PROVIDER: Executive Environment Agency at the Ministry of Environment and Water, Bulgaria

June, 2008

BULGARIA: verification of high resolution soil sealing layer

- Qualitative assessment -

Prepared by:

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Version 1.0

European Environment Agency

1. Preparatory work

1. Upload the data that will be made available by EEA via ftp server or sent by mail. Please inform EEA on reception of the data;
2. Check for available reference data that will be used during the verification;
3. List the experts/expertise that are involved in the verification task:

Expert name	Field of expertise	Institution
Rumiana Vatseva	Land cover, CLC2000 and 2006, GIS	BAS - Institute of Geography
Anton Stoimenov	Remote Sensing, CLC2000 and 2006	BAS - Solar-Terrestrial Interactions Laboratory Telephone number: ++359-2-870 92 20 Email address: astoimen@bas.bg

The table below gives an indicative estimate for the EEA member countries.

Country	Area (km^2)	Person days	Country	Area (km^2)	Person days
Austria + Liechtenstein	83.855	9	Lithuania	65.200	7
Belgium	30.520	3	Luxembourg	2.586	<1
Bulgaria	110.994	11	Malta	316	<1
Cyprus	9.251	1	Netherlands	41.526	4
Czech Republic	78.864	8	Norway	323.878	33
Denmark	43.075	4	Poland	312.683	31
Estonia	45.200	5	Portugal	88.935	9
Finland	338.145	34	Romania	237.500	24
France	543.965	55	Slovakia	20.251	5
Germany	357.028	36	Slovenia	49.035	2
Greece	131.957	13	Spain	504.782	51
Hungary	93.030	9	Sweden	449.964	39
Iceland	102.820	10	Switzerland	41.293	4
Ireland	70.282	7	Turkey	789.452	79
Italy	301.245	30	United Kingdom	244.082	25
Latvia	63.700	6			

2. Reference data

Please list the reference data that is used for this verification:

1. Topographic maps

☐ No ☒ Yes Year: NA Area: Full country

If only a subset, then please specify the area(s):

2. Aerial orthophotos

☒ No ☐ Yes Year: Area: Please, select:

If only a subset, then please specify the area(s):

3. Very High Resolution satellite data

☐ No ☒ Yes Year: 2005-2007 Area: Subset

If only a subset, then please specify the area(s):

Shape files available

4. CLC2000

☐ No ☒ Yes

5. Other

Name: CLC2006 Year: 2006 Area: Full country

If only a subset, then please specify the area(s):

Name: Year: Area: Please, select:

If only a subset, then please specify the area(s):

Name: Year: Area: Please, select:

If only a subset, then please specify the area(s):

Name: Year: Area: Please, select:

If only a subset, then please specify the area(s):

Comments concerning the reference data used (if any):

B. Geometric quality

Please provide your qualitative assessment of the geometric quality of the data. The objective of this task is to perform a visual analysis of the soil sealing dataset concerning its co-registration when put in overlay with other reference datasets.

1. Check geometric accuracy:

Is there a visible shift? ☒ Yes ☐ No

If yes:

a. Is there a systematic shift? ☐ Yes ☒ No

b. Is there a local shift? ☒ Yes ☐ No

Where? Up to 10 m in comparison with topomaps

Please indicate the region, place name, coordinates or other description of location:

2. Is the used projection correct? ☒ Yes ☐ No

3. Comments concerning geometric issues (if any), or in case the geometric quality could not be checked, please provide a short explanation:

C. Thematic quality

Please provide your qualitative assessment of the thematic quality of the data. The objective of this task is to perform a visual comparison between available reference data and the soil sealing dataset. You are requested to verify for a number of land cover classes (similar to the CLC classes at levels 2 or 3) to check if any errors in the data can be identified. Please note that many land cover classes can include sealed surfaces, especially for features <25 ha.

For this part of the verification, it is recommended to use a binary mask (built-up/non-built-up area) that can be used in overlay with the reference data:

1. Apply a lookup table to map all pixels > 80% degree of soil sealing as built-up area;
2. Perform the checks on pixels > 80% degree of soil sealing by screening for each of the land cover classes if built-up or non built-up areas are correctly mapped. Feel free to add screenshots with examples to illustrate the quality judgement.

For your qualitative assessment, following examples of check boxes can be ticked:

☐ "excellent" meaning that you expect that the accuracy of the built-up data is reaching almost 100%; no errors could be found in the areas that were verified.

☐ "good" meaning that you are confident that the classification results are at least 85 % correct; only sporadic errors were encountered in the areas that were verified.

☐ "acceptable" meaning that you estimate that in most of the verified areas the classification results will probably reach an accuracy of 85 %; some minor errors could be detected in the areas that were verified.

☐ "insufficient" meaning that you do not expect that the classification results will reach the minimum of 85 % accuracy; you encountered several errors in different regions.

☐ "very poor" meaning that you are confident that the classification results are bad with regard to presence of built-up area; most of the areas verified are wrongly mapped.

Urban fabric:

a. Did you check if built-up/non built-up areas are correctly mapped within urban fabric (e.g. houses, buildings, streets, etc.)?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality of the mapped built-up area within the urban fabric?

☐ very poor ☒ insufficient ☐ acceptable ☐ good ☐ excellent

a. Short description of errors found (if any):

Omission errors:

Unclassified built-up areas (≥ 80% soil sealed) in the cities and the large towns and a lot of unclassified built-up areas in the small towns. Buildings and large areas with dark color are not included in the built-up areas.

Commission errors:

Many examples of incorrectly classified as built-up pixels in areas with up to 100% vegetation and water surfaces.

Figures 1 to 4 illustrate the patterns of omission and commission errors in CLC 11x classes.

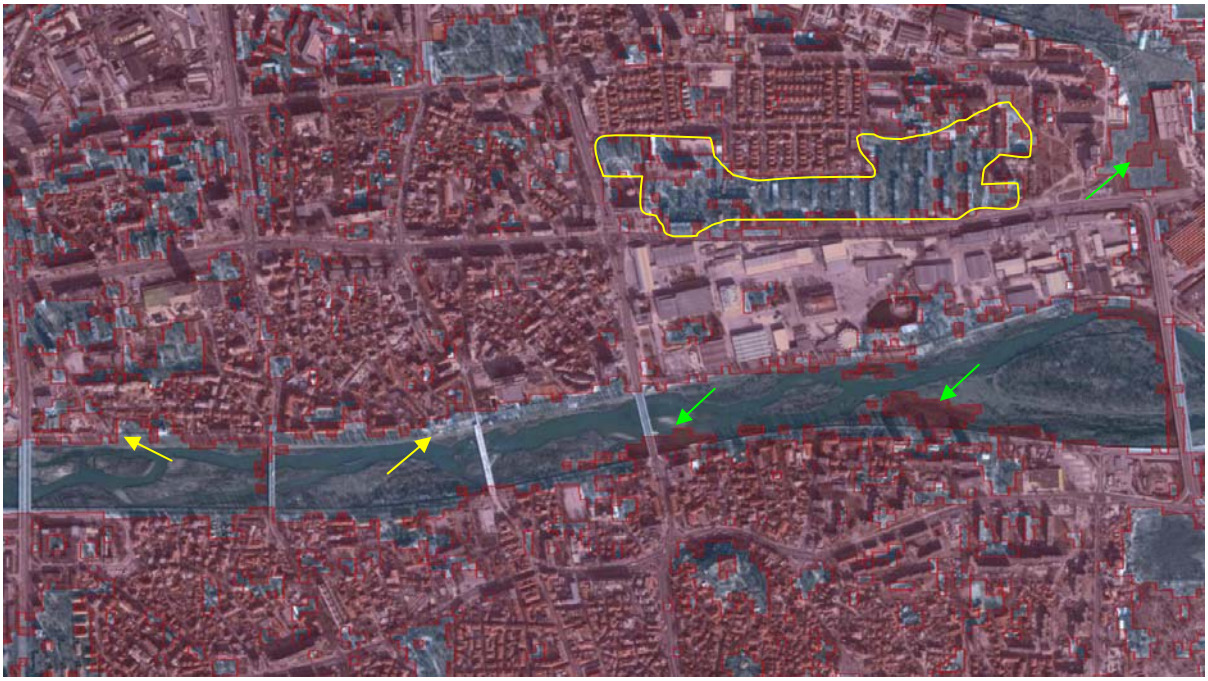

Fig.1. Omission (yellow) and commission (green arrows) errors in 112 - Urban fabric in Plovdiv city.

Fig. 2. Patterns of omission errors (yellow arrows) and commission errors (green arrows) - Sofia downtown.

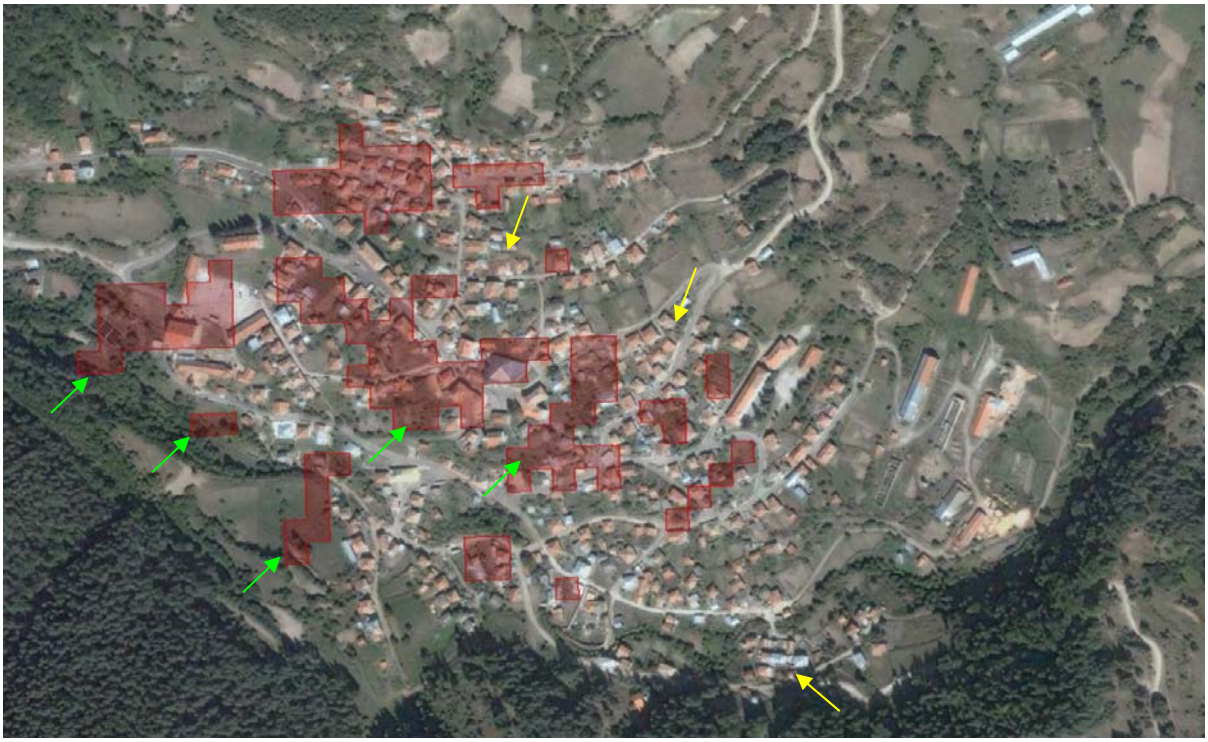

Fig. 3. Omission errors (yellow arrows) – buildings not mapped and commission errors (green arrows) in a village area.

Industrial or commercial units:

a. Did you check if built-up/non built-up areas are correctly mapped within industrial or commercial units (e.g. parking lots, buildings, etc.)?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☒ insufficient ☐ acceptable ☐ good ☐ excellent

b. Short description of errors found (if any): incorrect classification (omission and commission errors) of built-up- and vegetated areas.

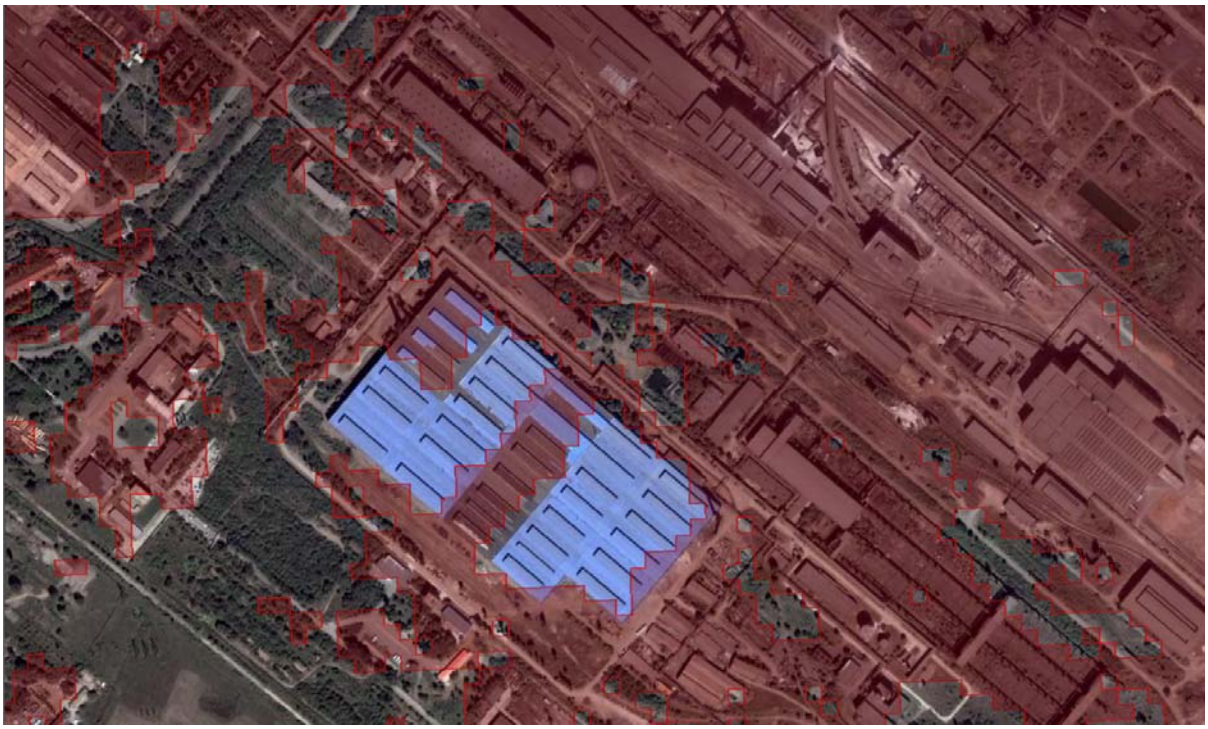

Fig.4. Omission error – unclassified industrial unit (blue roof) – Kremikovci

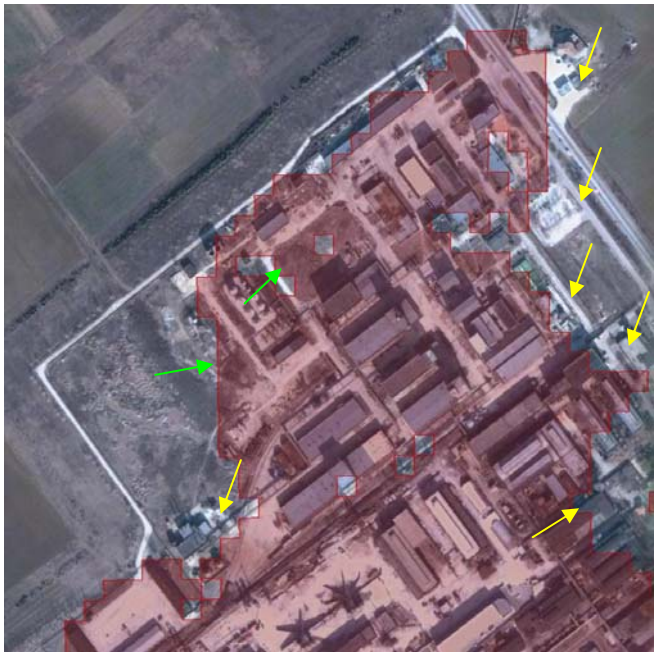

Fig.5. Omission (yellow) and commission (green) errors – Asenovgrad.

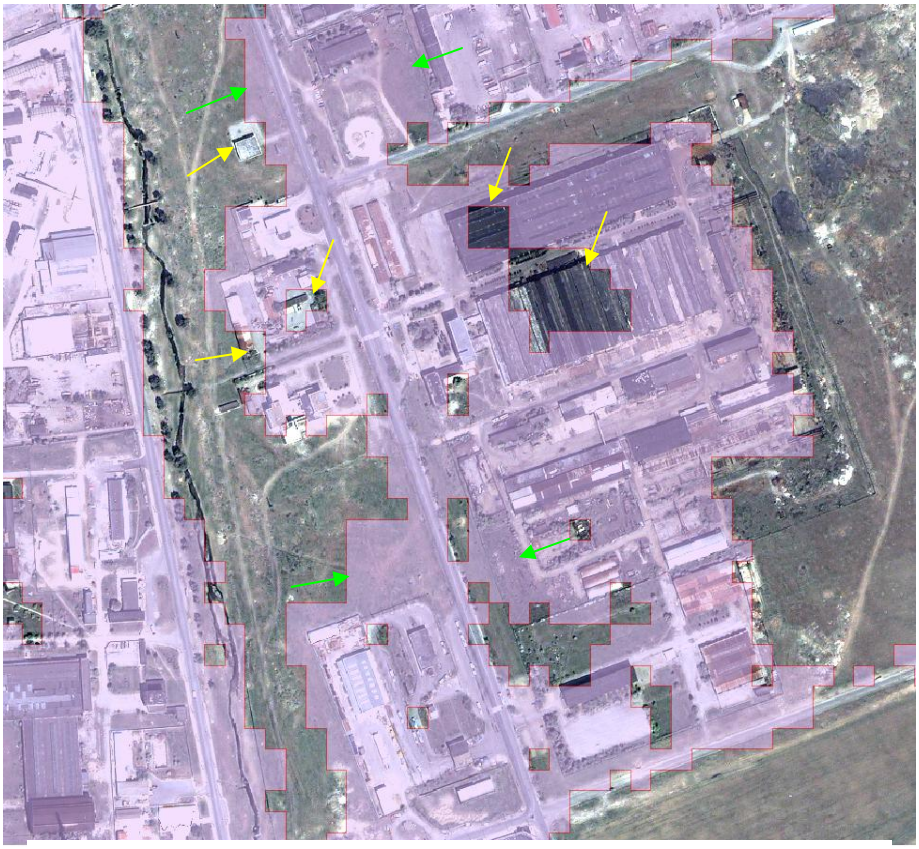

Fig.6. Omission (yellow) and commission (green) errors – Sliven

Road and rail networks and associated land:

a. Did you check if built-up/non built-up areas within road and rail networks and associated land are correctly mapped (e.g. railway stations, highways >20 m width, etc.)?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☒ insufficient ☐ acceptable ☐ good ☐ excellent

c. Short description of errors found (if any):

Missing or not consequently mapped wide roads and rail networks (Fig. 7.).
In general only highways are classified in acceptable way (Figure 10.), but there is a not recognized highway (Fig. 8.) and not consequently mapped highways (Fig. 9.).

Fig. 7. Commission errors along the railway and wide road

Fig. 8. Commission error (green arrows) – missing highway – Burgas

Fig. 9. Not consequently mapped highway - Galata.

Fig. 10. Highway exactly mapped – Hemus

Port areas:

a. Did you check if built-up/non built-up areas in port areas are correctly mapped (e.g. installations, dykes, etc)?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☒ insufficient ☐ acceptable ☐ good ☐ excellent

d. Short description of errors found (if any):

Many commission and omission errors in the sea ports (Varna and Burgas examples) and river port areas – Russe (Fig. 11-13)

Fig. 11. Omission (yellow) and commission (green) errors - Varna Black Sea Port

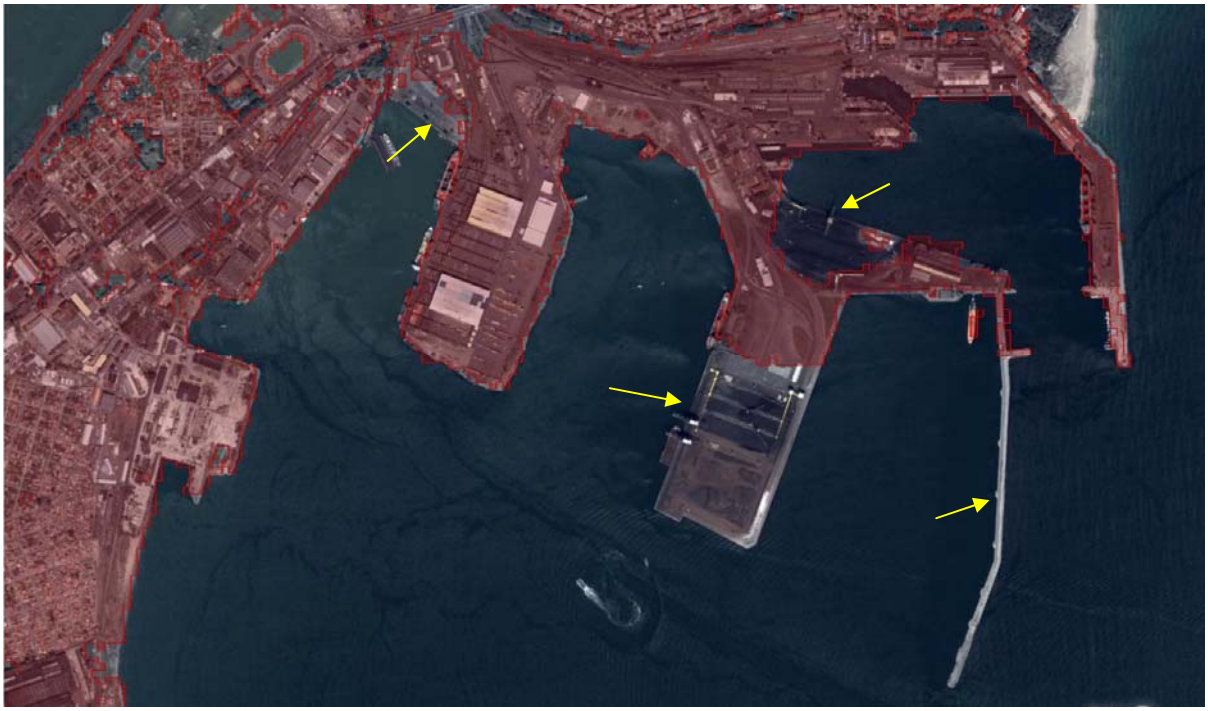

Fig.12. Not mapped port areas - Burgas

Fig.13. Omission errors (yellow arrows) and Commission errors (green arrow) - vegetated area classified as built-up – Ruse Danube river port.

Airports:

c. Did you check if built-up/non built-up areas in airports are correctly mapped (e.g. runways, buildings, etc)?

☒ Yes ☐ No ☐ Not possible

d. How would you assess the quality?

☐ very poor ☐ insufficient ☒ acceptable ☐ good ☐ excellent

e. Short description of errors found (if any):

The overall quality is acceptable concerning the runways and the main infrastructure. Some commission and omission errors are illustrated in Figures 14 – 17.

Fig. 14. Sofia Airport - overview

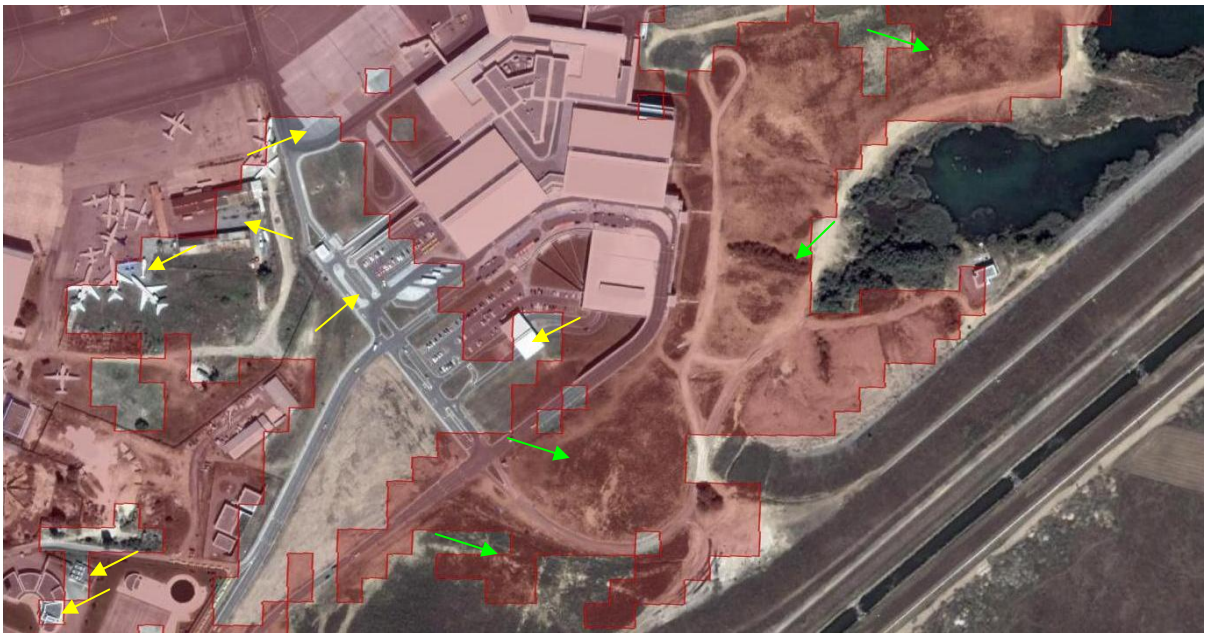

Fig.15. Omission (yellow) and Commission errors (green) - Sofia Airport (detail).

Fig. 16. Not consequently mapped runway and airport

Mine, dump and construction sites:

a. Did you check if built-up/non built-up areas in mine, dump and construction sites are correctly mapped (e.g. buildings, infrastructure, etc)?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☒ insufficient ☐ acceptable ☐ good ☐ excellent

f. Short description of errors found (if any):

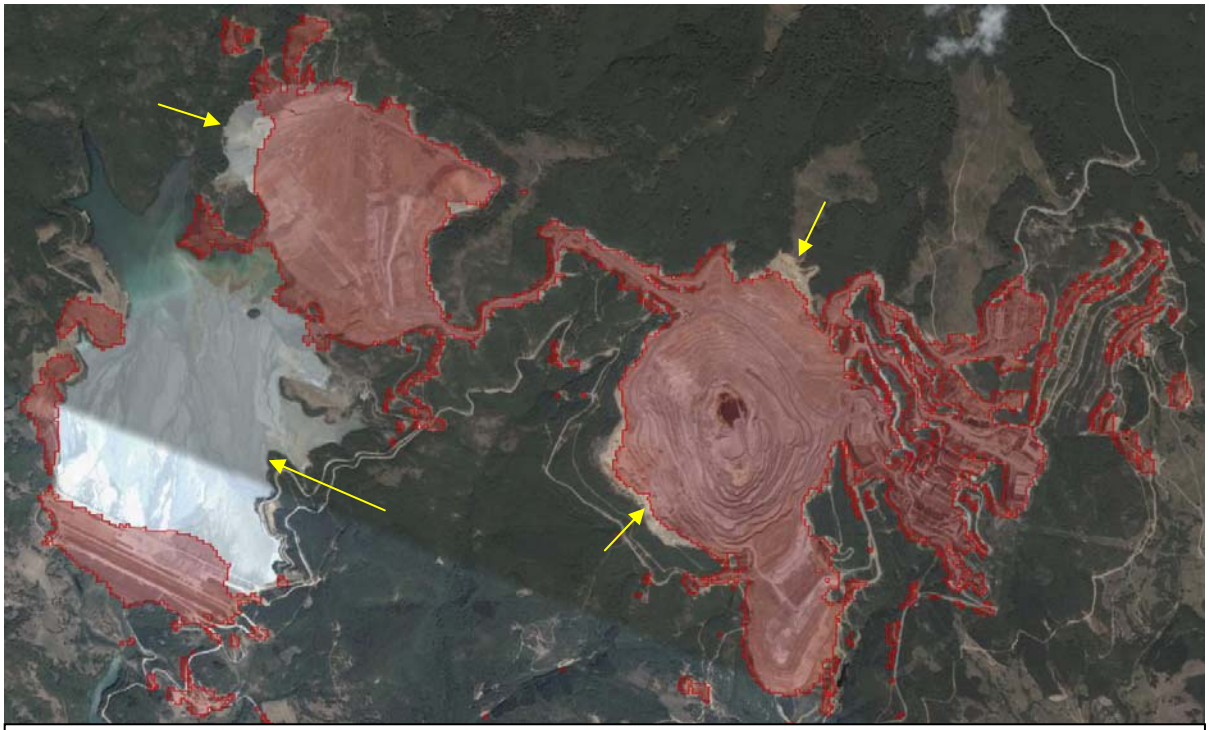

Fig. 17. Large unclassified dump and Mine areas (omission errors pointed) – Asarel

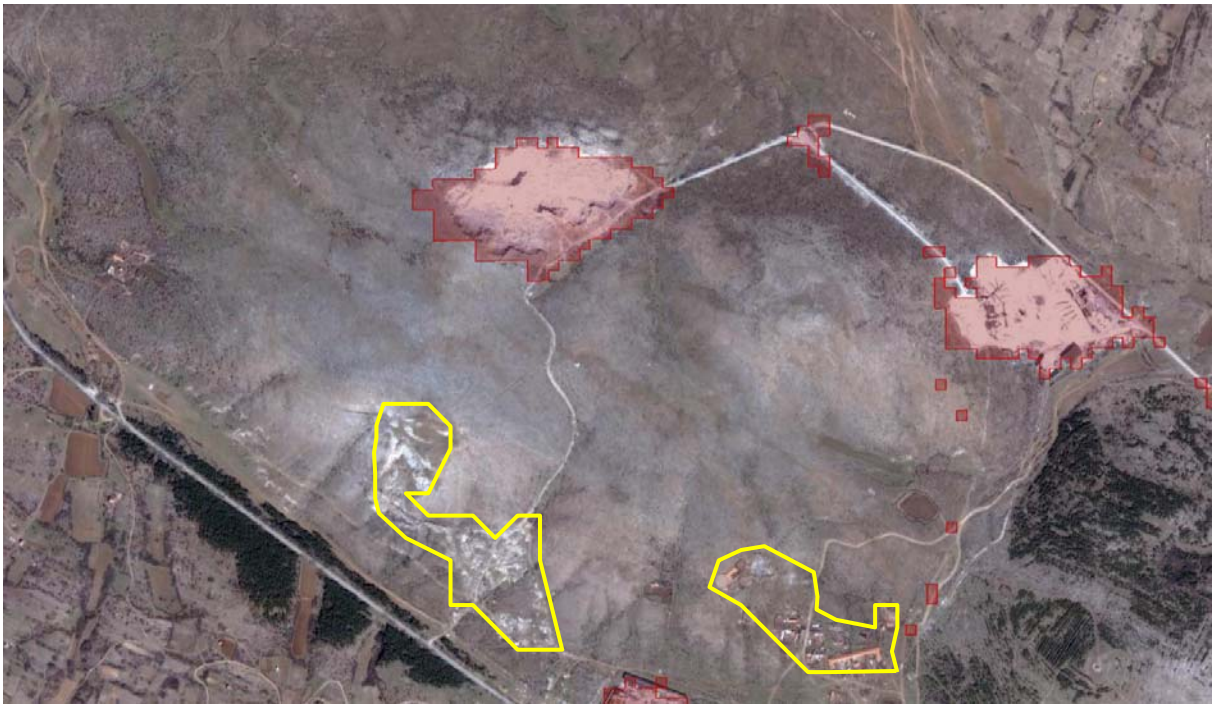

Fig. 18. Omission errors - unclassified mine area – Topolovgrad

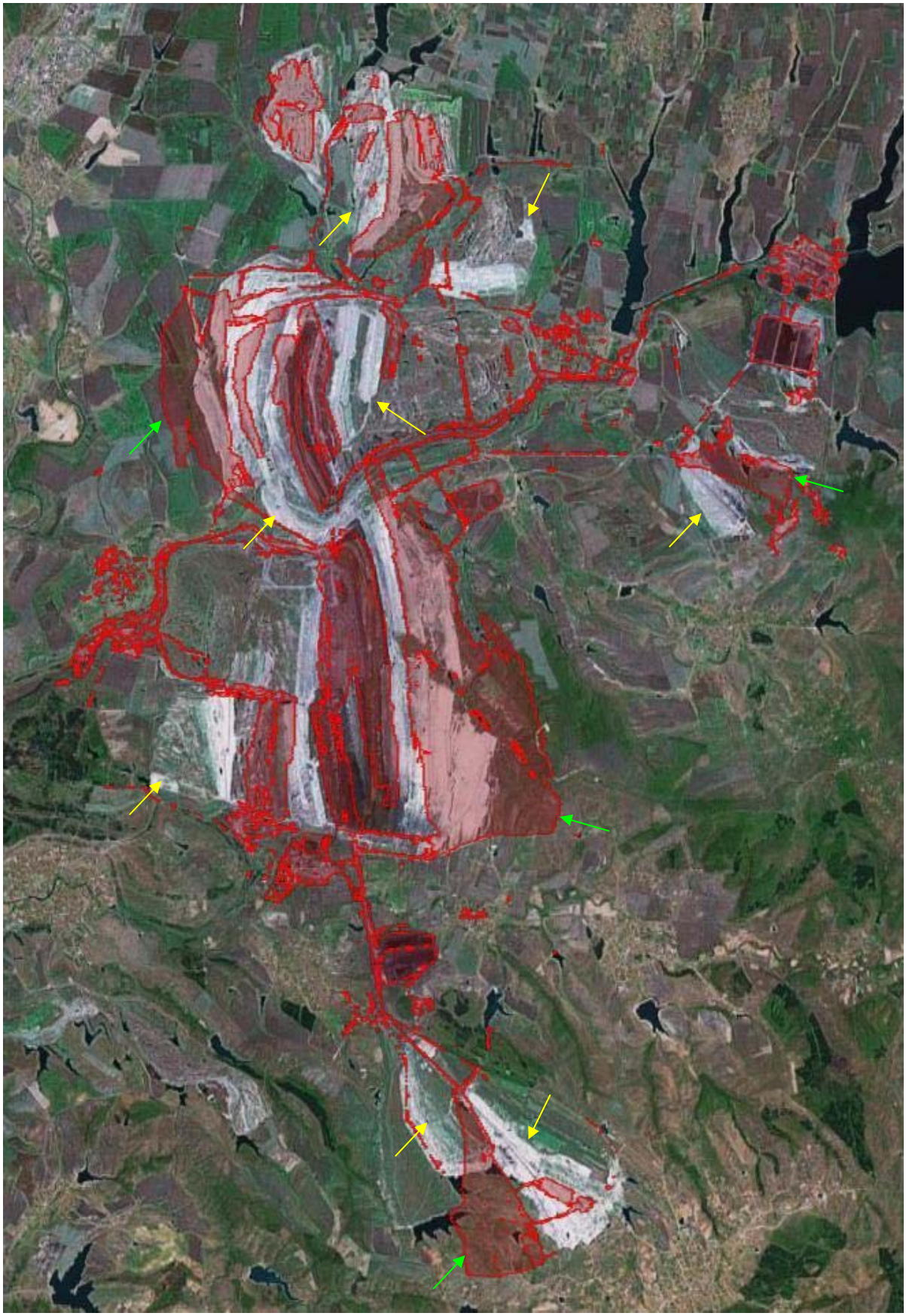

Fig. 19. Large areas of commission (green) and omission (yellow) errors – Marbas

Arable land:

a. Did you check if built-up/non built-up areas in arable land are correctly mapped (e.g. bare soil, large farm houses, roads>20m width, etc)?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☐ insufficient ☒ acceptable ☐ good ☐ excellent

g. Short description of errors found (if any):

In general (concerning the huge area of the CLC class Arable land) the quality is acceptable. On this background many commission and omission errors are encountered and illustrated in Figures 20 – 22.

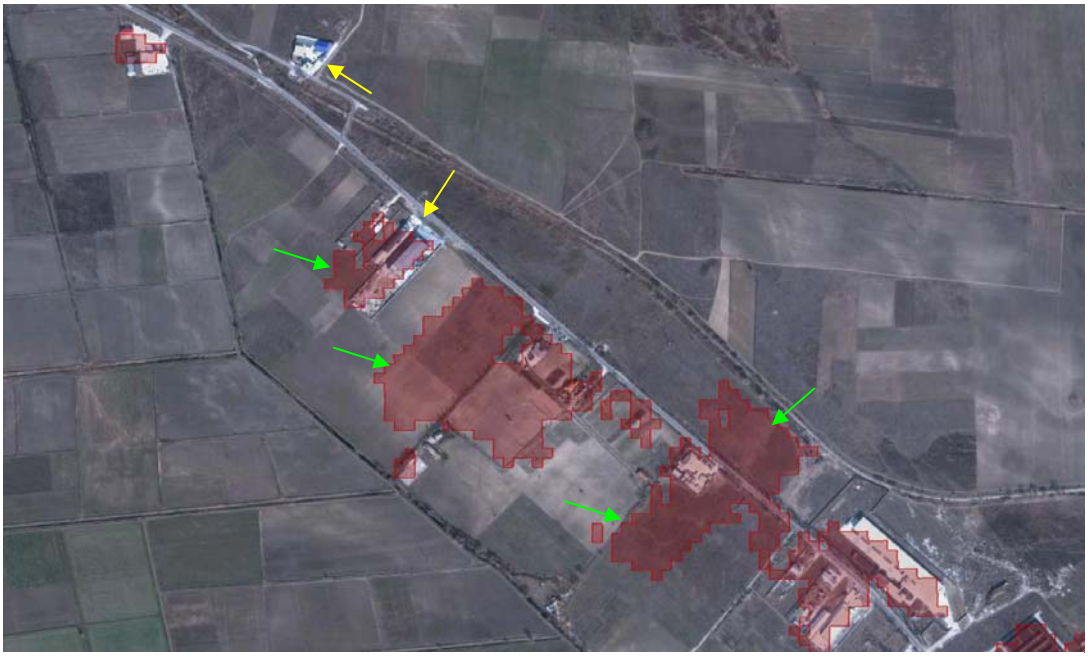

Fig. 20. Omission (yellow) and commission errors (green) in arable land – Plovdiv region.

Fig. 21 Commission errors (arable land classified as built-up area) – Balchik.

Fig. 22. Omission errors (yellow) unclassified build-up areas in arable land – Plovdiv region

Heterogeneous agricultural areas:

a. Did you check if built-up/non built-up areas in heterogeneous agricultural areas are correctly mapped (e.g. buildings, roads >20m, etc)?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☒ insufficient ☐ acceptable ☐ good ☐ excellent

h. Short description of errors found (if any):

A lot of unclassified build-up areas in heterogeneous agricultural areas (CLC 24x) see Figures 23 and 24.

Fig. 23. Ommission errors (unclassified build-up areas in heterogeneous agricultural areas –Rodopi.

Fig. 24. Omission errors (unclassified build-up areas in heterogeneous agricultural areas) – Mihalkovo.

Forest:

a. Did you check built-up/non built-up areas in forests are correctly mapped (e.g. clear-cuts, roads, etc.)?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☐ insufficient ☐ acceptable ☒ good ☐ excellent

i. Short description of errors found (if any):

Scrub and/or herbaceous vegetation associations:

a. Did you check if built-up/non built-up areas in scrub and/or herbaceous vegetation areas are correctly mapped (e.g. dry vegetation, rock outcrop, etc.)?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☐ insufficient ☒ acceptable ☐ good ☐ excellent

j. Short description of errors found (if any):

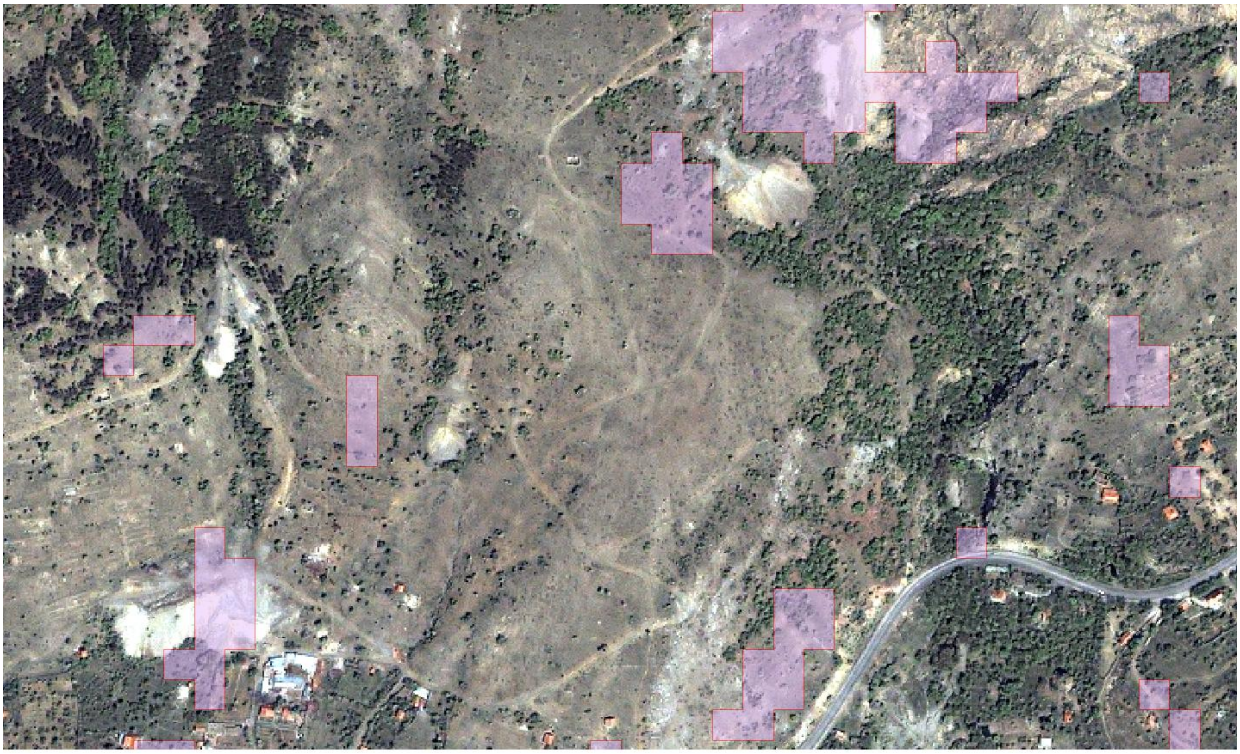

Fig. 25. Commission errors – Stara planina (systematic shift of 1 pixel in the IKONOS image).

Fig. 26 Omission errors (yellow arrows) – Chirpan region.

Beaches, dunes and sands:

a. Did you check if built-up/non built-up areas in beaches, dunes and sand areas are correctly mapped?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☒ insufficient ☐ acceptable ☐ good ☐ excellent

k. Short description of errors found (if any):

Too much beaches, dunes and sands are wrongly classified as built-up areas (Figures 27, 28, 29).

Fig. 27 Commission errors (beaches wrongly classified as built-up areas) – Pomorie.

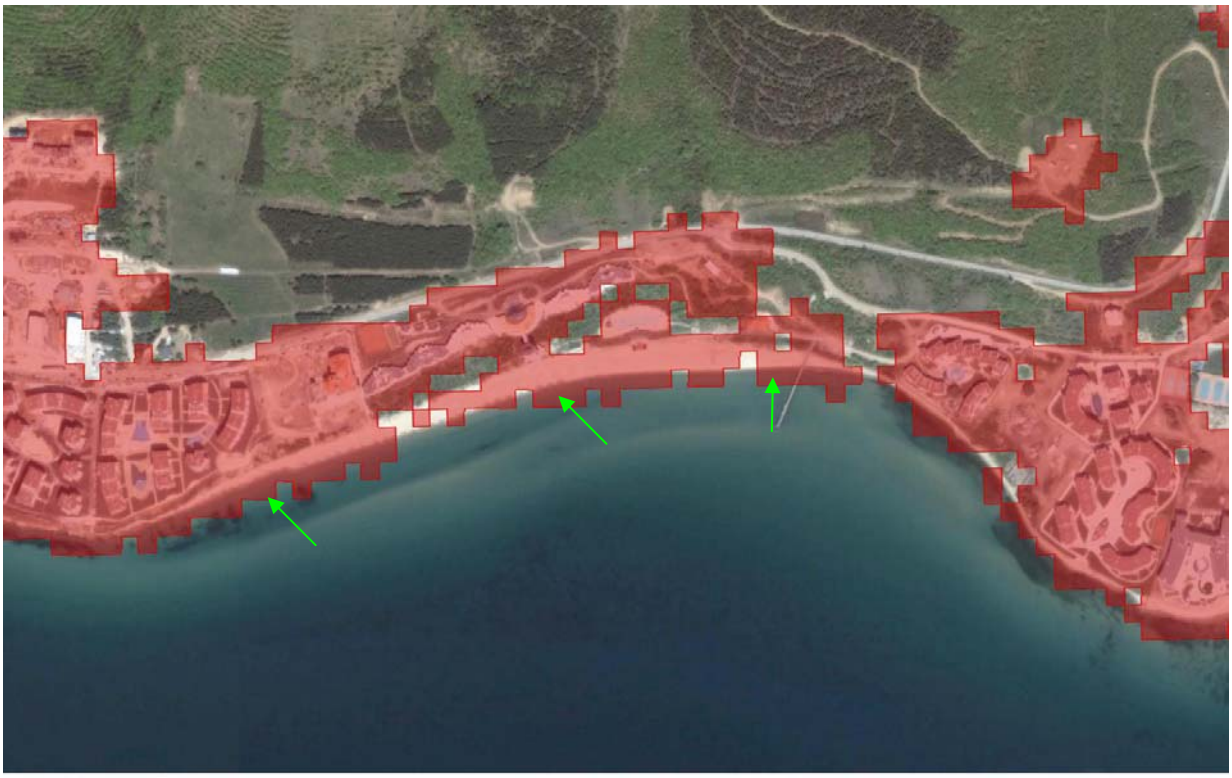

Fig. 28. Commission errors (beaches wrongly classified as built-up areas) – Vlas.

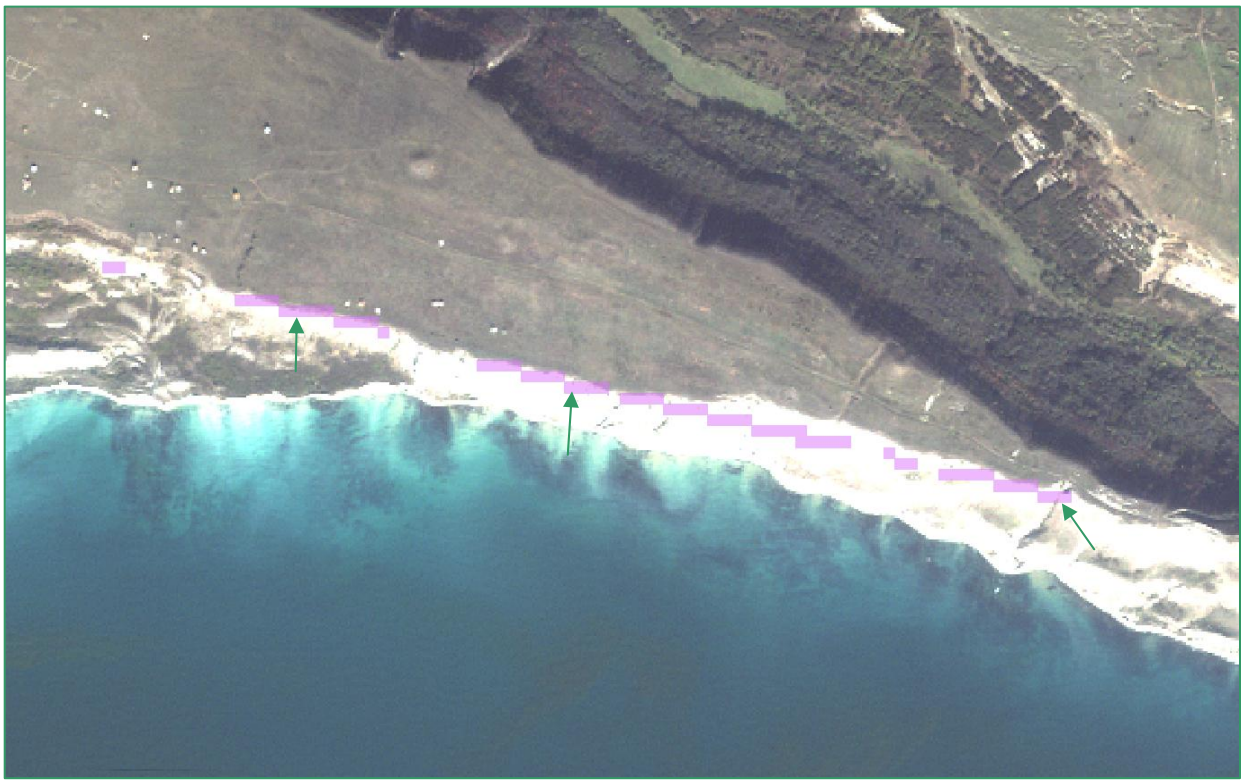

Fig. 29. Commission errors (sands wrongly classified as built-up areas) – Kavarna.

Bare rocks:

a. Did you check if built-up/non built-up areas in bare rock areas are correctly mapped?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☐ insufficient ☒ acceptable ☐ good ☐ excellent

l. Short description of errors found (if any):

Sparsely vegetated areas:

a. Did you check if built-up/non built-up areas in sparsely vegetated areas are correctly mapped?

☒ Yes ☐ No ☐ Not possible

c. How would you assess the quality?

☐ very poor ☐ insufficient ☒ acceptable ☐ good ☐ excellent

m. Short description of errors found (if any):

Some sparsely vegetated areas are wrongly classified as built-up areas (Figures 30 and 31).

Fig.30. Commission errors (sparsely vegetated areas wrongly classified as built-up areas) – Topola.

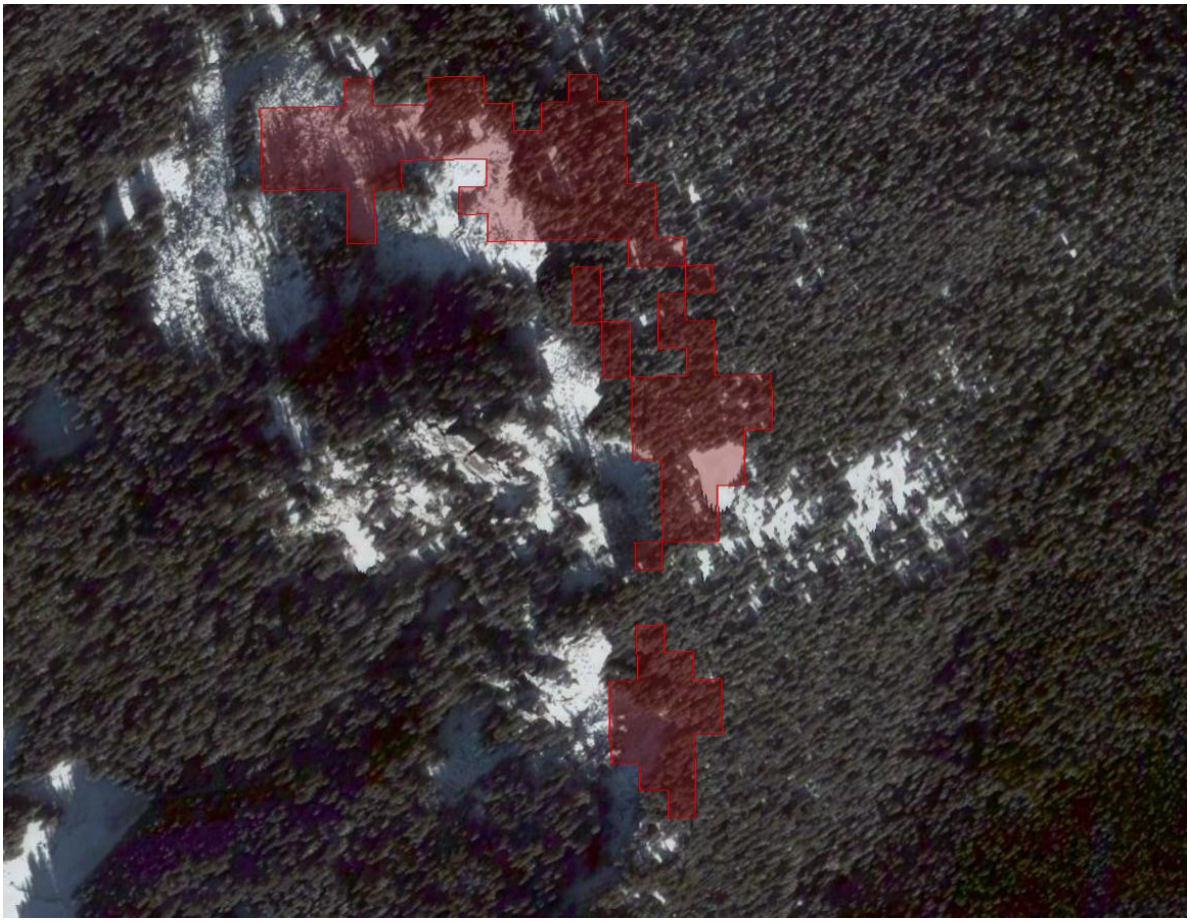

Fig.31. Commission errors (should be considered pixels shift) – Smolyan.

Glaciers and perpetual snow:

a. Did you check if built-up/non built-up areas in glaciers and perpetual snow areas are correctly mapped?

☐ Yes ☒ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☐ insufficient ☐ acceptable ☐ good ☐ excellent

n. Short description of errors found (if any):

Inland wetlands:

a. Did you check if built-up/non built-up areas in inland wetlands are correctly mapped ?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☐ insufficient ☒ acceptable ☐ good ☐ excellent

o. Short description of errors found (if any):

Some omission and commission errors are encountered.

Fig.32. Omission (yellow) and commission errors (green) – Shabla.

Fig.33. Omission (yellow) and commission errors (green) – Srebarna.

Salines:

c. Did you check if built-up/non built-up areas in salines are correctly mapped?

☒ Yes ☐ No ☐ Not possible

d. How would you assess the quality?

☐ very poor ☒ insufficient ☐ acceptable ☐ good ☐ excellent

p. Short description of errors found (if any):

Omission and commission errors in salines are present (see Figures 34 and 35).

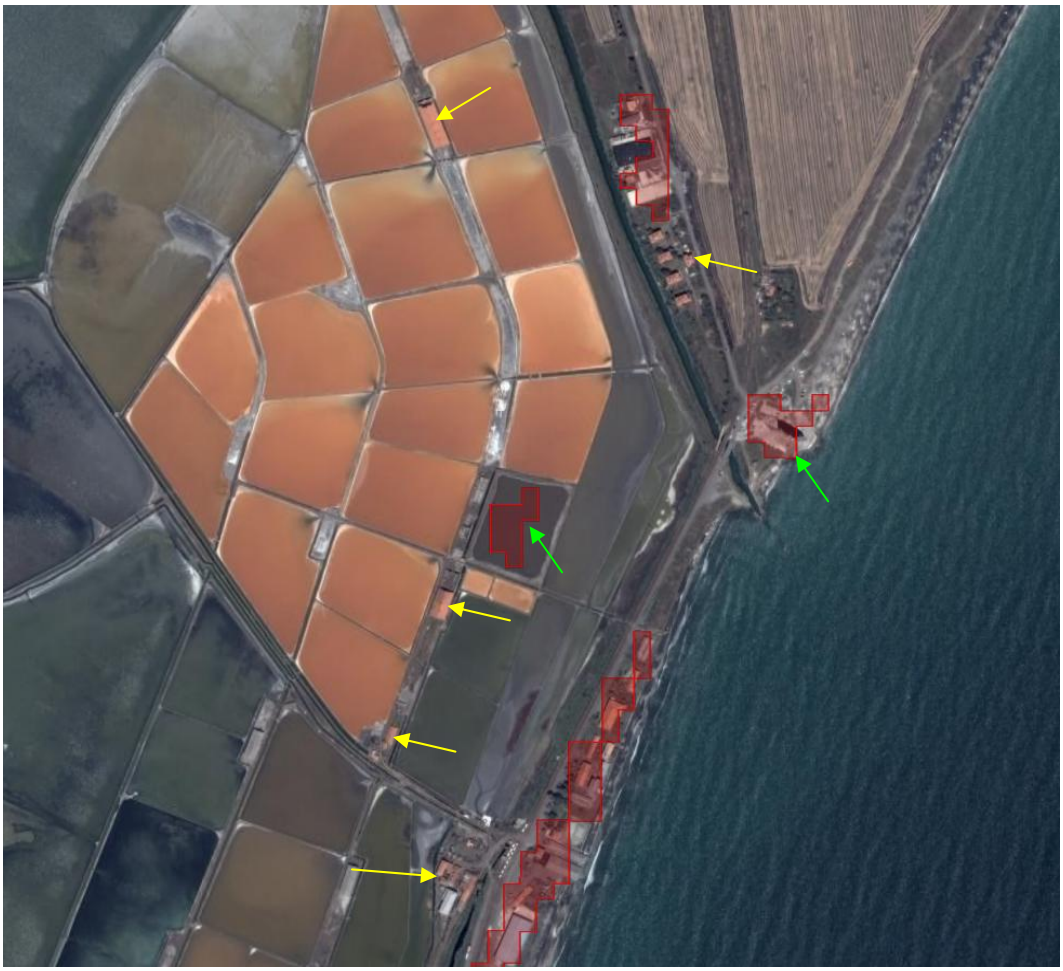

Fig.34. Omission (yellow) and commission errors (green) – Atanasovsko ezero.

Fig.35. Commission errors – Pomorie.

Intertidal flats:

a. Did you check if built-up/non built-up areas in intertidal flats are correctly mapped?

☐ Yes ☒ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☐ insufficient ☐ acceptable ☐ good ☐ excellent

q. Short description of errors found (if any):

Coastal lagoons:

a. Did you check if built-up/non built-up areas in coastal lagoons are correctly mapped?

☒ Yes ☐ No ☐ Not possible

b. How would you assess the quality?

☐ very poor ☒ insufficient ☐ acceptable ☐ good ☐ excellent

r. Short description of errors found (if any): All coastal lagoons checked - unacceptable nujmber of errors find.

Fig.36. Omission (yellow) and commission errors (green) – Pomorie.

3. Comments concerning thematic content check (if any). Please indicate which part of the data was verified (full coverage or partial coverage, etc.):

The whole area covered by high resolution imagery available (our archive and Google Earth – shape files available) is checked.

D. Overall qualitative assessment of the dataset

The overall qualitative assessment is meant to support EEA in our contractual procedures with the service provider regarding the acceptance of the dataset. While the previous thematic quality assessment was looking at class by class, this section should provide your assessment of the quality for the whole territory.

How would you assess the overall quality of the mapped built-up/non built-up areas for the dataset provided?

☐ very poor ☒ insufficient ☐ acceptable ☐ good ☐ excellent

Please provide your final comments and additional remarks concerning overall qualitative assessment (e.g. difference in quality between regions e.g. mountains, agglomerations, coastal zones, etc), if any:

Please provide your final comments and additional remarks concerning overall qualitative assessment (e.g. difference in quality between regions e.g. mountains, agglomerations, coastal zones, etc), if any:

The main problems of the qualitative assessment done is the lack of guiding instructions and first of all the contradictions in the built-up/soil sealed area synonyms used in the documents supplied. The automatic classification on pixel level has some inherent limitations that are in contradiction with the definition used "Land under houses, roads, mines and quarries and any other facilities, including their auxiliary spaces, deliberately installed for the pursuit of human activities…". Such mixture of land cover and land use categories is quite confusing.

We have made detailed investigations in Urban areas using VHR satellite imagery (QuickBird and IKONOS) overplayed with 20*20 grid coinciding with the built-up data provided on pixel level. The precise visual assessment followed by calculations in 100*100 m and 200*200 m overlapping grids shows commission and omission errors for 40 to 60 % of the samples/areas under investigation.

The qualitative assessment is rather subjective compared with the absolute and relative errors encountered in the different CLC classes comparing the areas investigated and the absolute area of these classes in this country.

In conclusion we have to mention that the results presented in this document are truly qualitative and subjective, based on our experience in the field of Remote Sensing land cover investigations and the execution of CLC2000 and 2006 projects in this country.
The task is not clearly formulated and supplied by proper methodology and manual..

E. Quantitative validation

Are you planning to carry out a statistical validation (quantitative assessment) of the national dataset?

☒ Yes ☐ No

If yes, it would be helpful to provide us information about the timing, methodological approach or any other additional information which might be available:

Yes, if financial support will be allocated by the Ministry of Environment and Waters.

Are you willing to contribute to the final validation of the European dataset (actions scheduled from the second half of 2008 onwards)?

☒ Yes ☐ No

Filled in by Executive Environment Agency at the Ministry of Environment and Water, Bulgaria
Telephone number: ++359-2-940 64 80
Email address: todorova@nfp-bg.eionet.eu.int

Date: June 08, 2008

Thank you!