Centre for Integrated Earth System Science Education (iEarth)

**VISION:** iEarth will create a student-centred, innovative learning environment for future Earth system scientists and citizens to meet complex societal challenges and opportunities. This will be done by promoting active learning and real-world problem-solving through a nationally integrated Earth system science education with a global perspective.

Earth System Science (ESS) is the study of natural systems closely linked to human activity and decision-making. The challenges imposed by a changing climate, resource demands, and shifting energy landscapes acutely highlight the interdependence between human society and our planet, as reflected in the United Nations Sustainable Development Goals (SDGs). ESS education is a precondition for societal resilience and environmental safety and underpins major energy and resource-based industries. This is particularly evident in Norway with our strong economic reliance on an oil and gas industry that depends on Earth science expertise. At the same time, Norway’s ambition to become a global environmental leader has sparked the need for renewed thinking about the future of ESS education and its role in society.

In iEarth, students and instructors will join forces with public and private stakeholders to build an educational system that connects many of the SDGs with our renewed ESS education goals, such as tackling climate change and working to preserve our land and oceans. Modern Earth science takes a systems perspective, which treats physical, chemical, and biological processes, including human activities, as components of a complex, dynamical system. ESS education thus provides unique opportunities for students to learn sought-after skills associated with real-world, complex problem-solving. However, existing curricula and teaching practices are too fragmented for these opportunities to be harnessed. Our goal is to unleash this potential and foster student engagement, self-motivation, and employability in an authentic learning environment. By transforming our curricula and our culture for teaching and learning, we aim to prepare students for a wider range of job opportunities and to empower the next generation of citizens to help solve the great challenges of the 21st century.

We specifically aim to realise our vision by the following strategies: 1) transform national Earth science curricula through a competence-oriented curriculum redesign; 2) create an effective learning environment by engaging students as partners in the educational process; 3) build a collaborative, innovative, research-based culture for teaching and learning among students and staff; 4) enhance student learning in the field by systematically investigating the effectiveness of field-based learning activities; and 5) develop internship practices and alumni networks as natural interfaces between students and future employers.

iEarth will provide the framework and resources required to implement these strategies, monitor and evaluate progress, and share best practices nationally and internationally. This application for a
Centre for Excellence in Education hosted by the Department of Earth Science at the University of Bergen (UiB) is a joint effort by four key national institutions (forming the consortium) engaged in ESS education in Norway: the Department of Earth Science and the Geophysical Institute at UiB, the Department of Geosciences at the University of Oslo (UiO), the Department of Geosciences at The Arctic University of Norway (UiT), and the Departments of Arctic Geology and Arctic Geophysics at the University Centre in Svalbard (UNIS). We have a number of collaborators in order to ensure pedagogic excellence and innovation, including the Higher Education Research Unit at UiB, the Competence Centre for Research in Natural Sciences and Technology at UiO, the Centre for Learning and Education at UiO, the Centres for Excellence in Education, BioCEED at UiB, CCSE at UiO, Vis-innovation at UiB, the Centre for the Science of Learning and Technology at UiB, and the Institute for Teaching Excellence and Faculty Development at the University of Massachusetts Amherst in the United States. International collaborators on education include Lund University’s Department of Geology, the University of Iceland’s Faculty of Earth Sciences, the University of Copenhagen’s Department of Science Education, and Washington College in the United States. Furthermore, the iEarth consortium has strong links with partners in industry, stakeholders, and public administrations to help develop teaching and learning approaches tailored to ESS. Contributing funding to iEarth will provide us with the means to establish an unprecedented Nordic competence centre for ESS learning capable of contributing to the international society of scholarship of teaching and learning (SoTL).

In the following sections, we provide a baseline describing the current status of our teaching and learning culture and establish a set of benchmarks to help us envision what ESS education at UiB, UiT, UiO, and UNIS should look like five years from now. The key is that both students and instructors should be able to envisage the starting point, the journey, and the goal, and they should be able to measure the progress along the way.

I. Documentation of quality in existing teaching and education

Following the previous call for SFU proposals in 2016, when our application was positively assessed, we systematically formalised and developed the national iEarth consortium (www.iearth.no). During the past two years, we have focused on promoting students as partners in the educational process, put more emphasis on increasing interaction with society, piloted SoTL projects, promoted new student-active learning methods, and disseminated our activities nationally and internationally [e.g. 1]. Our teaching staff is required to take 20 ECTS in basic pedagogies for higher education to secure competence and interest in the pedagogies of the consortium. We started mapping the curriculum with the goal of making it transparent at the undergraduate level, operated an annual ‘Learning Forum’ and instructor retreat for the exchange of teaching experiences, developed and improved our field teaching and evaluation, developed alumni networks, prepared for a ‘flipped classroom’ methodology, performed baseline surveys among staff and students [2], started
the development of an innovative programme for undergraduate research, and held frequent international webinars as part of our curriculum\(^1\). We have introduced innovative student-active learning methods in several of our courses. We have developed the first Massive Open Online Course\(^2\) on climate change that is now part of our curriculum and our students have been involved in outreach and dissemination through Scisnack\(^3\). GeOracle meetings, in which students help students with assignments and projects, and staff meetings addressing innovative ways of teaching and learning have been successful undertakings. Our staff is engaged in outreach and dissemination activities through national and international media. Students and instructors have been active in National Research Schools, such as the Research school on changing climates in the coupled earth system (CHESS) and the Norwegian Research School for Dynamics and Evolution of Earth and Planets (DEEP). In 2018, one of our professors was among the first five to be accepted into the Pedagogical Academy of UiB’s Faculty of Mathematics and Natural Sciences. Several of our staff members have received teaching awards, including the Olav Thon Foundation Award for outstanding teaching and the Norwegian Geological Society prize for outstanding teaching practices. In 2017, our new geohazard course was awarded for its learning environment\(^4\). Fundamental to our approach is the assumption that research excellence may serve as a stepping stone to excellence in teaching. The consortium’s shared excellence is evident in the form of research and innovation activities, participation in four Norwegian Centres of Research Excellence\(^5\), and numerous European Research Council (ERC) grants, including the only two ERC synergy grants given to Nordic countries\(^6\). The consortium has shared access to state-of-the-art research infrastructure, including “field stations” from Finse in southern Norway to Arctic Svalbard, fully equipped research vessels and state-of-the-art laboratory facilities for training and undergraduate research experiences.

The iEarth consortium represents a strong tradition of research-based education where the students are exposed to a broad range of teaching and assessment methods. We prioritise field teaching as excursions, fieldwork and cruises as part of their education to enhance hands-on experience with research methods in Earth science. Students in geophysical fluid dynamics have a strong mathematics and physics background that is put into practice through fieldwork, laboratory studies, and computational exercises. These on-site learning environments also support the development of transferable skills and lifelong learning \([3, 4]\). In some curricula, students are involved in research-based activities modelled after course-based undergraduate research experience

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\(^1\) https://www.geo.umass.edu/climate/webinar.html.


\(^3\) http://www.scisnack.com.

\(^4\) https://www.uib.no/en/node/109509

\(^5\) Bjerknes Centre for Climate Research (BCCR), Centre for Arctic Gas Hydrate, Environment and Climate (CAGE), Centre for Earth Evolution and Dynamics (CEED), and the Centre for Geobiology (CGB).

\(^6\) Ice2ice at UiB and WHOLESUN at UiO.
[5]. This will be implemented in all bachelor’s programmes in iEarth. Furthermore, iEarth is focused on developing independent thinking and introducing students to the culture and methods of research to promote student learning. This is achieved through discussions, critical reading, writing, peer-review evaluations, and feedback in collegial environments. The focus on promoting student learning also includes small research projects during which students receive support and follow-up from staff and graduate students during the research process. These projects aim to help students identify research questions, develop aims and objectives, learn new techniques, collect data in the field and/or in the lab, analyse data, conduct numerical simulations, and write scientific reports and journal papers that contain hypotheses for testing and/or falsification. A variety of teaching and assessment methods are combined in most courses to foster and evaluate multiple skills and knowledge types.

Based on the evaluation of our study programmes and the study completion rates in the consortium, the present Earth science education provides a solid platform from which to launch iEarth. Surveys indicate that graduates are satisfied with the content, relevance, and quality of their education, which they believe provides valuable transferrable skills, such as analytical, communication, and cooperative skills. However, despite all the positive qualities mentioned above, the Earth science curricula are too compartmentalised to provide the educational coherence, progression and integration required to meet societal needs. For example, students outside of geophysics see a need for enhanced computational and data analysis skills [6]. We are confident that our educational provision is relevant to the continued development of our educational programmes. Despite this strong standing, we realise that the scope and practices of ESS education is in need of a major transformation, if we are to step up to societal challenges and demands for new forms of Earth science expertise, the transition to a more sustainable and low-emission society addressed in the UN’s SDGs, and development in didactic and digital educational methods. We are currently performing a baseline survey within the entire iEarth consortium where we map the qualities of current curricula, the teaching and learning environment, and the future needs for ESS education among both staff and students. The overall aim is to assess the status of teaching and learning culture, provide input and targets for future development, and monitor progress towards excellence in teaching and learning [2].

II. Centre plan — strategy, plan for innovation, and dissemination in iEarth

iEarth will have five interdependent progress domains (PD1-5) led by teams of passionate and highly qualified staff members from all four partner institutions. Our approach is to build on the strengths and resources available in the consortium and collectively transform our Earth system education into a transparent curriculum with the flexibility to develop cross-disciplinary and inter-institutional/national courses. We will develop the governance of iEarth through student involvement, shared leadership, shared resources, pedagogical expertise, and ‘Geolearning Forums’ within the consortium.
Progress Domain 1: Shaping the future (led by Bjarte Hannisdal, UiB)

Keywords: Systems thinking, real-world problem-solving, employability, curriculum redesign

Through iEarth, students and instructors will join forces with public and private stakeholders to build an ESS education that rests on five pillars of human and societal relevance: geohazards, resources, energy, environment, and climate. From a pedagogical point of view, ESS has a great advantage in being inherently tangible in terms of human experience, which enhances student motivation. On the other hand, the complexity of dynamical Earth systems poses a formidable challenge. Overcoming this challenge requires knowledge integration across the domains of temporal and spatial thinking [7], field learning (PD4), and systems thinking [8]. The integration of computational learning practices [9] and proficiency in mathematical and computational methods is needed to progress from our innate tendency to perceive events sequentially in linear causal chains towards an interconnected, dynamical process-like notion of causality that is characteristic of complex Earth systems [10, 11].

Objectives: We aim to empower students through an integrated systems perspective and sought-after general skills that underpin their employability whilst strengthening the craftsmanship needed to become a scientist. To pursue this dual goal, students and instructors will take a fresh look at problem-solving activities encountered in ESS curricula and recast them as instances of a general form of ill-structured problems encountered in real-world situations [12]. Unlike classic textbook problems, the key components of realistic, ill-structured problem-solving [13] require training on how to define unclear problems and goals, work with incomplete and uncertain information, evaluate multiple possible solutions, and build arguments. These components characterise both authentic scientific research problems, as well as other real-world problems in the workplace and society at large. iEarth is in a unique position to provide student-active problem-solving learning by mobilising a set of key scientific practices [14], such as asking questions, performing investigations (field, lab, numerical, theoretical), acquiring, analysing, and interpreting data, using and producing models, creating explanations, and communicating results. To foster student learning, motivation, and engagement, iEarth will involve students in the co-creation of a learning environment (PD2 and PD3) that supports this type of training [15, 16], including authentic, contextualised problems, sustained investigation, collaboration, expert coaching, scaffolding, and integrated, formative assessment.

Progress Domain 1 — key steps: PD1.1. Identify needs and gather data. A core team, including an iEarth PhD position, will lead the effort to gather internal data across the consortium (e.g., conducting SWOT analyses and change readiness surveys, defining a baseline for the status of the education), as well as external data (e.g., literature, international peer institutions, societal stakeholders). We will identify key factors relevant for motivating instructors to engage in a transformative redesign process [17] that aims to reorient a traditionally content-based curriculum (‘science as encyclopaedia’).
towards general competencies and skills (‘science as process’). PD1.2. *Curriculum mapping.* We will develop a framework for competence-oriented curriculum mapping that integrates institutional (e.g., course descriptions), instructor (e.g., teaching methods), and student (e.g., assessment) perspectives. To facilitate the change process, we will implement a very concise set of mapping categories (e.g., competence level, explicit/implicit, learning outcome coverage, assessment) [18, 19]. PD1.3. *Student involvement.* Students will be engaged in the redesign process by critically exploring formative assessment (e.g., rubrics) in a competence-oriented curriculum. By clarifying the relation between forms of self- and peer-assessment and learning outcomes directly relevant to real-world problems and their own employability, students will be active agents in the assessment of their own learning [20]. Thus, transforming the students’ approaches to learning (PD2) will be a key component of the curriculum redesign process. PD1.4. *Dissemination, evaluation, and revision.* Through monitoring and visual analytics, we will use feedback and evaluation data to learn, adjust, and revise the curriculum redesign process in five-year cycles. Given the rarity of competence-oriented Earth science curriculum redesign [21], our innovative approach will be the topic of an iEarth PhD-SoTL project. We envisage that this tool can be expanded across iEarth and implemented to monitor and measure progress and success.

**Progress Domain 2: A learning environment for students (led by Anders Schomacker, UiT)**

**Keywords:** Student engagement, student voice, independent learning, high-impact practices, course-based research experience

Society, employers, and academia require self-motivated, independent learners capable of lifelong learning. To foster independent learning, students need to be partners in the educational process [22], which is a cornerstone of the iEarth vision.

**Objectives:** Students will take part in their education as an active process of inquiry and not just a collection of disconnected facts. Traditional teacher-centred instruction will be reoriented towards student-active learning through high-impact practices [23], including authentic problem-solving [12] and undergraduate research experience [24]. By situating learning activities in an authentic context, students can experience the same problem-solving challenges in their education that they encounter in real life [4]. A curriculum that involves real-world ill-structured problems (PD1) requires an effective learning environment for students, including student-instructor interaction, collaborative learning, sustained investigation, reflection and argumentation, high expectations, scaffolding, and inclusive learning [3].

**Progress Domain 2 — key steps:** PD2.1 *Engage students as partners.* To increase the extent to which students understand and engage with their own educational goals, we will encourage peer instruction and assessment and ensure that student feedback to instructors more accurately targets the
learning process [25, 26]. A key factor in transforming students’ approaches to learning is to shift emphasis from traditional final exams towards integrated, formative assessment [27, 28]. Instructors will provide support (PD3) for students to develop learning strategies and self-efficacy. Independent learning and autonomy, which strengthen intrinsic motivation, engagement, and deep learning [11], will also support researcher training in iEarth by providing students with the freedom to pursue areas of special interest and encouraging them to initiate their own scientific projects. PD2.2 *Provide course-based undergraduate research experience.* We will establish such a framework early through repeated exposure to collaborative research projects in the auditorium, the field, and in the lab. By using technologically enhanced classrooms and real-world observational data, students will progress towards expert behaviour; they will do this by asking questions, framing and testing hypotheses, analysing data, producing models, making decisions under uncertainty, designing and performing experiments, building argumentation, and communicating results. The implementation of undergraduate research experiences in the curriculum will be the subject for PhD-driven SoTL projects and one postdoctoral fellowship. PD2.3 *Optimise instructional technologies and physical learning spaces.* Achieving our goals will require robust teaching and learning technologies and flexible physical learning spaces. We aim to create a physical environment that facilitates flipped classroom approaches [29], group work, lectures, webinars, mobile learning, and virtual reality, as well as hands-on experience with diverse sample materials, current measurement data, high-performance computing, and state-of-the-art laboratories. To this end, iEarth will prioritise the development of digital platforms by building on expertise at DigUiB and SLATE to disseminate learning resources, online collaboration, and webinars, to evaluate the use of new technologies, and to provide structured feedback and evaluation tools.

**Progress Domain 3: A learning environment for instructors (led by Mattias Lundmark, UiO)**

**Keywords:** Scholarship of teaching and learning, collaborative teaching culture, evidence-based teaching practices, Earth science education research, student involvement, dissemination

iEarth supports the development of excellence in teaching and learning as a collegial undertaking, and a key goal is to build a collaborative culture for teaching and learning capable of implementing an ESS perspective across the curriculum, developing shared courses across several institutions, and carrying out operational teaching development.

**Objectives:** We will build a collaborative and knowledge-based culture for teaching by emphasising an exchange of ideas and experiences, innovation, and the continuous development of teaching practices. Teaching development has always been a part of teaching but has commonly had a private and non-systematic character, decoupled from educational science. To address this, iEarth will support the systematic investigation of the relationship between learning activities and learning outcomes, as well as the sharing of results through the scholarship of teaching and learning [30]. We
will use the nascent national focus on excellence in teaching in higher education, which is reflected in, for example, new guidelines for academic hiring and promotion, [31] to drive institutional and staff ambitions in teaching development. One important goal is to support teaching and teaching portfolio development for temporary and permanent staff promotion and to have systems promoting staff to qualify for ETP status (not implemented at all institutions yet). We will develop shared courses across the consortium (PD2) to allow iEarth partners to provide a wider range of both highly specialised courses for postgraduate Earth science students and courses that reach across disciplinary boundaries for adapting to societal needs. We will engage students as participants and partners in teaching development by directly involving them in co-creating and evaluating existing and novel teaching practices, technologies, and materials [32, 33], thus giving students greater ownership of and influence on their education. We will build a national and Nordic Earth science education research group for higher education teaching. This will be done in collaboration with our partners in Sweden, Denmark, and Iceland. We will also work towards establishing a Nordic Earth science education research school based on the same model as CHESS.

**Progress Domain 3 — key steps:** PD 3.1 Catalyse cultural change for instructors at a national level in ESS education. This will be done through 1) organising annual ‘Geolearning Forums’ for national and international partners and collaborators (organised as a pilot in 2018 for the first time), as well as inter- and intra-institution-based seminars and workshops aimed at both permanent and temporary staff (in collaboration with DEEP, CHESS, BioCEED, etc.); 2) developing a virtual competence centre for knowledge and resource sharing for instructors and students; 3) employing SoTL as a means to change the perspective of both instructors and students towards a more collaborative and research-like view of Earth science teaching; 4) involving students as partners and participants in teaching and in teaching development through such things as giving rapid feedback on teaching initiatives, conducting micro-investigations of teaching and learning, and developing teaching materials; and 5) providing support and resources for teaching development (project funds have been allocated in the iEarth budget), such as time (e.g., educational sabbaticals), teaching and pedagogical support, and support staff in achieving ETP status. PD3.2 Develop generic approaches for cross-disciplinary courses distributed among the consortium partners. This will be done by supporting and coordinating the development of two consortium-wide courses among the entire iEarth team in geohazards and climate change. Following the experiences from these courses, we will review and develop sustainable course formats and communicate best practices. Based on feedback from students, alumni, and stakeholders, we will identify both specialised and interdisciplinary themes suitable for shared courses and initiate the further development of similar courses across the iEarth consortium. PD 3.3 Develop educational research and initiate SoTL activities in all progress domains in iEarth. We will build a national ESS education research group for university teaching that will
investigate and track the longitudinal changes in teaching culture and practices. This will be implemented through the hiring of five adjunct professors, five doctoral projects, and two postdoctoral fellowships that will explore and develop ESS teaching and learning in a Norwegian context through tailored SoTL activities and, based on the outcome of this, will develop innovative solutions to challenges of shared courses in Earth sciences. Dissemination will be secured through the establishment of a Nordic research school with partners in Sweden (Lund), Denmark (Copenhagen), and Iceland (Reykjavik). PD3.4 Appoint an education chair at each institution. The chair will be responsible for: 1) initiating, coordinating, and supporting teaching collaborations, ‘Geolearning Forums’, and science education research; 2) supporting and motivating staff to take part in SoTL projects; 3) following up on baseline surveys and measuring progress in the iEarth project; and 4) coordinating and supporting the dissemination of research and practices nationally and internationally. PD3.5 Dissemination, evaluation, and revision. iEarth will foster a culture change where instructors participate in an increased number of conversations on advances in teaching and learning locally, nationally, and internationally. We will develop new arenas for these conversations in addition to those at MNT nationally and ISSOTL internationally. An important part of evaluating this culture change will be to develop tools that can monitor progress in this participation (as listed in PD1).

Progress Domain 4: Field-based education (led by Lena Håkansson, UNIS)

Keywords: Deep learning in the field, location-focused field learning, assessment, digitalisation and technology, development of unique learning environments

Traditionally, field-based education has been an important component in Earth science curricula [34] by providing practice and a foundation for the development of specific skills within the discipline [7, 35, 36]. Organising and conducting field teaching is, however, a demand on resources and recent economic constraints on Earth science university education have caused a significant reduction in all field activities. However, it is a very important component, and field-based education in marine and terrestrial environments pushes students across important thresholds to give them deep learning of Earth science. Moreover, it drives interaction through observation, instrumentation, and technology in real research environments further in allow students to practice and develop those skills in authentic settings [37, 38]. Learning in the field provides students with a unique opportunity to apply the techniques and concepts that they have worked with theoretically [7, 35, 36].

Objectives: We aim to place our field-based education on a more solid foundation by expanding research-based knowledge on effective student learning in the field. To achieve this expansion within realistic economic constraints we need to make efficient use of local field laboratories and instrumentation. We will develop, test and evaluate digital tools and assessment methods together
with the DIKU project AKTIV-2018/10172, a collaboration between UiB and UNIS focusing on constructive alignment between field learning outcomes and assessment methods.

**Progress Domain 4 — key steps:** PD4.1 Develop field-learning outcomes and test and implement assessment methods for these learning outcomes. To improve learning outcomes and justify the priority of field-based education in future curricula, we need to document student-learning processes in the field. Our aims are to strengthen the knowledge base about field learning and use this actively in the development as a resource for instructors to align courses with field-based learning activities. A core team, including an iEarth PhD, will lead this work. PD4.2 Establish local field laboratories in the landscape around the iEarth institutions. This will enable location-based learning and a sustainable increase in field learning, which is emphasised in the ESS approach. Expanding the use of local field laboratories and instrumented sites and networks will facilitate repeated training of basic skills, thus allowing students to perform fieldwork independently with other students in well-known areas following earlier, more guided fieldwork. Local field laboratories will also be a hub for the development and implementation of new teaching methods and assessment strategies inspired by the Real Data initiative\(^7\) at UiB. PD4.3 Establish a comprehensive baseline study on the position of fieldwork in university Earth science education in Norway and on Svalbard. Recent literature has demonstrated the importance of fieldwork [4]. However, as resources become scarce, field experiences are often targeted for cuts [39]. Therefore, it is crucial to document and develop these activities and to set up SoTL activities to increase the awareness of field teaching in ESS education [38]. One PhD position will be allocated to this activity. PD4.4 Test and document the use of digital methods to improve student field learning. Significant technological advances often result from a series of evolutionary steps rather than breakthroughs. To take part in such evolutionary steps, the academic institutions need to be more hands-on when new technology is emerging. In Earth science, and especially within geomatics, this development has emerged in the industry as the implementation of new technology in field learning at the university level, but this lags behind the development in industry. iEarth will strive to close this gap and collaborate with external partners, such as NVE and NGU, alumni (PD5), and stakeholders, to share competence and explore the use of drones, virtual-reality field-trip preparation in our field education [1].

**Progress Domain 5: Networking and society contact (led by Iver Martens, UiT)**

**Keywords:** Alumni, internships, communication, employability and dissemination

Alumni connections are important resources that can contribute to educational development [1] and can be an engaged, supportive network that can secure communication between iEarth and society. If communication ends once graduates leave an institution, their understanding of the

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\(^7\) [https://ektedata.uib.no/](https://ektedata.uib.no/)
university will become stale. Instead, they should be kept involved so they can remain engaged and be kept abreast of the progress of the university. Good alumni relationships bring many benefits to both the institution and the alumni. Talented alumni will have a wealth of experience and skills to share with current students via talks, newsletters, or meetings. Two-way interaction between higher education institutions and society is essential to secure broad societal relevance of ESS education. iEarth will be an important asset for dissemination and two-way communication at every scale between institutions in higher education, research, industry, the public sector, and NGOs. Traditionally, Norway has seen few alumni networks, but in the iEarth consortium, each member institution will promote, establish, and develop an alumni network. For the relationship between stakeholders and the academic community, trust, honesty, a safe space for deliberation, and the acknowledgement of the others’ competence must be nurtured. These are the core themes to be developed in the alumni network. By building on industry contacts through alumni networks, we will promote and implement internships as an integrated part of ESS education (PD2) and empower our graduates to clearly articulate their skills and the broad societal relevance of their education. We have already established an open 10 ETC course code and started drafting internship projects together with NVE on geohazards. Such experiences will contribute to enlarging the students’ skills bases, building awareness of competence, and enabling students to trust their own capabilities. Many employers use internships as a fast track into their tenure programmes for hiring new staff.

**Objectives:** We aim to develop alumni networks at the iEarth institutions to ensure good contact between academia and potential employers. We aim to generate databases and social channels for alumni information by creating spaces for meetings and outreach between candidates and the alumni networks. Based on industry and stakeholder contacts, we will establish routines and put internship solutions into play across the consortium and its alumni networks for the various study programmes.

**Progress Domain 5 — key steps:** PD5.1. *Establish and develop alumni networks at individual institutions.* A key network component is advocating for alumni to offer practical support for students in work placements and help them launch their work careers. At UiT, the network has already been established by using LinkedIn and by holding annual alumni gatherings. Based on their experience, the entire iEarth consortium will start developing an alumni network. PD5.2. *Establish, develop, and maintain the internship capacity.* This will be done together with partners from industry and potential employers, such as consultant companies and governmental agencies. We will establish a database for internship possibilities and design an overview of potential employers and contacts, develop routines for student-employer contact, and disseminate the internship schemes to potential employers. Internships should ideally be aligned with the employer’s wishes and be in parallel with iEarth’s ideas on undergraduate research experiences, arranged as small-scale research projects. Student interns will perform well-defined research projects at the host institution, among industry partners, and with
stakeholders. In addition, we will establish an annual networking day (career day) at each institution to secure communication and share experiences from the internship programme.

**III. Organisation of the iEarth consortium**

Securing an organisation able to run a centre and fulfil the goals of this proposal require clear management. The centre manager/leader (Jostein Bakke, UiB) and his deputy (Hanne Hvidfeldt Christiansen, UNIS) will be responsible for project leadership. They will report to the consortium and the advisory board, monitor progress through communication with education chairs, communicate with DIKU, manage internal projects, and manage iEarth financially and administratively. The consortium structure is outlined in Figure 1 and indicates the arrangement of the centre and the interaction between the centre board, the advisory board, and the management. The advisory board, whose members are representatives from our international collaborators, will be a particularly important asset that will monitor and advice iEarth activities. The centre board and the involvement of heads of departments in iEarth are crucial for securing the iEarth legacy after the project period. Dissemination of the results is a key component of iEarth and will be targeted in each PD. The outcome of key steps in each PD will be subject to monitoring, and we will measure success using visual analytical tools as described in PD2. The legacy of iEarth can only be maintained if our research-based findings are implemented as best practices in the consortium as part of strategies at each institution.

![Figure 1. Annual Geolearning Forums are important for dissemination and for communication within the consortium. Building a collegium of PhDs, postdocs, and adjunct professors is crucial for executing the key steps in each PD and for running internal development projects.](image-url)
References:


## iEarth budget from autumn 2020 to spring 2025

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**Personnel:** *Management:* Scientific project manager and centre leader (50 %), administrative project coordinator (100 %) and 4 education chairs (50 %) representing each of the institutions will lead the centre management. The education chairs will oversee project progress and manage development of PDs at their respective institutions, thus ensuring implementation of iEarth policy throughout the consortium. In addition, 1 lab technician (20%) will lead technical field and laboratory development throughout the consortium. Each of the PD leaders (20 %) will oversee development. *Pedagogic research and development:* funding of five PhD students (1 in kind from each of the consortium institutions and one in addition from UiB) working in the projects focusing on teaching methods and innovation supervised by department of Pedagogics, UiB and SLATE in collaboration with Earth scientists from the consortium (all PDs). In addition, we will hire three post docs for taking part in the undergraduate research experiences including responsibility for setting up systematic tools for evaluation (all PDs). To secure international dissemination and quality control in iEarth three 20% adjunct professors as in kind from UiB/UiO and one over the iEarth budget financed from DIKU will be guest lectures on courses and take part in the supervision of PhD candidates. These adjunct professors will in kind aid iEarth in upholding a high international standard as well as promote exchange of teaching practices across the collaborating partners. *In kind:* Teaching time from all scientific staff and lowered institutional overhead costs, including office space, IT, HR and administrative services as well as publication and research services. Expertise from department of Pedagogics, UiB. Student guidance and administrative support.

**Development and innovation:** This post will cover the day-to-day cost of running the centre as well as infrastructure digital tools and travel expenses for retreats and conferences. The largest expense included in this post is internal projects (5 mill. NOK total), which will function as a fund the PDs can apply for in the start-up phase of each internal project. This post is crucial for implementing the new curricula and will cover teaching assistance, production of instruction videos, software development, implementing of digital tools in teaching, development of visual evaluation tools etc. *In kind:* use of webinar facilities at UiB.

**Teaching:** Equipment for webinar facilities (600 000 NOK) and expenses related to internships and travel. *In kind:* Access to laboratories, ship time and field cost. **Dissemination:** The costs associated with dissemination are mainly for organizing and participation in workshops and international conferences regarding Earth science education as well as a virtual competence centre as a shared resource in the consortium and for collaborators.

**Plan for financial resource acquisition:** DIKU; 40 mill. NOK In kind from UiB and consortium members 43.8 mill. NOK.
Letters of intent

From the consortium institutions
Confirming UNIS role in the iEarth SFU application

The University Centre in Svalbard, UNIS has been involved in developing the national iEarth consortium since 2016, represented by several staff members from the Arctic Geology Department. We look very much forward to taking the leading role in iEarth with respect to establishing and operating the field learning development area in close collaboration with the other consortium partners. For UNIS to take on this role is very natural as we have a key mandated focus on field learning in all our educational activities making full use of the geographical position of the institution in the Arctic in Svalbard. Therefore the planned iEarth field educational development is very important also for UNIS as an institution, and we expect to have effects on all parts of our extensive field learning activities.

The iEarth SFU ambition comply fully with the overall UNIS educational strategy to be world-leading in research-based field education in high Arctic science and technology – preparing students for future challenges. And fits especially nicely to one of the main educational goals at UNIS to provide specialised and interdisciplinary education relevant for science and society, including competencies needed for a sustainable future. Participating in iEarth also further strengthen the close collaboration with Norwegian universities that UNIS also is mandated to do.

At UNIS it will be both the entire Arctic Geology Department and the Arctic Geophysics Departments that will be involved in the iEarth work.

We confirm that we will be fully funding a 4 year PhD position from UNIS in iEarth, who will be working within the field educational development area. We also confirm that our staff will be involved in the planned activities, and look very much forward to taking active part in shaping the future Earth science education in Norway in iEarth.

Yours sincerely

Harald Ellingsen
Managing director

Hanne H. Christiansen
Vice Dean Education
Statement from UiT The Arctic University of Norway regarding application for iEarth Centre for Excellence in Education

We are pleased to confirm that UiT The Arctic University of Norway (UiT) supports the application from our Department of Geosciences at the Faculty of Science and Technology to be awarded status as Diku Centre for Excellence in Education (Centre for Integrated Earth System Science Education (iEarth)). We view the proposal as an important contribution to the achievement of our strategic goals, and we accept the described responsibilities and obligations as member of the iEarth consortium.

In particular, iEarth will help us reach our strategic goals of developing and applying new pedagogic tools and student active learning, as well as to increase the use of new digital technology promoting learning. Furthermore, the concept of iEarth as a centre consisting of four geographically spread institutions will provide UiT with highly valuable experience for our own multi-campus educations. We are confident that iEarth will make our geoscience education more attractive and improve student interaction with research and future employers throughout the study.

The Department of Geosciences has already experience as host for two research centres: the Centre for Arctic Gas Hydrate, Environment and Climate (CAGE), as well as the Research Centre for Arctic Petroleum Exploration (ARCEx). The department has also successfully led a PhD school for more than ten years. Hence, UiT offers iEarth an excellent geoscience research environment as well as experience with operating large centres as background for the proposed Diku Centre for Excellence in Education (SFU).

Best regards,

Wenche Jakobsen
Prorektor of education and quality

Wenche.jakobsen@uit.no
+47 77 62 51 24
Application for Centers of Excellence in Education

We refer to the call for proposals for new Centers of Excellence in Education of 15. February 2019. With this, The University of Oslo (UiO) promotes the following three applications:

Centre on Experiential Legal Learning (CELL)
CELL is an initiative from the Faculty of Law directly addressing the weight University of Oslo currently is putting on stronger links between education and practice. In the upcoming strategy of the university, “knowledge in use” has become a key term for describing how knowledge and skills acquired during study trajectories need to be relevant for both current and future societal needs and challenges. This emphasis is also key for CELL where clinical training, digital skills and a continuing dialog between students, teachers and working life is an essential characteristic of the planned activities in the center. The University of Oslo is strongly supporting the systematic approach designed to develop the future skills of students at CELL, and we believe we can gain much experience through this establishment.

Oslo Academy for Studies in International History (OAS-HIS)
OAS-HIS is an initiative from the Faculty of Humanities which in a pro-active way seeks to strengthen and renew the links between the humanities and working life. This will be done through a systematic establishment of new arenas for constructive alignment between a more global society and the insights and lessons history may provide as a way to interpret, understand and shape this development. OAS-HIS has a clear ambition to work closely with private and public actors, and to demonstrate the relevance of humanistic knowledge through new models for cooperation and partnerships. Through this initiative, the planned center echoes the strong weight given to facilitate “knowledge in use” as it is labelled in the upcoming strategy to be launched by the University of Oslo.

Center for Sustainable Health Care Education (SHCE)
SHCE is an initiative from the Faculty of Medicine directly addressing the Sustainable Development Goals (SDGs) identified by the United Nations. More specifically, the ambition of SHCE is to create a new educational model for educational offerings within the field of health where ethical reflection, critical judgement, and knowledge about power relationships and structures are key building blocks. In this way,
SHCE reflects the University of Oslo’s long tradition for thinking and acting globally and for developing educational offerings that are inclusive and that can inspire others – domestically and abroad. In our current strategy, the University of Oslo has underlined the ambition of being a groundbreaking university with a strong engagement for global challenges. SHCE strongly reflects this ambition.

UiO confirms its support for each of the three centers with NOK 0.8 million per year in the period in which the center / centers would become part of the SFU scheme.

In addition to CELL, OAS-HIS and SHCE, UiO is one of the consortium partners to the Centre for Integrated Earth System Science Education (iEarth). iEarth is a collaboration between the Faculty of Mathematics and Natural Sciences and several other Norwegian institutions having the ambition of creating a completely new geoscience education in Norway. The application is a follow-up of an earlier application, and the work that has been conducted since 2016 demonstrates the strong and continuing engagement for this project. iEarth is based on the idea of a more integrated and problem-based educational approach in the geoscience educational area, and the center is directly linked to our strategic ambitions of a stronger links between research and education, and the need to strengthen students’ independent thinking and their critical judgement. The funding from UiO to iEarth are as follows:

One PhD position
One 20 % position (Professor II)
The working hours of some of the permanent scientists are part of own funding.
The Faculty of Science at the UiO grants NOK 300,000 annually

Sincerely yours

Svein Stølen (signature)
Rector

Arne Benjaminsen (parafering)
University Director

This document is approved electronically by UiO and is therefore not signed.
Officer in charge:

Lene Fosshaug
+4722857899, lene.fosshaug@admin.uio.no
iEarth – Centre for Integrated Earth System Science Education  
- SFU Proposal 2019

Climate and energy transition is one of the three main areas of research at the University of Bergen (UiB), along with marine research and global challenges. Educational excellence within the priority areas is of equal strategic importance to UiB, which is why the institution committedly supports the iEarth consortium and shares its vision for tomorrow’s earth science education.

The consortium’s ambitions and plans for a Centre for Integrated Earth System Science Education resonate clearly with UiB’s strategy objectives pertaining to quality in education. If the centre is awarded SFU status UiB is committed to coordinate and co-fund it, based on invaluable experience from hosting bioCEED - Center of Excellence in Biology Education. UiB acknowledges and appreciates that the SFUs have a particular responsibility to disseminate knowledge and practices both within and outside their host institutions.

Yours sincerely

Oddrun Samdal
Vice-Rector for Education

This document has been electronically approved and therefore has no handwritten signatures
CV

Centre Leader – Jostein Bakke
Leader PD1 - Bjarte Hannisdal
Leader PD2 – Anders Schomacker
Leader PD3 – Anders Mattias Lundmark
Leader PD4 – Lena Håkansson
Leader PD5 – Iver Martens
Name: Jostein Bakke

Position: Professor of Quaternary Geology

Jostein Bakke (JB) holds a position as professor at Department of Earth science, University of Bergen. JB is Dr. scient (PhD) in Physical Geography from Department of Geography at University of Bergen and has research experience in Quaternary geology, physical geography, glacial history, palaeoclimatology, geomorphology, and lake sediments world wide. JB defended his doctor Scientiarum thesis "Late Weichselian and Holocene glacier fluctuations along a coastal south-north transect in Norway – climatic and methodological implications” 16.04.2004 at Department of Geography, University of Bergen. JB has 18 years with experience as lecturer through 25% teaching during his PhD and first 20% and later 100% position as Associate Professor/Professor at Department of Geography and Department of Earth Science, UiB. At present JB is leader of the Quaternary System Research group in the department and leader of Centre for Integrated Earth Science Education (iEarth). JB has supervised 52 master and 9 PhD students and 3 Post Docs, extensive teaching experience from 11 courses, published 64 papers in international peer-reviewed scientific journals, numerous reports, 31 popular science articles and 94 conference papers at international conferences. JB has extensive experience as fieldwork-leader from Svalbard, Greenland, Scandinavia, South Georgia and polar Ural. JB is currently leader of Earth Surface Sediment laboratory, a national infrastructure finances by NRC. JB is holder of the Fulbright Arctic Chair Award for the academic year 2011/2012. JB has three periods as a guest scientist abroad, Department of Geography, St Andrews University, Climate Geology, ETH Zurich and Climate System Research Centre, UMASS, US. JB has earlier been funded through and are funded through various NRC project such as X-LAKE, ARCTREC, SHIFTS, EISCLIM, GLASINSIA, ICEHOUSE2, PALEODRAKE.

Education

2000-2004, University of Bergen, Dr. Scient

Employment

2012: Professor, Department of Earth science, University of Bergen (Leader of Quaternary Earth Systems group and Leader of Centre for Integrated Earth Science Education and member of the Bjerknes Centre for Climate Research at University of Bergen)
2011-2012: Professor, Department of Earth Science, University of Bergen
2008-2011: Associate Professor Department of Geography, University of Bergen
2005-2007: 50% Research scientist at Bjerknes Centre of Climate Research
2006 - 2007: 50% Associate Professor at Department of Geography, University of Bergen and 50% post doc at X-LAKE (NFR project)
2004 - 2005: 20% position as Associate Professor at Department of Geography, University of Bergen
2004 - 2005: 80% position as Research Fellow at Bjerknes Centre for Climate Research, University of Bergen (NORPAST-2, module 4)
2000-2004: PhD scholarship at Department of Geography and Bjerknes Centre for Climate Research, University of Bergen
Teaching
GEOV 226 Field and laboratory methods (2012-) (responsible for course)
GEOV 102 Intro. to geology – seminars, field and laboratory (2012 -) (responsible for course)
GEOV 101 Introduction to geology (responsible for course) (2012 -)
GEOV 217 Geohazards
GEOV 324 (2010 - ) Paleoclimatology-International Quaternary Webinar-(responsible for course)
GEOV 322 (2013 - ) Master excursion in Quaternary Geology (responsible for course)
GEO 100 (2008-2011) Introduction to geography (responsible for course from 2008-)
GEOV 106 (2001) – Quaternary geology
GEO 112 (2000 - 2011) (responsible for course in 2006)
GEO 115 (2007 -2011) Cartography (responsible for course from 2007-)
GEO 211/212 Field course in physical geography (2000 - 2007)
GEO 291 (2007- 2011) - Paleoclimatology
GEO 310 (responsible for course in 2006) – writing course for MSc students
WAT310 (2004-2006) – Water and resources – Department of geography

Key teaching goals:
• Be an enthusiastic and engaged teacher for my students open for new ideas and teaching methods. Focus on ownership for the individuals learning.
• Use student feedback to improve my own teaching both in classroom, in field and in laboratory.
• Make students globally engaged and take responsibility for the development of Earth Sciences.
• Make sure that innovation and new ideas can develop under my leadership as teacher and supervisor.
• Advising students to prepare not only for careers, but also for lives of success, leadership, and service.

Key publications (in total 64 papers in international journals)

Awards
2011, Fulbright Arctic Chair Award (2011)
Curriculum vitae

PERSONAL INFORMATION
Family name, First name: Hannisdal, Bjarte
Date of birth: 24.04.1975
Sex: Male
Nationality: Norway
Researcher unique identifier: ORCID 0000-0002-7637-758X

EDUCATION
2006 PhD, date of graduation: 08.12.2006.
The Department of the Geophysical Sciences, The University of Chicago (UofC), USA.
Thesis: Inferring phenotypic evolution in the fossil record by Bayesian inversion.
2000 Cand. scient. (MSc) Department of Geology, University of Bergen (UiB), Norway. Thesis: Cladistic analysis of entelophyllid rugose corals from the Silurian of Northern Europe.

CURRENT AND PREVIOUS POSITIONS
2019- Associate Professor
Department of Earth Science, UiB, affiliated with the Bjerknes Centre for Climate Research, and the K.G. Jebsen Centre for Deep Sea Research, UiB
2007-2018 Postdoc/Researcher
Department of Earth Science, UiB, affiliated with the Centre of Excellence in Geobiology, Bjerknes Centre for Climate Research, and K.G. Jebsen Centre for Deep Sea Research, UiB

FELLOWSHIPS AND AWARDS
2014-2018 Bergen Research Foundation, Starting Grant
2014-2017 Research Council of Norway, Young Research Talents, project 231259
2012 Burgen Scholarship, Academia Europaea (The Academy of Europe)
2004-2006 The American Chemical Society grant 41014-AC8
2004 UofC Provost's Award for Academic Technology Innovation (with D. MacAyeal)
2002 Obering fund for Graduate Research, UofC
2001-2004 Research Council of Norway, Doctoral Fellowship, project 143085
2000 Fulbright Scholarship (declined)
1999 Scandinavia-Japan Sasakawa Foundation Grant

SUPERVISION OF GRADUATE STUDENTS AND RESEARCH FELLOWS
2015-2019 David Diego, PostDoc, UiB
2015-2019 Kristian Agasøster Haaga, PhD, UiB
2016-2019 Jo Brendryen, Researcher, UiB
2017- Tor Einar Møller, PhD, UiB (co-supervisor)
2017- Laura Vittoria De Luca Peña, PhD, UiB (resigned)
2017- Maria Salem, MSc, UiB

TEACHING
2017- GEOV114 Introduction to geobiology, a new student-active course I have designed and am responsible for. Undergraduate level, UiB.
2016- GEOV302 Data analysis in the geosciences, a student-active course I have designed and have shared responsibility for (with E. Iversen). Graduate level, UiB
2015- GEOV244 Principles of geobiology, co-lecturer, undergraduate/graduate level, UiB.
2015 ACDC 2015: Advanced Climate Dynamics Course Summer school on Volcanism and Climate, Iceland. Research school on changing climates in the coupled earth system (CHESS). Guest lecturer, graduate level, UiB.
2013-2015 MSc field course: Advanced Field Course in Carbonate Geology, San Salvador Island, Bahamas. Guest lecturer, field teaching, graduate level, UiB
2010 - BIO318/GEOV348 Current topics in geomicrobiology & geochemistry, seminars, graduate level, UiB.
2008 - GEOV105 Historical geology and palaeontology, lectures, exercises and field trip, undergraduate level, UiB.
2006 GEOS 22200 Principles of Stratigraphy, Geophysical Sciences, UofC.
SELECTED PUBLICATIONS

Five selected post-PhD publications as first author:


Five selected publications where I had a leadership/decisive role:


TEACHING STATEMENT

I am deeply involved in the current rethinking of the role of modern Earth scientists in society and the future of Earth science education in Norway. Our challenge is two-pronged: (1) to clarify the fundamental importance of Earth science in the face of global change and empower students to help solve the societal problems of tomorrow, and (2) to strengthen the disciplinary craftsmanship required to become a cutting-edge scientist. I believe we can meet this dual challenge by taking advantage of three interlinked aspects of Earth science: (i) Earth science is the study of natural systems tightly linked to human activity and decision making. Under this definition, Earth science is not a separate, esoteric domain, but fully embedded in society. (ii) Modern Earth science has adopted a systems perspective, which treats physical, chemical, and biological processes, including human activities, as components of a complex, dynamical system. (iii) Earth science education provides unique opportunities for student learning of transferable skills associated with solving real-world, ill-structured problems. I wish to engage students in an authentic learning environment, where they can mobilize key scientific practices and skills to address realistic, unclear problems with multiple possible solutions. As instructors we need to support this type of learning by allowing students enough time to perform sustained investigations with multiple rounds of feedback. I am particularly interested in the importance of computational practices as a key to both systems thinking and authentic problem solving. I have recently assumed responsibility for two courses at UiB where we are exploring the effect of computational practices on student learning of data analysis (statistical thinking) and carbon cycle modeling (systems thinking). We presented these initiatives at the International Society for the Scholarship of Teaching and Learning conference 2018: https://issotl18.w.uib.no/poster-session/computational-practices-in-student-learning-of-earth-systems/ https://issotl18.w.uib.no/poster-session/data-analysis-in-geosciences-fostering-computational-learning/
Name: Anders Schomacker

Position: Professor of Quaternary Geology, Department of Geosciences, UiT

Anders Schomacker (AS) holds a position as full professor at Department of Geosciences, UiT The Arctic University of Norway. His research experience is in Quaternary and glacial geology/sedimentology/geomorphology, glaciology, volcanology, palaeoclimatology, and lake sediments. AS has 17 years of teaching experience, starting as teaching assistant during his M.Sc. and PhD, and as course responsible since 2010. He has formal education in university teaching and learning from Lund University, The Norwegian University of Science and Technology (NTNU) and University of Copenhagen. AS is vice head of department and chair of the study programme board. In 2018, AS led a major quality check and revision of all courses offered by the department in order to make sure that they live up to the standards set by the Norwegian qualifications framework for lifelong learning. AS has supervised 26 master (+5 ongoing) and 3 PhD students (+5 ongoing), currently supervises one Post doc., has extensive teaching experience from a total of 19 courses since 2002, published 50 papers in international peer-reviewed scientific journals, numerous reports, 22 popular science articles and >100 conference papers at international conferences. AS has extensive experience as fieldwork-leader from Svalbard, Greenland, Iceland, and Scandinavia. He has received major research funding from The Nordic Volcanological Center (Iceland), The Carlsberg Foundation, RANNÍS (The Icelandic Research Council), Energy Research Fund of Landsvirkjun (Iceland), EU FP7 Marie Curie Actions, GeoCenter Denmark, and the Research Council of Norway.

Education
2003, University of Copenhagen, Denmark, Cand. scient.
2007, Lund University, Sweden, fil. dr. (PhD).

Employment
2015-: Full Professor of Quaternary geology (permanent position, 100%). Vice head of department since 2017. Department of Geosciences, UiT The Arctic University of Norway.
2019-: Adjunct Associate Professor of Quaternary geology. Natural History Museum of Denmark & Department of Biology, University of Copenhagen.
2016-2019: Associate Professor of Quaternary geology (20% position). Natural History Museum of Denmark, University of Copenhagen.
2014-2015: Associate research Professor (2-yr 100% position, EU Marie Curie funding). Natural History Museum of Denmark, University of Copenhagen.
2010-2015: Associate Professor (permanent position; on 80% leave in 2014-15). Department of Geology, Norwegian University of Science and Technology.
2007-2010: Post doc. (funded by Nordvulk and the Carlsberg Foundation). Institute of Earth Sciences, University of Iceland.
2003-2007: PhD scholarship at Department of Geology, Lund University, Sweden.

Teaching (last 5 years)
2015-17. Human and Physical Geography – taught introduction to glacial geomorphology as lectures and exercises.
2016-. Quaternary Geology (GEO-2003). Course responsible, lectures, exercises, and a 2-day field excursion. UiT.
2016-. Scientific writing for PhD students (FSK-8002). Mentoring 5 PhD students. UiT.
2017-. GIS and Geostatistics (GEO-2011). Course responsible, lectures, exercises, and project supervision. UiT.

Key teaching goals and teaching philosophy
- Stimulate student learning from person-to-person training in the field and lab in projects, much similar to the way craftsmen are educated.
- Encourage deep learning by Problem-Based Learning in most of my teaching activities.
- Engage and involve students in their own education from individual course evaluations (my own teaching) to program level (at department level).
- Have dialogues with my students and stimulate activity, even when lecturing for large groups. I find that the students learn significantly better, when they interact actively with each other and the teacher.
- Always deliver education relevant for the future geoscience careers of my students.

Selected recent key publications (in total 50 papers in international journals and book series; Scopus h-index 20; ORCID: http://orcid.org/0000-0002-8031-9008):

Awards/fellowships
2017, Elected member of the Norwegian Scientific Academy for Polar Research.
2015-19, Member, Vice Chair (2015-16), Chair (2016-17), the Young Academy of Norway.
Name: Anders Mattias Lundmark

Position:
Mattias Lundmark (ML) holds a position as associate professor at the Department of Geoscience, University of Oslo. ML has a Ph.D. in Geology from the Department of Geoscience, University of Oslo, and has research experience in geochronology, structural geology, provenance, geochemistry and tectonics. ML defended his Ph.D. thesis "Orogenic cycles along the Baltoscandian margin - a geochronological study of the Jotun Nappe Complex, SW Norway” in 2006. ML has 13 years of experience as a teacher at Oslo University and the Norwegian University of Life Sciences, including course responsibility for advanced training for geoscience high school teachers (60 ECTS credits). At present ML heads the science education group at the Department of Geosciences, and is a member of the Centre for Teaching and Learning in Science and Technology at Oslo University. ML has supervised 10 master and 1 PhD student, and has extensive teaching experience from 10 courses, is lead author on 13 papers in international peer-reviewed scientific journals, 5 reports, 1 popular science article and lead or co-author on 38 conference papers at international conferences. ML has mentored 10 bachelor and 3 master students contributions at national and international conferences, and has co-written two scientific articles with students.

Higher Education
2003 - 2006 Ph.D., Geology, Department of Geology, Oslo University. Dissertation: “Orogenic cycles along the Baltoscandian margin - A geochronological study of the Jotun Nappe Complex, SW Norway”. Advisor: Fernando Corfu
1995 autumn Ecole Supérieure de Commerce de Paris (ESCP), Business studies, Paris, France
1992 autumn Swansea University, History and Social anthropology, Swansea, U.K.

Academic Employment
2014 – present Associate professor in Earth Science education and geology, Department of Geology, Oslo University
2013 – 2014 Head of research support and teaching, Science Library, Oslo University
2012 – 2013 Senior lecturer, Department of Geology, Oslo University
2008 – 2012 Postdoctoral researcher, Department of Geology, Oslo University. Geology of the Embla field, North Sea
2008 spring Research assistant, Oslo University. The tectonometamorphic evolution of the Arabian-Nubian Shield, Eastern Desert, Egypt
2007 autumn Senior lecturer, Norwegian University of Life Sciences, Ås
2007 spring  Research assistant, Oslo University. Isotope analysis (U-Pb TIMS and U-Pb/Lu-Hf LA-ICPMS)

**University Teaching**

GEO100 Geology (2007) (teacher)
SVALEX (2009-14) Multi-disciplinary field course on Svalbard (teacher)
GEO4230 Basin formation and sequence stratigraphy (2012-14) (responsible for course in 2012)
GEO1010/GEO1100 Geological processes and materials (2014-18) (teacher)
GEL2150 Field course and methodology in geology and geophysics (2016-2019) (responsible for course)
GEO2910V Feltarbeid i geotop (2013/17) (responsible for course in 2017)
GEO2920V Naturkatastrofer (2014) (responsible for course)
GEO2930V Georesurser og miljø (2015) (responsible for course)
GEO2940V Jorda i forandring (2016) (responsible for course)

**Key teaching goals**

- Teaching for understanding
- Support students in becoming interactive, engaged and curiosity driven in their studies
- Promote undergraduate / graduate involvement in research
- Develop teaching through exploring novel teaching practices in collaboration with students and colleagues
- Contribute to a social and collaborative teaching and learning environment

**Recent publications (in total 17 published papers in international journals)**


**Lundmark, A.M.:** Augland, L.E., Jørgensen, S.V. (submitted to Journal of Geography in Higher Education) Digital fieldwork with Fieldmove - how do digital tools influence geoscience students learning experience in the field?


Name: Lena Håkansson

Position: Associate professor, Quaternary and glacial geology, department of Arctic Geology, The university Centre in Svalbard (UNIS)

Lena Håkansson is associate professor at the department of Arctic Geology at UNIS where she focusses her teaching and research on field-based glacial geology, sedimentology, geomorphology and climate history. She has 17 years of teaching experience starting as teaching assistant as a MSc and PhD student, and as course responsible since 2015. Håkansson has supervised 8 MSc students (+ 2 ongoing) and 2 ongoing PhD students, developed and coordinated a field-based course for MSc and PhD students at UNIS, and has teaching experience from 10 different courses at Lund University, The Norwegian University of Science and Technology (NTNU) and UNIS.

Håkansson has led and coordinated student evaluation of the field teaching in the geology bachelor courses at UNIS in 2018/2019. She has extensive experience as leader of Arctic field campaigns to Svalbard and Greenland and has participated in 20 expeditions to Arctic Russia, Greenland, Svalbard, Iceland and Kyrgyzstan. Håkansson has published 18 peer-reviewed papers and has received major research funding from the Swedish research council.

Education
2008 PhD: Department of Geology, Lund University, Sweden
2003 Master: Department of Geology, Lund University, Sweden

Employment
2016- Associate professor 100% Arctic Geology, University Centre in Svalbard (UNIS), Norway
2014-2015 Associate professor (temporary contract) 100% Arctic Geology, UNIS
2013-2014 Postdoc, Department of Geology, Lund University, Sweden
2012-2015 Adjunct associate professor 20%. Department of Geology and Mineral Resources Engineering, Norwegian University of Science and Technology, Norway

Teaching (last 5 years)
2014- The Quaternary and Glacial geology of Svalbard 15 ECTS, course responsible since 2015. Autumn semester bachelor course at UNIS. Research-based activities modelled after course-based undergraduate research experience (CURE).
2016- Glaciers and Landscapes 10 ECTS, course developer and responsible. 5 week summer course for MSc and PhD at UNIS. Focus on field learning and authentic research experiences.

Peer-reviewed papers
MÖLLER, P., BENEDIKTSSON, Ió., ANJAR, J., BENNIKE, O., BERNHARDSON, M., FUNDER, S., HÅKANSSON, L., LEMDAHL, G., LICCIARDI, JM., MURRAY, AS., SEIDENKRANTZ, M-S. 2019. Glacial history and palaeo-environmental change of southern Taimyr Peninsula, Arctic Russia, during the Middle and Late Pleistocene, Earth-Science Reviews, in press.


ALEXANDERSON, H., HÅKANSSON, L. 2014. Late glacial retreat of local glaciers from Jameson Land, East Greenland. Polar Research 33


KIJAER, K.H, LARSEN, E., FUNDER, S., DEMIDOV, I., HÅKANSSON, L., MURRAY, A. 2006. Eurasian ice-sheet interaction in northwestern Russia throughout the Quaternary. Boreas 35, 444-475


Name: Iver Martens

Iver Martens holds a position as university lecturer at the Department of Geoscience at UiT The Arctic University of Norway. His position is affiliated with ARCEX, the Arctic Research Centre for Petroleum exploration. Iver Martens has a master’s degree in applied geophysics from the Department of Geoscience at UiT The Arctic University of Norway. Iver Martens has 6 years of teaching experience from different courses, through his positions as advisor and later on University Lecturer. His main topics of teaching has been through the classes of Marine Geophysics at master’s level, and Petroleum Geology at master’s level. He has also been involved in the development of the new master’s specialization in Petroleum Geosciences at the Department of Geoscience at UiT The Arctic University of Norway. He is involved in study development projects at the Department of Geoscience, and is currently the leader of the Result BaseGeo project.

Iver Martens has supervised 22 master students, affiliated with Petroleum Geology and Geophysics.

EDUCATION

- **UIT The Arctic University of Norway**
  - Single Courses in physics. 2012

- **UIT The Arctic University of Norway**
  - Master in applied geophysics. 2009

EMPLOYMENT

- **UIT, Tromsø ARCEX**
  - University Lecturer in Petroleum Geogy and Geophysics. 2018 April-

- **UIT, Tromsø ARCEX**
  - Advisor. 2013 -2018

- **Front Exploration, Tromsø**
  - Geologist - Geophysicist 2010-2012

- **Alfa Rollemodell, Tromsø**
  - Rolemodel for MNT topics high school. 2011-
Det Norske Oljeselskap, Harstad
Geologist 2009-2010

Norges Klatreforbund
Club developer and instructor 2004-2009

TEACHING AND EDUCATION DEVELOPMENT

UIT, Tromsø
Project leader BaseGeo 2017 H- 2019
RESULT project to define a baseline for study quality at the Department of Geoscience.

UIT, Tromsø
GEO 3115 Petroleum Geology 2015-2018
Master’s degree course in Petroleum geology.

UNIS, Longyearbyen, Svalbard
AT-833 Arctic Petroleum Sciences 2015-2018
Multi-disciplinary course in Petroleum sciences. Guest lecturer in Geophysics.

UIT, Tromsø
GEO 3123 Marine Geophysics 2013-2016
Master’s degree course in contents and applied methods in Marine Geophysics.

UIT Tromsø
Geo 3127 3D seismic interpretation 2017-2018
Master’s degree course in seismic interpretation.

UIT Tromsø
Geo 3126 Applied Seismic processing 2012
Masters degree course in applied seismic processing.

UIT, Tromsø
Supervisor for Master’s theses and Projects 2015-

KEY TEACHING GOALS
- Be an enthusiastic teacher and supervisor.
- Have belief in the student’s potential and use this to develop and enhance the teaching and learning quality.
- Be dynamic and have an open eye for the student’s needs and wishes, use the students response to develop my courses style and learning methods to the student’s best.
- Offer interesting courses, theses and lectures, with a high relevance for students.
- Supervise student’s in a way that makes them release their best potential, and develop their understanding.