

111 с. **6.** *Пособие по определению расчетных гидрологических характеристик.* – Л. : Гидрометеозат. – 1984. – 447 с.

**Медведєва Ю. С.** Максимальні модулі схилового припливу в період весняного водопілля на території Причорноморської низовини. У статті розглядаються розрахункові характеристики поверхневого схилового стоку в період весняного водопілля на території Причорномор'я.

*Ключові слова:* весняне водопілля, схиловий стік, максимальні снігозапаси, опади, модулі стоку.

**Medvedeva Y.S.** Maximum modules of slope inflow during the spring flood in the territory of the Black Sea Lowland. In the article the calculated characteristics of the surface slope runoff during spring flood in the Black Sea area.

*Keywords:* spring flood, flow slope, maximum snow storage, precipitation, runoff modules.

**Медведєва Ю. С.** Максимальные модули склонового притока в период весеннего половодья на территории Причерноморской низменности. В статье рассматриваются расчетные характеристики поверхностного склонового стока в период весеннего половодья на территории Причерноморья.

*Ключевые слова:* весеннее половодье, склоновый сток, максимальные снегозапасы, осадки, модули стока.

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#### **DIGITAL GEOMORPHOLOGICAL MAP OF GORCE NATIONAL PARK- PRELIMINARY RESULTS. Part I**

*Keywords:* Digital geomorphological map, Gorce National Park

**Introduction.** The map is one of the basic sources of geographic information. The map is referred to mathematically design, relationship between the real world and its model presented on a scale using special character systems, as well as the choice and the generalisation of those phenomena (Robinson et al. 1988, Saliszczew 2003).

Digital map is a set of coordinates that the position of objects in space, together with information about the presentation of these data stores site and geometrical geographical objects with information describing these objects (Myrda 1991). Digital map is a geographical model of reality presented in digital format and adapted to the computerized processing of personal data as well as generate maps of the area of analog (Gaździcki 2002). Analog map contains a finite number of thematic layers, as opposed to digital maps, where we can join the new datasets and selectively view spatial information. The advantage of digital maps is also that it is possible to create your own maps by the user system, while analog map formed by the editors (Napiórkowska 2011).

The main aim of research is to present the principles of transformation of geomorphological maps to digital image. Developed geomorphological map of the Gorce National Park in scale 1: 10 000 (Zuchiewicz 1998). Methodology of the study included data sourcing, topology and processing in GIS programs. As a result, we have received not only a digital map but also digital geomorphological database, which we can update and use it in any way.

**Review of analog and digital geomorphological studies.** Due to the scale, geomorphological maps we can divided into detailed (1: 10 000 to 1: 100 000) and review (less than 1: 100 000). Detailed maps are developed on the basis of field mapping with the use of auxiliary materials, for example topographic maps or aerial photos. Review geomorphological map in scale 1: 200 000 and 1: 1 000 000 is the result of intimate studies (Klimaszewski 1978).

In the case of analogue maps the first map is a detailed geomorphological map feature of Poland 1: 50 000, released in 30 sheets in the years 1958-1969 and in the following 4 sheets between 1988-1994 . The next analog geomorphological maps, which originated in Poland, Kraków and Toruń in the 1950s to 90s of the 20th century (Klimaszewski 1978, Starkel et al. 1980). Following are the maps from Poznań, originally analog (Żynda 1964, Rotnicki 1965, Rosa 1968).

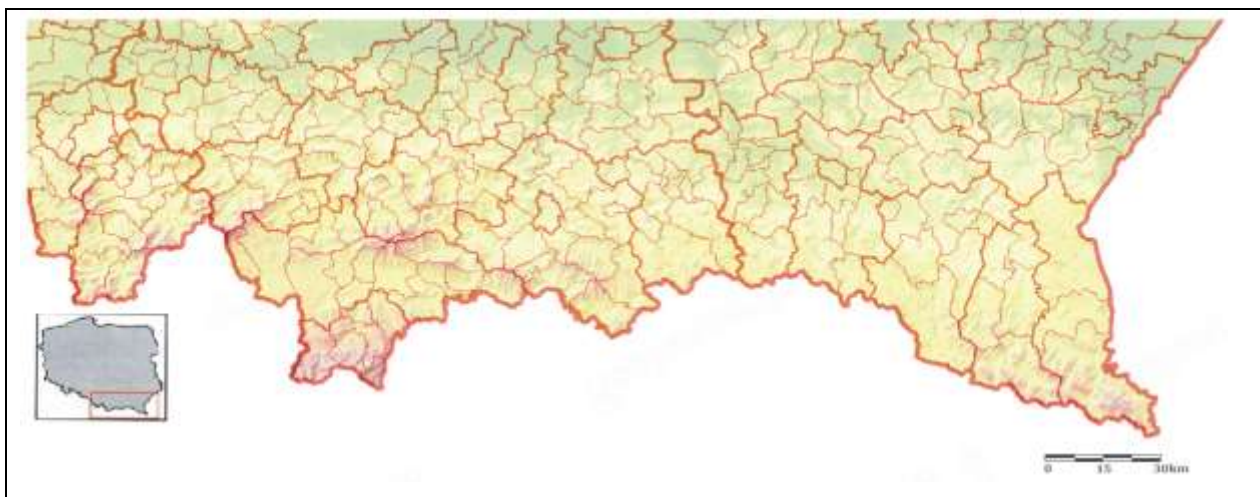
In 1963, Klimaszewski announced the so-called "cracovian" legend, it placed emphasis on the forms and processes specific to mountain and highlands areas, without the specificity of lowland glacial origin, which were supplemented in the legend created by Galon, which relied heavily on the classification using the genetic sequence of forms of sculpture progressing as far as going away from the front of the ice sheet. Geomorphological mapping for the northern Poland took the legend of Toruń, southern the legend of Kraków (Klimaszewski 1978). In 1980 was developed Survey geomorphological map of Poland 1: 500 000, edited and compiled by a team led by L. Starkel. The map was released in 6 sheets (Starkel et al. 1980, Gilewska et al.1982).

Digital thematic map must meet all the requirements for the content and its readability for cartographic analog studies. An additional feature of the digital maps is the fact, that they are spatial database allowing to carry out all sorts of analyses not only quantitative but qualitative (Borzuchowski 2011). The first attempts to define the principles to develop detailed digital maps have been in the 1980s. of the last century (Wołk-Musiał 1984). This work continued in subsequent in 1992, E. Wołk-Musiał, using the interpretation of aerial photographs, supported by field researches and geological documentation, prepared and published a detailed geomorphological map on a scale of 1: 50 000, sheet of Choroszcz. The legend of the map includes 42 distinctions (Borzuchowski 2011).

In the Department of Geoinformatics and the Faculty of Geography and Regional Studies also developed some other detailed digital maps. The experience gained as a result of the implementation of the above maps have empowered to attempt to develop instructions for performing detailed geomorphological mapping. The development of such, under the care of dr Elżbieta Wołk-Musiał made Jakub Binduga. This guide also includes geoinformatic aspects of geomorphological mapping. To 2011 for the Polish site were developed survey review geomorphological maps covering the area of the Carpathian Mountains, Masovia, Kuyavia, and Polish part of the North-West in the vicinity of Szczecin (Borzuchowski 2011).

In 2011, the project was launched, "Digital Geomorphological Maps". It aims to the development of technical specifications of the implementation of thematic studies mapping in the form of digital geomorphological maps, referred in § 2 (1) (a). (c) the regulation of the Council of Ministers of the Council of 3 October 2011 on the types of studies and special thematic mapping (Journal of laws No. 222, item 1328). On 6 February 2014 at the headquarters of the Institute of Geography and Spatial Organisations PAS located at Twarda 51/55, in Warsaw, Poland, held a meeting entitled "Digital Geomorphological Maps". Preliminary results were presented to develop six sheets of illustrative maps in scale 1: 100 000. Further works currently underway.

**Characteristics of the research area.** Gorce National Park is a park in Lesser voivodeship, southern Poland. Since 1981 this area is subject of strict protection (year of establishment of the Gorce National Park). It covers central and northeast parts of the Gorce Mountains, which are the part of Western Beskid (Figure 1). By geomorphological division of Carpathians (Klimaszewski 1972) Gorce form the region of Beskid Sądecki, which stretches between Sieniawska Gate (711 m a.s.l.) and the Tylicka Gate (688 m a.s.l.) (Klimaszewski, Starkel 1972). It consists of several groups of mountain (Gorce, Lubań, Radziejowa) of similar height (1300-1100 m). Backs, broad and ragged line narrowed closer to the main valleys, which are indented 400-600 m below the ridges and have steep slopes with a gradient of 20-40°. Process the entire shaft of Beskid Sądecki is slightly skewed relative to the synklin and antyklin, and occurs as a rule lack depending on the ridges of the resistance of the rocks and the rejuvenated of valleys testifies to the youth sculpture (Starkel 1969). Gorce represent the culmination of this region (Turbacz-1311 m). They represent the type of medium mountains sculpture (Klimaszewski, Starkel 1972).



*Fig. 1 – Location of study area*

Sculpture of Gorce mountains, as well as the whole of the Western Carpathians in Poland was created in stages (Izmailow et al. 1995). Modeling the area began after the orogeny movements and in conditions of active tectonic conditions and variables, and warm, humid climate (Oszast, Stuchlik 1977), which guided the type and intensity of the morphogenetic processes (Starkel 1965). The sculpture has grown to periods of cutting elevated area in the damp climate were separated phases of convergence and the creation of peneplen (Klimaszewski 1948).

Neolithic cultures entered in the Beskids area during the Bronze Age (Valde-Nowak 1988), and anthropogenic changes escalated, especially since the Middle Ages (Gerlach, Niemirowski 1968, Margielewski et al. 2008, Bucala 2012). In the Gorce mountains the most important forest roads transformed into holweg (hollow road), which are the main way of transport of material for rivers (Froehlich, Słupik 1986, Władyskowski 2006, 2007). gutters after transport felled trees developed by erosion, linear scars caused by insufficient and sometimes the beginning of a new form of erosion on the slopes. Those forms traverse the slopes and affecting their balance, which runs the mass movements, as well as collection and rubbles within the hydro-flow (Niemirowski 1972, 1976, Krzemień 1976, 1984).

**Methodology.** Digital map can be defined as a numerical record of actual space. The elements of such an area can be represented in two ways on your computer: on the principle of the raster write or as a vector. Both types of digital space provide a computer maps, however, give various possibilities of its use. In the course of the

selection of the expected conduct algorithm to determine the purpose of which is to serve map. Raster System based on respect for the fundamental fields is simpler, but requires more computer memory (Borzuchowski, 2011). It allows spatial analysis of the surface. While the vector notation allows you to present your form proving ground, line, and point. Thus its capabilities with respect to spatial analysis are larger (Borzuchowski 2011). The whole process of constructing digital geomorphological map take place in three stages: data acquisition, data processing, digital and graphical presentation of individual partial divisions (Table 1).

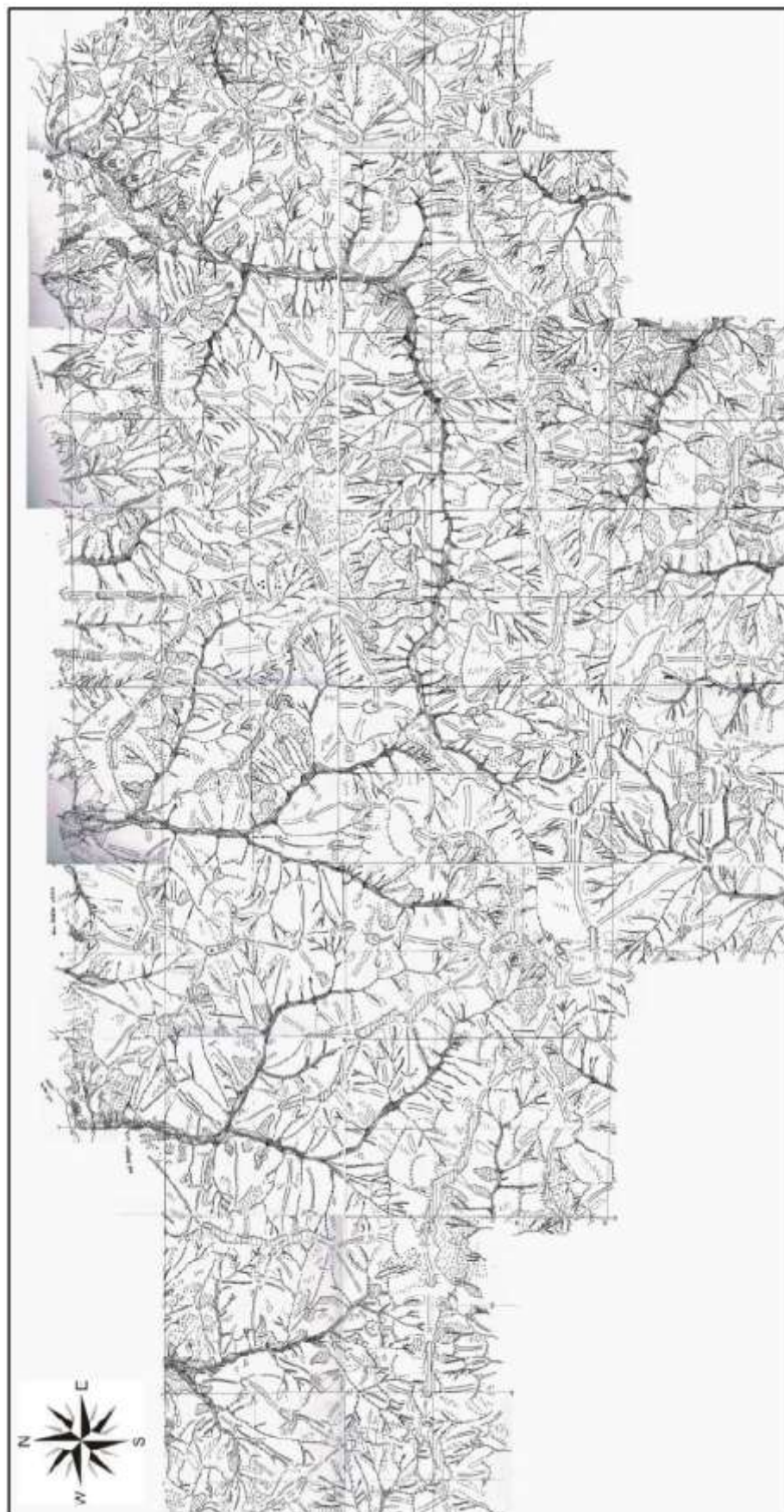
*Table –. Algorithm of creation of the Digital Geomorphological Map by J. Borzuchowski (2011), changed*

Stage I	Data acquisition Scanning of map sheets Georectification of scans Mosaicing of scans
Stage II	Digital data processing Digitalising of thematic layers
Stage III	Edditing of the map

To create a digital geomorphological map has been used free program QGIS. This program was used to vectorize layers, registration raster layers using "Georeferencer" tool. Detailed geomorphological map in scale 1: 10 000 is a result of comprehensive use of appropriate materials. To develop the study used Geomorphological Map of Gorce National Park 1:10 000 (Zuchiewicz 1998) and Topographic Map of Gorce Mts. 1:10 000 GUGiK 1965.

**Characteristics of analogue geomorphological map.** Analog geomorphological map of Gorce NP consisted of 6 sheets: Poręba Wielka, Lubomierz, Szczawa, Młynne, Turbacz and Jamne. Each of the six sheet consists of several A4 card. Each card was scanned at a resolution of 300 dpi. Thanks to the frame with the coordinate system it was possible the exact combination of scans in sheets and sheets in the entire map. After scanning the next step was to register the image. Uses for this purpose 'georeferencer tool'. Using this tool we are able to register image in any coordinate system. In this case we preliminary use WGS 84 EPSG 4326. As it turned out it was ultimately changed to PUWG 1992.

In this way, we get some kind of digital map in raster form. It can be distributed in electronic form, but it is not a database as a map composed of vector layers. The legend to the analog geomorphological map of Gorce National Park consists of 11 surface (polygons), 19 linear and 7 point sings. The map was made as part of the sampling frame for the conservation resources and values of the inanimate and soils in Gorce National Park.



*Figure 2 – Analog geomorphological map of Gorce National Park, raster image (Zuchiewicz 1998)*

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**Божуховські Я., Фронцек М., Каліцкі Т., Крупа Й.** Цифрові геоморфологічні карти Горчанського національного парку : попередні результати. Частина I. Мета даного дослідження полягала у підготовці цифрової геоморфологічної карти Горчанського національного парку в масштабі 1:10 000. За основу було використано геоморфологічну карту Горчанського національного парку та топографічну карту Горчанського хребта 1:10 000. Ці матеріали були оброблені в цифровій формі та імпортовані в систему координат WGS 84 EPSG 4326. Геоморфологічна складова цифрової карти була доповнена додатковим шаром, який був растровим фоном топографічної карти Горчанського хребта в масштабі 1: 10 000 GUGiK 1965, експортований у систему координат WGS 84 EPSG 4326. На їх основі був проведено інтерпретацію і векторизацію геоморфологічних форм. Листи карт було відскановано, векторизовано, географічно скоректовано і оцифровано. Основною проблемою було визначити метод кодування і графічні позначення даних на цифровій карті. Останній етап цього дослідження полягав у компоновці карти для друку.

Результатом досліджень стали геоморфологічні карти Горчанського національного парку в системі координат PUWG 1992, на трьох аркушах у масштабі 1:10 000, а бази даних – у форматі файлу (\* .SHP).

*Ключові слова:* цифрова геоморфологічна карта, Горчанський національний парк.

**Borzuchowski J., Frączek M., Kalicki T., Krupa J.** Digital geomorphological map of Gorce national park: preliminary results. Part I. The aim of this study was to prepare digital geomorphological map of Gorce National Park in scale 1:10 000. Analysis were based on the Geomorphological Map of Gorce National Park 1:10 000 (Zuchiewicz 1998) and Topographic Map of Gorce Mts. 1:10 000. These materials were processed into digital form and imported them to WGS 84 EPSG 4326 coordinate system. The content of the geomorphological feature of the digital map, has been supplemented by an additional layer, which was the raster background of Topographic Map of Gorce Mts. in scale 1: 10 000 GUGiK 1965 exported to WGS 84 EPSG 4326 coordinate system. Based on them was lead interpretation and vectorization process of geomorphological forms. The map's sheets were scanned, vectorised, geocorrected and digitalised. The basic problem was to define the method of encoding and graphic marking of data in the digital map. The last stage of this study was to prepare a composition for printing maps.

The effect of studies are geomorphological maps of Gorce National Park, in PUWG 1992 coordinate system, in three sheets in scale 1:10 000, and an databases in shape file format (\*.shp).

*Keywords:* Digital geomorphological map, Gorce National Park.

**Божуховски Я., Фронцек М., Калецки Т., Крупа И.** Цифровые геоморфологические карты Горчанського національного парка: предварительные результаты. Часть I. Цель данного исследования: подготовка цифровой геоморфологической карты Горчанского национального парка в масштабе 1:10 000. За основу было использовано геоморфологическую карту Горчанского национального парка и топографическую карту Горчанского хребта, 1:10 000. Эти материалы были обработаны в цифровой форме и импортированы в систему координат WGS 84 EPSG 4326. Геоморфологическая составляющая цифровой карты была дополнена слоем, который был растровым фоном топографической карты Горчанского хребта в масштабе 1: 10000 GUGiK 1965, экспортируемый в систему координат WGS 84 EPSG 4326. На их основе были проведены интерпретация и векторизация геоморфологических форм. Листы карт были отсканированы, векторизованы, географически откорректированы и оцифрованы. Основной проблемой было определение метода кодировки и графические обозначения данных на цифровой карте. Последним этапом исследования стала компоновка карты для печати.

Результатом исследований стали геоморфологические карты Горчанский в системе координат PUWG 1992, на трех листах в масштабе 1:10 000, а базы данных – в формате файла (\* .SHP).

*Ключевые слова:* цифровая геоморфологическая карта, Горчанский национальный парк.

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