

Centre Plan iEarth – 2020-2025

Preface

The Centre Plan has developed through a series of discussions in the core team in iEarth during the spring of 2020 after we were granted SFU status by DIKU. The process has been supported by input from a consortium meeting in Tromsø in February 2020 and through our weekly digital consortium meetings since then. Each of the five progress domain leaders had a special responsibility to formulate the action plan for their respective domains.

Our objectives and actions for the first five-year period build on the goals from the proposal submitted in April 2019. We have elaborated on the original iEarth actions with specific action points, their audiences, and how they will be assessed. Monitoring the success of iEarth will, therefore, be transparent as the accomplishment of action points can be checked off during the first centre period (1 of June 2020 until 31 of May 2026). At the same time, this gives us the opportunity to re-think the structure and functioning of the Centre and Action Plan along the way.

Part of this document outlines the centre management plan and how we intend to interact in the consortium. It is crucial for the success of iEarth that we manage to communicate and collaborate on a national level.

On behalf of the national iEarth team (UiB, UiO, UIT and UNIS), we would like to thank DIKU and the review panel for a constructive assessment of our proposal in 2019, including the specific feedback from the panels together with the general feedback on the SFU mandate.

Now we all look forward to start the journey that we have outlined in the centre plan and to fruitful collaboration with DIKU and with other SFUs in Norway.

Jostein Bakke (Leader iEarth) and Åse Hestnes (Network coordinator iEarth) on behalf of the iEarth institutions

1. Vision

iEarth's vision is to 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 program with a global perspective. We have described the visions and the specific objectives for the different PDs in more detail below (section 2).

In iEarth, students and instructors will join forces with public and private stakeholders to build an educational system that connects many of the UN Sustainable Development Goals with our renewed Earth System Science (ESS) education goals, such as tackling climate change (e.g. adaptation to geohazards), renewing our energy supply, exploring new geological resources in the deep sea, and at the same time working to preserve our land and oceans. ESS education, thus, provides unique opportunities for students to learn sought-after skills associated with real-world, complex problem-solving.

An important take-home message from existing SFUs is the importance of staff engagement in teaching and learning. We will, therefore, focus much efforts during the first iEarth funding period on stimulating an emerging collegial teaching culture among our staff. We will arrange faculty meetings for all teaching staff, pave the way towards a sharing culture, and support new teaching methods and approaches and have annual Geolearning forums for all staff.

An important innovation in the iEarth project will be the development of a curriculum database management system and an associated web-based interface for visual analytics, as outlined in the action plan for PD1. This tool will enable users to monitor changes, both quantitative (e.g. number of courses implementing a particular form of assessment) and qualitative (e.g. cultural changes expressed in the way students phrase their responses to certain survey questions). From this platform, we will be able to extract detailed information on the impact of iEarth projects and initiatives, perform a comprehensive evaluation of activities at any point in time, and make necessary adjustments if needed.

An important milestone for iEarth is to provide 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). This will be an important asset for dissemination within Norway, the Nordic countries and beyond, through meetings, workshops and publications in international journals. We will communicate also non quantitative changes in the consortium such as changes in practices and outcomes of teaching. One of our benefits in iEarth is that we are a large community allowing large numbers of cases monitoring the progress from baseline to excellence. Further we will work cross disciplinary to disseminate the pedagogical work that we do within earth science also to other disciplines.

2. Centre Objective

Here we describe the objectives and specific actions planned for each of the iEarth progress domains. Note that there are actions targeted at different audiences (students, teachers, programmes, leadership, stakeholders and the wider scientific community) and at different levels (locally, nationally and internationally), and each area is associated with specific assessment criteria. Progress evaluation will be important for all activities in iEarth. This includes follow-up of the baseline questionnaire (from 2018) and research on cultural change together with the use of Visual analytics to track teaching and learning development.

Progress domain 1 – Shaping the future (leader Bjarte Hannisdal, UiB)

PD1 will be instrumental in the iEarth change process by coordinating a competence-oriented redesign of Earth science curricula. Existing frameworks for curriculum redesign (CR) typically recommend an ordered sequence (e.g. data gathering, learning outcome descriptions, mapping, course design, evaluation). Some other programs at our institutions are already engaged in this type of redesign (e.g. BIO at UiB). In PD1, however, we will advance beyond these existing CR frameworks, for three main reasons:

(1) The canonical CR elements (e.g. data gathering, mapping, course design) are continuous, open-ended processes. PD1 will leverage the opportunity to develop an innovative cyber-infrastructure designed to significantly enhance the quality, dissemination, and impact of these processes.

(2) Let's face it: the prospect of curriculum redesign won't make scientists very excited. Hence, PD1 will engage colleagues through a simple, yet professional, visual interface that lets Earth scientists focus on real disciplinary problems and practices.

(3) Engaging students in the CR process should accelerate cultural change. PD1 will train student working groups to develop formative, competence-oriented progress assessments (multiple choice questionnaires, MCQs), that will be tested locally and implemented nationally, as an integral part of CR.

Action	Audience	Assessment criteria
Establish a "Curriculum Task Force"	Instructors, students, administration, employers in collaboration with Learning Lab (UiB), LINK (UiO) and Result (UiT)	<i>Engagement</i> ; individuals as change agents locally and across the consortium. Input from all partner institutions and sub-disciplines.
Develop a curriculum database architecture	IT technician (global admin), task force (local admins), users (instructor, student, admin, employer, researcher)	<i>Functionality</i> ; Demonstrate robust configuration and user management. Support input of local organizational structures, definitions, and addition of diverse course metadata. Seamless integration of complex curriculum data.
Develop a web-based user interface for visual analytics	IT technician, users (Instructors, students, administration and employers)	<i>Application</i> ; Successful curriculum mapping, monitoring and visualization. Easy access to analyses from multiple different perspectives. Easy-to-use, reliable web interface as an effective framework for dissemination and evaluation.
Develop a student-generated formative progress assessment	Students, instructors, employers, researchers	<i>Cultural change</i> ; Students test MCQs locally and implement them across the consortium. Curricular transparency.

Progress domain 2 – A learning environment for students (leader Anders Schomacker, UiT)

iEarth's key vision is to engage students as partners in the educational programs. Therefore, one of our main objectives is to engage students in new ways motivating them to 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 practice, including authentic problem-solving and undergraduate research experience. A curriculum that involves real-world ill-structured problems requires an effective learning environment for students, including student-instructor interaction, collaborative learning, sustained investigation, reflection and argumentation, high expectations, scaffolding, and inclusive learning.

Action	Audience	Assessment criteria
Engage students as partners in their education	Instructors, students, administration and leaders	Large # students participate in faculty meetings, boards etc.
Peer instruction and peer feedback	Students	Students have forums for peer instruction and feedback.
Transition to include formative assessment on courses	Instructors	>50% of courses at all institutions use formative assessment.
Course-based undergraduate research experience (CURE)	Instructors/students/industry collaborators	CURE implemented in >3 B.Sc. courses at all institutions.
Optimise instructional technologies and physical learning spaces	Instructors/students	All institutions have access to and use Active Learning Classrooms and webinar facilities as part of the physical learning space.
Arrange national workshops for iEarth students – e.g. on Design Thinking, peer instruction and feedback etc.	Students	>4 workshops arranged with attendance from all institutions.
Students write a Bachelor's thesis as part of their B.Sc. degree	Students	B.Sc. thesis is offered as a part of the undergraduate degree at all institutions.
Students define their own M.Sc. project	Students	>50% of the M.Sc. students define the topic and research questions for their M.Sc. thesis.
National iEarth course in geohazards	Instructors/industry partners	A national geohazards course offered by UiB, UiO and UiT will be operated and developed.

Progress domain 3 – A learning environment for instructors (leader Anders Mattias Lundmark, UiO)

Our main objective is to 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. 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. One important goal is to support teaching and teaching portfolio development for temporary and permanent staff and to have systems promoting staff to qualify for Excellent Teaching Practitioner or the like status. We will develop shared courses across the consortium 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 material. We will build a national and Nordic Earth science education research group for higher education teaching. The work within this progress

domain has a potential to extend into other related science disciplines as the outcome of our cultural change and focus on pedagogical competence will be possible to translate into general competence. Specific actions that can be translated to other disciplines are the effort we plan to do with evidence-based teaching practice, development and use of a virtual competence centre as a national resource and the establishment of a research group on higher education as advisers and the monitored effect on teaching culture this feeds back to the scientific community.

Action	Audience	Assessment criteria
Strengthen pedagogical competence among staff (engage ETP competence, and arrange workshops)	Instructors and students	>10 ETP status applications. Active colleagues in workshops and seminar (>50% of staff active).
Develop teaching as a collegial enterprise (meeting places, collaborative teaching culture, students as partners)	Instructors and students	Collaborative faculty meetings with students and stakeholders.
Make teaching a scientific enterprise through evidence-based teaching practice, initiate and support SoTL activity with students as partners	Instructors and students	Initiation of >10 SoTL projects among staff that are published. >10 applications per year to iEarth development funds.
Develop and implement systems for shared courses across the consortium	Instructors, students and stakeholders	Establish two pilot courses and continue building a portfolio of courses across the iEarth consortium.
Develop Geolearning forum into a national meeting place for earth science teaching	Instructors, students and stakeholders	>100 participants at annual Geolearning forum.
Develop Virtual Competence Centre	Instructors and students at all Norwegian higher education Earth Science institutions	Widely used online support and inspiration for teaching and learning activities. Both web based and on the Teams platform.
Establish competence group on higher education research in Earth Science in Norway with Nordic and international collaborations	Faculty staff, national and international partners	Complete five Phd projects in iEarth and one post-doc, >20 peer reviewed papers, establish Nordic Research School.

Progress domain 4 – Field-based education (leader Lena Håkansson, UNIS)

Our main objective is to test and document methods to enhance connection and knowledge transfer between classroom and field learning. In order to do so we need to further develop the pedagogical, technical, logistical and safety basis upon which we further develop our field education. Parallel we will conduct SoTL activities on our renewed program together with the pedagogical academy in iEarth. We aim to base our field-based education on a solid foundation by expanding our research-based knowledge on the effect of student learning in all kinds of field learning environments from local field trips by foot to cruises on huge research vessels. We will develop, test and evaluate digital tools and assessment methods focusing on constructive alignment between field learning outcomes and assessment methods.

Action	Audience	Assessment criteria
Document present status and monitor the culture change in how teaching and learning in the field develops	Students, instructors	Complete a comprehensive baseline study on the position of fieldwork in earth science education in Norway.

Develop a framework for certification of field skills	Students, instructors, stakeholders	Issue a <i>Field Certificate</i> approving field skills at >3 courses from each iEarth partner.
Develop, test and evaluate new assessment methods for assessing field learning outcomes	Instructors, students	All courses having field activities are assessed towards field learning outcomes.
Ensure more effective field learning in geoscience education in iEarth by establishing local field laboratories close to all the iEarth institutions	Students, instructors	All programs with a field component use local locations for parts of their field activities.
Test and document methods to improve student field learning and to improve knowledge transfer back and forth between classroom and field	Students, instructors, stakeholders	Digital teaching tools such as Virtual field guides, and digital field tools are implemented in >2 courses at each of the iEarth partner institutes.

Progress domain 5 – Networking and society contact (leader Iver Martens, UiT)

Our main objectives are to develop alumni networks at the iEarth institutions to ensure good contact between academia and potential employers. And also, to establish internship courses at all partner institutions. We aim to generate databases and social channels for alumni information by creating spaces for meetings and outreach between candidates and the stakeholders. Based on industry and stakeholder contacts, we will establish routines and put internship course solutions into play across the consortium for the various study programmes.

Action	Audience	Assessment criteria
Establish and develop alumni network at all institutions	Stakeholders, instructors and students	Alumni networks at all institutions. Alumni's contributes to teaching. Enhanced interaction between industry and universities.
Apply for funding for an internship coordinator	Students and stakeholders	Funding for one position.
Develop an internship course at UiT Pilot run of internship course at UiT Course quality check and re-design Implement at all iEarth institutions	Students and stakeholders	Database of possible internships. Signed letters of intent with stakeholders. Designed generic internship course 10 ECT at all institutions.

3. Organisation and management

The Department of Earth Science at UiB will serve as the hub, coordinating the joint effort among the national partners and host the leader and network coordinator. More details on the management and organisation is described in the consortium agreement. Each Progress Domain (PD) are led by one representative from each of the consortium partners (UiB, UiO, UiT and UNIS). The five Phd positions are in-kind, two located at UiB and one at each of the other institutions. The DIKU financed post doc will be located at UiO and the DIKU financed IT position (2 years) will be located at UiB. The adjunct professor positions will be employed at each of the institution in the iEarth consortium. Phd, post doc and adjunct professors will be the core of our pedagogical academy motivating the rest of the consortium to take the necessary steps towards teaching excellence.

The Centre Management Board (CMB), consisting of the centre leader (Jostein Bakke), Education Chairs, network coordinator and student representatives, oversees the daily operation of the centre, ensures that centre objectives are met, and allocates resources to and responsibility for projects. Students are involved as active partners in iEarth at all levels.

The mandate for the *Centre leader* is to oversee all iEarth activities with the responsibility of fulfilling the centre plan, the budget, and the obligations towards the students, the instructor, the stakeholders and DIKU. This will be done through creation of an inspiring team environment, open communication culture, clear team goals, tasks and deadlines. Centre leader is professor Jostein Bakke at UiB.

The mandate for the *Education chair* is to support the implementation of action from the different progress domains at each institution. They are expected to take part in the weekly meetings to be up to date on what's going in the consortium. Hence also be responsible for communication both ways.

The mandate for the *Network coordinator* is to be the administrative support for the entire consortium and to be responsible for day-to-day communication with the partners, the students and the stakeholders. The coordinator will be the main responsible for outreach through social media and webpages, and for coordination of iEarth events. Network coordinator is Anne Stensland (Åse Hestnes until 1 of September 2020), UiB. The leader and the coordinator together form the core engine of iEarth, running the day to day business in the consortium.

The CMB will be integrated in the existing structures of our educational programs currently managed by the program boards at each institution. To secure effective management of the five progress domains in iEarth we have leaders that are enthusiastic and at a relatively early stage of their career with a lot of ideas and energy to initiate the anticipated transformation in Earth Science education. Each of the PD leaders will have special responsibilities for communication and dissemination of new ideas between the domains and across the partner institutions. The tasks for the PDs are outlined in the action plan described above where the leader has a special responsibility for executing and oversee the plan.

iEarth's *Board* has the mandate to supervise and to oversee all centre activities, and will be involved in developing collaboration within our partner institutions, implementation of iEarth activities in the institutions and maintain communication with students and external partners in Norway and beyond. The *Advisory Board* has a mandate to provide non-binding strategic advices to the iEarth and will be an important resource for pedagogical development, student co-creation, SoTL activities etc. Members of the Advisory Board will be appointed for two years, and iEarth will evaluate the Advisory Board size and composition after the first period in 2022.

Consortium, stakeholders and student involvement

We will focus on instructor, student and stakeholder co-creation in iEarth (weekly meetings, Geolearning forum etc.). Care will be taken to involve students and stakeholders as participants in the iEarth leadership and management, in R&D projects and as participants in and target audience for innovations and projects.

International collaboration is ensured through our four adjunct professors, who are responsible for collaborative educational R&D and policy development projects, through staff and student exchange, through networks (e.g. ISSOTL) and through incoming and outgoing mobility with relevant partners internationally.