

# Annual Report 2017

## About EuroSDR

EuroSDR - formerly known as OEEPE - is a not-for-profit organisation linking National Mapping and Cadastral Agencies with Research Institutes and Universities in Europe for the purpose of applied research in spatial data provision, management and delivery. The result is a network of delegates, effectively and practically addressing Europe's spatial data research requirements. EuroSDR also organizes, in collaboration with related organisations, international workshops and courses which address key issues in a timely and focused manner.

## Vision

EuroSDR is the recognised provider of research-based knowledge to a Europe where citizens can readily benefit from geographic information. Our mission is to develop and improve methods, systems and standards for the acquisition, processing, production, maintenance, management, visualization, and dissemination of geographic reference data in support of applications and service delivery.

## Our Member States and their Prime Delegates (2017)

<b>Austria</b>	Michael Franzen	Bundesamt für Eich- und Vermessungswesen
<b>Belgium</b>	Eric Bayers	Institut Géographique National Belgique
<b>Croatia</b>	Ivan Landek	Državna Geodetska Uprava
<b>Cyprus</b>	Andreas Sokratous	Tmima Ktimatologiou Kai Chorometrias
<b>Denmark</b>	Thorben Hansen	Styrelsen for Dataforsyning og Effektivisering
<b>Finland</b>	Juha Hyyppä	Maanmittauslaitos
<b>France</b>	Bénédicte Bucher	Institut Géographique National France
<b>Germany</b>	Hansjörg Kutterer	Bundesamt für Kartographie und Geodäsie
<b>Ireland</b>	Paul Kane	Ordnance Survey Ireland
<b>Norway</b>	Jon Arne Trollvik	Statens Kartverket
<b>Poland</b>	Piotr Woźniak	Główny Geodeta Kraju
<b>Slovenia</b>	Dalibor Radovan	Geodetski Institut Slovenije
<b>Spain</b>	Antonio Arozarena	Instituto Geográfico Nacional
<b>Sweden</b>	Tobias Lindholm	Lantmäteriet
<b>Switzerland</b>	François Golay	École Polytechnique Fédérale de Lausanne
<b>The Netherlands</b>	Jantien Stoter	Technische Universiteit Delft and NL Kadaster
<b>United Kingdom</b>	Sally Cooper	Ordnance Survey Great Britain



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## Message from the President

Eric Bayers



2017 was, as usual, a very intense year for EuroSDR. It's always remarkable to see how much information is exchanged and how much interesting topics are discussed during the Board of Delegates meetings (BOD) and during all the activities organised in the different commissions.

For my part, I will remember from this year:

- that EuroSDR is unique;
- that the trend of the dissolution of our GeoICT niche solutions to more holistic IT solutions is still growing;
- that applications using geodata cover increasingly broad domains;
- that the trend of the evolution of the NMCA role of geodata and geoservices producer towards new roles of geodata and geoservices integrator and broker is widespread;
- that the new vision of the economy related to the fourth revolution, the development of the internet of things, the emerging technologies and the new models for managing and accessing data and information are completely changing our world;
- that EuroSDR must continue to be innovative. User needs evolve and it is therefore important for our association to clearly identify these evolution in order to adapt our research plan;
- that we need to continue to propose good scientific and technical research projects but also take more into consideration other aspects such as the societal and economic aspects.

During this year, I have noticed that EuroSDR is a well-known and much appreciated actor in the world of geographic information. I would like to thank sincerely all persons who have been actively implicated in the organisation and the proceedings of the EuroSDR activities (projects, workshops, classes, EduServ, meetings with the partners, publications) these last months. The quality of an organisation is closely linked to the quality of the persons who are making things happen.

EuroSDR is unique, mainly due to the people who make up this association. Some are coming and some are leaving. I would like to sincerely thank Andy McGill, Kevin Mooney, Malcolm Havercroft and Wolfgang Kresse for all these hours and days dedicated to EuroSDR the last years and I wish you all the best for all your future activities.

I also would like to give a very warm welcome to our new delegates Ivan Landek (Croatia), Željko Bačić (Croatia), Tessa Anderson (Denmark), Paul Kane (Ireland), Audrey Martin (Ireland), Krzysztof Bakula (Poland), Tobias Lindholm (Sweden), Claire Ellul (UK), Sally Cooper (UK), and our new Commission Chair 1, Jon Mills (UK).

In 2017, EuroSDR delegates had the opportunity to participate in two very interesting and very informative BOD organized in Poland (Warsaw) and in Finland (Hanasaari). I would like to thank Piotr Woźniak, Juha Hyypää, Jurkka Tuokko and their team for all the work they have done to welcome us to these BODs. Our 131st BOD on the remarkable site of Hanasaari was unique for several reasons. We have, for the first time, officially welcomed a representative of the industry (Nick Land from ESRI), the « third » pillar of EuroSDR for the future (together with the NMCAs and the academic world). It was also the last BOD for André Streilein to act as Vice-President and for Fabio Remondino to act as Commission Chair 1. I wish great success to Fabio who will become our next Vice-President (from 2018) and above all, I would like to sincerely thank André for his investment as Vice-President for the last 4 years. This function is essential for the smooth operation of EuroSDR and your investment, André, was really impressive in terms of quantity but also and especially in terms of quality.

EuroSDR is a small association that does a lot of great things. I invite you to read this annual report which will describe all these things in detail. Good reading!

## Message from the outgoing and incoming Vice-President

André Streilein & Fabio Remondino



2017 was an intense and prosperous year for EuroSDR. The organisation became noticeable through many practical achievements in an increasing heterogeneous and complex research environment. The ongoing **Rolling Research Plan 2015-2018** defined the framework in which EuroSDR research, development and education activities were performed. Its main purpose is to properly structure the work for the coming years, while leaving enough flexibility to be able to react to unforeseen developments.

The improvements initiated by EuroSDR are achieved by common tests, workshops, cooperation with partner organisations, and the exchange of experiences with other organisations. The main research activities of EuroSDR in this year dealt with

- rapid technical development (ICT, sensors, processes, VGI, RPAS, mobile devices, etc.),
- growing demand for up-to-date spatio-temporal, 3D, multi-scale data and services,
- increasing focus on data integration and quality issues,
- historical data and processes.

Many **projects** have been finalized and new projects have been launched, often based on the open tackled questions from workshops or Board of Delegates Meetings. Since autumn 2013 the National Mapping Agencies of EuroSDR are working together in the EuroSDR 3D Special Interest Group (3D SIG) to a) define and coordinate the long-term 3D research agenda of EuroSDR based on experiences and developments of both research institutes and NMAs; b) carry out research projects on topics of common interest, and c) organise a workshop series on relevant topics. The EuroSDR 3D SIG members meet 2-3 times a year. During 2017 they carried out the research project “Economic Value of 3D Geo-Information for NMAs” jointly with Commission 5. They also worked on common guidelines for 3D mapping at National Mapping Agencies. There is also a joint EuroSDR/GSDI project which focusses on research about how coastal marine communities and NMCAs can work together more effectively where land meets the sea. The project “Crowdsourcing and National Mapping” is already running in its second phase. The use of crowdsourced geographic information by NMCA and the Geomatics Industry is a very current, challenging and topical subject. The project on oblique aerial camera systems was successfully closed with a workshop in Barcelona and a new one on Single Photon Lidar is under investigation. Further projects deal with the potential design and use of a marine spatial data infrastructure or on the accessibility and use of historical data, which are typically archived at NMAs and are especially relevant in the establishment of time series and aspects of monitoring of the natural and man-made environment over a longer period.

Many of the activities, exchange of ideas and opinions, generation of new ideas and projects are performed in **workshops**. It is typical for EuroSDR workshops that these take place as joint events together with other relevant scientific organizations. To mention just a few: “Identifying the Economic Value of 3D Geoinformation (30 - 31 March 2017, Barcelona, Spain) as integral part of the project on the economic value of 3D geoinformation; the second workshop “Crowdsourcing and National Mapping (3 - 4 April 2017, Leuven, Belgium); “Quality Assessment of Geospatial Data: Does It Fit Your Needs?” (9 May 2017, Wageningen, the Netherlands), which dealt with the issue that due to the enormous growth of available spatial data, quality of spatial data is becoming a very important selection criterion to find the most adequate data for the intended use; “High-Resolution Earth Imaging for Geospatial Information - EuroCOW 2017” (6 - 9 June 2017, Hannover, Germany), where sensor calibration, image orientation, object extraction and scene understanding from images and image sequences were discussed as important research topics in Photogrammetry, Remote Sensing, Computer Vision and Geoinformation Science; “Improving the Usability of Geospatial Data” (14 June

2017, Southampton, United Kingdom), where problems were discussed, that providers of geospatial data wish to be able to maximise the use of their data and solve users' problems quickly and the understanding whether a dataset is suitable for an intended use is critical in deciding which dataset to use; "Sustainable Open Data Business Models for NMCAs" (18 - 19 September 2017, Delft, the Netherlands), where the fact was reflected that the concept of open data is gaining momentum as open data are often associated with realizing many government ambitions, such as increased economic value and solving societal problems; "EuroSDR/ISPRS workshop Oblique 2017" (9 - 10 October 2017, Barcelona, Spain), which dealt with the topic of geospatial data automatically generated from imagery, which is currently experiencing a very positive momentum provided by an increasing quality of digital airborne imagery, developments and availability of oblique multi-camera systems. Most of the presentations given in the aforementioned events are available on the EuroSDR website.

In terms of **publications**, there have been many scientific and state-of-the-art papers produced during the year. Amongst these, two official publications of EuroSDR are notable: publication no. 66 "Assessing the Economic Value of 3D Geo-Information" and publication no. 68 "Adapting NMCA Business Models to Open Data"

In terms of **knowledge transfer**, EuroSDR is continuously active in documenting the outcome of their research results and workshop results in their publication series. In addition, this knowledge is disseminated via the Educational Service **EduServ**. The 15<sup>th</sup> series of the EuroSDR Educational Service (EduServ15) continued from March till May 2017. Four two-week e-learning courses were followed by 51 participants. The courses had the following topics: 3D City Modelling (J. Stoter, R. Peters, H. Ledoux); Synthetic Aperture Radar for Mapping Applications (O. Hellwich); Oblique Aerial Camera Systems for Mapping Purposes (F. Remondino, I. Toschi, M. Gerke, F. Nex) and Terrestrial Point Cloud for Forest Modelling (X. Liang, J. Hyypä, Y. Wang). The pre-course seminar was hosted by Jantien Stoter and Ravi Peters from the 3D Geoinformation Research Group of Delft University of Technology on 6th and 7th March 2017. The seminar was attended by 25 participants. Based on the distributed questionnaires, the seminar was positively evaluated regarding both the content of the lectures and the organization. The program of the seminar and a description of the course content are available on the EduServ15 homepage (<http://www.eurosd.net/education/course/eduserv-2017>). Beside the successful EduServ course, a short intensive course in photogrammetry tutored by M. Cramer and N. Haala (University of Stuttgart) was hosted by Ordnance Survey UK from 11th to 13th October 2017 in Southampton. This new EuroSDR's educational activity is currently under evaluation and will probably be offered again in 2018.

Finally, the evaluation commission for the **EuroSDR Award 2017** for the best PhD thesis related to Geoinformation Science awarded the work of Filip Biljecki from TU Delft titled "Level of Detail in 3D City Models".

2017 also witnessed the end of André Streilein in his position of Vice-President of Research and the election of Fabio Remondino as new Vice-President.

In conclusion, the year 2017 was a very productive and successful one for EuroSDR with a lot of new research activities, events and educational courses planned for 2018.

## Interesting examples of real life practices at NMCAs based on results of existing applied research

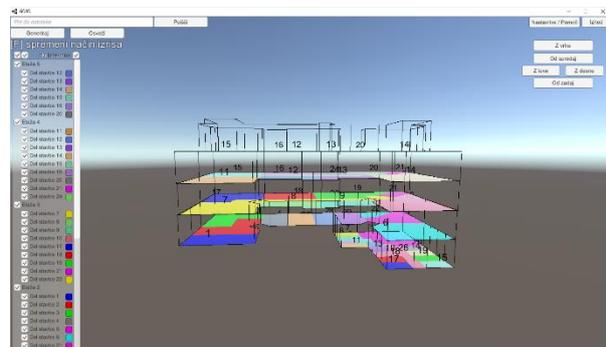
### 1. FLOOR PLANS IN 3D FORM

SURVEYING AND MAPPING AUTHORITY OF THE REPUBLIC OF SLOVENIA (SMA) – TOMAŽ PETEK

Surveying and Mapping Authority of the Republic of Slovenia (SMA) started activities regarding reengineering of real estate records. It is one of the subprojects of the project "e-space". The objectives of the "e-space" umbrella project are the establishment of a common information infrastructure for spatial information in Slovenia, the establishment of a spatial information system and the implementation of information renovation of real estate records. The renovation of real estate records was launched in order to realize the objectives of the project "e-space" and to eliminate the aforementioned shortcomings of the existing system in the country. Information renovation of real estate records is a project that will change the existing way of data exchange with related institutions and authorized geodetic service providers. It will also introduce changes in the existing way of work at the SMA.

#### Vectorization of floor plans

Information renovation of real estate records will enable the management of floor plans in vector form. In the cadastre of buildings, only the data of the ground plan of the building is stored in vector form, while other graphical data - the layout of the floors and parts of the buildings are guided in an analogous or in raster form. The layout plans, which are still kept in an analogue form (on paper), will need to be vectorized. In order to carry out the vectorization of the floor plans, it was necessary to develop the software.



The vectorization will be carried out massively, within the available resources, and individually, within the available time and before each change of data (until all data is in vector form).

The vectorial form of managing the floor plans will allow:

- easier (cheaper) and controlled modification of floor plans;
- 3D display of ownership units within the building - better protection of property for the purpose of more precise definition of the object (part of the building);
- better data quality (3D errors are easier to detect in the floor plan);
- insights (3D display of the building) and a review of the last state of the graphics - parts of the building, plans of individual floors and the building as a whole.

The image below represents the first partial results of the project of vectorization of floor plans which will be completed in 2021.

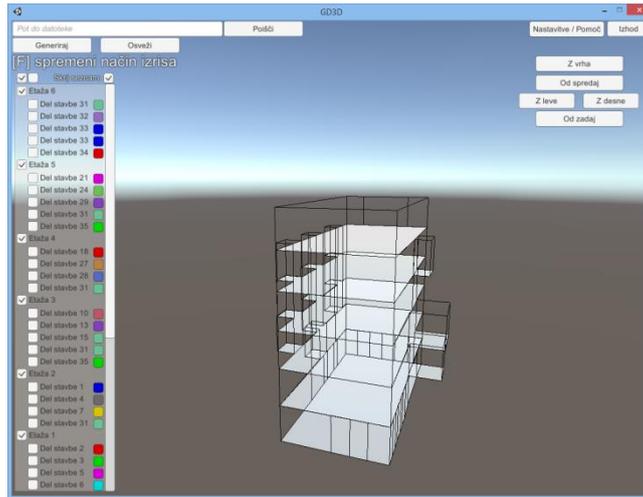


Fig. 1: The first partial results of the project of vectorization of floor plans

The result of the vectorization of scanned floor plans will be the floor plans in vector form and arranged relationships (topology, heights and links to data on buildings and parts of buildings). For the development of GeoVector application Visual Studio 2015 was used, the main project file is located in GeoVector / GeoVector.sln. Next to the file, the GD3D should be a GD3D project.

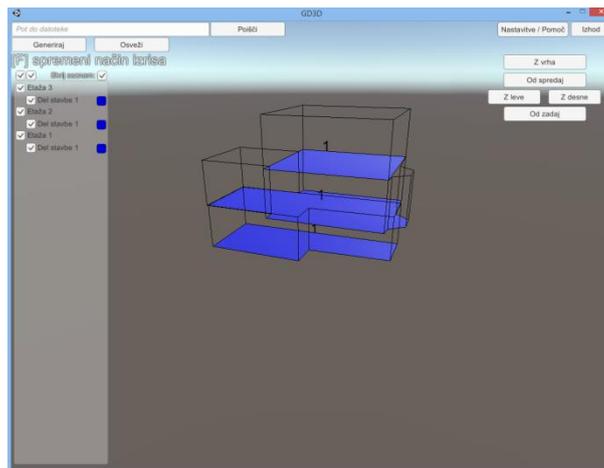


Fig. 2: Floor plans in vector form and arranged relationships

## 2. NEW NATIONAL CHART DATUM AND GEOID AT SEA

GEODETIK INSTITUT SLOVENIJE – UNIVERZA NA LJUBLJANI – FAKULTETA ZA GRAĐEVINARSTVO IN GEODETIKO

Keywords: sea, chart datum, geoid, reference system, Slovenia

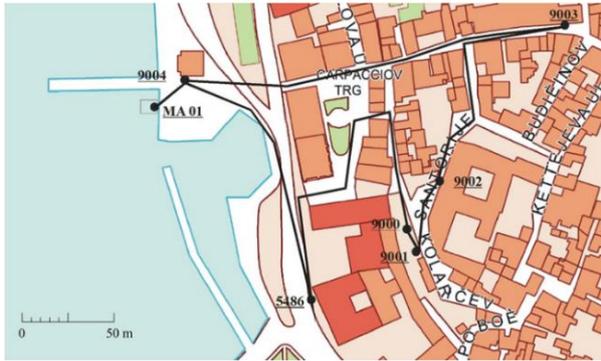
The national chart datum (i.e. hydrographic zero - reference sea level for soundings) is represented by geodetic tie-points, values and surfaces which are crucial for measuring and determining depths of the sea in the selected area. It is connected to the vertical coordinate system on land. Both of them are related to the geoid and ellipsoid models, and the mean sea level (MSL). The chart datum is aimed at ensuring safe navigation, quality nautical charts and official data on the depths of the sea, which are currently based on the old hydrographic zero from the former Yugoslavia. Since the implementation of the new national vertical system on land is in the finalization process, it is also necessary to include maritime part, which will also enable harmonization with neighboring countries, and fulfill obligations to the International Hydrographic Organization (IHO). The environmental reasons for the new chart datum are the increased traffic load at sea, the determination of land use regimes in the coastal zone and the changing depth of the sea due to global warming.

The determination of the geoid model refers to the determination of the vertical difference between the geoid surface and the ellipsoid. The difference between the two is the geoid height or the geoid undulation. In order to calculate the geoid at sea and in the coastal belt, we need several types of data, especially gravimetric, which are homogeneously distributed over the area. On land they can be obtained by surveying the geodetic, levelling and gravimetric points, and at sea by special gravimetric survey from the ship.

The methodology for determining the geoid and the chart datum in the Slovenian sea was prepared, a description of the procedures for their use in hydrographic survey, the design of the data transformation process to the new chart datum and the proposal for its legal definition. Most data are already collected. In 2018, the calculation of the geoid and the realization of a chart datum will follow, which will be in line with the transition of the national geodetic service to a new vertical datum on land at Koper tide gauge.

A scheme was developed in which the geoid model, i.e. mean sea level is associated with the chart datum represented by mean lower low water springs (MLLWS). Levelling, gravimetric and GNSS points at the tide gauge in Koper were also connected. The main instruments in depth sounding are the sonar and the GNSS receiver. At each synchronous measurement of the position and depth, their separate positions on the hydrographic vessel are related to the geoid, ellipsoid, current sea level and seabed surfaces according to the mentioned scheme.

The sea level observation laths in Piran, as well as in Marina Koper and Portorož, were connected to the levelling network. The height differences between these laths and the reference lath at the Koper tide gauge were analyzed in the vertical datums of Bakar 1933 and Koper 2010. On the basis of the 18.6-years tide gauge observations of the national environmental agency, a new chart datum was determined and the difference between the old and the new datum. It was found that the depths of the sea, expressed in terms of a new chart datum, would be only 2 centimeters lower, causing no changes to the depths mapped on the nautical charts.



Figures: Tide gauge in Koper, Adriatic sea – levelling, gravimetric and GNSS permanent station

### 3. LIDAR-BASED ELECTRONIC TERRAIN AND OBSTACLE DATA (ETOD) FOR CIVIL AVIATION GEODETIC INSTITUTE OF SLOVENIA

Keywords: civil aviation, terrain, obstacles, lidar, Slovenia

According to ICAO (International Civil Aviation Organization) requirements, every member state should provide data about terrain and ground obstacles to air navigation in four different areas: Area 1 for the entire country for objects exceeding the height of 100 m, Area 2 for the wider region around each international airport, Area 3 for the airport's inner traffic zone, and Area 4 for the region along the airstrip. Strict standards are applied to obtain every single object which is higher than the prescribed value in a target precision.

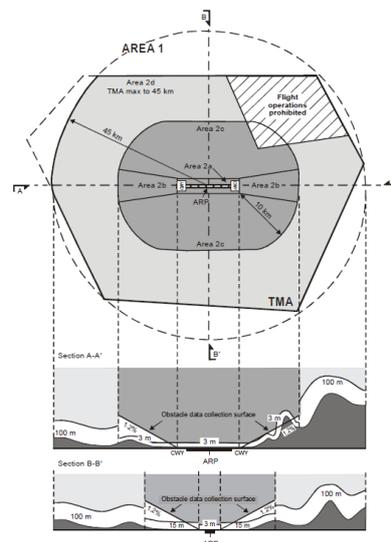
The initial mass obstacle identification in Slovenia was performed using GIS analysis based on nationwide laser scanning (LSS) products. In addition, identification was performed on the basis of national topographic datasets. An interpretation of the type of the obstacle and the determination of attributes was performed. Individual obstacles were photogrammetrically captured based on LSS and/or cyclic aerial survey (CAS), where necessary.

The obstacle data in Slovenia currently cover Areas 1 (green, see figure below) and 2 (yellow, LJU airport) pursuant to ICAO Annex 15. Obstacle data is feature based, captured as three geometrical types: point, line and area, distributed in ESRI shapefile format (\*.shp). For the exchange and publication of obstacle coordinate data, the WGS-84 is used. Taking into account the data sources and methods of acquisition used for capturing obstacles, the estimated horizontal and vertical accuracy is as shown on figures below.

LSS proved as very convenient dataset for eTOD identification and acquisition:

*“Compared to other states, LJU eTOD is among the ones with highest quality so far for us.” - Lufthansa Systems FlightNav AG*

Geometry type	Obstacles
Point	2622
Line	124
Area	919
<b>TOTAL</b>	<b>3665</b>



	LSS source data	PPP source data
<b>Horizontal accuracy</b>	<b>0,5 m (RMSE)</b>	<b>1 m (RMSE)</b>
	<b>1,07 m (90 % confidence level)</b>	<b>2,15 m (90 % confidence level)</b>
<b>Vertical accuracy</b>	<b>0,15 m (RMSE)</b>	<b>1 m (RMSE)</b>
	<b>0,25 m (90 % confidence level)</b>	<b>1,65 m (90 % confidence level)</b>

#### 4. AUTOMATIC EXTRACTION OF POWER LINES FROM AERIAL LIDAR IN THE PNOA-LIDAR PROJECT NATIONAL GEOGRAPHIC INSTITUTE (IGN), SPAIN

The National Geographic Institute of Spain directs and coordinates the PNOA-LiDAR Project. The aim of this project is measuring the whole Spanish territory by an aerial laser scanner (ALS) every 6 years. This project started in 2008 and in 2015 the first national coverage was completed. Currently, the second coverage is being measured. The density of the registered 3D point clouds is around 1 point/m<sup>2</sup>, with a precision of 20 cm in z component.

An automatic methodology to extract height lines from PNOA LIDAR ALS point clouds has been developed. Both power lines and catenary wires are present in urban, forestry and agriculture environment. The knowledge of its location is important, because it is a potential source of forest fires. For this reason it is of great importance to have updated cartography about its location, as well as the forest masses in the surrounding areas.

In the developed methodology a series of geometric variables has been taken into account whose behaviour in the considered land covers has a characteristic response. These variables are combined in a decision tree that allows the separation of those points of the cloud that represent an electrical wiring from the rest of the points of the cloud.

The considered geometric variables are density and roughness. LiDAR intensity is also used as descriptor of power lines. These variables are computed for every single point. Thus, roughness is defined as the distance between every studied point P and the least square best fitting plane comprising P and its neighbour points inside the radius r sphere. It has been observed that land covers that best fit to a flat surface, such as ground or low vegetation, take low roughness values, while power lines take higher values, especially with large neighbourhoods. Density is defined as the number of points contained in a radius r sphere centred in the studied point P. Power lines have a density around 0.05 points/m<sup>3</sup>, much lower than other land covers such as ground or buildings, which reach densities above 0.3 points/m<sup>3</sup>. Both roughness, density and intensity are combined in a decision tree that separate power lines from the rest of the point cloud.

The province of Valencia has been used as test zone and the results have been compared with the National Topographic Database at 1: 25,000 (BTN25) and PNOA orthophotos. This methodology will be used to automatically classify LAS files of PNOA LiDAR Project.

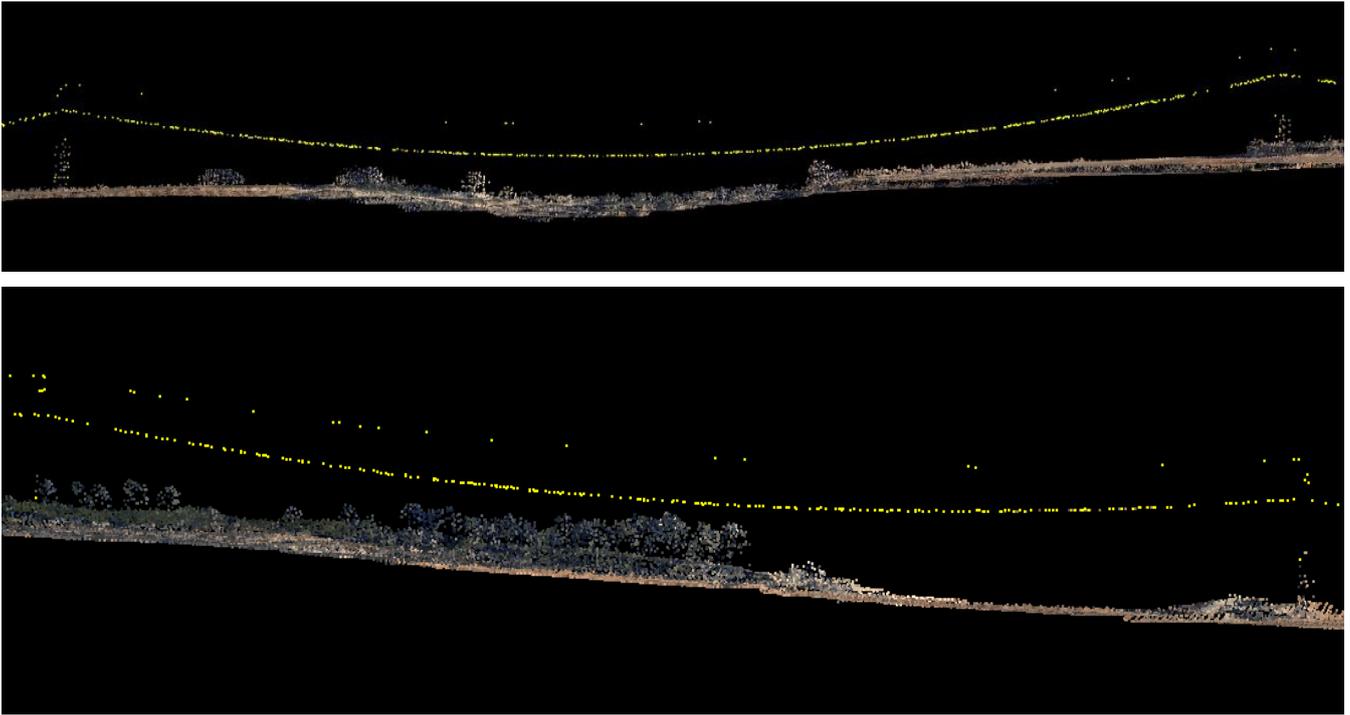
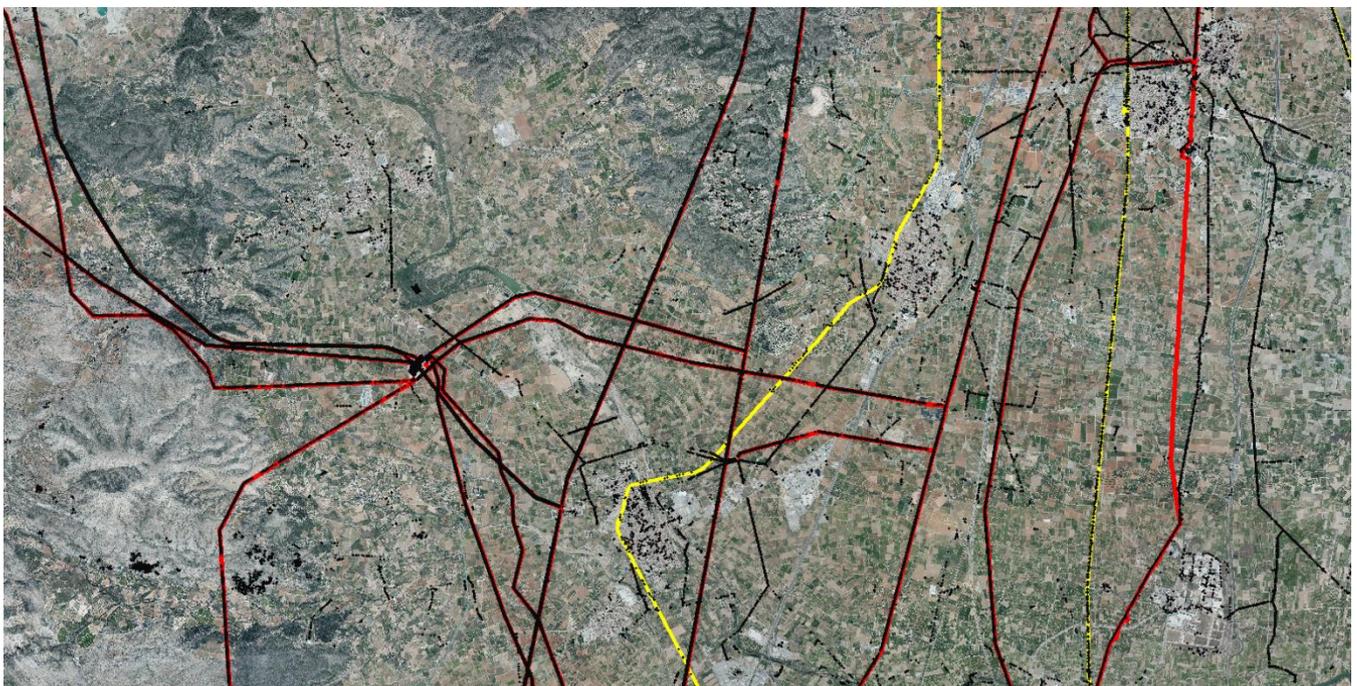


Fig. 1: In yellow, power lines detected in the studied area



- Power lines detected from ALS point clouds
- Power lines in BTN25
- Railway lines in BTN25

Fig. 2: Detail of the results obtained in the province of Valencia. Black lines are the detected power lines from LIDAR files, in yellow and red, the height wiring contained in the National Topographic Database (BTN25)

## 5. TOPPLUS-WEB-OPEN – THE OPEN-SOURCE WEB MAP FEDERAL AGENCY FOR CARTOGRAPHY AND GEODESY, GERMANY

### TopPlus

The method used to create TopPlus was designed and implemented at the Federal Agency for Cartography and Geodesy (BKG) in order to provide maps at various scales for both the web and for print purposes using the available geodata [Kutterer, H., 2015]. All maps within the TopPlus process display a graphically uniform design. They represent not just Germany but also large areas of its surroundings and are more up-to-date than the existing topographic maps. In addition to providing maps in monitor-resolution, it also allows the generation of high resolution raster datasets. Using TopPlus, both good quality prints in poster or presentation formats as well as georeferenced raster data for Geographical Information Systems (GIS) can be produced [Kunz, P. 2014]. Since the creation of TopPlus, it has already been used to create many web maps and high-resolution presentation graphics.

### *TopPlus Product Portfolio*

Since 2012 the BKG has been producing various products of TopPlus to be used within the internal departments of the federal institutions. Parallel to providing monitor-resolution map services, maps in customised map scales and high resolutions (200 lines/cm, 508 dpi) were also created for high-quality prints. At present the product family of TopPlus consists of the following single products:

- TopPlus-Web (Web Map Service for Germany and Europe, UTM32, EPSG:25832)
- TopPlus-World (Web Map Service Global, EPSG:3857)

Presentation graphics in UTM32, EPSG: 25832, for Germany and the neighboring areas are available in the following mapscales:

- TopPlus-P5                      1:5.000
- TopPlus-P10                    1:10.000
- TopPlus-P17.5                 1:17.500
- TopPlus-P25                    1:25.000
- TopPlus-P50                    1:50.000
- TopPlus-P100                 1:100.000
- TopPlus-P250                 1:250.000

Presentation graphics in Lambert Projection (LAEA), EPSG: 3035, for Europe is available in the following mapscale:

- TopPlus-P250-Europa        1:250.000

For the Federal Republic of Germany, these maps are based exclusively on the official data of the State such as the Digital Landscape Model (Basis-DLM), the house footprint dataset (Hausumringe Deutschland HU-DE), the official house coordinates (Hauskoordinaten Deutschland HK-DE) and the Digital Terrain Model 1:10000 (DGM10) for elevation information. There have been restrictions on the use of data and services of the TopPlus for certain applications due to the conditions of official geospatial reference data providers. In particular, this involved the sublicensing and transfer of data to third parties for use outside the internal domain of the authorities. Thus, the use of this data in the federal, state and local authorities was made difficult or even impossible because of these licensing restrictions. This is one of the reasons why the BKG 2017 created the open product TopPlus-Web-Open [URL 3].

### *TopPlus-Web-Open – The Open Map*

With another product of TopPlus, the so-called TopPlus-Web-OpenBKG has, for the first time, provided a web map that is completely based on open or free data sources that can be used without restrictions. The data which has been used within TopPlus-Web-Open are provided mainly from:

- BKG,
- German States with Open Data policy (Hamburg, Berlin, North Rhine-Westphalia and Thuringia),
- OpenStreetMap (OSM), and
- Deutsche Bahn AG (German Rail).

The TopPlus-Web-Open has 18 predefined zoom levels, from the global overview map to detailed city maps in Germany, and is divided into three different presentation areas:

- Worldwide presentation for small scales
- Europe-wide representation down to the mid-scale
- Detailed presentation for Germany and neighboring areas in large scales

The map image of the TopPlus-Web-Open can be viewed in detail in the web application "Maps of the BKG" [URL 4].

The services of the TopPlus-Web-Open were released in September 2017 and were very well received by the public, private and scientific communities. It is presently used as a background map in many portals (Geoportal RLP, LANIS, openrouteservice, ArcGIS Online). The free access and cross-border map display was met with positive responses everywhere. With this project, the BKG illustrates how new products with added value can be created through the combination of various existing open-data services and free sources. This project also illustrates the necessity for an open-data strategy for releasing official datasets. The TopPlus web map is available as an internet service via the standardized Open Geospatial Consortium (OGC) compliant interfaces Web Map Service (WMS) and Web Map Tile Service (WMTS). It can be easily integrated into popular GIS and web map applications such as ArcGIS, QGIS, OpenLayers or Leaflet and can be used on a wide range of devices, from smartphones to desktop PCs. The product is produced in the widespread Web Mercator projection (EPSG: 3857). However, via the WMS interface, the web map can also be presented into other common projections.

The TopPlus-Web-Open is provided under the "Data License Germany - Attribution - Version 2.0" [URL 6] which states that data and documents under this license may be used in any conceivable manner for commercial or non-commercial purposes. The use is temporally and spatially unlimited. The only condition for use is that the name of the providing authority is mentioned. The way in which this "naming" in the case of the TopPlus-Web-Open must be made, is described on the websites of the service center of the BKG [URL 3].

### **Input Data**

In principle, a wide variety of data can be used in the TopPlus process: official geobasis data, georeference data [URL 2] as well as non-official geo-information. When available, only official open source geo-data is used in the TopPlus-Web-Open. In all other cases, free data and OpenStreetMap data are used. The following data are used in the TopPlus-Web-Open [URL 5]:

### Digital Landscape Models

- Digital Landscape Model (Basis-DLM) of Berlin, Hamburg, North Rhine-Westphalia and Thuringia
- OpenStreetMap for all the other states of Germany and for the surrounding countries Digital Landscape Model 1:250.000 (DLM250) Digital Landscape Model 1:1.000.000 (DLM1000)
- EuroGlobalMap (EGM)
- Natural Earth

### Other topographic vector data sources

From the federal states of Berlin, North Rhine-Westphalia and Thuringia:

- Buildings: official building footprints (HU-DE)
- Industries and official buildings, POIS: official 3D-building model (LoD1), House numbers: Official house coordinates (HK-DE)
- Geographic names (GN250)
- Administrative areas 1:250.000 (VG250)
- Official list of national names for use in Germany (Foreign office)
- Land cover CORINE Land Cover; European Environmental Agency (EEA)
- River Kilometrage: Federal Network of Waterways, Federal Waterways and Shipping Administration (WSV)
- Train stations: Deutsche Bahn AG
- Settlements: GeoNames

### Digital Terrain Models

Europe:

- Digital Elevation Model over Europe from the GMES RDA project (EU-DEM)

Global:

- GMTED2010, U.S. Geological Survey
- SRTM15\_PLUS Global Bathymetry, Data: SIO, NOAA, U.S. Navy, NGA, GEBCO

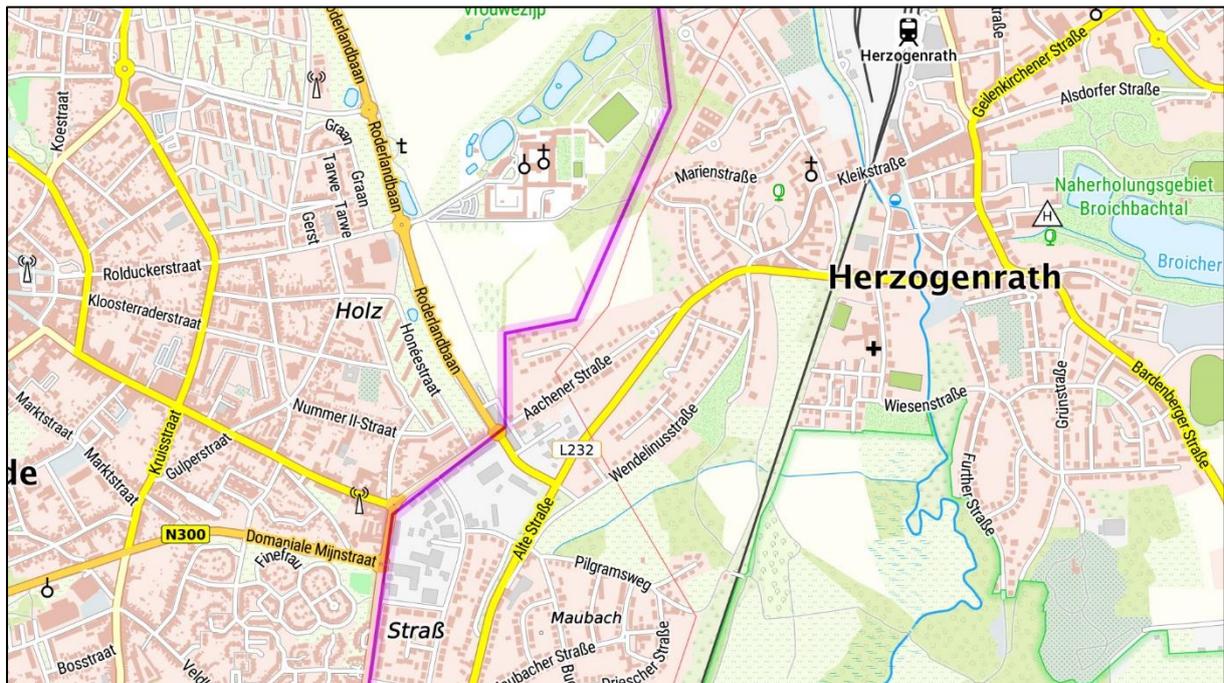


Fig.: TopPlus-Web-Open (Zoom level 15): multi-border view: Basic DLM for North Rhine-Westphalia (right), OpenStreetMap in the Netherlands (left)

## Results and Outlook

BKG has recently signed an agreement with the surveying and cadastral authorities Rhineland-Palatinate, Mecklenburg-Vorpommern and Brandenburg for the use of their geospatial reference information. This agreement allows BKG to use their official data in TopPlus-Web-Open. With the next update in April 2018, in addition to the open data states of North Rhine-Westphalia, Thuringia, Berlin, and Hamburg, the official data of these three states will also be incorporated. However, the whole of Germany can only be represented in TopPlus-Web-Open with complete official data when the other states also sign an agreement such as this one.

In the future, a map-on-demand service for retrieving presentation graphics (raster data, PDF documents) in print quality via the Internet will also be implemented using the print edition supported by the TopPlus process. For this, the desired presentation will be created on the server-end using the original vector data and will then be sent to the client for printing. The data of the European Union's Earth Observation Program Copernicus is also planned to be added to the map displays of the TopPlus process. Preliminary results are already available (e.g. creation of satellite image maps).

The products from the TopPlus process are now being successfully used by many federal institutions. The BKG uses the presentation graphics in high resolution for the production of customized maps. Whether it be for the G7 summit at Schloss Elmau 2015 or the G20 summit in Hamburg 2017 – customized maps were provided by BKG using the TopPlus products for the operational planning of these major events. At the BKG, the procedure is now being used intensively to fulfill the legal mandate for the preparation, updating and provision of location and spatial data.

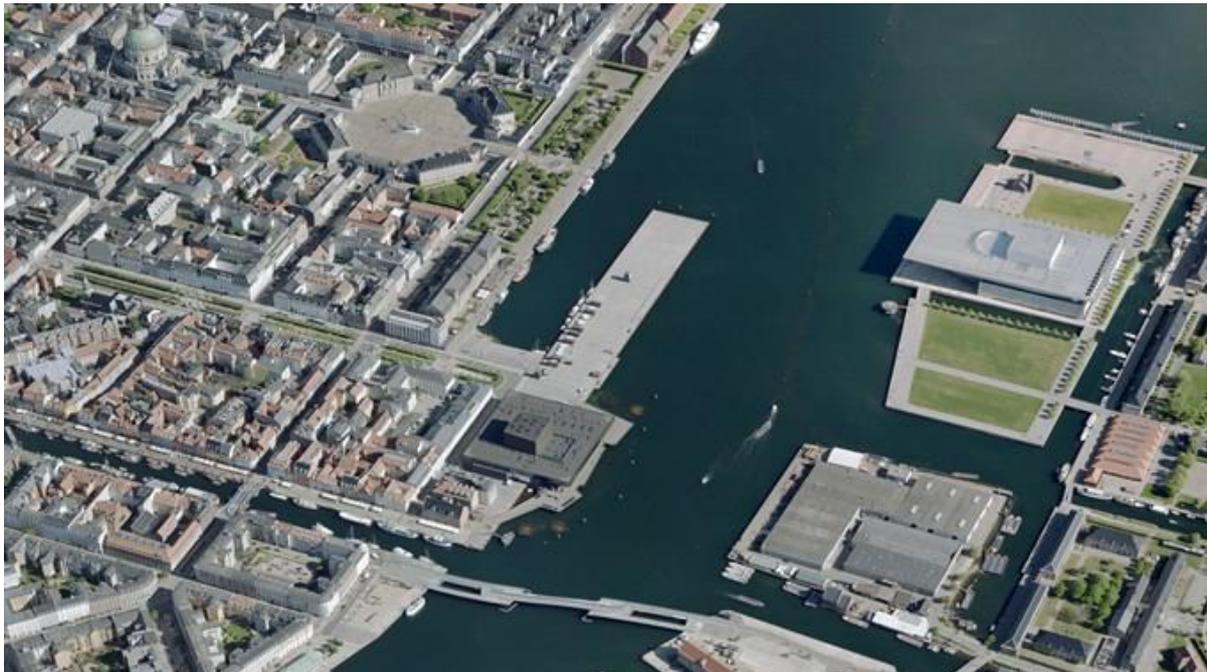
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- KUNZ, P., 2014: TopPlus – von der detaillierten Stadtkarte bis zur europaweiten Übersichtskarte. In: Kartographische Nachrichten 2/2014, 59-67
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### *Websites used - 01/2018*

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- [URL 2] Dienstleistungszentrum des BKG (DLZ): <http://www.geodatenzentrum.de>
- [URL 3] TopPlus-Web-Open (documentation): <http://www.bkg.bund.de/TopPlusOpen>
- [URL 4] TopPlus-Web-Open (Web application):  
[http://sg.geodatenzentrum.de/web\\_bkg\\_webmap/applications/bkgmaps/minimal.html?CRS=EPSG:3857](http://sg.geodatenzentrum.de/web_bkg_webmap/applications/bkgmaps/minimal.html?CRS=EPSG:3857)
- [URL 5] TopPlus-Web-Open (datasources):  
[http://sg.geodatenzentrum.de/web\\_public/Datenquellen\\_TopPlus\\_Open.pdf](http://sg.geodatenzentrum.de/web_public/Datenquellen_TopPlus_Open.pdf)
- [URL 6] Datenlizenz Deutschland – Namensnennung – Version 2.0:  
<https://www.govdata.de/dl-de/by-2-0>

6. NATIONAL COVERAGE OF HIGH-RESOLUTION OBLIQUE IMAGES – WITH FREE AND OPEN ACCESS  
AGENCY FOR DATA SUPPLY AND EFFICIENCY (SDFE), DENMARK



*Fig. 1: Oblique image showing part of Copenhagen with the Royal Palace, the Royal Playhouse and the Royal Opera*

The Danish mapping agency, SDFE, is producing a national coverage of oblique images with 10 cm resolution.

All buildings and other objects are covered by four oblique images with views pointing north, east, south and west plus an image with a nadir view.

The national coverage was recorded in 2017 and consists of 1,3 million images.

The oblique images will be used when considering cases in state and local government in situations where visual inspection is necessary. An important application for this is valuation of land and property for taxation purposes.

The images will be available for free and open viewing on the internet.

Private businesses are expected to develop new business opportunities based on the availability of the images, e.g. rendering of 3D city models. For citizens the images will add a new dimension to their geospatial experience – the screenshot illustration below shows the house in City of Odense, where the writer Hans Christian Andersen was born in 1805.

Private contractors selected via a public tender do the production of images. The groundwork of EuroSDR in the oblique image field provided important knowledge necessary for SDFE to master when defining the requirements for the tendering, requirements that should balance user requirements with the technological maturity level of oblique imaging and the economy involved.

On the dissemination side, no standards are currently available for making oblique images available via web-services. Therefore, viewing will initially be offered in a proprietary environment. SDFE wishes to make the viewing available according to open standards allowing application providers to embed the oblique images in their applications. To achieve that, SDFE is working with EuroSDR and OGC to come up with open standards that can be used for this in the future.

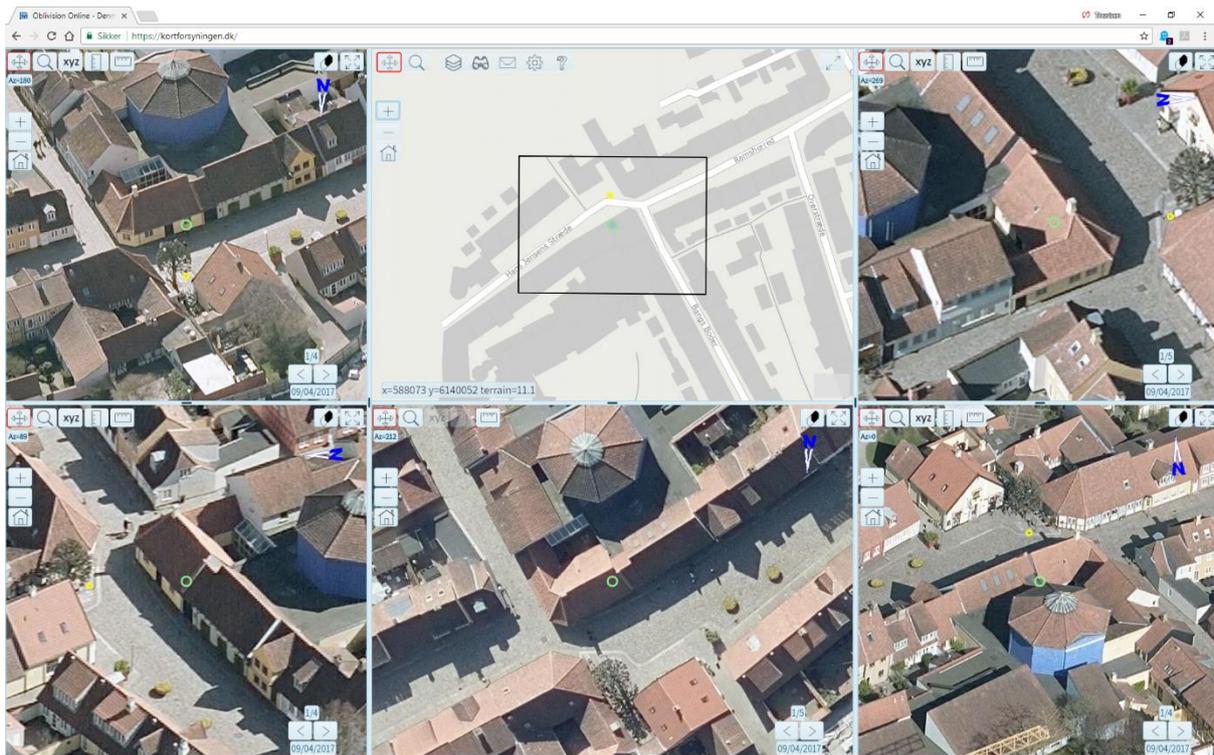


Fig. 2: Web-browser view showing the four oblique views, the nadir view and a map view

## 7. AUTOMATED CHANGE DETECTION

ORDNANCE SURVEY, GREAT BRITAIN – SLAWOMIR BRUSZKOWSKI

As part of a wider programme of work, within the Ordnance Survey (OS) Remote Sensing research department, we are making continuous efforts to automate the identification of change within our topographic data capture flowlines.

We have already developed an automated flowline to identify the most important and valuable changes within urban geographic areas, and now work is being done to expand this automated process to identify all changes which meet our mapping specification within both urban and rural geographies. The aim is to significantly reduce the cost of data capture and increase currency of OS vector data.

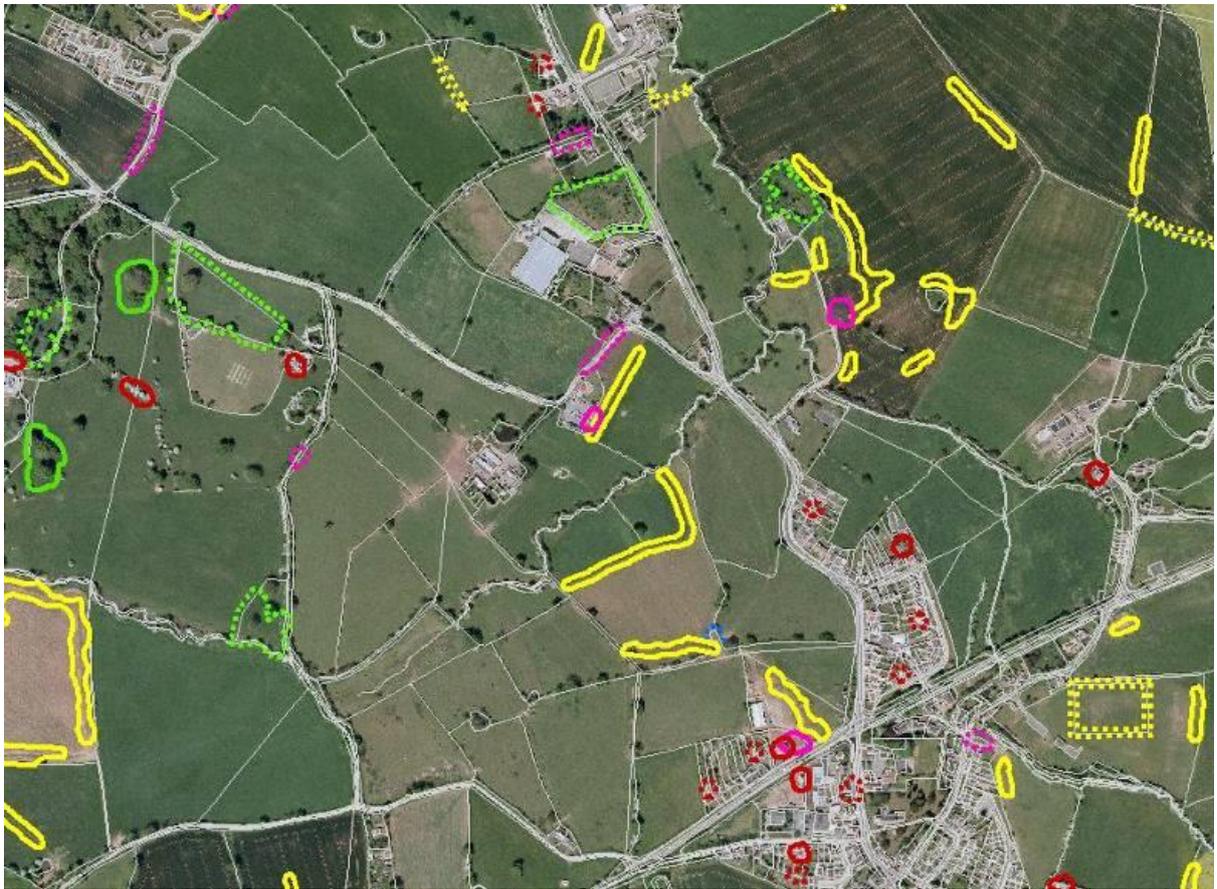
We are using raster to vector change detection techniques, which means that we are classifying 'new' OS aerial imagery and comparing this to 'old' (pre-updated) OS MasterMap® Topography Layer Data. Trimble® eCognition software is used to create an object based, ruleset driven classification derived from Aerial Photography and associated Height Data. The data inputs are 4band (RGBnIR) 25cm GSD orthorectified raster data as well as Digital Surface Model data derived from the same imagery and OS Terrain 5 Digital Terrain Model data. Other layers are also created from the Height datasets (nDSM, Slope).

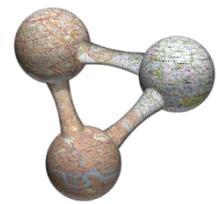
The classification method we have developed is robust and transferable to all of the GB geographies and is sufficient for use as a reference dataset to enable automated change detection.

Comparing classification to pre-existing vector data in post classification change detection process in eCognition flags up predictions of areas that has changed. We propose to use the distribution and density of predicted changes to efficiently identify areas for topographic update (and more importantly, those areas which require no further manual inspection).

Even though some human verification is still necessary, this level of automation increases both efficiency and consistency across the entire flowline.

Below you can find examples of classification as well as change predictions.





## 8. SEMANTIC GEOSPATIAL WEB ORDNANCE SURVEY, IRELAND

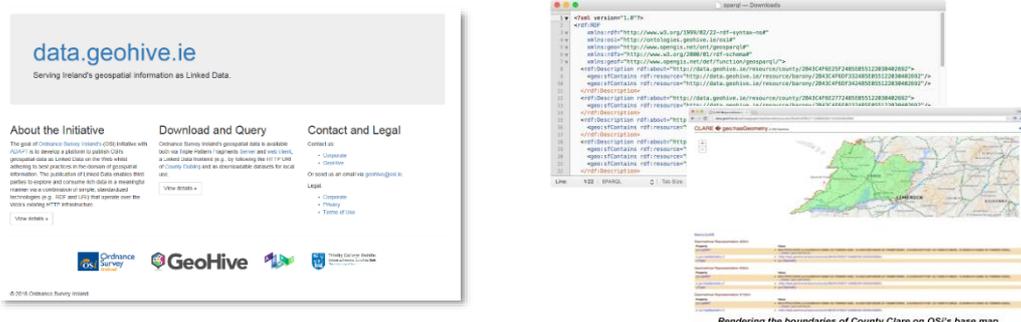
Ordnance Survey Ireland (OSi), Providing the Link between the national authoritative geospatial platform “Prime2” and semantic web. OSi, Ireland’s national mapping agency, aims to adopt Linked Data to enable third parties to explore and consume some of OSi’s authoritative datasets.

In 2014, OSi delivered a newly developed spatial data storage model known as Prime2. With Prime2, OSi moved from a traditional mapcentric model towards an object-oriented model from which various types of mapping and data services can be produced. Prime2 and the associated workflows furthermore incorporated governance practices to cope with evolution of spatial objects in their model. The system currently holds information of over 55,000,000 spatial objects (road segments, buildings, fences, etc.), of which some have more than one geometric representation.

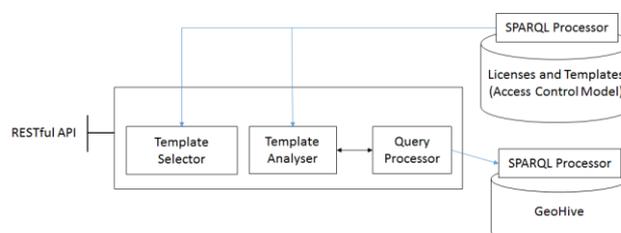
These objects are stored in an Oracle Spatial and Graph database. The OSi furthermore aims to leverage user engagement with their geospatial information (and derived maps), which has a legal weight in Ireland. One of the initiatives they launched is called GeoHive, allowing one easy access to publically available spatial data – but not as Linked Data. Though OpenStreetMap, Google Maps, etc. allow people to easily engage with maps, the information provided by those are i) not always authoritative, and ii) not always correct.

The question that the OSi wanted to answer was: “Can the Prime2 data storage model be used as a basis for publishing OSi’s authoritative geospatial data as Linked Data according to best practices and guidelines on the Web?”

The answer is yes, The OSi’s Linked Data platform is currently live at <http://data.geohive.ie/>. The landing page provides links to the various components and links to several dumps of the data. A Linked Data frontend was set up using Pubby, and the ontologies are following content-negotiation principles by means of URL rewriting rules that considers the requested content type. Maps are rendered whenever a user requests information about the geometries. As of yet, we have chosen not to provide a public SPARQL endpoint and, instead, have set up a Triple Pattern Fragment (TPF). OSi aim to extend the Linked Data frontend to support RDF serialization formats for RDF graphs in the near future.



The next phase of OSi’s linked geospatial data platform will be how to secure the data endpoints for commercially sensitive data but still providing the access and usability of the Semantic Geospatial Web. This will be achieved using the OSi’s Data Access Control Module, publishing Secure URI endpoints OWL/RDFS vocabulary.



## 9. ACQUISITION AND REGULAR UPDATE OF A COUNTRYWIDE DSM BASED ON IMAGE MATCHING FEDERAL OFFICE OF METROLOGY AND SURVEYING (BEV), AUSTRIA

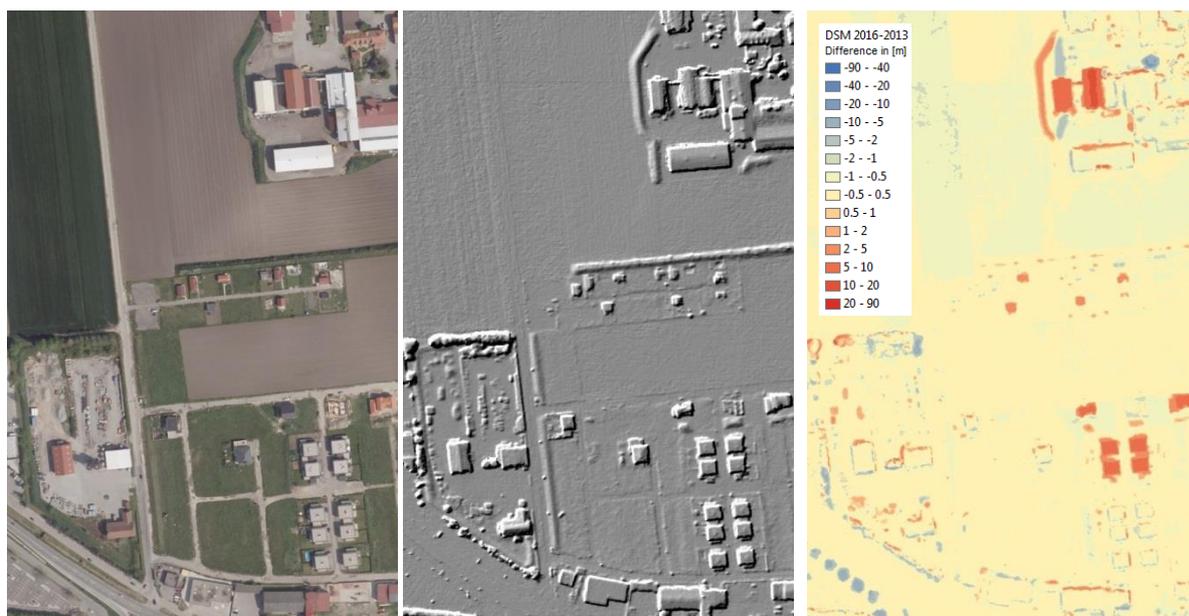
A set of digital aerial images and orthophotos with an update cycle of three years for the whole area of Austria (84 000 square kilometers) is provided by the Federal Office of Metrology and Surveying (Bundesamt für Eich- und Vermessungswesen, BEV) in cooperation with the Ministry of Agriculture and the federal provinces of Austria. Key parameters of this dataset are digital aerial images with a ground sampling distance of 20 centimeters and an overlap of 80% along track and 40% across track.

In order to obtain classified land cover information from the orthophotos additional information about object height is necessary. This was the motivation to start a program to generate a countrywide DSM which is continuously updated in a three year cycle and coordinated with the land cover classification program. There were two main arguments for choosing image matching instead of laser scanning for data acquisition:

1. Landscape can change rapidly, so it is crucial that DSM and image data are recorded at the same time.
2. No other additional information is needed, thus lower costs.

Based on studies which were presented in EuroSDR workshops on High Density Image Matching (2012, 2013) and on the experiences of other EuroSDR members (e.g. Department of Geodesy and Geoinformation at TU-Vienna) a workflow for DSM generation was designed. BEV chose Match-T DSM from Trimble/Inpho with an adapted method by using single image pairs for matching and final gridding and fusion. The advantage to the direct matching method of MATCH-T DSM, which uses only one image pair for surface point detection, is to benefit from high image overlap (80/40). Due to higher redundancy the results were better in terms of accuracy, reliability and completeness.

A countrywide DSM with 0.50 meter grid distance is now available after finishing the first three year cycle from 2013 to 2015. Based on data of the second cycle investigations are carried out how differences between DSM generations can be used for change detection. We expect that this new dataset will be valuable to other processes, .e.g. land cover classification and change detection.



Figures: Orthophoto 2016, DSM shading 2016, DSM differences 2016 – 2013. The difference map shows new buildings (large red areas), removed trees (blue circular areas, LL corner) and a relocated earth wall (UR corner)

## 10. GUGIK'S CONTRIBUTION TO EUROSDR

HEAD OFFICE OF GEODESY AND CARTOGRAPHY (GUGIK), POLAND

As a member of the EuroSDR Association, Head Office of Geodesy and Cartography (GUGiK) is getting substantive support from specialists from other Member States. Based on their experience and the results of projects and analyses carried out by the Association, GUGiK conducts a series of activities aimed at building reference databases for the entire country. One of the main tasks, carried out continuously, is the ongoing development and constant updating of the high resolution DTM (1m GRID) and DSM (1m GRID outside the cities, 0.5m GRID in the cities) based on ALS technology. This product is based on ALS point cloud of 12 points per square meter density in cities and 4 points per square meter outside the cities. At present, these products are prepared for an area of 310 014 square kilometers and completion of the entire country coverage (area of 312 679 square kilometers) is planned in 2018. At the same time, GUGiK updates ALS data and resulting DTM and DSM for selected urban areas with the highest dynamics of changes. This data is the most frequently used product of the National Geodetic and Cartographic Resource.

Thanks to GuGik's membership of the EuroSDR Association and to national consultations, GUGiK had the opportunity to get to know the user's needs and trends in development of spatial databases observed in Europe. Furthermore, based on the collected experience, GUGiK has undertaken steps allowing production of 3D buildings models for the whole country. Participation in the works of SIG3D is in this context crucial for good practice and knowledge exchange, especially in elaboration of 3D buildings models, in order to secure high utilization, timeliness and usability of this product in Poland. Based on the experience gathered by other European countries, GUGiK decided to develop 3D buildings models based on the central topographic database and ALS data. Two contracts for the elaboration of buildings models have been signed and the first data sets have already been submitted for inspection. Moreover, in order to maintain timeliness of developed data, GUGiK is taking steps to prepare the process of updating the data at the central level. Effective use of these data sets by stakeholders is crucial, so it is planned to implement a set of automatic update mechanisms guaranteeing high quality and timeliness of data.



*Fig.: Scrap of 3D Building Models data set of Zamość*

As a member of the EuroSDR Association, GUGiK had the pleasure to organize the 130th EuroSDR Board of Delegates meeting. During 3 days, the participants took part in two science sessions where they could familiarize themselves with geospatial information production, research, innovation and education activities in Poland.

## 11. OPEN INNOVATION THROUGH IGN<sup>FAB</sup>

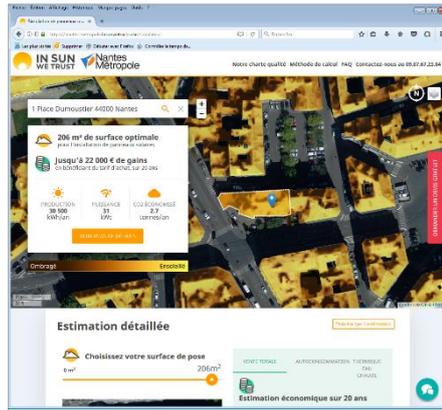
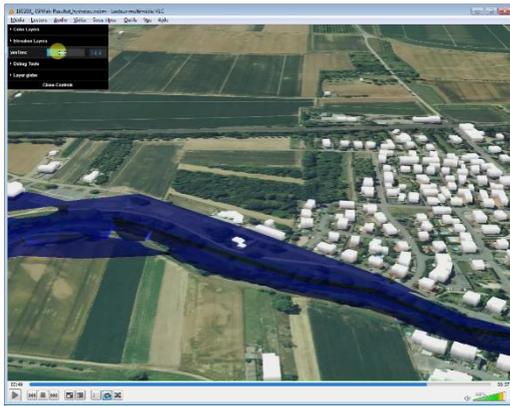
NATIONAL GEOGRAPHIC INSTITUTE (IGN), FRANCE – NICOLAS LAMBERT

Open innovation is central to IGN's strategy, and its business incubator *IGNfab* is a good example of this. *IGNfab* is an acceleration programme for digital services projects owned by SMEs and start-ups. Its main principle is that IGN provides a support through co-development: unlike traditional business incubators, it provides neither permanent hosting of companies nor funding. 2017 has been a year of maturity for *IGNfab* and this article describes its genesis.

Back in 2014, IGN sought complementarity with numerous emerging organisations supporting innovation in France such as business clusters, incubators, local/regional development agencies, the French Tech network, etc. and in particular Cap Digital, a digital business cluster that includes about 900 SMEs and is used to dealing with relationships between SMEs, academics and big companies. *IGNfab* was designed to answer to both IGN's wills and SMEs' remaining needs in this landscape. On IGN's side, there was a strong willingness for openness in order to accelerate the pace of innovation, cope with a fast-moving context and accompany the development of innovative usages of IGN's data through digital services. In a mid-term perspective, IGN is also striving to federate a network of innovative businesses which will use its data and services. On SMEs' side, there was a need for support to access reliable data and technical expertise to exploit them, to access the market and to funding.

*IGNfab* (<http://ignfab.ign.fr>) offers start-ups and SMEs a range of skills in order to help them go from an idea to the market. This support can take many forms. First, IGN provides start-ups with a large access to its data, services, homemade software and hardware. IGN can also provide technical expertise through IT development, but also specific expertise, capacity building, etc. *IGNfab* also provides a workspace dedicated to co-development activities with SMEs. A development platform was set up to this end. In addition, IGN offers an access to a network of potential partners. This network is composed of IGN's traditional institutional partners (ministries, local authorities, etc.), members of the innovation community mentioned above and other public bodies with a complementary expertise in areas such as climate, environment, agriculture, transport, etc. In connection with such partners, an "IGN labelling" on their services can be very useful for SMEs. Everything is free for the start-up during the development phase. Then for the operational phase, a case by case pricing policy is adopted for the data that is not already open suitable for the business model of the start-up: most of the time, the start-up does not earn money in the first years.

Start-up projects are selected through thematic calls for proposals upon criteria such as the innovation dimension (not only technological), the market potential and the technical feasibility at short to medium term. Since the beginning in 2014, 4 calls for proposals were launched on urban and land planning, climate change and risk prevention, tourism and outdoor activities and, for the last call, the city of tomorrow with a focus on energy and mobility issues. 106 Proposals were submitted in total among which 20 projects have been selected. Examples of projects resulting from the *IGNfab* process are mentioned hereafter. 'In Sun We Trust' has developed an Internet platform aiming at providing easy access to photovoltaic energy for citizens through a sharp and instantaneous evaluation of their rooftops' potential (<https://nantes-metropole.insunwetrust.solar/>). Delair-Tech has industrialized the ultralight camera developed by IGN, (Souchon and Meynard 2017), and will integrate it on their UAV (<http://delair.aero/>). 'Open Forêt' proposes an Internet platform connecting logging companies and the millions of small forest owners through detailed and accurate information on wood resource locations (<https://openforet.com/>). Hydratec connects its modelling tools applied to hydrology and hydraulics on an open platform based on iTowns, an open source solution for immersive user navigation, co-developed by IGN (Devaux 2017), aiming at improving real time flood forecasting (cf. <http://hydra-software.net/>).



Figures: Visuals from hydratec and from InSunWeTrust

The communication process is very important, not only to inform the SMEs of the launch of a call for proposals but also the data and services already available in IGN and relevant for a specific thematic. This may give ideas on which the start-up could build their own services. Some events called “Happy hours” are organised to this end.

In terms of impacts for start-ups, the support of *IGNfab* brings a real acceleration of their projects and leads to the creation of business and employment. For IGN, in addition to enhancing its data and technologies (including valorising results from R&D), *IGNfab* contributes to the qualification of IGN’s data in an operational context and, under the pressure of SMEs, accelerates the development of some products.

An important lesson learned is a huge need for available and harmonised data at European level: almost all the start-ups accelerated by *IGNfab* are willing to expand their product(s) or service(s) very soon at European level (at least). In this regard, Inspire, which harmonises data *structure*, and the EuroGeographics European Location Services (ELS) platform, which is developing a unique access point to Inspire reference data of many countries, may help SMEs to transpose their product(s) or service(s) in such countries (<http://www.eurogeographics.org/content/european-location-services>). Beyond, start-ups need reference data *content* to be harmonised at European level e.g. core data.

*IGNfab* also includes an internal part meant for prototyping internal IGN projects in order to accelerate the innovation process at IGN. When an idea of new products or services emerges from IGN’s staff, its potential value and feasibility are assessed. If the idea is selected, there may be a technological obstacle to overcome to implement it. Then a small project is quickly set up mobilizing *IGNfab*’s team and 1 or 2 developers when needed, and in a very short period (generally less than 3 months) a prototype is developed. Depending on the results (response to the need, cost of production, etc.), the management then takes the decision to industrialize the solution or not.

Devaux, A., 2017, iTowns: an open source project connected to a research platform for continuous innovation, EuroSDR Annual Report 2016

Suchon, J.-P., Meynard, C., 2017, A new ultra-light and high resolution digital camera for photogrammetry, EuroSDR Annual Report 2016

## 12. THE MAPMUXING RESEARCH PROJECT: MULTIPLEXING CARTOGRAPHIC REPRESENTATIONS NATIONAL GEOGRAPHIC INSTITUTE (IGN), FRANCE – GUILLAUME TOUYA

MapMuxing<sup>1</sup> is a collaborative research project aiming at the design of cartographic multiplexing techniques. The project is led by the COGIT team from LaSTIG lab at IGN France and gathers computer scientists (INRIA Saclay) and geographers (Montpellier University). It is funded by the French national research agency (ANR-14-CE24-0011-01) for 42 months (2014-2018).

Geoportals enable the navigation between multiple cartographic representations: maps at different scales, with different styles, aerial imagery, etc. It is often complex for a user to keep focus during this navigation, to understand how the map element he was looking at in the initial representation has changed in the new representation. This phenomenon is well-known in the domain of human-computer interaction as ‘desert fog’. The MapMuxing project aims at the joint design of human-computer interactions and cartographic techniques to soften this desert fog whether the display is a standard computer screen, a small device, or even a wall-sized device (Figure 1).



*Fig. 1: A ‘Drag-Mag’ interface on a wall-sized screen to show specific zoomed representations while still displaying a large context map*

The main innovation proposed by IGN researchers in the project is the concept of cartographic continuums between two representations of an existing geoportal, i.e. two maps at different zoom levels, two maps with different styles, two maps at different dates, or even a map and aerial imagery. The continuums are composed of a discrete number of intermediate representations that are both standalone legible maps and progressive transitions from one side to the other on the continuum. For instance, Figure 2 shows a scale continuum between existing maps at the 1:25K and the 1:100K, where three intermediate maps were added by a progressive automated map generalization process. The project proposed good practices and tools to derive the continuums from existing maps.

The other main outcome of the project relates to user evaluation of the navigation based on this continuum. The complexity of maps makes the control of the experiment biases complex, for instance, the efficiency of a continuum based on a progressive road generalization for wayfinding tasks. We should be able to control the contribution of other items to the navigation, like labels that are present on both the initial and on the final representations and that are used for the particular task of the assessment.

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<sup>1</sup> <http://mapmuxing.ign.fr>

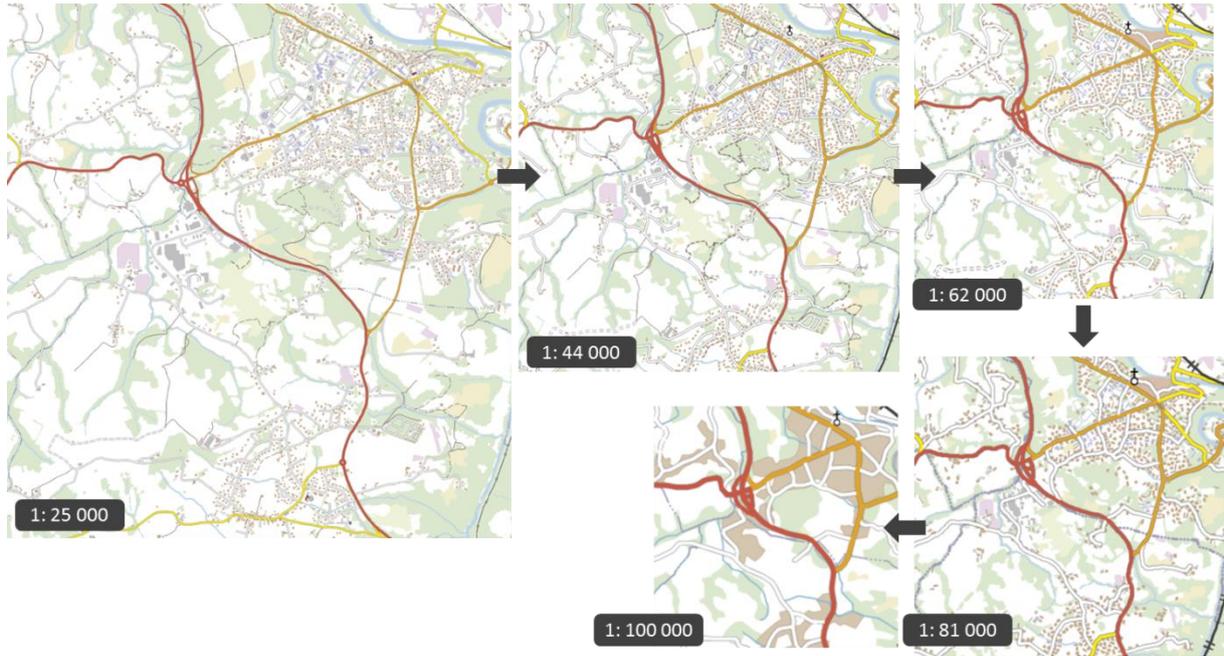


Fig. 2: Three intermediate maps are added between 1:25k and 1:100k maps by progressive map generalization

## Report by the Secretary-General

Joep Crompvoets

2017, the year that EuroSDR/OEEPE exists for 64 years. This report reviews the annual Board of Delegates meetings happening in the framework of EuroSDR in 2017, the activities related to our partner associations, and some logistics.



### Meetings

The 130<sup>th</sup> EuroSDR Board of Delegates meetings took place in Warsaw (Poland) from 31 May until 2 June 2017. These meetings were hosted by Piotr Woźniak (GuGik). 38 persons from 19 countries joined the events. The 130<sup>th</sup> Board of Delegates meetings started with an overview of excellent examples of Geographical Information research, education and professional activities in Poland. The highlights of the meetings were 1) the keynote presentation “Innovative Research at École Polytechnique Fédérale de Lausanne” by François Golay and 2) the presentation about POLKEN (Policy Knowledge Exchange Network of EuroGeographics) by Dominik Kopczewski. François Golay presented some relevant research issues at EPFL’s GIS Research Lab (LASIG) and beyond, e.g. designing effective spatial databases and data infrastructures as an exploration basis and identifying and documenting spatial data that may serve as decision criteria (spatial indicators). The keynote presentation of Dominik Kopczewski focused on EuroGeographics as an organization (goals, membership, activities, products, projects and KENs), the Policy Knowledge Exchange Network and their challenges. The topics of the breakout sessions were “Innovative Research” and “Good practices for EuroSDR projects”. An important decision was the appointment of Fabio Remondino as the new Vice-President of EuroSDR. He succeeded André Streilein as from the end of BoD 131 in Hanasaari, Finland.



*Fig. 1: Group photo at the 130<sup>th</sup> Board of Delegates meeting in Warsaw, Poland*



*Fig. 2: Retiring directors Wolfgang Kresse, Malcolm Havercroft, Kevin Mooney and Andy McGill*



*Fig. 3: Keynote presentation by François Golay*



*Fig. 4: Presentation by Petr Dvořáček*

The 131<sup>st</sup> EuroSDR Board of Delegates meetings took place at the Hanasaari/Hanaholmen Conference Hotel from 18 until 20 October 2017 and was hosted by Juha Hyyppä from the National Land Survey of Finland (Finnish Geospatial Research Institute). 38 persons from 19 countries attended the meetings which started with an excellent overview of relevant innovations happening in Finland at the Finnish mapping agency (NLS), companies and research institutes. The highlights of the meeting were the keynote presentation about ONERA research in optical remote sensing given by Yannick Boucher (ONERA), the presentation of the winner of the EuroSDR Award 2017 titled “Level of Detail in 3D City Models” (Filip Biljecki, Delft University of Technology & National University of Singapore), and the presentation about Esri (by Nick Land). Esri became Associate Member of EuroSDR as from this Board of Delegates meeting. The topic of the breakout session was “Alternative sources for NMCAs data”.

As decided during the 130th Board of Delegates meeting in Warsaw, Fabio Remondino would succeed André Streilein as from the end of the 131st Board of Delegates meeting in Finland. Fabio’s successor of Commission 1, Jon Mills, was elected at this meeting as well, while André officially became Prime Delegate of Switzerland. He replaced François Golay, who became Second Delegate of Switzerland. Jon Arne Trollvik was re-appointed as Commission Chair 3 during BoD 131. This will be his third and last term as Commission Chair 3. As from BoD 131, Ivan Landek is Prime Delegate of Croatia. He succeeds Danko Markovinović. The delegates also appointed Željko Bačić as Second Delegate of Croatia. Tessa Anderson has been appointed as Second Delegate of Denmark, replacing Per Knudsen. Since 2014, the delegates explored several possibilities for continuing the Italian membership, but they did not succeed in finding an organisation who could represent Italy. EuroSDR therefore decided to end the Italian EuroSDR membership during BoD 131.



Fig. 5: Group photo at the 131<sup>st</sup> Board of Delegates meeting in Hanasaari (Helsinki), Finland



Fig. 6: Some impressions

In preparation for these two Board of Delegates meetings, the Executive Team met at Delft University of Technology (6-7 March 2017, Delft, the Netherlands) and Charles University Prague (21-22 August 2017, Prague, Czech Republic).

### Partnerships

In 2017, EuroSDR continued collaborating with its key partner associations, e.g. EuroGeographics, Association of Geographic Information Laboratories for Europe (AGILE), Open Geospatial Consortium (OGC), International Society for Photogrammetry and Remote Sensing (ISPRS), Council of European Geodetic Surveyors (CLGE) and International Cartographic Association (ICA).

Some examples indicating our successful collaborations with our partner associations are the following:

- Contribution to the 2<sup>nd</sup> international workshop on Spatial Data Quality in Malta (6 - 7 February 2017)
- Participation to the General Assembly of CLGE in Lausanne (Switzerland) on 21 and 22 April 2017
- Attendance to the Extraordinary General Assembly of EuroGeographics at the Leuven Institute for Ireland in Leuven (Belgium, 9 - 10 May 2017)
- Attendance to the pre-conference workshop of the 20<sup>th</sup> AGILE International Conference on Geographic Information Science (Wageningen, the Netherlands, 9 – 12 May 2017)
- Support for ISPRS – EuroCOW workshop ‘High-Resolution Earth Imaging for Geospatial Information’ (Hannover, Germany, 6 - 9 June 2017)
- Attendance to the UN-GGIM Europe meeting in Brussels (Belgium) on 7 - 8 June 2017

- Co-organization of the EuroGeographics Quality KEN 'Improving the Usability of Geospatial Data' workshop (Ordnance Survey, Southampton, United Kingdom, 14 June 2017)
- Co-organisation (with EuroGeographics and Geonovum) of the INSPIRE workshop 'Profile and extension' (Marne-la-Vallée, France, 20 - 21 June 2017)
- Attendance to the General Assembly of EuroGeographics in Vienna (Austria, 1 - 3 October 2017)
- Co-organisation of the second ISPRS – EuroSDR workshop 'Oblique Aerial Cameras' (ICGC, Barcelona, Spain, 9 - 10 October 2017)
- POLKEN (EuroGeographics) supports the follow-up activities of the EuroSDR project on Sustainable Open Data Business Models
- Presentation on Education at the General Assembly of CLGE (Potsdam, Germany, 29 September 2017)

### **Logistics**

Regarding the associated logistics, the Secretariat was among others strongly involved in preparing the meetings, processing the meetings' minutes, decisions and actions, registering for EuroSDR events (e.g. workshops, EduServ), editing the annual report, financial accounting, auditing, managing websites, etc.

On behalf of the Secretariat, I would like to express that we really look forward to continue cooperating with our members, Commission Chairs, President, Vice-President, representatives of our partner associations and those that are simply interested in the activities of EuroSDR in the (near) future.

## Commission I: Data Acquisition

Fabio Remondino & Jon Mills

*Mission: To explore, test and validate platforms, sensors and algorithms to acquire geospatial data, with emphasis on accuracy, reliability and standardization of data processing procedures.*



In 2017 EuroSDR Commission I finalized its activity on **oblique aerial imagery**. Oblique aerial cameras and imagery have become one of the most significant recent developments in the photogrammetric field, a great source of geo-information and a powerful mapping solution. Oblique airborne multi-camera systems (Vexcel Osprey, Leica CityMapper, IGI Pentacam, Midas Octoblisque, WaldoAir XCAM Ultra, etc.) are now an established sensor technology across a growing geospatial market, as a complementary data source to the traditional near-vertical sensors. Some NMCA's have already adopted this technology for mapping urban areas in a more efficient manner while, on the processing side, software solutions are still lagging and present space for improvements.

The ISPRS/EuroSDR "Multi-platform Photogrammetry" dataset was fully released with all images and ground truth data ([http://www2.isprs.org/commissions/comm1/icwg15b/benchmark\\_main.html](http://www2.isprs.org/commissions/comm1/icwg15b/benchmark_main.html)).

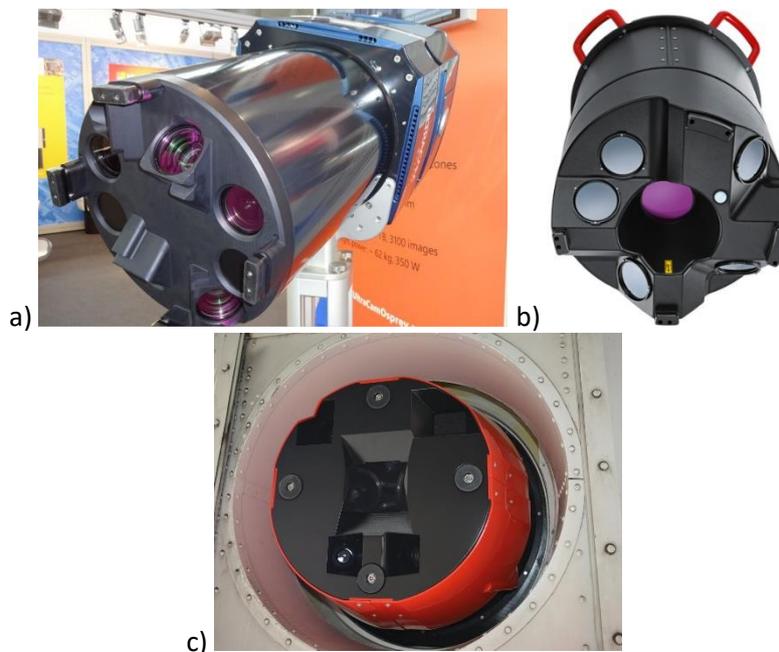


Fig. 1: Examples of oblique aerial cameras: Vexcel Ultracam Osprey (a), Leica CityMapper (b), IGI UrbanMapper (c)

In April the EduServ course on Oblique Aerial Cameras attracted some 30 participants. The course included theoretical aspects (history of oblique systems, actual cameras, recap of photogrammetric image triangulation and DSM generation, etc.), as well as practical experience (image triangulation, dense image matching, orthophoto production, etc.). The course was positively evaluated and will be repeated in Spring 2018.



Fig. 2: Group photo taken at the EuroSDR Oblique Aerial Camera workshop in Barcelona, October 2017

In October, the 2<sup>nd</sup> workshop on “Oblique Aerial Cameras” was held in Barcelona, Spain. 50 participants had the opportunity to listen to 15 oral presentations, presented by mapping companies, R&D organizations and NMCAs, discuss open issues, opportunities and future trends of oblique camera systems, as well as to see demonstrations and mockups.

An activity on “New LiDAR Sensors” is under discussion in order to better understand, explore and report developments in Single-Photon / Geiger-Mode technology. Several sensor and data providers (e.g. Harris, AGERpoint, IntelliEarth, Sigma Space, Leica Geosystems, LeddarTech, etc.) are actively promoting this new acquisition methodology, but further independent studies are needed. Aerodata have kindly provided a dataset that is now under preliminary investigation.



Fig. 3: A graphical comparison between traditional airborne LiDAR and the new Single-Photon / Geiger-Mode technology

2017 also witnessed the election of the new Commission I Chair, Jon Mills, with Fabio Remondino taking up a new position as Vice-President of Research.

## Commission II: Modelling and Processing

Jantien Stoter



*Mission: To contribute to advanced ways of modelling and processing spatial information by investigating, demonstrating, evaluating and documenting new ways of structuring, maintaining, processing and distributing spatial information.*

The EuroSDR 3D SIG has been one of the main activities of this commission in 2017. Since autumn 2013, the National Mapping Agencies of EuroSDR work together in the EuroSDR 3D Special Interest Group (3D SIG) to define and coordinate the long-term 3D research agenda of EuroSDR based on experiences and developments of both research institutes and NMAs; to carry out research projects on topics of common interest, and to organise a workshop series on relevant topics. The EuroSDR 3D SIG members meet 2-3 times a year.

### **Project: Assessing the Economic Value of 3D Geo-Information**

In 2017, the EuroSDR 3D SIG finished the project on the Economic Value of 3D Geo-Information, which was a joint project with Commission 5 (chaired by Joep Crompvoets). The aim of this project was to give the participating NMAs understanding in the business case of 3D data: in what applications does a 3D approach give added value?; what are the required 3D data for these applications; and, what are the costs and benefits to collect and maintain these 3D data nationwide?

Partners in the project - which was coordinated by the company ConsultingWhere - were: Agency for Data Supply and Efficiency, Ordnance Survey UK, Lantmäteriet, swisstopo, Ordnance Survey (Ireland), Główny Urząd Geodezji i Kartografii, Institut Cartogràfic i Geològic de Catalunya, IGN (Belgium), IGN (France), National Land Survey of Finland, Netherlands' Kadaster, and IGN (France). The project has been undertaken in three stages.

In the first phase of the project six use cases were selected for an initial assessment of economic value of 3D data. These were: Forestry Management, Flood Management, 3D Cadastre and Valuation, Resilience (civil contingency), Asset Management and Urban Planning.

In a second stage, for each of the selected use cases, value chain workshops were organised, hosted by NMAs, with public and commercial sector representatives at six different locations across Europe. From analysis of the results of the stage 2 workshops, two use cases - flood management and urban planning - were selected for a cost-benefit analysis in the third stage. Cost-benefit analysis is a technique for expressing quantitatively the benefits of a particular investment, in this case, high resolution Digital Terrain Models (DTMs) and, where appropriate, 3D City Models. In essence, it facilitates estimation of Return on Investment (RoI) which can be expressed as "for each €1 Invested the return is €x". The analysis also covered qualitative benefits identified in the value chain that may be politically or socially significant.

The results of the project were reported at a public workshop at ICGC Barcelona, 30/31 March 2017. The results indicate that there is a significant positive return on investment from 3D geo-information even when considering only the two use cases in isolation. In reality, the 3D geo-information will add value to a number of use cases and whilst the costs of satisfying other use cases will increase incrementally, the benefits of such re-use are additive, meaning that the case for investment becomes stronger as each additional application is implemented. Apart from the results addressing the project objectives, the project also appeared to be a very good platform to intensively exchange knowledge and experiences on the business models of 3D data at NMAs.

The final report of the study has been published in the EuroSDR publication series.

## Standards & Data Modelling

In 2017, the EuroSDR 3D SIG has continued its work on defining common guidelines to represent map objects from existing 2D databases at NMAs in 3D (Transport, Buildings, Water, DTM/Elevation, Vegetation and Structures). The objectives of these guidelines are to be able to remove any ambiguities of the term “3D modelling”. A clear definition of 3D modelling is needed to build on each other’s developments and to articulate uniform 3D mapping needs and specifications to industry, academia and standardisation organisations like OGC and INSPIRE. We will continue this work in 2018.

## Kick off GeoBIM project

Several EuroSDR members expressed interest to repeat the successful funding structure of the study of “Economic Value of 3D Data” to a new EuroSDR project on a topic of common interest. We concluded that this way of funding (and collaboration) is specifically useful for topics that still need more focus and understanding and that can benefit from a cross-country approach. In line with this, we agreed to explore interest to collaborate (and co-fund) a EuroSDR project on Geo/BIM integration and we had a kickoff meeting for this project at the end of November at Kadaster, Amsterdam.



In both the Geographic Information (Geo) and Building Information Modelling (BIM)<sup>2</sup> domains, it is widely acknowledged that the integration of data from both domains is beneficial and a crucial step in facing the multidisciplinary challenges of our built environment. The result of this integration – which can broadly be termed GeoBIM – could answer questions such as identifying an appropriate HVAC system for a building based on room usage, outside air temperature, solar exposure and traffic pollution or validating whether a proposed built asset meets relevant planning constraints and support tasks that include logistics for construction, asset management, facilities upgrades, and road safety design improvements amongst many more.

From the data perspective, this integration raises the question of how to integrate very detailed design and construction data from the BIM domain with contextual geospatial data (both 2D and 3D) that models a very diverse range of aspects of the wider built environment and also underpins analytical analysis.

Developing a coherent approach to GeoBIM integration requires consensus between multiple stakeholders from both the Geo and the BIM side. Logically this is best addressed at the multi-country level, and it is the topic of the new EuroSDR project on GeoBIM integration. The general aim of the project is to detail both the needs and the issues of GeoBIM integration, studied from use cases as well as from existing experiences in the participating countries.

The project is divided into two phases: the first phase will make an inventory of the GeoBIM state-of-play in the participating countries (by means of a questionnaire). Based on the results of phase 1, the second phase will further investigate one or two commonly identified issues from a number of selected use cases such as urban planning, or life-cycle management.

The partners in this project (besides EuroSDR) are: Lantmäteriet, Sweden; GUGiK, Poland; NLS, Finland; Kartverket, Norway; Agency for Data Supply and Efficiency, Denmark; Kadaster, the Netherlands; Swisstopo, Switzerland; Ordnance Survey, UK; Ordnance Survey, Ireland; IGN, France;

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<sup>2</sup> Note that we use the term BIM in its broader sense here – to encompass not only buildings but also the built environment. We also focus specifically on the data-related aspects of BIM rather than managerial or workflow aspects.

and ICGC, Catalonia. Apart from co-funders, these organisations are active partners in the project and they will carry out parts of the project. Also a few universities and research institutes are partners in the project, i.e. University College London, Dublin Institute of Technology, Lund University and the Delft University of Technology.

The project is expected to finish by the end of the year 2019.

## Commission III: Updating and Integration

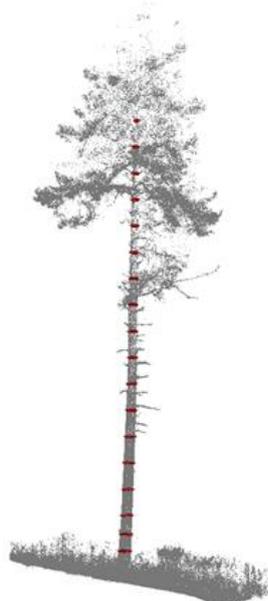
Jon Arne Trollvik



*Mission: To contribute to advanced ways of updating and integration of spatial information. The task of automated updating and automated integration of external data sources will become more important in the future. The focus is moving from data acquisition to integral data updating and data integration from various sources, while maintaining the level of quality of the data sets.*

In 2017, activities within Commission 3 covers completion of a report on terrestrial laser scanning and the organization of a workshop in cooperation with EuroGeographics Quality Ken.

### Projects and reports



The past two decades have witnessed tremendous research efforts and significant progress in the application of terrestrial laser scanning (TLS) in forest inventories. To evaluate the potential of applying TLS in characterizing sample plots and to clarify the strengths and weaknesses of TLS as a measure of forest digitization, as well as the capability of recent algorithms to extract attribute of trees in forests, an international benchmarking of TLS approaches for forest inventories was launched in 2014 by EuroSDR and coordinated by the Finnish Geospatial Research Institute (FGI). Eighteen groups successfully processed the identical TLS datasets for a standardized set of forest attribute criteria and submitted their results for evaluation through a standard evaluation procedure respecting reliable references. The benchmarking results clarify the status quo of TLS-based forest investigations, the current automation level, the bottleneck of data processing, and future development needed.

*Fig. 1: Stem curve, one of the attributes measured in benchmark*

- A popular article was published in GIM international in 2016.

Liang, X., Hyyppä, J., Kaartinen, H., Pfeifer, N., 2016. Terrestrial Laser Scanning in Forest Inventories. GIM Int. 30, 26–29.

- Two academic publications were submitted to ISPRS journal and are still in review.

### Workshops

The EuroGeographics QKen/EuroSDR workshop on „Improving the usability of Geospatial data“ hosted by Ordnance Survey GB in June 2017 resulted in the following findings and actions:

- Quality metadata is often insufficient to communicate how usable or relevant a dataset is to a user, because it is either incomplete, not easily obtained, not understandable to the non-geospatial professional or it is ignored.
- Other industries have developed easy to understand visual metrics to communicate relevant information about the product (examples include: food, energy efficiency in white goods, and water consumption in dish washers).
- Geospatial information is increasingly being used by non-experts in many different domains (e.g. sat-navs).
- The experts identified that different use cases require different quality of data.
- What appears to be required are easily understandable quality metrics that relate to specific use cases to enable the user to assess whether the dataset is relevant to their use. Included in the information should be data regarding provenance and lineage.

- Visual metrics, including colour coding, are easily understood by all.
- There was some doubt on whether the users (and sometimes producers) were able to receive and understand this information.
- It might be useful to allow users to rate a dataset so that others could see the feedback.
- There is a need for quality metadata to be machine readable.

The outcome from the workshop was a proposal for combined activity between experts and research with feedback from users. It should be noted that this is not an academic exercise but a practical one.

Actions included:

- Identification of a number of datasets and identification of use cases that make use of these datasets
- Definition of data quality metrics
- Identify and test various ways of presenting this information to potential users including machines
  - Whether this is the right information for potential users:
  - The best way of presenting the information and
  - Whether this adds value to the potential user

## Commission IV: Information Usage

Bénédicte Bucher



*Mission: To explore, demonstrate and contribute to further increase in access to authorized geodata. To contribute to the development of better mechanisms for dissemination of geodata from database to end user. To investigate, evaluate and document developments in the technologies for data integration, service-level interoperability and delivery of all forms of geoinformation, data and services.*

In 2017, Commission 4 activities were developed around three themes:

- historical data, embracing archived data and any geodata that has been or will be replaced by newer one, so to say time stamped geodata,
- digital information infrastructures,
- 'digital natives'.

### Historical Data, Time Stamped Geodata

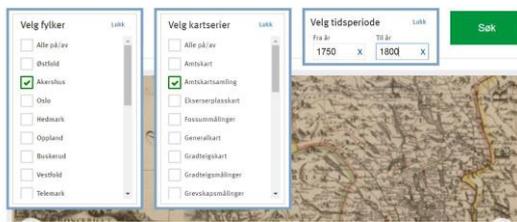
The EuroSDR *Seminar on Graphical Interfaces for Historical Data*, co-organised by EPFL and IGN-F, gathered 21 participants from 6 countries (Switzerland, France, Norway, Belgium, Sweden, Poland) in Paris on June 26<sup>th</sup> 2017 to present latest research and developments about graphical interfaces to interact with geographical historical data. This focus on graphical user interface (GUI) followed up the identification during a first seminar (december 2014) of two important objectives for national and cadastral mapping agencies:

- to reach out to users of historical data to learn what their priorities and requirements are
- to share resources in this domain between NMCAs and possibly other actors (good practices, infrastructure components, datasets, servers, software, licenses, etc.)

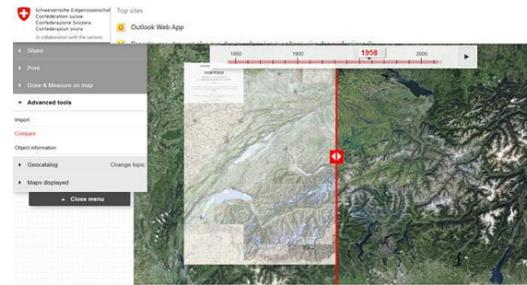
The focus on graphical user interface (GUI) was convenient to target both facets. The report is available on the website of EuroSDR and is briefly summarized in the next paragraph ([http://www.eurocdr.net/sites/default/files/uploaded\\_files/histdataaws.pdf](http://www.eurocdr.net/sites/default/files/uploaded_files/histdataaws.pdf)).

Presentations from national portals (see figure), evidenced common experiences, findings and expectations, often confirmed the conclusions from the 2014 seminar. Publishing historical data had tremendous success and media focus. Different kinds of users are interested in these data and services: amateurs, professionals and scientists. Some portals for historical geodata – not limited to NMCAs data – have met strong communities, e.g. global portals for administrative data or the mapire portal dedicated to the Habsburg empire. Presenters underlined that current interfaces could give access to more types of resources like oblique imagery, ortho-imagery, old postcards and also vector data. The geo-referencing of digitized maps and images can also be improved to attach better coordinates to the content of the new digital asset. Besides, current visualization and edition paradigms are limited when it comes to this rich content that should be browsable in many dimensions. Last, the economic model is yet to find; digitizing archives, generating metadata, developing the software component and the hardware infrastructure have a cost that cannot be covered by selling data since they are released within free licences. During the second part of the seminar, presentations from research partly met the expectations from national portals. Some scientists develop solutions for collaborative registration and collaborative vectorization of digitized assets to generate new information products more adapted to rendering or to analysis. Others are developing new automated data matching methods for the purpose of querying large collections of iconographic documents based on content. The TimeMachine FET Flagship proposal was presented during the seminar. It aims at designing and sharing a stack of technologies to organise and query digitized archives in order to support a more seamless navigation among archives, especially in a 3D space and along the time dimension, back to the past and forth to the future and to develop services in addition to such a new asset that can be seen as the Big data of the past.

## HISTORISKE KART



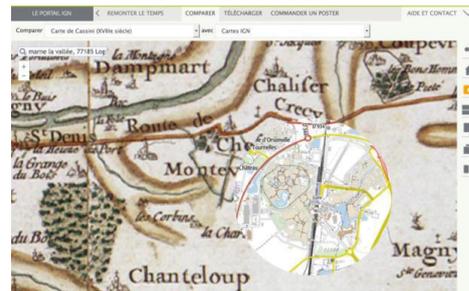
(a)



(b)



(c)



(d)

### Figures:

(a) The Norwegian Historical Map-portal query criteria

<https://www.kartverket.no/Kart/Historiske-kart/>

(b) Swisstopo journey through time experience

<https://map.geo.admin.ch/>

(c) and (d) IGN-F remonterletemps visualization experiments

<https://remonterletemps.ign.fr/>

Follow-up actions on historical data are listed below and all readers of EuroSDR annual report are welcome to join these actions:

- To create a **platform** for discussion and collaborative work around the theme of historical data.
- To constitute a **technical group** who would analyse the interoperability potential of current implementations, the codes and libraries that are used, maybe component by component, possibly propose one unified API for developers, study what are common pipelines and pre-processes, and possibly propose consistent GUI patterns for users who use the graphical interfaces.
- To **publish the analysis** of users, usages and relevant communities around historical data that emerged during the seminar in June 2017 in Paris.
- To investigate potential connections between EuroSDR and the **FET Flagship Time Machine** where the surveying community was quite little represented in comparison with archivists, computer scientist and digital humanities.

Last activity in the domain of historical data was the preparation of a **survey** to identify how national mapping agencies develop new usages of aerial pictures archives by IGN-F and Swisstopo. It was finished mid-2017 and distributed to EuroSDR members. 20 members participated to the survey.

### Digital Information Infrastructures (GeoWeb, SDIs)

With respect to digital information infrastructures, a strategic objective for EuroSDR is to reach out scientific communities that can bring contributions to unsolved issues in geospatial information infrastructures. A specific difficulty is the communication, how to evaluate the complementarity of contributions from different fields, e.g. the contributions of semantic web technologies with respect

to the existing literature in spatial information sciences. To meet this concern, EuroSDR Commission 4 pursues the design of problem-driven and technology-neutral benchmarks related to digital (geographic) information infrastructure: challenges organized around particular concrete problems (illustrated with data) that could be used to challenge scientists or developers. As a result, three focuses are currently explored.

One focus is the ongoing design of an **integration and visualisation challenge** around place names. This challenge will be based on the following categories of specific problems:

- Difficult cases of interconnections between local open data sets, where place names may help.
- Portraying place names at different levels of details.

Another focus is the design of a challenge based on **brokering heterogeneous and redundant data sources at the application level**. The idea of the challenge is to identify applications where the brokering is not performed on the data, but at the application level. One application identified so far is the rendering of the quality of patchwork data, like OSM data. More applications need to be found and we are especially looking for applications related to European policies.

Last focus is on **user oriented catalogues**. Theoretically, user-oriented cataloguing and diffusion of geodata should benefit from new technologies like the semantic web; they favour information browsing (graphs instead of trees), sharing of complex data semantics in contexts possibly far from the production context (thanks to a common vocabulary to describe data content) and recommendations (thanks to logical description and knowledge representation). Yet, it reveals that it is difficult to isolate a specific problem to organise a challenge around it in the domain of user-oriented catalogues. We do not have tangible observations of users searching for geodata. In order to build such tangible observations on this issue, 2017 was dedicated to set up <http://geometadatalabs.eu>, a wiki-like environment that can be used to write questions and reviews about resources (data, software), in a similar way to TripAdvisor. It can be seen as a metadata sandbox that can be used in projects where users and data specialists need to exchange information about data relevance and usability, in other words, to host **infolabs**. This approach was presented during the joint workshop on Data Usability organized by Eurogeographics KEN Quality and EuroSDR Commission 3. A first project where our sandbox is used to create an infolab for a project is the European project URCLIM. In this project, climate change scientists are looking for fine grained geodata in different European cities to improve their simulation models. Cities on which the proofs of concept are developed are: Helsinki, Toulouse, Bucharest, Gent, Brussels, Rotterdam, The Hague, Amsterdam, Utrecht. So far, scientists are expressing data requirements; data providers are giving references to existing data products that meet these requirements.

The implementation of EuroSDR strategy to **reinforce collaboration with Eurogeographics** is also a priority in the domain of digital information infrastructures.

The **Seminar on INSPIRE Data extensions and beyond workshop** was co-organised by the Eurogeographics Knowledge Exchange Network on INSPIRE (aka KEN INSPIRE), Geonovum and EuroSDR. It took place on June 21<sup>st</sup> in Marne la Vallée, France, and gathered participants to share their experiences in extending or adapting INSPIRE Data specifications and to identify potential for collaborative innovation in this domain by connecting to researchers belonging to EuroSDR community. INSPIRE Data Specifications are non-binding technical guidelines, “common data models, code lists, map layers and metadata to be used when exchanging spatial data sets.” These specifications call for extension or adaptation, to include more data in the next generation European information infrastructure and also to reach more consistency and connections between current INSPIRE products and data that are nation-specific (enrich INSPIRE data with non-INSPIRE data). The same situation stands for the specifications of the national map product. During the workshop, participants shared their experience in data models, and specifically what UML patterns to use. They

also agreed on common issues: meeting user demand, finding a sustainable economic model, combining efforts with the industry, getting enough expertness/assistance in digital information technologies, facing design choices with enough awareness on (all) their impacts, the need for knowledge and community management solutions.

The ***Land Use/Land Cover Products: Challenges and Opportunities workshop*** was co-organized by the INSPIRE KEN (Knowledge Exchange Network) of EuroGeographics, EuroSDR, the INSPIRE Thematic Cluster on LC/LU and EEA on November 15<sup>th</sup> 2017. In INSPIRE, Land Cover and Land Use are two different themes but there are also products that mix land cover and land use concepts. The examples presented during the workshop showed a clear trend for separation of land use and land use concepts, using different technical solutions: separate products or same product with two layers and consistent geometries and update cycle. Important data sources are Sentinel images and VGI data – to yield the data or for quality control. New content requirements are emerging, such as need for 3D concepts (e.g. various strata of vegetation, coupling with DSM) and the interest for temporal aspects (seasonal changes, historic data). Standards and interoperability is an important concern in Land use and Land cover. Different approaches also exist here: the trend is not to standardize the classifications but the descriptors, as it is done in EAGLE. The report is pending.

### **Mapping Places for Digital Natives (and different generations)**

On January 19<sup>th</sup> 2018, a working seminar took place where scientists were invited to share their perspective on the general topic of mapping places for the digital natives, and more generally to the new generations. An expected output of this seminar was to identify potential further actions. How can EuroSDR support scientific communities in this field? What results are mature enough to be benchmarked for future developments in the field of national mapping agencies missions?

The day was organized in 3 parts:

- practical experiences of some national mapping agencies with digital natives,
- perspectives brought by academics,
- a discussion and a set of recommendations.

It was a very inspiring day where scientists, new to EuroSDR and often discovering the specific challenges faced by national mapping and cadastral agencies, shared findings from the literature and their thoughts and suggestions to go forward. The report is pending and a more detailed description will be published in the 2018 Annual Report.

## Commission V: Business Models and Operation

Joep Cromptvoets



*Mission: To contribute to the development and implementation of business models describing the rationale of how mapping and cadastre agencies can create, deliver, and capture value, in economic, legal, social, governance, cultural or other contexts.*

As chair of Commission 5 ‘Business Models and Operation’, it is my pleasure to contribute to the EuroSDR annual reports series. This new commission was established at the 126<sup>th</sup> Board of Delegates meeting in Tønsberg (Norway, May 2015). In the third year of the existence of the Commission, it organised several workshops and launched some projects.

### Workshops

Commission 5 co-organised several workshops that are linked to the projects ‘Crowdsourcing and National Mapping’ and ‘Sustainable Open Data Business Models for NMCAs’.

#### *Crowdsourcing and National Mapping*

At the 128<sup>th</sup> Board of Delegates meeting in Paris the second phase of the project ‘Crowdsourcing and National Mapping’ was relaunched by Peter Mooney (Maynooth University, Ireland) and Rob Lemmens (Twente University, The Netherlands). As a start the 2<sup>nd</sup> Crowdsourcing and National Mapping Workshop was organized at the Irish College in Leuven on 3 and 4 April 2017. More than 60 people participated in this successful workshop. It is an exciting time in the development of Volunteered Geographic Information (VGI), Crowdsourcing, and Citizen Participation. The use of crowdsourced geographic information, VGI, crowdsourced spatial data and information by National Mapping and Cadastral Agencies (NMCA) and the Geomatics Industry is a very current, challenging and topical subject. Today we see very rich potential for collaboration and integration of NMCAs, the Geomatics Industry and citizen-based crowdsourcing (such as OpenStreetMap, Ushahidi, Geonames, Galaxy Zoo, GeoWiki, Flickr, GeoWiki, etc.). We have seen some limited examples of where collaboration and integration has happened. However, for a myriad of reasons realizing this potential for collaboration is not very easy. The goal of this workshop was to engage with stakeholders from NMCAs, the Geomatics Industry, academic research, software developers, citizens involved in geographic crowdsourcing and VGI, leaders or managers of crowdsourcing or VGI projects over 1.5 days to develop a set of the most prominent and pressing questions related to crowdsourcing and national mapping in Europe (and beyond) today. The outcomes of the workshop were synthesised and summarised into a final report. It is the intention to organize a follow-up workshop on Crowdsourcing in National Mapping in Autumn 2018 (Leuven, Belgium). As a preparation, a small workshop will be organized discussing the outcomes of the Hackaton session.



Fig. 1: Group photo



Fig. 2: Impression of the workshop Crowdsourcing and National Mapping

### *Sustainable Open Data Business Models for NMCAs*

Another small project about business modelling for Open Data at NMCAs was proposed by Bastiaan van Loenen (Delft University of Technology) at the 129<sup>th</sup> BoD meeting in Madrid. This project included a questionnaire on Open data business models sent to members of EuroSDR and EuroGeographics. A workshop was organised on 18 and 19 September 2017 in Delft, The Netherlands, in which the questionnaire results were presented and discussed.

The concept of Open Data is gaining momentum as Open Data are often associated with realizing many government ambitions, such as increased economic value and solving societal problems. However, to implement an Open Data policy and maintain high quality data in a sustainable manner may pose a challenge to the traditional business models of National Mapping & Cadastral Agencies (NMCAs). Especially self-funding NMCAs have to find a balance between generating sufficient revenue to cover a substantial part of their operating costs and at the same time comply to Open Data principles. The traditional business models of NMCAs are based on generating revenue from licence fees for their datasets, which contain authoritative and authentic data used as register data. A shift from supplying licensed data to Open Data not only means a loss of revenue in the short term but also a loss of control over the reuse of the data and customer contact. A decrease in revenue may pose a risk to data quality or to the level of services. On the other hand, Open Data may also offer direct benefits to NMCAs, for example, more feedback on data quality by citizens and companies, or more efficient use of resources. However, it is by no means a certainty that the much-lauded indirect benefits of Open Data will outweigh the direct costs the NMCAs incur to supply Open Data according to the Open Data principles. To be able to adapt their business model, will require NMCAs to think out of the box. EuroSDR, with support of Eurogeographics, commenced a research to assess the effects of Open Data policies on the business model of NMCAs. This includes the way NMCAs are able to (re)finance their operational costs and to ensure long-term sustainability of their (open) data.

The workshop brought together NMCAs of Belgium, Denmark, France, Ireland, Poland, Slovakia, Sweden, Switzerland, The Netherlands and UK, to present and share their experiences of Open Data and discuss the research results with representatives of academia (Delft University of Technology, KU Leuven). Questions answered were the following: What were the outcomes of the online survey of April 2017? Which funding models can be utilised by NMCAs and how sustainable are these? What have the effects of Open Data been on the operational costs of the NMCA? Which options do NMCAs have to their disposal to refinance their operational costs? Is the supply of Open Data living up to expectations? What are the non-financial challenges to implementing Open Data? Is there a future for a pan-European open Data Infrastructure? The questionnaire results and answers to the workshop questions are presented in a workshop report.

A keynote was presented by Thorhildur Jetzek of Copenhagen Business School.

Follow-up actions refers to setting up a repository on existing Open Data reports, repeating the survey as a joint EuroSDR/EuroGeographics action in 2018, investigating 3-4 NMCA Open Data use cases at NMCAs, exploring key characteristics of sustainable Open Data business models, and repeating the workshop in 2018.

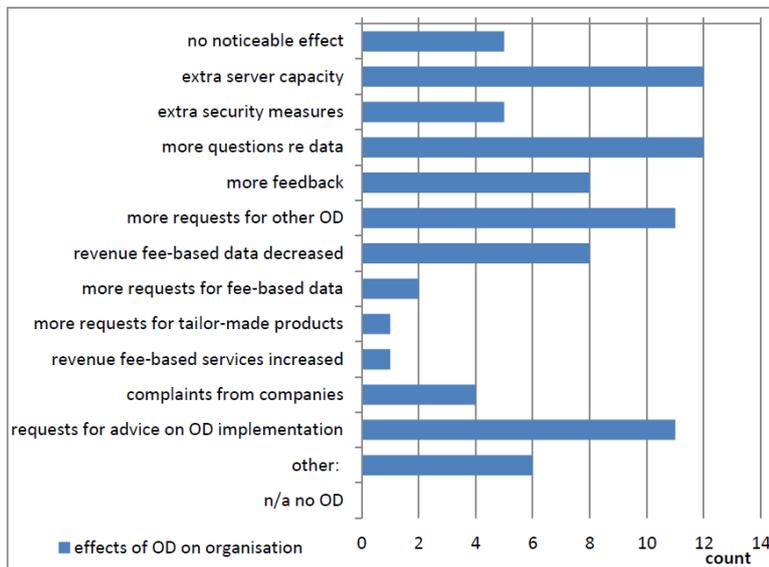


Fig. 3: Effects of Open Data on National Mapping and Cadastre Agencies

#### Wageningen UR/EuroSDR workshop Quality Assessment of Geospatial Data: Does this fit your needs?

This workshop was a pre-conference workshop of AGILE 2017 (9 May 2017, Wageningen, The Netherlands). Due to the enormous growth of available spatial data, quality of spatial data is becoming a very important selection criterion to find the most adequate data for the intended use. Fitness for use is leading in determining quality of data. A framework is set up to assess the quality of a data set to meet specified user requirements. In this workshop, the framework was discussed and validated against real world use cases. In the workshop, an overview was given on data quality and recent developments worldwide. The keynote was Robert Jeansoulin (Université de Paris-Est-Marne-la-Vallée), co-author of "Fundamentals of spatial data quality" [Devillers et al; 2006], who will elaborate on Essentials of Data Quality and Fitness for Use. The second invited speaker was Karin Mertens (Quality Control Manager, National Geographic Institute, Belgium) who presented the work of the Quality Knowledge Exchange Network (QKEN). Karin is a member of QKEN, a network established by EuroGeographics, the European National Mapping Agencies. At the Expertise Centre for Geospatial Data Quality at Wageningen University & Research a geospatial data quality framework is developed for communication and assessing spatial data quality for specific use. This is ongoing work but the approach is presented in this workshop in real world cases. We invited participants not only to register for the workshop but also to submit cases on data quality from own practice or related future initiatives. Four cases from Dutch Kadaster (case on cadastral geometry accuracy), University of Twente (on sensor quality), University of Avignon (on voting analysis algorithms, and Province of Overijssel (on portal quality usability) were selected. 25 persons participated in this workshop.

Finally, this Commission also contributed to the *EuroGeographics/EuroSDR/Ordnance Survey GB Workshop Improving the Usability of Geospatial Data* (14 June 2017, Ordnance Survey, Southampton, United Kingdom).

## **Projects**

Commission 5 launched and contributed to the following research projects: 'Economic Values of 3D', 'Marine Spatial Data Infrastructures' and 'Preservation of the Geographic Information Production Processes'.

### *Economic Values of 3D Geo-Information*

Together with Commission 2, this Commission was also strongly involved in the execution of the crowdfunding project 'Economic Values of 3D'. A final workshop was organized on 30 and 31 March 2017 in Barcelona. A final version of the report was submitted and reviewed by the members of the project consortium.

### *Marine Spatial Data Infrastructures*

A pre-conference workshop entitled 'Marine SDI, INSPIRE and the EU Marine Directives' was organized by Roger Longhorn as a part of INSPIRE (September 2017, Kehl-Strasbourg). This workshop introduced the reporting requirements of the EU Marine Strategy Framework Directive (MSFD) and the EU Maritime Spatial Planning Directive (MSPD), specifically regarding marine information components of national SDIs and INSPIRE compliant data in the coastal and marine information sectors. Significant challenges exist regarding coastal data sets of importance to MSFD and MSPD, which typically contain data from multiple INSPIRE themes. Some data required for MSFD and MSPD reporting is not included in the current INSPIRE specification, which raises additional questions and challenges regarding pan-European data harmonisation for compliance with these Directives. Existing good practice were presented based on recent research into how European NMCAs and Hydrographic Offices (HOs) are contributing to the objectives of achieving a pan-European SDI based on INSPIRE specifications. Cross-border issues are especially relevant since the marine and coastal environments do not respect national boundaries.

### *Preservation of the Geographic Information Production Processes*

A final project report was submitted and published as an Official EuroSDR Publication.

## Commission VI: Knowledge Transfer

Markéta Potůčková



*Mission: To provide education services in order to support the transfer of knowledge from EuroSDR research projects to NMCAs, academia and industry and to fulfil specific NMCAs demands for knowledge update. To collect and disseminate methodologies, developed tools and other research outcomes in the form of EuroSDR's official publications and via EuroSDR's homepage. To contribute to the development of curricula in GI.*

In 2017 the commission organised two educational events, EduServ, a short course on photogrammetry, and the EuroSDR PhD Award.

The annual EuroSDR Educational Service (EduServ) continued with its 15<sup>th</sup> series. The two-day pre-course seminar was hosted by prof. Jantien Stoter and Ravi Peters at the Delft University of Technology from 6<sup>th</sup> to 7<sup>th</sup> March 2017. The seminar was attended by 25 participants from 10 countries. Four two-week e-learning courses were scheduled from March to June 2017 and covered following topics:

- **3D City Modelling**  
Tutors: Jantien Stoter, Ravi Peters and Hugo Ledoux (Delft University of Technology)
- **Synthetic Aperture Radar for Mapping Applications**  
Tutor: Olaf Hellwich (Technical University Berlin)
- **Oblique Aerial Camera Systems for Mapping Purposes**  
Tutors: Fabio Remondino and Isabella Toschi (FBK Trento), Francesco Nex (ITC/University of Twente) and Markus Gerke (Technical University Braunschweig)
- **Terrestrial Point Cloud for Forest Modelling**  
Tutors: Xinlian Liang, Juha Hyyppä and Yunsheng Wang (National Land Survey of Finland)

The courses were actively followed by 49 students (25 from NMCAs, 13 from industry and 11 from academia and research institutions), which is one of the highest participations in the EduServ history. There were only four applications for EduServ scholarships from one Master and three PhD students. Based on the evaluation of the EduServ Advisory Board, all of them received grants covering the course fee and the travel expenses of the pre-course seminar (up to 500 EUR each).

Two new topics of e-learning courses for 2018 were approved during the 130<sup>th</sup> BoD meeting in Warsaw. They focus on “Topographic Maps through Description and Classification of Remotely Sensed Imagery and Cartographic Enhancement” and “Open SDIs”. Registration opened in October 2017 (<http://www.eurosd.net/education/current>).

In addition to EduServ, a short intensive course on photogrammetry was organised as a new form of EuroSDR educational activities. It was initialised by Ordnance Survey UK and took place in its headquarters in Southampton from 11<sup>th</sup> to 13<sup>th</sup> October 2017. 27 participants from 9 NMCAs had a chance to refresh and deepen their knowledge in photogrammetry and image processing. Tutors of the course, dr. Michael Cramer and prof. Norbert Haala from the Institute for Photogrammetry, University of Stuttgart, explained and discussed topics like camera models and camera calibration, collinearity concepts, bundle adjustment, GNSS/inertial supported aerotriangulation, direct georeferencing, image matching, structure from motion or multi-view stereo for the generation of point clouds. The course was very well evaluated by the attendees both regarding the content and the form. Thus, reflecting the demands and inputs from NMCAs, Commission 6 will continue with organising short courses on different topics in future.

Since 2016, EuroSDR awards recent PhD theses that have significantly contributed to the development of Geoinformation Science in the context of national mapping and cadastre. The second announcement of the EuroSDR Award was issued in March 2017. Out of 10 applications, the Award committee selected the thesis of dr. Filip Biljecki from 3D Geoinformation group of TU Delft titled “Level of Detail in 3D City Models”. The Award was handed over during the 131<sup>th</sup> BoD meeting in Hanasaari, Finland.



*Fig.: EuroSDR short course in photogrammetry, 12<sup>th</sup> October 2017, Southampton UK*

## Workshops

- Workshop 'Identifying the Economic Value of 3D Geoinformation' (Barcelona, Spain, 30 - 31 March 2017)
- 2<sup>nd</sup> workshop 'Crowdsourcing and National Mapping' (Leuven, Belgium, 3 - 4 April 2017)
- Workshop 'Quality Assessment of Geospatial Data: Does it fit your needs?' (Wageningen, the Netherlands, 9 May 2017)
- EuroCOW workshop 'High-Resolution Earth Imaging for Geospatial Information' (Hannover, Germany, 6 - 9 June 2017)
- EuroGeographics Quality KEN 'Improving the Usability of Geospatial Data' workshop (Ordnance Survey, Southampton, United Kingdom, 14 June 2017)
- INSPIRE workshop 'Profile and extension', co-organized with EuroGeographics and Geonovum (Marne-la-Vallée, France, 20 - 21 June 2017)
- Seminar 'Graphical Interfaces for Historical Data' (Paris, France, 26 June 2017)
- Workshop 'Open Data Business Models for NMCAs' (Delft, the Netherlands, 18-19 September 2017)
- Workshop 'Oblique Aerial Cameras', co-organized with ISPRS (ICGC, Barcelona, Spain, 9 - 10 October 2017)
- Workshop 'Land Use / Land Cover Products: Challenges and Opportunities' (15 November 2017, Brussels, Belgium)

## Publications

- 68 Coote, A.; Knight, P.; Colding, T.S.; Home, R.; Fröjdenlund, J.; Lysell, G.; Streilein, A.; Kane, P.; Brady, K.; Wozniak, P.; Plá, M.; Bayers, E.; Ilves, R.; Tuokko, J.; Rijdsdijk, M.; Witmer, R.; Cantat, F.; Crompvoets, J.; Stoter, J: Assessing the Economic Value of 3D Geo-Information. 2017, 128 pages.
- 67 Donker, F.W.; Crompvoets, J.; van Loenen, B.: Adapting NMCAs Business Models to Open Data Supply: the Survey Results. 2017, 36 pages.
- Bucher, B.; Golay, F: Graphical Interfaces for Historical Data. 2017, 16 pages.
- 66 EuroSDR contributions to the ISPRS Congress XXIII, Special Session 12 – EuroSDR, 12 – 19 July 2016, Prague, Czech Republic. 2017, 129 pages.
- 65 Crompvoets, J.; Streilein, A.; Masser, I.: How should NMCAs adapt to alternative sources for NMCA data? 2016, 9 pages.
- 64 Domenech, E.; Malle, C.: Change Detection in High-Resolution Land Use/Land Cover Geodatabases (at Object Level). Walter, V.: A survey on state of the art of 3D Geographical Information Systems. Haala, N.: Dense Image Matching Final Report. Mooney, P.; Morley, J.: Crowdsourcing in National Mapping. 2014, 172 pages.
- 63 Fritsch, D.; Pfeifer, N.; Franzen, M. (eds.): 2<sup>nd</sup> High Density Image Matching for DSM Computation Workshop. 2013, CD.
- 62 Honkavaara, E.; Markelin, L.; Arbiol, R.; Martínez, L.: Radiometric Aspects of Digital Photogrammetric Images. Kaartinen, H.; Hyyppä, J.; Kukko, A.; Lehtomäki, M.; Jaakkola, A.; Vosselman, G.; Oude Elberink, S.; Rutzinger, M.; Pu, S.; Vaaja, M.: Mobile Mapping - Road Environment Mapping using Mobile Laser Scanning. 2013, 95 pages.
- 61 Fritsch, D.; Pfeifer, N.; Franzen, M. (eds.): High Density Image Matching for DSM Computation Workshop. 2012, CD.
- 60 Höhle, J.; Potuckova M.: Assessment of the Quality of Digital Terrain Models. 2011, 85 pages.

All publications can be downloaded on the EuroSDR website ([www.eurosd.net](http://www.eurosd.net)).

EuroSDR secretariat  
KU Leuven Public Governance Institute  
Parkstraat 45 bus 3609  
3000 Leuven  
Belgium

[www.euroedr.net](http://www.euroedr.net)