the PSIL shapefiles*

Name	Description
<b>Id</b>	Id of the polygon
<b>Filename</b>	File name of the image as defined in the ESA Data Warehouse
<b>ProdType</b>	Product Type as defined in [RD.9] and [RD.10]
<b>Start_Sens</b>	Start date and time of the acquisition of the image
<b>Stop_Sens</b>	Stop date and time of the acquisition of the image
<b>Platform</b>	Satellite platform code
<b>Datasets</b>	Name of the dataset including the image file in the ESA Data Warehouse
<b>Delivery</b>	Delivery number for which the image has been used

## Appendix A: Re-coding table from 4<sup>th</sup> to 5<sup>th</sup> class level

The following re-coding rule table from 4<sup>th</sup> to 5<sup>th</sup> class level has been agreed with EEA and applied to all the CZ mapping products in order to maximize coherence between CZ and N2k nomenclatures.

forth level of old nomenclature class code	Fifth level of new nomenclature class code
<b>1111</b>	11110
<b>1112</b>	11120
<b>1113</b>	11130
<b>1121</b>	11210
<b>1122</b>	11220
<b>1210</b>	12100
<b>1220</b>	12200
<b>1231</b>	12310
<b>1232</b>	12320
<b>1233</b>	12330
<b>1234</b>	12340
<b>1235</b>	12350
<b>1236</b>	12360
<b>1237</b>	12370
<b>1240</b>	12400
<b>1310</b>	13110
<b>1320</b>	13120
<b>1330</b>	13130
<b>1340</b>	13200
<b>1400</b>	14000
<b>2110</b>	21100
<b>2120</b>	21200
<b>2210</b>	22100
<b>2220</b>	22200
<b>2310</b>	23100
<b>2320</b>	23200
<b>2330</b>	23300
<b>2340</b>	23400
<b>3110</b>	31100
<b>3120</b>	31200
<b>3210</b>	32100
<b>3220</b>	32200
<b>3310</b>	33100
<b>3320</b>	33200
<b>3400</b>	34000
<b>3500</b>	35000
<b>3600</b>	36000
<b>4100</b>	41000
<b>4210</b>	42100
<b>4220</b>	42200
<b>5100</b>	51000

<b>5200</b>	52000
<b>5300</b>	53000
<b>6110</b>	61100
<b>6120</b>	61200
<b>6211</b>	62111
<b>6212</b>	62112
<b>6220</b>	62120
<b>6230</b>	62200
<b>6311</b>	63110
<b>6312</b>	63120
<b>6320</b>	63200
<b>6330</b>	63300
<b>7110</b>	71100
<b>7121</b>	71210
<b>7122</b>	71220
<b>7210</b>	72100
<b>7220</b>	72200
<b>7230</b>	72300
<b>8110</b>	81100
<b>8120</b>	81200
<b>8130</b>	81300
<b>8210</b>	82100
<b>8220</b>	82200
<b>8230</b>	82300
<b>8240</b>	82400
<b>8310</b>	83100
<b>8320</b>	83200
<b>8330</b>	83300
<b>8410</b>	84100
<b>8420</b>	84200