Recently, airborne laser scanning became a prominent technology of data acquisition for high precision terrain models, especially in wooded and in urban areas. Characteristic problems with airborne laser scanner data are dependent on local geomorphology of the terrain surface. Critical areas are valley baselines covered by dense bush-type vegetation: the problems are due to specific difficulties in such areas with eliminating (filtering) the rays reflected by the vegetation, and also to difficulties with reaching the surface underneath it at all. Detecting such cases and correcting them represented the main motivation for these studies.

The concept as applied assumes that the terrain surface is formed by dynamic geomorphologic processes. Analyzing the surface as represented by the digital terrain model, suspicious forms contradicting these dynamic processes are detected; relevant forms are then processed in special ways to enforce proper geomorphology. Raster-based methods of surface analysis have major advantages: they are efficient; they provide for attractive visualizations; and they allow for applying in special ways the rich spectrum of algorithms available in digital image processing. This dissertation deals in detail with raster-based methods of surface analysis corresponding to morphometric and hydrologic laws.

Hydrologic surface analysis is employed in areas shaped predominantly by fluvial processes. To improve terrain models in such areas, digital rain simulation is applied, and water drainage on the surface modeled. The most important results are the following:

The drainage lines thus derived, to be included into the set of data as structure lines for a subsequent re-interpolation of the model surface;

Depressions with no drainage. They – or characteristically a series of them – will be re-modelled by artificial introduction of artificial draining paths with elevations correspondingly lowered.

Terrestrial measurements in the fluvial defined test area Wienerwald have indicated a considerable improvement of elevation accuracy by the above described processes.

The methods have been applied also to the Mars surface in Vallis Marineris – the largest rift system of the planet. Data are from the NASA Mars mission MOLA (Mars Orbiter Laser Altimeter). The hydrologic and morphometric results of this analysis provide detailed and specific information on the topography of the Mars surface, in a form very well suited for interpretation, with exceptionally attractive renderings. This data is now available for studies of the geologic and climatic history of the planet.

The methods proposed here have been implemented within the frame of the SCOP++ DTM program package. SCOP++ is organized within a universal application programming frame, enabling a relatively easy extension of the SCOP kernel software by additional algorithms.

Prepared by M. Lapaine

Ivana Barišin, MSc in GIS

Ivana Barišin defended successfully her Master's thesis on 30th April, 2003 at the University of Ulster, Coleraine, UK, titled *Water quality assessment using Landsat TM imagery*. Her tutor was Dr. Victor Mesev, and a member of dissertation committee Dr. Sally Cook.

Ivan Barišin was born on 19th August 1970 in Split where she also visited the Mathematics and Informatics Educational Centre. After graduating from the secondary school she enrolled the Faculty of Geodesy at the University of Zagreb and graduated from it in 1996. From 2000 till 2003 she visited the postgraduate studies at the University of Ulster. She finished the studies by giving her defence of master's thesis and gained a title of *MSc in GIS*. From 2005 she has been working on her doctoral dissertation titled *Usage of Optical Satellite Images in Measuring Ground Deformations after Earthquakes*.

From August 1996 till October 1999 she worked in the Geodetic Institute in Split. After that she went to Northern Ireland and was employed in the firm B.K.S. Surveys. She worked at first on the production of orthophotos and mosaics at various photography scales and resolutions from scanned images obtained from the air. She was trained to be an operator on all modules of the station Z/I, which includes orthorectification, aerial triangulation and collecting the points for DTM using semiautomatic and automatic procedures. She worked on geocorrection of maps using the ErdasImagine software. She participated at various projects, including the production of orthophotomaps of a few European cities (Brussels, Amsterdam, Karlsruhe, Belfast, Dublin). Some projects have been made for very sensitive areas as e.g. Bermuda Islands with coral reef, or the bay of Morecombe in England.

After two years spent in the photogrammetric department she started to work in the department of technical support at B.K.S. She worked there on researching lidar and lidar technology, and on monitoring the lidar data processing and projects. She visited the

gdje su u pravilu prekrivena vrlo gustom vegetacijom. Stoga je količina podataka dobivena refleksijom laserske zrake od terena nedovoljna za kvalitetno modeliranje terena na tom području, a dolazi i do poteškoća u eliminaciji (filtriranju) podataka dobivenih refleksijom laserske zrake od vegetacije. Pronalaženje računalnih metoda za automatsko otkrivanje i ispravljanje ovih pogrešaka glavna je motivacija za ovaj rad.

Primijenjeni koncept ne smatra više površinu terena statičnom, već razmatra uzajamno dinamičko djelovanje geomorfoloških procesa i fizičke površine terena. Na taj je način moguće otkrivanje nerealnih geomorfoloških oblika u DTM-u glede djelovanja pretpostavljenih geomorfoloških procesa, a DTM se računalno korigira tako da bude u skladu s djelovanjem tih procesa. Rasterske metode analize površine terena imaju sljedeće glavne prednosti: efikasne su, omogućavaju atraktivne vizualizacije i dopuštaju primjenu čitavog niza algoritama iz područja digitalne obrade slike. Ova se disertacija detaljno bavi rasterskim metodama analize, istražujući hidrološke i morfometrijske osobine površine terena.

Hidrološke analize su prije svega opravdane u područjima pretežno oblikovanim fluvijalnim procesima. Korekcije DTM-a provode se računalnom simulacijom kišenja te površinskog otjecanja, a najvažniji rezultati su da se izvedene linije koncentriranog otjecanja uključuju kao strukturne linije u interpolaciju DTM-a, a pojedinačne depresije odnosno depresije u nizu računalno se korigiraju uvođenjem izvedene linije koncetriranog otjecanja u DTM.

Kontrolna terestrička mjerenja u fluvijalnom test-području Bečke šume (Wiener Wald) pokazala su značajno povećanje visinske točnosti primjenom navedenih postupaka. Ti su postupci primjenjeni i na dio površine Marsa, u području Vallis Marineris – najvećem kanjonskom sustavu na Marsu. Podaci potječu s instrumenta MOLA (Mars Orbiter and Laser Altimeter). Rezultati hidroloških i morfometrijskih analiza prikazuju detaljne i specifične informacije o topografiji površine Marsa u obliku prikladnom za daljnju interpretaciju. Ti su podaci sada dostupni za daljnje studije o geološkoj i klimatološkoj povijesti Marsa.

Predložene metode su implementirane u okruženje programskog paketa SCOP++ DTM, budući da univerzalno razvojno okruženje softvera SCOP++ omogućuje relativno lako proširenje njegove jezgre dodatnim algoritmima.

Pripremio M. Lapaine

Ivana Barišin, magistrica GIS-a

Ivana Barišin obranila je 30. travnja 2003. na Sveučilištu u Ulsteru, Coleraine, UK, magistarski rad *Water quality assessment using Landsat TM imagery* (Procjena kvalitete vode upotrebom snimaka Landsata TM). Mentor je bio dr. Victor Mesev, a član povjerenstva dr. Sally Cook.

Ivana Barišin rođena je 19. kolovoza 1970. u Splitu, gdje je pohađala Matematičko-informatički obrazovni centar. Nakon toga upisuje Geodetski fakultet na Sveučilištu u Zagrebu i diplomira 1996. god. Od 2000. do 2003. na poslijediplomskom je studiju na Sveučilištu u Ulsteru. Taj studij završava obranom magistarskog rada i stječe zvanje *MSc in GIS*. Od 2005. radi na doktorskoj disertaciji *Upotreba optičkih satelitskih snimaka u svrhu izmjere deformacije tla nakon potresa*.

Od kolovoza 1996. do listopada 1999. radila je Geodetskom zavodu u Splitu. Nakon toga odlazi u Sjevernu Irsku i zapošaljava se u tvrtci B.K.S. Surveys. Najprije radi na izradi ortofota i mozaika različitih mjerila snimanja i rezolucija skaniranih snimaka iz zrakoplova. Prošla je obuku za operatera svih modula stanice Z/I, što uključuje ortorektifikaciju, aerotriangulaciju i prikupljanje točaka za DTM poluautomatskim i automatskim načinom. Radila je na geokorekciji skaniranih karata koristeći softver ErdasImagine. Projekti na kojima je surađivala bili su raznovrsni, a među njima je bila i izrada ortofotokarata nekoliko europskih gradova (Bruxelles, Amsterdam, Karlsruhe, Belfast, Dublin). Nekoliko projekata rađeno je za vrlo osjetljiva ekološka područja kao što su Bermudsko otočje s koraljnim grebenima ili zaljev Morecombe u Engleskoj.

Nakon dvije godine provedene u fotogrametrijskom odjelu prelazi u odjel tehničke podrške B.K.S.-a. Tu radi na istraživanju lidara i lidarske tehnologije te nadziranju obrade lidarskih podataka i projekata. Pohađa obuku obrade i filtriranja lidarskih podataka u firmi EarthData u Sjevernoj Karolini. Osim toga, pohađa nekoliko tečaja i seminara firme TerraSolid koja proizvodi softver za filtriranje lidarskih podataka. Pohađa seminar za upotrebu softvera Applanix.

Od svibnja 2004. radi u Oxfordu, U.K., u N.E.R.C.-u (Natural Environment Research Council – Airborne Remote Sensing Facility). Obrađuje različite podatke skupljene instrumentarijem koji nose zrakoplovi N.E.R.C.-

courses in processing and filtering of lidar data in the firm EarthData in North Carolina. Apart from that, she also visited a few courses and seminars of the firm TerraSolid producing the software for filtering the lidar data. She visited the seminar on the application of the software Applanix.

From May 2004 she has been working in Oxford, U.K., in N.E.R.C. (Natural Environment Research Council – Airborne Remote Sensing Facility). She is working on the processing of various data collected by means of the airborne instruments from N.E.R.C. These are hyper spectral cameras Casi and Atm, digital and conventional cameras, lidar and navigation system Applanix. If necessary, she works as an operator in an aeroplane carrying the above-mentioned instruments.

Her Master's thesis was written in English, it contains 133 pages with the A4 format, 41 images, 25 tables, list of abbreviations, abstract, appendix, and the list of references.

The Master's thesis is divided into the following main chapters:

1. Introduction
2. Background
   - 2.1. Landsat TM
   - 2.2. Water Quality Parameters
3. Study Area and Materials
4. Methodology
   - 4.1. Image Processing
   - 4.2. Subset of the image and masking out the land information from an image
   - 4.3. Creating a new vector layer with sample stations represented as points
   - 4.4. Populating vector layers with the field data as attributes of vector layer
   - 4.5. Deriving new raster images
   - 4.6. Extraction of image brightness data for the sampling stations
   - 4.7. Correlation Coefficient Statistics
   - 4.8. Deriving Linear Regression Model and creating maps of distribution for chlorophyll, suspended sediment and Secchi disc depth
   - 4.9. Multiple Regression analysis
   - 4.10. Change Analysis
   - 4.11. Creating Maps using Erdas Imagine module Map Composer
5. Results and Discussion
   - 5.1. GeoReferencing
   - 5.2. Extraction of image brightness data for the sampling stations
   - 5.3. Statistical Analysis
   - 5.4. Change Analysis
6. Conclusion
7. Appendix
8. References

This study reports on the analysis of water quality parameter calibration algorithms using 3 Landsat TM satellite images acquired for the area, and the *in situ* data for the water quality parameters. The water quality parameters determined are Suspended Sediment, Chlorophyll and Secchi Disc Depth. The area investigated was Belfast Lough, Strangford Lough, Larne Lough and parts of the Irish Sea. The objectives of the study were to find the predictive models for the distribution of these water quality parameters, and to investigate the temporal change for those parameters where possible.

Water pollution is one of the major global environment problems. Various human activities such as waste discharge, waste from domestic livestock, sewage outfall and industrial waste causes pollution of lakes, rivers and coastal waters. In order to prevent worsening water quality, continual monitoring is required. Water quality methods have been in practice since the early 1600's with the implementation of the Secchi disc – the measurement of the transparency of water. Concentration of chlorophyll and suspended sediment are two important optically active parameters of coastal water quality.

Total Suspended Sediments (TSS) (mg/l) is a measurement of all abiotic and biotic material suspended in the water column (website). Ritchie et al. stated that TSS affects aquatic systems and their recreational use. Turbidity (NTU- Nephelometric turbidity units) is a measurement of the transmission of light that is affected by the scattering and absorption of light by organic and inorganic particles in the water column. Chlorophyll-a is the primary pigment of all oxygen-producing plants and it is also present in algae.

Many water quality monitoring techniques are time consuming and very costly. The traditional method used to estimate these parameters was *in situ* sampling aboard a ship followed large laboratory measurements. For instance, chlorophyll concentration of surface waters has traditionally been measured spectrometrically after samples were collected, preserved and transported to the laboratory. However, these methods are not able to give an overview of the three parameters suspended sediment, chlorophyll and turbidity because of the limited amount of sites that are sampled. Marine studies are often limited by the inability to collect the synoptic data. Extrapolations of surface sample results to unsampled areas are often inaccurate because significant changes in conditions that can occur over short distances and time period, especially in estuarine and marine environments near deltas. The main weakness is the limitation in the gathering of large spatial and temporal data efficiently in order to assess and monitor the quality of surface water on time. Although, the traditional point sampling methods give accurate measurements they are time consuming and, more importantly, they do not give the spatial overview that is necessary for global assessment and monitoring of water quality as they provide only single point measurements. For instance a patchy distribution of chlorophyll requires a synoptic coverage and makes the sample collections from ship rather unsatisfactory.

a. To su hiperspektralne kamere Casi i Atm, digitalna i konvencionalna kamera, lidar te navigacijski sustav Applanix. Po potrebi radi kao operaterka u zrakoplovu s navedenim instrumentima.

Magistarski rad napisan je na engleskom jeziku, sadrži 133 stranice formata A4, 41 sliku, 25 tablica, popis kratica, popis literature i sažetak.

Rad je podijeljen u sljedeća osnovna poglavlja:

1. Uvod
2. Podloga
   2.1. Landsat TM
   2.2. Parametri kvalitete vode
3. Područje i materijali proučavanja
4. Metodologija
   4.1. Obrada snimaka
   4.2. Podskup snimke i maskiranje informacija o zemljištu
   4.3. Kreiranje novog vektorskog sloja s uzorcima stanica prikazanim točkama
   4.4. Vektorski slojevi s terenskim podacima kao atributima
   4.5. Izvođenje novih rasterskih snimaka
   4.6. Izvlačenje podataka o svjetlini snimka za uzorke stanica
   4.7. Statistika koeficijenta korelacije
   4.8. Izvođenje modela linearne regresije i kreiranje karata raspodjele klorofila, suspendiranog sedimenta i dubina Secchi diska
   4.9. Analiza višestruke regresije
   4.10. Analiza promjene
   4.11. Kreiranje karata upotrebom modula Map Composer programa Erdas Imagine
5. Rezultati i rasprava
   5.1. Georeferenciranje
   5.2. Izvlačenje podataka o svjetlini snimka za uzorke stanica
   5.3. Statistička analiza
   5.4. Analiza promjene
6. Zaključak
7. Dodatak
8. Literatura

U magistarskom radu izvještava se o analizi algoritama za kalibraciju parametara za kvalitetu vode. Upotrijebljena su tri satelitska snimka Landsat TM i podaci dobiveni *in situ* o kvaliteti vode. Parametri kvalitete vode koji su određivani su suspendirani sediment, klorofil i dubina Secchi diska. Područja istraživanja bila su zaljevi Belfast, Strangford i Larne te dijelovi Irskoga mora. Cilj istraživanja bio je pronaći modele predikcije za raspodjelu tih parametara kvalitete vode i istražiti promjenu tih parametara s vremenom tamo gdje to bude moguće.

Onečišćenje voda jedan je od najvećih globalnih problema okoliša. Razne ljudske aktivnosti kao što su odlaganje otpada, otpad životinjskog porijekla, kanalizacija i industrijski otpad uzrokuju onečišćenje jezera, rijeka i obalnih voda. Kako bi se spriječilo daljnje pogoršanje kvalitete vode, potrebno je kontinuirano sustavno praćenje stanja okoliša (monitoring). Metode određivanja kvalitete vode koriste se od početka 17. stoljeća upotrebom Secchijevog diska – mjerenjem prozirnosti vode. Koncentracija klorofila i čestica sedimenta u suspenziji dva su važna optički aktivna čimbenika kvalitete obalnih voda.

Ukupni suspendirani sediment (USS, eng. Total Suspended Sediments – TSS) (mg/l) je količina svih biotičkih i abiotičkih tvari suspendiranih u stupcu vode (web stranica). Ritchie i suradnici su utvrdili da USS utječe na vodene sustave i njihovu upotrebu u rekreacijske svrhe. Zamućenost (NTU – Nephelometric turbidity units) je mjera prijenosa svjetlosti na koju utječu organske i anorganske čestice koje upijaju i raspršuju svjetlost u stupcu vode. Klorofil a je primarni pigment biljaka koje proizvode kisik, a nalazi se i u algama.

Većina metoda monitoringa kvalitete voda zahtijeva puno vremena i financijskih sredstava. Uobičajena metoda koja se koristila za procjenu tih čimbenika bila je *in situ* uzorkovanje sa broda nakon čega bi uslijedila opsežna laboratorijska mjerenja. Na primjer, koncentracija klorofila u površinskim vodama se nakon uzorkovanja, konzerviranja uzoraka i njihovog prijenosa u laboratorij uobičajeno mjerila spektrometrijskim metodama. Međutim, te metode nisu u mogućnosti pružiti prikaz navedena tri čimbenika (suspendirani sediment, klorofil i zamućenost) zbog ograničenog broja lokacija na kojima se uzorci skupljaju. Morska istraživanja su često ograničena nemogućnošću skupljanja sinoptičkih podataka. Ekstrapolacija rezultata dobivenih iz površinskih uzoraka prema neuzorkovanim područjima često je netočna zbog značajnih promjena u uvjetima koji se mogu pojaviti u kratkom vremenskom razdoblju i na kratkim udaljenostima, osobito u estuarskim i morskim staništima u blizini ušća. Glavni nedostatak je ograničenje u učinkovitom skupljanju velikih prostornih i vremenskih podataka kako bi se procjena i praćenje stanja kvalitete površinske vode obavilo pravovremeno. Iako uobičajene metode točkastog uzorkovanja pružaju točne podatke, one zahtjevaju puno vremena i što je bitnije, ne pružaju prostorni prikaz koji je neophodan za globalnu procjenu i monitoring kvalitete vode jer pružaju samo točkaste podatke. Na primjer, fragmentirana rasprostranjenost klorofila zahtjeva sinoptičku pokrivenost i uzrokuje nezadovoljavajuće podatke uzorkovane s broda.

Prema tome, monitoring i procjena kvalitete vode jezera i obalnih voda idealne su primjene daljinskih istraživanja. Multispektralne satelitske snimke su relativno novi instrument u akvatičkim znanostima, a u širokoj primjeni su od 1980-ih godina kada je prostorna razlučivost senzora povećana.

Prednosti upotreba metoda daljinskih istraživanja za procjenu kvalitete voda su pružanje sinoptičke pokrivenosti, financijska isplativost, pravovremenost, mogućnost kvantitativne usporedbe za brojne vodene površine, kao i potreba za pružanjem prostorne i

Therefore, monitoring and assessing the water quality of lakes and coastal waters is an ideal application of remote sensing. Multi-spectral satellite imagery is a relatively new tool in the aquatic sciences, but since the 1980's when the spatial resolution of remote sensing sensors was reduced, many investigators have used it.

The advantage of using remote sensing techniques for water quality assessment is in providing a synoptic coverage, cost effectiveness, timeliness, ability for quantitative comparisons for numerous water bodies, as well as the need to provide a spatial and temporal variability for fast moving waters. Multi-spectral remote sensing techniques have been used to identify or measure numerous water quality parameters.

In the master thesis an empirical statistical method was used in order to find a possible significant relationship between the TM data and the water quality *in situ* data. It was investigated for a linear relationship and a multiple regression relationship. There was some significant correlation between Chlorophyll and the average between band3 and band4 (r = 0.622, at 0.01 level), and between Secchi Disc Depth and Band4 (r = –0.506, at 0.05 level) for the satellite image acquired in 1995; Suspended Sediment and band4 (r = 0.598, slightly lower then 0.05 level) for the satellite image acquired in 2000, and for the satellite image acquired in 2001 there was a significant multiple regression established between Chlorophyll and band1, band2, band3 and band4 (r = 0.931, at 0.01 level). However, it failed to show any significant relationship for the cases of chlorophyll and Secchi Disc Depth for the image acquired in 2000, and sediment for the image acquired in 2001. For the significant relationships, the prediction models were developed for the water quality parameters, and maps of their distribution were created. Finally, the change analysis was performed for two different dates for maps of distribution of chlorophyll in order to try to show the distribution differences over time. This was the only water quality parameter that was possible to perform change analysis, since it was possible to create the maps of distribution for two different dates. Nevertheless, a methodology using the Erdas Imagine software and the SPSS statistical package was proposed in order to achieve this analysis.

Prepared by M. Lapaine

Tomislav Ciceli, MSc in Technical Sciences

Tomislav Ciceli finished postgraduate scientific studies at the Faculty of Geodesy in Zagreb on November 18, 2004 by defending his master thesis titled *Digital Camera Application in Terrestrial Photogrammetry*. Prof. Dr. Teodor Fiedler was his mentor, and Prof. Dr. Božidar Kanajet and Prof. Dr. Milan Bajić were the members of the commission for the evaluation and defence of the thesis.

Tomislav Ciceli was born in Zagreb on 12th September 1972. He attended and finished the primary school in Sesvete. He graduated from the Secondary Technical School *Nikola Tesla* in Zagreb in 1991. In the same year he enrolled the graduate studies of the Faculty of Geodesy, University of Zagreb. He graduated in 1998 by making a diploma thesis titled *Digital Orthophoto Application in Physical Planning*.

At beginning of 1999 he started to work at the Faculty of Geodesy as an assistant at the Institute of Photogrammetry. The same year he became a student on postgraduate studies at the Faculty of Geodesy, in Zagreb, in the field of Photogrammetry and Cartography. In teaching activity he is responsible for exercises in courses of: Introduction to GIS and Remote Sensing and GIS. As a member of Croatian team CROMAC in the period 2001-2003 he was involved in two international projects sponsored by the European Committee: ARC – Airborne Minefield Area Reduction, and SMART – Space and Airborne Mined Reduction Tools. As a lecturer he participated in a student GIS seminar GIS: Grab it this summer, with the theme: Photogrammetry & Remote Sensing, Data Sources in GIS. During 2003 he collaborated in the project *Study on aero triangulation and equalization of block of aero photos* made for the State Geodetic Administration. As a member of the Institute of Photogrammetry he was actively engaged in number of professional projects in the field of aerial and terrestrial photogrammetry. His fields of interest are Photogrammetry and GIS and Remote Sensing. He published several papers as a co-author.

His Master's thesis contains 92 pages of A4 format, an appendix of 5 pages, a reference list, an abstract in Croatian and English, a list of 86 illustrations and 29 tables, and short curriculum vitae of the author. The thesis is divided into eleven chapters, as follows:

1. Introduction
2. Digital Camera
3. Evaluation Criteria for Digital Camera
4. Eyesight and Colours
5. Sensors in Digital Cameras
6. Digital Image Formats
7. Digital Camera Calibration in General
8. Application of Digital Camera in Terrestrial Photogrammetry

vremenske varijabilnosti za tekućice. Multispektralne metode daljinskih istraživanja se upotrebljavaju kako bi se identificirali ili izmjerili brojni čimbenici koji utječu na kvalitetu vode.

U magistarskom radu upotrijebljena je empirijska statistička metoda da bi se pronašao mogući značajan odnos između podataka dobivenih iz satelitskih snimaka i podataka s terena. Tražena je linearna veza i višestruka regresija. Pronađena je značajna korelacija između klorofila i sredine između pojasa 3 i 4 (r = 0.622, uz razinu 0.01), i između dubine Secchi diska i pojasa 4 (r = –0.506, uz razinu 0.05) za satelitske snimke snimljene 1995.; suspendirani sediment i pojas 4 (r = 0.598, malo manje od razine 0.05) za satelitske snimke snimljene 2000., a za satelitske snimke snimljene 2001. bila je ustanovljena značajna višestruka korelacija između klorofila i pojaseva 1, 2, 3 i 4 (r = 0.931, uz razinu 0.01). Međutim, nije pokazan nikakav značajni odnos između klorofila i dubine Secchi diska za snimke snimljene 2000., i sedimenta za snimke iz 2001. Za značajne odnose razvijeni su modeli predikcije za parametre kvalitete vode i kreirane su karte njihove raspodjele. Na kraju, provedena je analiza promjene za dva različita datuma za karte raspodjele klorofila da bi se pokušala prikazati razlika u raspodjeli nastala s vremenom. To je bio jedini parametar kvalitete vode za koji je bilo moguće napraviti analizu promjene, jer je bilo moguće kreirati karte raspodjele za dva različita datuma. Analiza je izvedena upotrebom softvera Erdas Imagine i statističkog paketa SPSS.

Pripremio M. Lapaine

Tomislav Ciceli, magistar tehničkih znanosti

Tomislav Ciceli završio je poslijediplomski znanstveni studij na Geodetskom fakultetu u Zagrebu 18. studenog 2004. obranom magistarskog rada pod naslovom *Primjena digitalne kamere u terestričkoj fotogrametriji*. Rad je izrađen pod mentorstvom prof. dr. sc. Teodora Fiedlera, a u povjerenstvu za ocjenu i obranu rada bili su još prof. dr. sc. Božidar Kanajet i prof. dr. sc. Milan Bajić.

Tomislav Ciceli rođen je 12. rujna 1972. godine u Zagrebu. Osnovnu školu pohađa i završava u Sesvetama. Srednjoškolski obrazovni centar *Nikola Tesla* u Zagrebu završava 1991. Iste se godine upisuje na dodiplomski studij na Geodetskom fakultetu Sveučilišta u Zagrebu. Izradom diplomskog rada iz fotogrametrije pod naslovom *Primjena digitalnog ortofota u prostornom planiranju* 1998. stiče titulu diplomiranog inženjera.

Početkom 1999. godine zapošljava se na Geodetskom fakultetu kao mlađi asistent u Zavodu za fotogrametriju. Iste godine upisuje poslijediplomski studij na Geodetskom fakultetu usmjerenje Fotogrametrija i kartografija. U nastavi je držao vježbe iz sljedećih kolegija: Uvod u GIS, Daljinska istraživanja i GIS. Kao član hrvatskog tima CROMAC u razdoblju od 2001. do 2003. godine sudjeluje na dva međunarodna projekta: ARC – Airborn Minefield Area Reduction, znanstveno-stručni projekt Europske komisije i SMART – Space and Airborn Mined Reduction Tools, također znanstveno-stručni projekt Europske komisije. Kao predavač 2002. sudjeluje na međunarodnom studentskom seminaru o GIS-u: GIS – Grab it this Summer s temom predavanja Photogrammtery & Remote Sensing; data sources in GIS. Tijekom 2003. surađuje na projektu *Studija o aerotriangulaciji i izjednačenju bloka aero-snimaka* izrađenom za potrebe Državne geodetske uprave. Kao djelatnik Zavoda za fotogrametriju Geodetskog fakulteta aktivno je učestvovao u izvedbi raznih stručnih projekata iz područja aero i terestričke fotogrametrije. U dosadašnjem znanstvenom radu bavi se fotogrametrijom, daljinskim istraživanjima i GIS-om. U koautorstvu je objavio nekoliko radova iz tih područja.

Magistarski rad sadrži 92 stranice formata A4, 5 stranica priloga, popis literature od 89 radova, sažetak na hrvatskom i engleskom jeziku, popis 86 slika i 29 tablica, te kratak životopis autora. Rad je podijeljen u jedanaest poglavlja:

1. Uvod
2. Digitalna kamera
3. Kriteriji za procjenu digitalne kamere
4. Vid i boje
5. Senzori u digitalnim kamerama
6. Formati zapisa digitalnih snimki
7. Općenito o kalibraciji kamere
8. Primjena digitalne kamere u terestričkoj fotogrametriji
9. Kalibracija digitalne kamere Fuji FinePix S2 Pro
10. Zaključak
11. Literatura

U uvodu je dan kratak pregled razvoja fotogrametrije s naglaskom na digitalnu fotogrametriju. Navedena je problematika koja se obrađuje u radu i što se radom želi postići.