

Scientific report for COST STSM: “Lecturer for SMRT model training workshop and 4th snow science winter school”

Applicant:

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STSM reference details:

COST Action ES1404
STSM title Lecturer for SMRT model training workshop and 4th snow science winter school
Reference number 40122
STSM dates from 07-02-2018 to 17-02-2018
Location Col du Lautaret, France
Host Dr. Marie Dumont Météo-France/CNRS – CEN, 38400 St Martin d’Hères, FR

1 Purpose of the STSM

The goal of the STSM was to support the applicant’s attendance as a lecturer on the two consecutive training schools

1. 1st SMRT Training (08-11 February 2018)
2. 4th Snow Science Winter School (11-17 February 2018)

both held at Col du Lautaret, France. The SMRT training was dedicated to educate 23 participants in the new Snow microwave radiative transfer (SMRT) model <https://www.smrt-model.science/>. The Snow Science Winter School educated 24 students (selected among 61 applications) from 11 European countries, USA, and Canada in state-of-the-art snow characterization methods to support the harmonization of snow measurements in view of detailed snow modeling. Further details can be found on <https://www.slf.ch/de/ueber-das-slf/veranstaltungen-und-kurse/snow-science-winter-school.html>.

2 Work carried out and main results obtained

2.1 SMRT Training

After shuttle transport from Grenoble to Lautaret on Thursday 08 October, the first part of the STSM was organized in the form of lectures from the three organizers Ghislain Picard (GP) Melody Sandells (MS) and myself (HL) plus interactive practicals supervised by GP, MS and HL. The work was organized as follows:

Friday, 09 February: Introduction to core topics:

- Lecture: Introduction to microwave modeling and motivations for developing SMRT (GP)
- Lecture: SMRT Overview (MS)
- Practical: Getting started with SMRT including Python / Git / Jupyter Notebook
- Practical: SMRT: sensor and snow inputs, sensitivity analysis and time-series
- Lecture: Electromagnetic theory (HL)

The day was closed by lightning talks of the applicants to foster discussion.

Saturday, 10 February: Advanced topics:

- Lecture: Snow microstructure (HL)
- Practical: Snow microstructure
- Practical: Model evaluation
- Lecture: Radiative transfer solution (GP)
- Practical: Electromagnetic theory intercomparisons and wrappers to other microwave models
- Lecture: SMRT future and becoming a SMRT developer (GP)
- Practical: Adding SMRT modules

Sunday, 11 February: Consolidation:

- Lecture: Substrate and atmosphere (MS)
- Practical: bring your data (substrate / atmosphere for those without)

The group photo with all participants is shown in Fig. 1



Figure 1: SMRT group photo

2.2 Snow Science winter school

The second part of the STSM comprises theoretical and practical teaching units in the form of practical, hands-on introductions to different measurement techniques, lectures for the theoretical background and supervision of students in field work and data analysis sessions. The work was organized as follows:

Monday 12th February:

- Lecture: Snow microstructure and basic metrics (M. Schneebeli)
- Lecture: Alpine snowpack evolution
- Lecture: Microstructure and macroscopic properties (H. Löwe)
- Field: Introduction to snowpits: Subdivision into groups where each group conducted their own snowpit with lecturers as observers

Tuesday 13th February:

- Lectures: Instruments and poster presentations (All lecturers)
- Field: Detailed introduction into different instruments with working groups in the field (one lecturer for each instruments, 45 minutes for each device).

Wednesday 14th February:

- Lecture: Detailed snowpack modelling (C. Fierz)
- Field: Field trip to sites near Col du Lautaret (1 hour walk with snowshoes), two big groups of students for i) a forest site and ii) a higher elevation site. All students were given the same task to organize their measurement campaign to collect data for later validation of a detailed snowpack model.

Thursday 15th February:

- Lecture: Impact of climate on the snowpack structure : the example of the Arctic (F. Domine)
- Lecture: A few snow climate feedbacks (M. Dumont)
- Lecture: Snowpack hydrology, modelling and applications (J. Lundquist)

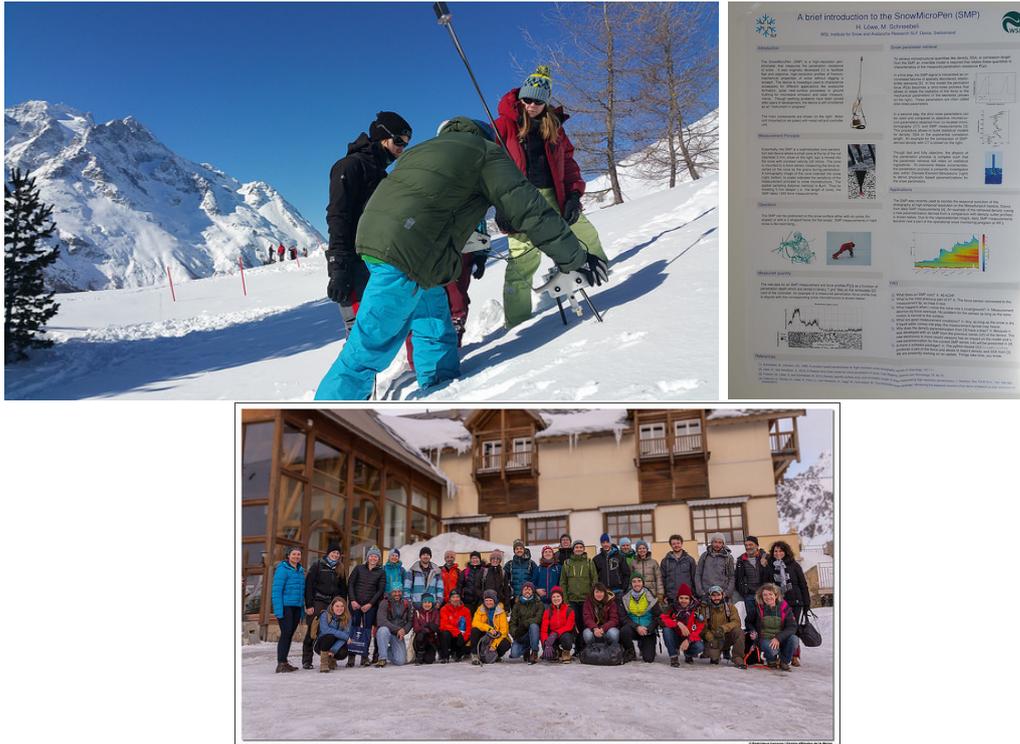


Figure 2: Top left: Introduction to the SMP device by H. Löwe. Top right: SMP poster. Bottom: Group photo

- Field: The day was a repetition of Wednesday with groups and locations swapped.

Friday 16th February:

- Lecture: Comparing measurements and models (I. Gouttevin)
- Lecture: Uncertainties in snowpack modelling (M. Dumont)
- Practical: Data analysis session.

Impressions from the winter school are given in Fig. 2. A more complete list of photos can be found on <https://www.flickr.com/photos/160225822@N02/>

3 Summary

According to the feedback from the participants, both schools must be considered as a great success and the continuation and support of these type of training schools in the future is highly recommended. The 5th edition of the snow school will take place in February 2019, Finland.

4 Future collaboration with the host institutions

During the STSM the existing collaboration between SLF (H. Löwe) and IGE (G. Picard) and Meteo-France/CEN (M. Dumont) was further consolidated. Follow-up activities for SMRT and snow model developments will be taken up during the sabbatical of H. Löwe in Grenoble from August-October 2018.