Oslo, 31 December 2020

LATICE – Annual letter 2020

Dear all,

This is the last day of 2020 and it is time to thank you all for your contribution to making it yet another exciting and fruitful LATICE year, despite it being a very unusual year. The pandemic that led to lockdown in March affected us all in many ways, from the start when people had to evacuate from Finse on short notice, to cancelled fieldwork, seminars and travels – to working from home with less interactions and informal meeting places. We have also had fewer international exchanges than planned, including less students joining our group and several planned visits had to be cancelled.

Nevertheless, thanks to the effort of you all, we have been able to maintain a high level of activities, both in the field and within the modelling groups, endorsing LATICE's position as a natural hub for research within the field of land-atmosphere interactions at high latitudes. This is due, not only to LATICE, but to also the many projects that are closely associated with it. Our close contact with NCAR has been further strengthened, notably through the EMERALD project, which has allowed significant time being devoted to the development of a common modelling platform for CLM/FATES.

The LATICE 2020 annual meeting originally planned in March 2020 had to be cancelled. However, the event was successfully organized as a hybrid meeting in Drøbak on 4-5 November 2020, taking the proper measures to minimize risks related to the corona situation. We missed the physical presence of our international advisory board members, Roy Rasmussen, NCAR and Eleanor Blyth, CEH Wallingford, and other invited speakers, but were grateful for their commitment to join the meeting online providing valuable and inspiring feedback as always.

A continuing effort is undertaken to keep the LATICE Flux sites - and associated sites - up to date and running, including the Finse eco-hydrological observatory (Finse-EcHO), Iškoras and Hedmark, encompassing various infrastructure and field investigations, with important contribution from associated projects. These datasets are vital for improved modelling of high latitude land-surface processes; within LATICE notable the land surface model CLM/FATES and the Shyft (hydrological) modelling framework. Worth mentioning is also the Cold Climate Container (CCC), which is now in place at campus, being prepared for the first experiments. The facility is unique - also in an international context - and is expected to provide novel insights into high-latitude processes. LATICE is also a key contributor to the Infrastructure proposal Fram-CI led by John Burkhart, which if funded, will represent a major step forward on the flux-enabled real time infrastructure in place at Finse.

A special highlight this year was the PhD defense of the first of our LATICE PhDs, Jon Håvard Hartveit Eriksrød, who successfully defended his thesis "Ultra-wideband In-situ Bi-static Snow SAR for Water and Stratigraphy Assessment" for the degree of Philosophiae Doctor, on 18 September. As with many other activities, it was an online event, so we missed out celebrating with Håvard, but enjoyed very much listening in on the discussion. Congratulations!

Some further highlights and details of activities in 2020 (our sixth year / second extended year) are presented below:

Observations at FINSE-EcHO and other sites

2020 was a good year for our flux measurement stations at Finse, Iškoras, and Hedmark. All sites are connected to our database management system and reports observations in real time. Even though some maintenance trips had to be cancelled due to the pandemic, most instruments recorded useful measurements throughout the year. We documented how the extremely snow-rich spring at Finse delayed the start of the growing season by about one month compared to 2019. At Iškoras, we collected further flux data to document the biogeochemical interactions at this degrading palsa mire. The measurements at the drained mires in Hedmark, funded by the Norwegian Environment Agency, have now established the baseline of the carbon balance, which is hypothesised to change strongly upon the planned wetland restoration in 2021. At all three sites, we also tested new methods for surface flux measurements with drones as part of the Spot-On project (presented below). This provides a different perspective than the well-established eddy covariance technique.

Our flux monitoring was complemented by manual vegetation mapping around the flux towers at all sites, performed by Astrid Vatne and Ane Vollsnes, with the aim to provide a better understanding of the drivers of evapotranspiration. Furthermore, the GEco group at NHM arranged a mapping excursion to Iškoras in August. The purpose was training and harmonization of field-based ecosystem (NiN) mapping, gaining experience and data of nature types typical for this northern environment. The experience gained constitutes the basis for a paper about mapping procedures and quality control. The data sampled will be made available to LATICE researchers. Similar mapping done within two plots at Finse, by Anders Bryn and Peter Horvath, was published this year (NHM Rapport 96). The maps are available online: https://www.mn.uio.no/geo/english/research/groups/latice/news/-natur-i-norge--map-over-finse.html

In May 2020, we got the housing for our cold climate container delivered to Blindern. With power, plumbing, network, and the chillers (which cool the cooling liquid to about -50 $^{\circ}$C) now in place, the first simple experiments can be conducted. We will extend the facilities of this new lab in 2021 to enable a diverse range of new experiments on land-atmosphere interactions.

A number of related activities benefit from the data collected and experience gained through the establishment of the LATICE Flux sites. This includes Postdocs, PhD and master students, as well as interns, both from UiO and abroad. Two Erasmus interns joined our team in 2020, Janneke Remmers from the Netherlands and Iris Mužić from Croatia. Janneke Remmers, a M.Sc. student at the Wageningen University, visited us for four months at the start of the year. Her research topic was "Investigation of snow cover changes in Fennoscandia from satellite data''. Immediately after receiving her M.Sc., she enrolled as a PhD student in Wageningen. Iris Mužić focused on high latitude ecosystems and their climate interactions. During her internship, she joined several field excursions, actively participated in scientific training/events, and made valuable contributions to LATICE research. As of January 2021, she starts as a PhD student at CICERO. Her PhD research will be closely linked to the LATICE with co-supervision from LATICE members.

New team members

Emiliano Gelati joined the (GeoHyd) group as a LATICE postdoc on 1 October. He has a background in hydrology, water resources and land surface modelling. In LATICE, he will work on modelling - integrating hydrological and land surface modelling efforts and is among other tasks involved in the LATICE Model Intercomparison Project (MIP).

Andrea Popp started her position as a KD-postdoc in hydrogeology in January, and her position is equally shared between the GeoHyd and the GG section. The focus of her research is alpine/cold region groundwater resources and processes (both quality and quantity). She has chosen Finse as the key area for her research using an integrated approach of field observation and modelling.

Devaraju Narayanappa started as a postdoc at MetOs in August. He is part of the GreenBlue project in CBA. He works on including transport of Dissolved Organic Carbon (DOC) through catchments, rivers and lakes in the CLM/Mosart river transport model and has become part of the CLM group.

The LATICE group currently consists of five PhDs and two Postdocs funded by the Faculty. 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. 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 is now well established under the leadership of Kjetil, Hui and Yeliz. Their frequent meetings are well attended, including the CLM and FATES users in our department, coordinating also with the CLM group in Bergen and at NHM. The growth in the CLM staff is a result of extended funding to LATICE and external funding to RCN funded projects, notably EMERALD. The model platform (interface) for application and development of CLM and FATES has gained strong momentum in 2020 despite the corona situation. The platform allows users to run experiments (cases) specifically for their field sites. Atmospheric forcing data are provided for several localities, such as Finse, Iškoras and other EMERALD sites across Norway. The model platform allows testing of various variables to help improve parameterizations and set parameter values for model updates. A scientific concept paper on the development of the platform is in progress.

In addition to the model development efforts and weekly group meetings, three workshops were organized at UiO, strengthening the local and international network of the CLM group. CLM/FATES Workshop (11-12 February), where two NCAR partners in EMERALD were invited to discuss future plans, exchange ideas, and learn about the ongoing model development at NCAR. David Lawrence, leader of the CLM developers at NCAR, and Rosie Fisher, one of the main developers of FATES, participated. Issues discussed were among others inclusion of new PFTs (mosses and lichens) and merging of EMERALD developed codes with NCAR. The CLM/FATES Galaxy Workshop (26-27 October) was organized by Anne Fouilloux in the framework of the Earth Open Science Cloud project and the Galaxy Training Network, with EMERALD co-hosting the event. The EMERALD Writing and Coding Retreat (28-30 October) aimed to move ongoing coding and modelling efforts forward, and to discuss ideas for joint publications. All these activities closely align with the ambitions of LATICE.

We drafted a MIP protocol draft describing the details of the LATICE-MIP efforts. This site-level model intercomparison initiative utilizes the measurements from the Finse, Iškoras and Bayelva field sites, and an overview of measurements at these field sites has been created. The data will be used for atmospheric forcing and evaluation of several land surface models (LSMs). These three LATICE-MIP sites are also integrated in the CLM/FATES modeling platform. A specific focus is given to snow cover parameterizations in LSMs. For a comprehensive analysis of the fractional snow-covered area (fSCA) performance of the CLM model and improving these processes in the CLM model, the LATICE group

created a satellite-based fSCA climatology for the last two decades over Scandinavia. The processed snow products will be shared with the wider scientific community under the FAIR principles. Based on this data set, a paper is on the way.

During 2020, a collaboration with the regional climate downscaling initiative in Norway led by MET-Norway was established. More information about this initiative is available on the recently launched website: https://sites.google.com/met.no/downscaling/.

New associated projects and initiatives

Spot-On – the young research talents project of Norbert Pirk officially started with a kickoff Zoom meeting in May. After successful pilot tests with the custom drone system, his team was active at the three flux sites this summer, performing automated simultaneous drone flights to measure several meteorological variables. The project lasts for four years (May 2020 – April 2024) and aims to ingest these unique measurements into LES models to improve surface flux mapping. Together with LATICE, Spot-on is trying to push the boundaries of surface flux estimation with new sensors and analysis techniques. The project recently established a Twitter account where you can follow the newest developments in the years to come: https://twitter.com/spoton_fluxes

The GreenBlue project – a LATICE relevant project in CBA - had its kickoff meeting in Finse in March. Project work includes modelling of transport of Dissolved Organic Carbon (DOC) through catchments, rivers and lakes into the ocean. A hypothesis of GreenBlue is that DOC transport into the ocean will make the ocean less transparent to solar radiation, resulting in lower visibility and a cascade of impacts in the ecosystems, including change in time of cod spawning. The CLM framework is used, allowing LATICE to broaden the spectrum of CLM applications and contributing to further development to the benefit of both NorESM and CESM (the NCAR Community Earth System Model).

Interdisciplinary teaching and training

GEO9915/5915 Ecological Climatology, led by Anders Bryn and Frode Stordal, was taught for the third time in spring 2020. The course addresses relationships between climate and ecology, with focus on climate related feedbacks within boreal, alpine and arctic terrestrial ecosystems. This year the course gathered eight master and seven PhD students, with bioscience dominating in number over geoscience. Like previous years, several specialists from the LATICE community contributed with lectures in their fields of specialty.

GEO3032 Climate Change and Impacts was given for the first time in spring 2020. The LATICE leadership has played a major role in establishing and developing the course. LATICE participants gave several lectures in the course, which gathered more than 20 students.

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 the online EGU and AGU conferences as well as invited talks at more targeted events, e.g. the CBA seminar series. Contributions from LATICE scientists at these events are now provided online, for instance at the "EGU2020: Sharing Geoscience Online": https://www.mn.uio.no/geo/english/research/groups/latice/news/egu2020spring.html

We also created a CRiStin project page for LATICE and encourage you all to link your publications to this page, https://app.cristin.no/projects/show.jsf?id=2492739

The LATICE affiliated projects *EMERALD* and *Natur i endring*, a Citizen Science project on vegetation migration in Norway, developed a specialized temporary exhibition in the Climate House. The main target group is the age 12 – 16 years. It is presented in Norwegian and English. Its main focus is the importance of climate feedbacks, with focus on terrestrial feedbacks. The exhibition is funded by the EMERALD project, presenting *EMERALD* and its research tasks, using *Natur i endring* as an activity to exemplify vegetation – climate interactions. The Climate House opened in June, and the temporary exhibition was in place from the start.

Six LATICE seminars were organized over the course of the year, either as hybrid meetings or pure online via the zoom platform due to the ongoing corona situation. The webinars helped the regular LATICE community to stay in touch and enabled new faces to more easily integrate with the community and follow ongoing LATICE activities. We have started to share some announcements from LATICE collaborators and the wider land-atmosphere community on the LATICE website. These include relevant upcoming scientific conferences, workshops, training events and job postings with a particular emphasis on early career scientists, see:
https://www.mn.uio.no/geo/english/research/groups/latice/announcements/

Our 2021 annual meeting likely will take place at Drøbak (Reenskaug hotel & Tollboden) in fall (October/November). We appreciated the pleasant atmosphere of the meeting facilities at this year's meeting, and hope that we can all gather again as a group next year. We look particularly forward to meeting our advisory board again, Roy Rasmussen and Eleanor Blyth. More details will follow in due time.

We look forward to continue our community effort in what we are sure will be another motivating LATICE year with exciting new research results and initiatives emerging. 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, Norbert and Yeliz,

LATICE coordination team