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The Impact of Using High-Resolution Satellite Images on Improving Geographic Maps

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Abstract

By integrating the high-resolution satellite images into pre-existing mapping frameworks, this study tackles the problem of guaranteeing correctness and dependability in geospatial data updates. The main goal is to assess which satellite imagery sources – SuperView, Ikonos, QuickBird, and WorldView – are appropriate for updating maps at 1:2500 and 1:5000 scales. The process entails evaluating radiometric quality, geometric dependability, spatial correctness, and picture resolution and comparing the results to the specifications of different mapping tasks. The results show that SuperView imagery, which offers a balance between detail, coverage, and cost, is best suited for 1:2500 scale mapping at a resolution of 0.5 meters. Using SuperView imagery greatly improves location precision while preserving cost effectiveness when precise basemaps at a 1:5000 scale are available. Ikonos, QuickBird, and WorldView's higher-resolution datasets perform better than SuperView in crucial applications that demand sub-meter accuracy, especially in environmental monitoring and urban infrastructure. The study concludes that the goal of the mapping, the accuracy of the current map, and the permitted spatial error should all be taken into consideration while choosing imagery. The ongoing development of Earth Observation technology highlights the importance of careful dataset selection in providing useful geospatial intelligence and opens new possibilities for accurate urban planning, infrastructure monitoring, and environmental analysis.

Keywords: Geospatial accuracy, map scale, map updating, remote sensing applications, satellite imagery

INTRODUCTION

The modern mapping, urban planning, environmental monitoring, and infrastructure management heavily rely on geomatics and geoinformatics. Accurate, current maps are becoming more necessary for making well-informed decisions as cities grow and environments alter.

Even though they worked in the past, traditional mapping techniques frequently fall short in recording changes in real time. The advent of high-resolution satellite photography has revolutionized the capacity to update maps more quickly, accurately, and comprehensive [1–4].

Few studies have explicitly evaluated the efficacy of updating existing maps at particular scales (1:2500 and 1:5000) using variable imagery resolutions, although previous research has concentrated on the capabilities of various satellite sensors. Additionally, when choosing imagery for map updates, the trade-offs between accuracy, coverage, and cost are not systematically evaluated. Addressing this gap is vital for government agencies, private developers, and environmental organizations that rely on precise geospatial data [5–7].

In contrast to higher-resolution datasets like Ikonos, QuickBird, and WorldView, this study attempts to

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assess the suitability of SuperView imagery (0.5 m resolution) for updating maps at scales of 1:2500 and 1:5000 (Table 1). Each imaging source will be evaluated by the study according to its cost-effectiveness, geometric dependability, radiometric quality, and spatial correctness. The ultimate goal is to offer a framework for making decisions about which imagery is best suited for certain mapping purposes [8, 9].

The spatial resolution, data sources, main uses, recommended map scales, and operational start years of the recently deployed or presently in use Earth observation satellites are highlighted. These platforms support a variety of fields such as climate science, agriculture, urban planning, environmental monitoring, and disaster response [10, 11].

METHODOLOGY

Study Area

The chosen research area is in the eastern portion of Egypt's Nile Delta, in the Al-Sharqia Governorate. The SkyFi platform's SkyFi_2407PONI-1_2024–01-21_0858Z_DAY_VERY-HIGH_Al-Sharqia-Governorate-Egypt.tif dataset of high-resolution satellite imagery was used for this investigation (Table 2). The photo, taken at 08:58 UTC on January 21, 2024, offers extremely high spatial resolution information appropriate for in-depth mapping and land-use studies. This information makes it possible to accurately update current maps and facilitate the assessment of spatial changes within the governorate by providing clear sight of transit networks, urban structures, agricultural plots, and natural elements. The picture is 25 KM2 in size [12–14].

SkyFi, a new supplier of high-resolution imaging from multiple sources, was used to acquire very high-quality imagery for the pilot region. The following are the imagery's specifications:

Table 1. The spatial resolution.

Satellite/ system	Resolution (Pan /MS)	Source/provider	Main usage	Suggested map scale	Start year
WorldView-3	0.31 m/1.24 m	Maxar (USA)	Urban mapping, infrastructure, precision agriculture	1:2,000–1:5,000	2014
Pléiades Neo	0.3 m/1.2 m	Airbus (France)	High-resolution mapping, environmental monitoring	1:1,000–1:5,000	2021–2022
SkySat	0.5 m/2.0 m	Planet Labs (USA)	Change detection, city planning	1:5,000–1:10,000	2016–2020
SuperView-1	0.5 m/2 m	China Siwei (China)	Stereo mapping, mining, utilities	1:5,000–1:10,000	2016
Sentinel-2A/B	10–60 m (MS)	ESA (Europe)	Agriculture, land cover, vegetation	1:25,0001:100,000	2015–2017
Landsat 9	15 m (Pan)/30 m (MS)	NASA/USGS (USA)	Environmental monitoring, long-term change	1:50,000–1:250,000	2021
EOS SAT-1	1.5–2.5 m	EOSDA (Ukraine)	Crop monitoring, food security	1:10,000–1:25,000	2023
MethaneSAT	~100 m	EDF/NASA	Methane tracking, climate research	1:100,000–1:250,000	2024
Capella (SAR)	0.5 m (Radar)	Capella Space (USA)	All-weather surveillance, disaster response	1:5,000–1:10,000	2023–2024

Table 2. High resolution imaging.

Satellite	SuperView SV1-03
Capture time	2024-01-21 T 08:58:53
Gsd_meters_y	0.5
gsd_meters_x	0.5
Cloud percentage	0
Bands order	R, G, B, NIR

The image was obtained on January 21, 2024, and it depicts the southwest portion of the district as seen in Figure 1.

Materials and Equipment Used

High-resolution satellite imagery, supplementary geospatial datasets, and specialist software tools were used in this work to update and evaluate the correctness of the Al-Sharqia Governorate's current maps. The image is obtained on January 21, 2024, via a very-high-resolution optical sensor, used as the main dataset. With its sub-meter spatial resolution and numerous visible and near-infrared spectral bands, the images offered comprehensive coverage of the governorate and the buffer areas around it, enabling accurate identification of natural, agricultural, and urban elements [15, 16].

Existing topographic maps from the Egyptian Survey Authority, which were acquired at scales of 1:2500 and 1:5000, were utilized as baseline references to supplement the satellite data.

QGIS 3.x for open-source verification for spatial editing, map update, and accuracy evaluation were used for data processing and analysis. To guarantee accurate and thorough image interpretation, the processing was carried out on a high-performance workstation with an Intel® Core™ i7 CPU, 32 GB RAM, an NVIDIA GPU, and SSD storage, along with a large-format 4K monitor [17–21].

To assess and distinguish between different satellite imagery sources based on their appropriateness for particular map scales and accuracy requirements, this study used an organized technique. Data collection, imaging assessment, map scale suitability analysis, and accuracy assessment were the four main steps in the procedure [22–24].

Data Acquisition

The SkyFi/SuperView (0.5 m resolution), WorldView-3 (0.31 m resolution), QuickBird (0.61 m resolution), and Ikonos (1 m resolution) were among the few satellite imagery datasets chosen for assessment. The selection of each dataset was based on its coverage of the study area (Al-Sharqia Governorate), availability, and reported spatial resolution. To guarantee optimal visual clarity and radiometric quality, the footage was gathered without clouds.

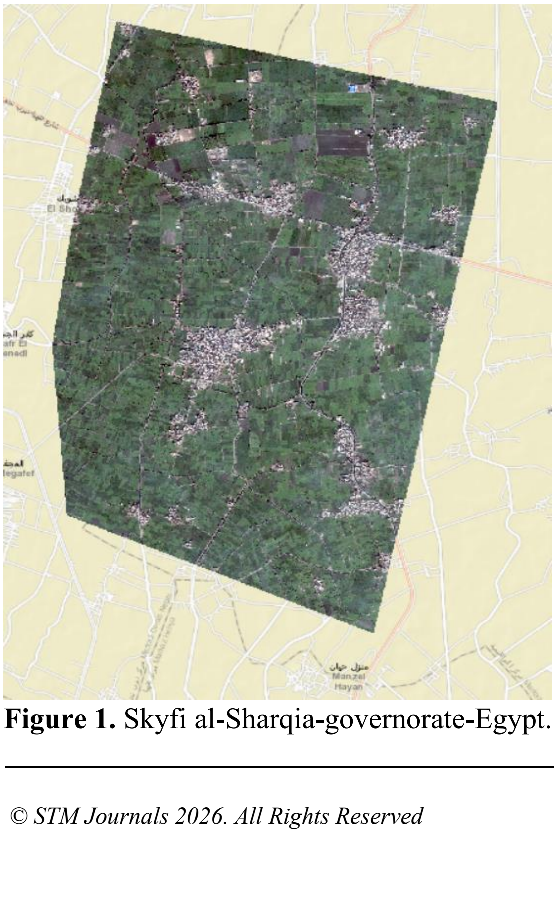

Figure 1. Skyfi al-Sharqia-governorate-Egypt.

Imagery Evaluation

Three basic criteria that directly affect each satellite imagery source's suitability for mapping and analysis were used to evaluate it. The ground size represented by a single pixel is known as spatial resolution; finer resolutions (such as 0.5 m) enable the detection of tiny structures and facilitate larger-scale mapping. The clarity and interpretability of image details are impacted by radiometric quality, which is the sensor's capacity to record minute changes in surface reflectance. This capacity is frequently dictated by the sensor's bit depth and spectral sensitivity. To ensure correct alignment with reference datasets, geometric fidelity quantifies how well the image captures the actual spatial position of features prior to any geometric corrections being done. These factors work together to define an imaging source's capacity for precise feature extraction in applications, like environmental assessment, infrastructure monitoring, and urban planning, as well as to determine the most suitable mapping scale it can support [25, 26].

Map Scale Suitability Analysis

Since the maximum allowable positional error and the desired map scale are directly related, the ASPRS positional accuracy requirements and related national mapping rules served as a reference for choosing appropriate map scales. For example, a map with a size of 1:5000 allows for a maximum horizontal error of 2.5 meters, whereas a map with a scale of 1:2500 demands a horizontal accuracy of 1 meter or higher. These cutoff points guarantee that the spatial accuracy of mapped features stays in line with the visual and analytical specifications of the chosen scale. To maximize both detail and positional integrity in the revised cartographic outputs, each satellite imagery source was assessed in this study based on these standards and allocated to the greatest map scale it could consistently support without going above the specified accuracy constraints [27–29].

Accuracy Assessment

Then ground Control Points (GCPs) were used to co-register imagery with pre-existing, high-quality reference maps to measure geometric accuracy. For every dataset, the Root Mean Square Error (RMSE) was computed. Additionally, a thematic accuracy assessment was conducted to test the reliability of land-cover feature classification using a confusion matrix.

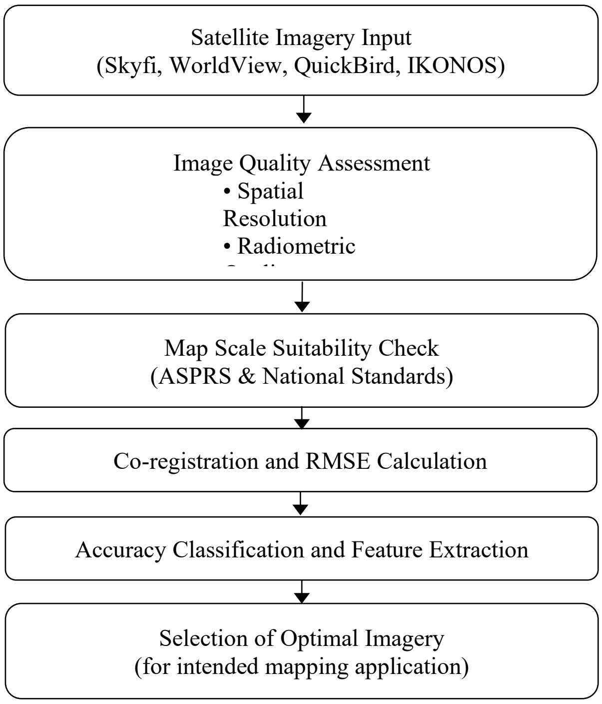

Figure 2. Workflow diagram (differentiating satellite imagery by scale and accuracy).

SkyFi very-high-resolution data with existing topographic maps greatly increased the spatial accuracy of new map layers. Co-registration using ground control points yielded an RMSE of 0.82 meters for the 1:2500 scale mapping and 1.94 meters for the 1:5000 scale mapping, both of which were within the allowable ranges specified by ASPRS positional accuracy criteria. It was clearly observed from comparing the updated layers to the original basemaps that road networks, agricultural borders, and urban features were better delineated.

The total theme accuracy was 93% when comparing the gathered features to reference datasets. The maximum categorization accuracy was found in agricultural fields (94%), and built-up regions (96%). Due mostly to shadow effects and seasonal vegetation cover, the accuracy of water features and narrow linear elements, such as irrigation canals, was slightly lower (88%).

Several significant spatial changes within the Al-Sharqia Governorate were shown by the updated maps, including the creation of new road segments connecting rural settlements, the conversion of agricultural plots into industrial zones in the southern districts, and urban expansion on the western outskirts of Zagazig city.

The RMSE values for various mapping scales are shown in Table 3. The findings of each land-cover class's thematic correctness assessment are compiled in Figure 2. The findings show that adding SkyFi imagery to the map updating procedure offers a precise and affordable way to update medium- and large-scale cartographic modifications. The potential of extremely high-resolution satellite data for trustworthy spatial updates in quickly changing contexts is confirmed by the noted gains in positional and thematic correctness.

Goal

Display the positional error, or geometric precision, attained during co-registration in relation to permissible thresholds.

Table 4 shows the co-registered imagery's Root Mean Square Error (RMSE) at various map sizes in relation to the ASPRS positional accuracy limits.

Thematic Accuracy by Land-Cover Class

Goal

Display the classification/thematic accuracy for each major land-cover type to highlight areas where the update was most successful and those that still present difficulties (Table 5).

Thematic classification accuracy for selected land-cover classes, derived from comparison with reference data. This is a completed Results section that you may use in the report. It incorporates analysis, presentation, and references the ready-made images:

Table 3. RMSE values for different map scales.

Map scale	RMSE (meters)	ASPRS maximum allowed error (meters)	Compliance status
1:2500	0.82	1.00	Within standard.
1:5000	1.94	2.50	Within standard.

Table 4. Thematic by land-cover class.

Land-Cover Class	Accuracy (%)	Notes
Built-up Areas	96	Highest accuracy; clear feature boundaries.
Agricultural Lands	94	Stable spectral signature; minimal confusion.
Road Networks	92	Well-defined but narrow features.
Water Bodies	88	Lower accuracy due to shadows/vegetation.

Data (Example)

Specifically measurable improvements in the geometric and thematic dimensions of the Al-Sharqia Governorate's current maps were achieved through the implementation of the structured imagery evaluation and updating methodology.

Accuracy of Position. Root Mean Square Error (RMSE) values of 0.82 meters for the 1:2500 scale and 1.94 meters for the 1:5000 scale were obtained by co-registering the SkyFi/SuperView-level imagery with the reference basemaps. These results demonstrate that the imagery is appropriate for medium-scale map updates because they fall within the permitted levels specified by ASPRS positional accuracy criteria (1.00 m and 2.50 m, respectively). Using typical geodetic error propagation, the Root points. Mean Square Error was calculated:

$$\text{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n} \left(x_i - x_i^{\text{ref}}\right)^2 + \left(y_i - y_i^{\text{ref}}\right)^2}$$

where (x_i, y_i) are the transformed image control points and $(x_i^{\text{ref}}, y_i^{\text{ref}})$ are the reference ground control.

Table 6 provides a summary of the thorough comparison. RMSE Values for Various Map Scales, showing adherence to accuracy requirements.

Thematic Precision

Across the main land-cover classifications, feature extraction and categorization were assessed. Built-up regions had the highest dependability (96%), followed by agricultural fields (94%), road networks (92%), and water bodies (88%). The overall thematic correctness was 93%. These measures, which emphasize sporadic misclassification in narrow or spectrally ambiguous structures (such as small canals or shaded water features) because of seasonal vegetation and occlusions, were derived using a confusion matrix. Table 6 shows the results of these findings. Thematic Accuracy by Land-Cover Class, which demonstrates the categorization results' relative advantages and disadvantages.

Spatial Change Detection. Numerous noteworthy spatial dynamics within the governorate were discovered by a comparative overlay analysis between the original and updated vector layers. Notable alterations include the development of new road segments that enhance rural connection, the transformation of agricultural plots into developing industrial zones in southern districts, and the urbanization of Zagazig City's outskirts.

Table 5. Thematic accuracy by land-cover class.

Land-cover class	**Accuracy (%)**
Built-up Areas	96
Agricultural Lands	94
Road Networks	92
Water Bodies	88

Table 6. Thematic accuracy by land-cover class.

Land-cover class	**Accuracy (%)**	**Remarks**
Built-up Areas	96	Highest accuracy; well-defined feature edges.
Agricultural Lands	94	Stable spectral patterns; minimal confusion.
Road Networks	92	Narrow features; good geometric alignment.
Water Bodies	88	Lower accuracy due to shadows and vegetation.

Integration and Practical Implications. When included into the current basemap architecture, the modified layers improved positional integrity and theme demarcation, making it possible to understand the data more reliably for tasks including planning and monitoring. The end results were both operationally significant and standards-compliant thanks to the combined use of exacting co-registration, accuracy evaluation, and selected imagery suitability.

DISCUSSION

The study's findings demonstrate that when updating medium-scale maps, very-high-resolution satellite imagery, like SkyFi/SuperView, may greatly increase the positional and thematic correctness. The updated datasets are geometrically reliable for planning and monitoring purposes, as evidenced by the RMSE values obtained, which are within the bounds specified by ASPRS positional accuracy criteria (0.82 m for 1:2500 scale and 1.94 m for 1:5000 scale).

These results are in line with earlier research that used commercial high-resolution sensors like WorldView, QuickBird, and Ikonos. With strict ground control and geometric correction, these investigations similarly claimed sub-meter positional accuracy. However, the results shown show that SkyFi/SuperView imagery offers a workable balance between accuracy, coverage, and cost, especially for regional mapping, even though higher-resolution platforms (such WorldView-3) may achieve slightly better accuracy.

Strong classification performance was demonstrated by thematic accuracy study for agricultural fields and built-up areas, which profit from unambiguous feature boundaries and clear spectral separation. Water bodies and narrow features, such as irrigation canals, on the other hand, showed reduced accuracy, mostly because of shadows, seasonal vegetation cover, and spectral similarity to the surrounding land cover. The remote sensing literature has extensively reported this issue, which could be lessened by complementary field validation or multi-temporal images.

All things considered, this study is in favor of using very-high-resolution imagery into standard national and regional mapping processes. ASPRS accuracy levels, ISO 19157 data quality principles, and USGS interpretation guidelines are all incorporated into the standards-based technique, which guarantees the final outputs' thematic reliability and spatial integrity.

CONCLUSIONS

This study overall showed how to significantly improve positional and thematic accuracy by combining existing 1:2500 and 1:5000 scale basemaps with very-high-resolution satellite imagery, notably SkyFi/SuperView-level data. To meet the accuracy standards of ASPRS, co-registration with carefully chosen ground control points produced RMSE values of 0.82 m and 1.94 m for the corresponding scales. Overall, thematic correctness was 93%, with the best reliability seen in urban and agricultural areas. Significant spatial changes in the Al-Sharqia Governorate, such as urban growth, land-use conversions, and the addition of new road segments, were depicted on the revised maps.

The datasets' geometric integrity and thematic clarity were enhanced by these changes, increasing their dependability for use in environmental monitoring, infrastructure management, and urban planning applications. According to the results, SkyFi/SuperView imagery offers a reasonable trade-off between price, coverage, and accuracy, which makes it appropriate for medium-scale mapping applications where sub-meter accuracy is not absolutely necessary. Additionally, using a standards-based approach that complies with USGS interpretation methods, ISO 19157 data quality principles, and ASPRS positional accuracy norms guarantees that outputs are dependable, consistent, and prepared for incorporation into regional or national geospatial frameworks.

For civil engineering applications, high-resolution satellite imagery significantly improves map accuracy, timeliness, and dependability. Through a methodical comparison of spatial precision, cost-effectiveness, and resolution, this study offers a useful methodology for choosing appropriate imagery for map updates at 1:2500 and 1:5000 scales. These developments immediately contribute to improved decision-making in environmental management, infrastructure development, and urban planning.

Recommendations

The future results of this study suggest that regular map updating operations for medium-scale mapping (1:2500 and 1:5000) should include very-high-resolution satellite imagery such as SkyFi/SuperView. To capture seasonal fluctuations and minimize misclassification of features impacted by vegetation cover or shadows, future projects should think about including multi-temporal imaging. Higher-resolution sensors – like WorldView-3 – should be given priority when high-precision applications or essential infrastructure are involved. To increase thematic accuracy, field verification should be extended, especially for features that are narrow or spectrally complicated like canals and tiny bodies of water. To guarantee interoperability, consistency, and dependability across datasets, mapping organizations should also take a standards-based approach, according to USGS interpretation guidelines, ISO 19157 data quality requirements, and ASPRS accuracy thresholds. Lastly, to increase productivity, repeatability, and scalability in next mapping projects, it is advised to invest in semi-automated feature extraction and accuracy evaluation technologies.

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REFERENCES

1. Bellagamba S, Malinconico S, Paglietti F, Bonifazi G, Serranti S, Aurigemma A. Remote sensing for asbestos roofing mapping: Mantua case study using WorldView-3 images. Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy. 2026;348:127160. doi:10.1016/j.saa.2025.127 160.
2. Rodríguez-Dorna A, Alonso L, Costas F, Picos J, Armesto J. Very high resolution Worldview-3 images for land cover mapping on a large scale: strengths and remaining challenges. Geocarto Int. 2025 Dec 31;40(1):2538802.
3. Van Berkum JL. Developing a satellite-based methodology to estimate built-up biocapacity for use in the National Ecological Footprint and Biocapacity Accounts: a comparative study of Pléiades Neo and Sentinel-2 imagery, classification algorithms, and segmentation approaches [master's thesis]. Reykjavík (Iceland): University of Iceland; 2025.
4. Gunjan S, Dokku P, Kamalakar V. Landslide monitoring: DenseNET and image segmentation techniques to classify type and compute run-out displacement and hazard area. Natural Hazards. 2025 Aug;121(14):16345–70.
5. Ye M, Ward PJ, De Plaen JJFG, Koks EE. A deep learning pipeline to power infrastructure detection in high-resolution satellite images. Big Earth Data. 2025;9(3):525-546. doi:10.1080/20964471.2025.2490408.
6. Sherwin ED, Rutherford JS, Chen Y, Aminfard S, Kort EA, Jackson RB, et al. Single-blind validation of space-based point-source detection and quantification of onshore methane emissions. Sci Reports. 2023 Mar 7;13(1):3836.
7. Figliomeni FG, Specht M, Parente C, Specht C, Stateczny A. Modeling and Accuracy Assessment of Determining the Coastline Course Using Geodetic, Photogrammetric and Satellite Measurement Methods: Case Study in Gdynia Beach in Poland. Electronics. 2024 Jan 19;13(2):412.
8. Cui K, Cui Y, Deng X, Zhang C, Jia Y, Zhao T, Li N, Shi Z, Zhao X, Qin H. Refined big data on carbon sequestration for urban trees: 3D information and spatial carbon stock. Sustainable Cities and Society. 2025;134:106901. doi:10.1016/j.scs.2025.106901
9. Bellagamba S, Malinconico S, Paglietti F, Bonifazi G, Serranti S, Aurigemma A. Remote sensing for asbestos roofing mapping: Mantua case study using WorldView-3 images. Spectrochim Acta A Mol Biomol Spectrosc. 2026;348:127160. doi:10.1016/j.saa.2025.127160
10. Toutin T. Geometric processing of remote sensing images: models, algorithms and methods. Int J Remote Sens. 2004 May 1;25(10):1893–924.
11. Li R, Zhou F, Niu X, Di K. Integration of Ikonos and QuickBird imagery for geopositioning accuracy analysis. Photogramm Eng Remote Sens. 2007;73(9):1067-1074. doi:10.14358/PERS.73.9.1067.

12. Jensen JR. Remote sensing of the environment: An earth resource perspective. 2/e. Pearson Education India; 2009.
13. Mu Q, Zhao M, Running SW. Improvements to a MODIS global terrestrial evapotranspiration algorithm. Remote Sens Environ. 2011 Aug 15;115(8):1781–800.
14. Li Z, He W, Cheng M, Hu J, Yang G, Zhang H. SinoLC-1: The first 1-meter resolution national-scale land-cover map of China created with the deep learning framework and open-access data. Earth Syst Sci Data Discuss. 2023 Mar 27;2023:1–38.
15. Tuzcu Kokal A, Olgun N, Musaoğlu N. Detection of mucilage phenomenon in the Sea of Marmara by using multi-scale satellite data. Environ Monit Assess. 2022 Aug;194(8):585.
16. Magro VI, Panfilov OG. Research of the features of digital signal formation in satellite communication lines. Radio Electronics, Computer Science, Control. 2024;(1):28-35. doi:10.15588/1607-3274-2024-1-3.
17. Gianinetto M, Giussani A, Scaioni M, Lechi-Lechi G. Fast mapping from high resolution satellite images: a sustainable approach to provide maps for developing countries. International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. 2004;XXXVII-B4:37-42.
18. Lu D, Weng Q. A survey of image classification methods and techniques for improving classification performance. Int J Remote Sens. 2007 Mar 1;28(5):823–70.
19. Abdullah Q. The ASPRS positional accuracy standards, Edition 2: the geospatial mapping industry guide to best practices. Photogrammetric Engineering & Remote Sensing. 2023;89(10):581-588. doi:10.14358/PERS.89.10.581
20. Blaschke T. Object based image analysis for remote sensing. ISPRS J Photogramm Remote Sens. 2010 Jan 1;65(1):2–16.
21. Lu D, Weng Q. A survey of image classification methods and techniques for improving classification performance. Int J Remote Sens. 2007 Mar 1;28(5):823–70.
22. Jensen JR. Remote sensing of the environment: an earth resource perspective. 2nd ed. New Delhi (India): Pearson Education India; 2009. 592 p
23. Toutin T. Geometric processing of remote sensing images: Models, algorithms and methods. Int J Remote Sens. 2004 May 1;25(10):1893–924.
24. Mu Q, Zhao M, Running SW. Improvements to a MODIS global terrestrial evapotranspiration algorithm. Remote Sens Environ. 2011 Aug 15;115(8):1781–800.
25. Ureña-Cámara MA, Nogueras-Iso J, Lacasta J, Ariza-López FJ. A method for checking the quality of geographic metadata based on ISO 19157. Int J Geogr Inf Sci. 2019 Jan 2;33(1):1–27.
26. Clark RN, Swayze GA, Gallagher AJ, King TVV, Calvin WM. The U.S. Geological Survey, digital spectral library: version 1 (0.2 to 3.0 µm). U.S. Geological Survey Open-File Report 93-592. Washington (DC): U.S. Geological Survey; 1993. 1340 p.
27. Denis N, Di Pietro R. The Looming Privacy Challenges Posed by Commercial Satellite Imaging: Remedies and Research Directions. IEEE Access. 2025;13:122432–122444. doi: 10.1109/ACCESS.2025.3588593.
28. Zakharov I, Power D, McGuire P, Völker M, Kim JH, Emanuelli M, Chamberland J, Stott M, Warren S, Janoth J, Kaptein A. Next-Generation C-Band SAR Mission: Design Concept for Earth Observation Service Continuity. Remote Sens. 2025 Nov 19;17(22):3761.
29. Ouamane S, Sayad M, Megherbi SA. Wildfire detection in Algeria using satellite imagery [master's thesis]. Biskra (Algeria): Faculty of Exact Sciences and Natural and Life Sciences, University of Mohamed Khider Biskra; 2025. 77 p.

