

# Landsat Classification Demonstrator

## 1. INTRODUCTION

The new SOIL MAPPER classification algorithm of MEEO (<http://www.meeo.it/>) can now be run against the ESA collection of Landsat Thematic Mapper images over Europe. This demonstration service is available free-of-charge to ESA Cat-1 users from March to August 2007, within the Service Support Environment (SSE).

Any ESA Cat-1 user interested in this demonstrator should contact:

EOHelp (ESA Earth Observation Help Desk, e-mail: [EOHelp@esa.int](mailto:EOHelp@esa.int), phone: +39 06 94180777)

During the demonstration period, up to 3 service activations are allowed. Requests for further use might be submitted to EOHelp.

The SOIL MAPPER classifies input image pixels onto a discrete set of (up to) 72 spectral categories (types, layers) without requiring any user supervision. Its Output Product is a classification map stored on a temporary FTP directory for user transfer within 5 days from service activation.

**Use of the Output Product is subject to specific Terms and Conditions** (see the SLA for this service at [https://services.eoportal.org/massRef/documentation/IBS\\_LCDS\\_SLA.pdf](https://services.eoportal.org/massRef/documentation/IBS_LCDS_SLA.pdf)).

EOHelp should be contacted for questions, problems, complaints, special requests, comments or recommendations (e.g.: to improve service quality or Output Product).

## 2. SCOPE OF SERVICE – SERVICE ELEMENTS

The Landsat Classification Demonstrator service applies the MEEO SOIL MAPPER algorithm to the ESA Landsat Thematic Mapper Images in order to obtain Output Products.

See the SLA for this service within the SSE portal for detailed description of process, algorithm and Output Product.

### 2.1 Landsat Classification Demonstrator functionalities

The Landsat Classification Demonstrator service permits to:

- Search the inventory and select one of the images within the Landsat TM Dataset
- Choose SOIL MAPPER classification mode among
  - Full set mode, capable of detecting 72 output classes (see SLA document, Appendix A, Table 1)
  - Reduced set mode, capable of detecting 38 output classes (see SLA document, Appendix A, Table 2)
  - Limited set mode, capable of detecting 15 output classes (see SLA document, Appendix A, Table 3)
- Choose SOIL MAPPER Output Product format between
  - ENVI, where each pixel is labelled with a pseudo colour, a numerical index, and an alphabetical acronym provided with a semantic meaning
  - GeoTIFF, where each pixel is labelled with a grey level (numerical index) provided with a semantic meaning

- Start the service: the selected image is first radiometrically calibrated by a sensor-specific algorithm and then submitted to SOIL MAPPER, which generates the Output Product
- Download the Output Product (classification map) from the FTP temporary directory (link provided within the SSE user order list)

## 2.2 SOIL MAPPER capabilities

SOIL MAPPER is a fully automated spectral rule-based per-pixel classifier capable of mapping multi-spectral satellite images into a discrete set of output spectral categories (types, labels). In other words, SOIL MAPPER requires neither user-defined parameter nor ground truth data sample to run. Its spectral rules are not learned from input data. Rather, they are modelled from prior spectral knowledge acquired from remote sensing literature.

SOIL MAPPER input consists of either a Landsat 5 TM or a Landsat 7 ETM+ image calibrated into planetary reflectance and at-satellite temperature. As output, SOIL MAPPER generates a preliminary (baseline) classification map (primal sketch) of the input Landsat image.

## 2.3 Output Product characteristics

Main features of SOIL MAPPER Output Product are:

- Spatial resolution: same as the input image
- Geocoding: same as the input image
- Data coding: 8 bit (256 levels)
- Classification map representation: output classes are represented as a discrete and finite set of pseudo colours provided with a semantic meaning. In the ENVI format, these pseudo colours are associated with numerical labels and alphabetical acronyms whose meaning can be found in a coding table (see SLA document).
- Number of output classes to be selected by the service user: 72, 38, or 15.

## 3. HOW TO

In this section a synthetic description of the basic guidelines to use Landsat Classification Demonstrator service is given.

### 3.1 Locate the service on SSE

In order to locate the Landsat Classification Demonstrator service the user needs to start from the SSE Portal (<http://services.eoportal.org>) and select "Services". In the section "2.Thematic Services" the user shall select "Land Management": in the page that will show up the user will find the link to the start page of the Landsat Classification Demonstrator. Alternatively, the user can use the "Search" box inserting the words "Landsat" or "Classification".

### 3.2 Request authorisation

A SSE registered user can request access to the service from its start page. Specifically, the registered user needs to login into the SSE Portal and enter into the start page of the Landsat Classification Demonstrator service: at the bottom of this page there is the "Request access" button. Clicking on it the registered user will start the authorisation process.

Non registered users shall contact EOHelp (ESA Earth Observation Help Desk, e-mail: [EOHelp@esa.int](mailto:EOHelp@esa.int), phone: +39 06 94180777) for requesting authorisation to access Landsat Classification Demonstrator service.

### 3.3 Select an image and activate the service

Once authorised, the user will be able to select an image and activate the service. To this aim the user shall login into the SSE Portal and reach the start page of the service: at the bottom of this page the user will find the "Search" button. Clicking on it the user will enter into a page that allows selecting a geographical area of interest on a map comprising Europe, Middle East and North Africa, and a time window. The selected Area of Interest (AOI) will be shown on the map as a red polygon. After the selection, the user shall click on the "Search" button: in few seconds a list of Landsat products matching the search parameters with their metadata will be shown in the scrolling window at the bottom of the page. If the list is greater than the number indicated in the box "Retrieve metadata", the user can click on the button "Next" to see more metadata. The ground frames (or scenes) corresponding to the metadata shown in the list are also visualized on the map where the area of interest has been selected; each blue polygon represents a scene.

The user can choose one or more tracks, either from the list or clicking directly into the track on the map. In this last case, the arrow icon just over the top of the map needs to be pressed. Once a scene is selected, the blue polygon on the map turns to yellow.

Now the user can add the selected product(s) to the basket and go to the basket, by clicking the buttons at the bottom of the page (not the scrolling window).

In the shopping basket the user can select just one product and click the button "Proceed". Then the user can choose between three elaboration types:

Full number of classes (72)

Reduced number of classes (38)

Limited number of classes (15)

and two output data formats:

ENVI data format

GeoTiff data format

After clicking the buttons "Proceed" and then "Confirm", the service is activated: the Landsat Classification algorithm is running and the result will be available in about one hour.

Notice that the user can only activate the service a limited number of times (3 by default).

After reaching this limit, the user must contact EOHhelp for issuing more credits before being able to use the service again.

### 3.4 Download the Output Product

In order to verify the order status, the user shall check the "Order List" (the link is in the top menu bar). When the status is "Completed" the user can download the Output Product: clicking on the Order ID link, the user will see the Order Result page where the download ftp link is provided in the field "Order Result URL". The Output Product will be downloadable via such ftp link during the successive 5 days from the service activation.

To successfully establish an FTP connection, your FTP client must support an Active connection type. To use the FTP download link within the browser, when using Internet Explorer, in menu Tools, Internet Options, Advanced, Browsing, De-select the checkbox "Use Passive FTP (for firewall and DSL modem compatibility)". Mozilla Firefox currently doesn't provide this functionality but you can use an FTP plugin for Firefox.

### 3.5 Obtain support and information

In order to obtain any information or request support in relation to the Landsat Classification Demonstrator service, the user shall contact EOHelp (ESA Earth Observation Help Desk, e-mail: [EOHelp@esa.int](mailto:EOHelp@esa.int), phone: +39 06 94180777).

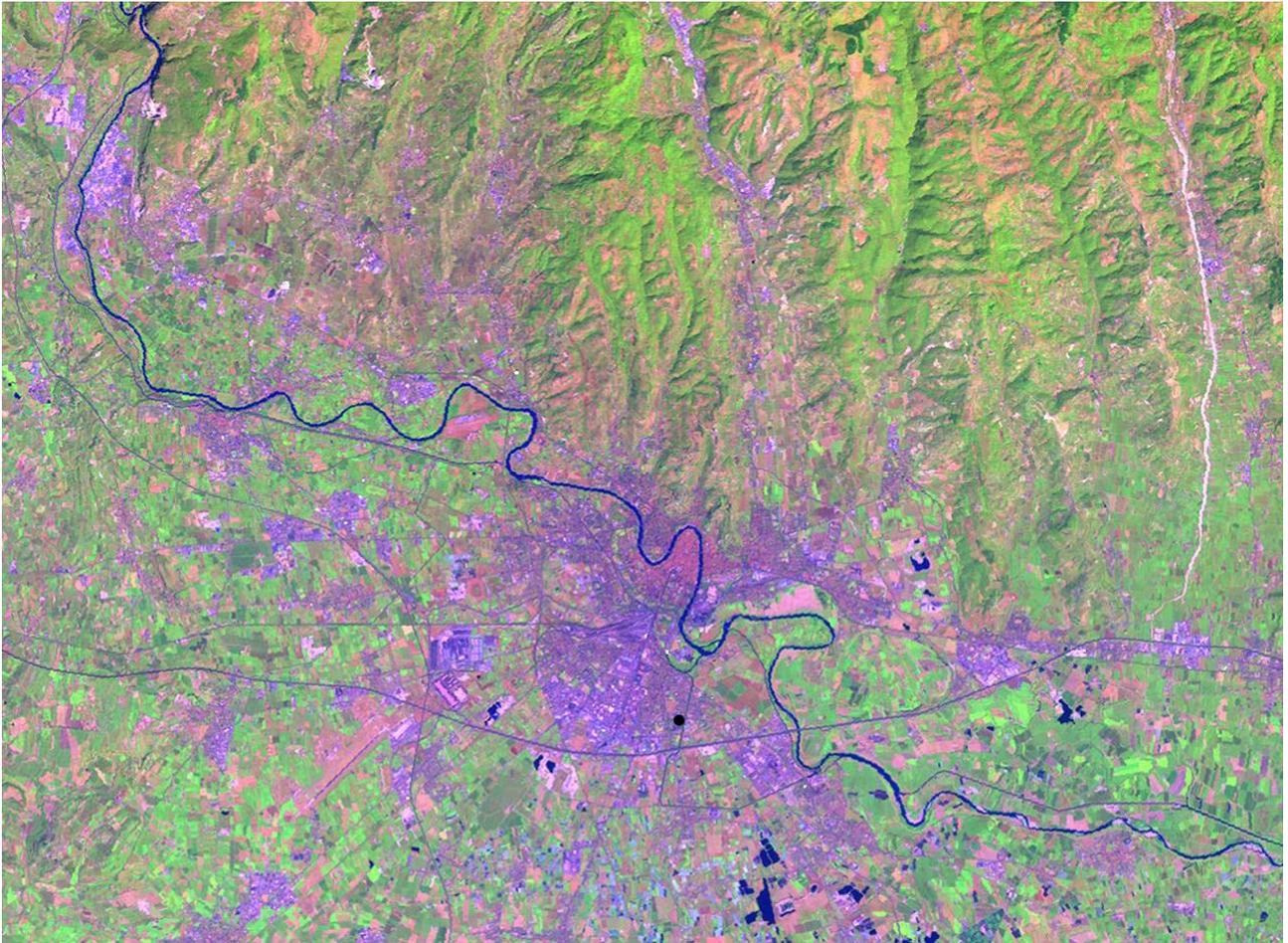


Figure 1 - Landsat 7 ETM+ depicted in false colours (R: band TM5, G: band TM4, B: band TM1). It shows the city of Vicenza, Italy, lying on the Po Valley in the proximity of a rugged terrain area belonging to the Alpine range.

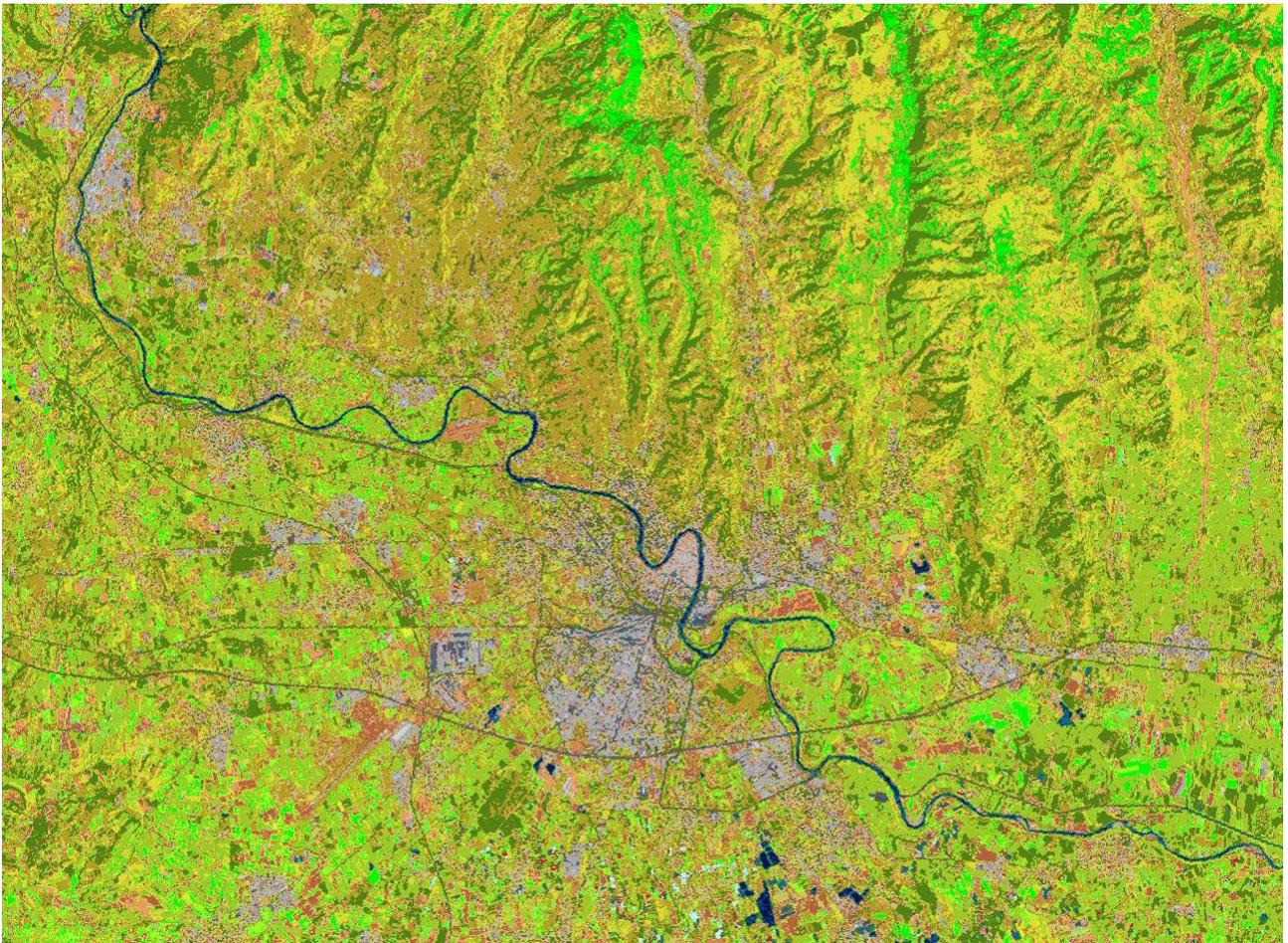


Figure 2 – Classification map, consisting of 72 output spectral categories depicted in pseudo colors, automatically generated by SOIL MAPPER from the Landsat image shown in Figure 1.



a)



b)

Figure 3. Landsat 7 ETM+ depicted in false colours (R: band TM5, G: band TM4, B: band TM1) showing the Lipari Island, Italy (a), and SOIL MAPPER classification map (b), consisting of 72

output spectral categories depicted in pseudo colors.