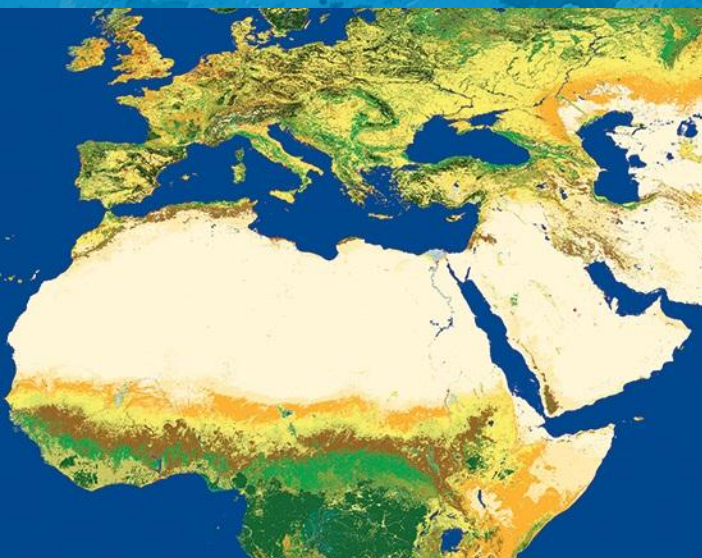


# → CLIMATE CHANGE INITIATIVE

## Land Cover CCI Newsletter

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- Internal release of 2008-2012 global land cover map
- Development of an aggregation tool
- Development of a validation tool
- New project WP: Global urban area map based on the entire archive of Envisat ASAR images

### Internal release of 2008-2012 global land cover map (V1.0)

The CCI Land Cover team has now successfully released its first global land cover map (V1.0) with improved accuracy over the existing state of the art (75.6%). This map covers the 2008-2012 epoch and will be updated (V1.1) by the end of the project (October 2013). It will be delivered along with two other maps covering the 1998-2002 and 2003-2007 periods to form a three-epoch series.

After an intensive and hot summer, the CCI Land Cover team is proud to announce that it has successfully produced and internally released its first global land cover map. This map corresponds to a first epoch (2008-2012) of a three-epoch series that will be delivered to the scientific community at the end of the project.

**Product description:** As planned at the start of the project, this map was produced using a multi-year and multi-sensor approach in order to make use of all suitable data and maximize product accuracy. Five years of

MERIS RR and FR L1 data were pre-processed by Brockmann Consult into L3 surface reflectance products and delivered to UCL-Geomatics. SPOT-VGT P data (pre-processed with the same pre-processing chain as the MERIS data to ensure a high consistency) could be an additional source of data.

In order to meet the user requirement set in this project, the map proposes a legend based on the UN Land Cover Classification System (LCCS) and uses a typology aiming for maximum compatibility with other global projects

like GLC2000 and more recently, GlobCover 2005 and 2009. In addition, LCCS has also been selected to be considered by the climate community as a compatible approach with the PFT concept of many models.

The product spatial resolution is 300m and the map projection is a Plate-Carrée (WGS84 geoid). The map is predominantly based on MERIS FR products as MERIS RR data were used to compensate for a lack of MERIS FR acquisitions.



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**Land cover state and land cover conditions:** As land cover maps are mostly generated from a few instantaneous observations of the land cover state they are rather sensitive to the date(s) of observation and can reflect temporary conditions

(e.g. map savannahs as burnt scars, boreal forest as snow, croplands as bare soils, etc.). For this reason the CCI Land Cover team has introduced for the first time the concept of *land cover state* and *land cover condition* (see Project Specification Document available from the project website <http://www.esa-landcover-cci.org/>). The land cover state stands for the stable component of the land cover and is derived from multi-year observation datasets. The land cover condition reflects the instantaneous observations of the land cover and is considered within the perspective of a time cycle (typically a year). The land cover condition analysis over a multi-year period (under the assumption of stable land cover state over this period) therefore enables to derive a reference land cover condition as well as information about the intra-annual variability. The relevance of these additional products for climate modeling activities is currently being assessed as the following two land cover conditions have now been produced and internally delivered to the climate modelers: burnt areas and NDVI.

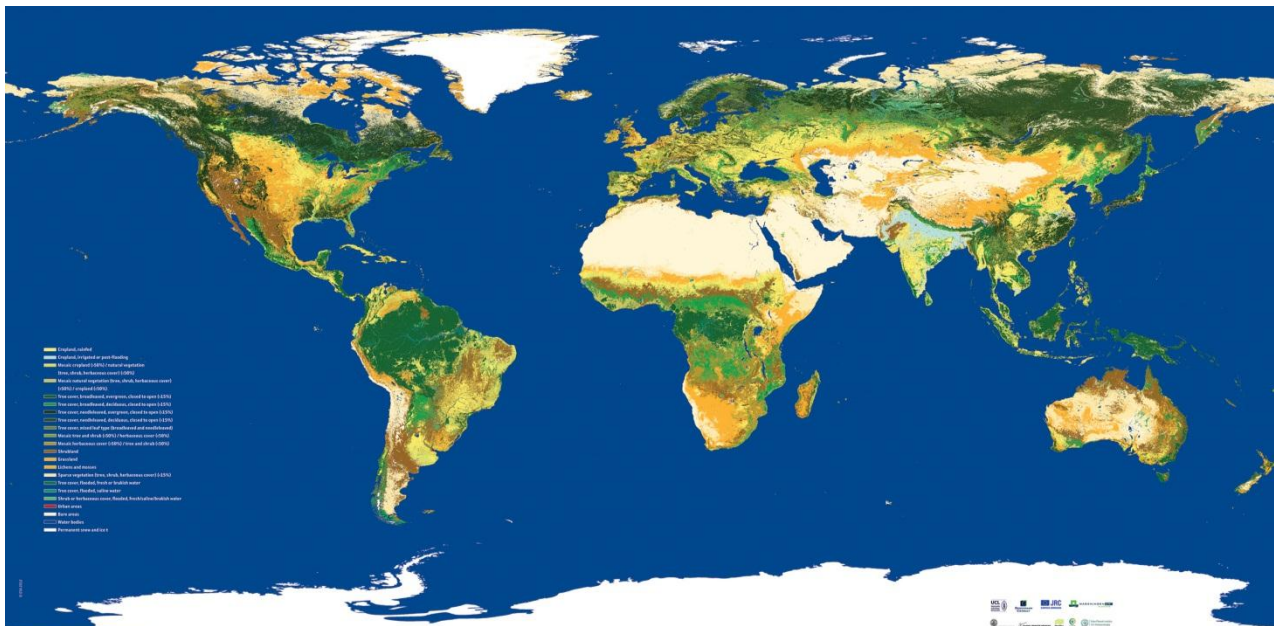


Figure 1: CCI Land Cover 2008-2012 epoch (300m).

## Aggregation tool

The CCI Land Cover consortium has developed a tool enabling the users to adjust the product spatial resolution and convert the land cover classes into Plant Functional Types (PFT).

The land cover maps will be delivered in a full spatial resolution version, both as global files and as regional subsets, in a Plate Carree projection. However, climate models may need products associated with a coarser spatial resolution, over specific areas (e.g. for regional climate models) and/or in another projection. In order to face the variety of requirements, the CCI Land Cover

consortium has developed a tool that allows users to adjust these parameters of the land cover products in a way that is suitable to their model. This tool also provides the users with the possibility of converting the CCI land cover product into a PFT-derived product. The tool has been released internally to the CCI Land Cover consortium.

The current version allows the resampling in the original Plate-Carrée projection. It ensures an appropriate aggregation of the classes when decreasing the resolution. It also allows the conversion of the LCCS classes into PFT. The next tool release will allow a modification of the projection type and further resampling.



## Validation tool

The Land Cover CCI consortium is developing a user friendly graphical tool that will be used by experts to enhance the quality and extent of the reference dataset needed for the validation phase of the land cover products.

In order to produce the reference dataset required for the validation phase of the Land\_Cover\_cci project, remote sensing specialists with international land cover expertise will contribute to the interpretation of high and very high resolution imagery. For this purpose, the experts will be provided with a specifically developed graphical interface to interpret satellite imagery over the sampling unit. The interface combines satellite imagery and ancillary information, such as Google Earth imagery and multi-temporal NDVI and NDWI profiles (to display seasonal variations of vegetation) available from year 2000 through UCL. The tool also includes the implementation of an automatic object-oriented approach with a minimum mapping unit (MMU) of 5 hectares for segmentation of the satellite imagery.

During the sample interpretation phase achieved by experts, quality control procedures will be introduced

For instance, the objects segmentation allow quantifying precisely the respective share of elements included in the sample unit. Similarly, the set of three high resolution images should improve the interpretation reliability by being less

image or season dependent.

Indeed it is a major challenge to further improve the reliability of the reference data set in order to deliver a more accurate global land cover products better validated than ever.

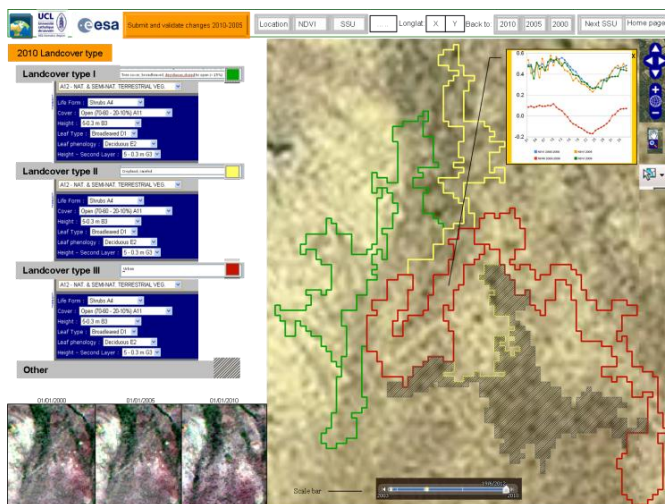


Figure 2: Snapshot of the CCI Land Cover validation tool (current status).

## Urban area detection based on the entire archive of Envisat ASAR images

Preliminary development, implementation and testing of SAR-based urban area detection algorithms during the round robin exercise opened new perspectives for increasing overall land cover mapping accuracy. A CCN was signed between ESA and the CCI Land Cover consortium to fund the development of a consolidated SAR urban area product.

During Year 1 of the CCI Land Cover project two algorithms, the Urban Area Detecting Parameter (UADP) and Urban EXTraction procedure (UEXT), were developed and implemented for deriving urban area extent. These algorithms were tested and validated during the Round-Robin exercise. The validation results show that both approaches represent useful contributions to the urban mapping. Both UADP and UEXT algorithms outperform the GlobCover urban

detection (overall accuracy up to 30% better, depending on the regions) and show complementary performance. To enhance the CCI Land Cover mapping results, a fusion of both approaches was therefore proposed to and accepted by ESA within an additional CCN. Starting from December 2012 a base urban layer will start being developed by Gamma RS (pre-processing) and UJena (Classification) using the UADP approach, which will then be

complemented by results of the UEXT algorithm to enhance the mapping of city centers. The product will be derived from multi-temporal ENVISAT ASAR Wide Swath data and will correspond to a Level 4 product according to the CEOS nomenclature. With respect overall production timing, it is planned that the multi-temporal SAR data-based urban layer will be ready for global land cover map integration at the start of the ESA CCI Programme Phase 2.