Preface

Welcome to the 6th edition of the GlobCover newsletter. In the time since the last edition there are been considerable evolution within the project.

First, the GlobCover consortium is pleased to announce the production of the Intermediate GlobCover Land Cover Product. This map was produced at the beginning of December 2007 and is the 1st product derived from the validation campaign. It integrates feedback from the network of vegetation experts involved in the calibration/validation process. This product was presented during the United Nations Framework Convention on Climate Change held in Bali (Indonesia) in December 2007.

In addition to this successful delivery, several key milestones have been achieved. In May 2007, ESA and the GlobCover consortium released the first reflectance products. 2 bi-monthly composites were distributed to the general public through an ESA on-line dedicated tool: The IONIA GlobCover Access Tool (GCAT). In June 2007, the full set of GlobCover reflectance products was made available through GCAT (6 bi-monthly reflectance composites and 1 annual composite, covering the period of May 2005 to April 2006).

Following this successful data release, the 1st User Consultation Meeting took place at the Joint Research Centre (JRC) in Ispra (Italy) on the 20th June 2007. This event was a perfect platform to collect feedback from the user community, in particular, EEA, UNEP, GOFC-GOLD and JRC, on product quality and to define options for a GlobCover version 2.

With the availability of the reflectance products, the strategy prepared for the validation campaign started. A specific calibration/validation tool was developed by the consortium to help experts in selecting the most dominant Land Cover type for specific sample points following the FAO Land Cover Classification System (LCCS) terminology.

The future is now focused on the release of the final Land Cover product during the 2nd User Consultation in March 2008.

With these words, we wish you a happy new year

The ESA GLOBCOVER TEAM
Distribution of the GlobCover products: The IONIA GCAT tool

The production of the GlobCover Reflectance composites was completed in June 2007. The products cover the period between May 2005 and April 2006 and all at 300m resolution:

- GlobCover Bimonthly MERIS FR Composites: 6 products per year computed every 2 months that provide for each spectral band the average surface reflectance calculated from all valid observations during each two month period.

- GlobCover Annual MERIS FR Composite computed by advanced averaging of the surface reflectance values of the bimonthly product generated over one year.

At the same time, ESA announced the availability of these data through the ESA IONIA GlobCover Access Tool [http://www.esa.int/due/ionia/globcover](http://www.esa.int/due/ionia/globcover). The Product Description Manual describing the structure, format and content of the GlobCover products is also available at this address.

IONIA GCAT is an easy and fast "on-line" internet access to GlobCover data product (Gigabytes of data to be distributed on line). It is accessible to any Authorized Web User through a simplified password protected registration scheme.

Once authorized, users can select any subset of the GlobCover data product through a GUI (fig.1) from where the type of product (bimonthly, Annual), geographical area and time period can be set. Distribution is based on the BitTorrent protocol (P2P) to capitalize on the number of simultaneous users and reduce the overall stress on the server during peak user access. For this reason GlobCover actors (ESA, Consortium and partner) participating in the distribution are "seeders" in the bit torrent terminology. In other words, they share servers where GlobCover products are stored.

To optimise distribution performance, each GlobCover composite is sub-divided in Macro Tiles (4x4 GlobCover Tiles). Users can select which type of GCAT product they wish to download (GlobCover tile, Macro tile, continental or world coverage). In December 2007, 3154 Users were registered and more than 10,000 macro tile have been downloaded. Fig.2 shows the number of macro tile downloaded in June 2007 for the May-June 2005 product.

Even if P2P protocol is the most convenient means to distribute such large datasets, it is not accepted by the full end user community. Therefore an FTP access has been proposed and shall be requested via due@esa.int
The 1st User Consultation Meeting took place on the 20th June 2007 at the premises of one of the main partners of the Project: The Join Research Centre (JRC) in Ispra (Italy). Representative of the users, i.e. The European Environmental Agency (EEA), the United Nation Environment Programme (UNEP), the Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) and JRC actively participated.

This event was necessary to collect the user feedback in terms of reflectance product quality but also to focus requirements in terms of format, structure and distribution of products. It was also a perfect platform for users to present their experience and show how GlobCover data will be integrated in their studies. The GlobCover consortium also took the opportunity to give an update on the production and to describe the Land Cover Calibration and Validation campaign.

The first major feedback concerns the very satisfying quality of the GlobCover composite in terms of geolocation and resolution. As shown in box 2, the finest resolution discriminates features that were not visible on products from similar projects but at coarser resolution. A particular request was to continue the acquisition plan of MERIS FRS to generate new composites covering the next years. Nevertheless, it was highlighted that the quality is also related to the number of valid observation available. With no valid observations (due to cloud coverage or no MERIS), no reflectance value can be computed and, with a low number of observations, some artefact appear on the product (virtual line, haze). Solutions proposed to overcome this issue were: 1) to extend the period of acquisition or 2) to use other data source (such as MERIS RR). Currently these solutions are under investigation.

Users expressed also their wishes concerning the technical specification of the product. For instance, in respect of product ease of access, Geotiff is preferred for the Land Cover map compared to HDF. The users also requested a spectral/spatial resizing tool to reduce the size of GlobCover composite when ordering on-line.

Algorithm improvements presented by the consortium concerned the generation of the Reflectance composite (Geo-location with updated version of AMORGOS, new climatology model used for aerosol correction, integration of a new mask for flooded areas...). Particular attention was addressed to the Classification methodology and the definition of the validation strategy. Users could assess the efficiency of combining the high spatial consistency of classes obtained from the multispectral composite(s) with the greater land cover discrimination provided by the analysis of temporal profiles. These first results represent the non-calibrated and non-validated version of the Land Cover product. The legend was also a key element of discussion and it was accepted that the thematic legend shall remain compatible with the Land Cover Classification System (LCCS).

**Box 1:**

<table>
<thead>
<tr>
<th>Schedule for GLOBCOVER Products Delivery</th>
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<tbody>
<tr>
<td><strong>Dec 2007</strong> V1 product delivery:</td>
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<tr>
<td>• bi-monthly global mosaics 2005/2006</td>
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<tr>
<td>• Annual Global mosaic 2005/2006</td>
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<tr>
<td>• Calibrated Global land cover</td>
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<tr>
<td>classification</td>
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<td><strong>Feb 2008</strong> V1 product delivery:</td>
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<tr>
<td>• Validated global land cover</td>
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<tr>
<td>classification</td>
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<tr>
<td>• GlobCover Validation Report</td>
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<tr>
<td><strong>May 2008</strong> V2 product delivery:</td>
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<tr>
<td>• bi-monthly global mosaics 2005/2006</td>
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<tr>
<td><strong>June 2008</strong> V2 product delivery:</td>
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<tr>
<td>• Validated global land cover</td>
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<td>classification</td>
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Box 2:

Comparison of the first GLOBCOVER products with VGT mosaics and GLC2000 Land Cover map

These images were presented during the 1st User consultation held in JRC (Italy) on the 20th June 2007. The advantage of the higher spatial resolution of the MERIS products (images on the left side) becomes apparent in comparison with the VGT - RGB composite and GLC2000 classification (respectively the upper and lower right images). Linear features and fine details are clearly visible in the GLOBCOVER MERIS products. The RGB image presented shows the Can Tho province in Vietnam. The Land Cover maps show the deforestation zone in Rondonia (Brazil) in the Amazonia forest.
The Calibration/Validation process

In October 2007, an Internal Validation meeting was held at Catholic University of Louvain (UCL). UCL, the consortium partner responsible for the Classification part of the service, presented the latest results of the Land Cover product and demonstrated the robustness of the validation strategy.

The Validation campaign is split in two different but complementary steps: Calibration and Validation. Calibration results aim to improve the procedure applied and to contribute to the product confidence building. The main objective of validation is to allow a potential user to determine the "fitness for use" of the map for his application. Given the world wide coverage of the GlobCover product, it is obvious that no field surveys were foreseen but ground “truthing” will be obtained by the involvement of “regional vegetation experts”. A group of 20 regional experts from several institutes with an undisputed experience in Land Cover studies agreed to participate. Experts are requested to process calibration and validation points. Calibration points are used to tune the rules to allocate the spectral-temporal classes into well described Land Cover classes (see Box 3). Validation points are divided in two sets, one for the first validation round and one for the validation of the possibly reclassified and improved product.

![Figure 4 GUI of the report form to be used by Expert. 3 Land Cover type can be selected](image)

The selection of the sample points in terms of distribution and size is therefore a key element. To Each class is represented by at least 5 points. This is achieved by applying stratification per Land Cover class. Sample size is related to the Minimum Mapping Unit/Observational Unit concept since the smallest spatial unit within GlobCover (MERIS pixel) corresponds to something quite different when same point is placed over a higher resolution data. The Observational unit (set to a window of 5x5 pixels) gives more weight to the neighbourhood. This is quite meaningful given that an expert may base his conclusion using neighbourhoods to decide what the dominant land cover type is over an area of 9ha (size of a MERIS pixel).

![Figure 5. Tailor made information (Virtual Earth) that allows quick panning to the concerned validation point.](image)

Each of the sample sites needs to be labelled by the expert. Prior to the labelling, reference data have to be prepared in order to facilitate a smooth and swift calibration/validation process and experts must be familiar with the LCCS system. The inventory of requirements defines the preferred high resolution EO data (if available), that the reference and GlobCover products are in the same projection and the preferred spectral bands and preferences of images from a certain period of time (season) for each geographic zone. UCL have also provided a NDVI profile derived from times series of SPOT VGT to ease the determination of the dominant land cover type (fig 6). The Land cover classes, which form the foundation of the stratification, and the initial product (presented during 1st User Consultation) were sent to the expert well before the start of the calibration/validation campaign, accompanied by a description of the land cover classes.
Finally, in order to integrate these requirements and take advantage of expert’s knowledge, a tool to assist the calibration/validation process was developed (Microsoft Netherlands - International Remote Sensing - Virtual Earth) under the leadership of UCL. This tool is a compromise between flexibility for the expert and productivity. Flexibility is provided in the sense that experts validate the Land Cover Classifier and attributes according to LCCS rather than having static legend entries. For Productivity, many points can be processed per day. Experience shows that between 250 to 450 points can be processed in a whole week by a single expert. This result is quite significant as accuracy assessment can be improved using a higher number of points.

The tool is split in 2 separate components: The “report form” (fig.4) and the “Virtual Earth window” (fig.5). Experts fill the report form by selecting up to three land cover types per point (one land cover type is always the most dominant one). To help the expert, the Virtual Earth window allow a quick panning of the concerned validation point over the reference dataset combined with the associated NDVI profile over years.
Calibrated version of the GlobCover Land Cover (Version 0.9)

At the beginning of December, almost all of the regional experts from Africa, Europe, South America, North and Central America, Australia, Russia and Asia had completed their calibration / validation exercises. Calibration results were used to tune the allocation rules and generate the Calibrated version of the GlobCover Land Cover product (see fig.7). The validation data set will be used to assess the quality of the final version with the first release expected the 15th February 2008.

Meanwhile, the production of the 2nd version of the reflectance composites has started. This version is based on an extended time period for input data (01 December 2004 – 30 June 2006) and includes the comments collected during the 1st User Consultation. The production will be completed by the beginning of 2008. The quality of the Global Land Cover version 1 and Global Composites version 2 will be reviewed and discussed during the 2nd User consultation that will take place in March 2008.

Figure 7 Poster presented during the UNFCCC conference in Bali (03-14 December 2007)
**GLOBCOVER in Conferences**

<table>
<thead>
<tr>
<th>October 2007</th>
<th>December 2007</th>
<th>March 2008</th>
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<tr>
<td><strong>GOFC-GOLD EC</strong> (Boston, USA)</td>
<td><strong>COP13 - UNFCCC</strong> (Bali, Indonesia)</td>
<td><strong>2nd GlobCover User Consultation</strong> (FAO, Roma, Italy)</td>
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**ESA side event at UNFCCC COP 13 and CMP 3 in Nusa Dua**

**Thursday 6 December 13:00 at the Grand Hyatt Bali, Room WAVE**

**SPACE SUPPORTING UNFCCC**

**global products for a better understanding of our climate**

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**AGENDA**

**GLOBCOVER is an ESA Initiative in Partnership with**

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**Technical Officer**

Olivier Arino

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**GLOBCOVER Consortium and Contributors**

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http://dup.esrin.esa.it/projects/summaryp68.asp