LATICE – Annual letter 2019

Dear all,

It is the very last day of 2019 and time to thank you all for your contribution to making it yet another exciting and successful LATICE year. Due to not only LATICE as such, but also the many projects that are closely associated with it. Our international engagement is increasing and our close contact with NCAR has facilitated several research visits for our team. In sum, these activities have and will lay the basis for novel research in years to come, positioning LATICE as a natural hub for research within the field of land-atmosphere interactions at high latitudes, today and in the future.

A particular focus in 2019 has been on initiating the LATICE-X (X for Extension) project, which was granted two PhD (2019) and one Postdoc position (2020) by the faculty, allowing LATICE to further grow and consolidate its position, both nationally and internationally. We have carefully designed the PhDs proposals to align with another major project, EMERALD, starting this year. EMERALD is a national coordinated project funded by the Research Council of Norway (RCN; KLIMAFORSK), and has a focus on high latitude terrestrial ecosystem-climate interactions and their representations in ESMs.

A continuing effort is undertaken to keep the Finse eco-hydrological observatory (Finse-EcHO) up to date and running, encompassing various infrastructure and field investigations, with important contribution from associated projects. The Finse flux site and the new climate container are both unique - also in an international context - and are expected to provide novel insights to high-latitude processes. Other field sites are also advancing, including flux data collected at Iskoras and Hedmark. These datasets are vital for improved modelling of high latitude land-surface processes; within LATICE notable the land surface model CLM and the Shyft (hydrological) modelling framework. Work has also started building our new Cold Climate Container. The last week before Christmas, RCN announced that they will fund our development of drone-based flux measurements in the coming four years through a young research talented grant to Nobert Pirk - a great achievement indeed!

Some further highlights and details of activities in 2019 (our fifth year / first extended year) are presented below:

Observations at FINSE-EcHO and other sites

2019 was a successful year for our field observations at Finse. Apart from our regular monitoring of the snow conditions and eddy fluxes, we conducted a campaign in January to measure stable water isotopes together with the SNOWPACE project. We installed new sensors on our wireless sensor network (WSN) stations to improve our understanding of the microclimate in the area (jointly with the HIVE project). In a joint effort with the University of Copenhagen, our eddy flux tower was equipped with an additional gas analyser for BVOCs, showing that the ecosystem emits such compounds in the growing season. We also added a disdrometer to the tower to classify precipitation types. One of our two river discharge stations was destroyed during snowmelt, so that

we only have data from the summer season from one station. Our wireless sensor network prototype (LATICE WSN) developed for Finse, including a custom-made suite of sensors, a dedicated communication protocol, and a database management system, has been successfully copied into a similar system on Svalbard. Several students, both from UiO and abroad, joined our team and conducted their field work at Finse, many of them using drones for their measurements. Several related activities now benefit from the experience we gathered during the hard work at Finse.

In March, we moved the mobile eddy system to a palsa mire in Finnmark (in collaboration with the PERMANOR project), where it was supplemented with a methane sensor from our collaborators at NORCE in Bergen. We now also operate two eddy sites (in Hedmark) to monitor gas fluxes in a wetland restoration project of the Norwegian Environment Agency.

Meanwhile, we finalised the design of the Cold Climate Container together with different companies and manufacturers. The cooling container is expected to be delivered in March 2020, so that we can fill it with our experimental platforms from then on. So 2020 could become extremely exciting as our first experiments in this facility start, including dedicated snow-vegetation experiments.

New team members

Yeliz Yilmaz joint the group as a LATICE postdoc (1 May) having a specific focus on understanding changes in the terrestrial water and energy cycle using ESM. She is among other responsible for the LATICE Model Intercomparison Project (MIP) to be implemented in 2020. The two new LATICE-X PhDs started this year (1 October) and we are pleased to welcome Astrid Vatne and Lasse Keetz to the group. Both address the representation of vegetation in ESMs, focusing on the controls of evapotranspiration, respectively model parameterization using machine learning. Unfortunately, one of our original PhDs, Håvard Kristiansen, decided to leave UiO and we wish him all the best in his new job.

The LATICE group currently consists of six PhDs and two Postdocs funded by the Faculty, with the third Postdoc to be hired in spring next year. In addition, there are several other Postdocs and PhDs associated with the LATICE project, many of them contributing with important fieldwork at Finse and other high latitude sites in Norway. A new PhD student this year is Eirik Finne at NINA (Tromsø)/UiO funded by EMERALD. We are pleased to have you all as part of the LATICE team.

Land surface and Hydrological model developments

The CLM group in GeoHyd/MetOs has been growing substantially in 2019. Thus, we have organized the CLM work with a leadership group, consisting of Kjetil, Hui, Yeliz and Norbert. They organize frequent meetings with the CLM and FATES users in our department, coordinating also with the CLM group in Bergen. The growth in the CLM staff is a result of extended funding to LATICE and external funding to RCN funded projects, notable EMERALD. In order to facilitate experiments run by non-modelling-experts, a model platform (interface) for application and development of CLM and FATES has been established. This work, led by Hui with contributions from Peter and Eva, will allow users to run experiments (cases) specifically for their field sites. Atmospheric forcing data will be provided for several localities, such as Finse, Iskoras and several EMERALD sites across Norway. The model platform will allow testing of various variables to help improve parameterizations and parameter values for model updates, the latter which will be done by the CLM leader group.

The Shyft modelling framework, which is an (operational) tool for distributed hydrological modelling (https://github.com/statkraft/shyft), has been further developed with focus on improved simulation of radiation in steep terrain. Progress accounts for terrain topography, allowing slope/aspects and shading effects added as part of a new triangulation tool called *Rasputin*. The work is coordinated by Olga Silantyeva and John Burkhart and involves several PhD students.

New associated projects and initiatives

EMERALD is an interdisciplinary and nationally coordinated research project. It aims to improve the representation of high latitude ecosystems and their climate interactions in The Norwegian Earth System Model (NorESM) by integrating empirical data and knowledge in model development, thus following the already established LATICE approach. EMERALD is coordinated by the LATICE leadership and has participants in Bergen, Tromsø and Ås. For more information see: https://www.mn.uio.no/geo/english/research/projects/emerald/

During the last few years LATICE has helped developing the basis for the Centre of BioGeoChemistry in the Anthropocene (CBA) at UiO. The work of a KD funded PhD within CBA, Elin Ristorp Aas, is closely linked to LATICE. In 2019 Dag Hessen was appointed the leader of CBA, You-Ren Wang started a three year postdoc and a part time administrator was employed. In a LATICE relevant CBA project, GreenBlue, CLM is a key modelling tool (responsibility of a postdoc, which will start early next year).

Interdisciplinary teaching and training

GEO9915/5915 Ecological climatology, led by Anders Bryn and Frode Stordal, was taught for the second time in spring 2019. The course addresses relationships between climate and ecology, with focus on climate related feedbacks within boreal, alpine and arctic terrestrial ecosystems. The course gathered seven master and ten PhD students, with bioscience dominating in number over geoscience. Several specialists, many from the LATICE community, contributed with lectures in their fields of specialty.

Dissemination and Communication

The group has been active in dissemination and communicating the LATICE project and our research at various conferences and events, such as EGU, AGU and the 5th Modelling conference at Lillehammer, as well as invited talks at more targeted events, e.g. MET Office of Norway Internal research seminar and the KeyCLIM project kick-off meeting (another large KLIMAFORSK project). A specific initiatives towards the GEWEX community linked to our LATICE-MIP initiative, resulted in a presentation of the LATICE project in their Quarter 4 Newsletter (https://www.gewex.org/gewex-content/files_mf/1576784370Nov2019.pdf).

Our monthly LATICE seminar is well established and attended, also from outside the LATICE group, and our publication list is growing. Worth mentioning are two papers in Nature Climate Change; Partmentier and Pirk are co-authors of the paper "Large loss of CO_2 in winter observed across the northern permafrost region" (published in October), and Bryn, Parmentier and Stordal are co-authors of the paper "Complexity revealed in the greening of the Arctic" (accepted in December).

The LATICE affiliated project *Natur i endring*, a Citizen Science project on vegetation migration in Norway, has been awarded Forskerforbundet's (The Norwegian Association of Researchers) Hjernekraftpris 2019. The prize is awarded based on the ability to communicate the relevance of

research for society. The project engages hikers in mapping of tree and forest lines in Norway for use in LATICE research using a specifically developed user-friendly App. The project leader Anders Bryn together with Peter Horvath, Inger Kristine Volden, Michal Torma (all NHM) and Frode Stordal (GEO) received the award at an event in November. For further details see: *https://www.naturiendring.no/*

PhD candidate Marius Lambert (WINTERPROOF project) won the Best poster award at the Faculty and Science Library PhD day for his poster on Frost droughts – Congratulations!

We have started preparing for our 2020 annual meeting, which will take place at a new location this year, i.e. in a small city on the east shore of the Oslo Fjord - Drøbak (Reenskaug hotel & Tollboden) - from 25-26 March. We look forward to meet our advisory board again, Roy Rasmussen (NCAR) and Eleanor Blyth (CEH), who both have accepted to continue their advisory role for the extended LATICE period – thanks a lot! We will learn and discuss details of the progress being made, present key concepts of LATICE-X as well as new associated projects and discuss the way forward, including new initiatives. As last year, all external members are welcome and encouraged to participate, but have to cover their own costs. More details will follow soon.

We look forward to continue our community effort in what I am sure will be another motivating LATICE year with exciting new research results and initiatives being taken. The friendly and open atmosphere that characterizes LATICE makes it a great project to coordinate and be part of, so thanks to you all for making it so.

With our best wishes for the New Year - Godt Nyttår!

Lena, Frode and Norbert/John

LATICE coordination team