COST ES1404

A European network for a harmonised monitoring of snow for the benefit of climate change scenarios, hydrology and numerical weather prediction

2014-2018

http://harmosnow.eu/

Aim of COST ES1404

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

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.

Action Objectives & Benefits

1) Establish a European-wide science network on snow measurements

2) Assess and harmonise practices, standards and retrieval algorithms applied to ground, air- and space-borne snow measurements

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

5) Establish a validation strategy for climate, NWP and hydrological models against snow observations

6) Training of a new generation of scientists on snow science and measuring techniques

Structure – Working groups

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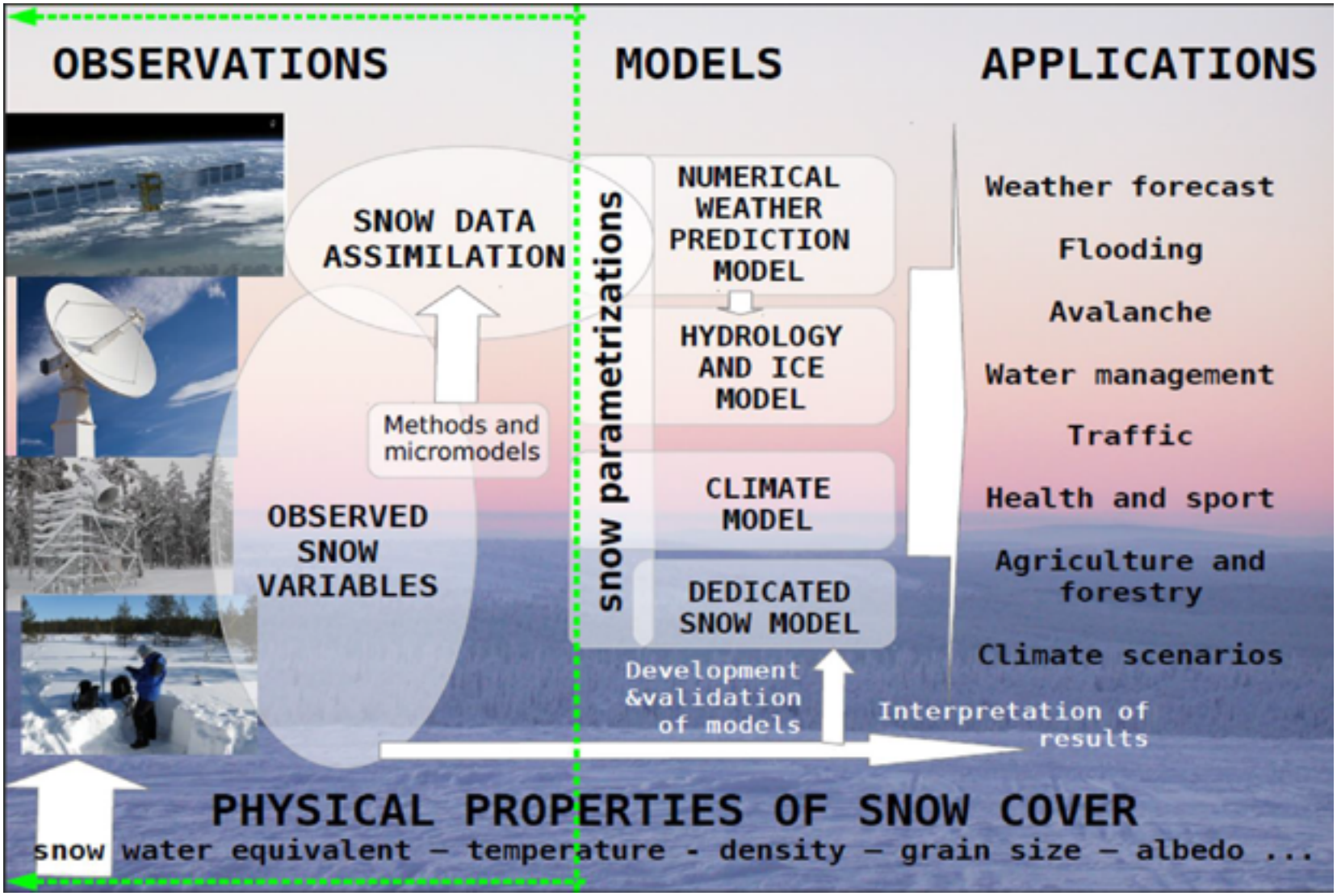
WG1: Physical characterization of snow properties

WG2: Instrument and method evaluation

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

Structure – Working groups



WG Structure

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DWD

WG3

Models

Snow schemes

NWP

Hydrology

Climate

Observations

Assimilation

Conventional

Remote Sensing

High-res networks

WG1

WG2

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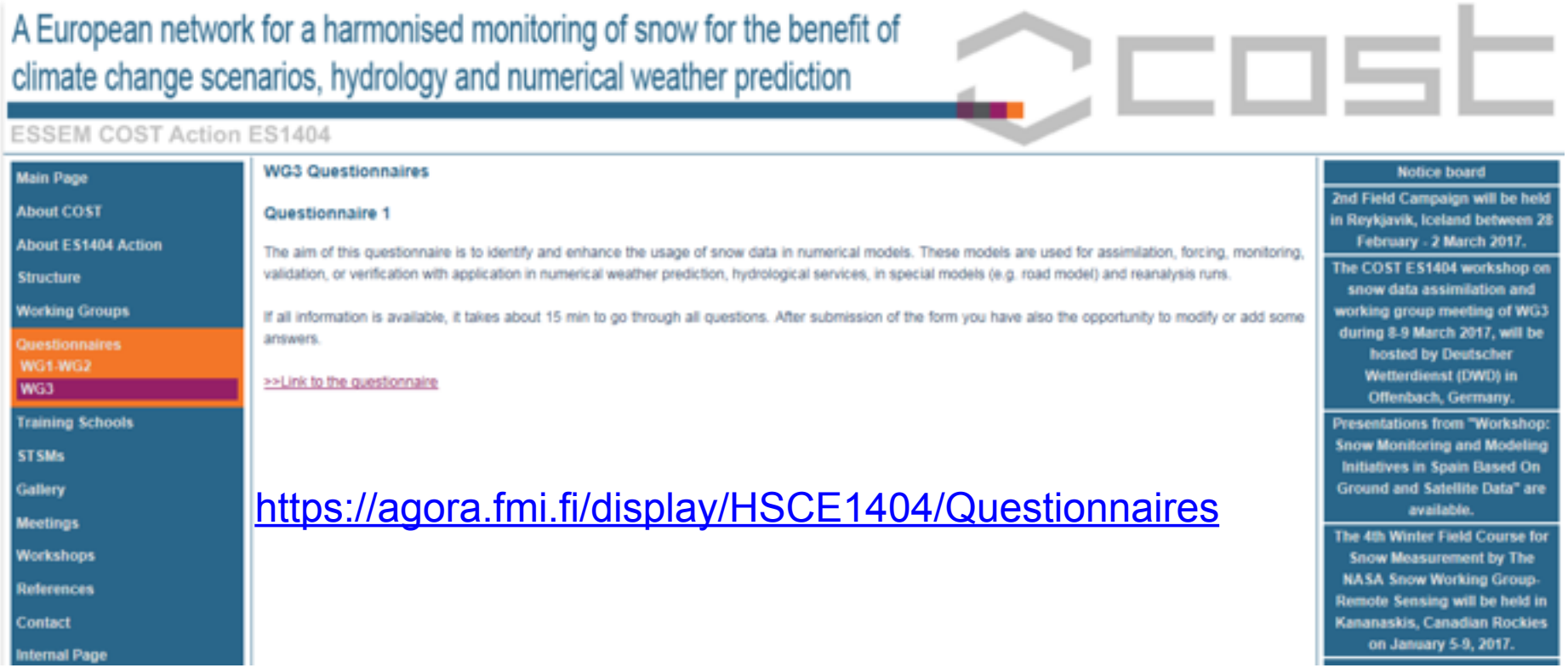
Tasks

Task 3.1: Overview of the various snow observations used in NWP, hydrology and climate studies for different purposes including validation and data assimilation



https://agora.fmi.fi/display/HSCE1404/Questionnaires

Tasks

Task 3.2: Finding a new method for combining satellite observations with conventional in-situ snow measurements and modelling results.

Task 3.3: Looking for strategies towards a more extended usage of conventional snow observations to include observations from high-resolution national networks into NWP, hydrological and climate models.

Task 3.4: Acquiring more information about observational errors relevant for DA by establishing links between the modelling and measurement communities via WG1 and WG2.

WG3 meetings

- First meeting of the WG3 in Grenoble (FR), 18-20 March, 2015
- Second meeting of the WG3 with Special Cold Lake Session during the workshop on Lakes in NWP and Climate modelling in Evora (PT), May 8, 2015
- Third meeting of the WG3 in Erzurum (TR), March 1st, 2016
- 4th WG3 meeting during the workshop on Remote Sensing Products of Cryosphere using Sentinels, in Vienna (AT), April 19, 2016
- 5th WG3 meeting during the COST ES1404 MC meeting in Granada (ES), November, 3, 2016
- 6th WG3 meeting during the COST ES1404 workshop on snow data assimilation, Offenbach (DE), March, 8/9, 2017

Deliverables

- **Review report** on *snow data assimilation* techniques and the use of snow observations in NWP, hydrology and climate models.
  Questionnaire, Evaluation and writing of a Review report

- **Recommendations** on how to get and use conventional snow observations from national networks for *data assimilation and model validation.*
  Impact studies, zero snow depth – COST impact

- **Recommendations** about sustainable ways to create snow products for users by *combining* remote-sensing and conventional snow observations with modelling results.
  Outcome of the workshop in Offenbach

Outcome

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COST ES1404 freely available tools:

- A web-based overview/data portal of snow observations, measurements and instruments with links to existing real-time snow databases

COST ES1404 impact in organisations:

- Connections to WMO, GCW Snow watch, EUMETNET, SRNWP
- International NWP consortia
- NWP center

Deliverables

- **Report** on *spatial and temporal representativeness errors* of snow measurements for DA in NWP and hydrological models.
  Questionnaire

- **Peer-reviewed publications** on advanced DA techniques for NWP and hydrological models.
  WG3 meeting

- **Two topical workshops** for addressing the different focuses of the Action
  Erzurum, March 1st, 2016, Offenbach, March 8/9, 2017

- **Training school** on snow measurements and DA.
  SMRT training Q1 2018
- Each of the three working groups will produce a **review paper** by the end of the Action.

Arctic Terrestrial Modelling Workshop

14-15 September 2017

Universities Canada, US, UK, MetServices, COST

❖ **Knowledge gaps in the current representation of processes**

Snow redistribution/feedbacks

LS3MIP looks into some snow feedbacks.
Snow cover fraction - snow depth/mass relationships still being investigated.
(e.g. ESM SnowMIP), hard to validate.
Machine learning can help – limitations to be considered.

Introducing blowing snow can reduce biases in snow depth. Blowing snow is also easily sublimated.
How to include into NWP/climate models?

Snow-vegetation interactions (snow on canopy), not represented in all models.
Snow refreshment value depends on resolution (temporal/spatial) at which models are run.

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- **Emerging modules/parameterizations and/or approaches (will depend on spatial and temporal scales – NWP, S2S, Decadal to climate scales; global to regional)**

  Complex snow models such as CROCUS doesn't capture **snow density profile in tundra**; **depth hoar important during the initial winter months** Some hydrology models probably has it.

  Subgrid parameterization of snow is required. Multilayer snow models and elevation bands or clusters considering elevation, slope, aspect etc. important for different regions. Vegetation-snow interaction to be improved.

  Hydrology – difficult to validate soil moisture/runoff, river discharge (streamflow) is available but adds another layer of modelling (and few models do it).

- **Validation approaches**

  COST-ES1404 (snow in-situ and satellite), NSF (Arctic data centre), ABOVE, ESA, NCAR, AWI, NGEE Arctic, NSIDC sites useful sources.