3-årig emneevaluering: GEOV113

Emne: Refleksjonsseismisk datainnsamling og prosessering/ Seismic Reflection Data: Acquisition and Processing

Semester og år for gjennomført emneevaluering: H2019, H2020, H2021

Navn på emneansvarlig(e): Stéphane Rondenay

Innhold:

1. **Beskriv og begrunn pedagogiske valg i emnet, reflektér over studentens læring som følge av disse valgene.**

GEOV113 is a third semester bachelor-level course which is attended by geophysics students (for whom it is mandatory) and some geology students within the Department of Earth Science, UiB. It is also a course that is identified as an Erasmus offering within the department, meaning that it is usually very popular with exchange students. Enrolment has varied considerably over the last few years, ranging from >40 students in the early 2010s to <10 students in in the late 2010s. Current numbers hover around 20 students.

The course introduces important theoretical and practical aspects pertaining to the acquisition and processing of seismic reflection data. These types of data provide a means to image subsurface structure at a range of spatial scales - from exploration (e.g., hydrocarbons) to solid earth (e.g., crust-mantle boundary). As such, it provides knowledge and skills in one of the fundamental tools used by geophysicists to characterise the subsurface.

The course is separated into two parts of equal duration (6 weeks each). The first part is more theoretical. It introduces basic concepts of signal processing and seismic wave propagation in heterogeneous media. From this part, the students acquire essential background knowledge on how seismic waveforms are transformed by the structures they travel through, and how signal-processing-based methods are used to transform these seismic waveforms into images of the subsurface. The second part is more practical. It is concerned with the acquisition of seismic data – i.e., it provides a technical overview of the instrumentation used in both marine and land surveys, and describes how these instruments (both sources and receivers) can be arranged optimally to ensure the collection of high-quality data. These two parts can be taught in any order, but after testing the two alternative sequences, we found that, in general, learning the more abstract concepts (signal processing and seismic waves) first leads to a more logical flow.

As a whole, the course material has remained unchanged over the past 3 years, as the fundamentals of seismic data acquisitions and processing have not changed over that time. The course provides a mix of lectures and practicals, the latter being in the form of written problem

sets, Matlab exercises, and e-modules. Part 1 involves mainly formal lectures (4 hours per week) plus exercises that are done in a supervised classroom environment (2 hours per week), where students can work on Matlab-based problem sets with the aid of teaching assistants and the instructor. We feel that blackboard lectures are important for this part, as this approach represents a tested and proven way to communicate relatively complex theoretical concepts. But we are aware that these can become hard to follow if communication only flows one way. For this reason, we try to involve the students as much as possible by asking them questions and initiating conversations withing the classroom. Problem sets allow the students to test some of the theoretical concepts they have learned in class with (mainly) synthetic data examples. Part 2 involves a mix of lectures and e-modules, in which students learn various aspects of data acquisitions and then get to explore these on their own through a set of online interactive modules. Each module is designed to provide all the facets of a certain type of survey, allowing the students to spend as much time as they need to explore any of these facets (and revisit them at a later time if necessary). The modules conclude with an online quiz (ungraded) that help the students determine if they have understood well all the concepts.

We feel that this mix of teaching tools (lectures, discussions, Matlab exercises, e-modules), plus reading of background material (textbooks), is a balanced approach that combines guided and independent learning, thus providing students with an applicable basic knowledge and set skills in seismic imaging.

Emneevalueringer skal også minst omfatte:

2. **Oppfølging av tidligere evalueringer**

The previous yearly evaluation, from H2020, highlighted one main issue – the fact that some students elect not to do the non-graded portion of the weekly exercises of Part 1. These should be done because they contain problem sets similar to those encountered in the final exam. One solution we proposed in the last report to address this issue was to grade these exercises, but we don't have the resources to do this. Therefore, we suggested instead to divide the weekly exercise periods in two - the first half to work on the non-graded problem set, and the second half to work on the final (graded) problem set. This has not yet been implemented due to practical limitations (i.e., not all students come to the optional exercise period). In H2021, it seems that by interacting more with the students during the exercise periods – i.e., walking around the classroom and asking students how they are doing on the non-graded weekly exercises – we succeeded in motivating them more to work on these problem sets. But there are still some students who complain about having to do non-graded exercises, as pointed out in student evaluations (see more details in section 3 below).

3. **Studentevaluering og andre evalueringer som er relevante for emnet**

Formal student evaluations are available for 2019 and 2021 – the evaluation was not done in 2020. The evaluation of 2019 (similar to previous years) was generally positive – it appears that the varied teaching approach we use in the class appeals to the students. However, the 2021 evaluation contained more criticisms, particularly about Part 1, which we will try to address here.

As an introductory comment, it is worth pointing out that Part 1 of H2021 was taught by a permanent researcher who has not taught the class before. He was aided by a Teaching Assistant who also worked on the class for the first time. Both worked very hard on the course. They were well prepared and met frequently with the course coordinator (who usually teaches Part 1) to ensure a smooth transition, but they were not as aware of the parts of the theory and/or specific slides that students often find more difficult to assimilate. This is something that becomes apparent after several years of teaching the course, and thus this limited awareness may have contributed to the students having a hard time to follow some sections of Part 1. We expect that this is why students criticized the blackboard lectures of Part 1 (something that was generally appreciated by the students of previous years).

Some students criticized that they didn't get all the answers they wanted from the TA during the weekly exercises. A big issue here, also, is that our budget was cut from 2 TAs to 1 TA, and 1 TA (+ instructor) is not sufficient to handle all the questions from a class of 20 students during the exercise period.

We appreciate criticism regarding the quality of some of the slides of Part 1, which are taken straight out of the tutorial and show signals that are at times too thin to be displayed clearly from a projector. We will try to modify the slides to make them clearer.

Some students do not appreciate having to work on exercises that are not graded. This view is concerning to us – we do not feel that every task should count toward the final grade. Working on non-graded exercises is in our opinion an excellent way to develop independent learning skills. We will convey this notion to the students in future years, and maybe turn some of these exercises into group work, to motivate students more. Some propose to have all of the weekly exercises graded, but as mentioned in Section 2, we do not have the TA resources to do that.

Students would like to have more feedback on their exercises. While we do not believe that providing a full solution is the way to go (as these solutions circulate from year to year and can thus hinder learning), we will make an effort to provide more annotations in the reports. For the final exercise, we also propose to organise an additional information session of 2 hours during which the instructor and TA will answer questions that students may have about their solutions.

Lastly, some students would like to have more hands-on experience. We agree that his would be a great addition to GEOV113. We are therefore looking into adding a field component to the

course. This would involve a day-long research cruise near Bergen, whereby students get to acquire marine seismic data which they can then process as part of Matlab-based exercises.

4. **Erfaringer fra andre som bidrar i undervisningen på emnet, både studenter og ansatte**

The TAs from past years greatly enjoy working in this class. They feel that they make a real difference helping students acquire new knowledge and skills. It is however difficult for one single TA to fully address the needs of the students when there are ~20 students in the class, as demonstrated by the student evaluations from H2021.

5. **Strykprosenten på emnet**

One student over the last 3 year, representing 2.9% of all the students who have taken the class during this period.

6. **Eventuell fagfellevurdering**

Not applicable.

7. **Vurdering av samsvar mellom emnets læringsutbyttebeskrivelse og undervisnings-, lærings- og vurderingsformer**

The varied teaching tools employed in GEOV113 seem well adapted to achieve the targeted learning outcomes (see section 1). With regard to skills/knowledge evaluation for the class, a few years ago we started grading the final exercises for Part 1 and 2 (40% of final grade) – something which had been proposed by the students, who did not want the final exam to count for 100% of the grade. Now some students are requesting that all the exercises be graded (including those of part 1). Though we do not have the resources to do this currently, we will consult with the students during the H2022 semester to gauge, in real time, what their preferred approach would be for the weekly exercises of Part 1. This will also allow us to determine whether a majority of students would like a change in the approach for these weekly exercises.

8. **Vurdering av om framdrift og opplegg for emnet er i samsvar med de fastsatte målene for emne og program**

The order in which the material is delivered addresses well the goals of the course (see also comments regarding Parts 1 and 2 in Section 1). The course fits well within the curriculum, after the introductory course in geophysics and before more advanced courses in signal processing and seismic imaging.

9. **I de tilfellene det er tilknyttet praksis eller arbeidsrelevans i emnet, skal det evalueres om ordningen fungerer tilfredsstillende.**

Not applicable