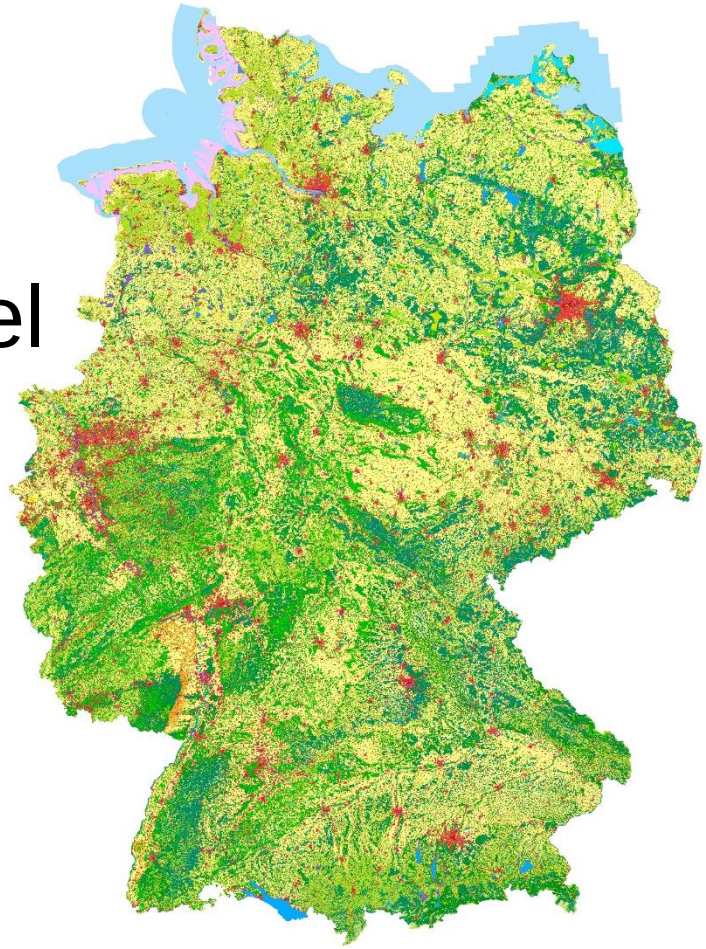
Federal Agency for
Cartography and Geodesy

German land cover model LBM-DE

quality assurance



Content

- Section GI7: development and remote sensing
- Introduction to national land cover/land use dataset LBM-DE
- Quality assurance procedure
  - automated classification
  - (topo)logic checks
  - interactive checks based on stratified samples

Section GI7

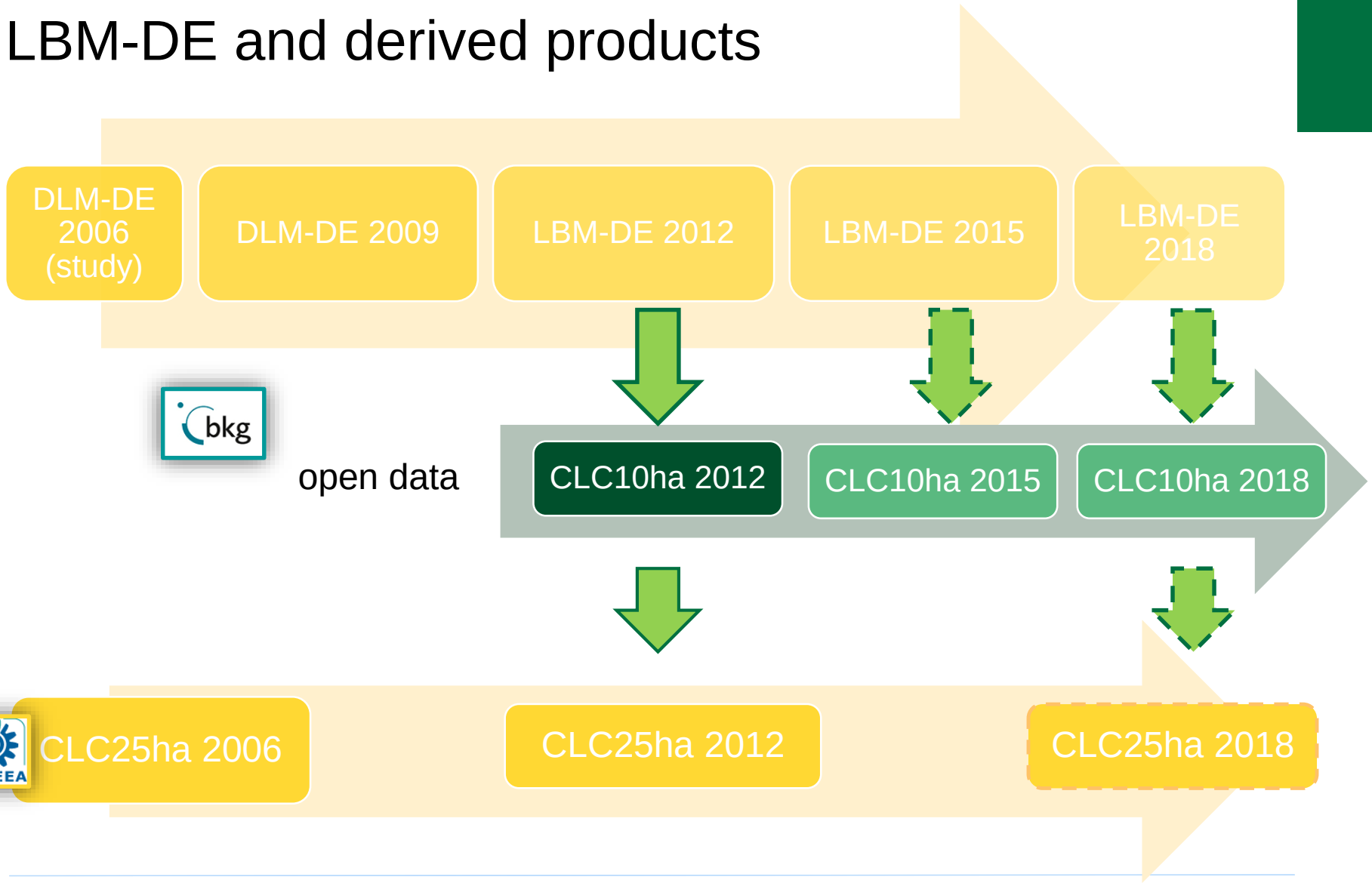
- DGM (Digital Terrain Model): Fusion and harmonization of elevation data (2)
- **LBM-DE (German Land cover model):** land cover information from aerial and satellite data (8)
-  : Technical coordination for land services and research projects (3)
- Research projects: using multispectral, SAR and laser scan data (5)
- ZKI-DE: Crisis management using remote sensing data (under development) (1)

LBM-DE: German Land cover model

Concept and technical details

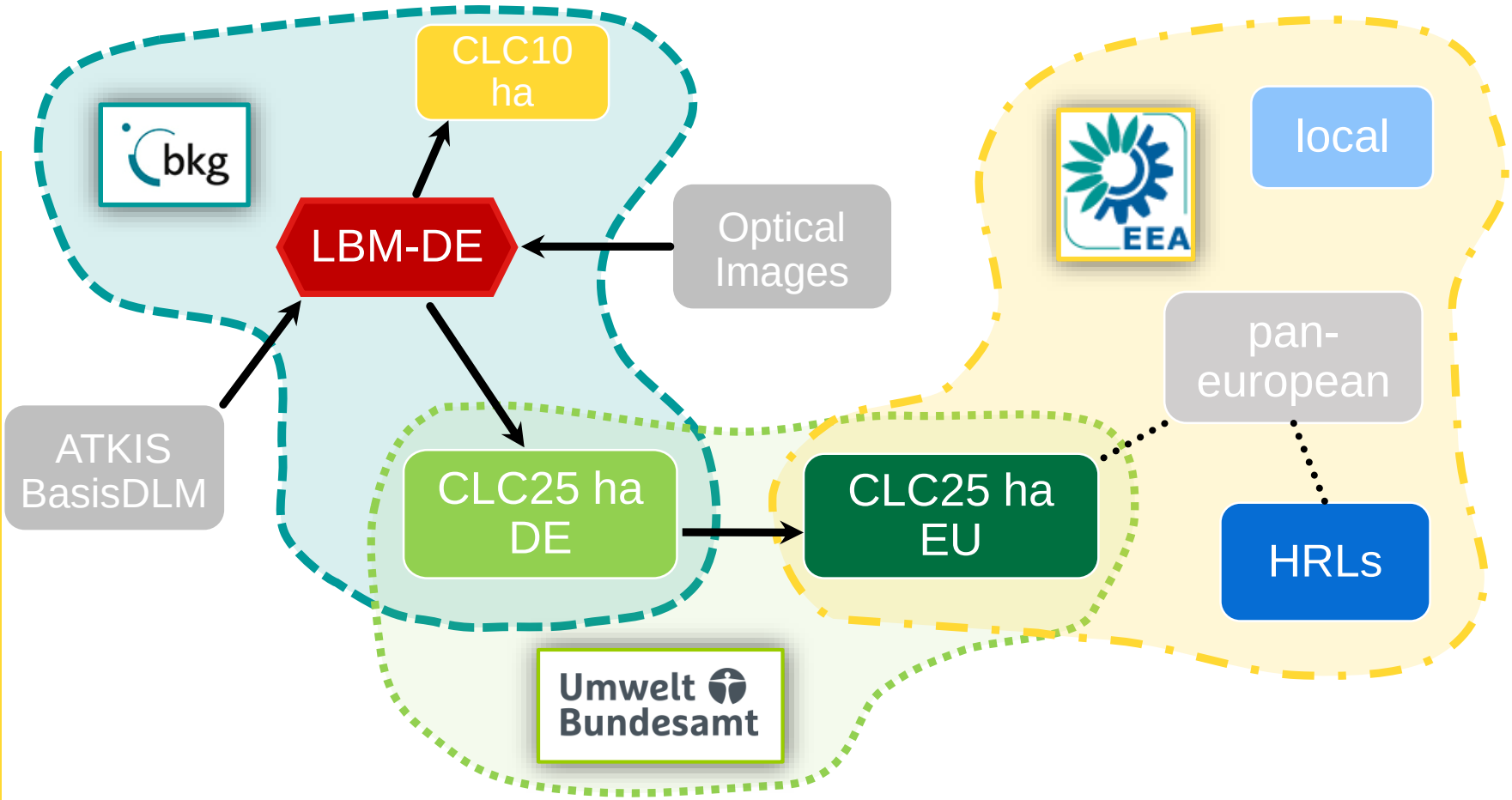
- LBM-DE provides a detailed **land cover / land use** mapping for Germany
- Consists of **31 land cover** (LB) classes and **16 land use** (LN) classes
- Main source of update information are **multi-temporal satellite imagery** of sensors RapidEye (5m) und DMC (22m)
- Minimum Mapping Unit (MMU) = **1 ha**
- Production of LBM-DE **synchronously with EEA** activities
- Deriving **CORINE Land Cover (CLC)** (MMU 25ha) from the LB/LN data in LBM-DE

LBM-DE and derived products



LBM-DE: German Land cover model

LBM-DE is national input to CLC



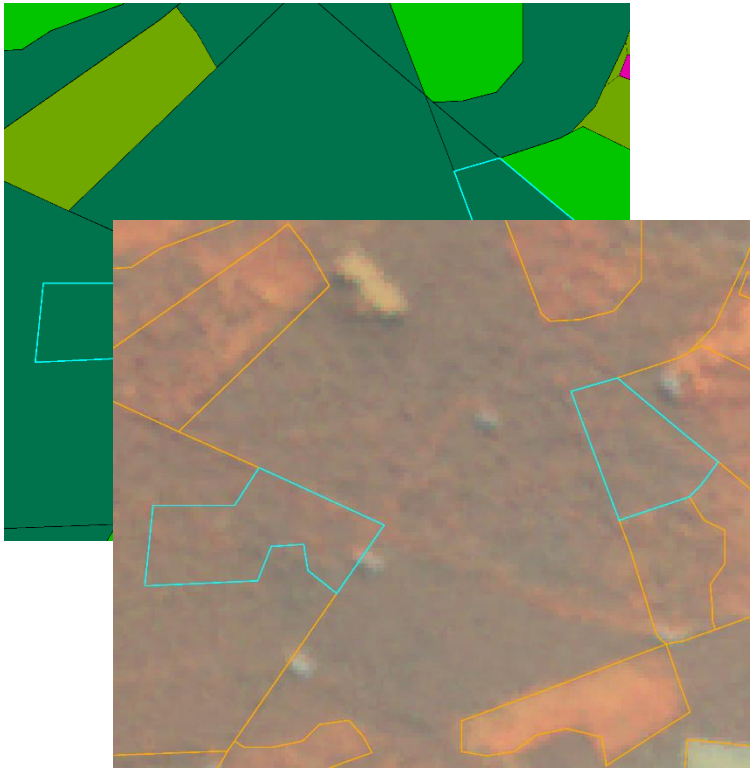
LBM-DE: German Land cover model

special feature: distinction between **land cover** (LB) and **land use** (LN)

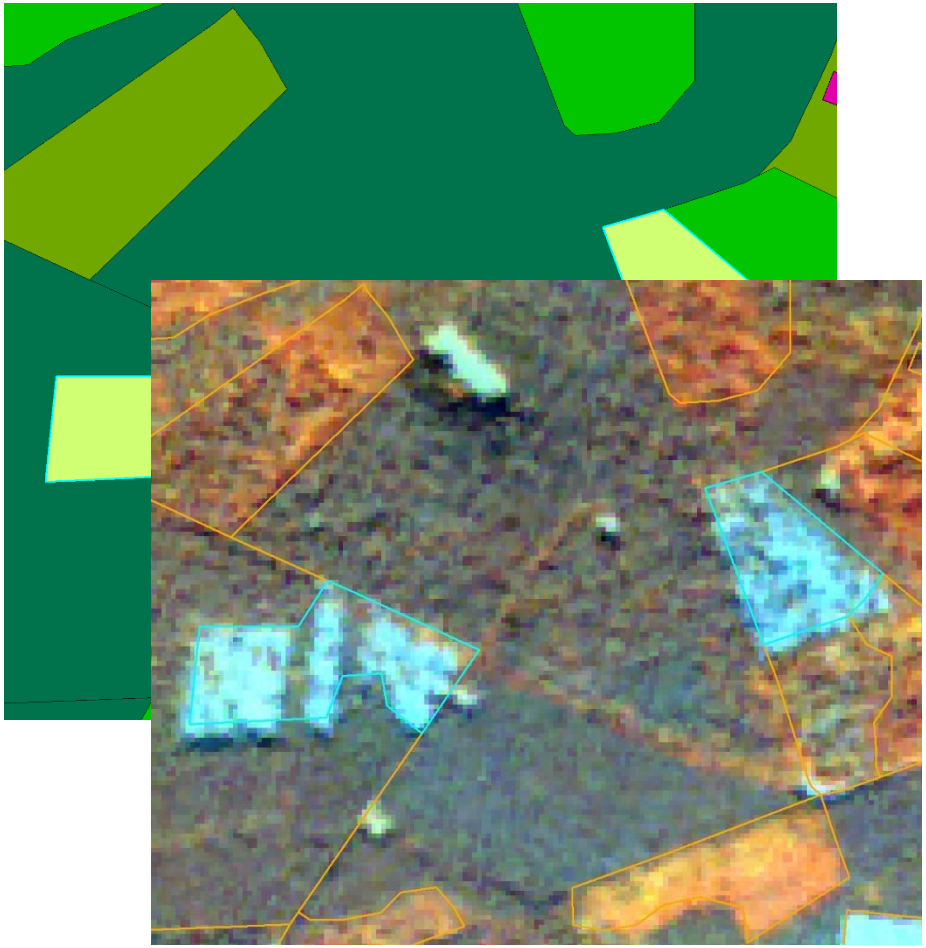
CLC: no consistent separation between cover and use

LBM-DE: separation into LB/LN for complete description of the environment

LBM-DE2015 Example



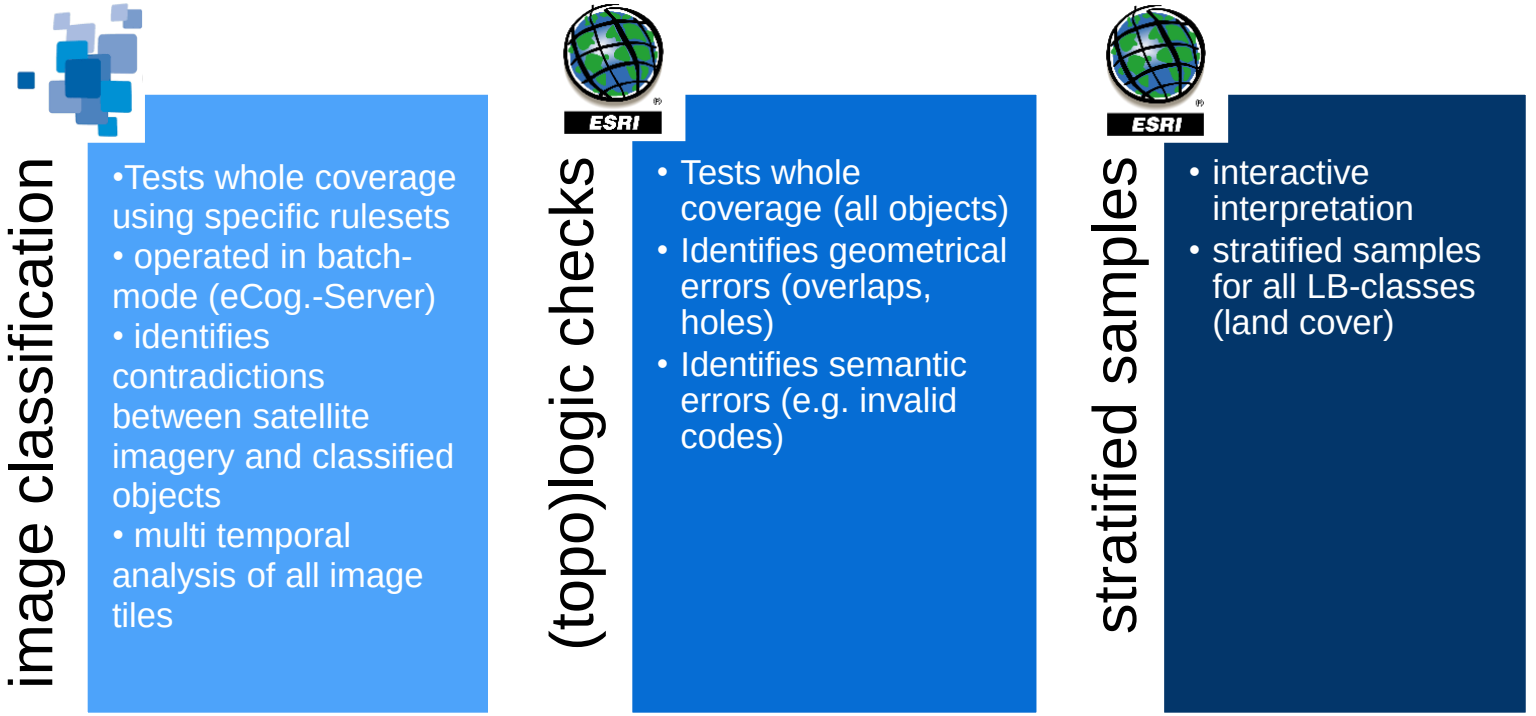
LBM-DE2012



LBM-DE2015

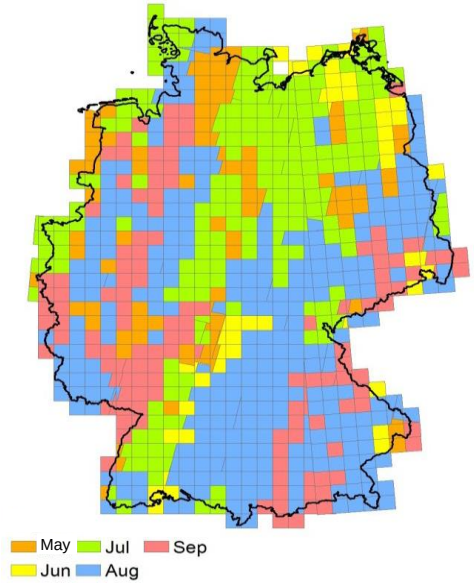
Quality assurance

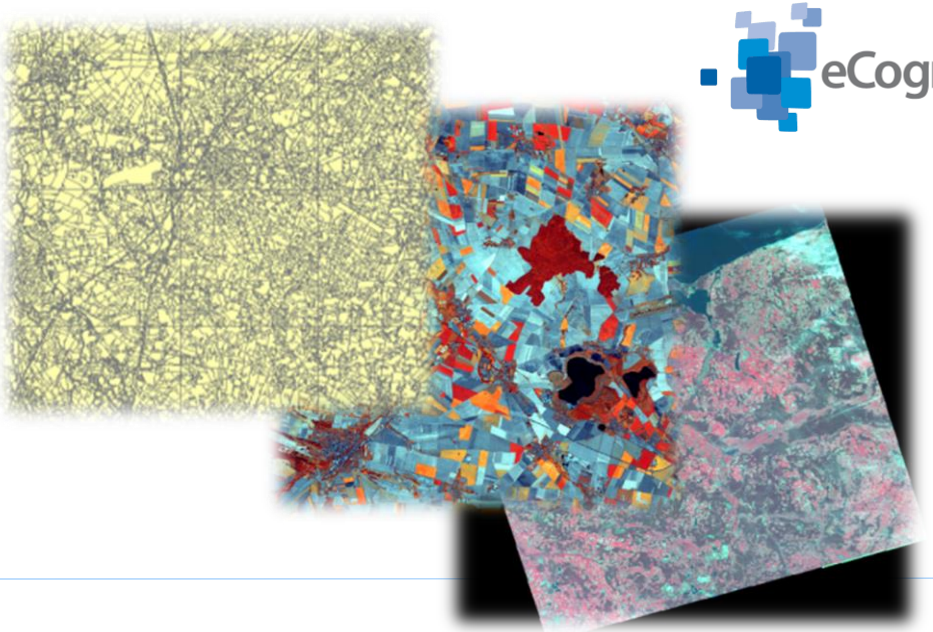
Quality assurance for LBM-DE is based on 3 pillars:



Quality assurance: image classification

- object based image analysis for quality assurance purposes
- automated process analyses over 800 images (25 km x 25 km) and corresponding vector data
- requested thematic accuracy: 97,5% / 90,0% correct classification



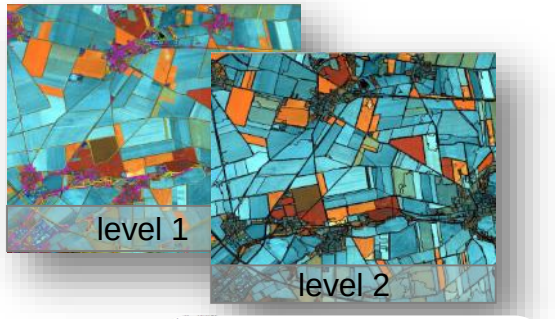


Quality assurance: image classification

procedure of multi temporal classification

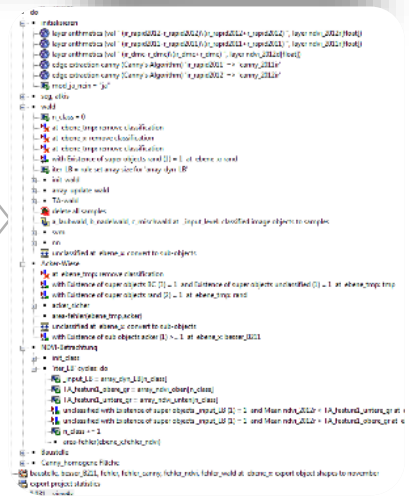
- input: LBM-DE (vector) + RapidEye (raster) + auxiliary imagery (raster)
- segmentation :

level 1 = features of LBM-DE
level 2 = further refinement based on level and raster imagery with different weights



- classification and isolation of blunders

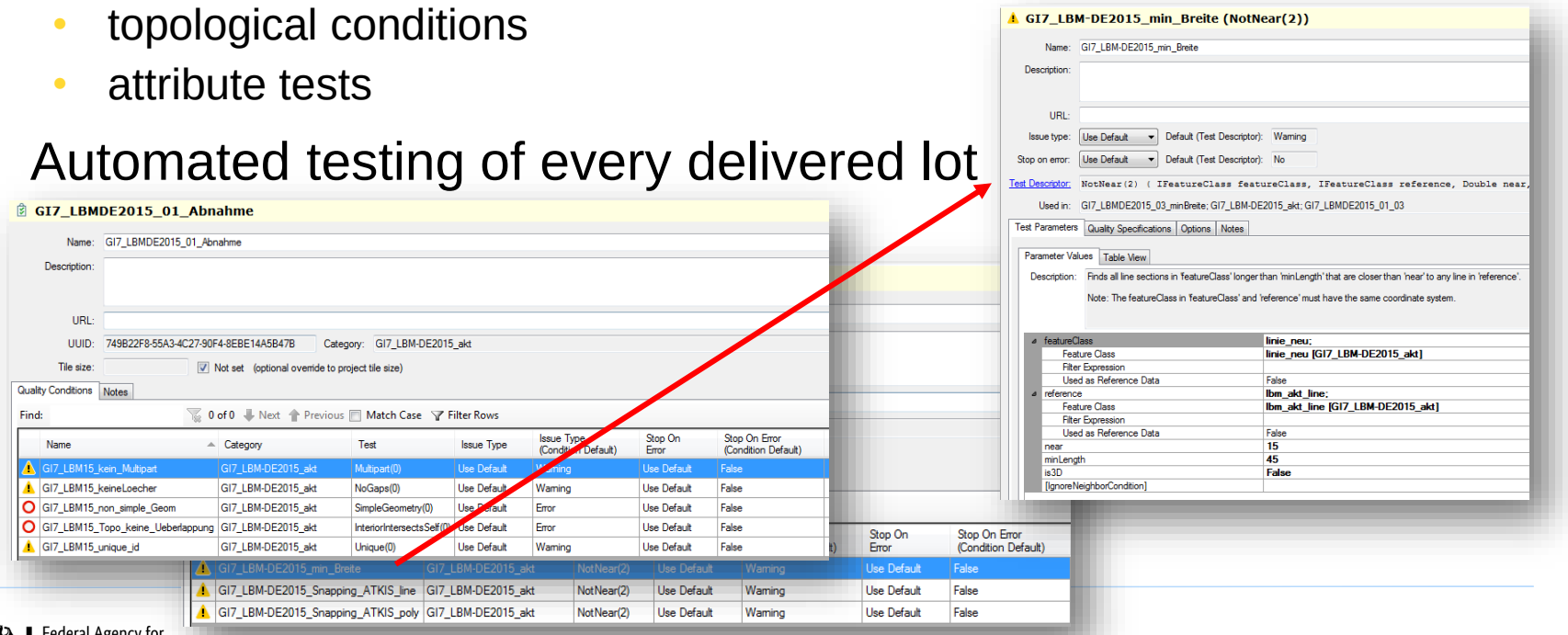
  - forest: automated generation of samples + classification (SVM,NN)
  - arable land - grassland: temporal variation of NDVI
  - evaluation of all LB classes regarding their allowable/required share of vegetation and sealing degree [NDVI (min,max)]
  - criterion of homogeneity



- export of identified blunders and statistics per image
- interactive visual evaluation of results

Quality assurance: (topo)logic checks

- QA Framework (ESRI Suisse): large set of tools for the identification, analysis and correction of errors
- Out of > 120 tests available, we used
  - proximity tests (distance between features)
  - topological conditions
  - attribute tests
- Automated testing of every delivered lot



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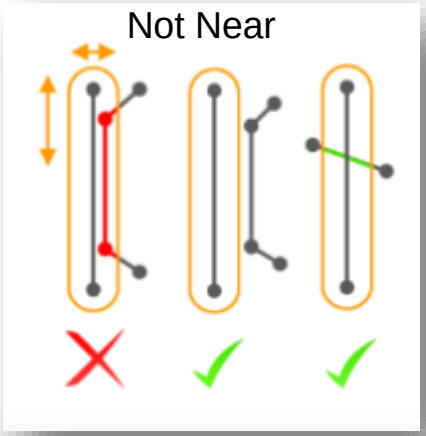
Quality assurance: (topo)logic checks

- example: test of condition of MMW (Minimum Mapping Width) >= 15m
- result: shapefile with error geometries



GI7_LBM-DE2015_min_Breite (NotNear(2))

Name: GI7_LBM-DE2015_min_Breite

Description:

URL:

Issue type: Use Default — Default (Test Descriptor): Warning

Stop on error: Use Default — Default (Test Descriptor): No

Test Descriptor: NotNear(2) (IFeatureClass featureClass, IFeatureClass reference, Double near,

Used in: GI7_LBMDE2015_03_minBreite; GI7_LBM-DE2015_akt; GI7_LBMDE2015_01_03

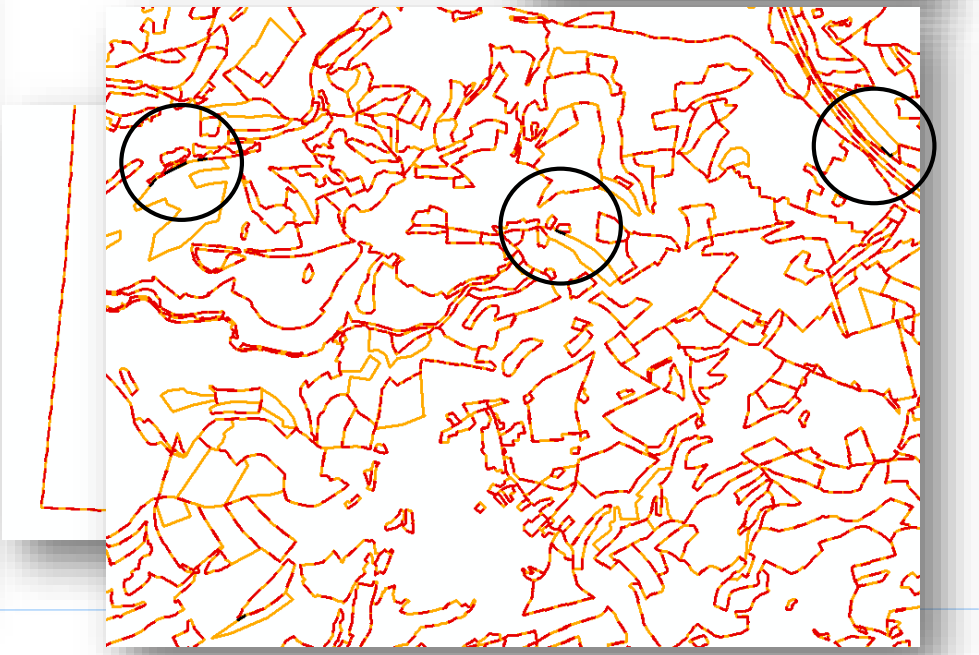
Test Parameters | Quality Specifications | Options | Notes

Parameter Values | Table View

Description: Finds all line sections in 'featureClass' longer than 'minLength' that are closer than 'near' to any line in 'reference'.

Note: The featureClass in 'featureClass' and 'reference' must have the same coordinate system.

featureClass	linie_neu;
Feature Class	linie_neu [GI7_LBM-DE2015_akt]
Filter Expression	
Used as Reference Data	False
reference	lbm_akt_line;
Feature Class	lbm_akt_line [GI7_LBM-DE2015_akt]
Filter Expression	
Used as Reference Data	False
near	15
minLength	45
is3D	False
[IgnoreNeighborCondition]	



Quality assurance: stratified samples

- Comparing LBM-DE with „real world“ (e.g. imagery)
- Quality assurance according to part Q5 of AdV-quality-concept
- Incorporates DIN ISO 2859-1
- Constraints:
  - Positional accuracy:
    newly recorded features: new lines to be drawn at pixel level of satellite imagery (RapidEye, 5 m pixel)
  - Thematic accuracy:
    97,5% / 90,0% according to ISO 2859 (stratified random sampling of each delivery)

Quality assurance: stratified samples

- stratified random sampling of each delivery according to DIN ISO 2859-1 (interactively)
- 1 delivery (= 1 federal state) = 1 lot
- stratified by LB-classes (land cover)
- samples have to fulfill criteria of quantity and area
- testing accuracy:
  - starting with decreased testing accuracy
  - in case of exceedance of the acceptance number, repeat procedure with normal testing accuracy

Quality assurance: stratified samples

- Python script (ESRI geoprocessing) for automated generation of feature class with samples to be tested

- Interactive image interpretation of samples (ESRI ArcMap)

- Evaluation of results

Lot N (dec. testing acc.)	AQL 1,0 SPU-AZ-RZ	AQL 2,5 SPU-AZ- RZ
2 … 8	2-0-1	2-0-1
9… 15	2-0-1	2-0-1
16 … 25	2-0-1	2-0-1
26 … 50	2-0-1	2-0-1
51 … 90	2-0-1	2-0-1
91 … 150	3-0-1	3-0-1
151 … 280	5-0-1	5-0-2
281 … 500	8-0-1	8-0-2
501 … 1.200	13-0-2	13-1-3
1.201 … 3.200	20-0-2	20-1-4
3.201 … 10.000	32-1-3	32-2-5
10.001 … 35.000	50-1-4	50-3-6
35.001 …150.000	80-2-5	80-5-8
150.001 … 500.000	125-3-6	125-7-10
500.001 and more	200-5-8	200-10-13

Thank you for your kind attention!

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