Brockmann Consult GmbH · Max-Planck-Str. 2 · 21502 Geesthacht · Germany
Telephone +49(0)4152/889 300 · E-mail: info@brockmann-consult.de

CCI Land Cover Pre-processing

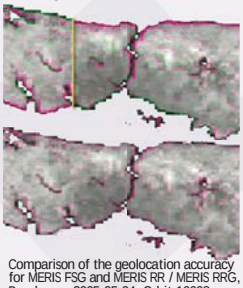
Challenges of pre-processing for Land Cover classification

G. Kirches [a]; O. Arino [b]; M. Boettcher [a]; S. Bontemps [c]; C. Brockmann [a]; O. Danne [a]; P. Defourny [c]; V. Kalogirou [d]; C. Lamarche [c]; M. Paperin [a]; J. Radoux [c]; F.M. Seifert [b]; S. Smollich [a]; M. Zuehlke [a]
[a] Brockmann Consult GmbH, GERMANY; [b] ESA/ESRIN, ITALY; [c] Université catholique de Louvain, BELGIUM; [d] European Union Satellite Centre, SPAIN

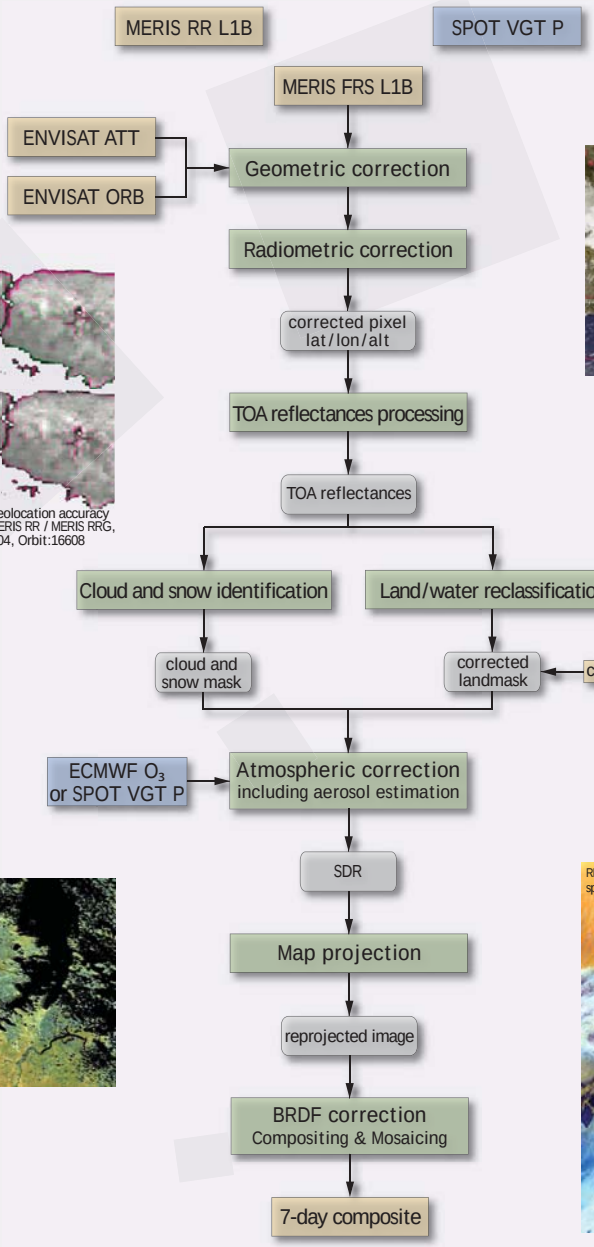
The **CCI Land Cover project aims to generate a multi-sensor global** land cover (ECV) dataset, using ENVISAT MERIS and ASAR as well as SPOT-VGT data. It will produce three combined land cover products for the years 2000, 2005 and 2010. The project builds upon the state-of-the-art technology from the GlobCover project. The processing chain contains 2 steps: pre-processing and classification. The work includes the already existing methods of validation, performance assessment and a detailed documentation of the processing procedures. Pre-processing includes the following steps: geometric and radiometric correction of the input data, pixel identification, atmospheric correction, compositing and mosaicing.

Geometric correction – AMORGOS 4.0

In order to meet CCI - Land Cover requirements, the geolocation accuracy has to be better than 150m.
AMORGOS (Accurate MERIS Ortho Rectified Geo-location Operational Software) achieves this for MERIS FR products. This software was developed by ACRI-ST and made available by ESA. MERIS RR products will complement the dataset, due to the lack of temporal and spatial coverage of MERIS FR data. Geolocation accuracy analysis showed a misalignment of MERIS FR and RR. An update of AMORGOS was required and achieved by ACRI-ST.

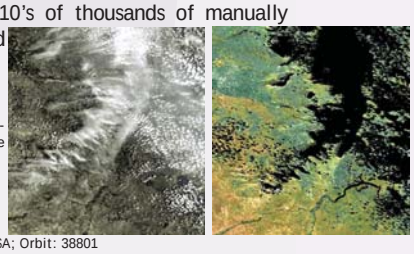


Comparison of the geolocation accuracy for MERIS FSG and MERIS RR / MERIS RRG, Bosphorus, 2005.05.04, Orbit:16608



IdePix - Pixel Identification

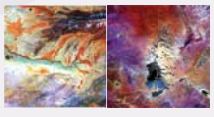
IdePix is a unique classification and uses a certain set of features calculated for each instrument and a probabilistic combination of these features to retrieve a set of pixel classification attributes. The most important measurement classifications are made over cloud, clear sky land surface, clear sky ocean surface and clear snow/ice surfaces. IdePix classified pixels are validated against a large database of 10's of thousands of manually classified pixels.



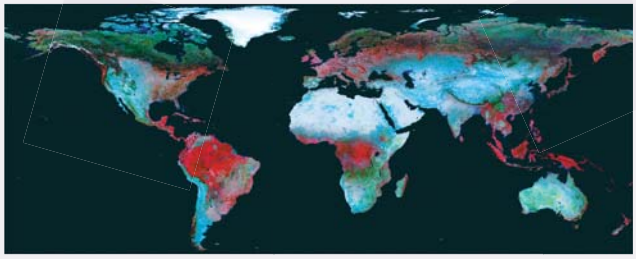
Result of the pixel identification for the MERIS FSG full resolution scene from 2009.08.01 over a test site in the USA; Orbit: 38801

Result of pre-processing chain

The pre-processing module delivers 7-day global surface reflectance composites, which will serve as input to the classification module. The quality of each global multispectral SR composite is described, on a per-pixel basis, by a set of flags and values: uncertainties for each spectral band; current status of surface; uncertainties for each spectral band; number of observations with clear sky land coverage, water coverage, clear sky snow and ice coverage, cloudy coverage and cloud shadow coverage for each pixel. The uncertainties of the SDR value is calculated from the contributions of each error source, assuming a negligible correlation between the different error sources. The obtained values are compared with in-situ data from CEOS LandNet sites and with reflectance of the 7-day composites.



Comparison of the mean of the retrieved SDR for the CEOS LANDNET site La Crau and in-situ measurement (taken and adopted from QA4EO-WGCV-IVO-CSP-001)



5 year global composite of surface reflectance between 2008 ÷ 2012 based on 7-day composites

Quality control of intput products

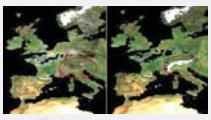
The use of MERIS full mission dataset in LC-CCI project in a consistent manner is a major effort. It requires advanced techniques for the development of specific quality checks related to the input data. In addition, the geo-metric and radiometric accuracy is quality con-trolled and reported.

Input data quality check - visual inspection - incidental large shift
MER_FSG_1PNUPA20100110_163005_000002952085_00484_41119_0390.N1

Atmospheric correction

Atmospheric correction removes several effects: absorption and scattering of atmospheric gases, Rayleigh scattering, and absorption and scattering due to aerosol particles. All components except aerosols can be rather easily corrected. A new aerosol properties retrieval approach for MERIS and AATSR has been developed throughout recent years by the University Swansea for the ESA GlobAlbedo project. It is based on an inverse modelling approach used to correct each single pixel and working on a 8x8 km area to estimate aerosol properties and then interpolated back to the original grid. The atmospheric correction developed by the Institute for Space Sciences, Free University of Berlin, is designed for MERIS Level2 data above land surfaces and is based on the inverse modelling of radiative transfer simulations using artificial neural network techniques.

RBG of 7-day surface reflectance composite, at 300m spatial resolution and tile h37v12, 2007.07.02



Quality control of output products

Because the quality check of the input data comprises some manual steps as the visual inspection of the L1b daily quick looks and the omission of these steps has lead to artefacts in the corres-ponding L3 product, specific quality checks related to the output data have been developed.

Acknowledgement
We thank both ESA and ACRI-ST for AMORGOS 4 and the GlobAlbedo project (ESA, Uni. Swansea, Free Uni. Berlin, Uni. College London) for designing the atmospheric correction with aerosol retrieval.