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Reply on RC1

Kim Senger et al.

Author comment on "Teaching with digital geology in the high Arctic: opportunities and challenges" by Kim Senger et al., Geosci. Commun. Discuss., https://doi.org/10.5194/gc-2021-6-AC1, 2021

Dear Reviewer 1

Thank you very much for your constructive feedback. We have now revised the manuscript and provide a point-by-point response. For ease of reading our response is highlighted in bold.

All the best,

Kim Senger (on behalf of all the authors)

Reviewer 1 comments:

Sizing Opportunities - give a handle, please.

In the paper Teaching with digital geology in the high Arctic: opportunities and challenges, Kim Senger and co-worker report a fascinating experience. The text reads very well, and the supplementary material (online) is rich; also, the supporting bibliography is extensive. As it stands, the paper is publishable – as reporting experiences. However, it is a choice whether the paper's (technical) detail is suitable given a critical limitation regarding the reproducibility of the experience.

Thank you for the input. We hope this work will be an inspiration for other groups seeking to obtain the same goals as us. We purposefully do not include "cookbook recipes" on how to manage such complex projects such as Svalbox/AG222 course, as different research/teaching groups will undoubtedly start on a different level with respect to financing (amount and longevity), geological access, licensing issues for non-open source software and previous experience. However, we have tried to revise the manuscript in a way to make our experiences from developing AG222/Svalbox even clearer, and thus more applicable elsewhere.

The authors communicate how modern tools (such as Digital Outcrop Models and Virtual

Field Trips) can be used to teach Bachelor students about Svalbard's geology, to horn some technical skills (e.g. data management and software integration) of the students, and to educate them to prepare (and report from) geological fieldwork. The overall account is optimistic but not overblown. The joke ('rattlesnake' in line 312) is charming.

Thank you for the input! Just a comment – a number of the authors encountered rattlesnakes while on fieldwork in Utah which were certainly not charming ☐☐

However, the noticeable preference for the word 'exponentially' (line 80, 89. 323, 422) should be scaled down – using a logarithmic scale in Fig.1 likely show that the increase is not exponential.

Changed "exponentially" to "rapidly" in places, removed elsewhere.

The authors rightly stress that the particular requirements at Svalbard caused the early development of a set of tools and practices that are of much broader applicability, now as the COVID-19 pandemic forces to alter (traditional) teaching modes in favour of remote modes.

The 'open access' to a significant part of the course material will allow many lecturers, students and 'aficionados' to learn about Svalbard's fascinating geology. That is an additional strength of the paper. However, the buck stops there. The article lacks vital information to allow other teams to build similar tools (for their preferred location). Hence, the paper lacks the necessary information to reproduce how to teach and educate using modern communication tools.

The material gathered in the paper is impressive. However, the reader misses part of the 'methodology section', for example, the information about necessary preconditions for success (e.g. lasting cooperation with mining companies, public and private funding, skill-full individuals, limited legal concerns about privacy or access). Such information is essential to allow other institutions to set up similar schemes. Likewise, to learn about insights into probable causes of failures would be helpful; this, as well for technology choices, supporting (IT)-infrastructure, advisable management structures, or required interpersonal skills.

Hence, teaching Svalbard's geology may cope with some 'shocks of the COVID-19 pandemic', as the experiences of the authors show. However, to teach the 'know-how' to cope with such shocks needs more than to report about events (= reporting observations). To illustrate the perceived lacuna, when seen from an educational / communication perspective: the paper shows an impressive 'educational outcrop' but does not analyse it, or the paper shows findings of an outcrop model but does not share the model code.

Drawing on the above, it is advisable to enrich the paper by reporting about 'preconditions for success & risks to fail' (before line 290) and discussing these preconditions (before line 410). Such a minor amendment seems mandatory for the benefit of the profession (and the reader); also, it would justify publishing the given detail. Finally, it would be 'nice to have' that the authors reflect a little about further opportunities of their experiences, e.g. for more open and participatory education, content accessible for anybody, and, tentatively, having a comprehensive outreach to non-professional communities.

Thank you for the comments. We have added a new section in the discussion

"Applications of Svalbox beyond Svalbard" that addresses these comments.

The Svalbox concept can, in theory, be established also in other locations worldwide. The main requirements are access to high-quality outcrops with varied geological features, complementary surface and subsurface data, and mid- to long-term funding to allow not just development but also regular updates. Clearly, programming skills are required in the team, together with local geological knowledge and data management skills. Ideally, a Svalbox-type project has a full-time data manager who can conduct regular data updates and develop the project over a longer-term. At present, Svalbox is essentially run on the side of other teaching and research duties, with key expertise covered by temporary PhD student duty hours, which is considered the biggest risk in terms of the project's sustainability over the long term. Nonetheless, the current focus on digitization across the society, access to open access data and focus on emerging technologies, promises opportunities to seek longer-term funding also with longer-term staffing.

A large part of Svalbox' success relates to the direct linkage with the AG-222 course and its students, who still represent the main user group of the portal. The students of AG-222 have a varied background from different Norwegian, Nordic and international universities. The students are introduced to state-of-the-art technology and teaching methods in the BSc-level AG-222, which may inspire and influence their future career choices and skill sets for example when pursuing a MSc project. Ideally, the AG-222 students may also bring some new knowledge and skills back to their home institutions, and thus contribute to broadening and advancing this type of technology-based and research-oriented teaching beyond Svalbard.

Furthermore, the strength of Svalbox compared to other DOM repositories in the world lies in the direct integration of DOMs with other geoscientific data. As far as we are aware, there are no other databases with such a rich (and growing) data set that integrates both DOMs and other geoscientific data. The geological playground of Svalbard with its rich history of coal and hydrocarbon exploration (Senger et al., 2019) and the well-exposed and stratigraphically diverse outcrops, provides a unique opportunity to develop Svalbard into a digital teaching and training hub for use beyond UNIS. For instance, the introduction of Svalbard's geology or the Festningen section is already an element of various courses at Norwegian mainland universities. In addition, Svalbox is already a valuable tool for planning fieldwork for bachelor and master students doing data collection for their thesis projects, and for national and international researchers that regularly visit the archipelago.