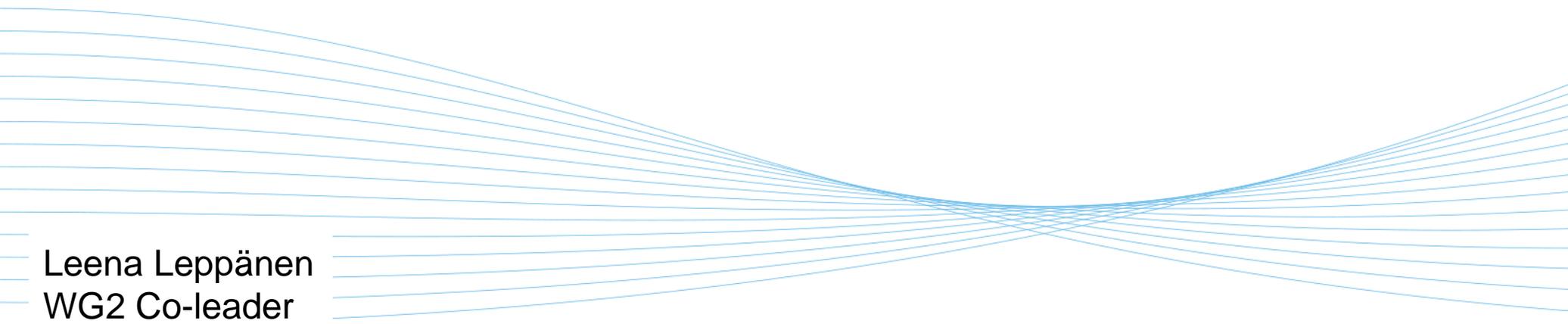




Status of WG1&2

- WG1: Physical Characterization of Snow Properties
- WG2: Instrument and Method Evaluation



Leena Leppänen
WG2 Co-leader



Scientific focus

Physical Characterization of Snow Properties (WG1):

- What physical properties of snow are needed? What quantities can be measured? What is the actual meaning of various parameters? How can they be extracted from measurements?
- Scaling issues and quantification of observation errors will be addressed.
- The Action will provide recommendation for network optimization, data quality control and data homogenisation as well as recommendations for harmonisation of snow observations.
- The Action will perform a survey of existing long-term snow series in Europe as well as their status as to data quality and accessibility.
- Additionally, a set of recommendations for ensuring sustainability of such network of snow series and their European dimension will be provided as part of the practical guide on snow measurements.

Instrument and Method Evaluation (WG2):

- The Action will conduct a detailed study of instrumental characteristics and methodologies to assess the physical characterization of essential snow parameters (e.g. depth, density).
- The newest snow instrumentation will be tested and inter-calibration promoted.
- Satellite data and retrieval algorithms will be assessed, calibrated and inter-compared through other planned campaigns involving Action's partners.
- A guideline for snow observations will be drafted for uptake by WMO



Meetings

Total 8 working group meetings

- WG Meetings, June 29 - 30, **2018, Évora, Portugal**
- WG Meetings, April 18 - 19, **2018, Tallinn, Estonia**
- WG Meetings in 3rd Field Campaign, February 20-22, **2018, Sodankylä, Finland**
- 6th MC Meeting combined with WG Meetings, September 20, **2017, Smolenice, Slovakia**
- WG Meetings in 2nd Field Campaign, February 28 - March 2, **2017, Reykjavik, Iceland**
- 5th MC Meeting Combined with WG Meetings, November 2 - 3, **2016, Granada, Spain**
- 4th MC Meeting Combined with WG Meetings, March 3, **2016, Erzurum, Turkey**
- 3rd MC Meeting Combined with WG Meetings, November 3-4, **2015, Helsinki, Finland**
- 2nd MC Meeting Combined with WG Meetings, March 18-20, **2015, Grenoble, France**



Workshops

Total 12 workshops are organized, 8 of them are related (partly) to WG1&2

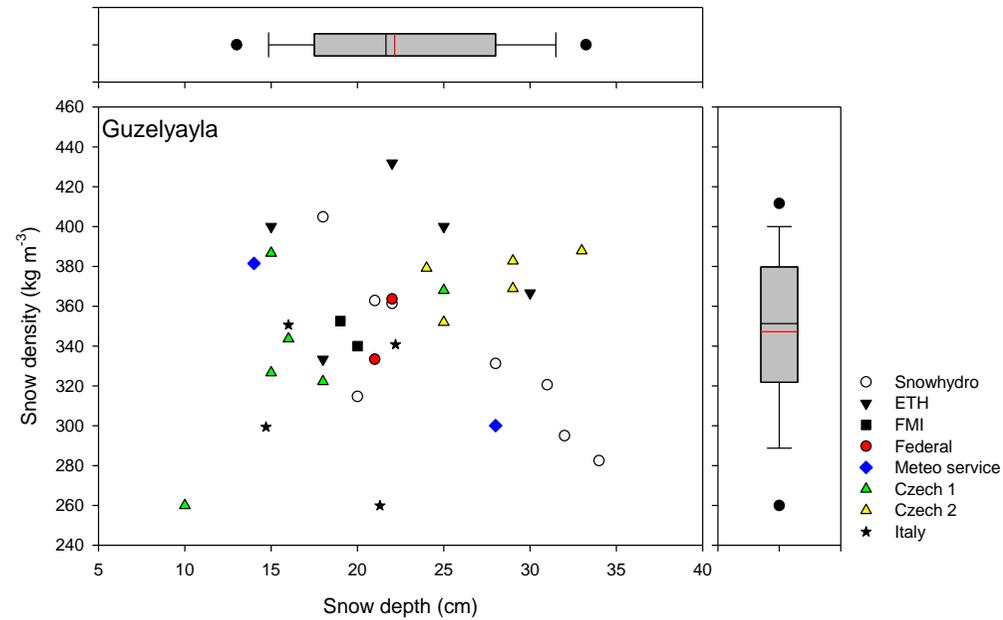
- Workshop on Snow Data Use in Chopok, Slovakia, February 15 - 16, **2015, Chopok, Slovakia**
- 6th National Seminar on Snow on the day of Pyry* in collaboration with the COST ES1404 Action (*Blizzard), November 2, **2015, Helsinki, Finland**
- Harnosnow Joint Event on International Workshop, 1st Field Campaign & Meetings, 01 - 03 March **2016, Erzurum, Turkey**
- Workshop on in-situ snow albedo measurements: toward a snow albedo intercomparison experiment, August 24 - 25, **2016, Helsinki, Finland**
- Workshop: Snow Monitoring and Modeling Initiatives in Spain Based On Ground and Satellite Data, in collaboration with the COST ES1404 Action, November 2, **2016, Granada, Spain**
- Workshop on Melting snow and ice data for real-time maps and hydrological models, 28 February - 02 March **2017, Reykjavik, Iceland**
- 7th National Seminar on Snow on the day of Pyry* in collaboration with the COST ES1404 Action (*Blizzard), part of the Finland 100 programme, November 1, **2017, Helsinki, Finland**
- Workshop on Integrated long-term Snow Chemistry Monitoring, 26 February - 02 March **2018, Salzburg, Austria**



Field campaigns

1st field campaign
Erzurum, Turkey
29.2-3.3.2016

[http://harmosnow.eu/dissemination/reports/Field Campaign Erzurum 2016.pdf](http://harmosnow.eu/dissemination/reports/Field_Campaign_Erzurum_2016.pdf)

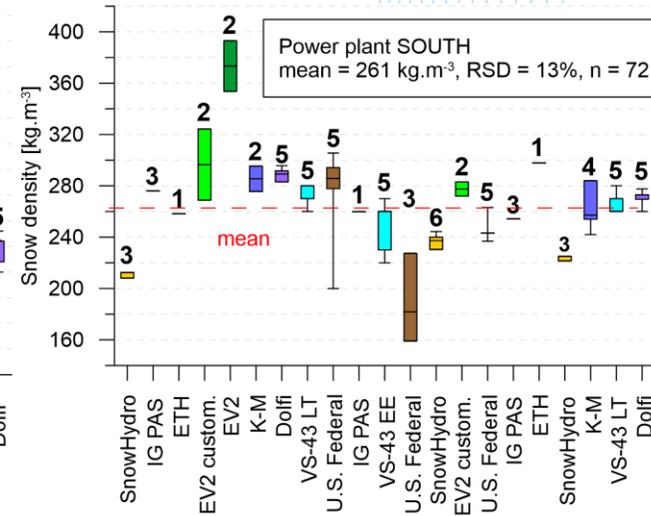
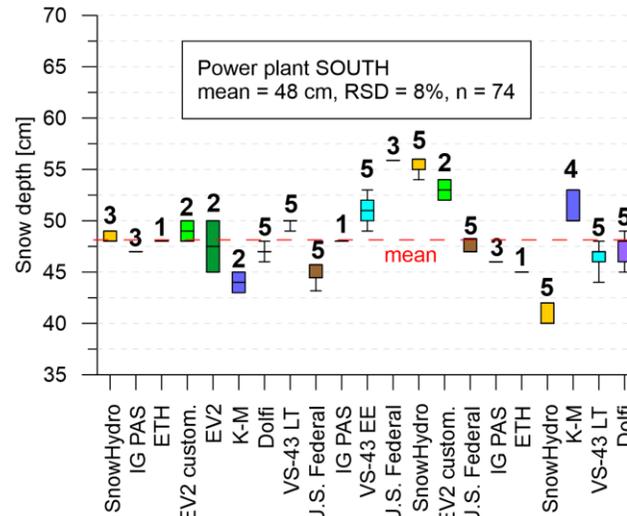




Field campaigns

2nd field campaign
Reykjavik, Iceland
28.2-2.3.2017

http://harmosnow.eu/dissemination/reports/COS_T_2nd_field_campaign_report.pdf

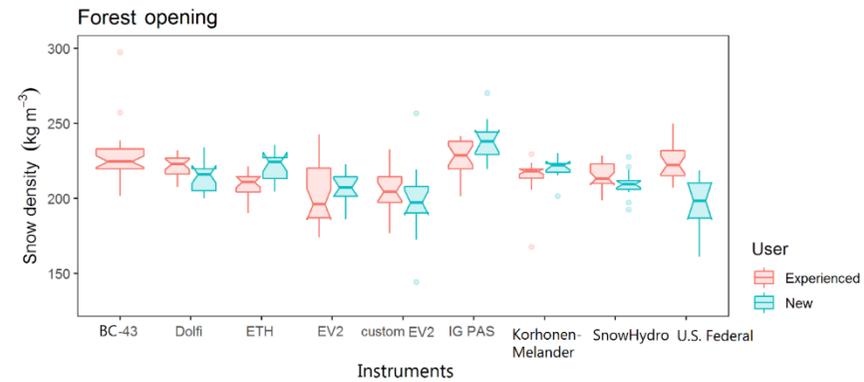
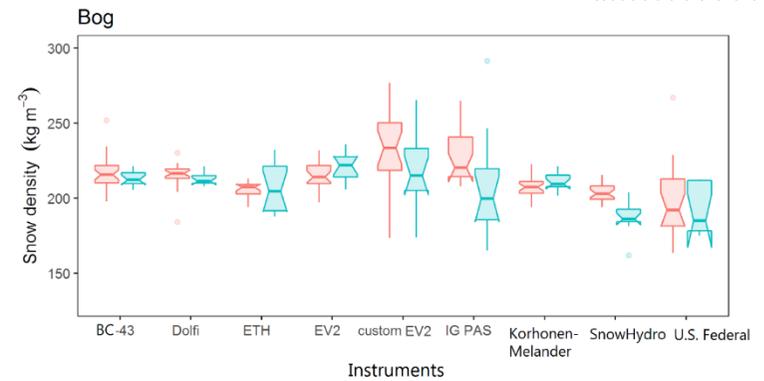
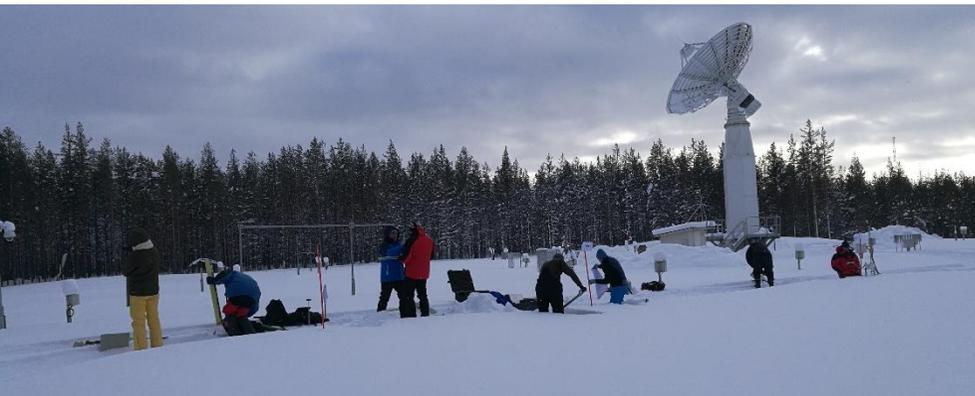




Field campaigns

3rd field campaign
Sodankylä, Finland
20-22.2.2018

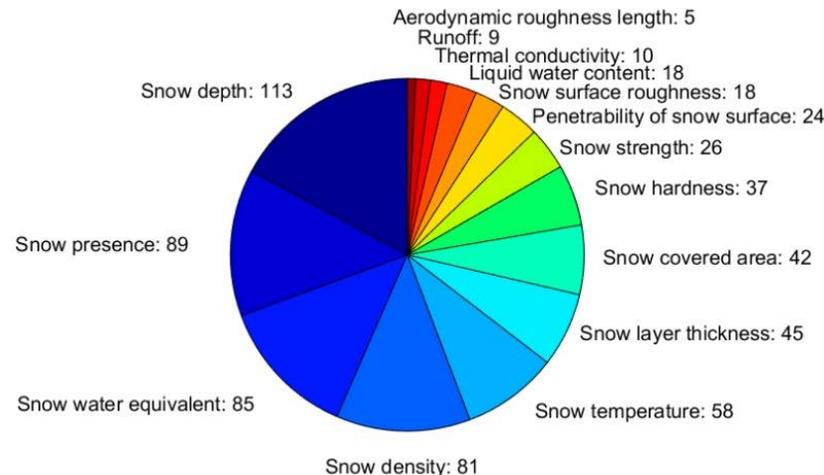
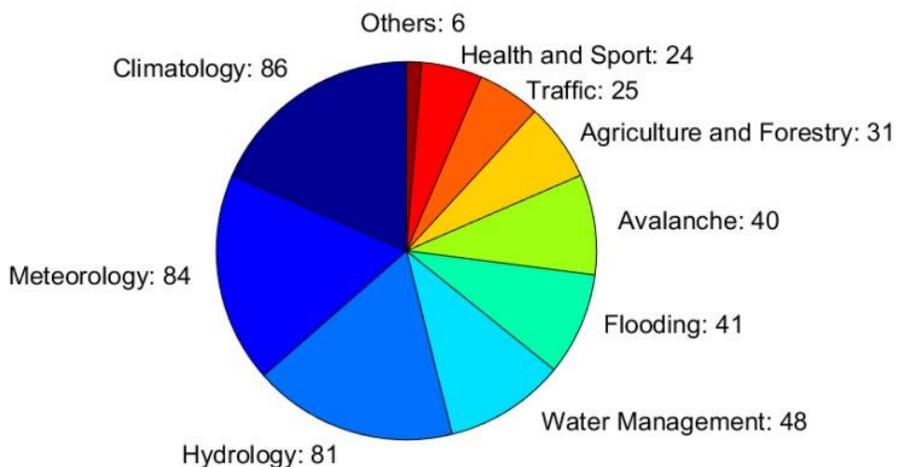
http://harmosnow.eu/dissemination/reports/Report_COST_Sodankyla.pdf





Questionnaire

- *European survey on snow measurement practices and applied instrumentation*
- The questionnaire was open from December 2015 to November 2017
- It was answered by 125 participants from 99 operational and research institutions from 38 European countries
- Responses from operational oriented institutions 71 and from the research only institutions 54





Publications

Pirazzini R., Leppänen L., Picard G., Lopez Moreno J. I., Marty C., Macelloni G., Anna Kontu A., von Lerber A., Tanis C. M., Schneebeli M., de Rosnay P., Arslan A. N., *European in-situ snow measurements: practices and purposes*, Sensors, 18(7), 2016, **2018**.

<https://www.mdpi.com/1424-8220/18/7/2016/htm>

López-Moreno J.I., Leppanen L., Lucks B., Holko L., Sanmiguel-Vallelado A., Alonso-González E., Finger D. C., Nadir-Arslan A. N., Picard G., Gillemot K. + more, *Differences on snow density and snow water equivalent estimation using different snow tubes: instrumental bias, variability induced by observers and influence of snow and terrain conditions*. In progress.

The chapters “Manual SWE instrument comparison in COST Action HarmoSnow field campaigns” and “WG 1 – WG 2 questionnaire” in The European Snow Booklet. In progress.



Deliverables

- D1** Review report on identifying and assessing the essential snow variables.
- D2** Summary of physical characterization and harmonized definition of snow variables.
- D3** Priority assessment of snow characteristics for various applications.
- D4** Handbook on standardized methods for snow data quality control.
- D5** Assessment of measurement errors and inter-calibration of measurement techniques.
- D11** Measurement reports and manuals to standardize measurement protocols will be issued based on the field campaigns results.
- D12** Two topical workshops for addressing the different focuses of the Action (1. Emphasis on characterization and measurements, 2. Emphasis on snow data assimilation in NWP and hydrology models).
- D13** Training school on snow measurements and DA.
- D14** Each of the three working groups will produce a review paper by the end of the Action.
- D15** Final workshop to summarise, promote and disseminate achievements of the Action, and involving users and stake holders



Deliverables

Overview of snow measurement practices and purposes in Europe based on the questionnaire

http://harmosnow.eu/dissemination/deliverables/D1D2D3_Deliverables_2018_1.pdf

Includes

- **D1** Review report on identifying and assessing the essential snow variables.
- **D2** Summary of physical characterization and harmonized definition of snow variables.
- **D3** Priority assessment of snow characteristics for various applications.



Deliverables

Field campaigns for demonstrating and comparing observation techniques, and identifying sources of variability of essential snow parameters

http://harmosnow.eu/dissemination/deliverables/D5D11_Deliverables_2018_2.pdf

Includes

- **D5** Assessment of measurement errors and inter-calibration of measurement techniques.
- **D11** Measurement reports and manuals to standardize measurement protocols will be issued based on the field campaigns results.



Deliverables

D4 Handbook on standardized methods for snow data quality control.

Partly related to WG1&2:

D12 Two topical workshops for addressing the different focuses of the Action (1. Emphasis on characterization and measurements, 2. Emphasis on snow data assimilation in NWP and hydrology models).

- Done (e.g. *Workshop on in-situ snow albedo measurements*)

D13 Training school on snow measurements and DA.

- Done (*Training School on Snow Observations and Data Assimilation*, Bormio, Italy, 12-16 March 2018)

D14 Each of the three working groups will produce a review paper by the end of the Action.

- One paper is published ("*European in-situ snow measurements: practices and purposes*") and one is in progress ("*Differences on snow density and snow water equivalent estimation using different snow tubes: instrumental bias, variability induced by observers and influence of snow and terrain conditions*") for working groups 1 and 2

D15 Final workshop to summarise, promote and disseminate achievements of the Action, and involving users and stake holders

- Almost done (*Workshop: Towards a better harmonization of snow observations, modeling and data assimilation in Europe*, Budapest, October 2018)



Final remarks

- The working groups 1 and 2 have been working together, since their focuses are closely related.
- Operation has been active (2015-2018):
 - 8 working group meetings organized
 - Several workshops organized
 - Three field campaigns organized
 - One questionnaire executed
 - Two publications are coming (one published and one in progress)
- HarmoSnow has created progressive and active network focused on snow properties, instrumentation, field measurements
- How that network could be utilized in the future?