EuroSDR

Annual report 2012

About EuroSDR

EuroSDR is a pan-European organisation established by International Treaty, as OEEPE, in 1953 in Paris in accordance with a recommendation passed by the Council of the Organisation for European Economic Co-operation. The spatial data research interests of European Countries are represented through the membership in EuroSDR of national organisations from their prodcution and research sectors.

The result is a network of delegates, from European Geographic Information organisations and research institutes, effectively and practically addressing Europe's spatial data research requirements.

Collaborative research projects address the aquisition, management and delivery of spatial data and services while international workshops and courses, in collaboration with related organisations, address key issues in a timely and focussed manner.

Our Member States and their Prime Delegates (2012)

Austria	Michael Franzen	Bundesamt für Eich- und Vermessungswesen (BEV)
Belgium	Ingrid Vanden Berghe	Nationaal Geografisch Instituut
Croatia	Željko Hećimović	State Geodetic Administration
Cyprus	Andreas Sokratous	Department of Lands and Surveys
Denmark	Thorben Hansen	Kort & Matrikelstryrelsen
Finland	Juha Hyyppa	Geodeettinen Laitos
France	Jean-Philippe Lagrange	Institut Géographique National
Germany	Hansjorg Kutterer	Bundesamt für Kartographie und Geodäsie
Ireland	Colin Bray	Ordnance Survey Ireland
Italy	Fabio Crosilla	University of Udine
Norway	Jon Arne Trollvik	Statens Kartverk
Spain	Antonio Arozarena	Instituto Geografico Nacional
Sweden	Anders Olsson	Lantmäteriet
Switzerland	Francois Golay	Ecole polytechnique fédérale de Lausanne (EPFL)
The Netherlands	Jantien Stoter	Technical University of Delft and NL Kadaster
United Kingdom	Malcolm Havercroft	Ordnance Survey of Great Britain

Vision

The vision of EuroSDR is to be the Euorpean research platform for National Mapping and Cadastral Agencies, Academic Institutes, the Private Sector, Industry and User Groups on issues related to the implementation of technology developments with respect to optimising the provision (collection, processing, storage, maintenance, visualisation, dissemination and use) of reference information (data serving as a spatial framework for organisations involved in monitoring, management and development) in a Geoinformation Infrastructure (GI) context.

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1. Message from the President Thorben Brigsted Hansen

In modern society a comprehensive and credible data infrastructure is an increasingly important foundation for e-government. Managing existing structures, planning new developments and communicating efficiently between government, enterprises and citizens require a solid understanding of current conditions. Location is at the heart of many of the issues in question and hence the spatial part of the data infrastructure is a key component.

Spatial data is available from a vast number of sources. The spatial data infrastructure must support the user in identifying the spatial data relevant for his purpose and must make it easy for him to combine the data without repetitive manual intervention. And most importantly: the data on which decisions important to citizens and society are made must be authoritative and interpretable for those affected by the decisions.

The European Union is driving the development of a European spatial data infrastructure based on national spatial data infrastructures. In 2012 we have seen how INSPIRE unfolds with reference data content offerings becoming available and with environmental content offerings coming up. In 2012 we also saw the European Union Location Framework (EULF) take form, targeting European public administration focusing on an EU-wide, cross-sector interoperability framework for the exchange and sharing of location data and services.

Developing national spatial data infrastructures is a complex undertaking. Sensor based technologies are revolutionizing data acquisition, mobility and internet pushes the limits for accessibility and collaboration and computing power allows for the unprecedented automation of processes. New producers and users of geodata are entering the domain and the role of both private and government players change. Geospatial technology is developing from being a niche technology to part of mainstream information technology.

We are in a situation, where our context is evolving rapidly and where the interest from our stakeholders in research-based knowledge is increasing.

EuroSDR is the research network linking National Mapping and Cadastral Agencies with Research Institutes and Universities for the purpose of collaborative applied research in acquiring, processing, storing, distributing, and improving the utilization of spatial data, i.e. in spatial data infrastructure.

Cooperation between government and the private sector is a long tradition in the field of spatial data infrastructure. EuroSDR based on the foundation of the close ties between National Mapping and Cadastral Agencies and academia, aims to closely cooperate with private industry. Advances in such cooperation have been made in the last year.

EuroSDR is one of several organizations dealing with research issues related to geographic information. EuroSDR is actively pursuing cooperation with these other organizations and, in 2012, multiple seminars and workshops have taken place in this cooperative environment for the benefit of the research network.

Europe is seriously influenced by the global financial crises that started in 2008. Unfortunately this has had a negative impact on the resources of our member organizations. Despite the tough times, EuroSDR has managed to maintain a sound level of activity and involvement in quality workshops and research projects, as well as develop a successful e-learning program.

This report contains a summary of and highlights from the activities in the organization in 2012. We have slightly changed the format compared to earlier years in an attempt to make the annual report even more informative and worthwhile. It is our aim to keep our stakeholders well informed and to reach a wider audience than before. We hope you enjoy the new format.

I would like to thank the former president, Mr. Jean-Philippe Lagrange, for his contribution to the success of EuroSDR. Jean-Philippe completed his presidential term at our 120th Board of Delegates meeting in Dublin in May.

At the same meeting Ulf Sandgren stepped down as chairman of commission IV, a position that was handed over to Jantien Stoter. I would like to thank Ulf for his contribution to EuroSDR over the years.

Finally I would like to thank Michael Cramer for his contribution as chairman of commission I. Michael ended his term at the 121st Board of Delegates meeting in Lausanne in October and was replaced by Fabio Remondino.

2. Message from the Vice-President Dieter Fritsch

The year 2012 passed by like a bird's life: EuroSDR has always been in action, flying high and looking for new opportunities in research and developments with a potential impact on future work of National Mapping and Cadastral Agencies. EuroSDR is in good shape, thanks to the delegates, the project leaders, the workshop organizers and the Executive Management Team, and last but not least the EuroSDR Office, located in Leuven, Belgium.

The year started with a very successful AGILE/EuroSDR joint workshop on "Crowd-Sourcing", organized by Jeremy Morley and Peter Mooney at the University of Nottingham, UK, on Jan. 19-20, 2012. Here, more than 50 participants discussed the future of "Crowd-Sourced Mapping" and finally delivered proposals for potential projects/internships to be carried out in 4 months' time. Currently, 4 projects are running and first results will be presented at the AGILE 2013 Conference in Leuven in May 2013.

Another quite successful EuroSDR workshop was held at BEV Vienna, Austria, on Feb. 16-17, 2012. This workshop focused on "High Density Image Matching for DSM Computations", and was a follow-up of the delegates' decision at the 118th Board Meeting in Udine, Italy, Oct. 2011. More than 80 participants registered for this workshop and were pleased that EuroSDR is triggering this topic, which will have a huge impact on future strategies of NMCAs. High Density Image Matching will lead to "All-in-One Photogrammetry", as airborne photography allows not only for aerial triangulations and orthophoto production, but also delivers high density point clouds that allow for change detection in urban areas, 3D city modeling and true orthophotos of excellent quality. Thanks to Marc Pierrot-Deseilligny, IGN Paris, who proposed this topic as an ongoing EuroSDR project and the local workshop organizers Norbert Pfeifer and Michael Franzen. The output of this workshop is published in the EuroSDR CD-ROM-Series. In the meantime the BoD has decided at the 121st EuroSDR Meeting in Lausanne to re-launch the project with a new management team.

On Feb. 21, 2012 the EuroSDR Executive Team had its spring meeting in Leuven to prepare for the 119th BoD Meeting in Dublin. Leuven is a nice city and its atmosphere had some impact on our meeting; evidently we did well, as the Dublin meeting was a great success.

EduServ 10 was launched at the Dublin Institute of Technology (DIT) on March, 12-13, 2012 with 61 participants, a remarkable number. Obviously, this demand had some key impacts: first of all the topics had to be well-chosen and, secondly, some financial support needed to be made available. As DIT has supported EuroSDR for 10 years, a joint Workshop organized by DIT and EuroSDR was held at DIT on March 14, 2013 with the headline "Towards A Sustainable Geo-Spatial Location Framework". This workshop acknowledged the contributions of the Irish geospatial community, including Kevin Mooney and Oonagh Birchall, who managed with great enthusiasm and continuous support the EuroSDR office for 8 years (2003-11).

The Board of Delegates Spring Meeting 2012 took place in Dublin, May 9-11, 2012 and was perfectly organized and hosted by Andy McGill and Colin Bray, OSi. Two remarkable keynotes were given: 1) Dr. Josef Aschenbacher, ESA, Frascati: "GMES Update and its Impact on EuroSDR", and 2) Prof. Hansjoerg Kutterer, Director General BKG, Frankfurt/Main: "GeoPortal DE and Web Atlas DE – Best Practice for GSDI in Europe". Another important issue was presented to the delegates, which is

“Archiving of Geoinformation” – an ongoing issue for all NMCAs in Europe and beyond. All enjoyed the wonderful Irish evening in the Wicklow Mountains with good beers, food and dancing.

A successful EuroSDR workshop on “PostGIS DBMS” was organized by former EuroSDR officer Peter Woodsford and EuroSDR BoD member Malcolm Havercroft, on May 23-24, 2012; in the new facilities of the Ordnance Survey, Southampton, UK. The highlight of this workshop was the Keynote delivered by Arnulf Christl, President of the Open Source Geospatial Foundation & OGC Board Member. Thanks to Peter and Malcolm!

EuroSDR was also invited by ISPRS to contribute to the ISPRS Congress in Melbourne, Australia, Aug. 25-Sept. 2, 2012. At the Congress we were involved in a ISPRS/EuroSDR Joint Session on “National Mapping Updates”, Aug 26, 2012; submitted and presented a paper on EduServ, Aug 28, 2012, gave input to a Panel Discussion with experts of ICA, FIG, ISPRS TC VI & ISPRS Student Council, Aug. 28, 2012; presented EuroSDR at a glance to the new incoming Technical Commission presidents, Sept 1, 2012; and conducted interviews with industrial exhibitors for future involvement of industry in EuroSDR affairs (during the exhibition days).

The Autumn Executive Meeting was held in Copenhagen, the home town of the current EuroSDR President Thorben Hansen, on Sept. 6-7, 2012. Thanks to Thorben for hosting us and for the stimulating atmosphere in the facilities of the Danish National Survey and Cadastre (KMS).

On Sept 13-14, 2012 the ICA/EuroSDR Joint Workshop on “Generalization” was organized in Istanbul, Turkey. Thanks to Dirk Burghardt, Cecile Duchene, William Mackaness and Jantien Stoter to deepen the important issues of generalization and multiple presentations.

The Autumn Meeting of the EuroSDR Board of Delegates was held in Lausanne on Oct 17-19, 2012, at the excellent facilities of the Ecole Polytechnique Federal de Lausanne (EPFL). Thanks to our BoD member Francois Golay for a perfect organization, including a wine tasting and the excellent dinner at Chalet Suisse. As Unmanned Aerial Vehicles (UAVs) seem to be the new generation for “Photogrammetry-on-Demand” delivering airborne photos asap, one focus was the first Keynote delivered by Olivier Kueng, Pix4D, that included a live demonstration using the SenseFly UAV and the Pix4D software. All delegates were impressed by the robustness and usability of the UAV and the fast delivery of orthophotos. Jarkko Koskinen, Director General Finnish Geodetic Institute, gave the second keynote “Future of Topographic Mapping – Best Practice in Finland” and impressed all of us with remarkable examples and statements. Finally, Emilio Domenech presented the EuroSDR project “Change Detection in High Resolution Land Use/Land Cover Geodatabases (at Object Level)” for the final review after 2 years of developments – in line with the general guidelines for managing EuroSDR projects.

In summary, this excerpt of ongoing EuroSDR activities reflects a very active pan-European organization dealing with all aspects of geospatial data collection and management. It is my pleasure to serve EuroSDR as Vice-President Research for another year.

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

3.1. BELGIUM: Map Generalization, the process of reducing the scale and complexity of map detail whilst maintaining the important elements and characteristics of the location, is a demanding and time-consuming process. The NGI examines whether the existing software, possibly completed with a specific code, can help automating this process.

Ingrid Vanden Berghe, Nationaal Geografisch Instituut

This study aims at automating demanding tasks within the generalization process, which would bring about a number of advantages. Primarily, it would save a lot of time, as the automated generalization process is much faster than the manual process, allowing the cartographer to devote the time previously spent on generalization tasks to other tasks. Additionally, automatic processes may be started after the traditional working hours and increase dataset consistency. Exceptionally, the cartographer will have to take certain decisions during the generalization process based on his own insights and experience. This may lead to different results depending on the cartographer.

In the past, the 1:50 000 map series production (now in its third edition) was mostly interactive. It required cartographers to manually introduce all changes that occurred in the reference data (at scale 1:10.000) in the generalized dataset. Only roads and buildings were updated in the third edition. As opposed to roads, where update propagation is used, this technique is not possible for buildings. That is why research is being done about automated building generalization.
Following our selection and technical criteria, generalization requires making a distinction between specified buildings, like town halls or police headquarters on the one hand, and non-specified buildings like houses on the other hand. Specified buildings are still manually updated. Soon, however, automated generalization will also be applied to those buildings. Non-specified buildings are processed according to the area where they are located. Built-up areas are automatically generated in dense areas like towns or village centers. These built-up areas make the map more readable as they simplify the map image. However, the research mostly applied to non-specified buildings in non-dense areas.

The removal of buildings smaller than 50m² is already an automated part of the generalization process. These buildings are indeed barely visible at a scale of 1:50.000. Meanwhile, buildings between 50m² and 400m² are automatically represented as 400m²-wide square buildings. The latter are also automatically aligned with line objects nearby, like roads or rivers. Buildings are then subjected to a typification operation. Typification consists of replacing a series of identical objects by a smaller amount of representative objects while taking into account the original spatial structure. Whenever possible, buildings bigger than 400m² are automatically simplified. Finally, an adjustment process is necessary to reduce overlaps between different buildings or between buildings and roads as much as possible.

A couple of months ago, the NGI started integrating the first results of the research effort into the production process. The output of automated generalization is still visually checked and corrected if necessary. In spite of the required visual check, automation does save a lot of time. Future research efforts will address the automated generalization of the remaining themes and the automated generalization to other map scales.

3.2. IRELAND: Ordnance Survey Ireland Research & Development Operational Activity 2012

Andy Mc Gill, Ordnance Survey Ireland

Ordnance Survey Ireland (OSi), the National Mapping Agency of Ireland, has been mapping the state since 1824. It has a mandate to create and maintain the definitive national mapping and related geographic records of the State, including the maintenance of the national grid, the national geodetic and height frameworks and to link these to international systems.

Since the establishment of OSi as a State Body in 2002, the organization's customer base has continued to grow and now includes multiple market segments in both the public and private sectors. The organization has a very strong culture to deliver increasingly higher levels of customer satisfaction. To this end, and in particular since the downturn in national economy, OSi has continued to take advantage of the advances in leading edge technologies both from a data processing and data supply perspectives. One such area of advancement within OSi is the processing of aerial imagery, both vertical and oblique.

In 2011 OSi formed a partnership with Stellacore Corporation, Colorado USA, to develop and test their high performance multi-sensor/multi-payload calibration and product processor for Airborne Sensors (PictoVera). PictoVera is a software system that processes source data from airborne pushbroom, frame and oblique multi-sensor and multi payload systems that has been re-engineered to fully utilize the latest multicore hardware architecture to achieve in excess of five times productivity gains.

OSi commissioned two purpose built hardware systems, one 16 core and one 48 core servers running Linux to utilize the re-engineered software. OSi have now successfully processed payloads with oblique, pushbroom and frame imagery. Among these projects were multi sensor and multi sorties with varying resolutions being processed simultaneously with outstanding efficiency and results.

Two example projects are the processing of 40 towns in Valencia Spain and an oblique imagery dataset provided by Leica Geosystems flown with their new oblique Pentapod system. The first example was a commercial contract in Valencia Spain, for which the imagery for this project was captured by a Pictometry system. The image resolution was captured to output 10cm orthos and the overall project had 46 trajectories. There were in excess of 700,000 images covering approximately 40 towns. Once the payload calibrations were established processing times averaged three days per 200,000 images utilizing both of our specially commissioned multicore Linux systems. The accuracies achieved over the entire project were sub pixel.

The second and latest example data set consisted of three sets of imagery flown by Leica Geosystems at 4cm GSD, 5cm GSD and 8cm GSD. There were 17 scenes for each data set with a total of 1,725 images. Once the imagery was successfully loaded onto the server processing time was 5 days utilizing a Dell T610 Server with two Intel Xeon E5530 2.4Hz – 2 Quad core. These three datasets were processed simultaneously with a combined result of 0.59 pixels RMSE. Ground control and a DTM were also supplied by Leica Geosystems to facilitate the generation of orthorectified imagery in the local ground coordinate system. The final processed imagery was successfully imported into LPS for further evaluation.

3.3. THE NETHERLANDS: Automated Generalisation in production at Kadaster NL
Jantien Stoter, Kadaster

In 2010 the Netherlands' Kadaster, who also holds the national mapping agency, started a feasibility study to introduce automated generalization in its map production line. The feasibility study led to a fully automated workflow to produce 1:50k maps, which will be practiced from 2013.

From the beginning it was clear, that the aim of the automated generalization workflow should not be replicating the existing map, even though the new automatically generated 1:50k map will replace the existing map. In addition, the generalization focuses on a fully automated workflow, i.e. it is not allowed to interactively improve generalization results afterwards, since this would significantly harm the benefits achieved with automated generalization.

One of the main challenges was how to redefine specifications for automated generalization, taking existing guidelines as starting point while assuring that users' requirements are met. Therefore the new map specifications were defined by iterative testing and evaluating intermediate results by our main customers.

For the implementation we use a mixture of standard ArcGIS tools (that recently adopted important research results), self-developed tools within Python and a series of FME tools. The complete generalization workflow is implemented within the Model builder tool of ArcGIS. The workflow consists of three main models and about 200 sub models that are responsible for each specific generalization problem that we need to solve in the process.

Figure 2 shows the 1:50k map that is generalized completely automatically with the resulting workflow from the data shown in Figure 1.

Based on the results and very good users' evaluations the Kadaster decided that a fully automated generalization workflow is the most sustainable workflow for the future. It is also the only way to produce products on demand. The production workflow for 1:50k maps will be practiced from early 2013. From then the new maps will replace the existing 1:50k map product. With thirty-six parallel processes run in Python we are able to perform the core generalization process of the entire Netherlands within approximately 50 hours. The aim is to achieve a three weeks process to produce countrywide 1:50k data from 1:10k data including pre-processing, generalization and visualization.

Based on the experiences with the new 1:50k product, the automated generalization approach will be extended to the 1:100k map and to on-demand products, such as the backdrop map at multiple (between 7 and 16) scales for the national geo-portal.

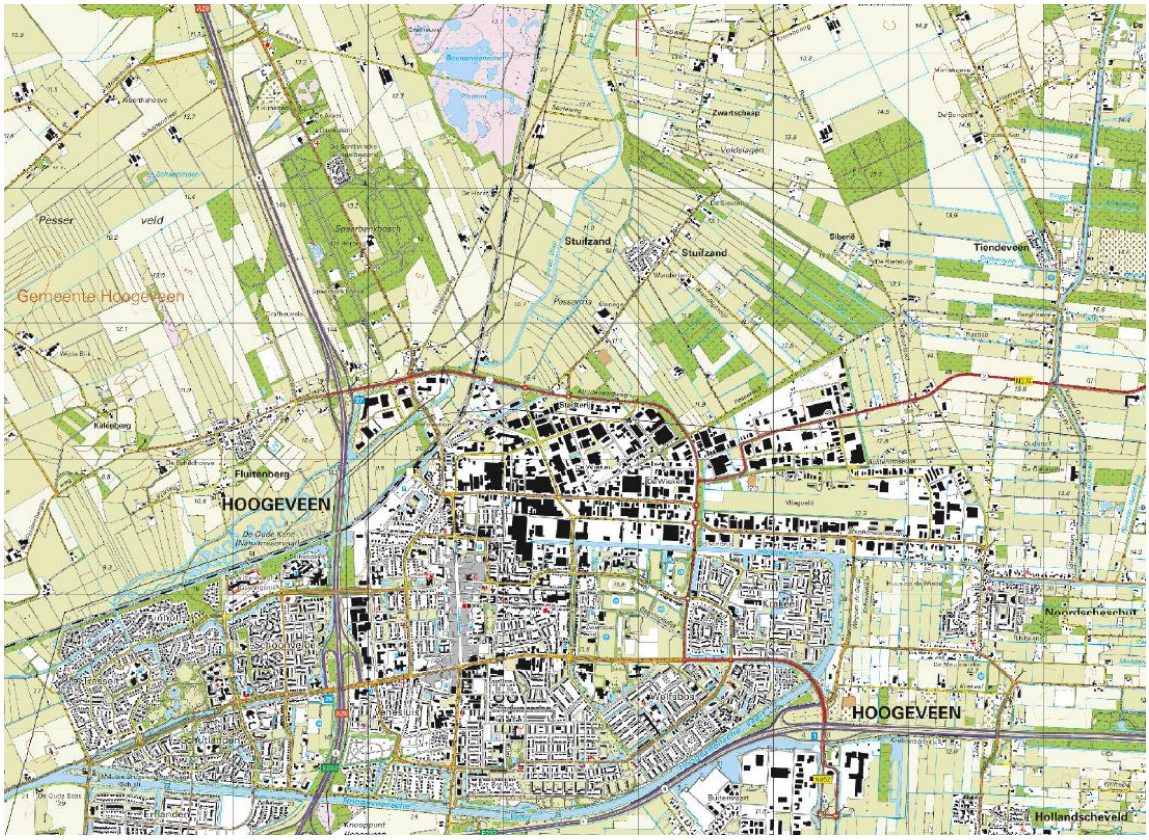


Figure 1 Source data (1:10k) of one of the test areas (displayed at smaller scale)

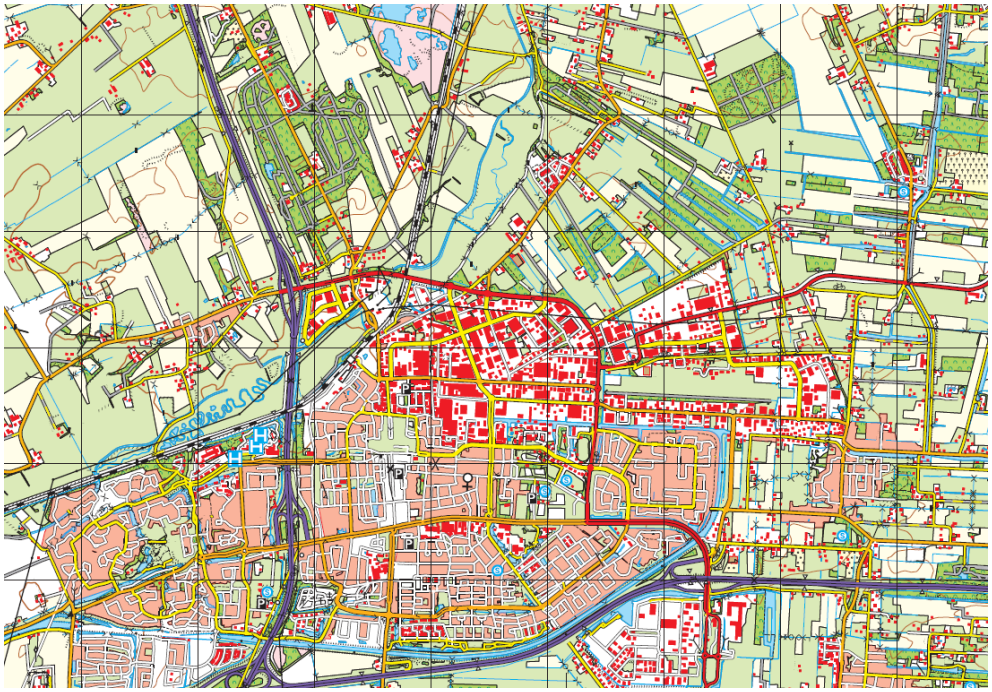


Figure 2 a: 1:50k map, obtained fully automatically; displayed at smaller scale

3.4. THE NETHERLANDS: 3D mapping with national coverage: case of The Netherlands

Jantien Stoter, Kadaster

In the Netherlands two initiatives are on-going that address the issues of nation-wide 3D mapping. The first initiative focuses on large scale for data collected by local governments (mainly municipalities). The second initiative is led by the Kadaster (who also holds the mapping agencies) and aims at automatically generating a 3D version of the 1:10k object oriented data set based on a smart combination of the 2D topographic data and high-resolution laser data.

3.4.1. Large scale 3D mapping in The Netherlands

The national 3D standard for large-scale topography mapping in the Netherlands was established in 2011 in the first phase of the 3D Pilot NL. The Kadaster, the Ministry of Infrastructure and Environment, the Netherlands Commission for Geodesy and Geo-information and Geonovum initiated the pilot to push 3D developments in the Netherlands by collaborating with all stakeholders. The new 3D standard is embedded in an information model, called "Information Model Geography", i.e. IMGeo, which is modelled as an Application Domain Extension of the OGC 3D standard CityGML. IMGeo contains object definitions for large-scale representations of roads, water, land use/land cover, bridges, tunnels etc. and prescribes 2D point, curve or surface geometry for all objects. As the new version of IMGeo is modelled as CityGML ADE, it facilitates extensions to 2.5D representations (i.e. as height surfaces; equivalent to CityGML LOD0) and 3D (i.e. volumetric; i.e. CityGML LOD1, LOD2 and LOD3) representations of the objects according to geometric and semantic principles of CityGML.

Although the 3D standard is an important prerequisite for 3D applications, the implementation of the 3D standard required further agreements. Therefore, in the second phase of the 3D Pilot the 3D community developed ready-to-use tools and best practice documents to support wide and easy implementation of the 3D standard. The deliverables of 3D Pilot NL, Phase II were published by the end of 2012 as an open source toolkit at www.geonovum.nl/3d/toolkit. This toolkit consist of:

1. Implementation specifications for the national CityGML extension that explains all technical details of the standard, for all classes.
2. Example standard-compliant 3D data (see Figure 3) to help newcomers to understand the national 3D standard and to experiment with 3D data.
3. 3D validator, an internationally unique, open source tool that checks 3D geometries according to ISO19107 and GML.
4. A document that describes a variety of update processes of 3D data sets based on tests with commercial software.
5. A website that collects and portrays 3D showcases to demonstrate the added value of 3D to policy makers and newcomers in the field
6. Strategy and policy for aligning CityGML to data generated in Building Information Models.

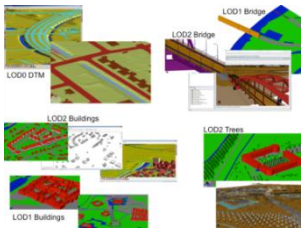
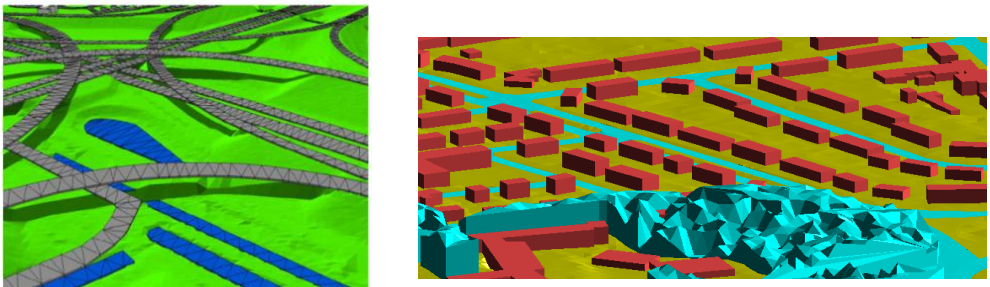


Figure 3: 3D standard-compliant data, generated within the 3D Pilot NL

3.4.2. 3D TOP10NL

The second initiative for national 3D mapping is the research project 3D TOP10NL of the Dutch Kadaster. The project aims at automatically reconstructing a 3D version of the object oriented version of the 1:10k data set in a fully automatic manner and delivering this 3D data as open data for the community. This is done in collaboration with the universities of Twente and Delft. For the automated reconstruction we use the algorithms and tools developed by the University of Twente[1].
Although IMGeo has been fully prepared for extension into 3D by integration of the information model with the OGC CityGML standard, 3D TOP10NL will serve other objectives. TOP10NL data is available nationwide while 2D IMGeo data will only be generated in the coming years. In addition, TOP10NL is less detailed than IMGeo and therefore better suitable for fully automatic 3D object reconstruction since fewer details are present (therefore less special cases). We assume that the resulting dataset is sufficient for a nationwide dataset (i.e. acceptable performance for nationwide applications), and that it can be further refined (for example with 3D IMGeo data) when applied in future projects.
Some tests on generating 3D TOP10NL fully automatically, have been done in the past years (see figure 4 and 5). In 2013, the research results will be made ready for further practice. The developments of 3D TOP10NL builds on the insights obtained by the pilots on 3D IMGeo, since the techniques to obtain LOD0 and LOD1 representations from a combination of 2D data and high-resolution height points are similar.

Figure 4: 3D TOP10NL of an urban scene (a), including real 3D objects such as bridges (b).



a b

Figure 5: 3D TOP10NL: Multi-level infrastructural crossings (left) and a urban scene including forest areas (right).

[1] Oude Elberink, S.J. (2010) Acquisition of 3D topgraphy : automated 3D road and building reconstruction using airborne laser scanner data and topographic maps. Enschede, University of Twente Faculty of Geo-Information and Earth Observation (ITC), 2010. ITC Dissertation 167, ISBN: 978-90-6164-288-6

3.5. SWEDEN: Swedish test lab GeoTest
Sweden, NMO Lantmäteriet and the work with testing SDI
Mikael Lilke, Lantmäteriet

An important part of the Swedish strategy for developing the national SDI, including implementation of the INSPIRE directive, has been to establish a test lab for developing test models for testing geodata and geodata services according to the INSPIRE directive. The test lab, GeoTest, was established in 2009 at the cluster organization Future Position X, FPX, in cooperation between FPX, Lantmäteriet and Gävle University. GeoTest has developed models and routines for different kinds of tests and offers a platform for testing and evaluating the systems and services in a realistic multiuser platform where the test population can test their product before putting it on the market. This establishment has resulted in a unique competence on a national level that contributes to R&D work for geodata and to the implementation of INSPIRE.

The work has been demonstrated through testing developed theories, models and standards and, by doing so, the results have pointed out the best way for practically implementing data specifications and new web-based services.

GeoTest cooperates nationally with authorities responsible for the provision of data according to INSPIRE as well as with some private companies and other kinds of test beds such as The Institute for Humane Technology, IHT in Bollnäs (IHT cooperates with Linköping University), where test and analysis for usability and availability are performed, and Compare Test lab in Karlstad, operated with Karlstad university, performing tests for IT systems and hardware.

At EU level cooperation has been executed with JRC (Joint Research Centre) for testing and commenting on referrals concerning specification proposals regarding Annex I, II and III. With EuroSDR cooperation has been established concerning establishing a web-based education programs and in networking related to the action on persistent test beds. Experiences have also been exchanged with OGC, projects like ESDIN, GISIG/NatureSDI+ and universities, such as University of Ostrava and University of Edinburgh.

4. Report by Secretary-General Joep Crompvoets

2012: the first year that Anneke Heylen and myself were serving on the secretariat of EuroSDR. It was a year full of challenges for us. Although we were very well prepared by Kevin Mooney and Oonagh Birchall, we still learnt a lot from the association and figured out little by little how the organization runs in practice. This report reviews the annual meetings happening in the framework of EuroSDR in 2012, the activities related to our partner associations (e.g. AGILE, EuroGeographics, ICA, ISPRS), our main publications and associated logistics.

4.1. Meetings

The 120th Board of Delegates meeting took place in Dublin at the Castleknock Hotel & Country Club from 9 until 11 May 2012. This meeting was hosted by the Ordnance Survey Ireland. It started with an overview of nice examples of GI research and professional activities in Ireland. The highlights of the meeting were the keynotes “GMES Update and its Impact on EuroSDR” by Josef Aschbacher (who is the head of the GMES Space Office of the Directorate of Earth Observation Programmes at ESA) and “GeoPortal DE and Web Arlas DE – Best Practice for GSDI in Europe” by Hansjörg Kutterer (who is the president of BKG). Another special moment was the changeover of the presidency from Jean-Philippe Lagrange (IGN-France) to Thorben Brigsted Hansen (KMS Denmark). During this event Jantien Stoter (Delft University of Technology) took over the chair of Commission 4 from Ulf Sandgren (Lantmäteriet). Finally, our Irish host arranged an unforgettable evening full of music, dancing and laughter at Johnny Fox Pub.

Figure 6: group photo at Castleknock Hotel & Country Club (10 May 2012)

Figure 7: Joep Crompvoets, Thorben Hansen, Dieter Fritsch, Jean-Philippe Lagrange (19 October 2012)

The 121st Board of Delegates meeting took place in Lausanne (Switzerland) at the university campus of EPFL from 17 until 19 October 2012. The hosts were both EPFL and Swisstopo. This meeting started with an overview of nice examples of GI research and professional activities in Switzerland. The highlights of the meeting were the demonstration on "UAV data collection and Processing" by Olivier Küng (Pix4D), and the inspiring keynote "Future of Topographic mapping - Best Practice in Finland" by Jarkko Koskinen (who is the Director General of the Finnish Geodetic Institute). During this meeting Michael Cramer (University of Stuttgart) stepped down as the Chair of Commission I and was replaced by Fabio Remondino (B. Kessler Foundation, Trento). During this event we also welcomed Roberto Piuzzo (INSIEL) as the official observer of Italy and said farewell to Anders Olsson as the Swedish EuroSDR delegate. The Swiss host EPFL arranged a great evening full of superb wines, delicious food, including the Swiss "Raclette", on the shore of Lake Geneva.

Figure 8: group photo at EPFL campus (18 October 2012)

Figure 9: group photo during demonstration on "UAV data collection and Processing" (18 October 2012)

In preparation for these two Board of Delegates meetings the Executive Team met at the Irish College in Leuven (Belgium) and at the headquarters of KMS in Copenhagen (Denmark). A special event was the seminar at the Dublin Institute of Technology "Towards a Sustainable Geospatial Location Framework" (14 March), which was in a way also a farewell event for Kevin Mooney being our Secretary-General for so many years.

Figure 10: Dieter Fritsch and Michael Cramer (18 October 2012)

4.2. Partnerships

In 2012, EuroSDR had many contacts with partner associations such as ISPRS, AGILE and EuroGeographics.
At the ISPRS Congress in Melbourne, our Vice-President Dieter Fritsch was very active. He presented the paper "EduServ – The Education Service of EuroSDR: Sharing Experience for Capacity Building" written by Dieter Fritsch, Kevin Mooney and Anders Östman. He also chaired the joint EuroSDR / ISPRS WG IV/2 session "Automatic Updates of national Core Databases". In addition, he participated in the EuroSDR, FIG, ICA, ISPRS TC VI, and ISPRS SC Panel Discussion "Cross-Border Education for the Global GI Community". In the future EuroSDR's link with ISPRS will remain strong since Fabio Remondino, chair Commission I, has become the new President of ISPRS Commission V.
At the AGILE 2012 Conference in Avignon (France), the President Jean-Philippe Lagrange gave a keynote that was strongly focused on EuroSDR. At the pre-conference session, EuroSDR co-organised and/or contributed several workshops. Also, Joep Crompvoets became a member of the Scientific Committee of AGILE 2013 Conference in Leuven.
EuroSDR strengthened the link with EuroGeographics. For example the Secretary-General contributed to the General Assembly of EuroGeographics in Helsinki, had a shared presentation at the Conference of the Global Spatial Data Infrastructures association in Quebec entitled "Europe needs a Location Strategy", and gave a presentation at a EuroGeographics workshop on "Project Funding".
On 10 July 2012 senior representatives of several European Associations with an interest in geo-information met in Brussels at the invitation of EuroGeographics to discuss their unique and common interests in supporting society with appropriate research, representation and information services. AGILE, EuroSDR, ELRA, Eulis, Eurogi, the PCC and EuroGeographics discussed ways of coordinating their activities and how to particularly bring focus to their representation activities. Many good ideas were expressed in a positive and constructive dialogue and the different organizations are committed to arranging another meeting in the future.
Finally, EuroSDR contributed to the 8th International Conference on Geo-Information for Disaster Management (Enschede) and the SDI-Days in Zagreb (Croatia) as well. Moreover, a Memorandum between EuroSDR and OGC was drafted.

4.3. Publications 2012

With support of BKG, the following paper was published "No. 61. Fritsch, D., Pfeifer, N. & Franzen, M., 2012. Proceedings of the EuroSDR workshop on 'High Density Image Matching for DSM Computation'. This report refers to the EuroSDR workshop that was held from 16th to 17th January 2012 in Vienna, Austria.

4.4. Logistics

Regarding the associated logistics, the Secretariat was among others strongly involved in preparing the meetings, processing the meetings' minutes, decision and actions, editing the annual report, financial accounting, auditing, sending e-newsletters, managing the website, etc..

After one year, we have the feeling that we are getting better accustomed to our secretarial tasks and look forward to cooperating with our members, chairs, president, vice-president, representatives of our partner associations and those that are simply interested in the activities of EuroSDR in the (near) future.

5. Commission I: Sensors, Primary Data Acquisition and Georeferencing
Michael Cramer

The activities in 2012 related to Commission I were manifold:

- Participation and support in the 4th European Calibration and Orientation workshop in Casteldefells, February 2012.
- Participation in the ISO standard developments, also covering the topics related to the field of digital airborne camera calibration and certification.
- And finally, as perhaps the main issue in 2012, activities on the use of Unmanned Airborne Systems (UAS, now officially named Remotely Piloted Airborne Systems RPAS) in European national mapping.

The increasing importance of UAS is obvious and a significant number of EuroSDR member agencies already have used UAS or at least are deeply following and investigating the potential use and integration of these technologies in their processing lines. There are different applications of interest: boarder surveys (coast lines and their changes), land consolidation/land management and applications in cadaster, to name a few. It is applications, which typically are limited in size/extension, that request up-to-date information. Sometimes data have to be captured several times with frequent updates to document changes. The UAS-technology is there, pilot tests have shown that these sensor systems can fulfill the requested accuracy. Still flight regulation, i.e. getting permission to fly, is an issue, that is not yet harmonized throughout Europe. But it is clearly visible that this common European framework for the use of UAS will be established in the next 2-3 years. In order to get a more important role within the UAV regulation and harmonization, EuroSDR has now established the first links to UVS International, one of the most important European organizations representing UVS manufacturers, as well as companies supplying services with or for UVS, research organizations and academia. With that, EuroSDR as stakeholder is linked to European Union UVS roadmap and other initiatives.

After 6 years as Commission I chairman, my third term came to an end after the fall meeting in Lausanne in October 2012. I spent 6 years serving the EuroSDR community and trying to continue what was initiated by my predecessor, Ismael Colomina. Looking back I can clearly confirm that EuroSDR is an important platform mainly because of the strong link between practice and research and its clear focus on Europe! In the last years, EuroSDR has started to increase its effectiveness, not only related to meetings but also referring to its impact and its role. As an example, the recent MoUs and the stronger involvement of industry in projects should be mentioned. This work definitely should be continued and will hopefully further increase the visibility of EuroSDR as an important organization linking academia and practice!

Since October 2012, Commission I has been chaired by Fabio Remondino, a very experienced person, with perhaps a slightly different scientific background. This may provide the opportunity to initiate new projects/activities with different topics within Commission I. As Fabio Remondino is also chairing the ISPRS commission V (Close-Range Imaging, Analysis and Applications) he will establish a lively link between EuroSDR and ISPRS. I do wish him good luck for his activities within EuroSDR! Thanks to all, who will support him in the future and have supported me during my time as EuroSDR Commission I president! It was my pleasure to serve the community.

6. Commission II: Image Analysis and Information Extraction
Norbert Pfeifer

In Commission II Emilio Domenech (IGN Spain) and Clément Mallet (IGN France) completed the project “Change detection in high-resolution land use/land cover geodatabases (at object level)”. The aim of this project was to understand the current capabilities to automatically update land use/land cover databases. Using Lidar data, ortho photos, and the current cartographic database, a method based on object based image analysis was developed. After segmentation of the Earth observation data, land cover is determined using a probabilistic approach. In a second step, in combination with the existing database, land use is derived by decision trees. While roughly 10% of the area was changed in the urban test site, wrongly detected as well as undetected changes were less than 2%. The image from the final report, currently under review, shows a color composite from 2004 (a) and 2008 (b), change detection results of samples without considering (c) and considering (d) 3D features (Figure 11). In a rural test site the quality figures for detection of changes in crop cover (unchanged, new, removed) were around 90%. The project is described in more detail at section 6.1.

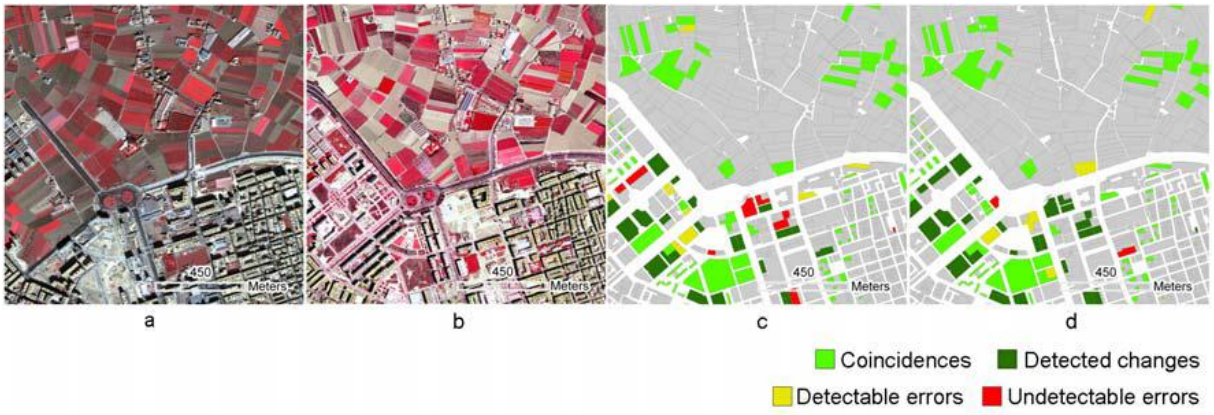


Figure 11: Detail of study area in color infrared composition for years 2004 (a) and 2008 (b); and maps showing change detection results of samples without considering (c) and considering (d) 3D features

The project “Benchmark on Image Matching” was re-launched and a very successful workshop was held at the Federal Office of Surveying and Metrology (BEV) in Vienna, Austria, 16-17 February 2012. It brought together mapping agencies, academia, and industry. A keynote given by Prof. Hirschmüller, inventor of Semi-global image matching (SGM), was followed by the presentation of matching results by different benchmark participants and break-out sessions on the formulation of requirements from the user (NMA) perspective. The project, led by Norbert Haala (IfP Stuttgart), Wolfgang Stössl (LVA Bavaria), and Michael Gruber (Microsoft Photogrammetry), was focused on reducing the number of datasets studied. The next workshop is planned for the second quarter of 2013. Dense image matching, as agreed by all workshop participants, offers very detailed surface descriptions from aerial imagery in the form of point clouds and grid models. The image below shows a subset of the Vaihingen DGPF test data set, processed by Vienna University of Technology: the top

left is a CIR image cut out, top right are the image overlaps (brighter means higher overlap), bottom left the shaded relief map as obtained from dense image matching, and bottom right the surface model dispersion (green low dispersion to brown high dispersion > 5m – Figure 12). This project is described in more detail at section 6.2.

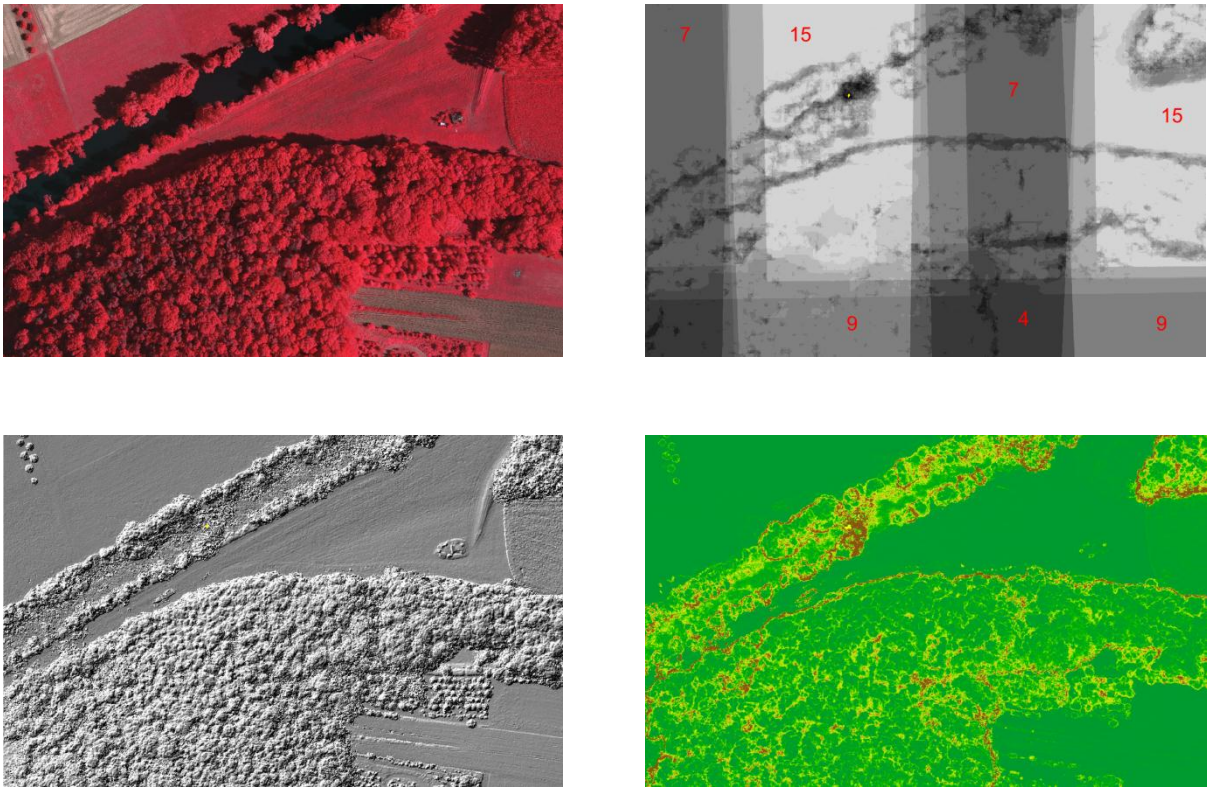


Figure 12: a subset of the Vaihingen DGPF test data set, processed by Vienna University of Technology: top left is a CIR image cut out, top right are the image overlaps (brighter means higher overlap), bottom left the shaded relief map as obtained from dense image matching, and bottom right the surface model dispersion (green low dispersion to brown high dispersion > 5m)

6.1. Project in the picture: Change detection in high-resolution land use/cover geodatabases (at object level)
Emilio Domenech (IGN Spain) and Clément Mallet (IGN France)

The most popular cartographic databases are those that provide land-use coverage, since they provide key information for land management and environmental planning. Land Use/Land Cover (LULC) databases have been updated by means of photo-interpretation of aerial images, and by field visits. These techniques are lengthy, subjective, and costly. The utilization of digital techniques in the processing of aerial images reduces the volume of information that needs to be interpreted manually. It would be desirable to have automatic or semi-automatic methods that offer the greatest possible degree of automation.

Automatic image classification techniques applied to LULC cartography allow for the detection of changes, which are then used to update cartographic LULC databases. The main idea for LULC change detention is to achieve reliable classification of the imagery. To do this, since classes are related to each another, it is necessary to assign classes to every pixel or region in the image.
The proposed methodology combines high resolution imagery, LiDAR data and database polygons as input data, generating two types of outputs: basic land cover classes, and land uses related to the objects. The objects could be delineated using the cadastral database polygons or any other type of polygon could be used.

The process can be divided into two main phases:

Segmentation and classification in basic land cover (LC) classes and classification in land use (LU) of objects based on multi-source descriptive attribute extraction and decision trees.

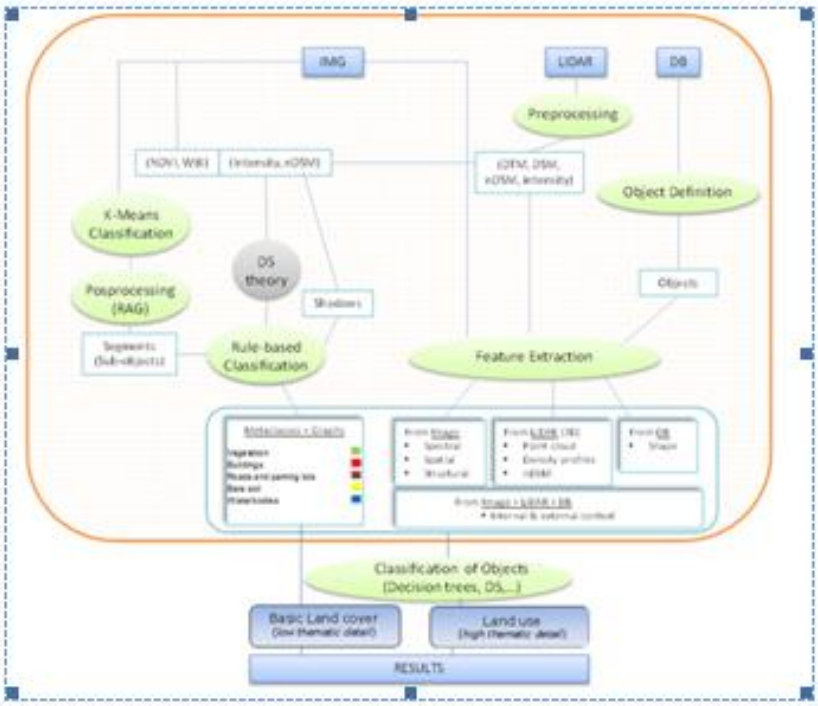


Figure 13: Proposed flowchart for Change Detection

The purpose of segmentation is to simplify the representation of an image in a way that is more meaningful and easier to analyze, to try to work at a region level rather than at pixel level, as animal vision does: rather than individual pixels, the brain of an animal “sees” homogenous regions that the

brain is able to interpret in a subsequent process. The objective of this phase is to generate basic LC classes of the objects obtained from segmentation. Once the image is segmented into regions, a Region Adjacency Graph (RAG) is considered. Each region is associated with a node or vertex of the graph, and then edges are created between every pair of vertexes that represent neighbouring regions in the image. Each node of the graph introduces all the necessary information, such as number of pixels, barycentre, median of the spectral value for a band, median of the NDVI index, etc. The RAG is applied to the segmented image to obtain an improved classification using Dempster-Shafer theory (DS theory), merging regions that are probably of the same.

An element to consider is the detection of shadows, because this is a common problem in the analysis of aerial or high-resolution satellite imagery. The main problem caused by shadows is the reduction or total loss of information in some areas of an image. The loss of information could lead to the corruption of biophysical parameters derived from the pixel values

Classification in land use (LU) of objects based on multi-source descriptive attribute extraction and decision trees is based on the definition of objects from a database (cadastral plots, SIOSE polygons, etc.), the extraction of an exhaustive set of descriptors from images, LiDAR and the database, and the classification of the objects in different land uses. It can be divided into two steps: feature extraction from objects (provide information about spectral, textural, geometrical, and 3D properties) and object-based classification combining rural cadastral sub-parcels and urban cadastral parcels.

The method of change detection is based on the combination of the two phases previously comparing classification of two different epochs or comparing the classification with a database.
Figure 13 presents the proposed flowharts for Change Detection, meanwhile figure 14 visually presents the evoluation of the change detection method.

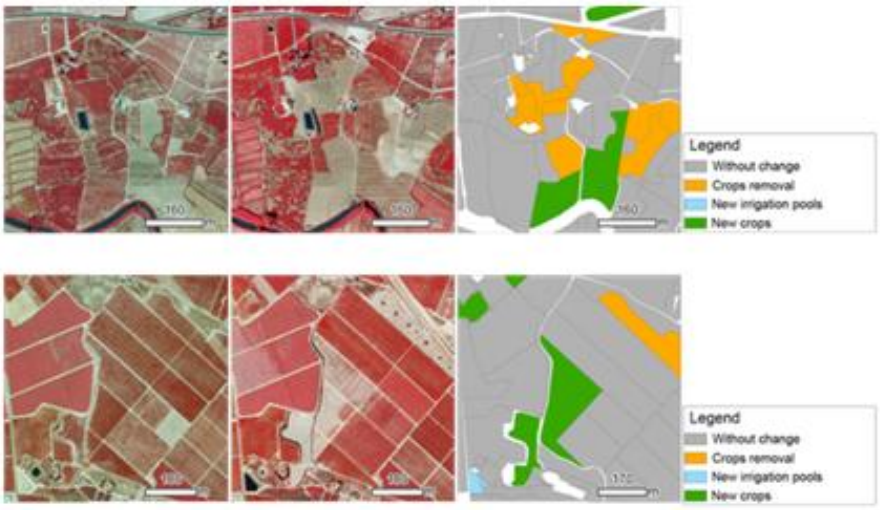


Figure 14: Evaluation of Change Detection method

6.2. Project in the picture: Benchmark on Image Matching

Prof. Dr. Norbert Haala, Institute for Photogrammetry, Stuttgart University
Wolfgang Stoessel, Landesamt für Vermessung und Geoinformation Bayern (LVG)
Dr. Michael Gruber, Microsoft Photogrammetry

6.2.1. Background

Recent innovations in matching algorithms in combination with the increasing quality of digital airborne cameras considerably improved the quality of elevation data generated automatically from aerial images. This development already motivated the launch of the EuroSDR project Benchmarking of Image Matching Approaches for DSM (Digital Surface Modelling) Computation in 2010 by Marc Pierrot Deseilligny and Grégoire Maillet (IGN).

6.2.2. Vienna Workshop, Feb. 16-17, 2012

Results from the initiative described above were presented at a workshop kindly organized by the Dieter Fritsch, Norbert Pfeifer and Michael Franzen at the Federal Office of Metrology and Surveying (BEV), Vienna from 16th to 17th February 2012. The large number of workshop attendees (more than 80 participated) clearly demonstrated the great interest in this project. Vendors of commercial photogrammetric software clearly indicated ongoing research and development, while DSM producers like national mapping authorities confirmed their great matter on high quality image based DSM generation.

All participants very much enjoyed the new structure of the workshop, with just three presentation sessions followed by breakout sessions in small groups. The results of the breakout sessions have been summarized by a representative of each individual group. A CD-ROM entitled as “High Density Image Matching for DSM Computation” has been published in Summer 2012, in the series of official EuroSDR publications.

6.2.3. Re-Launching the EuroSDR Project

During the EuroSDR BoD Spring Meeting Dublin, May 2012 the delegates decided to continue with this project, under a joint chairmanship. A re-launch was started by the principals Prof. Dr. Norbert Haala, Institute for Photogrammetry, Stuttgart University, Wolfgang Stoessel, Landesamt für Vermessung und Geoinformation Bayern (LVG) and Dr. Michael Gruber, Microsoft Photogrammetry. In order to evaluate the potential of ongoing developments in image based DSM generation all software developers, distributors and users of dense matching software have been invited to take part in these new tests.

6.2.4. Scope of the Re-Launched Project

As a **joint test data set,** aerial images are provided within the project for the potential participants. To limit the costs and time of the data processing, **two representative data** sets were selected, that provide different land use and block geometry. Vaihingen/Enz is from an aerial image flight collected in a semi-rural area. Both ground sampling distance and image overlap are rather moderate, thus this data set is representative of statewide data collection. In contrast, the test data set München has a higher overlap and resolution and is more typical for applications in densely built-up urban area.

The basic scope is the evaluation of **3D point clouds and DSM produced by different participants with different software systems**. In order to evaluate the respective image matching results, it is absolutely essential that all processing is based on the same image orientation. Participants therefore should use the provided image orientations, which are given as Inpho project file and individual orientation files with no modification. For each project corresponding image and ground

coordinates are additionally made available so the proper use of the transformations can be controlled by the participants on their own.

The performance of the implemented algorithms will be evaluated based on DSM, which have to be produced by the respective participants in a predefined format. As a common reference surface LiDAR-DSM are additionally available. Furthermore, participants should give some information on the IT environment and processing time. Participants will then have the opportunity to present their results during a **two day workshop from June 13th to 14th**, again organized by the Federal Office of Metrology and Surveying (BEV), Vienna.

6.2.5. Test Data Sets

The data set **Vaihingen/Enz** is a subset from a flight collected during the project on Digital Airborne Camera Evaluation of the German Society of Photogrammetry, Remote Sensing and Geoinformation (DGPF).

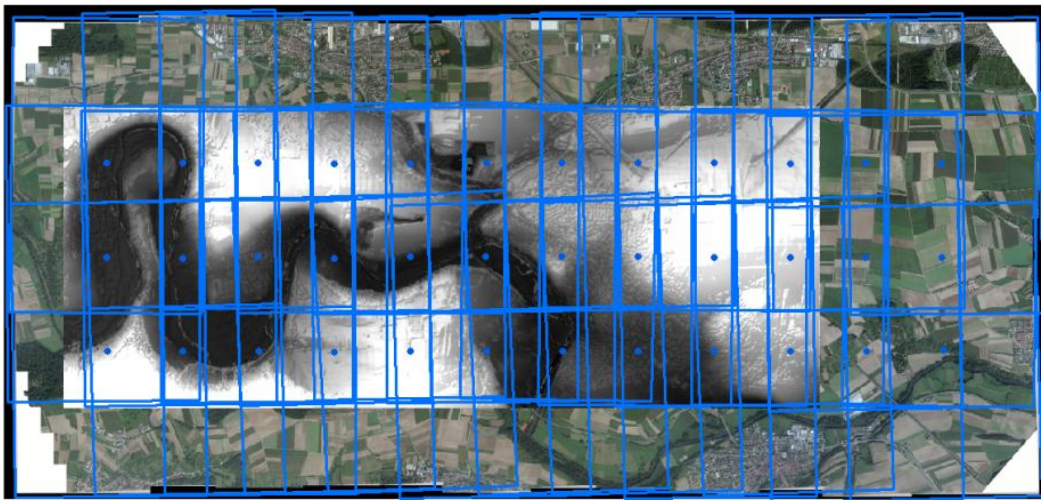


Figure 15: Ortho image and reference DSM of test area Vaihingen/Enz with image footprints and camera stations of UltraCam-X 20cm GSD flight

The aerial images were collected by a UltraCam-X at height of 2900m above ground and a ground sampling distance (GSD) of 20 cm. Figure 15 shows the ortho image and the LiDAR-DSM of the test area. Image footprints and camera stations are overlaid. The overall block consists of 3 strips with 12 images. Participants are required to generate a DSM for the central part with a size of 7.5kmx3.0km at a grid with of 0.2m. In figure 15 this part is visualized by the LiDAR-DSM, which can be used as a common reference surface during the evaluation. Details on the exact definition of the test area and the requested processing are given below.

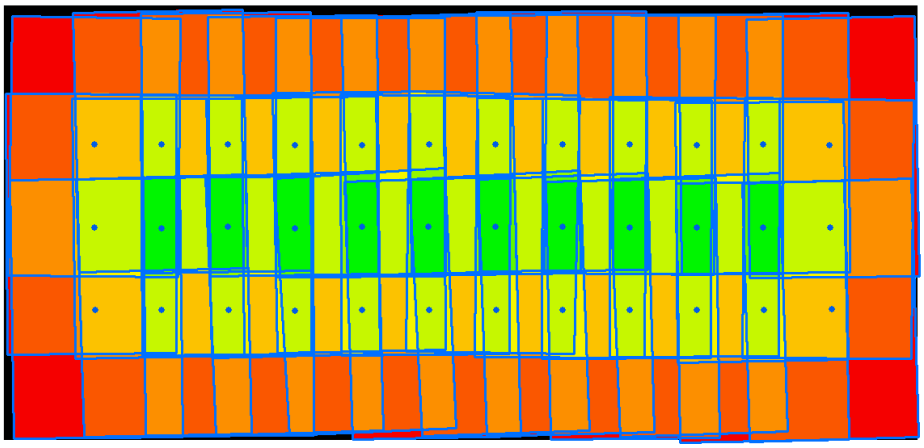


Figure 16: Color-coded image overlap (maximum nine-folded) for test flight Vaihingen/Enz.

Figure 16 represents the block configuration by a color coded map, with image footprints and camera stations again overlaid. As it is visible, the overlap of 63% in flight and 62% cross flight results in image overlap conditions from one-folded areas (red) to **nine-folded overlap** (dark green). For the test on image matching PAN images have to be used. For the test area Vaihingen/Enz they are made available as Tiled Tiff uncompressed 8 bit/pix with 9420x14430 pixel at a data volume of 180 Mbyte/image. On demand RGB images can be additionally provided as Tiled Tiff uncompressed 24 bit with 9420x14430 pixel at 537 Mbyte/image.

The data set **München** provided by the Landesamt für Vermessung und Geoinformation Bayern (LVG) with support from the City of Munich and the Company Astec covers a central part of the city. It was captured by DMC II 230 at a GSD of 10cm in spring 2011. Again a LiDAR point cloud with 4Pts./m² to be used as reference surface is available.

Figure 17 Ortho image of area to be processed with image footprints and camera stations(left) and DSM (right) for test area München.

Figure 17 shows the selected image sub-block to be processed. It consists of 3 image strips with 5 images each, collected at a GSD of 10cm. Each image has a size of 15552x14144 pixel at 16 bit/pix. In addition to the PAN images for image matching, again RGB images can be made available on demand, i.e. for visualization purposes.

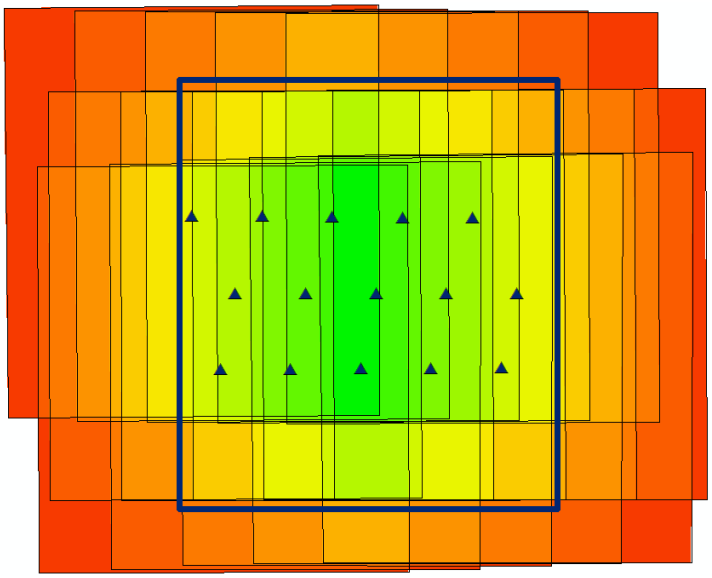


Figure 18 Color-coded image overlap (maximum fifteen-folded) for test München. Camera stations and image footprints overlaid.

The data set Vaihingen/Enz was selected as an example for nation-wide DSM generation at areas with varying landuse. In contrast, the data set München is representative for densely built-up urban areas with complex 3D structures. For such applications, images are usually collected at higher resolution and overlap. As it is visible in figure 18, the 80% in flight and 80% cross flight overlap results in up to fifteen-folded areas, which of course provided a considerable redundancy

6.2.6. Processing Parameters and Deliverables

The general aim is to compare the quality of DSM produced by different participants and/or software systems. In addition to the DSM data the participants also should provide the **required processing time as well as the used hardware** as additional information. Participants are cordially invited to discuss the results of the test during the **two day workshop from June 13th to 14th at the Federal Office of Metrology and Surveying (BEV),** Vienna.

7. Commission III: Production Systems and Processes
André Streilein

In 2012 the activities of Commission 3 were focussed on raising awareness, networking and capacity building in new fields of research such as change detection, 3D landscape models, crowd sourcing or archiving of digital reference data. A number of workshops, projects and working groups document these activities.

The project on "**Semantic Enrichment of 3D City Models for Sustainable Urban Development**" was approved as the **COST Action TU0801** and was finalized in autumn 2012. It concentrated on the support and enhancement of the decision-making processes of cities in a sustainable perspective. A better understanding of the integration of urban knowledge, 3D modelling, visualizations and simulations was achieved, so that urban decision makers and stakeholders will get a better understanding of the context and of the impact of their decisions.

There were two more COST actions that started in autumn 2012, which are supported by EuroSDR. Both are dealing with the issues of **crowd sourcing** and **volunteered geographic information**.
TD1202 (MACS - Mapping and the citizen sensor) seeks to increase the value of volunteered data provided by citizen sensors for mapping applications, with a particular focus on map production and map evaluation. The core aim of this action is to enhance the value of citizen sensors in mapping applications.

IC 1203 (ENERGIC - European Network Exploring Research into Geospatial Information Crowdsourcing) deals with software and methodologies for harnessing geographic information from the crowd. The main objective of this action is to build an open and flexible VGI European network of scholars, young researchers and industry representatives who will share their experiences in order to transform user generated information into exploitable data.

The joint EuroSDR/AGILE project on "**the use of crowd-sourced data for up-date intelligence and meta-data enrichment of national mapping**" is based on the results of the 1st EuroSDR Workshop on Crowd Sourcing for Updating National Databases, Wabern, Switzerland, 2009. The project addresses the issues of the quality of volunteered and crowd-sourced data, which is, in most cases, not audited prior to being made accessible to the wider public and the data varies significantly in terms of its geometric quality, its semantic consistency, in terms of its comprehensiveness of coverage and in terms of its currency. Crowd-sourced data is, almost by definition, data linked to where people are carrying out their everyday lives and related to things that are of interest or importance to them.

The EuroSDR project on **3D Data Management in Urban Areas** identifies the requirements of 3D data management for National Mapping and Cadastral Agencies and the deficits in existing GIS software products. It will make suggestions to software manufacturers and will identify research tasks. The first of three phases, the survey amongst EuroSDR members, has been finalized. A detailed description of this project is written in section 7.1.

The EuroSDR **Archiving Working Group** utilizes interdisciplinary experts from across Europe in discussion with geo-spatial stakeholders, to build a consensus on best practices and combined learning that is achieved through beneficial adoption and practical implementation of legislative obligations. Geo-spatial organizations across Europe face similar challenges in archiving data for public access. The output of the working group is a **policy paper on archiving of geo-spatial datasets** with an ordered list of principles. The revision process with EuroSDR, Eurogeographics and EBNA (European Board of National Archivists) is finished. The policy paper is read for final approval by the pan-European organizations.

The **Working group on "Common goals and requirements for NMA's in change detection"** baselines the current state of automated change detection research and provides a stimulus for practical implementation of automated change detection methodologies. The position paper "**Goals and requirements of European National Mapping Organisations for change detection *Findings of the EuroSDR Working Group on Common goals and requirements for NMAs in change detection***" has been completed. The next step is to invite vendors and researchers to submit change detection solutions for evaluation using specific test data sets.

7.1. Project in the picture: EuroSDR Project 3D Data Management in Urban Areas
Volker Walter, University of Stuttgart

In the last years, substantial technological progress in managing 3D geospatial data could be observed. New technologies for the collection of 3D data (in particular airborne and terrestrial laser scanning) as well as an increasing performance of CPUs and GPUs allow for 3D data collection and handling on standard PCs.

However, 3D Geographical Information Systems (GIS) are often not fully capable of handling the requirements of managing 3D data. One problem is that 3D data management and 3D analysis are in a state where 2D GIS was 10 to 15 years ago. The other problem is that in many cases no integrated IMAP (Input, Management, Analysis and Presentation) solutions are available, but different software systems are needed to process 3D data.

In order to investigate this situation in more detail and to find solutions for the future, we conducted a survey to identify the state-of-the-art nature of 3D data management, the future requirements as well as existing problems. We are very pleased that 32 institutions all over Europe participated in this survey.

The questionnaire consisted of two parts. The first part of the questionnaire contained fourteen questions about the market and the state-of-art of 3D data management. These questions could be answered by selecting one or more predefined answers. It was also possible to optionally add free-text for additional information or comments. This second part of the questionnaire contained six general questions about 3D data management. These questions could be answered with free-text.

A total of 32 institutions participated in the survey. Most of them (25) are public institutions. The public institutions can be subdivided into:

- National Mapping and Cadastral Agencies (10)
- Regional Mapping and Cadastral Agencies (8)
- City Surveying Offices (7)

Most of the questions were answered similary by public institutions and private companies. Therefore, the answers are evaluated for most of the cases together. We only made separate evaluations for questions where the answers were significantly different. This is the case for:

- *The working areas of the institutions*: the main tasks of public institutions are more focused on data acquisition whereas the main tasks of private companies are more focused on data processing.

- *The number of employees*: Most of the participating public institutions are national or regional mapping and cadastral agencies that have typically several hundred employees. City surveying offices are normally smaller with less than one hundred employees. The size of private companies, which participated in this study, ranges from single-digit to several hundred employees.

- *The level-of detail of the data which is typically used*: Public institutions are typically working with less complex levels-of-detail whereas private companies are typically working with more complex levels-of-detail. The most basic level-of-detail of 3D geospatial data, which is used by all participants, is "*2.5 DTM*". For public institutions the next two important levels-of-

detail are "*Houses as Block Models without Roof Structures without Textures*" (64.0%) and "*Houses with Roof Structures without Textures*" (60.0%). For private companies the next two important levels-of-detail are "*Houses with Roof Structures with Textures*" (71.4%) and "*Vegetation*" (71.4%).

The following list further summarizes the main important results of this study:

- The evaluation of the answers showed that the participants have very different views about the definition of a 3D GIS. The three definitions with the highest consensus are "*A 3D GIS can handle 2D and 3D spatial data*" (87.5%); "*A 3D GIS must provide functionalities for the interactive input/modelling of new 3D data*" (81.3%); and "*A 3D GIS must provide functionalities for the interactive editing of already collected 3D data*" (78.1%). The three definitions with the lowest consensus are "*A 3D GIS can handle only 3D spatial data*" (6.3%); "*A 3D GIS should be one single software system*" (18.8%); and "*The realisation and implementation of a 3D GIS must be independent from the application*" (34.4%).

- It is expected that 3D GIS will be a key technology in the near future. Most of the participants think that 3D GIS has the potential to become a key technology (84.4%). Not one of the participants believes that 3D GIS will never be a key technology, but 21.9% have the opinion that 3D GIS is already a key technology. Some participants selected both "*3D GIS is already a key technology*" and "*3D GIS has the potential to become a key technology*". Therefore, the sum of both answers is higher than 100%.

- The participants expect that the 3D geospatial market will grow in the next years. Hardware is the market segment with the lowest growth expectations. However, no more than 3.1% of the participants think that this market segment will shrink and only 6.3% think that it will stagnate. All other expect that this market segment will grow. The market segment Software is seen by most of the participants as moderately growing. Not one of the participants expect that this segment will shrink. The segments Data and Services are seen as strong segments: 34.4% of the participants think that these segments will grow fast in the future.

- The main customers of 3D geospatial data are currently public institutions (96.9%). Private companies represent only a small market segment at the moment, but it is expected that this segment will grow in the future. Private persons are momentarily and presumably in the near future not an important clientele.

- The application areas of 3D geospatial data are manifold. Nearly all areas where 2D geospatial data are used, are also potentially working areas of 3D geospatial data. The simple reason for that is that our world is three-dimensional and therefore people want to work with three-dimensional representations.

- Even though, only 32 institutions participated in this study, 40 different software systems were used. The software market for processing 3D geospatial data is very heterogeneous at the moment. Many different software products are in use and very often one specific product is only used by one or two institutions. This leads to problems, because the different systems are often not interoperable. The same situation holds true for the standardization of 3D geospatial data: 26 different 3D data standards are used by the participants.

- Most of the participants have difficulties processing 3D geospatial data. The existing tools and algorithms are not mature and powerful enough. The programs are difficult to understand and can be used only by experts.

8. Commission IV: Data Specifications
Jantien Stoter

In 2012, I had the honor of becoming the new Chair of commission IV “Data Specifications” and this is my first contribution to the annual report.

Data specifications are crucial for making large amounts of geo-information accessible via spatial data infrastructures for a wide public and a wide variety of applications. Data specifications are important to meet the currently high demands for interoperability between different data themes, different organizations, and different levels of detail.
Agreeing on spatial concepts is the first step for which the Open Geospatial Consortium (OGC) and ISO/TC211 have developed a rich set of standards. In order to combine different spatial data sources meaningfully, additional agreements are required to define thematic concepts in different domains.

INSPIRE
A major breakthrough for data specifications was the harmonization results established by the INSPIRE data specifications. Several experts from EuroSDR member organizations are deeply involved in the implementation of INSPIRE and progresses and issues are intensively discussed during EuroSDR Science and Committee meetings.

PostGIS
Whereas file based and ad hoc geo-datasets were sufficient for specialized applications in the past, geo DBMS are currently the only way to maintain well-structured, large volume geo-datasets to serve a wide variety of applications. There is an increasing use of the open source PostGIS database technology by mapping agencies and other governmental data providers. Therefore a better understanding is needed of benefits and problems related to implementation of this technology. To get an overview on issues and experiences, a workshop was organised in Southampton on 23-24 May 2012. The outcomes of the workshop were reported in more detail in section 8.1.

Generalization
Automated generalization has received a lot of research attention since digital maps became available and several National Mapping Agencies are introducing automated generalization within their production line. Making further steps towards fully automated generalization, requires strong collaboration between industry, national mapping agencies and research institutes.
To better address the both complex and important issues of automated generalization of geo-information, several activities have started within Commision 4, most of them in collaboration with the “Commission Generalisation and Multiple Representation” of the International Cartographic Association. The first achievement of this collaboration is the joint EuroSDR/ICA workshop on “Generalisation and Multiple Representation”, 12-14 September 2012, hosted by the Technical University of Istanbul and the General command of Mapping, Turkey. EuroSDR provided three travel grants for PhD students for the workshop. In one of the breakout sessions, the workshop participants discussed how NMAs can work more closely together on the challenges that are posed by new production lines, also in relation to INSPIRE. Therefore, a ICA/EuroSDR workshop was organized in March 2013 that was specifically dedicated to this question.

Figure 19: Pictures from ICA/EuroSDR workshop (12 – 14 September 2012)

3D modelling

For a long time, geo-data has been limited to two dimensions because technologies were not available to handle more dimensions on the one hand, and because 2D modelling proved to be sufficient in earlier geo-applications on the other hand. The growing awareness for our intensively used environment makes 3D information increasingly important in many applications.

For national mapping agencies one of the challenges is how to best extend their 2D mapping activities into 3D. To share experiences and to define requirements for further development of the OGC 3D standard “CityGML”, EuroSDR organized a workshop on 21/22 January 2013, at IGN, Paris. This workshop was organized with OGC, Geonovum (The Netherlands) and IGN (France), and focused on the challenges in obtaiing nation-wide 3D data models and to disseminate these within national geo-information environments (i.e. SDIs). The presentations showed that many National and Regional Mapping Agencies are making the step towards 3D mapping. An important conclusion was the need for a clear and widely accepted 3D standard and the need for national and European policy on 3D spatial information. These issues will be addressed further by both EuroSDR and OGC in the coming years.

8.1. Workshop in the picture: Workshop on PostGIS DBMS, 23-4 May 2012 at Ordnance Survey, Southampton, UK
Peter Woodsford, Snowflake Software

61 participants from 12 countries assembled on Wednesday 23 May 2012 at the state-of-the-art new Ordnance Survey Headquarters on the outskirts of Southampton for a EuroSDR Workshop on the PostGIS DBMS. 20 participants were from national mapping agencies (Norway, Sweden, Denmark, Great Britain and Switzerland). Others were from land registries, meteorological offices, universities, environmental agencies, local government, consultancies, service and data providers and commercial software companies. Delegates were split approximately 60/40 between people with experience of PostGIS and those contemplating its usefulness in their organizations. The Workshop was convened under a Programme Committee headed by Peter Woodsford, former President of EuroSDR Commission 5, to respond to the growing interest in the use of Open Source software and to the increasing maturity and level of adoption of the PostGIS DBMS.

The opening session addressed the rationale of adopting PostGIS and the practicalities of migrating existing data and applications. An Ordnance Survey presentation began with UK Government procurement policy, which has favored Open Source since 2011, all other factors being equal. After investigations in the R+D department, PostGIS is being used in a Web Services Consolidation project that operates in the Amazon Cloud and makes use of the Agile development methodology. Next came two presentations from the Norwegian Forest and Landscape Institute, established users of ESRI technology. The first described a method for updating read-only PostGIS databases from a master ArcSDE database used for updating, and the reasons behind this approach. This transfer and synchronization of data approach was complemented by the next presentation of a project to migrate a landscape analysis application to PostGIS. This had been successfully accomplished in 8 weeks using an OGC Simple Features data model. Benefits (some arising from the act of re-writing, some from the tools used) included faster execution, smaller and simpler code and unified storage. Finally the wide range of geospatial services provided by EDINA to the UK academic community since 1994 was described. All EDINA's geo-services and data management functions have been successfully migrated to PostGIS in 8 years. The service levels are impressive (eg 10 million bespoke maps in 2010/11). Careful data modelling and attention to indexing and clustering are key factors.

Session Two continued the theme of data migration and also reported on the experiences in service delivery of two NMAs. Snowflake Software described the benefits of a Model Driven Approach using formal data modelling (UML, XML Schema) and a mix of Open Source and proprietary tools for migrating legacy data to a new target, typically PostGIS. A presentation on experiences at Statens

Kartvek, the Norwegian NMA, highlighted the vital importance of good clustering in responding to the huge underlying growth in demand, with unexpected peaks superimposed, made upon their Web Map Service (WMS). Impressive performance and financial gains have come from switching to PostGIS. KMS, the Danish NMA, also use PostGIS to respond to huge increases in demand for the WMS, with nightly incremental transfers from the maintenance Oracle database. Performance has been very satisfactory. Lack of database monitoring tools was mentioned as a current issue.

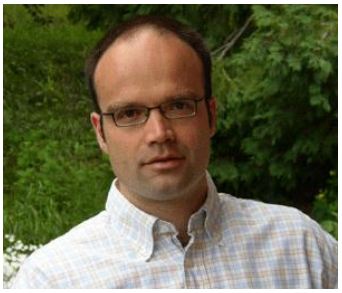
A predominant theme in the opening sessions was the widespread adoption of PostGIS in support of web mapping, arising from its simplicity and scalability (zero-cost replication). Hybrid architectures separating data maintenance and data delivery are being widely adopted. Breakout sessions on use cases and data migration concluded that in practice a mix of Open Source and proprietary software components is being used. The switch to Open Source involves cultural changes that are more readily made by the developers than by support staff. Participants departed to a most enjoyable Thai meal alongside Southampton Water, courtesy of Ordnance Survey and EuroSDR.

Day Two opened with a Keynote by Arnulf Christl, President and Director of the Open Source Geospatial Foundation and member of the OGC Architecture Board. After an enlightening History Tour he concentrated on issues of support, governance and the new functionality in PostGIS V2.0, topics that matched very well with the interests and concerns arising from the breakout sessions. Nowadays there is a Support website with bug tracking, downloads of release candidates and topic-based Wikis. Several organizations exist that will undertake remedial work, if necessary, on a paid basis. An important step forward in governance had just been achieved with PostGIS emerging from the OSGeo Incubation Process the set of rules set up by a diverse set of OSGeo members over the past years defining what an Open Source project has to offer to become a high quality OSGeo branded product. An internal revamp of the PostGIS storage mechanism ('serialization') had removed past limitations and underpinned major new functionality (support for topology and graphs, raster functionality and new 3D data types of Triangle, TIN and Polyhedralsurface).

The final session opened with a live demonstration by OS of a highly available PostgreSQL database holding over 450 million geographic features online 24/7. The implementation uses Streaming Replication and Pgpool-II middleware for load balancing and very high level of fault-tolerance is achieved. To date there is no experience of applying the technology in 'write' situations. Next a presentation from ESRI Europe addressed the topic of integrating ArcGIS with PostgreSQL and PostGIS, offering a choice of ways to access PostgreSQL databases, a choice of datatypes and the advantages of geodatabase for richer datatypes. ESRI has been looking into PostGIS 2.0. Finally Grontmij, working with the Danish municipalities, presented the only example of an update application at the Workshop under the interesting title of 'Hiding a Complex Data Model from GIS-Users'. The model uses persistent UUID's and includes version/history and uses Postgres rules to enable inserts, updates and deletes directly on the database views.

The concluding breakouts focused on practical issues and on the way ahead. Generally the experience with forums and 'self-teaching' resources is good, although some are reluctant to ask questions. The perception that Open Source software is free is generally seen to be incorrect and unhelpful. It is clear that PostGIS is becoming the platform of choice for Publishing and Delivery, particularly of Web Map Services. Use for applications involving Analysis or Update is still at a very early stage. PostGIS 2.0 is a major new release, introducing significant new functionality of particular interest to NMCA's and other data providers. The recent advances in governance are very welcome. A strong recommendation is that progress in using PostGIS V2.0 should be monitored with a view to sharing experience in another Workshop in 2013/4. A full set of recommendations is part of the proceedings available at www.eurosdr.net/workshops/PostGIS (to appear as a future Official EuroSDR Publication, provisionally No. 63). The Workshop was well reviewed by participants, who represented a diverse community not often reached by EuroSDR activities.

9. Commission V: Network Services
Lars Bernard



As in previous years, there has been a joint EuroSDR & AGILE workshop on **Testing Geospatial Web Services & Scientific SDI** prior to the AGILE 2012 Conference (24th April 2012 in Avignon). The workshop was successfully organized by Johannes Brauner (Technische Universität Dresden), Bastian Schäffer (52°North GmbH, Münster), Stephan Mäs (Technische Universität Dresden) and Stephan Schmid (University of the Bundeswehr, Munich). Various presentations and discussions addressed several aspects of SDI Service Testing and the development of Scientific SDI specifically. Scientific SDI was identified as infrastructures that especially support more efficient information sharing for research applications and also improve the dissemination of scientific findings in all research disciplines dealing with spatio-temporal data. Thus, to further progress the AGILE-EuroSDR-OGC Persistent Test-Bed Initiative (PTB) it was agreed that future PTB-initiatives become more closely linked with projects and activities that focus on Scientific SDI. A more detailed report and the presentations can be found at http://sdi-testbed.eu/.

Furthermore a new call for Testbed Projects was launched in 2012 to stimulate volunteer based projects on *Authenticated Access to European Spatial Data Sets* (see http://sdi-testbed.eu/). The call generated modest feedback. However, two small projects could be launched to prototype services and templates for licensing agreements allowing European research institutions to access geodata holdings of public administrations. The Mapping Agency of Saxony, Con Terra and TU Dresden as well as the Mapping Agency of Bavaria and the BKG have started first activities to develop use cases and to prototype solutions.

A newly EC funded project “Citizen Observatory Web” (COBWEB) started in November 2012 and will address various aspects of crowd sourcing. The €8.5 million, 4 year project will develop an "observatory framework" that will make it easier for citizens to collect environmental data suitable for use in research, decision making and policy formation. The project is built around UNESCO’s World Network of Biosphere Reserves (WNBR), with test areas in Biosphere Reserves within the UK, Germany and Greece. Having partners as EDINA, University of Nottingham and TU Dresden, all active in EuroSDR, participating in the project a close linkage to the EuroSDR related activities on the PTB and on crowd sourcing will be established. Further information about the project goals and its current state can be found under http://cobwebproject.eu/.

COBWEB
The Citizen Observatory Web

To kick-off further Commission 5 activities and to best match your current interests and needs, your input, your ideas and your wishes are very welcome.

10. Intercommission Working Group on Standards
Wolfgang Kresse

EuroSDR has developed important contributions to the International Standardization. The ISO/TS 19159-1 “Calibration and validation of remote sensing imagery sensors – Part 1: Optical sensors” has passed with no no-votes towards DTS (Draft Technical Specification) in autumn 2012 and is thus practically finished. The foundation of this standard was laid by the EuroSDR-Project on Digital Camera Calibration.
In the future, the ISO/TS 19159-1 shall be equipped with an implementation-level interface. This goal has been included in the Terms of Reference of the new ISPRS Working Group IV/6 “Sensor Web and Internet of Things“, and is thus officially on the ISPRS-agenda until 2016. The Open Geospatial Consortium is another partner in this project of building an implementation interface.
The project of developing calibration standards will be continued with the ISO/TS 19159-2 regarding airborne lidar. A working draft of this new standard will be completed in 2013. Standards regarding the calibration of radar and sonar (hydrography) are planned as the future parts 3 and 4 of the ISO/TS 19159.
Formally, EuroSDR is a liaison member of ISO/TC (Technical Committee) 211 “Geographic information / Geomatics”, while the Intercommission Working Group on Standards (IWGS) establishes the bridge.
The ISO-imagery standards are bundled in the Working Group (WG) 6 of the ISO/TC 211. Apart from the calibration standards, the WG 6 program of work includes imagery metadata (ISO 19115-2), an xml-interface for the imagery metadata (ISO/TS 19139-2), the georeference of geospatial imagery and sensors (ISO/TS 19130-1 for optical sensors and ISO/TS 19130-2 for lidar, radar, and sonar), and as a new topic, the encoding rules for imagery and gridded data (ISO/TS 19163).

11.Intercommission Working Group on Education
Markéta Potůčková

The 10th Educational Service of EuroSDR (EduServ10) started on 12 March 2012 with a two-day seminar hosted by Kevin Mooney from the Dublin Institute of Technology (DIT), Ireland. Four two-week e-learning courses reflecting the latest EuroSDR’s research projects and needs of National Mapping Agencies followed:

- Terrestrial Reference Frames: application to the realization of the European Reference System (ETRS89) tutored by Zuheir Altamimi from IGN France (19 to 30 March 2012),
- 3D data in Urban Environments organized by IGN France (Nicolas Paparoditis, Marc Pierrot-Deseilligny, Mathieu Brédif, Bruno Vallet, Nicolas Bellaiche,) and Finnish Geodetic Institute (Juha Hyyppä) (9 to 20 April 2012),
- Open Standards & Open Source WebMapping instructed by Barend Köbben and Ivana Ivanova from ITC University of Twente (7 to 18 May 2012),
- Radiometric performance of Digital Photogrammetric Cameras and Laser Scanners organized by Finnish Geodetic Institute (Lauri Markelin and Eija Honkavaara) and TU Vienna (Christian Briese and Norbert Pfeifer) (28 May to 8 June 2012).

Learning materials were provided via the Moodle Learning Management System, also hosted by DIT. During each course the tutors were available for the attendees to answer their questions and to correct their assignments within a few hours. 39 participants from 13 countries registered to the EduServ10. 31 of them received the certificate of successful completion the course(s). About 70% of participants came from National Mapping Agencies or governmental institutions, 16% from private industry and 14% from research and academia. The EduServ series is going to continue in March 2012 starting with a pre-course seminar hosted by Prof. Fabio Crosilla in CISM, Udine, Italy.

12.Workshops

EuroSDR/AGILE Crowdsourcing in National Mapping - A project development workshop leading to internships University of Nottingham, UK, 19th to 20th January 2012
EuroSDR Workshop on High Density Image Matching BEV, Vienna, Austria, 16th to 17th February 2012 http://www.ipf.tuwien.ac.at/eurosdr2012
EuroSDR archiving workshop Landesarchiv Baden-Württemberg, Ludwigsburg, Germany, 15th to 16th March 2012
EuroSDR/AGILE/OGC Workshop on Testing Geospatial Web Services - Scientific SDIs Avignon, France, 24th April 2012 (Pre-conference workshop of AGILE Conference)
EuroSDR workshop on PostGIS DBMS Ordnance Survey, Southampton, UK**,** 23rd to 24th May 2012 www.eurosdr.net/workshops/PostGIS
ICA/EuroSDR Generalization Workshop Istanbul, Turkey, 13th to 14th September 2012

13.Publications

All recent publications can be ordered or downloaded from our website.

61. Fritsch, D., Pfeifer, N. & Franzen, M., 2012. Proceedings of the EuroSDR workshop on **'High Density Image Matching for DSM Computation'** held from 16th to 17th January 2012 in Vienna, Austria

60. Höhle, J. & Potuckova, M., 2011. **Assessment of the Quality of Digital Terrain Models** Report of EuroSDR project, 85 pages. Frankfurt a.M. 2011

59. Ronholm, P., 2011. **Registration Quality - Towards Integration of Laser Scanning and Photogrammetry**
Vanden Berghe, I., Crompvoets, J., de Vries, W. & Stoter, J., 2011. **Atlas of INSPIRE Implementation Methods**
Report of EuroSDR projects, 298 pages. Frankfurt a.M. 2011

58. Stoter, J., 2010. **State-of-the-Art of Automated Generalisation in Commercial Software**
Grenzdörffer, G., 2010. **Medium Format Cameras**
Report of EuroSDR projects, 270 pages. Frankfurt a.M. 2010

57. Streilein, A. & Kellenberger, T. (eds.), 2010. Proceedings of the EuroSDR Workshop '**Crowd Sourcing for Updating National Databases**' held from 20th to 21st August 2009 in Wabern, Switzerland.
Colomina, I., Skaloud, J. & Cramer, M. (eds.), 2010. Proceedings of the joint EuroSDR/ISPRS '**International Calibration and Orientation Workshop EuroCOW 2010**' held from 10th to 12th February 2010 in Castelldefels, Spain.
Nebiker, S., Bleisch, S. & Gülch, E. (eds.), 2010. Final Report of the EuroSDR Project '**Virtual Globes**'. Frankfurt a.M. 2008.

56. Champion, N., 2009. **Detection of Unregistered Buildings for Updating 2D Databases**
Everaerts, J., 2009. **NEWPLATFORMS - Unconventional Platforms (Unmanned Aircraft Systems) for Remote Sensing** 102 pages. Frankfurt a.M. 2009.

55. Cramer, M., 2009. **Digital Camera Calibration** - report of EuroSDR project. 262 pages. Frankfurt a.M. 2009.

54. Kolbe, T.H. (ed.), 2008. Final report on the EuroSDR **CityGML** Project.
Patrucco, R. & Murray, K. (eds.), 2008. Proceedings of the EuroSDR/EuroGeographics workshop **'Production Partnership Management'** held from 7th to 9th November 2007 in Southampton, UK.
Colomina, I. & Hernández, E. (eds.), 2008. Proceedings of the Institut de Geomàtica / EuroSDR **'International Calibration and Orientation Workshop EuroCOW 2008'** held from 30th January to 1st February 2008 in Castelldefels, Spain.
Heipke, C. & Sester, M. (eds.), 2008. Proceedings of the ISPRS / EuroSDR Workshop **'Geosensor Networks'** held from 20th to 22nd February 2008 in Hannover, Germany.
Frankfurt a.M. 2008.

53. Kaartinen, H. & Hyyppä, J., 2008. **Tree Extraction** - report of EuroSDR project. 60 pages. Frankfurt a.M. 2008.

EuroSDR is a pan-European organisation established by International Treaty, as OEEPE, in 1953 in Paris in accordance with a recommendation passed by the Council of the Organisation for European Economic Co-operation. The spatial data research interests of European Countries are represented through the membership in EuroSDR of national organisations from their prodcution and research sectors.

The result is a network of delegates, from European Geographic Information organisations and research institutes, effectively and practically addressing Europe's spatial data research requirements.

Collaborative research projects address the aquisition, management and delivery of spatial data and services while international workshops and courses, in collaboration with related organisations, address key issues in a timely and focussed manner.

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