Coastal Erosion from Space

Coastal Erosion time series in Happisburgh (GB)

Coastal Erosion events:

in Nerja (Spain)   *in Kilkee (Ireland)*   *in St Laurent mouth (Canada)*

Seafront Verification and Quality Control

Ref:SO-TR-ARG-003-055-PVR-A4

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Customer: ESA

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Applicable and reference documents

| Id	Description	Reference
AD-1	Product Validation Report	SO-TR-ARG-003-055-PVR
AD-2	Seafront ATBD	SO-TR-ARG-003-055-ATBD-SF
AD-3	Product validation plan	SO-TR-ARG-003-055-PVP

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1. Seafront Verification

The ability of the processor to identify and class the different land cover classes is tested using different satellite data sets over different types of coast, and different weather conditions. Those tests are listed in the PVP (see AD-3). The classification process provides, as detailed on the seafront ATBD (see AD-2), different type of output with the final classification map. The processor computes the corresponding confusion matrix, see figure 1.1 and a confidence map, see figure 1.2. For each test, with the confusion matrix, we can estimate the score of over- and under-estimation of the classification. Those estimations allow us to qualify the ability of the processor to classify land covers.
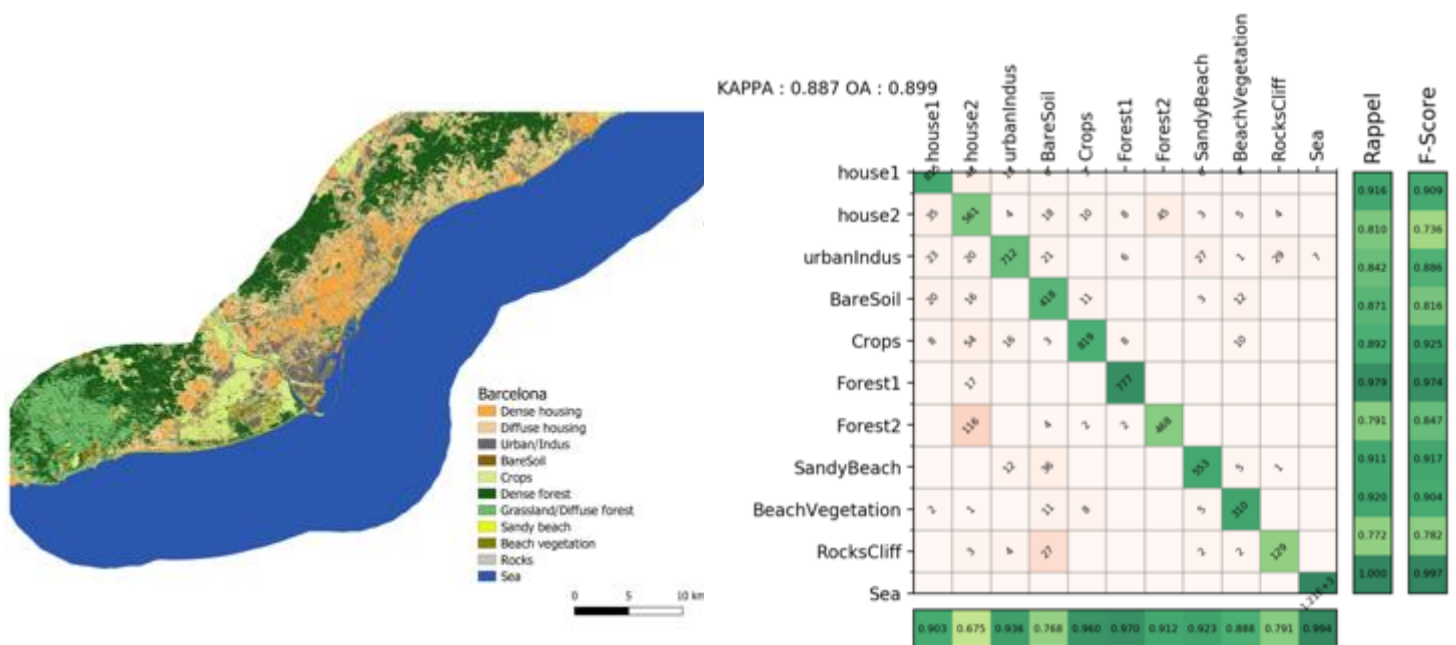
Figure 1.1: Land cover classification for Barcelona area with the corresponding confusion matrix

In a column we can read the overestimation, pixels classified as an 'A' but which don't belong to that class and the rows illustrate the pixels which belong to a class 'A', but have been classed in other categories. The processing chain used to perform land classification provides a confidence map (see figure 1.2) which estimates the confidence in the decision of the classifier. For each pixel it gives likelihood (from 0 to 100) of the result to be correct as estimated by the classifier itself.
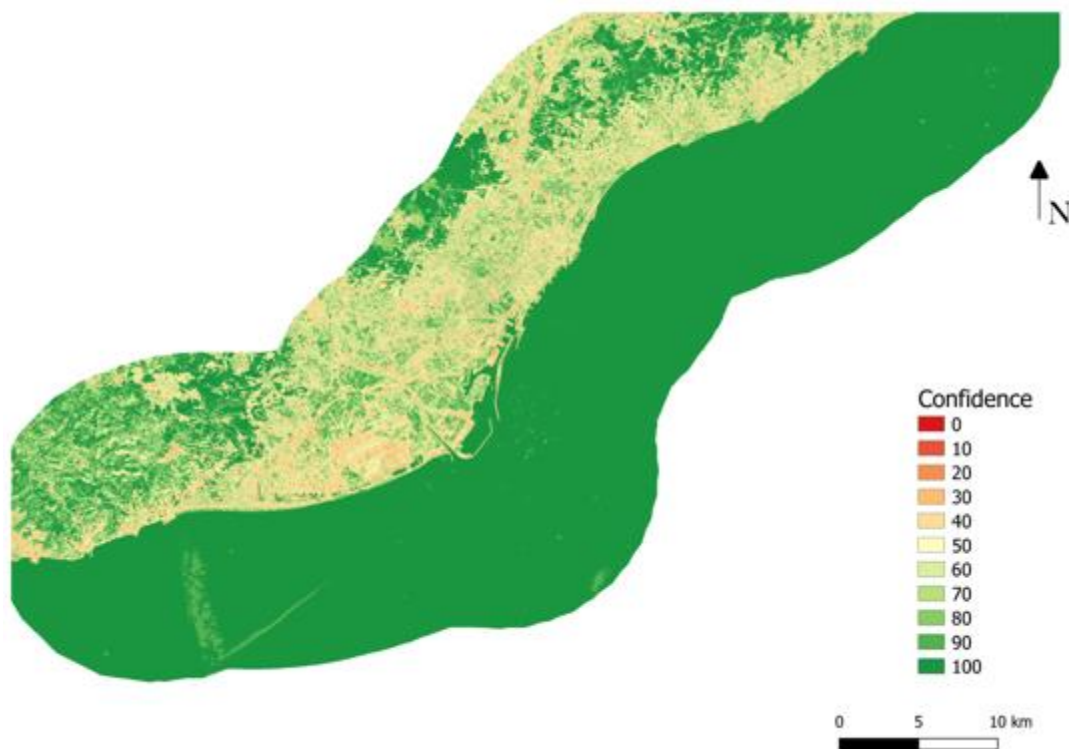
Figure 1.2: Confidence map

Through the analysis of the different maps from the classification processing chain, we can confidently state that the processor ability for land cover classification is verified and accepted.

The following tests reinforce confidence in the processor capacity by presenting the results obtained under various conditions and over different areas.
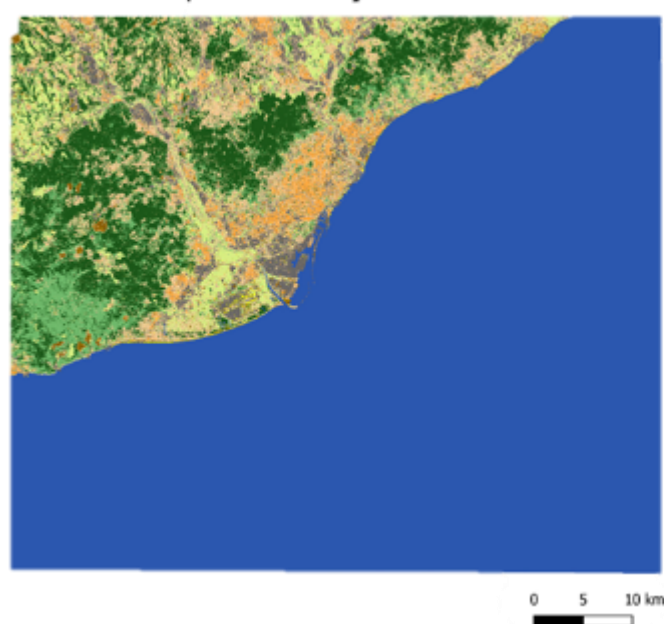
The processor is also able to classify the different land cover classifications using different spectral indices. Tests are perform using the same set of Sentinel-2 images but using different spectral bands and indices:

Table 1.1: Test of various spectral inputs

Red band, Green band, Blue band and NIR band

Classification map of Barcelona for 12 Sentinel-2 Sen2cor L2A products with just RGB and NIR bands

KAPPA : 0.854 OA : 0.870

Blue band, NIR band, GRVI index and NDBI index

Selection of those parameters according to a principal component analysis

Classification map of Barcelona for 12 Sentinel-2 Sen2cor L2A products from 4 independent variables

Classification
- Dense housing
- Diffuse housing
- Urban/Indus
- BareSoil
- Crops
- Dense forest
- Grassland/Diffuse forest
- Sandy beach
- Beach vegetation
- Rocks
- Sea

Red band,Greenband,Blue band, NIR band, SWIR band, NDVI, GRVI, NDWI, NDWI and MNDWI

Selection of those parameters according to a principal component analysis

Classification map of Barcelona for 12 Sentinel-2 Sen2cor L2A products from 10 independent variables
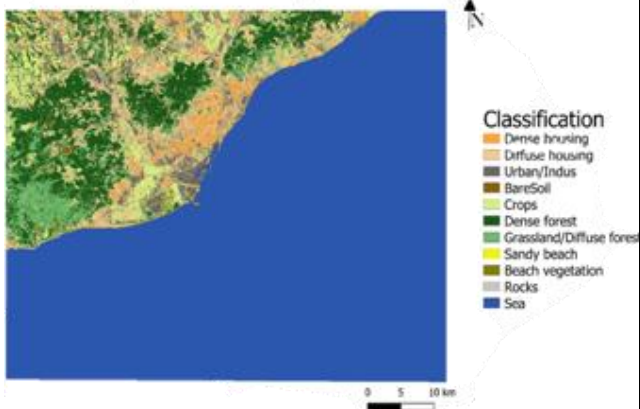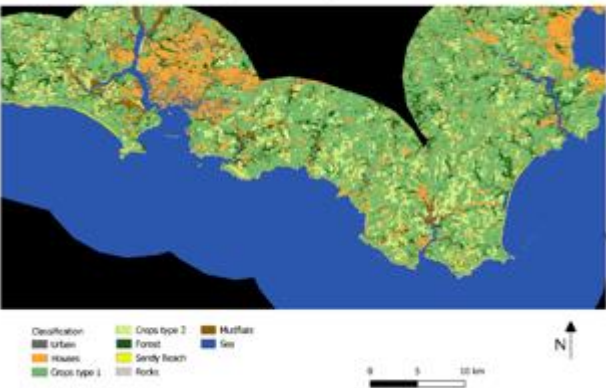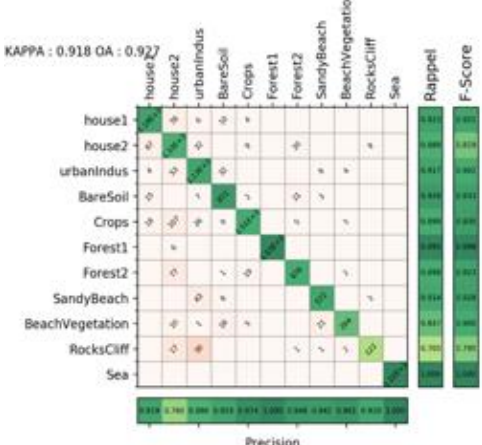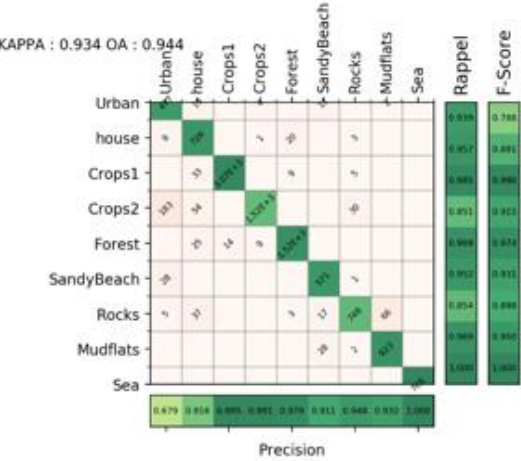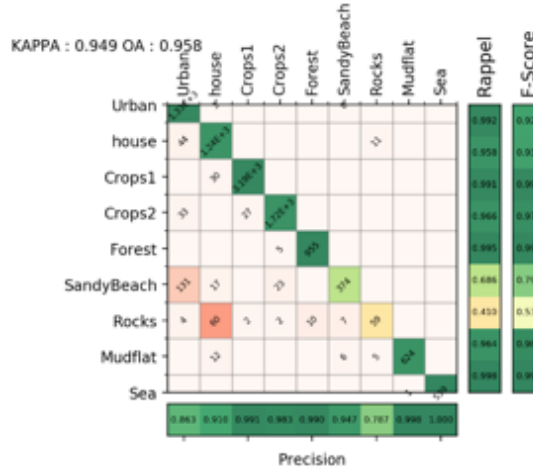
As we can see on table 1.1, the processor is able to classify different type of land cover using multiple comparison of spectral information. However, we can see that depending on the spectral set used, the precision of certain classes changes. The choice of spectral band relies on the requirement of the end-users, how many classes, which type of soils we want to discriminate or regroup.

If preliminary tests shown in the ATDBs and PVP were produced over Barcelona, the processor need to be equally accurate over different location, independently of weather condition or coast shape.

Table 1.2: Test of the classification process over different areas

| Barcelona area	Start Bay area	Dublin area
Classification map of Barcelona for 12 Sentinel-2 Sen2cor L2A products from 10 independent variables	Classification map of Start Bay area for the year 2017	Classification map of Dublin area for the year 2018

2. Seafront QC

The quality control of the classification maps will be evaluated by comparing the classification result with the associated satellite image. The different classes need to match the different land cover type.
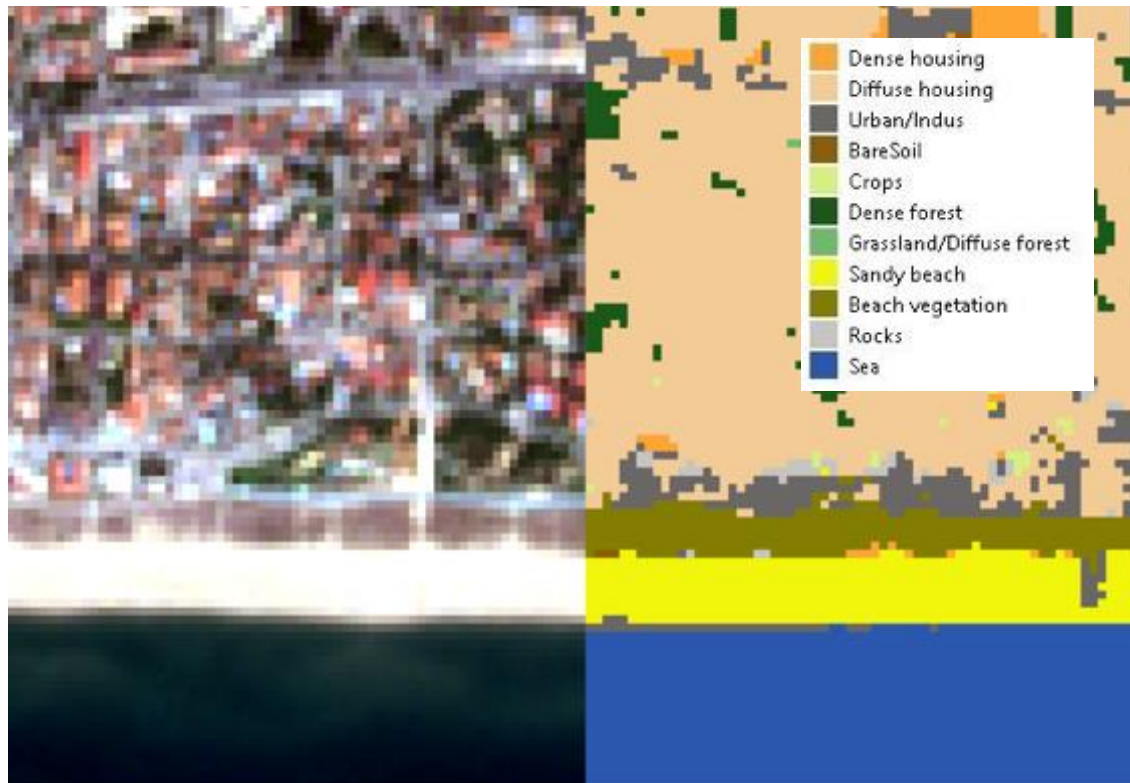
Figure 2.1: By eye comparison of a classification map of Barcelona and the associated satellite image
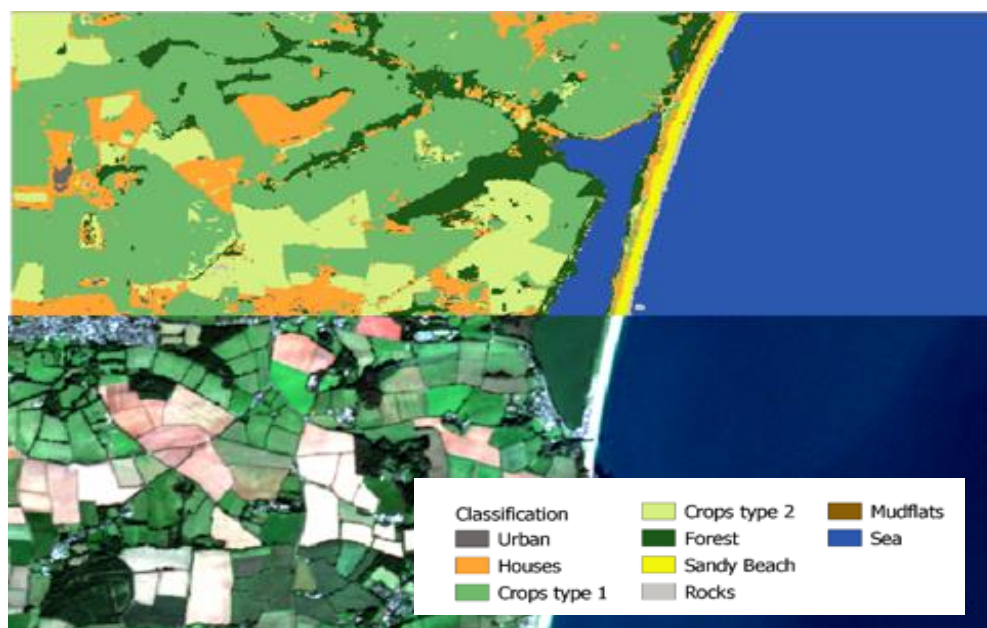
Figure 2.2 :By eye comparison of a classification map of Start Bay and the associated satellite image

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