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

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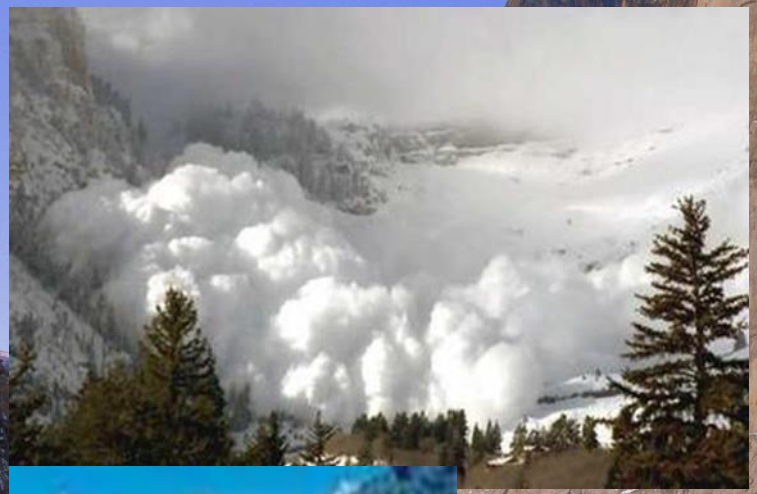


# IINTRODUCTION TO COST

**COST is an intergovernmental framework for European Cooperation in Science and Technology, allowing the coordination of nationally-funded research on a European level**

## What is a COST Action?

- ❑ 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 TO COST ACTION ES1404

**This COST Action on SNOW aims at building a better connection between snow measurements and models, between snow observers, researchers and forecasters, for the benefit of various stakeholders and the entire society**

# AIM OF THE ACTION

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.

# Scientific Programme

- The Action will scrutinise activities related to snow science in terms of

(1) **observations**, (2) **instrumentation** and (3) **data assimilation**, aiming at better effectiveness, harmonisation and coverage of snow data.

- **Harmonization activities will focus on the critical nodes of the measurement chain.**

- Three WGs will be defined according to the 3 focuses in the scientific programme.

# WG1: Physical Characterization of Snow properties

**Task 1.1:** Identifying and assessing the essential snow variables

**Task 1.2:** Physical characterization of the essential snow variables

**Task 1.3:** Snow network optimization, data quality control and homogenization

**Task 1.4:** Harmonization of snow observations in terms of the measured variables

# WG2: Instrument and Method Evaluation

**Task 2.1:** A review of existing space-borne and ground-based sensors/instrumentation applied for measurement of different snow characteristic, estimation of their uncertainties.

**Task 2.2:** Guidelines for in-situ snow observations and related training

**Task 2.3:** Spectroradiometry for snow studies

**Task 2.4:** Methods to measure snow grain size

**Task 2.5:** Methods to measure mechanical properties of snow

# WG3: Snow data assimilation and validation methods for NWP and hydrological models

**Task 3.1:** An overview assessment for understanding the future perspectives of how the various snow observations are used in NWP, hydrology and climate studies.

**Task 3.2:** Development of methods to update non-observed forecasted physical snow properties (such as snow temperature, wetness, density profiles, and mechanical properties) based on the observed ones (such as snow depth and extent).

**Task 3.3:** Advance in the assimilation of new and developing satellite observations of different snow properties and their combination with conventional in-situ snow measurements.

**Task 3.4:** Finding ways towards more extended usage of conventional snow observations in NWP, hydrological and climate models, including observations from high-resolution national networks.

**Task 3.5:** Reaching better knowledge on model and observational errors relevant for data assimilation, by establishing links between model and measurement communities via WG1 and WG2.

# Overall of Deliverables

- A web-based overview/data portal of snow observations, measurements and instruments with links to existing real-time snow databases
- A review and practical guide on snow measurements considering different user needs
- A catalogue of snow measurement instrumentation and best practices
- A review on snow data assimilation in European NWP and hydrological models
- Multidisciplinary articles in scientific journals (including above review results)
- A synthesis and strategic recommendations report.

# Milestones & Deliverables

| Milestones | Deliverables |
|---|---|
| M1 Establishment of the MC, with nomination of Chair, vice-Chair, Grant-holder, website manager, ESR and Gender monitors.<br><br>M2 Establishment of WGs and nomination of their leaders and co-leaders.<br><br>M3 Definition of work plan; schedule and items of WGs' meetings.<br><br>M4 Definition of 2 Workshops' topics and invitees.<br><br>M5 Call, evaluation and approval of yearly STSMs for each year.<br><br>M6 The Action's webpage is operational. | D1 Review report on identifying and assessing the essential snow variables.<br><br>D2 Summary of physical characterization and harmonized definition of snow variables.<br><br>D3 Priority assessment of snow characteristics for various applications<br><br>D4 Handbook on standardized methods for snow data quality control.<br><br>D5 Assessment of measurement errors and inter-calibration of measurement techniques.<br><br>D6 Report on spatial and temporal representativeness errors of snow measurements for data assimilation in NWP and hydrological models. |

# Milestones & Deliverables

| Milestones | Deliverables |
|---|---|
| M7 Questionnaire on measurements and instrumentation completed (i.e. drafted, sent and analysed). | D7 Peer-reviewed publications on advanced assimilation techniques for NWP and hydrological models |
| M8 Questionnaire on data assimilation techniques completed. | D8 Measurement reports and manuals to standardize measurement protocols will be issued based on the field campaign results. |
| M9 Essential snow variables identified. | D9 Two specific workshop for addressing the different focuses of the Action (1. emphasis on characterization and measurements, 2. emphasis on snow data assimilation in NWP models). |
| M10 Physical characterization of essential snow variables completed. | D10 Training school on snow measurements and data assimilation organized. |
| M11 1st Field campaign for inter-comparison of instruments and exchange of methods completed. | D11 Each of the three working groups will produce a review paper by the end of the Action. |
| M12 2nd Field campaign for testing the developed snow measurements protocols. | D12 Final workshop to summarise, promote and disseminate achievements of the Action, and involving users and stake holders. |
| M13 Links to peer-reviewed papers on international journals written by the Action participants collected to the Action web site. | |

# TIMELINES

| Year | | Activities/Milestones/Deliverables |
|---|---|---|
| 1 | Q1 | • Establishment of MC, with nomination of Chair, vice-Chair, Grant-holder, website manager, ESR and Gender monitors (M1).<br>• Establishment of WGs and nomination of their leaders and co-leaders (M2). |
| | Q2 | • Definition of work plan; schedule and items of WGs' meetings (M3), workshop#1 (M4) and STSMs (M5)<br>• Internal and external web sites are set up for further development (M6)<br>• Design and identification of addressees for the questionnaire on measurements, instrumentation and data assimilation practices (M7) |
| | Q3 | • Plans for participation to 1st field campaign in Year 2. |
| | Q4 | • End of Year 1's review and short reports from WGs meetings, workshop and STSMs. |

# TIMELINES

| Year | | Activities/Milestones/Deliverables |
|---|---|---|
| 2 | Q1 | • Assessing achievements against work plan: setting new steps for implementing the MoU;<br>• Schedule and items of WGs' meetings, workshop#2(M4) and STSMs (M5)<br>• Analyses of the questionnaires (D1, D2)<br>• Essential snow variables identified (M9)<br>• Plans of training school on snow measurements and data assimilation in Year 3 |
| | Q2 | • 1st Workshop (D9) with emphasis on characterization and measurements of snow<br>• 1st Field campaign of snow measurements (M11) |
| | Q3 | • Review report on 1st field campaign (D8) |
| | Q4 | • Preparing plans for 2nd field campaign in Year 3<br>• End of Year 2's review and short reports from WGs meetings, workshop and STSMs |

# TIMELINES

| Year | | Activities/Milestones/Deliverables |
|---|---|---|
| 3 | Q1 | • Assessing achievements against work plan: setting new steps for implementing MoU<br>• Schedule and items of WGs' meetings, Final workshop and STSMs (M5)<br>• 2nd Workshop with emphasis on snow data assimilation in NWP models (D9)<br>• Physical characterization of essential snow variables completed (M10) |
| | Q2 | • 2nd field campaign of snow measurements (M12) |
| | Q3 | • Review report on 2nd field campaign including guidelines for in-situ snow measurement techniques and protocol (D8) |
| | Q4 | • Training school on snow measurements and data assimilation (D10)<br>• End of Year 3's review and short reports from WGs meetings, workshop and STSMs |

# TIMELINES

| Year | | Activities/Milestones/Deliverables |
|---|---|---|
| 4 | Q1 | • Assessing achievements against work plan: setting new steps for implementing MoU<br>• Schedule of WGs meetings, workshops and STSMs (M5) |
| | Q2 | • Report on instrumental and representativeness errors of snow measurements for data assimilation in NWP and hydrological models (D6) |
| | Q3 | • Measurement reports and manuals to standardize measurement protocols will be issued based on the field campaign results (D8) |
| | Q4 | • Final Workshop/Conference with presentation of results to a broad multi-disciplinary audience (D12).<br>• Final reports, guidelines, training or dissemination materials from each WGs (D11)<br>• All links to peer-reviewed papers on international journals written by the Action participants available at the Action web site (M13) |


Thank your for your attention!