

OneGeology

Digital Twin workshop

DATE: 11 February 2021

TIME: 11:00 (GMT)

VENUE: Virtual Zoom

Aim: To explore One Geology's unique role and long-term vision for development of global geoscience based Digital Twins

Organisers: Matt Harrison (BRGM), Virginia Hannah, Hazel Napier, Tina Neale (BGS)

Participants: **44 delegates** from **21 organisations** across the globe: BRGM (France), BGS (UK), GSI (Ireland), VSEGEI (Russia), USGS (United States of America), GC (Canada), CCOP (East and South East Asia), GSJ AIST (Japan), GEUS (Denmark), TNO (Netherlands), IGME (Spain), SEGEMAR (Argentina), CPRM (Brazil), GSA (Australia), SGU (Sweden), GTK (Finland), GGSA (Ghana), PGI - NRI (Poland), CGS (Czechia), LNEG (Portugal), Africa Museum (Belgium)

Introduction

Tirza van Daalen, Chair of the OneGeology Strategic Steering Committee (OSSC), welcomed everyone to the workshop.

The OneGeology management team was delighted to welcome so many participants from its extended global geoscience community.

Matt Harrison presented an introduction to OneGeology, described OneGeology's interest in Digital Twins (DTs) and the purpose for this meeting – to explore OneGeology's long term vision for global geoscience DTs and the unique role it might play in their development.

Further presentations were given by:

- ❖ Michiel Van der Meulen (TNO) - Towards digitally twinned river dikes in the Netherlands
- ❖ Carina Kemp (AARNET) - Trends in Digital Twins for Research across disciplines – What we can learn?
- ❖ Guillaume Pepin (ANDRA) - From BIM towards 4D digital twin of Cigeo project (French deep geological radwaste disposal) to support operating survey

Discussion

In questions and discussion after the presentations the following observations were raised:

- There was acknowledgement that there are numerous examples of DTs projects for OneGeology to draw on.
- There may be issues with sharing/transferring large disparate datasets – this will need us to be smart about the data.

- Issues are broader than the subsurface – we will need to consider and possible work with different domains beyond our usual ones which will bring new challenges.
- There were discussions about the communication of uncertainty; We need to learn how to visualise the ‘unknown’ subsurface prior to consideration of standards.
- Geoscience needs to be better integrated into existing initiatives and the UN Group on Geospatial Information Management (UNGGIM) may provide a forum to do this.
- If OneGeology is to embrace DTs, it may need to move from the conceptual model paradigm to a mesh generation paradigm.
- OneGeology likely already has the tools and partnerships to embrace DT development

Breakout groups

Participants were divided into 4 breakout groups to discuss different aspects of OneGeology’s relationship with geoscience DTs. Each group was posed a different question (see below). An additional cross cutting question was posed to all groups: What are the funding challenges/opportunities?

Group A

Facilitator: Hiran Dias (CPRM)

Rapporteur: Koen Verbruggen (GSI)

Q: What is the risk of OneGeology not becoming involved in the Digital Twin discussions globally?

OneGeology has an impressive track record in getting international standards in place – OneGeology has a role in setting standards and enabling interoperability and is in a position to take the lead on global DT development. However, it is important to focus on a clear vision for DT development; work on standards can progress in parallel. OneGeology involvement would enable countries that are still organising their data to follow any standards created. Other roles could include provision of storage of/access to digital twin resources or provide digital twin research. The risks of not being involved are:

- It would be an opportunity lost that and a gap that others might fill.
- It may result in reduced interoperability and integration with collaboration datasets.
- Relevance of OneGeology will fade over time
- Our stakeholders are working in the 3D digital world - we need to engage and keep up

Group B

Facilitator: François Robida (CGI and OGC)

Rapporteur: Kate Royse (BGS)

Q: Who should OneGeology be partnering with/talking to about Digital Twins?

OneGeology should share DT concepts with stakeholders and needs to align with:

- Initiatives including Deep time Digital Earth (DDE) European Plate Observing System (EPOS) EDGE, AuScope Virtual Research Environment (AVRE) Earth Cube, LOOP
- Policy makers – UN, UNGGIM
- Commission for the geological map of the world (CGMW)
- The Commission for the Management and Application of Geoscience Information (CGI)

Need to recognise that DTs are broader than geology - OneGeology needs to partner with contributors outside geology and with end users and stakeholders – geological surveys should move their programmes towards this objective. The built infrastructure sector needs subsurface information. They are moving towards inventing new standards for the subsurface - geologists need to be involved and provide expertise. We need to cooperate with data providers, partners, platforms and providers of tools.

Frameworks for geoscience DTs are needed but should not be too prescriptive – primarily they should enable interoperability and ML. We need to move towards better conceptual models with our standards - OneGeology has a role to play in bringing these together. Bodies such as OGC are looking for example implementations of standards. But first we should use these implementations internally – within geological surveys.

Group C

Facilitator: Carina Kemp, (AARNet)

Rapporteur Ray Scanlon (GSI)

Q: Should the Digital Twin discussion be science led or technology led or both?

DTs need to be science-led primarily although both communities need to be involved. We need science and social sciences to be behind ethical issues in DTs e.g. how do we deal with regions with data scarcity? DTs need to answer important societal questions, not be technical demonstrators. However, process-based AI technologies have to lead the way to improve DTs. Science should define what should/could be considered and technology be used to deliver it – the science and technology input should be linked, not separate.

Group D

Facilitator: Matt Harrison (BRGM)

Rapporteur: Steve Hill (GSA)

Q: What roles do we need in OneGeology to drive the Digital Twin agenda?

OneGeology needs a strategy, with targets, for the next 10 to 50 years with a balance between responsibility (exploring and addressing societal issues) and opportunities (to develop a more technical approach and define technical standards/explore existing standards). Use cases could be defined by non-technical communities – geoscience DTs for selected areas of the world. Would provide a way to promote the geoscience DT concept. The current buddy system could be used to support surveys with developing IT infrastructure and tools/capacity. DTs may help enable communication with and between organisations so none are left behind.

Two examples use cases on the value of DTs were given:

- Latin America : standards help to raise awareness on the available technologies and reach broader user communities (but this is a challenge). OneGeology can contribute to raise awareness in this respect
- Democratic Republic of Congo: Develop an escape plan for the city of Goma in case of eruption of the Nyiragongo: Digital Twins could help to manage and visualise data feeding the model.

Roles that will be needed to support DT developments in OneGeology:

- Interoperability, standards and integration
- Identification of potential collaboration with ongoing projects
- Modelling
- Technological
- Identifying useful content and finding common themes for diversity
- Communication (internal and external)
- Seeking funding opportunities
- Identification of responsibilities
- Different approaches to scaling up from local, to regional to continental and beyond

Funding challenges and opportunities

It is not only a matter of finding (new) funds, but a decision to (re) invest existing funds – we shouldn't look at DTs as something additional that needs separate funding – DTs should be what we already do. Identification of funding opportunities and challenges largely depends on the role of OneGeology. OneGeology would benefit from a champion or organisation to lead the DT initiative – may help with identifying future funding sources, much as happened to develop and champion the Loop3D initiative. Any funding needs to be sustainable and not just 'project funding'.

Challenges:

- Could be great if the funding would be spread between research and private companies but it's challenging
- Acquiring funding for data provision (existing and new), data environment (storage and access), making data FAIR, provision of public versus commercial in confidence data, ethics for users, funding data at different scales.

Opportunities:

- The EU Digital Earth programme could be a funding opportunity
- The current DT hype means that there is a lot of money available at the moment.
- Crowd source funding
- To realise funding opportunities, DTs need to be aligned to organisational strategies
- Collaboration with other disciplines will make a DT initiative more attractive for funding

Conclusion

The aim of this workshop was to explore, in greater detail, the opportunities and challenges already encountered, but also anticipated, with Digital Twins by the OneGeology community. To an extent the workshop replaced a programmed session at IGC 36 in Delhi, India, which was unfortunately cancelled in 2020.

At the OneGeology Strategic Steering Committee (OSSC) in November 2020, there was a discussion of the OneGeology strategy, and the vision for development of a Digital Twin of the Earth; which would grow and be refined in detail over the next decade(s) by the OneGeology community. The OSSC wanted to know what unique expertise OneGeology would bring to the advancement of Digital Twins in the geoscience domain. Thanks to the input from all of the participants of this workshop the outputs of this report will guide and inform the response to the OSSC and inform the next steps for OneGeology in all its activities.

The organisers would like to thank all participants for their time and contribution and look forward to working together in the near future.