Consistency checking method of surface coverage data results

Hai Li , Wenchao Gao , Jing Guo, Qingqing Yan *, Jin Zhou, Su Yin

(National Quality Inspection and Testing Center for Surveying and Mapping Products, Beijing 100830, China)

KEY WORDS: Geographic Conditions Element Data; Geographical conditions monitoring; Quality control; Consistency requirements

ABSTRACT:

Combined with the acceptance of the surface coverage data results of the national geographic situation monitoring project, as well as the consistency requirements between the surface coverage data results and the background data, the "three tone" data results, the digital orthophoto data and the field investigation and verification data, this paper puts forward the quality control method of the surface coverage classification data results by analyzing the quality problems found in the inspection. This method provides a technical reference for the quality control of the national geographic situation monitoring project and a method basis for quality inspection.

1. INTRODUCTION

Surface coverage data results are one of the main data results of geographical national condition monitoring, including important features and attributes with clear identification, independent monitoring, analysis and statistical significance, and have a relatively stable spatial range or boundary. In order to ensure the quality of surface coverage data results, the acceptance inspection of results quality is an important means to ensure the quality of results. As a new surveying and mapping result, surface coverage data results are different from the quality inspection of traditional digital surveying and mapping results such as digital orthophoto, and their quality inspection methods can not directly use the quality inspection methods of traditional surveying and mapping results, The existing research results mainly focus on the inspection and spot check of the production process of surface coverage classification results, and the research on the acceptance inspection methods of results is less. In the production process of geographical situation monitoring data, all data results are not isolated, but consistent with other data results and mutually confirmed. In order to effectively ensure the accuracy and current situation of surface coverage data results and provide basis for normalized geographical national condition monitoring, the inspection of data consistency is very important in the process of quality control of surface coverage data results.

Combined with the quality control of geographical national condition monitoring results in recent years, according to the requirements of geographical national condition monitoring data results and the common quality problems in quality control, this paper summarizes and puts forward the consistency inspection method of surface coverage data results.

2. QUALITY INSPECTION CONTENTS AND METHODS

2.1 inspection contents

According to GB/T 18316-2018 and project design requirements, the quality inspection model of surface coverage data results includes quality elements, quality sub elements and inspection items, as shown in Table 1, including 6 quality elements such as spatial reference system, time accuracy, logical consistency, acquisition accuracy, classification accuracy and representational quality, 11 subdivided quality sub elements such as geodetic datum and elevation datum, as well as coordinate system Elevation datum and other 18 specific inspection items.

Serial number	Mass element	Inspection items	Inspection contents	Inspection method
1	Spatial reference system	Coordinate system	Check whether the coordinate system meets the requirements	Computer automatic inspection mode for internal inspection
		Elevation datum	Check whether the elevation datum meets the requirements	
		Projection parameters	Check whether the parameters of map projection meet the requirements	
2	Time accuracy	source	Check the current situation of image data, basic geographic information data, industry special data and other data sources	Internal inspection by manual inspection
		Outcome data	Check the current situation of achievement data	
3	Logical consistency	Attribute item	Check whether the attribute item definition meets the requirements (such as name, type, length, sequence number, etc.)	Computer automatic inspection mode for internal inspection
		data set	Check whether the data set (layer) definition meets the	

* corresponding author, email: 476175217@qq.com

Serial number	Mass element	Inspection items	Inspection contents	Inspection method
			requirements	
		data format	Check whether the data file format meets the requirements	
		data file	Check whether the data file is missing and the data cannot be read out	
		File naming	Check whether the data file name meets the requirements	
		Face gap	Check whether there are spots and gaps	Conduct internal inspection by means of human-computer interaction inspection
		Face overlap	Check for patch overlap	
		continuity	Check for discontinuity patch errors with consistent attributes adjacent to the location	
4	Acquisition accuracy	Geometric displacement	Check the overrun error between the patch boundary and the orthophoto	Reference data comparison method by manual inspection
		Vector Edge	Check the geometric position of the patch and the edge overrun error	
5	Classification accuracy	Classification correctness	Including the wrong classification of image spots, failure to be classified into subclasses as required, blank classification code, nonstandard filling, wrong edge connection, omission, redundant image spots, etc	Conduct internal inspection by means of human-computer interaction inspection
		Integrity		
6	Characterization quality	Geometric anomaly	Check the abnormal errors of feature geometry, such as small unreasonable faces, unreasonable hard folds of face boundaries, etc	Conduct internal inspection by means of human-computer interaction inspection

Table 1. Inspection contents and requirements of surface coverage data results

2.2 Inspection method

2.2.1 Reference data comparison method: Compare with the national 1:50000 basic data, field investigation and verification data, water conservancy census data used in production, special transportation materials, and various reference data published, released and published by national departments at all levels, so as to determine whether the tested data is wrong or missing, or obtain the difference between the tested data and the reference data.①Check the integration with image data, that is, manually compare and integrate with digital orthophoto map to check whether the plane position offset of road, water system, high water boundary, housing construction and other elements meets the technical design requirements; ②Check against the results of field investigation and verification, that is, check the consistency between surface coverage data and field investigation and verification data by means of human-computer interaction; ③ According to the inspection of professional data, the program module can be designed for automatic inspection. This automatic inspection method based on computer program module has the characteristics of high efficiency and accuracy. It is suggested to use relevant procedures for control and inspection in specific quality control.

2.2.2 internal inspection method: check the internal characteristics of the tested data. This method checks vector data and image data through indoor mode, such as spatial reference system, logical consistency, acquisition accuracy, classification accuracy, etc.

2.2.3 field measurement method: compare the result data with the field measurement results through field measurement or patrol inspection to determine whether the tested data is wrong or missing, or obtain the difference between the tested data and the field measured data. This method is applicable to the inspection of vector data and image data by actual measurement, such as whether there is redundancy or omission of surface coverage data acquisition and whether the expression of geometric elements is abnormal through field inspection.

2.3 Inspection process

In order to better carry out the inspection of surface coverage data results, the combination of computer automatic inspection, manual inspection and human-computer interaction inspection is adopted. Computer automatic inspection uses the quality inspection software to formulate the inspection scheme and check the relevant inspection items in batches, including the conformity inspection of spatial reference system and logical consistency, as well as the standardization of data content filling. The manual inspection focuses on the collection accuracy of the patch boundary and the classification accuracy of the patch, which is also the focus and difficulty of the consistency inspection. The human-computer interaction check uses the software to check the topological relationship of the data, the vector edge and the geometric anomalies representing the quality, and uses the manual check method to check the contents that prompt errors one by one. Finally, evaluate the quality of the inspection results and prepare the quality inspection report. The technical process of surface coverage data quality inspection is shown in Figure 1.

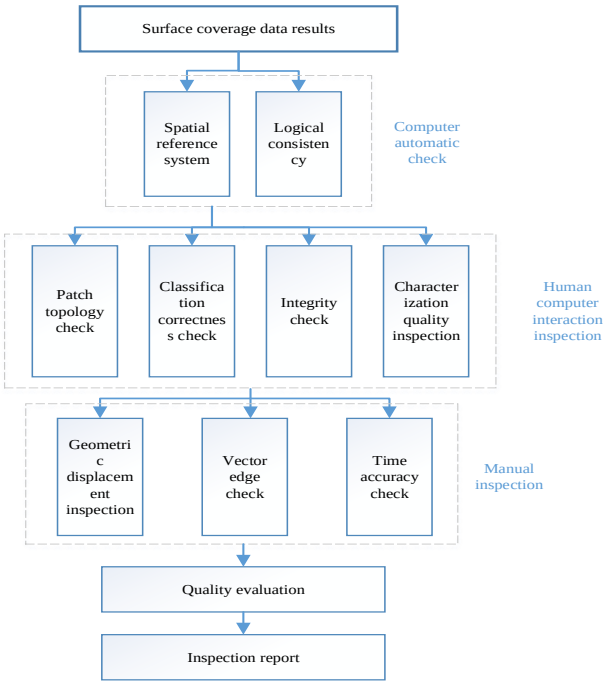

Figure 1. Technical flow chart of surface coverage data result quality inspection

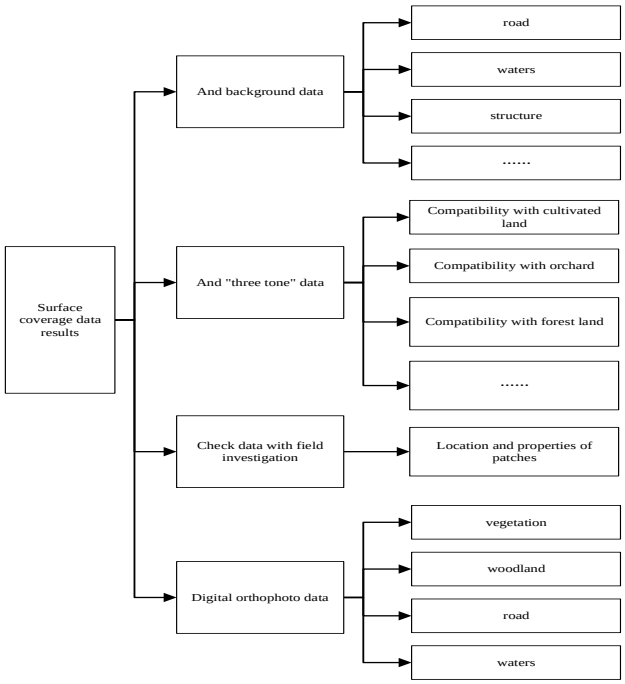

Figure 2. Consistency requirements of surface coverage data results

2.4 consistency analysis

The surface coverage data achievement is a classification system established by comprehensively considering the application needs of different industries on the basis of referring to the existing national technical standards and industrial technical specifications. The achievement involves 10 first-class categories, 46 second-class categories and 79 third-class categories such as cultivated forest, garden and grass. The classification system is complex and the classification accuracy inspection is difficult. In the acceptance inspection stage, the surface coverage type should be accurately identified, and the field measurement is the most objective But there are some problems objectively, such as wide range of mission area, large amount of tasks, tight time requirements and so on. It is not feasible to apply the field measurement method in a large scale. Therefore, it is a more feasible inspection method to adopt the inspection method based on reference data comparison and supplemented by field measurement in the acceptance process. According to the characteristics of the project, it is found that there are mutual constraints between the types of surface coverage data and background data results, the third national land survey and 2020 Land Change Survey (hereinafter referred to as "three surveys"), digital orthophoto data, field survey and verification data, By mining the consistent relationship between different results, more reference materials are provided for the quality inspection of surface coverage data results, so as to quickly and effectively identify errors and omissions and ensure the efficiency of results inspection.

3. REQUIREMENTS FOR CONSISTENCY INSPECTION OF ACHIEVEMENTS

According to the characteristics of the project and the reference materials used in the production process of surface coverage data results, the consistency of the results shall ensure the consistency with background data, three tone data results, digital orthophoto data, field investigation and verification data, as shown in Figure 2.

3.1 consistency requirements between surface coverage data results and background data

Background data is the monitoring data of geographical conditions in previous years. Among them, the classification level of relevant subordinate types such as houses, buildings (areas), structures and excavated surfaces of surface coverage data shall be consistent with the existing classification level of background data. In addition, the consistency of some types of surface coverage data with background data shall be checked.

3.1.1 roads: the roads in the surface coverage data include rail roads and trackless roads, which respectively correspond to railways, highways, urban roads and rural roads in the background data. Considering that the roads covered by vegetation are collected according to the principle of "what you see is what you get", it is necessary to check whether all road elements that meet the collection index requirements and are not covered by vegetation are in the trackless road surface covered by the surface, That is, whether the trackless pavement is omitted or wrongly collected into the coverage types such as rolling and trampling surface and other hardened surface.

3.1.2 water area: check whether the water surface, vegetation or water channel collected by the background data are correctly collected in the surface coverage, and whether there are omissions, or the wrong collection is rolling and trampling the surface, other hardened surface, embankment, pavement and other types.

3.1.3 structures: (1) check whether the dyke in the background data omits the dyke map spots of the collected surface coverage data, or the wrong collection is of other types, such as hardened slope protection, other hardened surface, rolling and trampling surface, etc. if the dyke is collected as vegetation or pavement in the surface coverage, further check whether the collection is reasonable; (2) According to the technical requirements of the project, the scope covered by the refueling (gas) and charging stations is generally classified according to the classification requirements of house building (area). During the inspection, it is necessary to pay attention to whether the corresponding

category in the surface coverage data is wrongly collected as other structures.

3.2 consistency requirements between surface coverage data results and "three survey" data results

There is a certain constraint relationship between the results of surface coverage data and the results of three survey data. The surface coverage data must not be collected across the three survey map spots. The surface coverage data across the boundary of three survey map spots is regarded as wrong spots. There is a compatibility comparison relationship between the types of surface coverage data and the "three survey" land types, as shown in Table 2. This table is for each "three survey" land type that mainly reflects the connotation of land cover, A list of surface cover classifications with similar or related characteristics is given, indicating that the surface cover data classification of the listed types in the "three key" land type map spot is reasonable. According to this table, the consistency between the surface coverage data and the "three survey" data can be checked.

"Three tune" land type code	Name of "three dispatching" land type	Compatible coverage type codes
0101	paddy field	0110,0120,03B1,0750,0391,0392,0393
0102	Watered land	0110,0120,03B1,0750,0391,0392,0393
0103	dry land	0120,03B1,0750,0391,0392,0393,0110
0201	orchard	0131,0132,0133,0140,0150,0160,0170,0180,0190,0191,0192,0193,0750, 0120,03B1,0391,0392
0202	tea garden	0140
0203	Rubber Garden	0160
0204	Other gardens	0131,0132,0133,0140,0150,0160,0170,0180,0190,0191,0192,0193,0120, 03B1,0391,0392
0301	Arbor forest	0311,0312,0313,0330,0340
0302	Bamboo forest land	0340,0311,0312,0313,0330,0321,0322,0323
0303	Mangrove woodland	0311,0312,0313,0320,0321,0322,0323,0330,0340,0350
0304	Forest swamp	0311,0312,0313,1001,0391,0392,0393,0910,0321,0322,0323,0330
0305	Shrub land	0321,0322,0323,0330,0370,0340
0306	shrub swamp	0321,0322,0323,1001,0391,0392,0393,0910
0307	Other woodlands	0350,0360,0370,0380,0170,0391,0392,0393
0401	Natural grassland	0391,0392,0393,0380
0402	Swamp grassland	0391,0392,0393,1001,0910
0403	Artificial grassland	03A1,0391,0392,0393,0110,0120,03B1
0404	Other grassland	03A2,03A3,03A4,03A9,03A1,03B1,03B2,0380,0391,0392,0393
0603	Yantian	1001,0601,0910,0391,0392,0393
1006	Rural roads	0601,0391,0392,0393
1101	River surface	1001,0391,0392,0393,0910,0920,0930,0940,0321
1102	Lake surface	1001,0391,0392,0393,0910,0920,0930,0940,0321
1103	reservoir surface	1001,0391,0392,0393,0910,0920,0930,0940,0321
1104	Pond surface	1001,0391,0392,0393,0910,0920,0930,0940,0321
1105	Coastal beach	1001,0391,0392,0393,0910,0920,0930,0940,0321,0110
1106	Inland Beach	1001,0391,0392,0393,0910,0920,0930,0940,0321
1107	Ditch	1012,1001,0391,0392,0393,0910,0920,0930,0710,0715,0718,0719,0721
1108	Swamp	1001,0391,0392,0393,0910,0920,0930,0321
1110	Glaciers and permanent snow	1050,1051,1052,0950,0940,0930
1203	ridge of field	0601,0110,0120,0391,0392,0393,0311,0312,0321,0322,0710,0718
1204	Saline alkali land	0391,0392,0393,0321,0322,1001,0910
1205	sand	0930,0393
1206	Bare land	0910,0393
1207	Bare rock gravel	0940,0930,0950,0393

Table 2. Comparison between surface coverage data types and the compatibility of "three regulation" land types

3.3 consistency requirements between surface coverage data results and field survey verification data

Field investigation and verification is not only an important basis for in-house editing and sorting of surface coverage data results, but also an important guarantee for the quality of results. In order to ensure the quality of surface coverage data, it is necessary to ensure the correctness of each classification position and attribute of surface coverage data, whether the new map spots in the external transfer data are completely collected, and whether the classification of the result map spots is consistent with the field verification results, that is, there is no redundant representation and no omission of collection. Except for obvious unreasonable circumstances, in principle, with the support of external transfer data, The pattern classification results shall be consistent with the external transfer data. When carrying out investigation and verification in the field, according to the reference image, if there are obvious changes on the ground, the field situation shall prevail. When editing and sorting in the field, the relevant attributes shall be assigned according to the field investigation and verification data.

3.4 consistency requirements between surface coverage data results and digital orthophoto data

Digital orthophoto is one of the main data sources of surface coverage data production. In the production process of surface coverage data results, orthophoto images from different sources that meet the requirements need to be comprehensively used. Before quality inspection, the main data sources, supplementary data sources and time point images corresponding to surface coverage data results need to be determined according to production metadata and other reference materials. Therefore, the consistency check with Digital Orthophoto Image is to check the accuracy of spot classification with reference to the image, focusing on the spots with large area. After overlaying the surface coverage data with the corresponding Digital Orthophoto Image and deducting the image matching difference, the map spots with the boundary position change difference of more than or equal to 5 pixels are regarded as consistency acquisition errors. It mainly includes the following types of spots for consistency inspection.

3.4.1 vegetation: judging from the image, the simple plastic shed covered by plastic film or people who cannot carry out production activities inside is classified according to the planting vegetation. The shed with certain facilities and can carry out production activities inside is classified as "greenhouse and shed" according to the structure. In the range of rivers, lakes, reservoirs and ponds, the areas where emergent plants are distributed in the image are classified according to the type of vegetation coverage, and the areas where phytoplankton and water surface are distributed in the image are classified according to the water surface.

3.4.2 forest land: judging from the image, the number is small, the branches and leaves are small, and the coverage proportion of planted trees is low. It is difficult to judge whether there are artificially planted trees on the image. It is classified as primary trees, with more forest leaves and high coverage. It can be clearly judged as tree coverage on the image, and it is classified according to the coverage type of natural trees. If the number of rows of forest land is less than two rows or the vertical projection width of canopy is less than 10m, it can not be classified separately. It can be classified into adjacent main land categories according to the principle of "nearby is large".

3.4.3 Road: judging from the image, when large bridges cross rivers and valleys, the surface coverage data are classified according to the real surface under the bridge, such as water area and vegetation; Overpasses and ramps are classified according to the pavement of trackless roads; The sidewalks on both sides of the carriageway are classified into trackless road pavement.

3.4.4 water area: judging from the image, the water retaining structures (canal embankments) on both sides of the canal are not collected as embankments, but as canals.

4. ANALYSIS OF TYPICAL PROBLEMS

In order to ensure the quality of surface coverage data, according to the requirements of the project, it is necessary to check the consistency of different surface coverage data types and a variety of reference materials, so as to highlight the key points in the inspection process and effectively find quality problems.

4.1 quality problems of road map spot collection consistency

4.1.1 consistency check between road map spots and background data: according to the technical regulations on monitoring data of geographical conditions (gqjc01-2020), the consistency between road map spots and road centerline information collected in background data needs to be ensured. Except where the road is covered by vegetation or other types, the roads collected in the background data (including railways, highways, urban roads and rural roads) should fall within the pavement of the surface coverage data type (including railway pavement and road pavement) at the corresponding position.

4.1.2 consistency inspection of road map spots and three survey data: check whether the road map spots in the surface coverage data results are combined with the "three survey" data results, and check whether the two data are obviously incompatible with the ground types and require field verification. If they are not updated, whether the road map spots are omitted or wrongly collected.

4.1.3 consistency inspection of road map and digital orthophoto results: integrate the surface coverage data with the Digital Orthophoto Image, and check whether the road map is missing or incorrectly collected through the image reflectivity. Generally, the image is bright, especially the images of new cement pavement and bare soil pavement are easy to judge. You can also judge whether the road or water system is through the bridge at the intersection with the river, and check the sidewalks on both sides of the carriageway, Whether the surface coverage classification is collected as roads.

4.1.4 consistency inspection between road map and field survey verification data: during field inspection, a certain number of unit results shall be randomly selected to verify the location, attributes and other contents of road map, such as whether the road is redundant or missing. During the field inspection, check whether the results of the comparison of surface coverage data are consistent with the field investigation verification data.

The above quality control methods can accurately and efficiently find the quality problems existing in the road map spots, such as the acquisition accuracy error of the road map spots and background data, the error of the road map spots crossing the "three tone" data, the inconsistency between the road map spots and the image texture, and the inconsistency between the results of the road and the field investigation and verification data. Common problems are shown in Figure 3 and Figure 4.

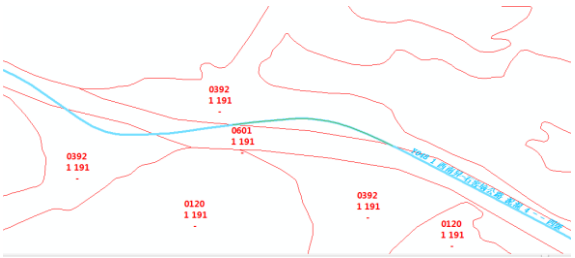

Figure 3. Road and background data highway element acquisition accuracy error

Figure 4. inconsistency between road patch and image texture

4.2 quality problems of water area map spot collection consistency

4.2.1 consistency check between water area map and background data: check whether the water area map in the surface coverage data is consistent with the water surface of the background data results, and check whether the range of water surface map collected in the surface coverage classification is less than (or equal to) the range of rivers, lakes and reservoirs in the water area elements collected in the background data results, except that the image based on is just taken in wet season; Refer to the structural lines of double track rivers in the background data, which should generally be included in the range of water surface map spots in the surface coverage data results.

4.2.2 consistency inspection of water area map and "three adjustment" data: check the combination of water area map and "three adjustment" data results in surface coverage data results, and refer to the images of previous years. If there is no change, check whether the classification of surface coverage data is consistent with the three adjustment land type, whether the water area map is within the scope of the same "three adjustment" map, and whether the same water area map crosses the "three adjustment" map.

4.2.3 consistency inspection of water area map and digital orthophoto results: integrate the surface coverage data with digital orthophoto, find the corresponding image data through metadata, check whether the collection range of water area map is consistent with the image, and check whether the assignment of map is reasonable for areas without water.

4.2.4 consistency inspection between water area map and field survey verification data: during field inspection, a certain number of unit results shall be randomly selected to verify the location, attributes and other contents of water area map, such as whether the water area map is redundant or missing. During the field inspection, check whether the results of the comparison of surface coverage data are consistent with the field investigation verification data.

The above quality control methods can accurately and efficiently find the contradiction between the collection range of water area map spots and the logical relationship between the background data and the river structure line, the wrong range of water area map spots across the "three adjustments", and the water area map spots are not updated according to the image (field investigation and verification data). Common problems are shown in Figure 5 and Figure 6.

Figure 5. wrong combination of water surface pattern and background data river structure line

Figure 6. wrong combination of river spots and images

4.3 quality problems of the consistency of structure pattern collection

4.3.1 consistency check between structure map and background data: check the dam map of surface coverage data results and dam elements in background data results. If dam data are collected in the same location for both types of results, check whether the dam in background data results is within the range of dam map of surface coverage data.

4.3.2 consistency check between the classified data of structures and the "three adjustment" data: check the combination of the structural spots in the surface coverage data results and the "three adjustment" data results, and check whether the spots of the two data are obviously incompatible and require field verification. If they are not updated, whether the structural spots are omitted or wrongly collected.

4.3.3 consistency inspection of structure spots and digital orthophoto results: integrate the surface coverage data with digital orthophoto images, find the corresponding image data through metadata, check whether the collection range of structure spots is consistent with the image, whether the attribute assignment is reasonable, and whether the collection of structure spots is omitted by combining the images of previous years.

4.3.4 consistency inspection between the structure pattern and the field investigation and verification data: during the field inspection, a certain number of unit results shall be randomly selected to check whether the location, scope and attribute of the structure pattern have changed significantly, and whether the collection is redundant or omitted; During the field inspection, check whether the results of the comparison of surface coverage data are consistent with the field investigation verification data.

The above quality control methods can accurately and efficiently find the logical relationship error between the element range corresponding to the structure pattern and the background data, the incompatibility between the updated collection of the structure pattern and the classification of the "three tone" pattern, and the inconsistency between the collection range of the structure pattern and the digital orthophoto (field investigation and verification data). Common problems are shown in Figure 7 and figure 8.

Figure 7. referring to Digital Orthophoto Image, the sandy surface is incorrectly collected as a structure

Figure 8. inconsistency between structural spots and background data

5. CONCLUSION

The inconsistency between the surface coverage data results and the background data results, "three adjustments" data results, digital orthophoto data and field investigation and verification data is complex. The main reasons are as follows: ① the operation unit does not refer to the background data when producing the surface coverage data, resulting in inevitable contradiction in the logical relationship during the combination; ② The analysis and utilization of various reference materials are unreasonable, resulting in confusion in the assignment of achievement attributes; ③ The understanding of operators is not in place, resulting in inconsistent grasp of collection indicators. As an important achievement of geographical condition monitoring data, surface coverage data will be questioned by relevant departments if there are quality problems, which will reduce the credibility of Surveying and mapping geographic information data and affect the later monitoring work. Therefore, it is very important to check the consistency of surface coverage data and ensure the quality of geographical monitoring data.

REFERENCES

Chen, H.P., Cheng, P.F., Zhang, L., etc. Discussion on the quality evaluation standard of geographical national survey data [J]. *Surveying and Mapping and Spatial Geographic Information*, 2017,40 (1): 43-49.

Chen, H.P., Zhang, L., Guo, J., etc. Quality inspection technology and method of surface cover classification data [J]. *Mapping and Spatial Geographic Information*,2018,41 (7):72-74.

Cheng, T., Zhou, X., Zheng, X.Y., Guo, J.K., yuan Rujin Optimization method of temporal and spatial consistency of water surface data monitored by geographical conditions [J]. *Journal of Earth Information Science*, 2018, 133(09):1216-1224.

Guo, X., How to use the existing basic surveying and mapping data to carry out the general survey of geographical national conditions [J]. *Beijing surveying and mapping*, 2015, (01): 26-27+ 86.

Li, W.S., Geographical situation monitoring and business transformation and upgrading [J]. *Geographic information world*, 2017, 122(02):1-6.

Liu, R.M., Re recognition of geographical national condition monitoring [J]. *Geographic information world*, 2013, 97(01):27-30+37.

Mao, W.J., Zhao, H.T., Li, C., etc. Key technologies and methods for quality review of geographical national condition monitoring results [J]. *Mapping and Spatial Geographic Information*, 2020,43(11): 32-37.

Mao, W.J., Zhang, L., Analysis on quality inspection methods and common problems of geographical element data [J]. *Mapping and spatial geographic information*,2017, 215(03):66-68+71.

Shi, W.Z., Chen, P.F, Zhang, X.K., Reliability analysis of geographical condition monitoring [J]. *Journal of Surveying and Mapping*, 2017, 46 (10): 1620-1626.

Yang, B.G., Wang, M., Liu, B.W., Construction and application of geographic national condition monitoring framework system for mega cities [J]. *Beijing surveying and mapping*, 2017, 134 (03): 31-34.

Zhang, J.X., Zhao, Y.S., Luo, F.J., Dang, Y., Construction and effect analysis of quality control system of geographical national survey [J]. *Surveying and Mapping Bulletin*, 2017, 484 (07): 72-75.

Zhang, L., Cheng, P.F., Han, W.L., Discussion on the quality evaluation standard of national major surveying and mapping

geographic information engineering achievements [J]. *Surveying and Mapping Bulletin*, 2015, (2): 55-57.

Zhou, X., Ruan, Y.Z., GUI, D.Z., Liu, F., Qiao, C.F., Xu, K., Research on the monitoring system and mechanism of geographical national conditions [J]. *Remote sensing information*, 2013, 126(02):121-124.