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The European Efforts on a Better Harmonization of Snow Observations, Modelling and Data Assimilation: EU COST Action ES1404-HarmoSnow

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HARMOSNOW TEAM

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CONTENT

- Introduction to EU COST Programme

- COST Action ES1404 - HarmoSnow
- Objectives
- Activities
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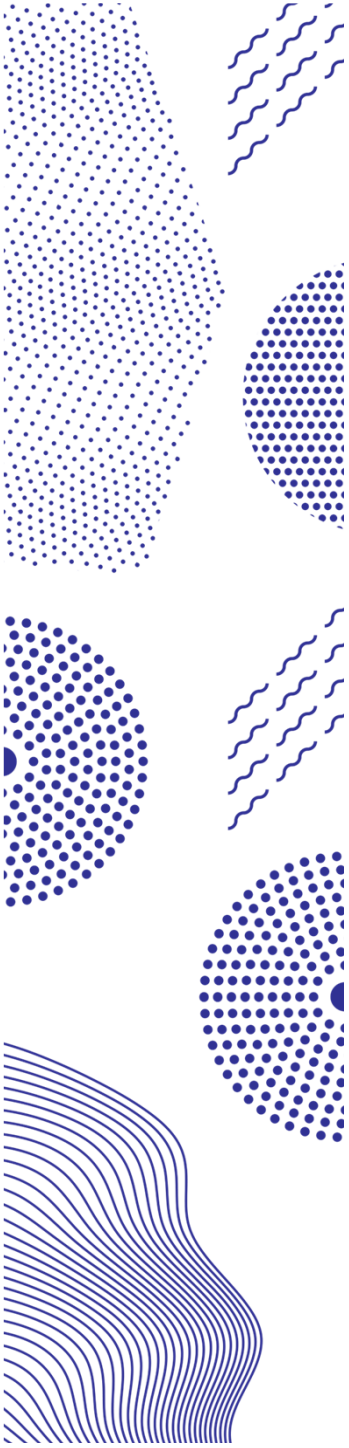
- Future Activities & Plans
- NordSnowNet
- EuroSnow



INTRODUCTION

- COST Actions are pan-European, bottom-up science and technology networks open to researchers from academia and industry or to policy stakeholders.
- COST does not fund research itself, but supports networking activities carried out within COST Actions.
- Every COST Action lasts for up to four years and requires the participation of researchers from at least 5 COST Member Countries.

INTRODUCTION

Programme outreach

38 COST Members:

Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Moldova, Montenegro, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the former Yugoslav Republic of Macedonia.

The countries in green are the less-research-intensive COST Members, also known as Inclusiveness targeted countries (ITCs).

1 Cooperating Member:

Israel.

COST Near Neighbour Countries

Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Jordan, Kosovo*, Lebanon, Libya, Moldova, Morocco, The Palestinian Authority, Russia, Syria, Tunisia, Ukraine.

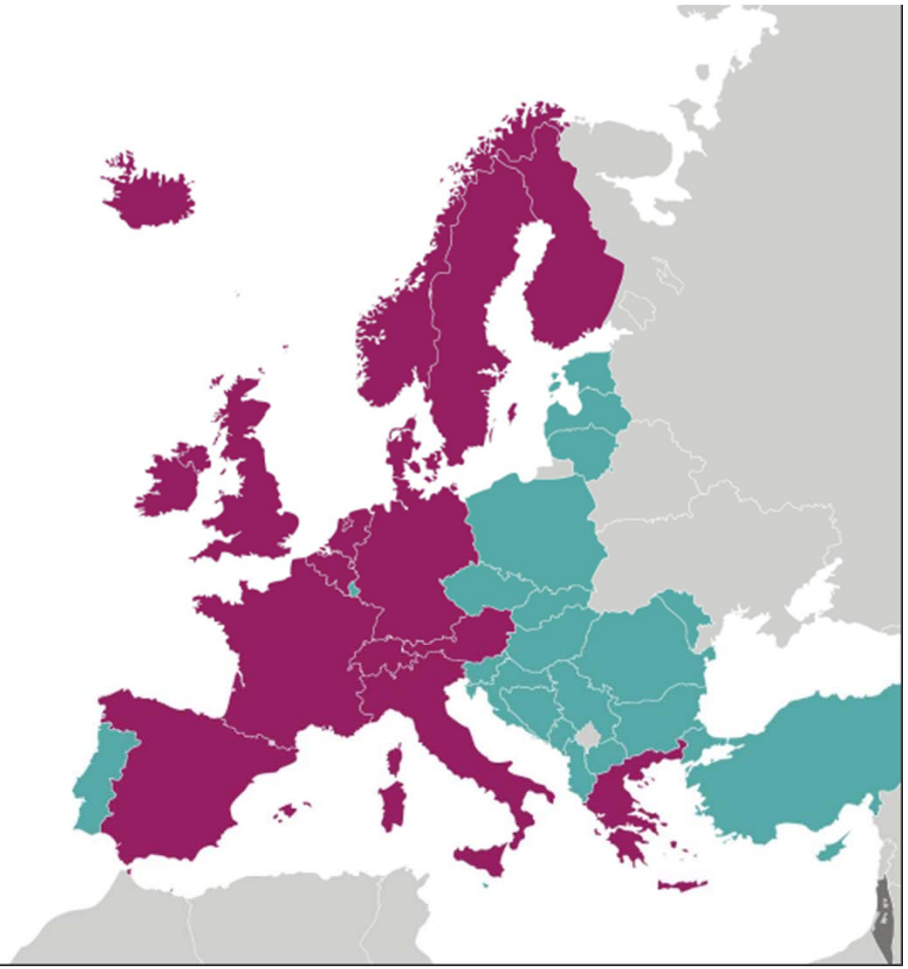
COST International Partner Countries

Any other country (worldwide) that it is not included in the previous list.

Excellence and Inclusiveness policy

This policy is tailored to foster scientific excellence throughout Europe by providing cooperation opportunities for researchers and innovators in 22 less-research-intensive countries. They are also known as Inclusiveness target countries, which COST helps to connect to knowledge hubs in the European Research Area.

*This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.



https://www.cost.eu/who-we-are/about-cost/

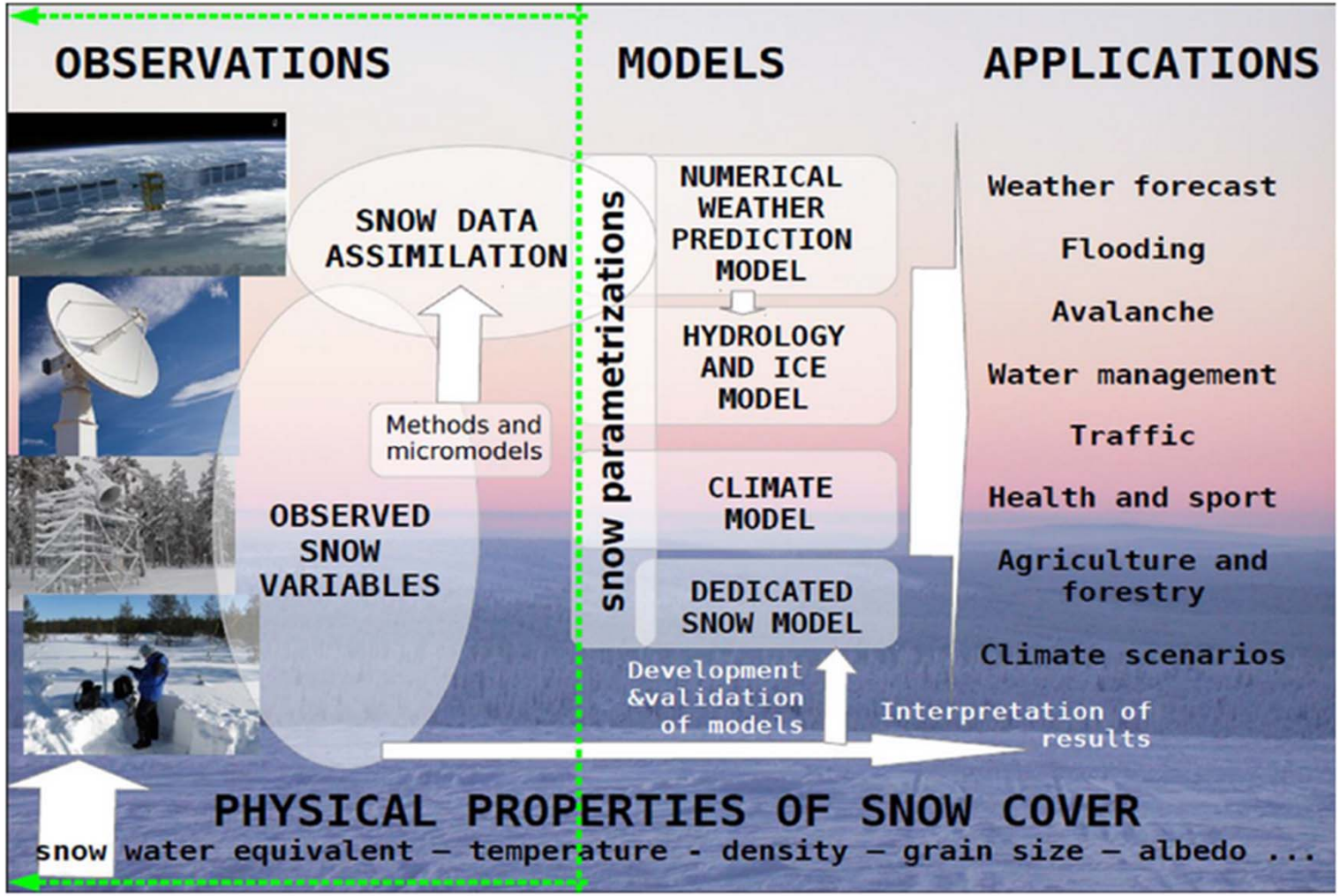
AIM OF THE COST ACTION ES1404

HARMOSNOW

To enhance the capability of the **research community** and **operational services** to provide and exploit **quality-assured and comparable** regional and global observation-based data on the **variability of the state and extent** of snow.

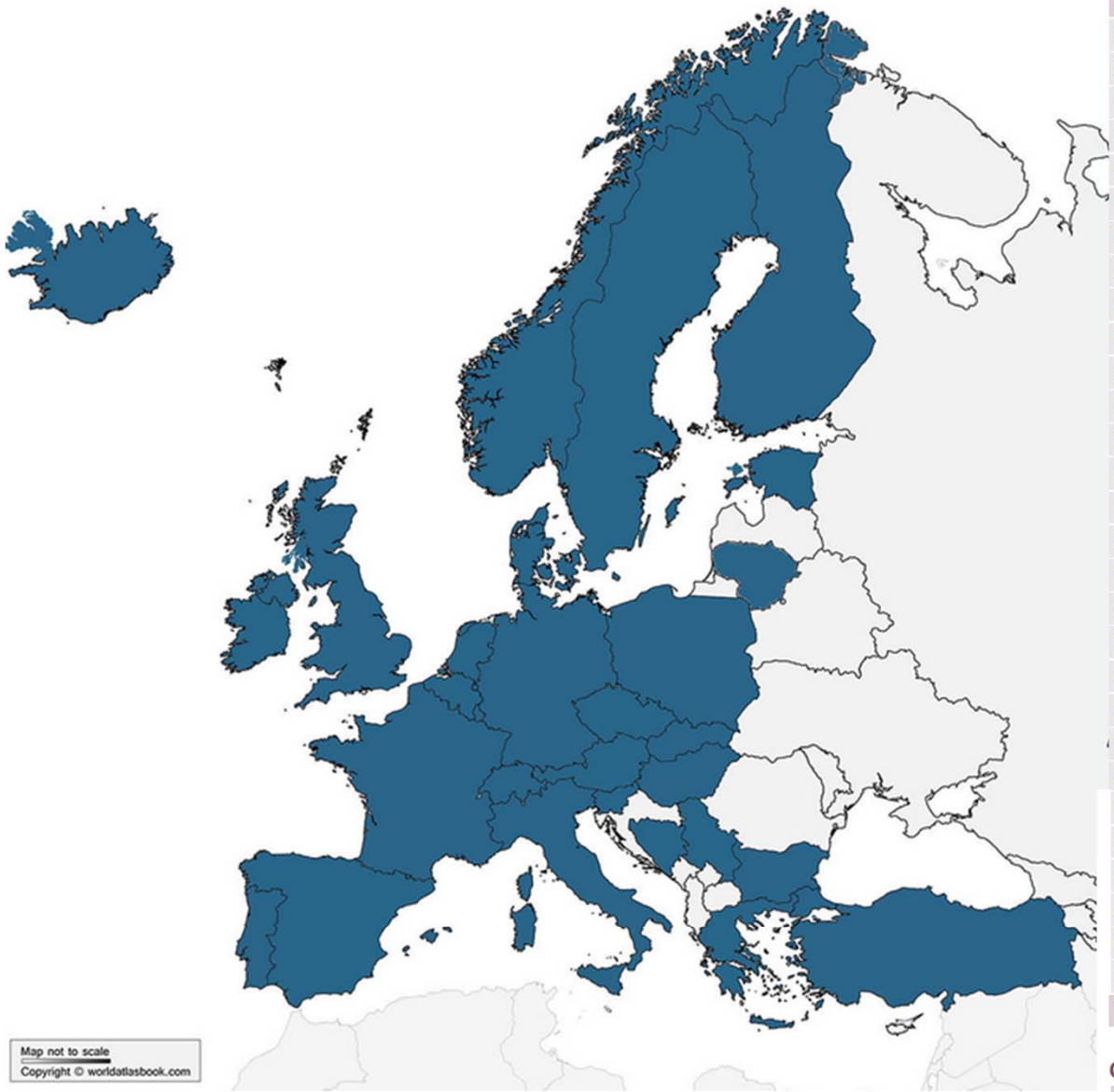
Overall Objectives & Benefits

1. **Establish a European-wide science network** on snow measurements for their optimum use and applications benefitting on interactions across disciplines and expertise.
2. **Assess and harmonise practices, standards and retrieval algorithms** applied to ground, air- and space-borne snow measurements => Foster their acceptance by key snow network operators at the international level.
3. Develop **a rationale and long term strategy** for snow measurements, their dissemination and archiving.
4. **Advance snow data assimilation** in European NWP and hydrological models and show its benefit for relevant applications.
5. **Establish a validation strategy** for climate, NWP and hydrological models against snow observations and foster its implementation within the European modelling communities.
6. **Training of a new generation of scientists** on snow science and measuring techniques with a broader and more holistic perspective linked with the various applications.



Three Working Groups:

- WG1: Physical characterization of snow properties
- WG2: Instrument and method evaluation
- WG3: Snow data assimilation and validation methods for NWP and hydrological models



Participations

Country	Date	Status
Austria	31/07/2014	Confirmed
Belgium	05/04/2016	Confirmed
Bosnia and Herzegovina	04/09/2014	Confirmed
Bulgaria	10/03/2015	Confirmed
Czech Republic	06/06/2014	Confirmed
Denmark	27/06/2014	Confirmed
Estonia	19/06/2014	Confirmed
Finland	11/06/2014	Confirmed
France	10/07/2014	Confirmed
Germany	18/06/2014	Confirmed
Greece	17/03/2016	Confirmed
Hungary	13/10/2014	Confirmed
Iceland	28/05/2014	Confirmed
Ireland	20/10/2015	Confirmed
Italy	19/08/2014	Confirmed
Lithuania	03/10/2017	Confirmed
Luxembourg	18/06/2014	Confirmed
Netherlands	01/07/2014	Confirmed
Norway	09/10/2014	Confirmed
Poland	29/05/2014	Confirmed
Portugal	28/10/2014	Confirmed
Serbia	12/02/2016	Confirmed
Slovakia	07/08/2014	Confirmed
Slovenia	08/10/2014	Confirmed
Spain	01/09/2014	Confirmed
Sweden	25/09/2014	Confirmed
Switzerland	15/07/2014	Confirmed
Turkey	18/08/2014	Confirmed
United Kingdom	22/05/2014	Confirmed
Total: 29		

COST International Partner Countries

Institution Name	Country
Snow and Mountain Research Center of Andorra (CENMA-â€IEA)	Andorra
Yuei-An Liou	Taiwan

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ACHIVEMENTS

13 WORKSHOPS

Workshops

- Workshop on "Parameterization of Lakes in Numerical Weather Prediction and Climate Modelling", May 7 - 9, 2015
- 6th National Seminar on Snow on the day of Pyry* in collaboration with the COST ES1404 Action (*Blizzard), November 2, 2015
- Workshop on Snow Data Use in Chopok, Slovakia, February 15 - 16, 2015
- Harmosnow Joint Event on International Workshop, 1st Field Campaign & Meetings, 01 - 03 March 2016
- Workshop on Remote Sensing Products of Cryosphere using Sentinels
- Workshop on in-situ snow albedo measurements: toward a snow albedo intercomparison experiment, August 24 - 25, 2016
- Workshop: Snow Monitoring and Modeling Initiatives in Spain Based On Ground and Satellite Data, in collaboration with the COST ES1404 Action, November 2, 2016
- Workshop on Melting snow and ice data for real-time maps and hydrological models, 28 February - 02 March 2017
- Workshop on snow data assimilation, March 8-9, 2017
- International Conference: Snow - An Ecological Phenomena, September 19 - 20, 2017
- 7th National Seminar on Snow on the day of Pyry* in collaboration with the COST ES1404 Action (*Blizzard), November 1, 2017, part of the Finland 100 programme
- Workshop on Integrated long-term Snow Chemistry Monitoring, 26 February - 02 March 2018
- Workshop: Towards a better harmonization of snow observations, modeling and data assimilation in Europe, 30 - 31 October 2018

3 field campaigns: Turkey, Iceland, Finland

38 SHORT TIME SCIENTICIF MISSIONS

1 training school Bormio-Italy

European winter snow schools supported

Dates	Name	From	To	Report
19.10.2015 - 27.10.2015	Ali Nadir Arslan	Finland	Bulgaria, Turkey	
28.10.2015 - 30.10.2015	Marion Leduc-Leballeur	France	Italy	
02.11.2015 - 06.11.2015	Miguel Potes	Portugal	Finland	
29.11.2015 - 04.12.2015	Anna Seres	Hungary	Andorra	
13.12.2015 - 19.12.2015	Dimitar Nikolov	Bulgaria	Slovakia	
14.02.2016 - 20.02.2016	Mustafa Cansaran Ertaş	Turkey	Switzerland	
14.02.2016 - 20.02.2016	Suheyla Sena Akarca Bıyıklı	Turkey	Switzerland	
14.02.2016 - 20.02.2016	Tomasz Wawrzyniak	Poland	Switzerland	
14.02.2016 - 21.02.2016	Maciej Miernecki	Germany	Switzerland	
27.02.2016 - 05.03.2016	Thomas Watts	UK	Finland	
14.03.2016 - 18.03.2016	Outi Meinander	Finland	Iceland	
14.03.2016 - 19.03.2016	Maria Gritsevich	Finland	Iceland	
[illegible] - 17.06.2016	Francesco Avanzi	Italy	Switzerland	
[illegible] - 25.06.2016	Esteban Alonso González	Spain	France	
15.08.2016 - 29.08.2016	Georg Heinrich	Austria	Switzerland	
22.08.2016 - 26.08.2016	Miguel Potes	Portugal	Finland	
01.10.2016 - 30.11.2016	Pavel Krajčí	Slovakia	Austria	
17.01.2017 - 25.01.2017	Leena Leppänen	Finland	Luxembourg	
22.01.2017 - 05.02.2017	Bulut Akkol	Turkey	Netherlands	
08.02.2017 - 22.02.2017	Cécile Ménard	United Kingdom	Finland	
10.02.2017 - 19.02.2017	Henning Löwe	Switzerland	Finland	
[illegible] - 19.02.2017	Marie Dumont	France	Finland	
[illegible] - 18.02.2017	Aleksander Uszczyk	Poland	Finland	
12.02.2017 - 19.02.2017	Silvan Leinss	Switzerland	Finland	
12.06.2017 - 17.06.2017	Pekka Rantala	Finland	Portugal	
14.07.2017 - 21.07.2017	Marjan Marbouti	Finland	Germany	
03.02.2018 - 24.02.2018	Katalin Gillemot	Hungary	Iceland	
10.02.2018 - 17.02.2018	Anna Seres	Hungary	France	
10.02.2018 - 17.02.2018	Henning Löwe	Switzerland	France	
25.03.2018 - 01.04.2018	Dimitar Nikolov	Bulgaria	Switzerland	
02.07.2018 - 13.07.2018	Cemal Melih Tanis	Finland	Turkey	
30.07.2018 - 03.08.2018	Cenk Dönmez	Turkey	Finland	
05.08.2018 - 11.08.2018	Gökçen Uysal	Turkey	Netherlands	
05.08.2018 - 11.08.2018	Aynur Şensoy Şorman	Turkey	Netherlands	
05.08.2018 - 15.08.2018	Antonio-Juan Collados-Lara	Spain	Netherlands	
03.09.2018 - 19.10.2018	Gaia Piazzi	Italy	Finland	
08.10.2018 - 27.10.2018	Elena Shevnina	Finland	Portugal	
02.11.2018 - 08.11.2018	Gökçen Uysal	Turkey	Netherlands	

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21 MEETINGS

Meetings

- 1st MC Meeting, November 4, 2014
- 2nd MC Meeting Combined with Working Group Meetings: March 18-20, 2015
- 3rd MC Meeting Combined with Working Group Meetings, November 3-4, 2015
- 4th MC Meeting in Harmosnow Joint Event, March 2, 2016
- Core MC Meeting, October 6, 2016
- 5th MC Meeting Combined with Working Group Meetings, November 2-4, 2015
- 6th MC Meeting, September 19, 2017
- 7th MC Meeting, October 29, 2018
- COST ES1404 Meeting on Reviewing Work Plan & Field Campaigns, June 4-5, 2015
- COST ES1404 WG3 Meeting with Special Cold Lake Session during the workshop on "Parameterization of Lakes in Numerical Weather Prediction and Climate Modelling", June 8, 2015
- WG Meetings in Harmosnow Joint Event, March 3, 2016
- WG Meetings in Workshop on Remote Sensing Products of Cryosphere using Sentinels, April 18 - 19, 2016
- Planning on the Action's dissemination and activities of next grant period, April 28, 2016
- COST ES1404 WG Meetings November 2 - 3, 2016
- WG Meetings in COST1404 2nd Field Campaign, February 28 - March 2, 2017
- WG Meetings in Workshop on Data Assimilation, March 08 - 09, 2017
- WG Meetings, September 20, 2017
- WG Meetings, April 18 - 19, 2018
- COST ES1404 WG Meetings, June 29 - 30, 2018
- COST ES1404 WG Meetings, Editorial Board and Dissemination Meeting, August 29-30, 2018
- COST ES1404 WG Meetings, October 29, 2018

Publications

Helmert, Jürgen and Lange, Martin and Dong, Jiarui and de Rosnay, Patricia and Gustafsson, David and Churulin, Evgeniy and Kurzeneva, Ekaterina and Müller, Richard and Trentmann, Jörg and Souverijns, Niels and Koch, Roland and Böhm, Uwe and Bartik, Martin and Osuch, Marzena and Rozinkina, Inna and Bettems, Jean-Marie and Samuelsson, Patrick and Marcucci, Francesca and Milelli, Massimo, 2018: 1st Snow Data Assimilation Workshop in the framework of COST HarmoSnow ESSEM 1404, Meteorologische Zeitschrift, DOI: 10.1127/metz/2018/0906

Helmert, J.; Şensoy Şorman, A.; Alvarado Montero, R.; De Michele, C.; de Rosnay, P.; Dumont, M.; Finger, D.; Lange, M.; Picard, G.; Potopová, V.; Pullen, S.; Vikhamar-Schuler, D.; Arslan, A. Review of Snow Data Assimilation Methods for Hydrological, Land Surface, Meteorological and Climate Models: Results from a COST HarmoSnow Survey. Geosciences 2018, 8, 489. https://www.mdpi.com/2076-3263/8/12/489

Leppänen, L., Kontu, A., and Pulliainen, J. Automated Measurements of Snow on the Ground in Sodankylä. Geophysica, 53(1), 43-62, Dec 2018. http://www.geophysica.fi/pdf/geophysica_2018_53_leppanen.pdf

Leppänen, L., and Kontu, A. Analysis of QualitySpec Trek Reflectance from Vertical Profiles of Taiga Snowpack. Geosciences, 8(11), 404, Nov 2018. https://www.mdpi.com/2076-3263/8/11/404

Pirazzini, R.; Leppänen, L.; Picard, G.; Lopez-Moreno, J.I.; Marty, C.; Macelloni, G.; 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 2018, 18, 2016. https://www.mdpi.com/1424-8220/18/7/2016

Rimkus E., Briede A., Jaagus J., Stonevicius E., Kilpys J. & Viru B. 2018: Snow-cover regime in Lithuania, Latvia and Estonia and its relationship to climatic and geographical factors in 1961-2015. Boreal Env. Res. 23: 193-208. http://www.borenv.net/BER/pdfs/ber23/ber23-193-208.pdf

López-Moreno, J.I.; Leppänen, L., Luks, B., Holko, L., Picard, G., Sanmiguel-Vallelado, A., Alonso-González, E., Finger, D.C., Arslan, A.N., Gillemot, K., Şensoy, A., Şorman A., Cansaran Ertaş, M., Fierz, C., Fassnacht, S.R., Marty, C., Intercomparisonof measurements ofbulk density and water equivalent of snow cover with snow core samplers: instrumental bias and variability induced by observers, submitted to AGU Water Resources Research , 25.1. 2019.

Salzano, R.; Salvatori, R.; Valt, M.; Giuliani, G.; Chatenoux, B.; Ioppi, L. Automated Classification of Terrestrial Images: The Contribution to the Remote Sensing of Snow Cover. Geosciences 2019, 9, 97. https://www.mdpi.com/2076-3263/9/2/97

Overview of the European In-Situ Snow Measurements obtained through the Harmosnow WG1-WG2 survey

Roberta Pirazzini (FMI), Leena Leppänen (FMI), Ghislain Picard (UGA, CNRS-IGE), Juan Ignacio Lopez-Moreno (Instituto Pirenaico de Ecología), Christoph Marty (WSL-SLF), Giovanni Macelloni (CNR-IFAC), Anna Kontu (FMI), Annakaisa von Lerber (FMI), Cemal Melih Tanis (FMI), Martin Schneebeli (WSL-SLF), Patricia de Rosnay (ECMWF), Ali Nadir Arslan (FMI)

Objectives of the survey:

- to obtain an updated picture of the existing variety of snow measurement practices and instrumentations in use by the European institutions.
- to draw recommendations on the best measurement practices and on strategies to increase the effectiveness and the extension of the snow monitoring network.

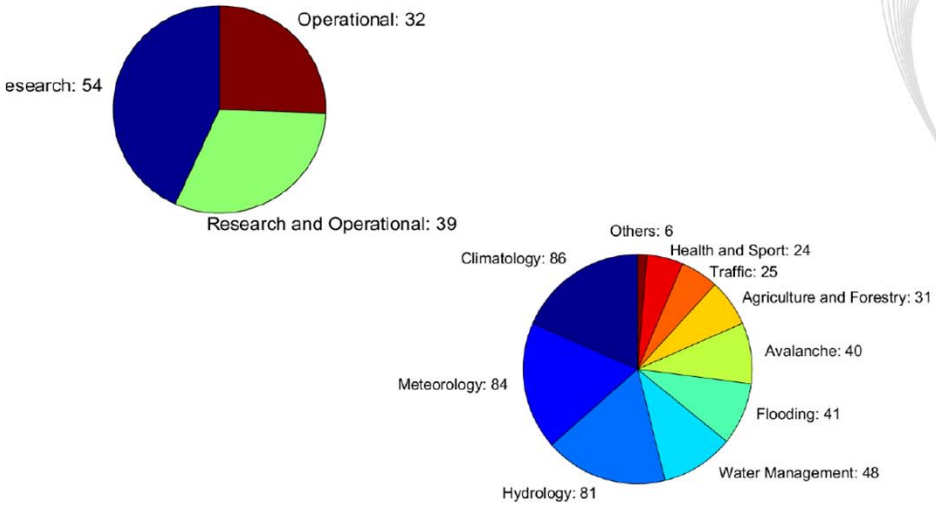
Countries that participated to the survey

125 participants

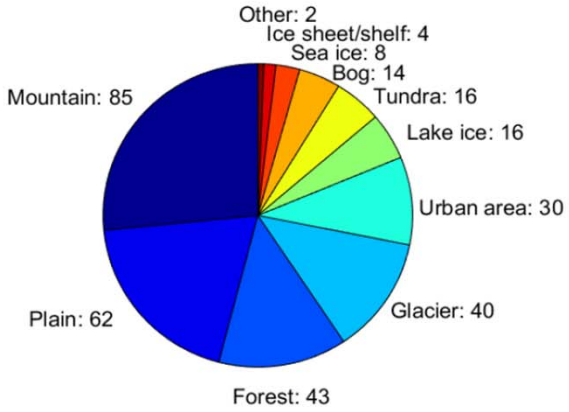
99 institutions

38 countries

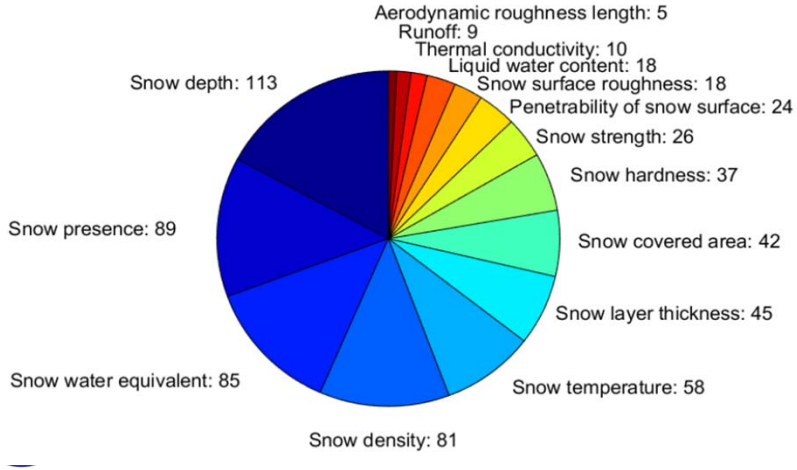
Results: purpose of the snow measureme and application areas



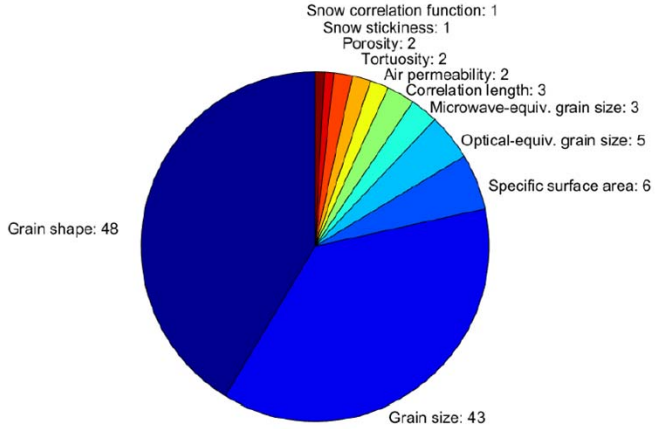
Types of measurement sites



Measured snow macrophysical properties



Measured snow microphysical properties



Final recommendations

1. Automatic instrumentation should be adopted, especially when cheap and practical solutions are available;
2. the properties that are presently measured for research applications would be needed and should be acquired also by operational networks, particularly when they are collected with automatic instruments.
3. The development and the increase in the use of internationally agreed measurement protocols for each of the applied measurement techniques are strongly encouraged, as their application will enhance the harmonization of the measurements.

Have a look at: *Pirazzini, R.; Leppänen, L.; Picard, G.; Lopez-Moreno, J.I.; Marty, C.; Macelloni, G.; 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 2018, https://doi.org/10.3390/s18072016.*

COST ES1404

Snow data assimilation methods for hydrological, land surface, meteorological and climate models:

Results from the COST HarmoSnow survey

Jürgen Helmert and Aynur Sensoy
with content by many colleagues and collaborators of WG3

Model requirements

Deutscher Wetterdienst
...us einer Hand

How can we measure this fit?
What are the consequences for observation networks and modeling systems of snow data?

Models

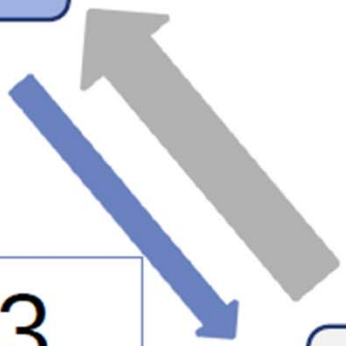
Snow schemes

NWP | Hydrology | Clima

Assimilation

Needs a fit in terms of:

- **Resolution (time,space)**
- **Coverage (global, limited area)**
- **Data content**
- **Errors (sensor, clouds), backup?**
- **Ready to use**



COST WG3 Survey

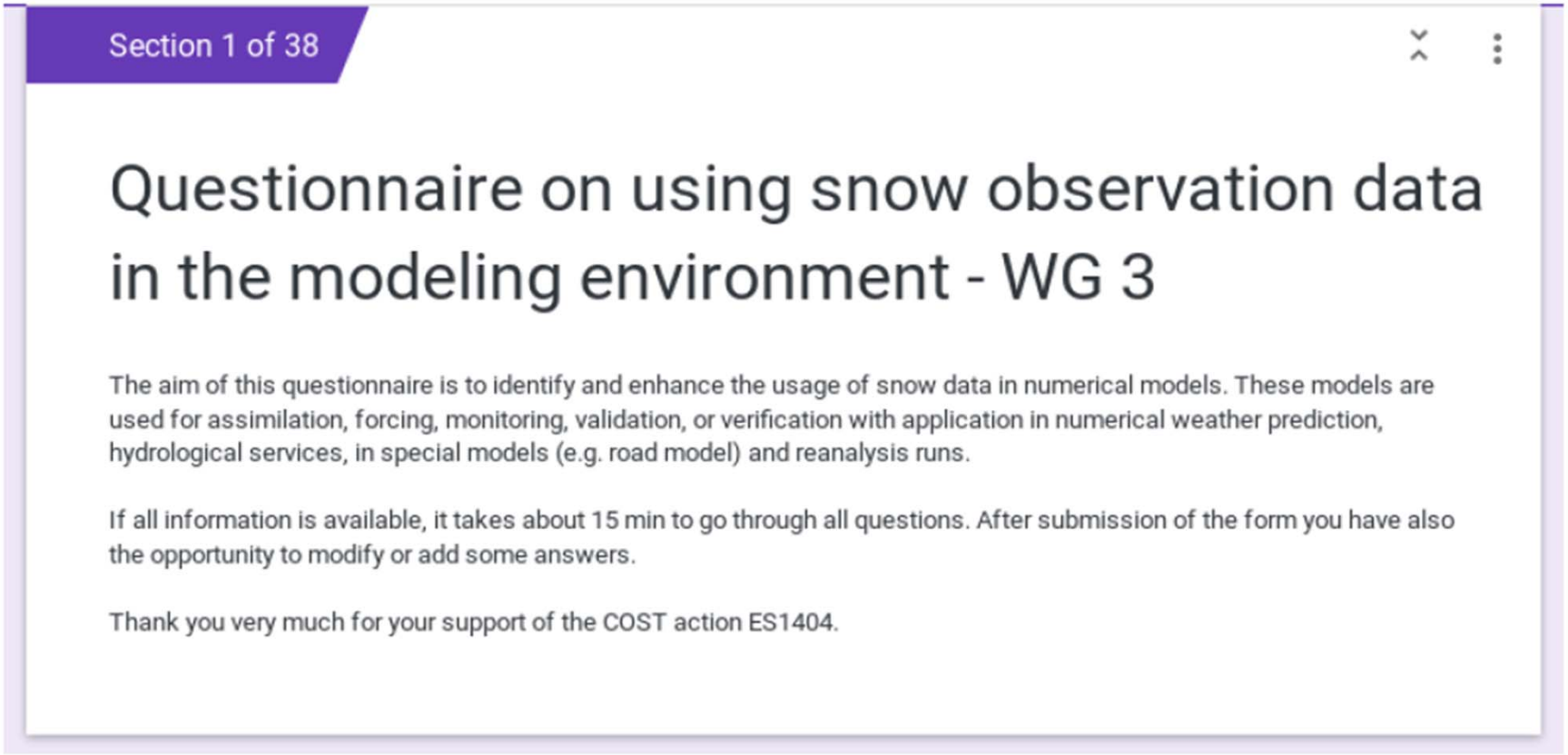
Observations

Conventional | Remote Sensing

High-res networks

Survey

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



- September 2015 – December 2017
- Distributed across COST, EUMETSAT H-SAF and GCW member networks
- 51 participants from 31 countries

Survey

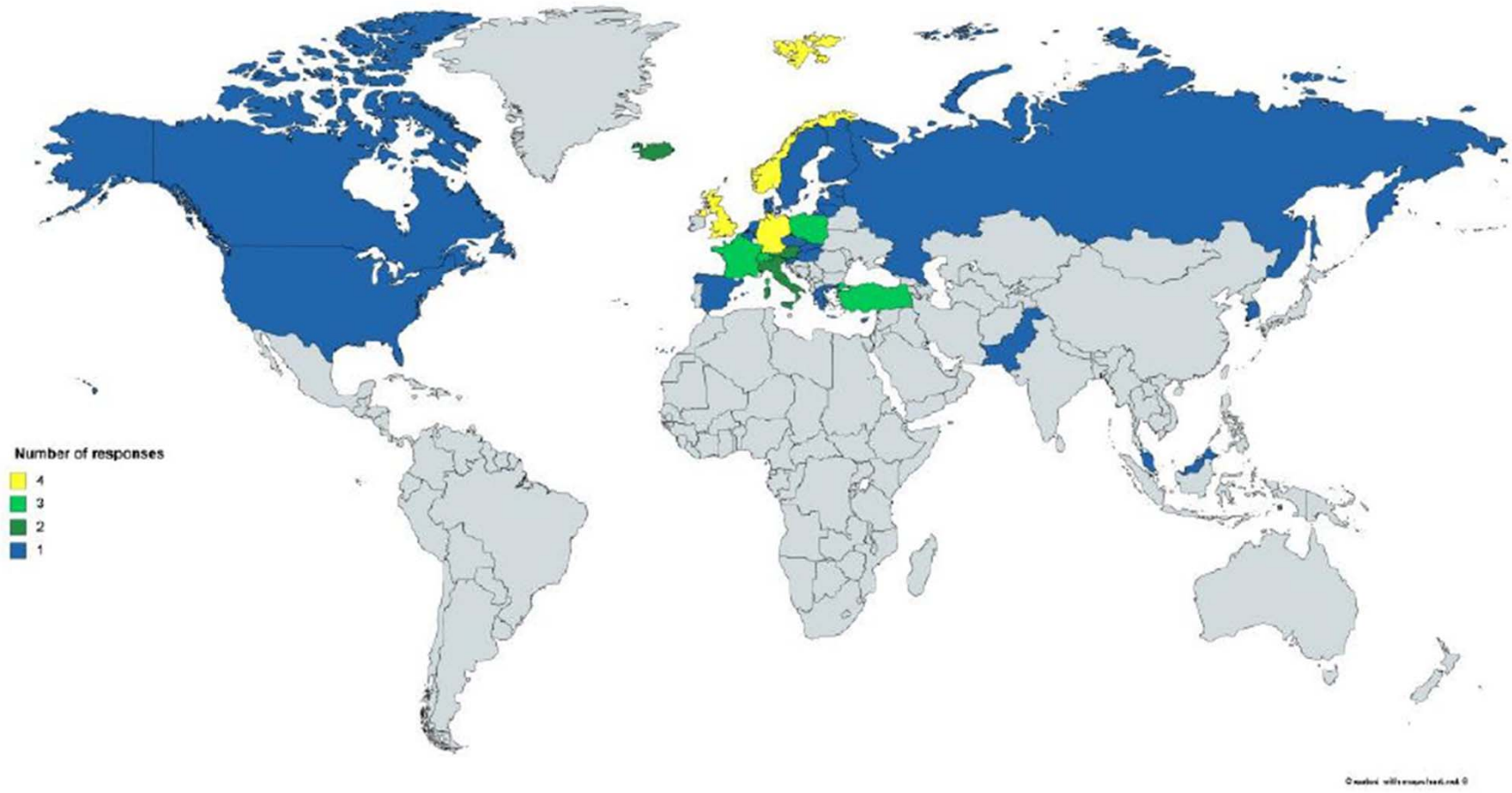


Figure 1. Geographical distribution of number of responses in the survey.

Conclusions

Needs a fit in terms of:

- **Resolution (time,space)**
- **Coverage (global, limited area)**
- **Data content**
- **Errors (sensor, clouds), backup?**
- **Ready to use**

What are the consequences for observation networks and modeling systems of snow data?

In-situ observations (resolution, coverage, data content, errors, ready to use)

- Sparse in some interesting regions
- Need for more observations in the GTS
- Improve SYNOP snow reporting practice (e.g., zero-snow depth)

Remote sensing: VIS/NIR (resolution, coverage, data content, errors, ready to use)

- Cloud problem – additional data needed (e.g., web cameras, drones in future?)
- Time-resolution issue for polar-orbiting systems

Remote sensing: MW (resolution, coverage, data content, errors, ready to use)

- No impact from clouds
- Low temporal but high resolution in space for active systems

Conclusions

Needs a fit in terms of:

- **Resolution (time,space)**
- **Coverage (global, limited area)**
- **Data content**
- **Errors (sensor, clouds), backup?**
- **Ready to use**

What are the consequences for observation networks and modeling systems of snow data?

Models:

- Large degree of heterogeneity : global and limited area systems, NWP, hydrology, special models
- Differences in used snow observation data (in-situ, remote sensing)
- Differences in applied DA methods
- Observation data every and within 24 hours are appreciated
- Revise assumptions about observation error for snow measurements
- Snow observation quality control and consistency checks are considered as important for DA

geosciences

MDPI

Review

Review of Snow Data Assimilation Methods for Hydrological, Land Surface, Meteorological and Climate Models: Results from a COST HarmoSnow Survey

Jürgen Helmert [1,*], Aynur Şensoy Şorman [2], Rodolfo Alvarado Montero [3], Carlo De Michele [4], Patricia de Rosnay [5], Marie Dumont [6], David Christian Finger [7], Martin Lange [1], Ghislain Picard [8], Vera Potopová [9], Samantha Pullen [10], Dagrun Vikhamar-Schuler [11] and Ali Nadir Arslan [12]

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3 Deltares, Operational Water Management Department, Delft 2600 MH, The Netherlands; Rodolfo.AlvaradoMontero@deltares.nl
4 Politecnico di Milano, Department of Civil and Environmental Engineering, P.zza L. da Vinci 32, Milano 20133, Italy; carlo.demichele@polimi.it
5 European Centre for Medium-Range Weather Forecasts (ECMWF), Reading RG2 9AX, UK; patricia.rosnay@ecmwf.int
6 Météo-France—CNRS, CNRM, UMR 3589, CEN, Saint Martin d'Hères F-38400, France; marie.dumont@meteo.fr
7 School of Science and Engineering, Reykjavik University; Reykjavik, 101, Iceland; fingerd@gmx.net
8 UGA, CNRS, Institut des Géosciences de l'Environnement (IGE), UMR 5001, Grenoble 38041, France; ghislain.picard@univ-grenoble-alpes.fr
9 Department of Agroecology and Biometeorology, Czech University of Life Sciences Prague, Kamycka 129, Prague 165 21, Czech Republic; potop@af.czu.cz
10 Met Office, FitzRoy Road, Exeter, Devon EX1 3PB, UK; samantha.pullen@metoffice.gov.uk
11 Norwegian Meteorological Institute, Oslo 0313, Norway; dagrun@met.no
12 Finnish Meteorological Institute, Helsinki FI-00560, Finland; ali.nadir.arslan@fmi.fi
* Correspondence: juergen.helmert@dwd.de; Tel.: +49-69-8062-2704

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Comparison of manual measurements of snow density and snow water equivalent measurements of snow cover: instrumental bias and variability induced by observers.

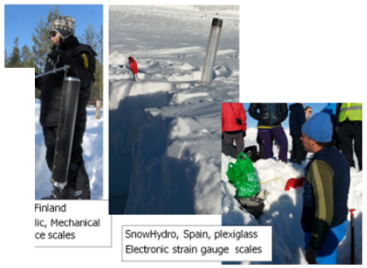
Natural spatial variability vs. observer/device induced variability

How to reduce the uncertainty??

Different sizes (length and diameter)
Different materials
Different procedures to be weighted

1.Erzurum-March 2016

2- Reykiavick: March 2017



Sodankila- Finland: February 2018

3 Field campaigns during HARMOSNOW action:

Focussing on snow water equivalent field campaigns aimed to quantify the impact of using different devices on the estimation of SWE.

Possibility to provide guidelines for bettter SWE mesurements and comparability of measurements in different sites

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KEY RESULTS

- Unique data set containing measurements from nine widely used snow core samplers in Europe and North America.
- The research quantified the uncertainty and isolated the source of errors in measurements of density and water equivalent of snow cover.
- Under homogeneous snowpack, instrumental bias clearly exceeds error induced by observers. Differences between snow samplers were generally below 10%, but sometimes reached up to 15%.

The European Snow Booklet is a new reference work which, for the first time, provides an overview of the operational snow measurements taken in 38 European countries. Information about the methods and standards applied in different locations helps practitioners and researchers to assess and interpret the data.

The information contained in the book's 363 pages includes the number, distribution and altitude zones of automatic and manual measuring stations. It reveals which snow variables are measured and describes the standards and techniques that are applied, which is crucial if the data are to be interpreted correctly. Among other contents is a list of contacts who can provide further information about the individual countries' measured data. Another section contains a preliminary edition of the measurement standards for snow, which are currently being formulated by the Global Cryosphere Watch (GCW) initiative of the World Meteorological Organisation (WMO).

The European Snow Booklet delivers a indispensable snapshot of current practice, and can serve as a starting point for further steps towards enhancing the comparability of snow measurements. It was produced within the framework of the COST Action HarmoSnow (European network for a harmonised monitoring of snow for the benefit of climate change scenarios, hydrology and numerical weather prediction). This Action serves the purpose of coordinating snow measuring methods and standards, and improving communication between operational services and researchers.

FURTHER INFORMATION

Contact | Links | Copyright

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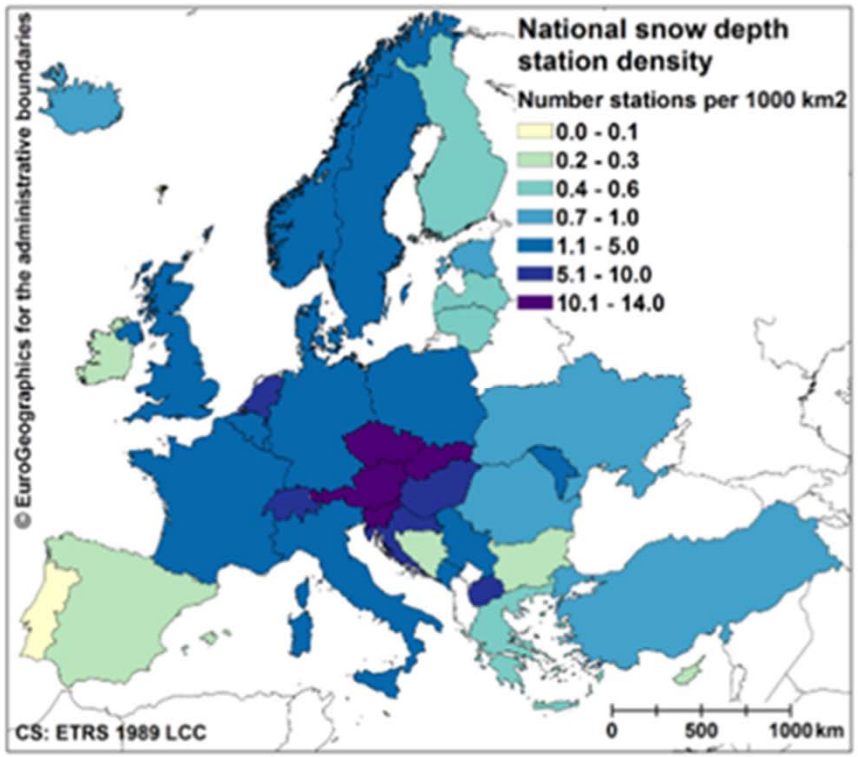

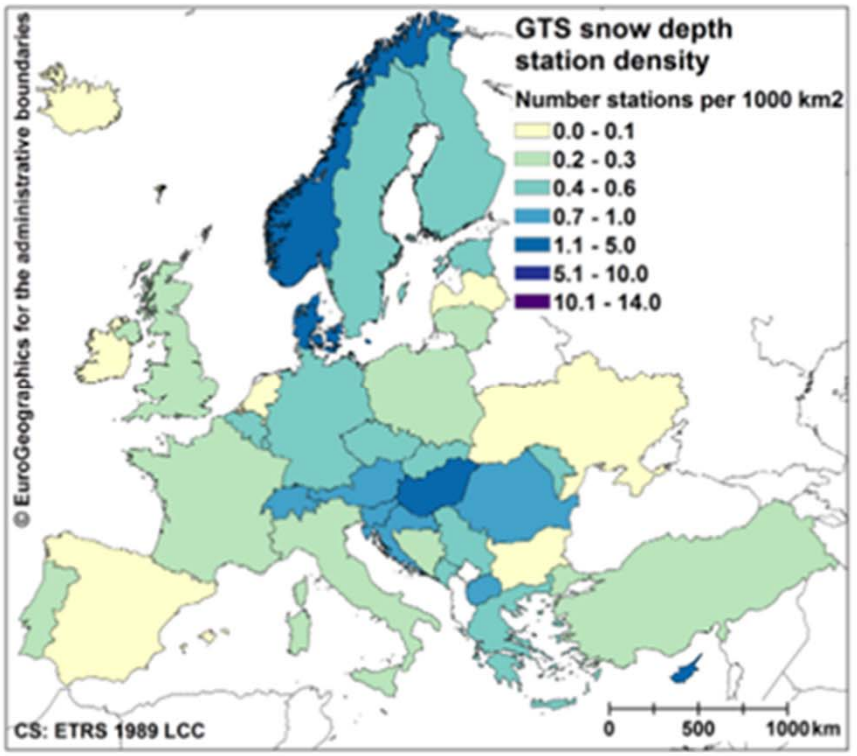

Map based on GTS data from 12/2017

MORE INFORMATION:

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NORDIC SNOW NETWORK-NordSnowNet

Funding: Nordic Council of Ministers

Project duration: 1.9.2019-1.9.2022

Participant countries: Denmark, Finland, Greenland, Iceland, Norway, Sweden, (and Estonia)

Overall goals: Continue existing and start new collaboration within Nordic countries about snow related research topics. Networking will benefit national activities and also create a new easily accessible platform for international collaboration. Snow information provided by meteorological and hydrological services is distributed and used by stakeholders to a greater extent than today.

NordSnowNet-Key outcomes

- Information of existing snow-related research and application projects and networks as well as observation and forecast data and resources on snow cover are shared at Nordic level. Web-based framework for open and continuous information exchange is created.
- Exploitation of the snow observational network in terms of (1) snow in-situ observations ((a) enhancing harmonization of the measurement practices, (b) enhancing standardization of data and metadata formats to facilitate the usability and interoperability of snow data) (2) remote sensing (development of snow retrieval algorithms from satellite-based sensors) and (3) data assimilation (coordinating the development of observational operators to assimilate radiances, in association with the modelling of snow processes) for the benefit of atmospheric and hydrological modelling from hourly to seasonal time scales.

EuroSnow-a proposal in preparation

Aim of EuroSnow

- Strength the established network of snow information providers and users
- Coordinate the process of the utilization of snow information through measurement via assimilation into numerical models and user-oriented products on European level
- Assisting community sections affected by snow related hazards and extreme events.

WG 1. Data collection, curation and management

The action will coordinate and support connection of existing projects and ideas for the

- Improvement of the in-situ data collection and remote sensing observations concentrating to novel technologies as UAVs
- Development of the quality control of snow measurements
- Compilation of historical data sets and rescue of non digitized data
- Identifying the needs on different scientific areas and society for assessment of the existing snow observing systems in Europe
- Harmonization and improvement of snow data management including data and metadata availability, formatting and findability

EuroSnow-a proposal in preparation

WG 2. Snow models, retrieval algorithms and data assimilation

The action will coordinate and support connection of existing projects and ideas for the

- Improvement of the representation of snowfall and snowpack processes in models of various complexities and spatial and temporal scales
- Improvements of retrieval algorithms and blending snow products
- Improvement of methods for hydrological modelling, water management and run-off prediction
- Exploitation of new data sources and concepts for data assimilation and model validation, as well as for verification

WG 3. Snow hazards and extreme events

The action will coordinate and support connection of existing projects and ideas for the

- Improving monitoring of snow hazards and extreme events as avalanches, extreme snow accumulation, extreme snowfall, extreme snowmelt and flooding
- Identifying impact of snow in extreme events on the community sections
- Improving adaptation strategies to snow hazards and extreme events

EuroSnow-a proposal in preparation

WG 4. Snow chemistry and microbiology

The action will coordinate and support connection of existing projects and ideas for the

- Improvements of the sampling protocols for chemical and microbiological analysis
- Identifying of the effects of black carbon, dust and micro-organisms on the cryosphere at high latitudes and mountains.

WG 5. Utilization and dissemination

The action will coordinate and support connection of existing projects and ideas for the identifying common aspects and links between the working groups.

The action will coordinate and organize field demonstrations and training in connection with other working groups.

The action will coordinate dissemination projects, create networks to existing projects on snow to enhance the visibility of the action and their results in the international community and the European society.

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THANK YOU!

29.7.2019

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