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# Towards Harmonization in Snow and Its Applications

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- CHALLENGES ON MONITORING AND APPLICATION OF SNOW
- TOWARDS TO HARMONIZATION IN SNOW
- POTENTIAL IMPACTS OF HARMONIZATION EFFORTS IN SNOW
- FMI-LEAD PAST, CURRENT AND FUTURE ACTIVITIES

# CHALLENGES ON MONITORING AND APPLICATION OF SNOW

- Snow observations (both in-situ and remote sensing) performed for different goals by different instruments and observers;
- Accurate snow data at different spatial and temporal resolutions;
- Climate models commonly exhibit biases in simulating the present-day statistics of snow cover;
- Observed snow cover trends are unclear due to inconsistencies in reporting;
- Hydrology and NWP need better links to relevant grid and observation scales, and proper definitions for various spatial and time averages and variations;
- New instruments and measurement concepts imposes to inter-compare and validate each of them;
- Description and the assimilation of the snow cover information into hydrological, land surface, meteorological, and climate models;
- Using existing internationally agreed snow measurement protocols and developing continuously for new instruments and measurement concepts.

# TOWARDS TO HARMONIZATION IN SNOW

- Harmonising practices, standards and retrieval algorithms applied to ground-based and remote sensing-based snow measurements
- Harmonising dissemination and archiving of snow measurements
- Coordination and networking efforts on harmonised monitoring practices and use of harmonised observations in hydrological, land surface, meteorological and climate models for application to society, economy and safety (e.g. hydro-power, water availability, transportation, tourism, flooding and avalanches)

# POTENTIAL IMPACTS OF HARMONIZATION EFFORTS IN SNOW

- **Climate modelling groups in Europe, North America, Asia and IPCC**: For validating and developing models that produce climate change scenarios
- **National Weather Services**: to assimilate improved snow observations in NWP models and validate models. For guidance in snow observation networks and training of operators
- **Hydrological Services**: to assimilate and calibrate hydrological models using improved snow observations. For guidance in hydrological observations related to snow
- **National environmental authorities and policy makers (nationally, EU-wide and internationally)**: to have better, sounder and more representative information on snow variability and impacts

# POTENTIAL IMPACTS OF HARMONIZATION EFFORTS IN SNOW

- **Entities responsible for monitoring snow-related hazards:** to use improved information about snow cover and its impacts on society
- **Entities responsible for road maintenance:** to enhance their monitoring and warning capacities
- **Instrument manufacturers and practitioners:** to have access to state of the art scientific information about snow physical properties and the usage of measurement data
- **Earth Observation community:** to harmonise ground-based and space-borne observation techniques on snow and their application
- **International organisations (WMO, EUMETNET):** to set improved harmonised guidelines in a coordinated manner

# FMI-LEAD PAST, CURRENT AND FUTURE ACTIVITIES

- COST HARMOSNOW – harmosnow.eu - **PAST**
- NORDIC SNOW NETWORK (NordSnowNet) – nordsnownet.fmi.fi - **CURRENT**
- COST EUROSNOW - **FUTURE**

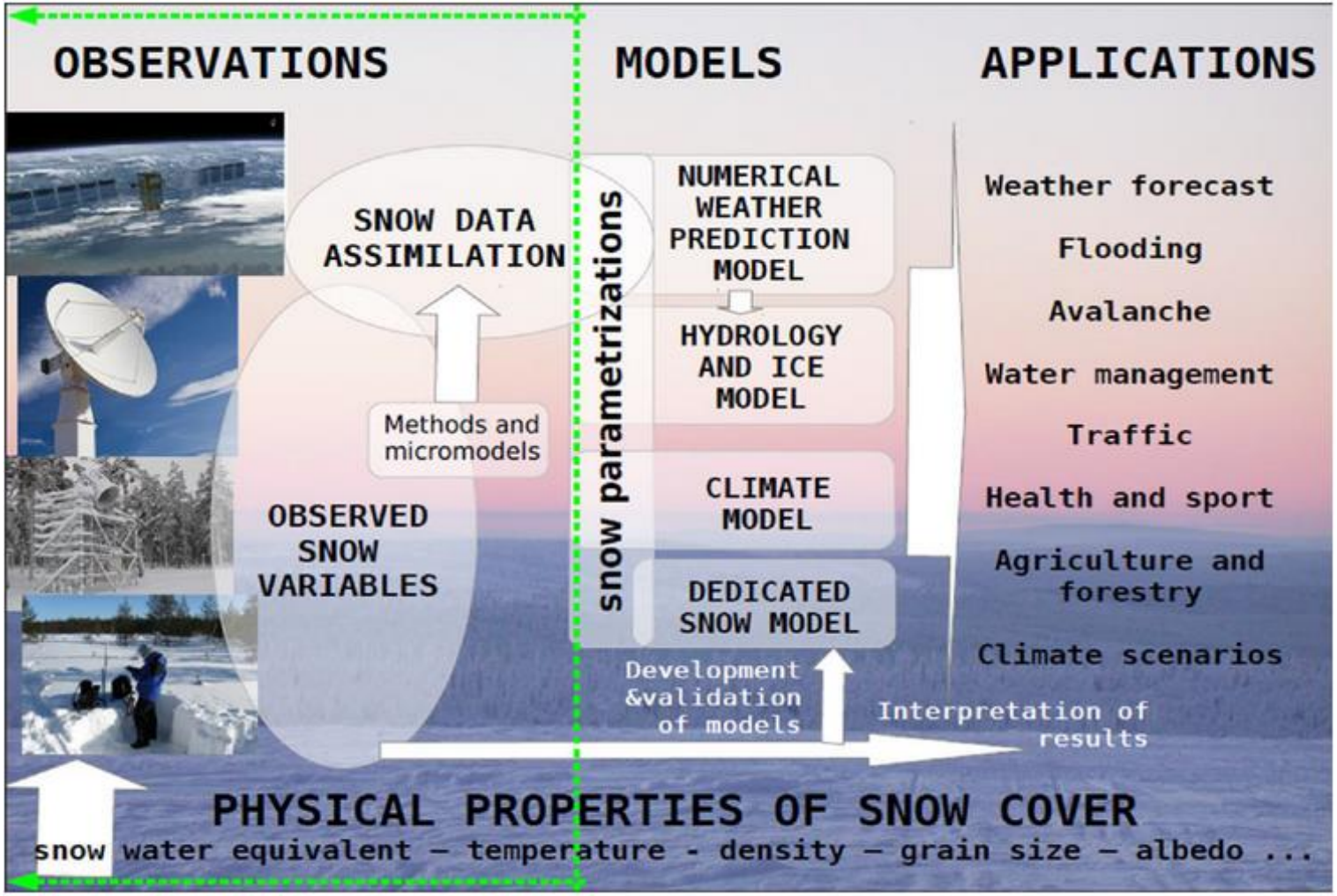
# COST HARMOSNOW – harmosnow.eu - PAST

**A EUROPEAN NETWORK FOR A HARMONISED MONITORING OF SNOW FOR THE BENEFIT OF CLIMATOLOGY, HYDROLOGY AND NUMERICAL WEATHER PREDICTION**

## AIM OF THE COST ACTION ES1404

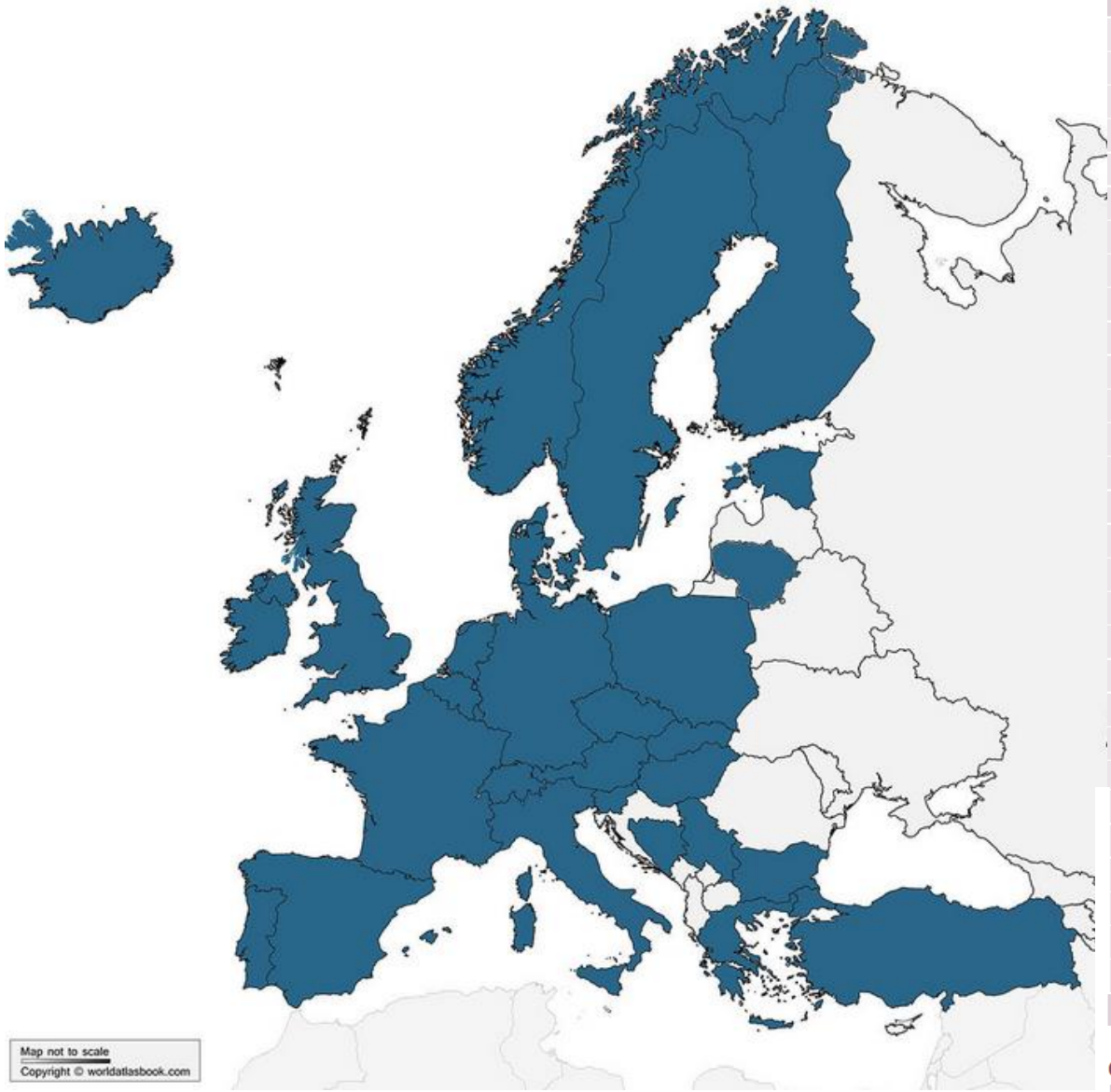
## HARMOSNOW

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.




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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Open Access Article

**European In-Situ Snow Measurements: Practices and Purposes**

by Roberta Pirazzini [1,*], Leena Leppänen [1], Ghislain Picard [2], Juan Ignacio Lopez-Moreno [3], Christoph Marty [4], Giovanni Macelloni [5], Anna Kontu [1], Annakaisa Von Lerber [1], Cemal Melih Tanis [1], Martin Schneebeli [4], Patricia De Rosnay [6] and Ali Nadir Arslan [1]

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

by 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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(12), 489; https://doi.org/10.3390/geosciences8120489

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**Intercomparison of measurements of bulk snow density and water equivalent of snow cover with snow core samplers: Instrumental bias and variability induced by observers**

J. Ignacio López-Moreno, Leena Leppänen, Bartłomiej Luks, Ladislav Holko, Ghislain Picard, Alba Sanmiguel-Vallelado, Esteban Alonso-González, David C. Finger, Ali N. Arslan ... See all authors

First published: 24 April 2020 | https://doi.org/10.1002/hyp.13785 | Citations: 8

**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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# NORDIC SNOW NETWORK (NordSnowNet) – nordsnownet.fmi.fi - CURRENT

**Funding**: Nordic Council of Ministers

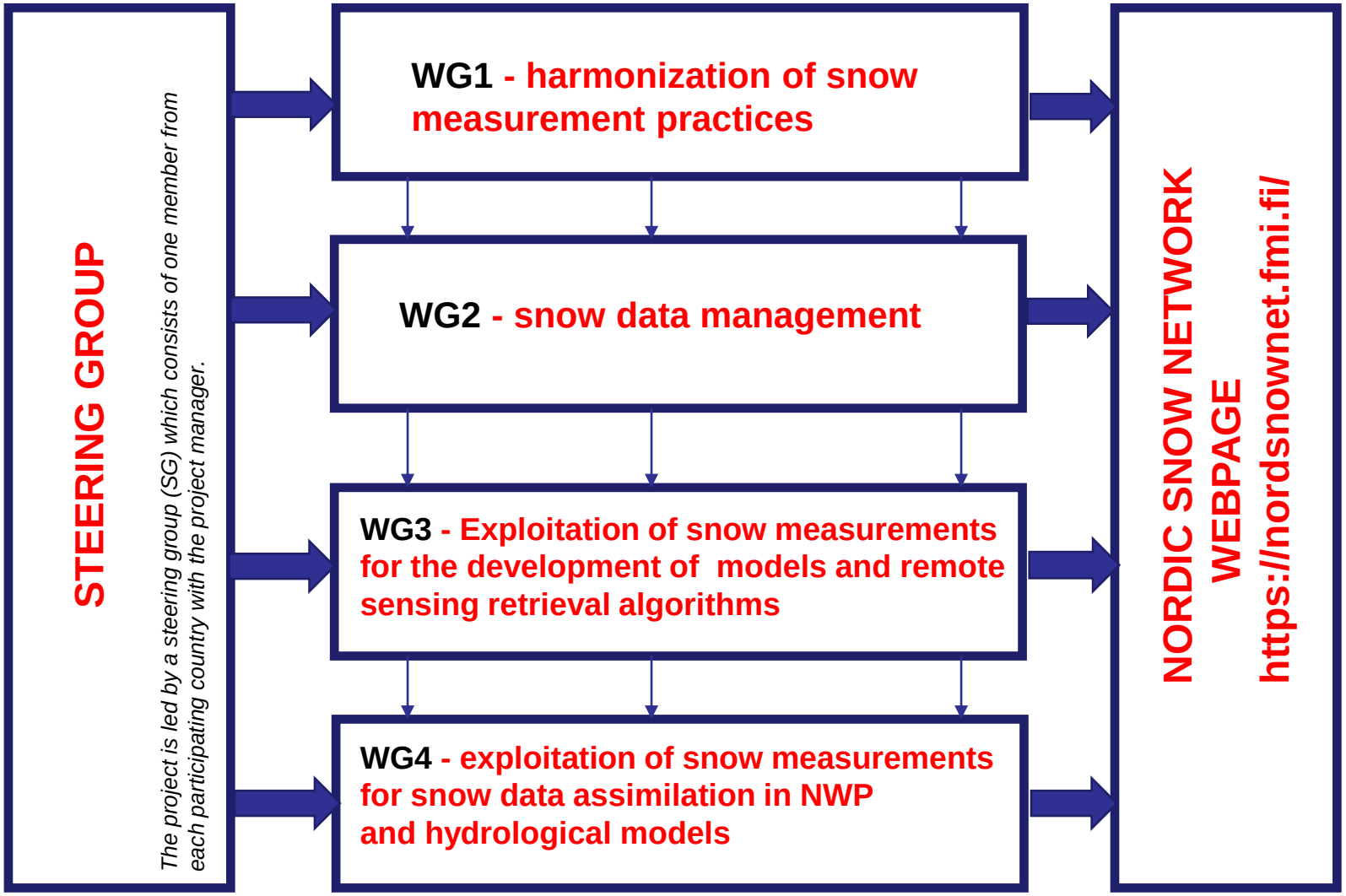
**Project duration**: 1.9.2019-1.9.2022

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

# OBJECTIVES

- **To facilitate and coordinate existing and new snow related collaboration within Nordic countries**
- **To create a new easily accessible Nordic snow platform including snow information and expertise for Nordic and international collaboration**
- **To provide snow information to be distributed and used by stakeholders to a greater extent than today.**

# PROJECT ORGANIZATION



# NordSnowNet Working Groups

**WG-1** on "harmonization of snow measurement practices" have as objectives **to explore the harmonization needs of the snow measurements, establish a list of actions to be taken to achieve the harmonization, and plan an instrument inter-comparison campaign.**

**WG-2** on "snow data management" have **as objectives the standardization of the snow data and metadata formats, and the collection and sharing of tools (software) to format the data and store them in open access repositories. The guiding line of the working group's actions is the fulfilment of the FAIR (Findable, Accessible, Interoperable, Re-usable) data principles.**

**WG-3** on "Exploitation of snow measurements for the development of models and remote sensing retrieval algorithms" have as **objectives to share the advances in model development, identify the working areas that can best benefit from an international coordinated effort, and favour the working synergy among the various institutions.**

**WG-4** on "exploitation of snow measurements for snow data assimilation in NWP and hydrological models" have as **objectives the sharing of progresses in snow data assimilation, as well as the coordination of the development work.**

# NordSnowNet Activities

1. **Maintain webpage with continuous update**

2. **Collection and assessment of snow related activities**

3. **Pilot version of a common Nordic snow monitoring service based on in-situ observations, remote sensing and model analyses that provide best available estimate of the current snow conditions in the Nordic countries from the National Hydro-meteorological services.**

4. **Nordic snow related mobility**

5. **Organizing workshops**

6. **Organizing snow field campaigns**

7. **Organizing training school**

# Nordic Snow Expert Pool

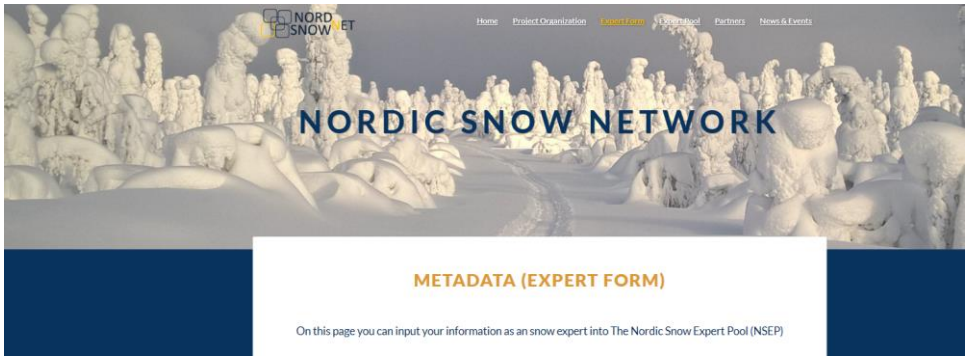
The Nordic Snow Expert Pool (NSEP) is a Nordic Region-specific network of expert including observers, forecasters, modelers, hydrologists, meteorologists, physicists, engineers whose scope of interest is from snow research to snow applications.

The main objective of the NSEP is to build a bridge across the snow experts in the Nordic Region for collaborating on snow measurements, snow related research and development and optimum use and applications of snow. The NSEP also aims at

(1) sharing know-how, information, activities and practices on snow activities

(2) strengthening Nordic collaboration to create strong Nordic expertise.

**https://nordsnownet.fmi.fi/metadata/**

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# European Snow Network EuroSnow

- EuroSnow is proposal for European Cooperation in Science and Technology (COST) funding organization call on October 2021
- Aim is to strengthen the network of snow information providers and users established in HarmoSnow COST Action
- EuroSnow will support connection of existing projects for
  - Improvement of data collection, snow modelling and remote sensing retrievals
  - Harmonization and improvement of snow data management (FAIR principles)
  - Improvement of methods for hydrological modelling and water management
  - Scaling and forecasting snow related hazards and extreme events
- Organize field demonstrations, field campaigns, training schools and workshops
- Main deliverables
  - European Snow Expert Pool of snow experts (observers, scientists, modellers) in website
  - Virtual Atlas of Snow in Europe will be a cloud-based combination of openly available snow information including overview of available snow information, illustrations and metadata
- Evaluated by 26 May 2022

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# Special Issue "Progresses and Gaps on Monitoring of Snow and Its Components at the Local, Regional to Global Scale and Its Applications"

- **Print Special Issue Flyer**

This Special Issue invites and encourages researchers to submit recent developments and progresses on topics including but not limited to:

- Harmonization towards snow data collection, curation, and management;
- Novel techniques and sensors for both the remote sensing of snow and in-situ measurements of snow;
- Snow models, snow retrievals and products, and data assimilation including improved modelling (snow, hydrology, NWP, climate, etc.) and prediction at different scales considering macro- and microscale snow properties;
- Monitoring snow-related hazards and extreme events including latest reanalysis and satellite data sets and models to predict and forecast extreme events and snow-related natural hazards;
- Climate change effect on snow dynamics including snow melting and rain-on-snow events;
- Impact of snow monitoring and predictions on different economic sectors (energy, tourism, agriculture, transportation, etc.).

Dr. Ali Nadir Arslan
Prof. Dr. Carlo De Michele
Dr. Bartłomiej Luks
Prof. Dr. Aynur Sensoy
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# THANK YOU!

3.2.2022

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