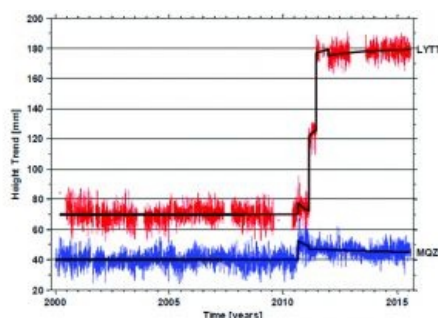
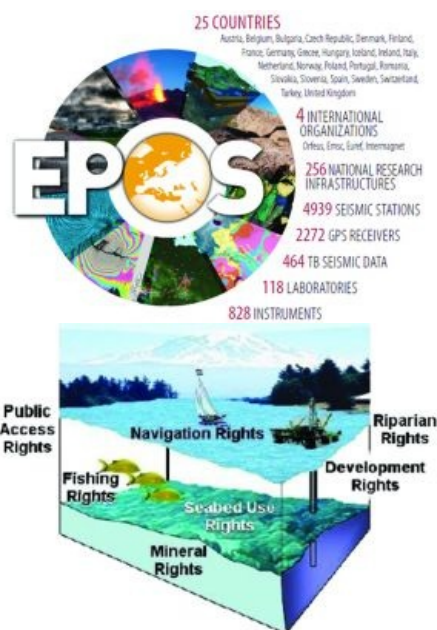


Geodesy and Land Administration - FIG Working Week 2017



GW was not at the Working Week in Helsinki in May, but FIG publishes most of the technical papers presented at the conference on its website www.fig.net. Richard Groom has been sifting through the proceedings and has drawn together papers on Geodesy and Land Administration and a few other interesting topics. The code in parenthesis indicates the session number where the papers

were presented.

It is some time since GW published an article by Chris Rizos on the Global Geodetic Observing System (GGOS). [Kutterer](#) (TS03C) provided an update. His paper gave a general overview of GGOS and its work in support of the UN-GGIM Geodesy committee. GGOS provides the observations needed to monitor, map and understand changes in the Earth's shape, rotation and mass distribution and provides the global reference frame. It is an observing "system of systems", which integrates observations from all geodetic technologies. The author sees GGIM as a means of providing resilience to the efforts of GGOS, which currently relies upon voluntary contributions on a best effort basis.

Geodetic Infrastructure

The Global Geodetic Reference Frame (GGRF) was endorsed by the UN General Assembly in 2015. This was followed by the development of a 'road map' by GGIM last year and a working group to oversee implementation. [Loevhoeiden and Johnston](#) (TS03C) describe how the work is being organised through focus groups and [Poutanen](#) presented a similar paper, but with a focus on Europe.

[Denys et al](#) (TS01C) look at vertical land motion (VLM) at New Zealand's tide gauges in order to remove VLM effects from tide gauge records. VLM can occur through isostatic readjustment after the last Ice Age, as in the UK, but in New Zealand occurs predominantly due to seismic activity and is measured using continuous GNSS receivers collocated at tide gauges.

[Hakli et al](#) (TS04C) describe the implementation of a semi-dynamic datum for Scandinavia and the Baltic nations to take account of movements in that area caused by post-glacial isostatic rebound. The effect is about 10mm in height and, perhaps surprisingly, several millimetres in plan.

Moving plates and dynamic datums disrupt the certainties of the legal world. [Grant et al](#) (TS05J) discuss the geophysical and geodetic issues arising from the definition of international boundaries which move with tectonic motion and are defined by changing global and local reference frames. This paper is very readable and serves as a geodetic refresher too.

EPOS

[Fernandez et al](#) (TS04C) provided slides which give information about EPOS, a long term project for the integration of research infrastructure for solid earth science in Europe. In practical terms, for surveyors this means storing GNSS data for stations throughout member nations and provision of data and products. The products will include daily and time series of coordinates, velocity fields and strain rate fields. The project is in its implementation phase and expected to become operational in 2020.

Human Geodesy

[De Vries](#) (TS03H) introduces the concept of Human Geodesy. The writer provides three 'vignettes' to support his proposition. Perhaps the clearest example is from his home town in the Netherlands, which is threatened by rising sea levels.

USA Modernises

[Roman](#) (TS05C) provides an update on the development of the US National Spatial Reference System (NSRS), which is due to be operational in 2022. This involves updating the plan and height datums by aligning to the latest International Terrestrial Reference Frames (ITRF). Interestingly, NSRS are going to promote the Online Positioning User Service (OPUS) as the official means of accessing NSRS and of processing GPS data. There will be four regional reference frames for the North America, Caribbean, Pacific and Mariana plates covering mainland and offshore US territories, which will each be tied to the specified ITRF and come with associated velocity models.

This represents a massive modernisation of the US spatial referencing system. [Ahlgren et al](#) (TS05C) describe the geoid modelling efforts required to support this and the Gravity for the Redefinition of the American Vertical Datum (GRAV-D) airborne gravity data project. The National Geodetic Survey produces experimental geoid models annually, using all available data. These are being assessed using geoid slope validation surveys over smooth, moderate and rugged gravity fields. Over ideal gravimetric conditions less than 10mm accuracy was obtained, and 10 to 30mm over moderate conditions. The test over rugged conditions was due to be completed this summer.

Security of Tenure – A Call to Arms

[McLaren and Enemark](#) (TS05A) presented a paper on, or more like a call to arms for, a global campaign to achieve 80% security of tenure by 2030. They call for the land sector to be more ambitious in its goals by innovating and collaborating to eradicate insecurity of tenure. They liken insecurity of tenure to the global eradication of infectious diseases, because it traps people in poverty. Fit for purpose (FFP) land administration is essential for this campaign to succeed and the paper gives examples of the kinds of technology that can achieve the goals at low cost.

[Enemark and McLaren](#) also presented a paper in TS05A on implementation of FFP land administration. They stress the importance of ensuring that it is country specific. They include a case study from Gresik, Indonesia centred on its One Map Policy (OMP) – an effort to establish one source for geospatial data but at small scale. This will be supported by village boundary mapping at 1:10,000 scale. Gresik is a pilot project.

[Schindler and Schutz](#) (TS05A) describe the application of Trimble technology to support FFP land administration. Their paper is useful for its clear reminder of the goals and available technology.

Land Administration

[Murtoniemi](#) (TS04A) describes in great simplicity, the land administration system in Finland. The databases and their links are described, as well as links to other government data, such as population and business records. There has been a rapid move from paper to digital records, including digital mortgages, which will be obligatory from 2020.

There are 784,212 survey control points in South Korea, most of which are local 'Cadastral Supplementary points'. [Lee](#) (ISS4B), describes a method for locating them using RFID and beacons. The study suggests that this will save time in searching for points but also that accelerometers and tiltmeters could be attached to the points and provide useful ground movement data. In a similar vein (although not really surveying), [Tiusanen and Skelly](#) (TS03H) describe a sensor for measuring soil moisture which can remain in the ground for 20 years. This is an IoT application which could, they claim, reduce wastage of irrigation water.

[Kohli et al](#) (TS03A) reports on studies on identification of property boundaries from satellite imagery with the goal of automating boundary extraction. They chose seven countries and with situations varying from urban to rural and compared these against cadastral maps. They found that the percentage of cadastral boundaries visible on the imagery ranged from zero to 71%. The method works best in smallholder and rural areas.

[Luthy and Kaul](#) (TS02E) take on the task of making the Canton of Zurich's SDI available to the general public. This is a useful paper in dealing the issues involved in making data that was collected for internal government use available to the public and delivering and maintaining the service.

[Pieper and Hakalin](#) (TS05A) describe the transformation of the land records system in three towns in Ethiopia to a digital system – a task hampered by missing index maps and the degradation of paper records.

Cadastre in the Caribbean

[Every et al](#) (TS01H) have made an inventory of 3D Cadastre use cases for eleven Caribbean nations. They see this as vital for the 'blue economy'. The Land Administration Domain Model (LADM), which is accepted as ISO standard and is used as a reference model. They also stress the importance of the time dimension for recording the history of property rights, although today's databases are limited to 3D.

In connection with discussion of 3D rights restrictions and responsibilities (RRR) several papers include utilities within the scope.

Blockchain

[Velpuri et al](#) (TS01I), presented a peer-reviewed paper on the use of Blockchain to improving access to credit in property markets. It outlines the problems with traditional systems and the potential benefits of 'fin tech'. It does not however reveal the mystery of Blockchain, although there are references which could prove useful for those wishing to understand more. However, there was further help from [Anand](#) (TS02A) who provided presentation slides, including a helpful graphic showing how a transaction is processed.

3D Cadastre

[Kalantari et al](#) (TS01H) presented a paper on the representation of property rights, restrictions and responsibilities in 3D. Interestingly, for fans of general boundaries, they consider the relationship between legal and physical boundaries, which are inevitable in buildings. They make a point, first argued by Van der Molen over a decade ago, of the importance of investigating institutional issues, yet little research has so far been carried out.

[Humby and Whittal](#) (TS01H) describe representation of 3D cadastral parcels in South Africa. They report that many land surveyors maintain that current practice is adequate for recording 3D cadastral rights, but they observe that technological advances are making 3D possible. They advocate a '2D plus 1D' representation of 3D space. They introduce us to the word 'erf'. In South African law, the only registrable property is the land itself – erf. So registration of apartments and other stratified property is accomplished using condition clauses and other legal devices on the land parcel. The argument for 3D centres around the need for clarity.

Meanwhile, [Markkula](#) (TS01H), states that in Finland “3D properties can be formed only if ordinary 2D properties are insufficient” and property ownership must not be put at risk by developments in 3D. Law reform is needed, but seen as a complex issue with many challenges. The author gives four situations where 3D parcels are needed. He also deals with the question of legal devices to gain access to 3D properties. Registration in the cadastre can refer to laser-scanned or BIM models and it is foreseen that these will eventually replace the cadastral index map.

In a slide presentation, [Astrom Boss](#) (TS01H) considers 3D documentation of condominiums in Switzerland. The situation is different in each of the 26 cantons and federal regulation is very general, but her focus is on the most advanced – Geneva. There, the registration authorities are poised to integrate BIM within the workflow and then automate the interface between BIM and GIS but, as elsewhere, regulations are lacking. Astrom Boss proposes new regulations at federal level to establish a data model.

Crowdsourcing

[Bshouty](#) (TS02E) considers using volunteered photographs to calculate building heights to LoD1 (block outline) for Open Street Map (OSM) using single view metrology. You need the height of reference objects in the image in order to calculate the building height. The resulting accuracy was 1 metre but only after a deal of manual scaling and calculation. It is not easy to see how such a process can be automated.

Session TS02E had volunteered geographic information (crowdsourcing) as its theme. [Gkelli et al](#) (TS02E) review the potential for using 3D modelling algorithms and crowdsourcing for 3D cadastre. The conclusion is positive (and arguably optimistic), that crowdsourcing could work provided the crowdsourcers are suitably trained.

The National Land Survey of Finland has been trialling the use of crowdsourced data for updating its national topographic database. [Laakso et al](#) (TS02E) describe development of a pilot, which has not yet been implemented. The focus will be hiking trails but the consequences of getting these wrong could be serious and there are still questions as to how the data will be validated.

UAVs

A paper by [Gottwald et al](#) in TS02C starts with the chilling thought that land mines kill approximately ten people per day. But research is underway to use a combination of sensors on UAVs to detect them. “Humanitarian Demining - UAV-Based Detection of Land Mines” updates the research, which involves a combination of photogrammetry, SAR and GPR sensing but is particularly dependent upon accurate positioning. This is a truly fascinating article and there will no doubt other spin-off applications.

INSAR and UAVs

In the first part of [Boudon et al](#) (TS04F), the authors describe clearly the current usage of INSAR for deformation monitoring. This is excellent CPD material. The second half discusses tests using UAV-mounted photography but only heralds tests now being carried out using LiDAR mounted onto a fixed-wing UAV.

[Hong et al](#) (TS04A) describe a means of classifying dead trees from photography flown using a UAV. The concern the spread of pests and diseases present in dead trees, through the Korean forests. Their success rate is 85%.

Miscellanea

'Georef' is an initiative for a service and application development platform that employs HTTP URLs of place names for geocoding different data assets to enable and improve combinations of spatial data and any other data using linked data technology. Quite a mouthful, which neatly sums up the complexities of linked data. This a Finnish initiative described by [Tiainen](#) (TS02E) and not for the faint-hearted although, in conjunction with other articles, it might shed light or even enlightenment on the inner mysteries of the subject.

[Kenny et al](#) (TS05G) takes a look at e-learning for geomatics. He sees it as entirely new, but surely it is a development of the old correspondence courses. He identifies the pros and cons, lists issues that can arise and how to deal with the fact that geomatics is a 'hands-on' subject. In ISS1B, [Paez and Rubio](#) compare class teaching with “pedagogical technologies” – virtualisation tools and aids. Initial results suggest 15% improvement when teaching technical courses.

[Annaert and Schalm](#) (TS05D) studied the movement of the principal fairway on the River Scheldt between Terneuzen and Hansweert. The study was prompted by unexplained movement of navigation channel between 1955 and 1964 and was carried out by examining historical charts with different horizontal and vertical reference systems. Interesting reading.

This article was published in Geomatics World January/February 2018