

Subset of the CCI Land Cover map of the 2008-2012 epoch

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Second official release of the CCI Land Cover products

The CCI Land Cover team is proud to announce the release of 4 improved interoperable and consistent products: (i) 3 global land cover maps at 300m corresponding to the 1998-2002, 2003-2007 and 2008-2012 epochs, (ii) a new global map of open water bodies at 150m spatial resolution, (iii) a reprocessed version of the full archive (2003-2012) of MERIS 7-day composites time series and (iv) a User Tool that now supports additional user maps such as the Köppen-Geiger climate classification.

The CCI-LC Phase 2 follows an iterative life-cycle of concurrent development and production with continuous improvements of Phase 1 outcomes as one of its main objectives.

In this framework, consolidated versions of the global land cover maps, map of open water bodies and MERIS 7-day surface reflectance time series have been released in January 2016 with improved representation of the land surface.

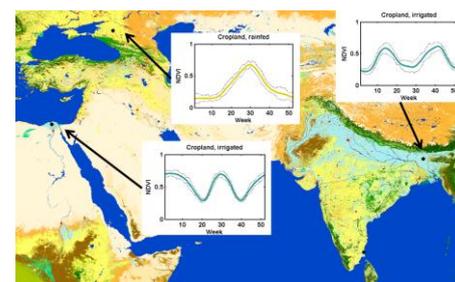
Together with the Phase 1 seasonality products, the CCI land cover climate research data package offers a synoptic

and consistent view at global scale of both static and dynamic aspects of the land cover for a 15-year period, ranging from 1998 to 2012.

The 3 global land cover maps, representative of 5-year epochs characterize the land surface at 300m with a detailed LCCS legend of 22 classes ranging from bare areas to cropland, forests and water.

This information is complemented by temporal information describing the global baseline behaviour and inter-annual variability of the land surface for the same

period in terms of vegetation dynamics, burned areas and snow occurrences.



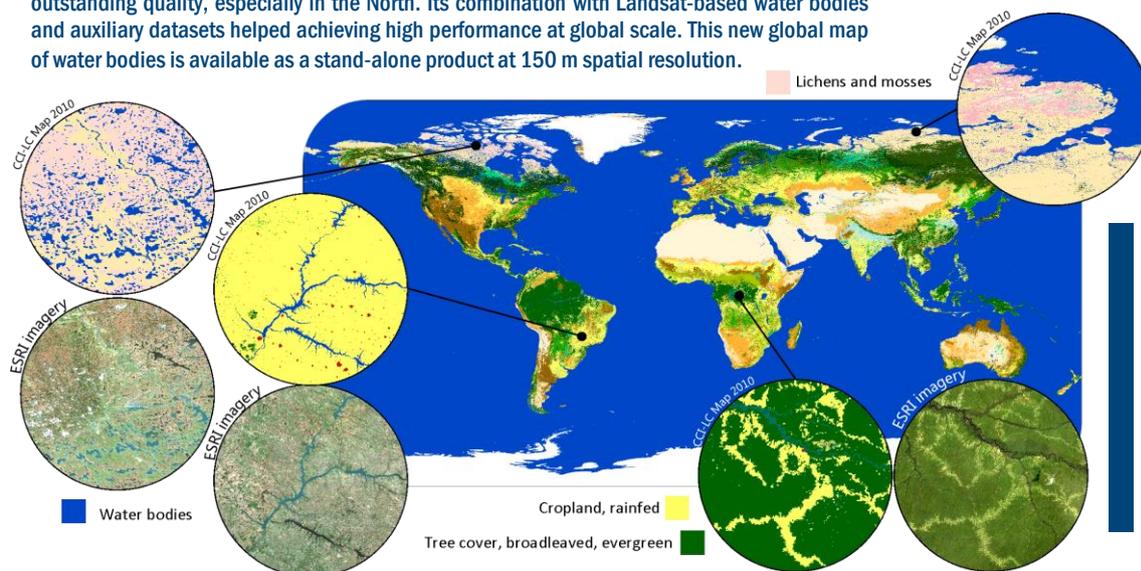
The new CCI land cover package offers an improved consistent description of the static and dynamic aspects of land cover within a 1998-2012 timeframe.



Global land cover maps with improved representation of selected land surface features

For this second official release, efforts were dedicated to include class lichens and mosses in Northern Eurasia, to delineate cropland patterns more accurately in the Republic Democratic of Congo and better characterize water bodies at global scale.

In Phase 1, the ASAR-based global land/water mask proved to characterize water bodies with outstanding quality, especially in the North. Its combination with Landsat-based water bodies and auxiliary datasets helped achieving high performance at global scale. This new global map of water bodies is available as a stand-alone product at 150 m spatial resolution.



Lichens and bryophytes play a significant role in the modelling of polar ecosystems.

Phase 1 global land cover maps only included lichens and mosses in Northern America. In Phase 2, driven by climate modellers' needs, the representation of lichens and mosses was extended to Northern Eurasia.

In the global land cover maps of Phase 1, the detection of deforestation patterns was overestimated in the Republic Democratic of Congo. In Phase 2, finer adjustments were brought to the classification algorithm and allowed a more realistic delineation of the cropland extent.

A more detailed characterization of water bodies at 150 m

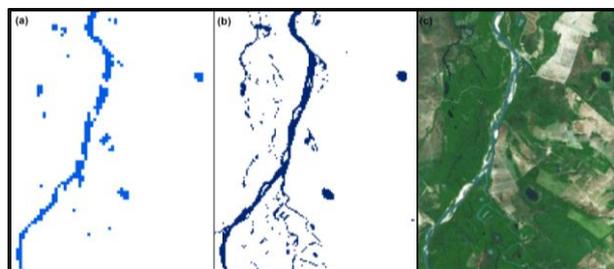
The Phase 1 ASAR-based global land/water mask at 300 m was further improved in Phase 2 using optical datasets representative for the 2000-2012 period. A global map of open water bodies is now available at 150m spatial resolution.

During the first Phase of the CCI Land Cover project, a global land/water mask of open permanent water bodies (WB) was released at 300 m. It was produced from the consolidation of a quasi-global indicator of WB representative for the year 2010 based on multiple observations of the backscattered intensity by the Envisat Advanced Synthetic Aperture Radar (ASAR) instrument.

This ASAR-based global land/water mask was further improved in Phase 2 by including two Landsat-based WB products selected for their 30m resolution and strong complementarities: the Global Forest Change datamask (Hansen et al., 2013) and the Global Inland Water v1.0 (Feng et al., 2015).

The resulting global map of open WB at 150 m and its constitutive inputs were assessed qualitatively and quantitatively against a reference validation database of 2110 samples spread throughout the globe.

The validation sampling strategy was intentionally biased towards areas prone to errors in characterizing WB according to existing datasets. It yielded more informative accuracy figures in terms of the relative improvement assessments between WB products and analysis of the type of errors. Overall accuracy figures were also calculated from this database.



The overall accuracy of the CCI global map of open WB at 150 m was found equal to 99% with a F-score of 88% for class water, significantly superior to its constitutive inputs.

Improvement in characterizing water bodies in Brazil from (a) the 300 m Phase 1 land/water mask to the (b) Phase 2 global map of open water bodies at 150 m. (c) Very high resolution Imagery (ESRI basemap). →



Full re-processing of the Envisat MERIS archive

A 3rd reprocessing of the whole archive of MERIS FR data allow to improve consistent radiometric, spectral and geometric calibration and consistent auxiliary dataset and to use the last delivery of MERIS FR data by ESA including some additional observations.

The SR products consist of a global time series covering the period 2003-2012. The spectral content encompasses the 13 surface reflectance channels and the spatial resolution is of 300 m and 1000 m for the full and reduced resolution datasets respectively. The time series are made of temporal syntheses obtained over a 7-day compositing period. The quality of each global composite is described by a set of quality flags and the uncertainties for each spectral band on a per-pixel basis.

The pre-processing chain developed to generate the products includes radiometric correction, geometric correction, pixel identification (i.e. attribution of a status to each pixel, being "land", "water", "snow", "cloud/cloud shadow" and invalid pixels), atmospheric correction with aerosol retrieval and BRDF correction as well as compositing and mosaicing.

Different versions of 300-m spatial resolution 7-day surface reflectance composite and the result of the improved cloud screening can be observed at indicated locations

With respect to Phase 1, significant improvements have been brought for the cloud detection, through the development of a new neuronal net and the adaption of particular features, e.g. the temporal-filtering feature.

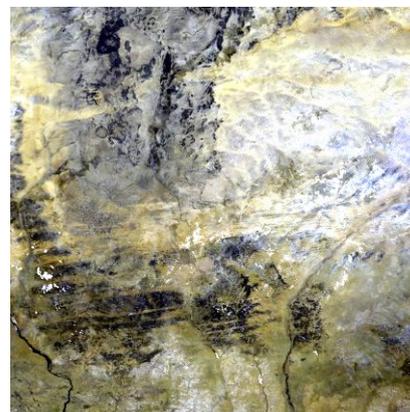
The new obtained SR values will be compared again with in-situ data from CEOS LandNet sites and with SR products

available from other sensors as well as with those from the previous version. Besides assessing the quality of individual composites, the quality of the global SR time series will be documented again, with the aim of quantifying its discrimination potential.

Phase 1



Phase 2



New functionalities in User Tool v3.10

In project Phase 1, the CCI Land Cover consortium has developed a tool enabling the users to adjust the product spatial resolution and to convert the land cover classes into Plant Functional Types (PFT). In Phase 2, new functionalities have been implemented such as the introduction of auxiliary datasets to further describe PFTs.

The land cover maps, map of open water bodies and seasonality products have been delivered at their full spatial resolution as global files, in a Plate Carrée 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. Users may prefer working with Plant Functional Types rather than with land cover classes.

In Phase 1, in order to face the variety of requirements, the CCI Land Cover consortium has developed a tool that allows users to adjust these parameters in a way that is suitable to their model.

The User Tool allows:

Re-sampling to obtain a coarser spatial resolution. This functionality is available in the original Plate-Carrée projection and ensures an appropriate aggregation of land cover classes when decreasing the resolution.

Regional sub-setting, according to predefined regional subsets or user defined corner coordinates.

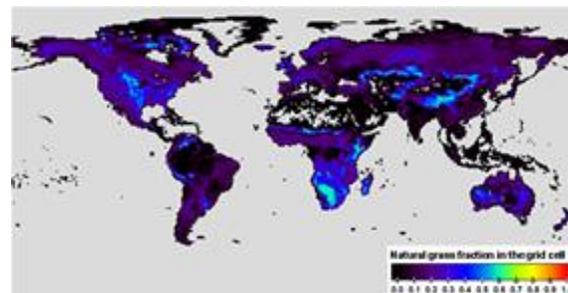
Projecting from the original Plate-Carrée projection to a Gaussian grid.

Converting the land cover classes into PFTs based on the CCI-LC standard conversion table or a user-defined conversion.

Various possibilities of combining re sampling, projecting, converting and regional sub-setting.

In Phase 2, the improved version 3.10 of the User Tool has been released with the possibility to include additional user-provided classification maps (e.g. Köppen-Geiger climate classification system) as requested by climate users.

Conversion of the global land cover map to the fraction of natural grass PFT inside grid cells of 9.8 km with the User Tool





Extending current products outcomes and moving to high spatial resolution

On-going processing aims now to extend the land cover time series back to the 1990s and to cover the current years thanks to PROBA-V and possibly Sentinel-3. In parallel, the next challenge is to move to high spatial resolution products based on the new ESA Sentinel-2 and Sentinel-1 sensors, to map as a prototype African land cover and water bodies at 10-20 meters.

A significant reprocessing effort is now ongoing to extend the land cover dataset timeline back to the 1990s and to current years by exploiting the Advanced Very High Resolution Radiometer (AVHRR) and PROBA-V data records, respectively.

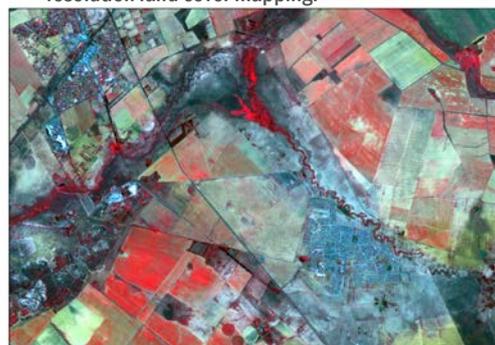
The spectral and spatial consistencies across surface reflectance time series originating from various sensors (AVHRR, MERIS and PROBA-V) represent a major challenge.

Taking advantage of global long term satellite time series (1992 - 2015), the classification chain is also adjusted to deliver global annual land cover maps, consistent over time. In addition, land cover

changes, currently limited to forest classes, are extended to the Intergovernmental Panel on Climate Change (IPCC) land categories.

The last year of the CCI LC project Phase 2 will be dedicated to the development of a processing chain to deliver a prototype map of the land cover and water bodies of Africa at 10-20 meters. The new capabilities offered by the Sentinel 2 in particular (temporal revisit frequency, swath, bands, and spatial resolution) complemented by Landsat-8 mission provide unprecedented time series to address this challenge.

This very large scale feasibility study should pave the way for regular global high resolution land cover mapping.



Sentinel-2 imagery at 10-m spatial resolution, over Free State, South Africa. False-color composite: R:B8, G:B4, B:B3.

Visualize and download the CCI Land Cover Climate Research Data Package online

<http://maps.elie.ucl.ac.be/CCI/viewer>

Land Cover Maps

3-epoch series of global land cover maps at 300m spatial resolution, where each epoch covers a 5-year period (2008-2012, 2003-2007, 1998-2002).

- 2008-2012 epoch (tif, 7z) - 2.8Go
- 2003-2007 epoch (tif, 7z) - 2.8Go
- 1998-2002 epoch (tif, 7z) - 1.8Go
- 2008-2012 epoch (netcdf) - 2.8Go
- 2003-2007 epoch (netcdf) - 2.8Go
- 1998-2002 epoch (netcdf) - 1.1Go

Legend (csv)

Vegetation greenness

The NDVI product describes globally the yearly reference dynamic of the vegetation greenness characterizing the 1999-2012 period. It is derived from 1km SPOT-VEGETATION (VGT) data.

- Vegetation part 1 (tif, 7z) - 17.1Go
- Vegetation part 2 (tif, 7z) - 11.4Go
- Vegetation (all) (netcdf, 7z) - 26Go

Snow occurrence

The snow product presents the frequency at which snow has been detected along the year, based on observations over the 2000-2012 period. Data originate from the MODIS/Terra Snow Cover 8d L3 Global 500m SIN Grid Product (MOD10A2).

- Snow (tif, 7z) - 7.8Go
- Snow (netcdf, 7z) - 7.8Go

Meris Surface Reflectance

The surface reflectance (SR) products consist of MERIS global time series covering the 2003-2012 period. The spectral content encompasses the 13 surface reflectance channels - the atmospheric bands 11 and 13 being removed - and the spatial resolution is of 300 m for the FR and 1000 m for the RR.

Given the amount and size of the MERIS surface reflectance archive (10 To), data transfer will be made, on request, through your own disks. Please contact contact@esa-landcover-cci.org

Water Bodies

Static map of stable open water bodies at 300m spatial resolution resulting from a land/water classification based on Envisat ASAR, SRM, SWBD and MERIS data. The water pixels of this map correspond to the class "Water Bodies" of the CCI-LC Maps.

Water Bodies (tif, 7z) - 517Mo

User tool

Dedicated user tool for sub-setting, re-projecting and re-sampling the CCI-LC maps and seasonality products in a way which is suitable to each climate model. This tool also allows converting the LCSS legend to user-specific PFTs.

User tool (jar, 26) - 31Mo

Burned areas occurrence

The burned areas product presents the frequency at which burned areas have been detected along the year, based on observations over the 2000-2012 period. Data currently originate from the GFEDv3 dataset.

- Burned-Areas (tif, 7z) - 4.8Go
- Burned-Areas (netcdf, 7z) - 5.1Go

www.esa-landcover-cci.org

For more information on the project, please write to: contact@esa-landcover-cci.org