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NAZAR M. S. NUMAN,* GHASSON J. AWDA,** HUDA A. THANNOON***

QUICK MAP REVISION USING DIGITAL LINE MAPS PRODUCED FROM ORTHOPHOTOMAPS OF BASHIQA AREA — NORTHERN IRAQ

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In a fast developing country like Iraq, there is an increasing and urgent demand for the most up-to-date terrain information in digital form as well as graphical format such as maps. Recent advances in photogrammetry, cartography and computer technology provide this possibility with a great speed, high degree of precision and a minimum of effort in the field.

This paper describes and discusses the application of these techniques in producing an up-to-date revised digital line map for the Bashiqa area using an orthophotomap (produced from up-to-date aerial photos) and existing old map. Use was made of a manual digitizer with interactive graphic display system. The digital interactive data acquisition, interactive editing and automated drawing are discussed. Field checks on the up--dated maps were done and their accuracy is discussed here.

Moreover, correlation of the up-dated map with the old existing map is carried out.

Administrators and planners have a high requirement for topographic maps that contain the most recent information to plan transportation and communication routes, to develop natural resources, and to shape and preserve the environment.

Countries covered by topographic maps have to keep their maps up-to-date in the settled areas where man's influence on landscape has already made its greatest mark.

The suggested East Jazeerah Irrigation Project related to the Saddam Dam Lake is situated north-east of Mosul (Figure 1, location map). The implementation of the project in its various stages requires that the existing maps be revised and new maps made for previously unmapped areas. The ability to carry out this task utilizing the recent advances in photogrammetry, cartography and computer technology are instigated in this work. This research

* Nazar M. S. Numan, Remote Sensing Centre, Mosul University, Iraq.
** Ghasson J. Awda, Directorate of Military Survey, Baghdad, Iraq.
*** Huda A. Thannoon, Technical Institute, Mosul, Iraq.

discussed the production of the digital line map from the orthophotomap and from the old existing map, for map revision, at a scale of 1:10 000.

Orthophoto production has been used in map revision for evaluation of digital data based on accuracy content and after evaluation for actual planimetric up-dating.

Manual digitizer with interactive graphical display system is used in this work.

The digital interactive data acquisition to represent the planimetric features of the terrain data in digital form, interactive editing and automated plotting are discussed. For height information contour line map is computed from the stored DTM of the test area. Field checking on the up-dated map with the addition of new geographic information is carried out.

The planimetric accuracy of the up-dated map is 0.14 mm in x—y direction and 0.2 mm in the radial direction. Vertical accuracy is about 0.035 percent to

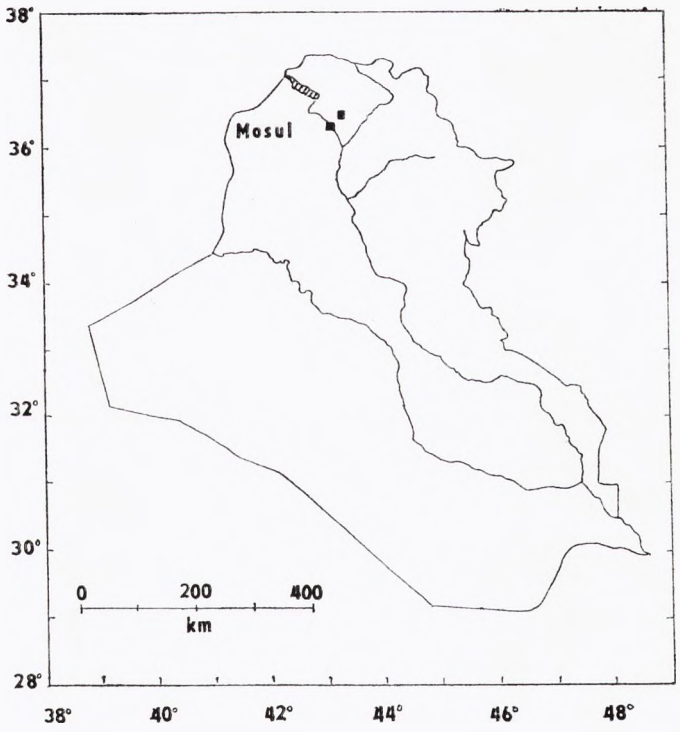


Figure (1) The location map of the study area

Obr. 1. Poloha študovaného územia.

0.04 percent of the flying height. Moreover, the correlation of the old existing map and the produced up-dated map are discussed. The percentages of changes are 82.2 % for urban expansion, 90.4 % for olive orchards extension, 79.49 % for metalled roads construction and 100 % for poultries construction.

TEST AREA AND THE APPLIED METHOD

The test area extended between latitudes (36° 25⁻ 29.77⁼ — 36° 28⁻ 44.43⁼) N. and longitude (43° 19⁻ 36.55⁼ — 43° 22⁻ 57.26⁼) E. The ground elevation ranges between 280 m and 620 m above the sea level. The main features are wa-

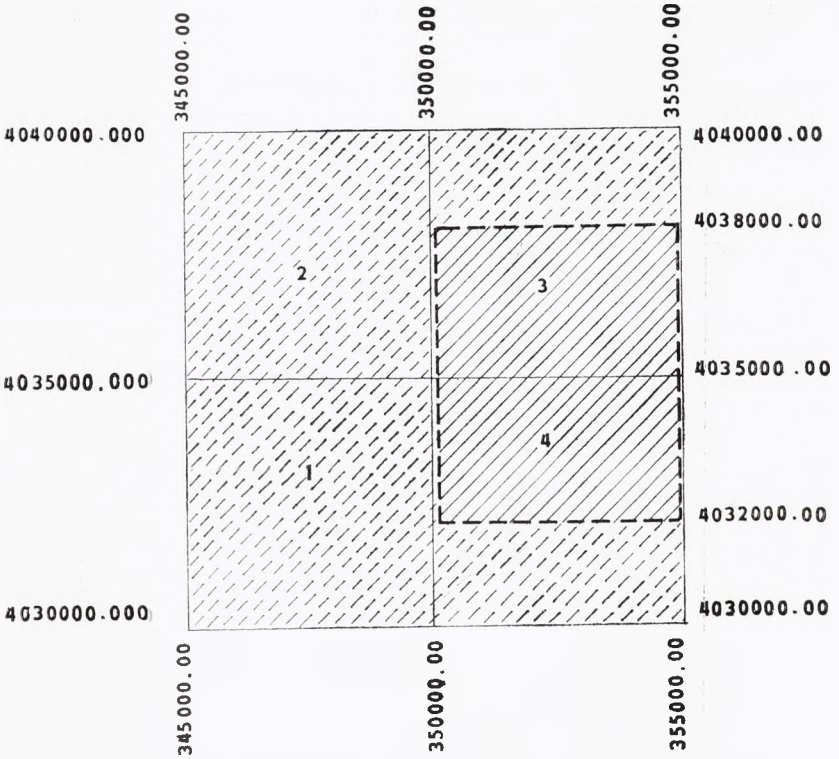


Figure (2) The chopen area on the four orthophotomaps.

Obr. 2. Vybrané územie na 4 ortofotomapách.

tercourses winding through the area, and the olive orchards near Ba'shiqa and Bahzani villages. This portion is selected for several reasons, which are:

1. The annotated orthophotomap of the area is available at scale 1:10 000 [9]. Figure 2 shows the chosen area on the orthophotomaps for digitizing and the production of line map.
2. The Digital Terrain Model for the test area is available [8].
3. There is a wide variety in the terrain surface of the selected area, a range of about 330 meters in topographic height level.
4. In this portion of the area, there are different types of features, such as (villages, olive orchards, graveyard, poultries, roads, watercourses etc.).
5. Finally, due to point three above the break lines shown clearly in this part of the area.

Black and white annotated orthophotomap printed on bromide paper at a scale 1:10 000 is used to produce the updated map for the test area. Off-line processing was used on a Zeiss Z—2 ORTHOCOMP to produce the orthophoto [9]. The orthophotomap was compiled from aerial photographs at a scale 1:35 000, taken by Zeiss RMK Camera, the flying height was 3100 meters above sea level. The date of photography was November 1981.

The DTM of the test area was acquired from the same aerial photographs used for orthophoto production. Height information at 100 meter intervals in x, y direction on ground coordinates (later interpolated to 50 m intervals) were collected along profiles, and points at 50 meter intervals along break lines utilizing a Zeiss C100 PLANICOMP analytical stereoplotter [9]. The stored DTM data is used to produce contour line map for the test area at a scale of 1:10 000 with (5—10) meter contour intervals [9]. The contour map is scribed using the DZ—7 automatic plotting tracing table which is connected to an HP—1000 computer [9].

A line map is obtained from the orthophotomap and from a portion of the old existing map. This portion corresponds to the area digitized from the orthophotomap.

For the purpose of digitizing mat type manual digitizer with ARISIOGRID 200 series digitizing table equipped with a 5-button cursor and with interactive graphical display system Tektronix 4957 is used in the the course of the present work, so that the map features are converted into digital form. HP—100/A600 computer is used for controlling the digitizing table and the interactive graphic display system. Figure (3) shows the flow diagram for digitizing the orthophoto and the old existing map.

The Universal Transverse Mercator (U. T.M.) projection is used to transform the geographic coordinates to a pane surface coordinates. The map sheet contains small distortion or errors during storage for a long period due to temperature and humidity effects in the storage room. Therefore calibration of the old line map is performed during this work to determine the correct dimensions of a map sheet.

DATA AQUISITOIN

In the digitizing process, all features on a map are assigned a code which contains the required information about the feature characteristics, so that the

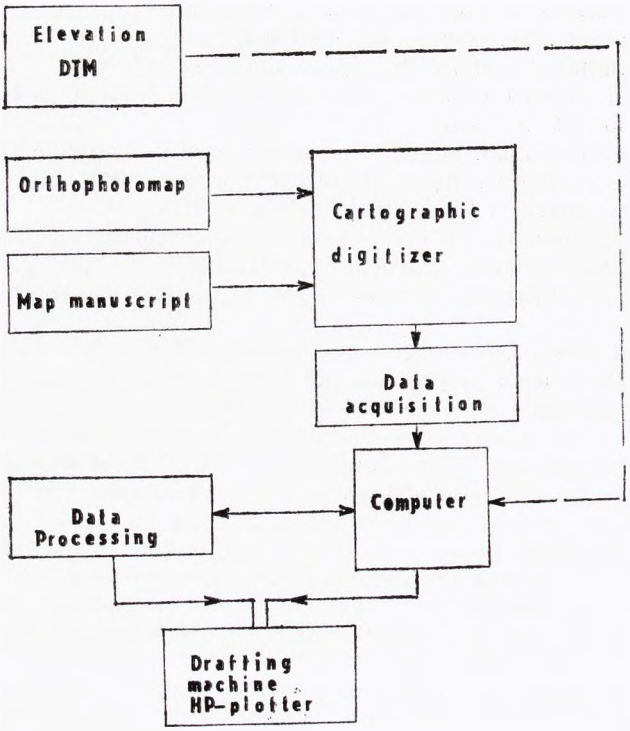


Fig. (3) Flow diagram for digitizing orthophotos and the map manuscript.

Obr. 3. Diagram dokumentujúci digitalizáciu ortosnímok a originálu mapy.

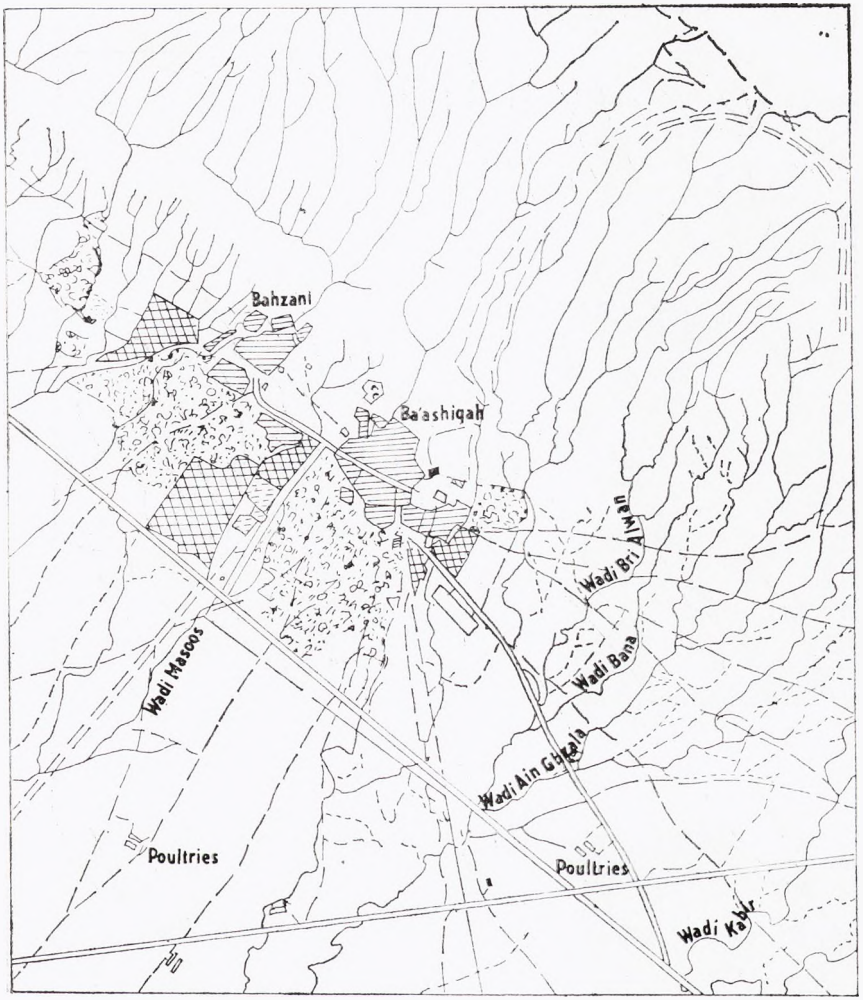
identification or selection of recorded data may be made for the purpose of processing, editing and plotting. The graphical information of the map features can be categorized as:

Open lines

Open lines with different parameters specifying the representation of different types of lines with optional symbols. In the course of this work, the open line features are divided into two main groups: the first comprises straight lines features — metalled and unmetalled roads, where only the beginning and the end points of such features need to be digitized, with a parallel line at a desired measured distance. The second comprises sinuous linear features —

Obr. 4. Líniová mapa z ortofotomapy.

MOSUL BA'ASHIQAH



Line Map From Orthophotomap Compiled From Air Photographs
November 1981

Projection Universal Transverse Mercator (U.T.M.)

N

500 0 500 1000m

REFERENCE

Road Metalled		Perennial Watercourses	
Road Unmetalled		Intermittent Watercourses	
Motorable Track		Olive Orchards	
Mule Track		Limit Of Defined Cultivation	
Villages		Poultries	
Building Areas Post-1981		Graveyard	
Contours	350 325	Public Building	

Figure (4) Line Map from the Orthophotomap.

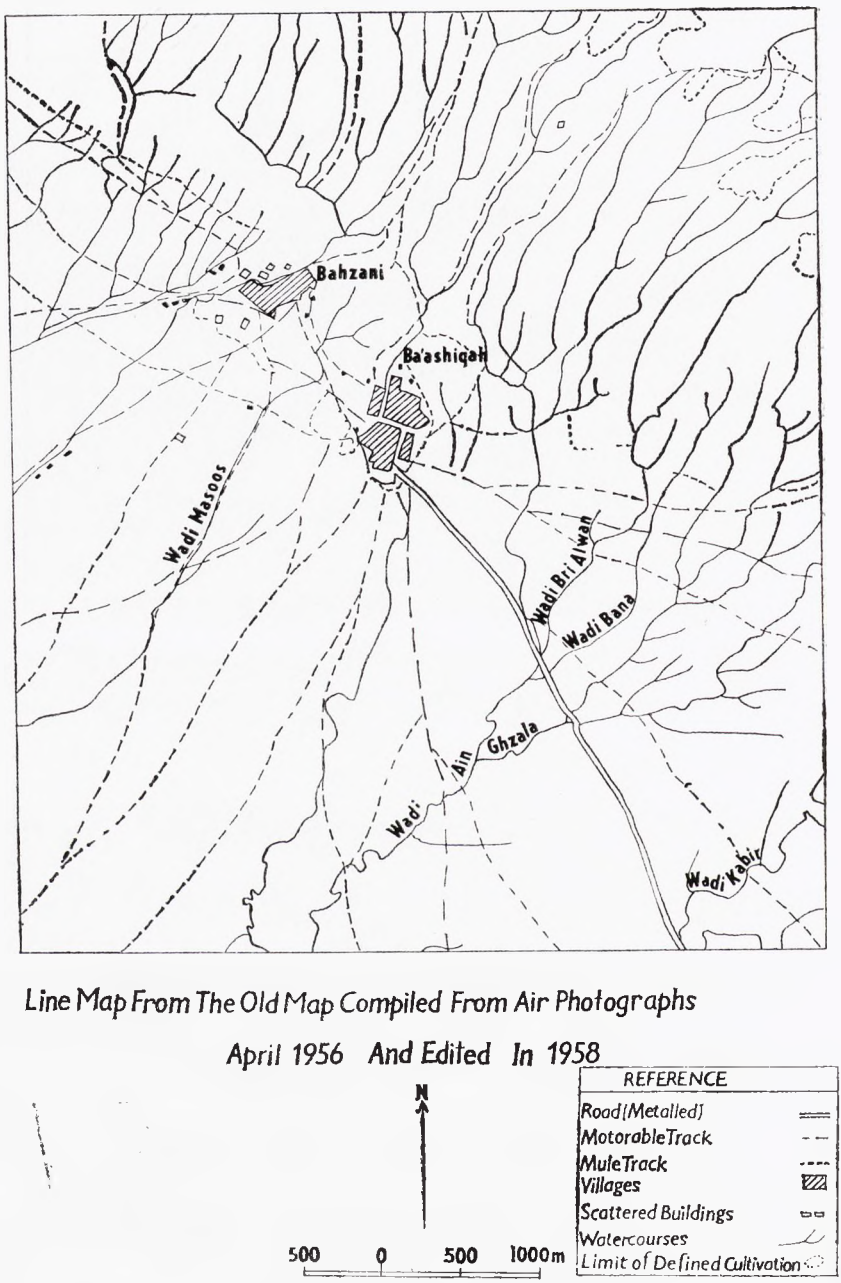


Figure (5) Line Map from the Old Existing Map.

tracks, watercourses, limit of defined cultivation, where the continuous mode with a tracing tube width 0.5 mm is used.

Closed Lines

Closed lines filling with symbols or hatching are used in this work to represent the villages, olive orchards, graveyard, and poultries. Only the corner of such features needed to be digitized. The symbol size, rotation, colour, distance and gap between the symbols is optional.

Point Symbols

Point symbols are used in this work to fill the closed area and to represent the different types of lines. The tree, grave and line symbol are used.

During the digitization, features and their coordinates are recorded. The sum of all features represent a *digital map.*

DATA PROCESSING/EDITING

The digitizing station is connected to an HP 1000/A600 computer. The computer handles the data reduction, storage, access, retrieval functions along with the calculation necessary to support the operation. The storage and management of the very large amount of digital data required an efficient means of referencing the data. Interactive editing is used for editing the digitized data. This enables the viewing of digital data simultaneously with digitizing and checking the completeness and precision of digitizing.

Plotting

The final output plotting of the maps is done by automatic plotting using HP—7585B plotter which is connected to an HP 1000/A600 computer. (Figure 4, 5).

Table 1. Coordinate transformation of the line map

Geographic		U. T. M. (Clarke)	
Longitude	Latitude	Easting [m]	Northing [m]
43° 19′ 36.55″	36° 25′ 27″	350000.00	4032000.00
43° 19′ 32.37″	36° 28′ 41.65″	350000.00	4032000.00
43° 22′ 53.22″	36° 28′ 44.43″	350000.00	4032000.00
43° 22′ 57.26″	36° 25′ 29.77″	350000.00	4032000.00

←

Obr. 5. Líniová mapa zo starej existujúcej mapy.

RESULTS AND DISCUSSION

Coordinate transformation from geographic to U. T. M. (Clarke) coordinate of the produced line map is as shown in Table 1. A digital line map at a scale of 1:10 000 is obtained by digitizing the planimetric features from the orthophotomap and from the old existing map. These features are roads, tracks, watercourses, villages, buildings, poultries, limit of defined cultivation and olive orchards. The updated map sheet is (60 cm X 50 cm) in size and covered an area of 30 Km^2. For height information contour line map is computed from the stored DTM and scribed using the D—7 automatic plotting tracing table at a scale of 1:10 000 with (5—10) meter contour interval [9].

The planimetric accuracy of the up-dated map is 0.14 mm in x and y direction and 0.2 mm in the radial direction. The vertical accuracy is about 0.035 percent to 0.04 percent of the flying height.

The up-dated line map is then checked in the field and new geographic information added to it (building areas post- 1981 and the public buildings area). Marginal information and names are added subsequently in the cartographic stages for the production of the line map. The old map was compiled from air photographs, during April 1956. Here, the up-dated line map digitized from the orthophotomap was compiled from air photographs taken in November 1981. During this time period (about 25 years) there have been no maps for the test area. So that there are a great amount of changes in the map content. These changes are metalled road construction, urban expansion, olive orchards extension and poultries construction. The changes post—1981 are recorded on the final map after field checks are carried out and information is gathered from local authorities.

The measured values on the up-dated map and the old one are respectively 1.081, 0.1915 Km^2 for urban, 1.472, 0.14 Km^2 for olive orchards, 1.585, 0.325 Km for metalled roads and 7, none for poultries. The percentages of changes are 82.2 % for urban expansion, 90.48 % for olive orchards extension, 79.49 % for metalled roads construction and 100 % for poultries construction.

CONCLUSIONS

Digital mapping and computer-assisted techniques play an important part in map production and revision.

The present study showed that the slow manual cartographic and traditional methods is replaced by computer controlled equipment for map production and revision.

The ability of handling terrain data in completely digital form holds for the promise of reducing drudgery of cartographic operation, providing a wide variety of data interaction, creating data banking, which solves the archival storage problems, and reducing cost.

To produce an up-to-date map, when the map imagery is available in digital form on tape or disc, the new information can be digitized from the orthophotomap coded in the same form and added to the old digital map.

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Назар М. С. Нуман, Гассон Й. Ауда, Худа А. Таннун

ОПЕРАТИВНОЕ ВЕДЕНИЕ КОРРЕКТУРЫ КАРТ С ИСПОЛЬЗОВАНИЕМ ЦИФРОВЫХ КАРТ ПОЛУЧЕННЫХ С ОРТОФОТОКАРТ (НА ПРИМЕРЕ БАШИКСКОЙ ОБЛАСТИ — СЕВЕРНЫЙ ИРАК)

В статье рассматривается использование ортофотокарт с аспектов сбора и обработки данных в цифровой форме при создании линейных карт. На примере избранной области (северный Ирак) коротко рассматривается способ быстрого автомати-

зированного сбора и обработки необходимых данных о рельефе и речной сети. Этот способ обработки является подходящим как с точки зрения оперативного отображения пространственных изменений отдельных компонентов в регионах со значительной динамикой изменений, так и с точки зрения оперативного ведения корректур содержания карт в областях с проектируемым строительством. В статье, затем, более подробно рассмотрена эффективность оперативной актуализации картографического рисунка речной сети в интеракции с рельефом, а также эффективность быстрого получения новых, актуализированных цифровых карт в м-бе 1:10 000, отображающих территорию проектируемого Саддамского водохранилища (на северо-востоке от г. Мосул).

Рис. 1. Местоположение изучаемой территории.
Рис. 2. Избранная территория на 4-х ортофотокартах.
Рис. 3. Схема процесса цифрования ортофотоснимков и оригинала карты.
Рис. 4. Линейная карта полученная на основе ортофотокарты.
Рис. 5. Линейная карта полученная на основе старой существующей карты.

Перевод: Л. Правдова

Nazar M. S. Numan, Ghasson J. Awda, Huda A. Thannoon

POHOTOVÁ REVÍZIA MÁP VYUŽÍVAJÚCA DIGITÁLNE MAPY ZOSTROJENÉ Z ORTOFOTOMÁP NA PRÍKLADE BASHICKEJ OBLASTI — SEVERNÝ IRAK

V práci je rozobraná problematika využitia ortofotomáp z hľadiska operatívneho zberu a spracovania dát v digitálnej forme pri tvorbe líniových máp. Na vybranej oblasti zo severného Iraku je stručne ukázaný spôsob rýchleho automatizovaného zberu a spracovania potrebných údajov o reliéfe a jeho riečnej sieti. Tento spôsob spracovania je výhodný jednak z hľadiska pohotového zobrazenia priestorových zmien jednotlivých zložiek v regiónoch s veľkou dynamikou a jednak z hľadiska pohotovej aktualizácie mapového obsahu v oblastiach s projektovanou výstavbou. V práci je potom bližšie ukázaná výhodnosť pohotovej aktualizácie mapového obsahu riečnej siete vo väzbe na reliéf, ako aj výhodnosť rýchleho zostrojenia aktualizovaných nových digitálnych máp v mierke 1:10 000 z oblasti projektovanej Saddamskej priehrady severovýchodne od Mosulu.