

Dear Reviewer,

Thank you very much for your constructive review. We here provide a response to your comments, highlighted in red.

Reviewer 2 comments:

The authors outline the main features of a master's and PhD level teaching course called Arctic Tectonics and Volcanism, which has been taught over a number of years at UNIS in Svalbard. The manuscript serves as a good reflection of the style of courses on offer at UNIS, which incorporates fieldwork, groupwork, research questions and teaching. Feedback from the students is used to highlight the longer-term impact such courses have on students, of which I am in agreement, as I also took a UNIS course during my PhD (a different course, prior to the start of the Tectonics and Volcanism course). There are also many good examples of open data and open science within the manuscript. At times, the manuscript is overly long, with too much detail on the specifics of the topic. There are also many figures which do not relate to the manuscript, but rather serve as a showing of available data. The readers would be better served with more analysis of the educational approach and impact of such courses, or a better insight into the multidisciplinary aspect, for those who are not experts in geology.

We sincerely appreciate your feedback. However, we are reluctant to broaden the perspective of this manuscript to other UNIS courses at the expense of the circum-Arctic geology approach. In essence we strive to describe a very special course in the UNIS portfolio (special largely because it has been externally financed through NORRAM until 2023 and includes a truly circum-Arctic approach, and integrating many disciplines within the geosciences to tackle large issues) to motivate the geoscientific community to establish similar courses elsewhere (and if desired, use the data packages provided by us). We do not strive to write a manuscript about courses at UNIS in general. We do realise this does not satisfy your suggestions, but is in line with the comments of Reviewer 1 who actually wants the Arctic geology thematic expanded.

Whilst the paper in its current form is just within scope of the GC journal, as it highlights practical, pedagogical research and geoscience curricula development for higher education, it does not go as far as to analyse the course in detail. The feedback from students has not been used to evaluate and amend the course, and there is little reflection from the authors on what limitations the course has. Additionally, it is not a completely novel method – this is typically the 'UNIS' model of teaching (guest lecturers, fieldwork and fieldwork safety, research question focused group work). However, this doesn't detract from the need for the publication – the increased geopolitical tension in the Arctic coupled with the decreasing numbers of students taking geoscience education at higher levels highlights the immediate need for more cross-border collaboration and continued science diplomacy in the region. This publication highlights that out-of-classroom education and networking can lead to further career development and increased interest in taking geology at PhD level.

We have certainly taken student input into consideration when optimising the course over the years – but you are completely right that this section is not reflected in the manuscript. We will address this by expanding section 3 “The AG-x51 course: motivation, establishment and incremental optimization”. And add a brief section where we reflect on the limitations of the course.

With some minor corrections, I believe this manuscript should be published in GC.

Minor comments:

The abstract a bit too long – some of it reads like introduction. The list of what the course entails is too much information for the abstract. It could be shortened in the second paragraph to mention the main components (field safety, Arctic geology theory, group exercises, digital visualization tools, course assessment) but not go into detail.

We will shorten the abstract.

The motivation for the publication could be stronger – I am left wondering if this should serve as a template for others who wish to teach this course. If you are to include some limitations of the course (content, pedagogical style, location) or reflection on how to improve, then I believe it could also serve as a foundation for others to build similar courses and/or a best practice assessment. Do you aim to have some longterm impact on the number of students in geosciences or increased careers in geology after education? As I do see this in the student feedback and discussion, but there is not a mention of this in the introduction, which could strengthen the motivation. At the moment, the motivation is very tectonics/volcanology specific, but it should be widened to fit the broader geoscience scope of the journal.

We will strengthen the motivation to make it clear we want this manuscript to serve as a blueprint for running similar courses elsewhere. We have no concrete plans or ongoing long-term pedagogical projects on the influence of the course on career choices, largely because UNIS only offers single courses and the background of the students is so varied. We will however include a comment that research that connects students’ experiences in courses with their pursuit of careers in geosciences warrants further investigation - are good experiences enough or do geoscience educators need to more proactively mentor, advise and encourage pursuing geoscience careers. The theme will be tectonics/volcanology (see also point 1 above about our dilemma of being thematically constrained vs UNIS constrained).

There is no reflection from the authors on the limitations of the course. There is a 'lessons learned' section, but doesn't really give any learnings. Whilst the education is free, travelling to Svalbard is not –

and this therefore provides a very real financial barrier to many students (especially masters students who often do not have project funding with a travel budget). Additionally, living in Svalbard for 6 weeks is costly, especially for those who are not already living in Norway. Whilst fieldwork in Svalbard is relatively safe (limited concerns for people who identify as women or within the LGBTQ community for instance), travelling to a remote destination is still a limitation for some with visa issues for example (Svalbard is outside of Schengen).

We will clarify this and add a section on the limitations. The NORRAM project actually fully funded all its affiliated students to participate in the course.

Were there any questions in the survey/evaluation which asked the students for constructive feedback on how the course could be improved? Whilst we can't go back in time, I do think it is a shame that the evaluation came after so many years, which could make it difficult for those who joined earlier to remember their feedback. It would be useful going forward for you to evaluate the course each year and make changes based on that feedback. If this sort of critical feedback isn't available, perhaps the authors could reflect amongst themselves on ways the course should be improved. Do you also have any other demographic information besides country? Gender for instance?

We have this kind of feedback internally at UNIS, but this was not part of the pedagogical aspects of this present manuscript. But we will cover some of this in the improvement section.

There's a lot of information in section 4 which I do not think is needed. The subsections describing the course modules should be significantly shortened, or perhaps (as reviewer 1 suggested) the information could be displayed visually. Similarly, many of the figures seem redundant to the manuscript's focus. Figure 3/4/5 are geological maps and are a focus on the topic of the lectures given in the course, but are not related to the course pedagogy or the educational approach. These figures can be removed and the results/conclusions would still be the same. The paper really is too long, so I hope the authors can see the benefit of shortening it to focus on the key aspects that the paper should convey.

Here we disagree, as we want to provide adequate information for the specific modules so that the course can be reproduced elsewhere. Clearly the fieldwork component would need to be either fully digital or visit other relevant Arctic locations (none of which are as accessible as Svalbard). We will clarify this motivation in the text.

Specific Comments

Line 70: could we provide a statistic here? Perhaps take this for some inspiration:

<https://nordregio.org/maps/indigenous-population-in-the-arctic/>. Whilst the density of Indigenous peoples varies and is relatively low in the European Arctic, there are also many millions of people who

live there who are not Indigenous, and who require sustainable development and better education opportunities too.

Ok, we will incorporate this

Line 78-80: A reference or two could strengthen this section regarding the Arctic being in the spotlight of media and policies. Take a read of this and the relevant references therein:

<https://arcticyearbook.com/arctic-yearbook/2020/2020-briefing-notes/367-an-arctic-boom-of-policies-strategies-56-and-counting>

Ok, we will incorporate this

Line 100-105: does this differ in non-Arctic nations? I could imagine that at least undergraduate education is carried out in country of origin for the vast majority of places/countries. I could be wrong though, I have not looked into it. In the case of the Arctic though, there is evidence of a southward migration of students (university level) and skilled workers to the south, due to the position of the capital cities outside of the north/arctic circle. It is complex, but there's a breakdown of countries here (Arctic+Scotland):

https://www.pure.fo/files/24328830/Arctic_Connections_Final_Report_Rural_Youth_Out_Migration.pdf

We will rephrase it. And specify that there are no indigenous people in Svalbard and that UNIS does not offer full degree education, just single/blocked courses.

Line 113: first mention of motivation – but a lot of relevant information above with which to strengthen the motivation further. Line 150 is the next motivation point – but could be stronger.

Ok, we will rephrase this.

Line 131: I'm not sure this is true – there are regular field courses run by the geosciences department at UiT in Lyngen and other northern regions of Arctic Norway. Additionally, UiT and other universities use the Abisko research station in Sweden too.

Yes, but still most mainland universities in Norway (who are also represented on the UNIS board) send their students to UNIS for field geology training.

Line 232: occurred since 'the' beginning

Ok, we will rephrase this.

Line 246: 'one lecture' – how long is this lecture?

Ok, we will rephrase this.

Line 556: There is no table 12, perhaps 2? However this table only showcases European and North American countries – where are the other students from?

Yes, this is table 2. All countries are listed, there were no students from outside Europe or North America (based on institution they study at, not based on passports.)

Line 563: Can you split up the number of answers into the years? Did more people from the 2023 course respond than those from many years prior? Were you able to get in touch with those from 2018 with email and affiliation changes over time?

This should be possible

Line 579: This lines up with my comment above: It is interesting that many respondents are still involved in Arctic research, but does this reflect that the majority of respondents were from 2022 or 2023 perhaps? In which case, they may still be doing their studies/PhD? Or are there also cases of longevity in the career choices? Which could be interesting to highlight if so, as this could be a further motivation of the course.

We will investigate this by considering the respondents from various years, and highlight how many of the respondents are still involved in Arctic research (there are several from the first edition of the course that are in permanent academic positions with at least some polar geology focus)

Figure 8: Two of the pie charts have the same title.

Ok, we will fix this.

Line 684: extra r in the sentence after 'necessary'.

Ok, will be fixed

Line 685: What are the nationalities/affiliations of the lecturers and guest lecturers? Does this course bring together not only students from diverse places but also the lecturers? One can look at the author list of course, but I assume these are not all the guest lecturers from over time.

Ok, we will incorporate this.

Line 773 – 793: I personally don't see the need for including this section – Table 5 is enough.

Ok, we will remove this section and rather expand Table 5 with some comments.

Conclusions: Perhaps bolster again the motivation of your paper – just to outline a project is not enough in the scope of the journal.

Ok, we will incorporate this, to clarify that we provide adequate material to reproduce the course elsewhere and highlight our experiences with this.