Science Meeting – Scientific Report

***Proposal Title**:* 1st European Snow Science Winter School

Application Reference N°: 5792

1) Summary (up to one page)

The 1st European Snow Science Winter School (ESSWS) took place in Sodankylä, Northern Finland, from 8. - 14. February 2015. Organized by the Finish Meteorological Institute FMI and the WSL Institute for Snow and Avalanche Research SLF from Davos, Switzerland, the snow school aimed at teaching graduate students in modern snow measurement techniques. In addition to the lectures, all traditional and modern field instruments were available for the students to get hands-on experience in the field. The instruments ranged from hand lenses and crystal plates for traditional snow pits up to high-resolution lasers and penetrometers.

The schedule of the school consisted of lectures in mornings, followed by hands-on field training in measurement techniques. The covered subjects in lectures ranged from advances in snow quantification techniques to physical snow models and remote sensing applications. The FMI facilities at Sodankylä allowed hosting the 27 students with direct access by foot to the field sites. On the final day of the school, a full day field exercise was organized in the Saariselkä Tundra region in Northern Finland.

2) Description of the scientific content of and discussions at the event (up to four pages)

Lectures

A series of lectures on snow science were given to attendants, varying from 30 to 60 minutes in length. The lectures took place in the mornings at the FMI facilities. After a welcome, safety & introduction session, the following topics were covered

Monday Feb 9

- Safety & introduction
- Snow metamorphism
- Snow measurement techniques

Tuesday Feb 10

- Operational snow measurements
- Techniques for measuring Snow Water Equivalent
- Advanced characterization of snow microstructure

Wednesday Feb 11

- Snow modeling at different scales
- SNOWPACK model

Thursday Feb 12

- Snow transport
- Remote sensing of snow
- Arctic research planning

On the last day of the school (Friday Feb 13), no lectures were held as the whole day was spent on the field.

Field exercises

The main purpose of the school was to familiarize students with current and emerging techniques for objective characterization of the snowpack for various applications. Traditional methods for snow quantification were also covered. The teaching method adopted was a hands-on approach in a real environment, supported by introductory lectures on the first day of the school. Field exercises typically took place in the afternoons after morning lectures. For the field exercises and subsequent reporting, the students were assigned to small groups of 3-4 people. The groups learnt to study different kinds of snowpacks (forest, open area, tundra) with different instruments. On the last day

of the school, a field expedition to Saariselkä, a tundra site, was organized for a full day of measurement activities. After each field day, students were required to use time with their group to summarize their measurements and enter the observations in a common database.

The daily activities consisted of the following:

Monday Feb 9

The first exercise consisted of an introduction to the various types of available instrumentation, with a demonstration of their usage followed by guided operation of the instrumentation by students in small groups. Each instrument was handled by a lecturer familiar with the use of the instrument in the field. One exercise was devoted also to classical methods for snow characterization (snow pit). The exercise took place in the immediate vicinity of the FMI facilities (but in real snow!).

Tuesday Feb 10

For the second day of field work, students learnt to characterize a typical deep taiga snowpack influenced by forest canopy and mild wind conditions. The groups of students operated independently, relying on skills acquired on the previous day to operate instruments and apply correct filed measurement protocols. Lecturers monitored the process correcting for possible errors, so a consistent field dataset from eight groups was acquired from the same site.

Wednesday Feb 11

The day was a repetition of the exercise on Tuesday, but at a different site. This time, measurements took place over a non-vegetated peat bog with distinctly different snow conditions from the previous day. The student groups operated mostly independently, but lecturers were available for guidance as needed.

Thursday Feb 12

The filed exercise of the day consisted of snow on lake ice; only limited measurements could be made due to schedule restrictions (transportation to the tundra site took place in the evening), but students were familiarized with natural lake ice properties and the influence of water-ice dynamics.

Friday Feb 13.

The last field exercise consisted of an excursion to a tundra snow site in Saariselkä, ca. 150 km north from the FMI Sodankylä facilities. The tundra site exhibited again highly different snow conditions with a variable wind-influenced snowpack. The task assigned to groups was to characterize the snowpack as detailed as possible using all the available instruments over a distance of 7 km, centering on a weather station in the middle of the tundra area. Skis, some pulkas and two skidoos for material transport and safety were provided, and the rest was left to the students. A main part of the exercise was to plan a

small "expedition", including everything which has to be considered: environmental conditions (cold temperatures and wind, time of daylight...), transport of equipment, where and what to measure, sampling design, but also non scientific issues such as group dynamics, personal wellness of group members, hypothermia and fatigue had to be considered.

3) Assessment of the results and impact of the event on the future directions of the field (up to two pages)

54 students applied for the course, from which 27 were selected. Almost equal number in gender resulted. 4 were Post-Docs, 19 PhD-students and 4 advanced Master-students from 11 European countries and 1 from the USA. The high number of applications showed the large interest in this subject.
The eight groups presented their results in written reports, which are in review by the lecturers. The presentations showed a good understanding of the applicability of the methods in different environments, their ease of use and limitations. The presentations will be made publicly available on the website of the European Snow Science Winter School after final redaction.
All students were very positive about the winter school, and expressed their satisfaction with the program (a more formal survey will be done until end of April). The main minor concern was that there was too limited time for working with the data during the winter school. This will be taken into account for the second edition, which is already planned to take place from 14-20 February 2016, in Preda and Davos, Switzerland.
The lecturers are convinced that this snow school will form a well-educated base of snow scientist knowing about in depth about quantitative methods to measure snow properties. We think that this will be very important for the forthcoming research projects in snow-related topics.

4) Annexes 4a) and 4b): Programme of the meeting and full list of speakers and participants

Annex 4a: Programme of the meeting

1st European Snow Science Winter School, Sodankylä, Finland

Date	Sunday 8.2.	Monday 9.2.	Tuesday 10.2.	Wednesday 11.2.	Thursday 12.2.	Friday 13.2.	Saturday 14.2.
8:00		breakfast	breakfast	breakfast	breakfast	breakfast	breakfast
9:00		Welcome, safety & introduction	Operational snow measurements	Snow modeling at different scales	Snow transport	Saariselkä field day: Field experiments / instruments / safety / skiing (ski-doos) / orientation / GPS use	Bus transportation to Rovaniemi
10:00		Modern snow metamorphism - why is snow a rock?	Snow water equivalent measuring techiques	Detailed snow modeling with SNOWPACK	Remote Sensing		
11:00		Snow Meaurements	Exercises	Exercises	Arctic Research Planning		
12:00		Lunch	Lunch	Lunch	Lunch		
13:00		classroom practice: instruments	Field experiments 1 (forest, opening, bog, lake)	Field experiments 2 (forest, opening, bog, lake)	PI Saariselkä field day planning: equipment, mapping, time management, weather, safety, participants, documentation		
14:00							
15:00							
16:00	Arrival at Rovaniemi, bus transportation to Sodankylä	Site tour (Meteo Station)	Field experiment wrap-up	Field experiment wrap-up	Travel preparations	Wrap-up session	
17:00		Dinner	Dinner	Dinner	Dinner		
18:00	Lodging at guesthouses	shopping tour to Sodankylä	Advanced snow microstructure characterization in the Laboratory	wrap-up and data evaluation	Transportation to Saariselkä	Sauna	
19:00	Dinner	Icebreaker	wrap-up and data evaluation	Sodankylä tour	Preparations field trip	ESSS official dinner	

transportation
lecture/classroom
field activity
social/meal etc

Annex 4b: Full list of speakers and participants

Participants

Arndt, Stefanie	AWI
Bircher, Simone	CESBIO
Calonne, Neige	WSL-SLF
Charrois, Luc	LGGE
Cimoli, Emiliano	DTU
Cosgrove, Christopher	Uppsala University
Dragosics, Mona	University of Iceland
Eriksson, Pia	Stockholm University
Hannula, Henna-Reetta	FMI
Hutin, Clement	University of Sheffield
Kepski, Daniel	Polish Academy of Sciences
Khan, Alia	Univ. of Colorado
Kheyrollah Pour, Homa	University of Waterloo
Laska, Michal	University of Silesia
Luks, Bartek	Polish Academy of Sciences
Maslanka, William	University of Reading
Palmer, Katharina	University of Oulu
Paul, Stephan	University of Trier
Piazzi, Gaia	CIMA Research Foundation
Rothmüller, Marion	ZAMG
Schaller, Christoph	AWI
Schiavone, Sophie	University of Besancon
Svensson, Jonas	FMI
Tikanmäki, Maria	VTT
Vera Valero, Cesar	WSL-SLF
Watts, Thomas	Northumbria Univ.

Speakers

Derksen, Chris	Environment Canada
Gouttevin, Isabelle	IRSTEA
Kontu, Anna	FMI
Langlois, Alexandre	University of Sherbrooke
Lemmetyinen, Juha	FMI
Proksch, Martin	WSL-SLF
Schneebeli, Martin	WSL-SLF
Stuefer, Svetlana	University of Alaska