FINNISH METEOROLOGICAL INSTITUTE

COST ES1404
Results of questionnaires on snow measurement practices and data assimilation in Europe

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Helsinki, Finland

Contents

- **WG 1 & 2 and related questionnaire**
- **WG 3 and related questionnaire**
- WG 1&2 questionnaire on snow measurement practices
  - Purpose
  - Participant countries
  - Topics of questions
  - Preliminary results
  - Conclusions
- WG 3 questionnaire on data assimilation
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WG 1 & 2 and related questionnaire

- **WG 1: Physical characterization of snow properties**
  - Tasks related to identifying and physical characterization of essential variables, harmonization of observed variables, and network optimization and homogenization
- **WG 2: Instrument and method evaluation**
  - Tasks related to review of existing instrumentation, guidelines for observations, and development of measurement methods

- Questionnaire: Snow measurement practices
  - Measured snow parameters and applied instrumentation/techniques

WG 3 and related questionnaire

- **WG 3: Snow data assimilation and validation methods for numerical weather prediction and hydrological models**
  - Tasks related to overview of snow observations used for modeling and data assimilation, methods to combining satellite observations and in-situ measurements and modeling results, usage of national snow observations, and observational errors relevant for data assimilation

- Questionnaire: Data assimilation
  - Questionnaire on using snow observation data in the modeling environment

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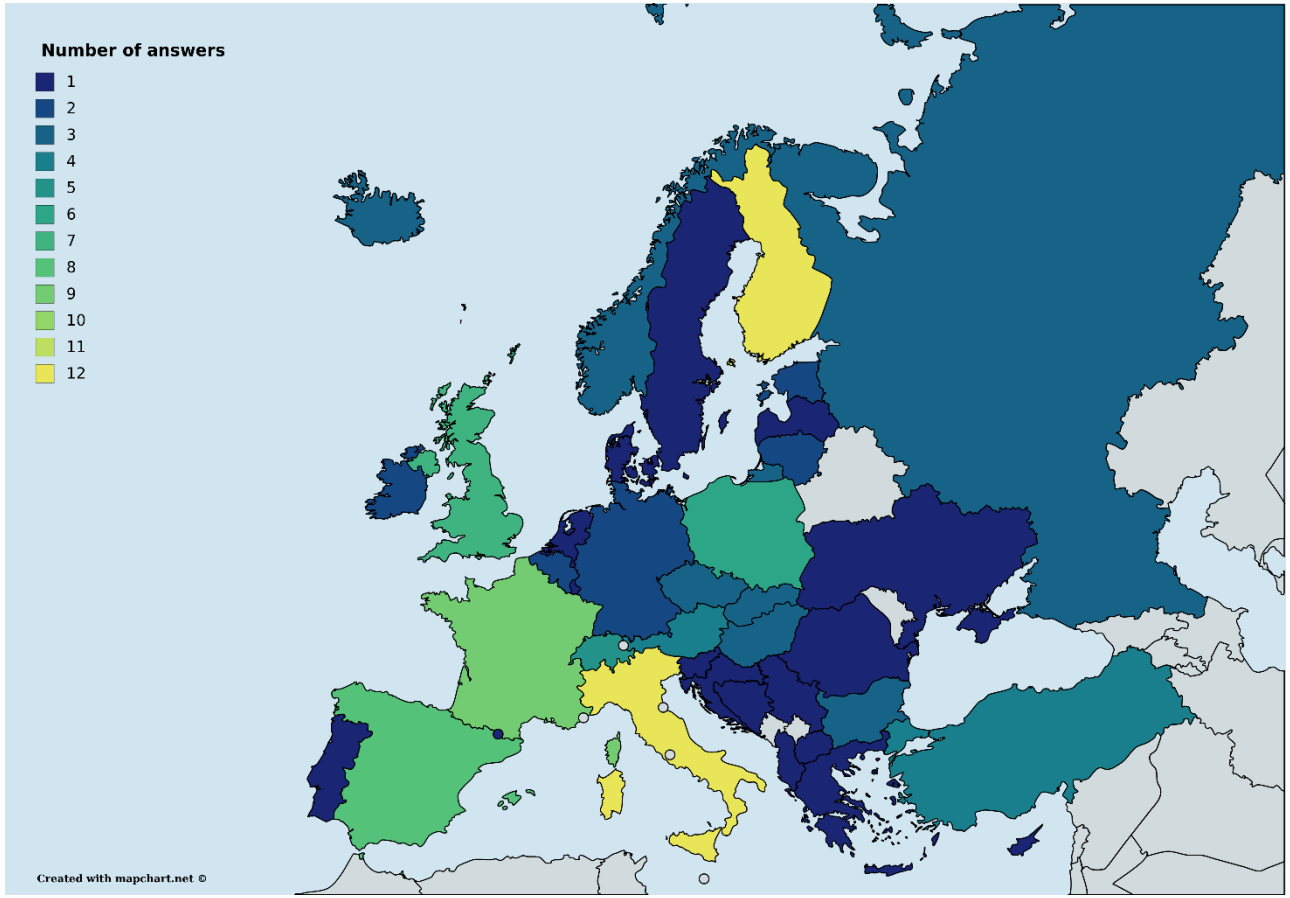
Snow measurement practices
Purpose

- The purpose of the questionnaire is to collect a compilation of the type of snow measurements (measured parameters and measuring techniques) carried out by the European countries for a large variety of applications.

- Answered by 115 (118) participants from 90 operational and research institutions from 38 European countries between December 2015 and February 2017.

- Questionnaire is opened again to collect more answers. New deadline 3 November 2017.

Snow measurement practices
European participant countries



Map: Cemal Melih Tanis

Snow measurement practices
Topics of questions

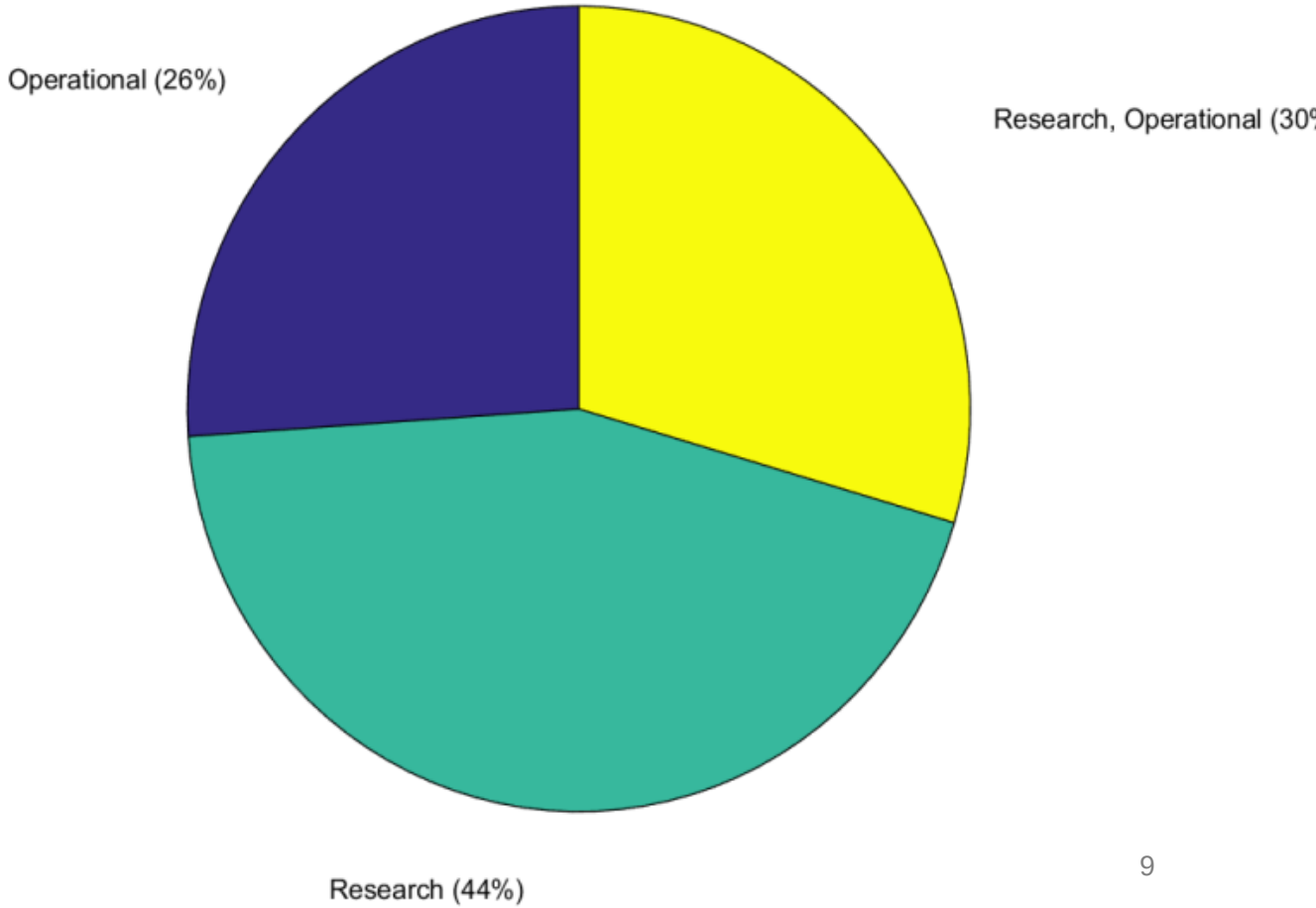
13 questions about:

- Measured snow parameters
  - Macrophysical parameters
  - Microphysical parameters
  - Electromagnetic properties
  - Solid precipitation
  - Snow composition
- Landscape
- Protocols of measured snow parameters
- Usage of measured snow parameters

Snow measurement practices
Preliminary results

Purpose

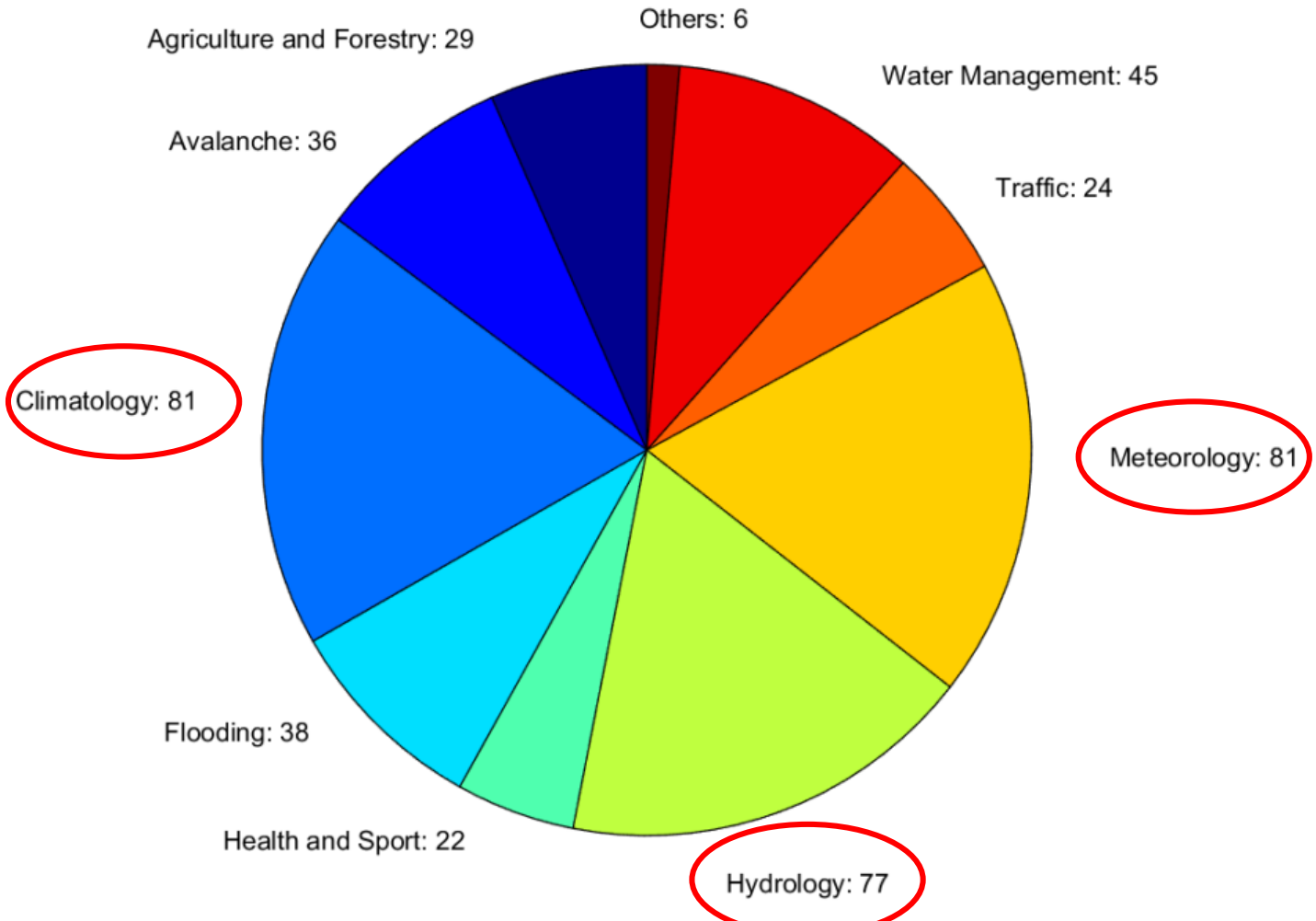
Operational	26 %
Research	44 %
Both	30 %



Snow measurement practices
Preliminary results

Purpose

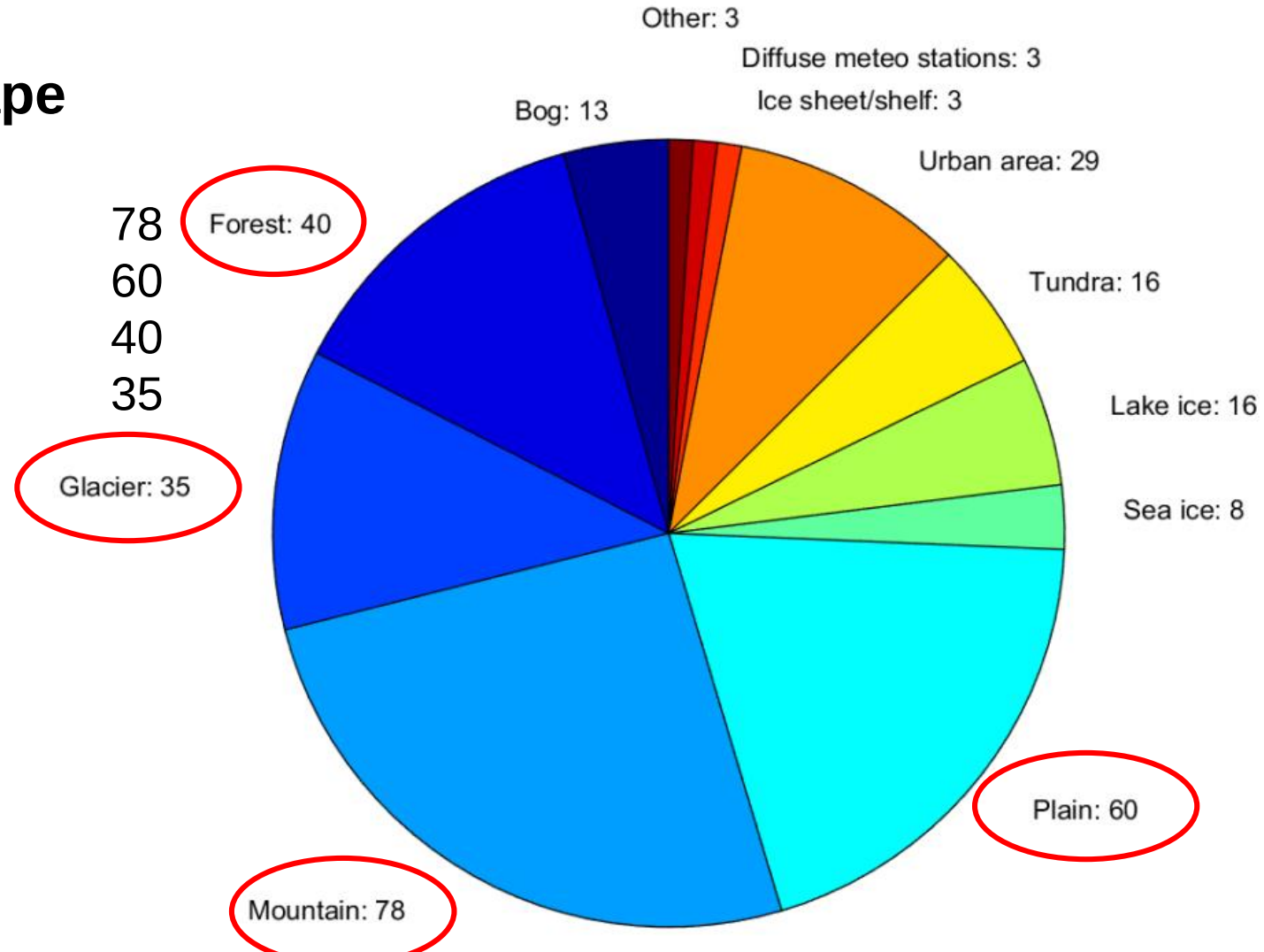
Climatology	81
Meteorology	81
Hydrology	77



Snow measurement practices
Preliminary results

Landscape

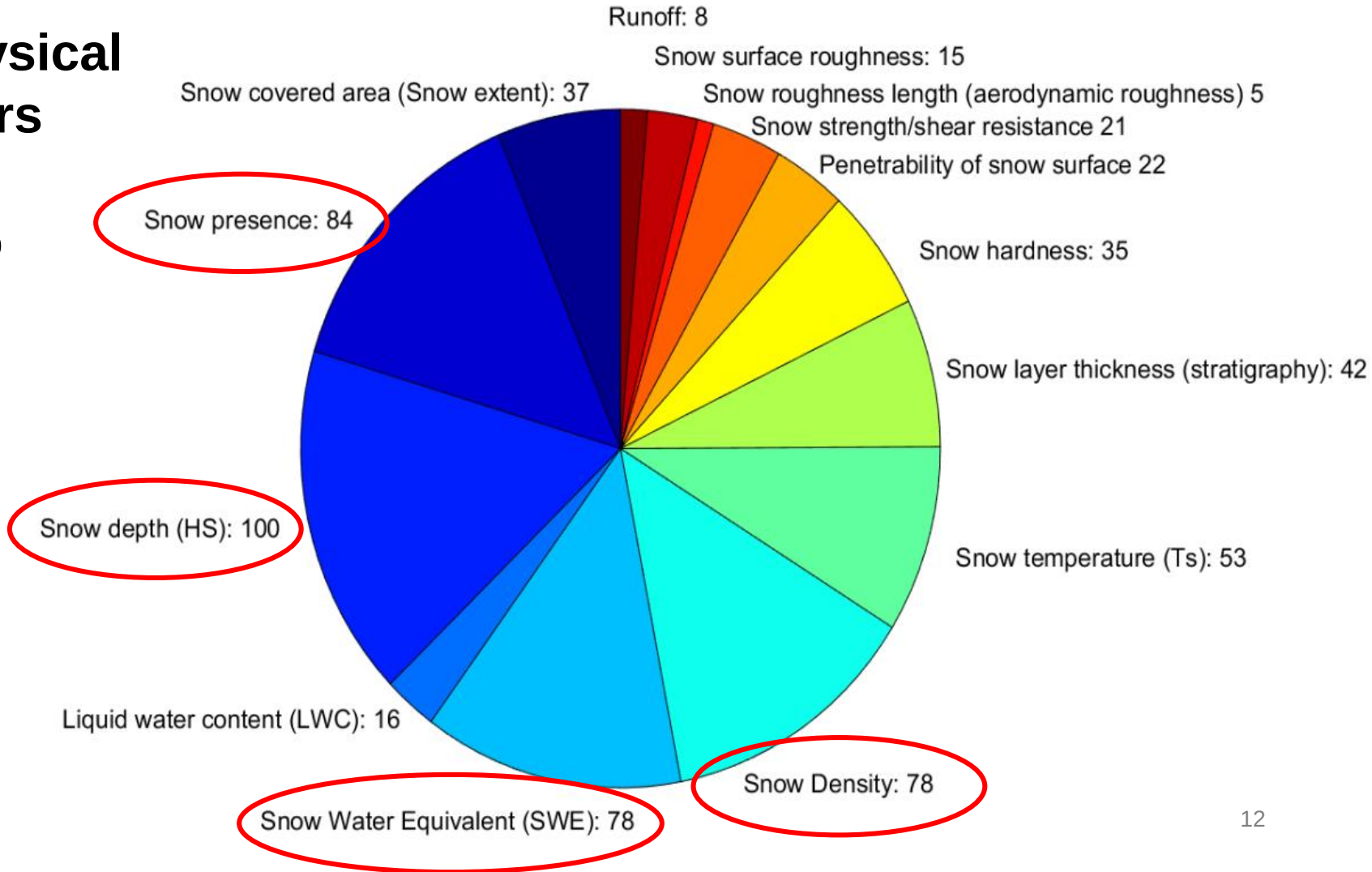
Mountain	78
Plain	60
Forest	40
Glacier	35



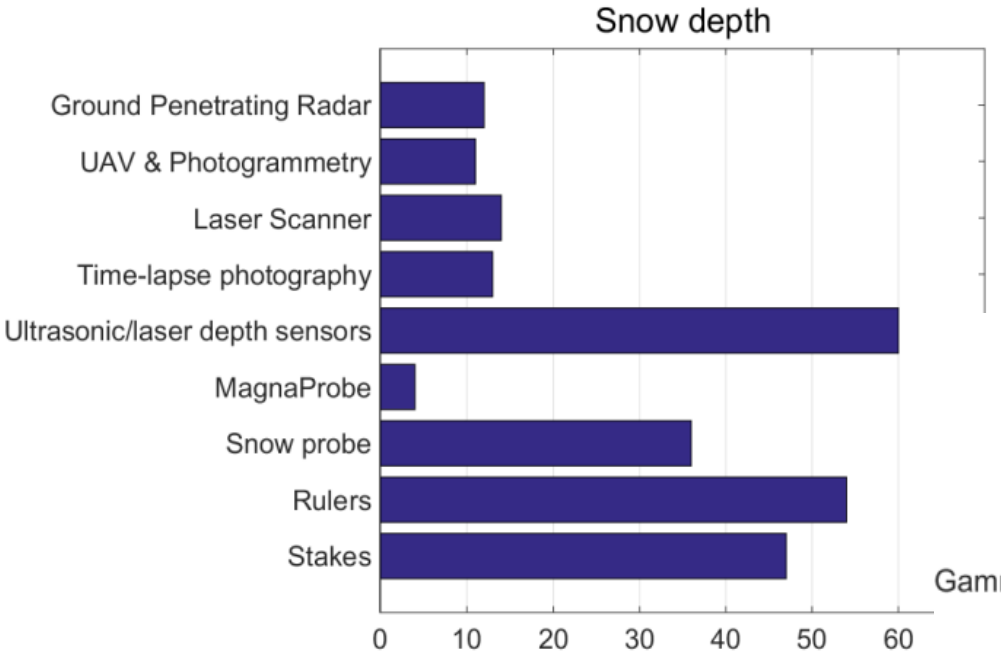
Snow measurement practices
Preliminary results

Macrophysical parameters

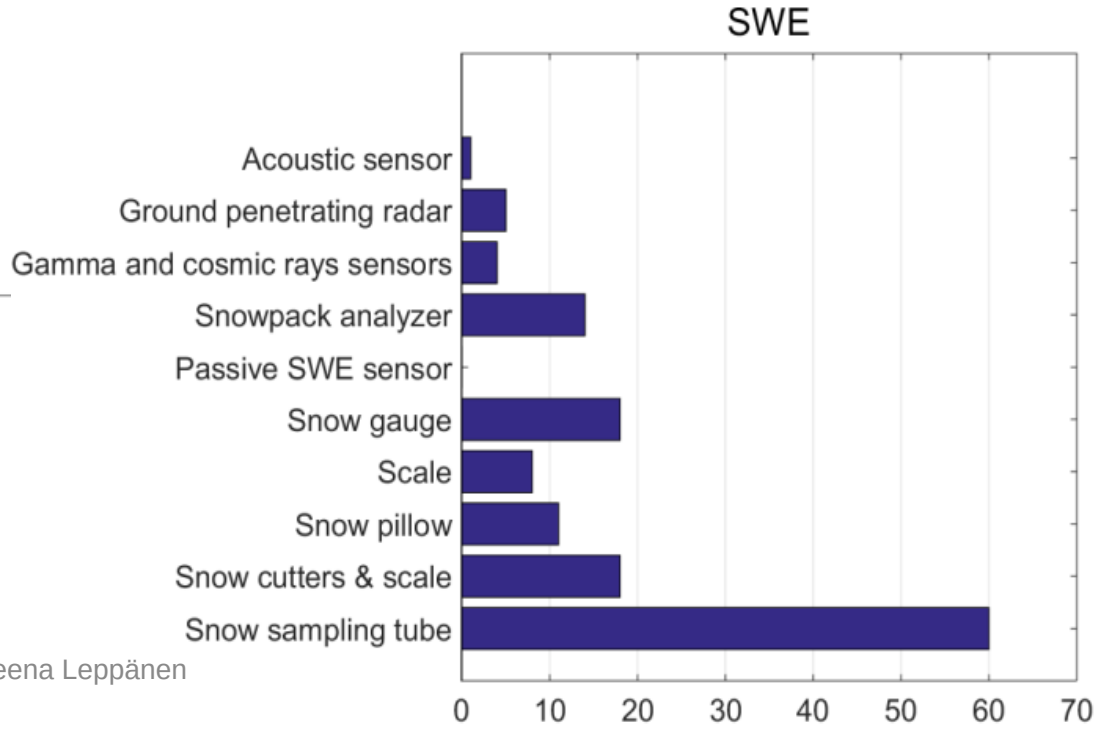
Yes: 93 %



Snow measurement practices
Preliminary results



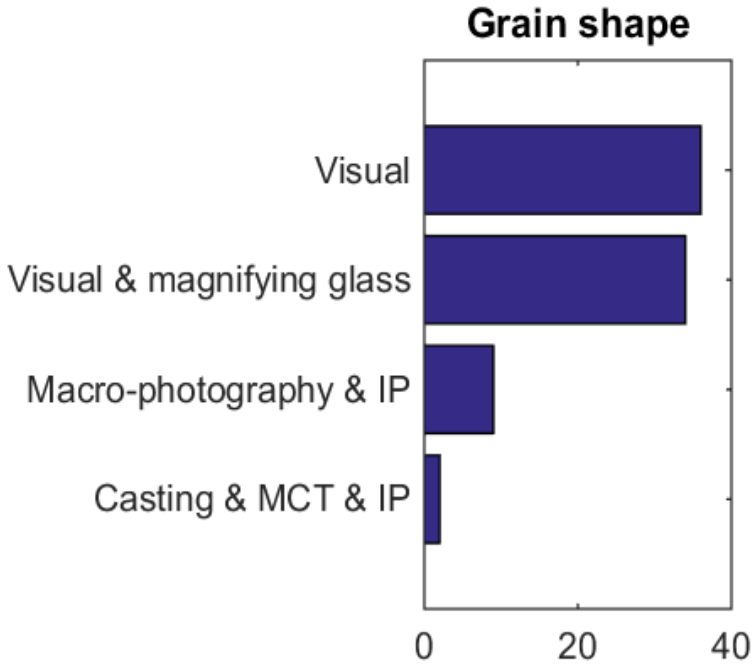
Macrophysical parameters

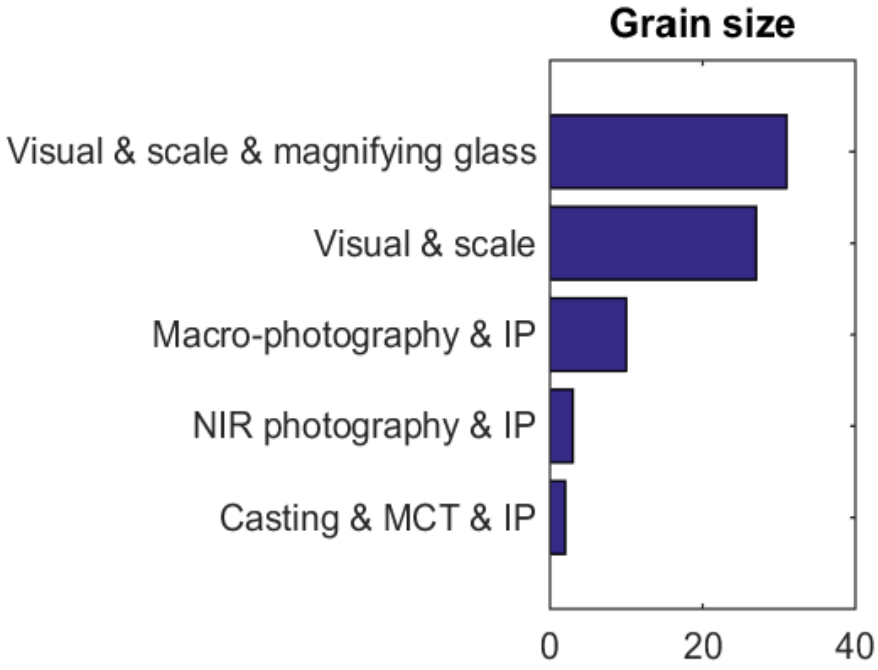


Snow measurement practices
Preliminary results

Microphysical parameters
Yes: 42 %

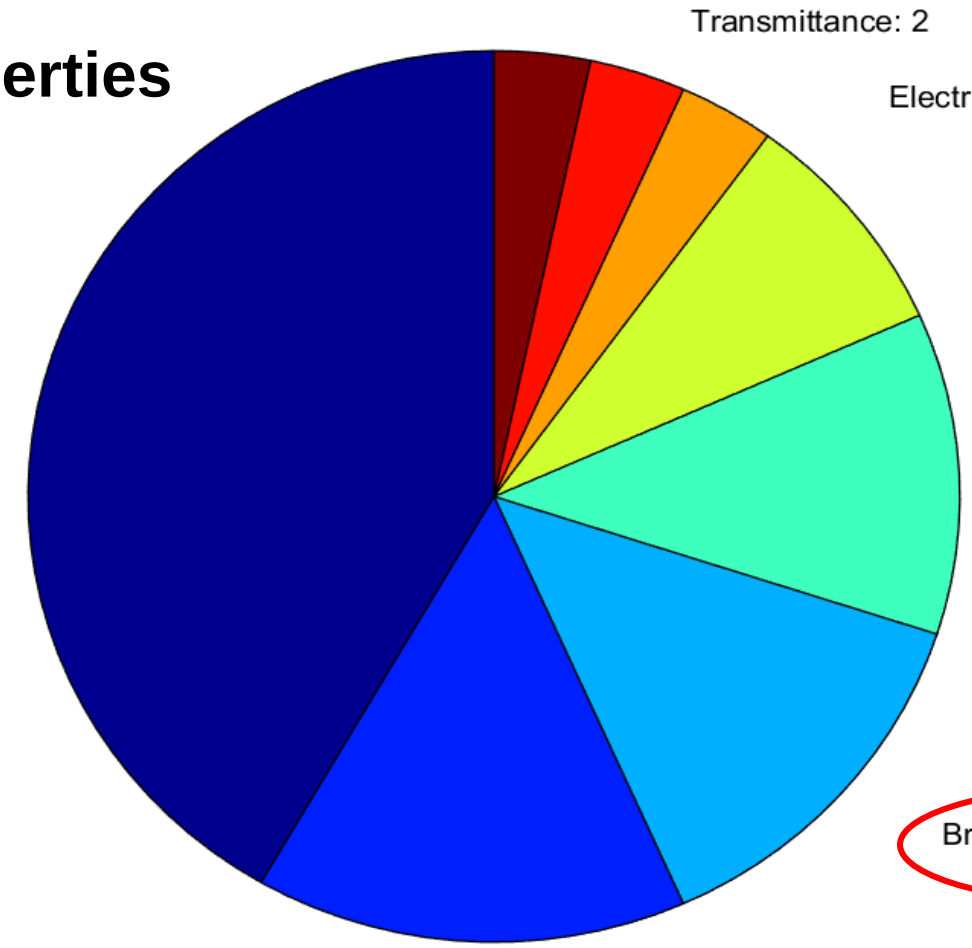
IP = image processing





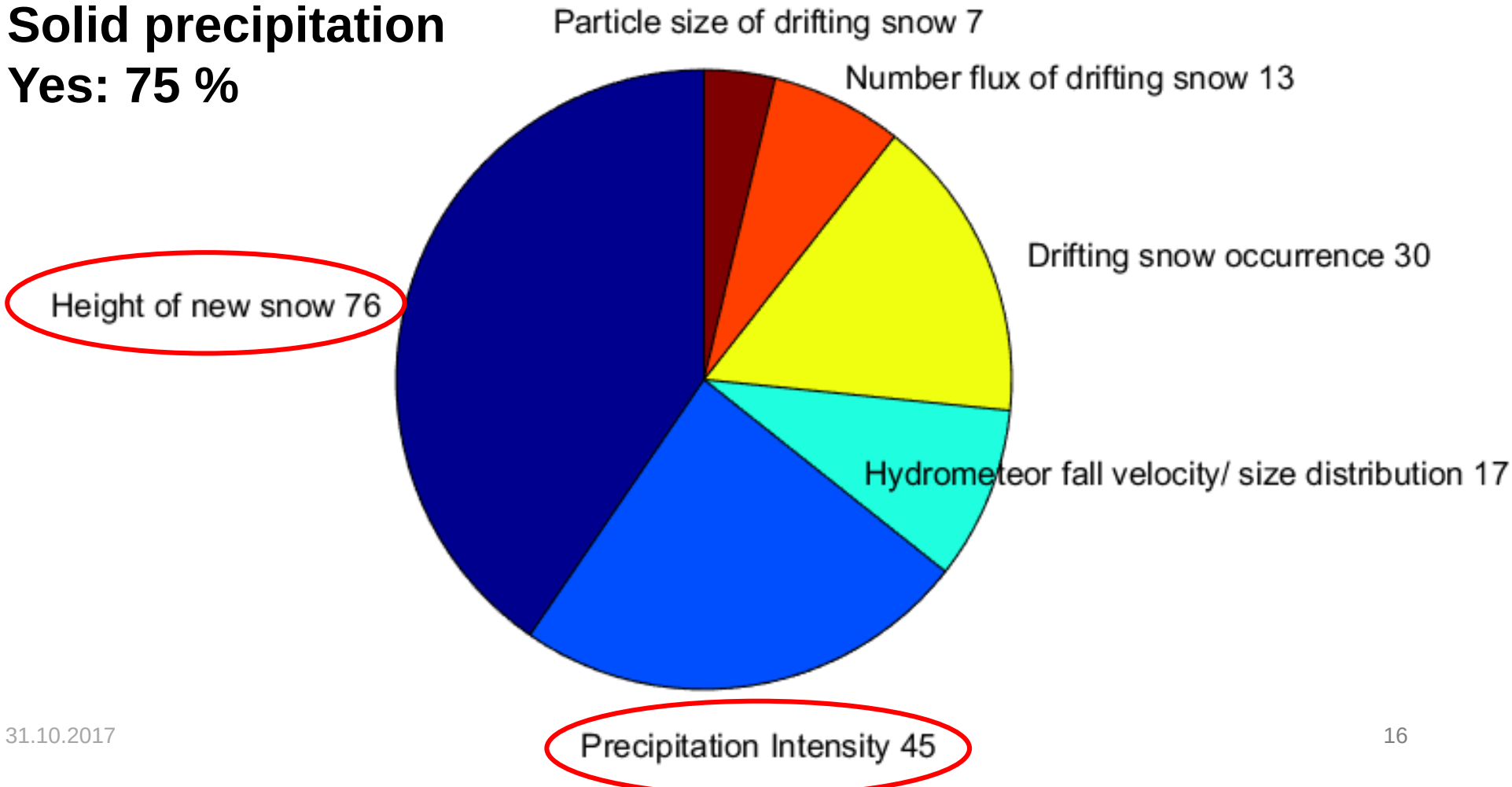
Snow measurement practices
Preliminary results

Electromagnetic properties
Yes: 27 %



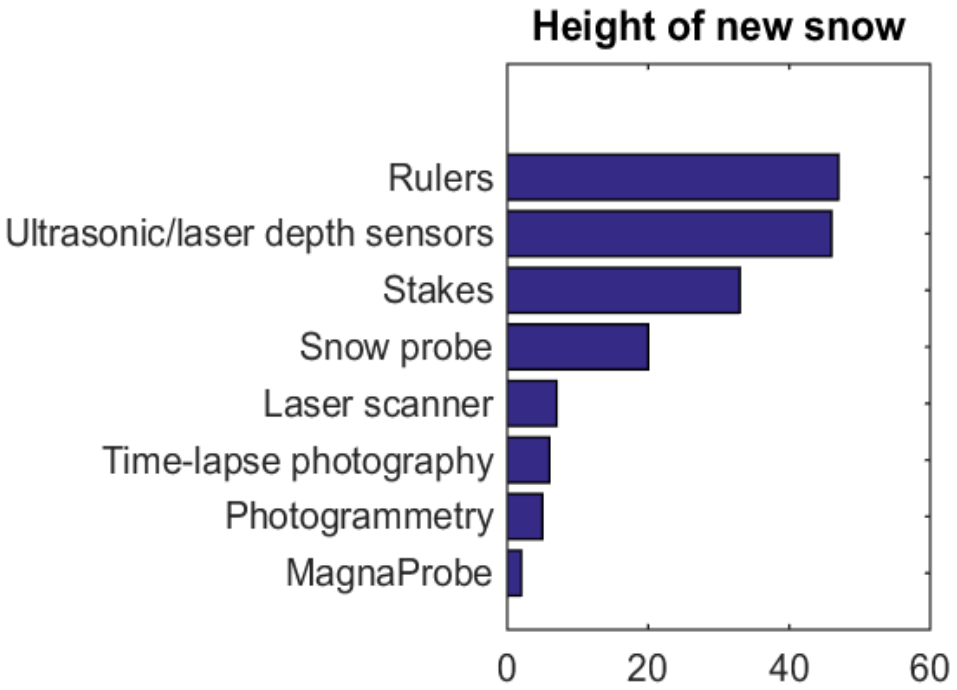
Snow measurement practices
Preliminary results

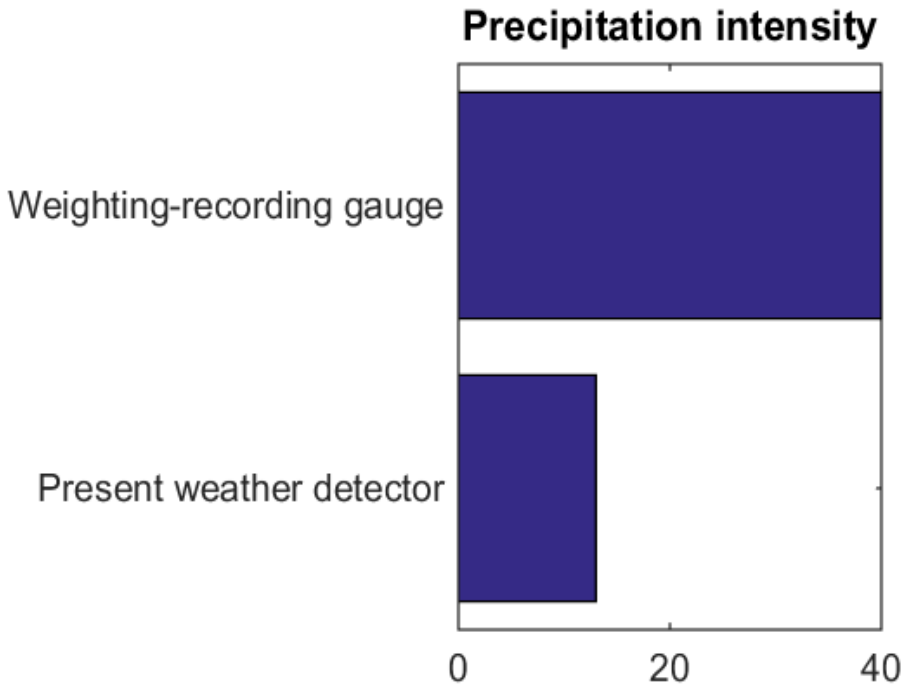
Solid precipitation
Yes: 75 %



Snow measurement practices
Preliminary results

Solid precipitation





Snow measurement practices
Conclusions

- Measurements mostly for **climatology, meteorology and hydrology**
- Mostly measured macrophysical parameters were **snow depth** (ultrasonic/laser sensors and stakes/rulers/probes), **snow presence and SWE/density** (tubes)
- Mostly measured microphysical parameters were **grain type and grain size** (traditional visual methods)

- Manuscript preparation is in progress by Pirazzini and other ("Snow measurements in Europe: purpose, practices, and applied instrumentation"), submission deadline in end of November 2017

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- **WG 3 questionnaire on data assimilation**
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Data assimilation
Purpose

- Aim is to identify and enhance the usage of snow data in numerical models.
- These models are used for assimilation, forcing, monitoring, validation or verification with application in numerical weather prediction, hydrological services, in special models and reanalysis runs.
- 34 answers in preliminary analysis

- Questionnaire is still open → this is only preliminary analysis!

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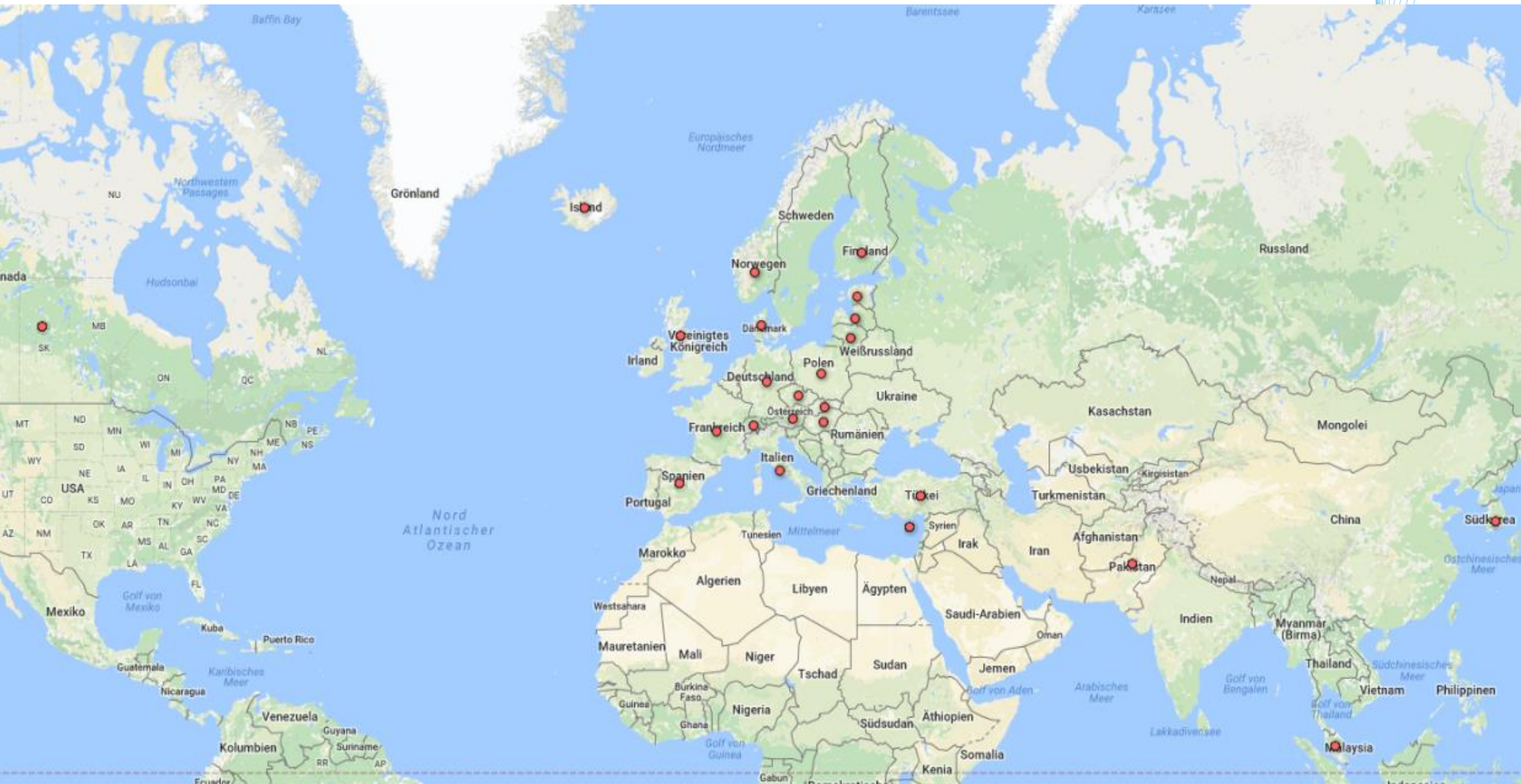
Data assimilation
Participant countries



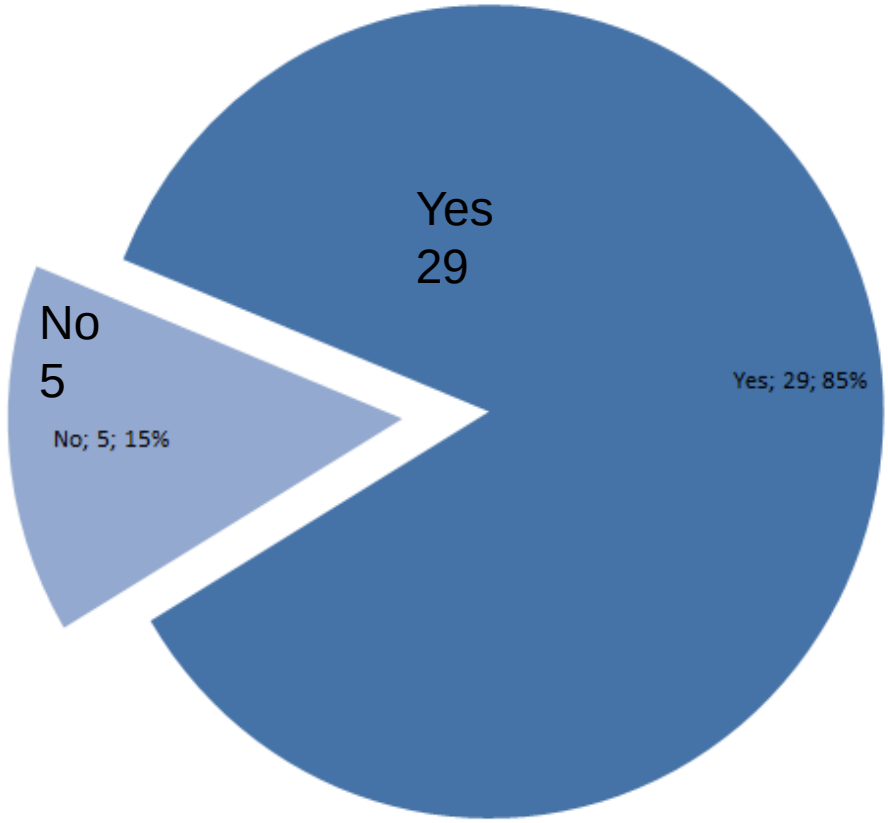
Data assimilation
Topics of questions

32 questions about:

- **Modeling environment and snow observation data**
- Modeling domain
- **Model resolution**
- Data assimilation method
- **Data assimilation update frequency**
- Data assimilation window
- SYNOP information
- Model variables
- Processing
- Background field
- Background error estimates
- Observation error estimates
- **Snow observations and products used in the modeling system**
  - Remote sensing ground-based
  - Preprocessed product
- Processing – Quality control
- Data consistency
- Observation data latency
- **Access requirements**
- Additional observations sources

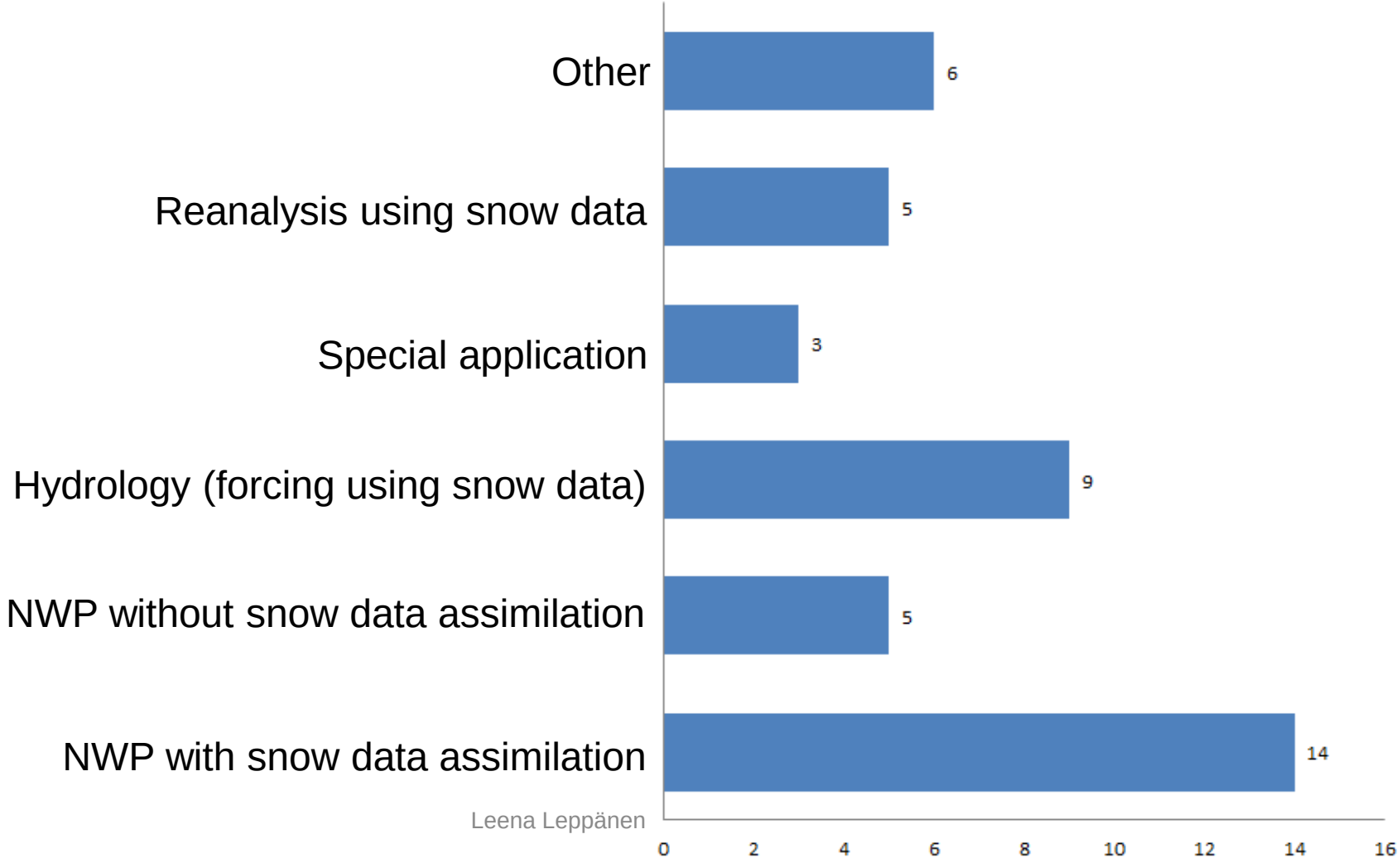
Data assimilation
Preliminary results

Do you use snow observation data in your modeling environment?



Data assimilation
Preliminary results

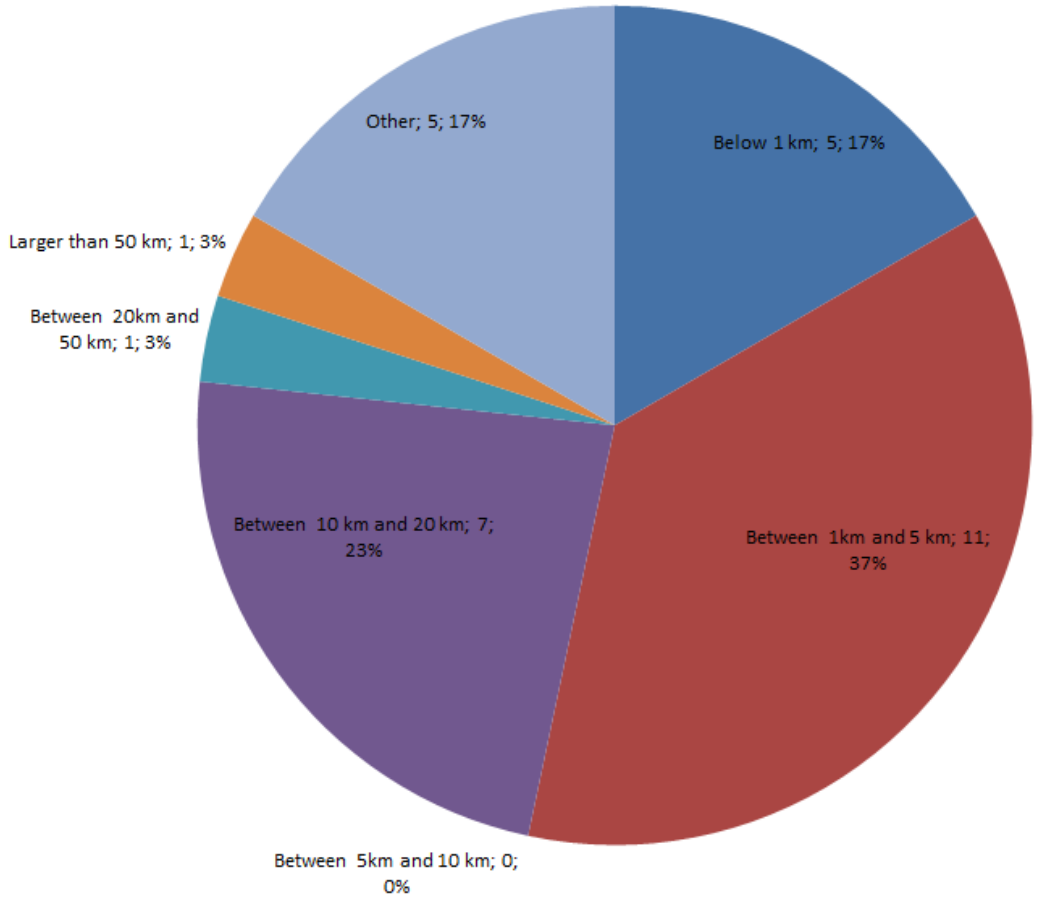
In which modeling environment you are using snow observation data?



Data assimilation
Preliminary results

Specify the model horizontal resolution

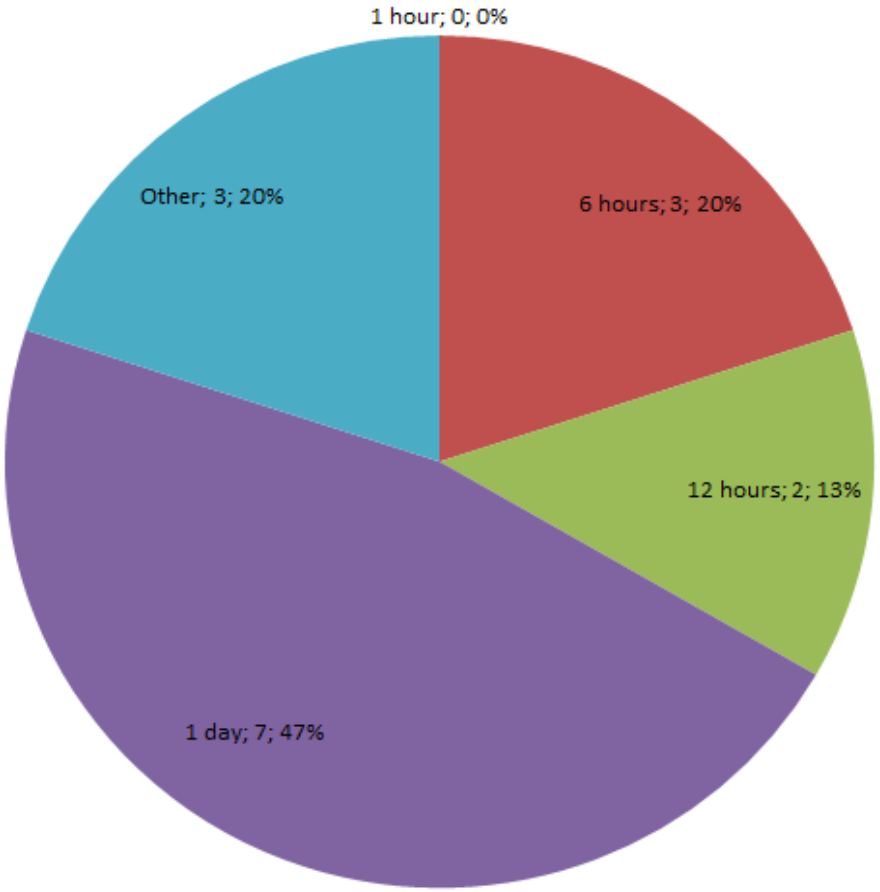
>1 km	17 %
1-5 km	37 %
5-10 km	0 %
10-20 km	23 %
20-50 km	3 %
>50 km	3 %
Other	17 %



Data assimilation
Preliminary results

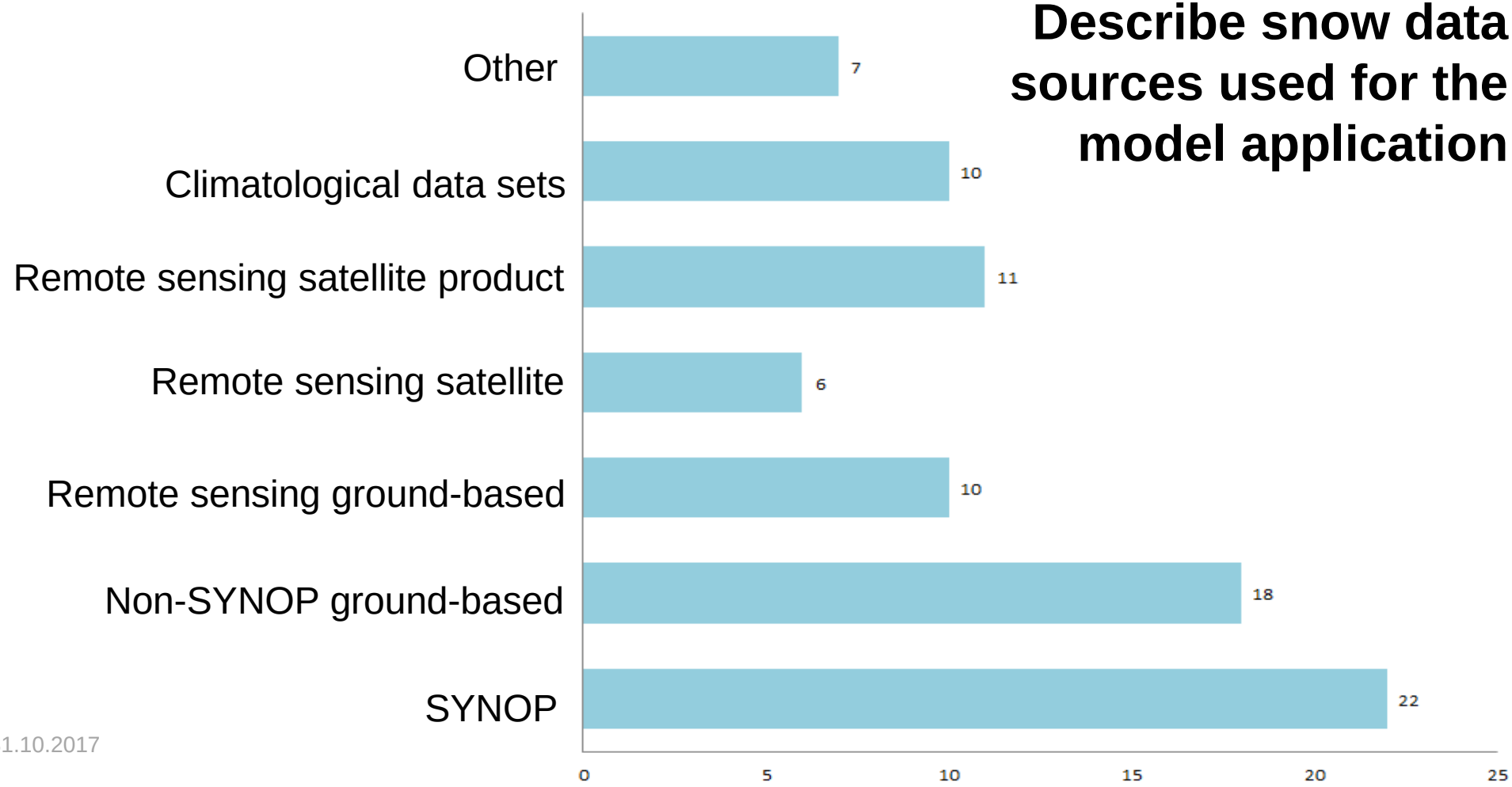
Which update frequency is used for your snow data assimilation?

1h	0 %
6h	20 %
12h	13 %
24h	47 %
Other	20 %



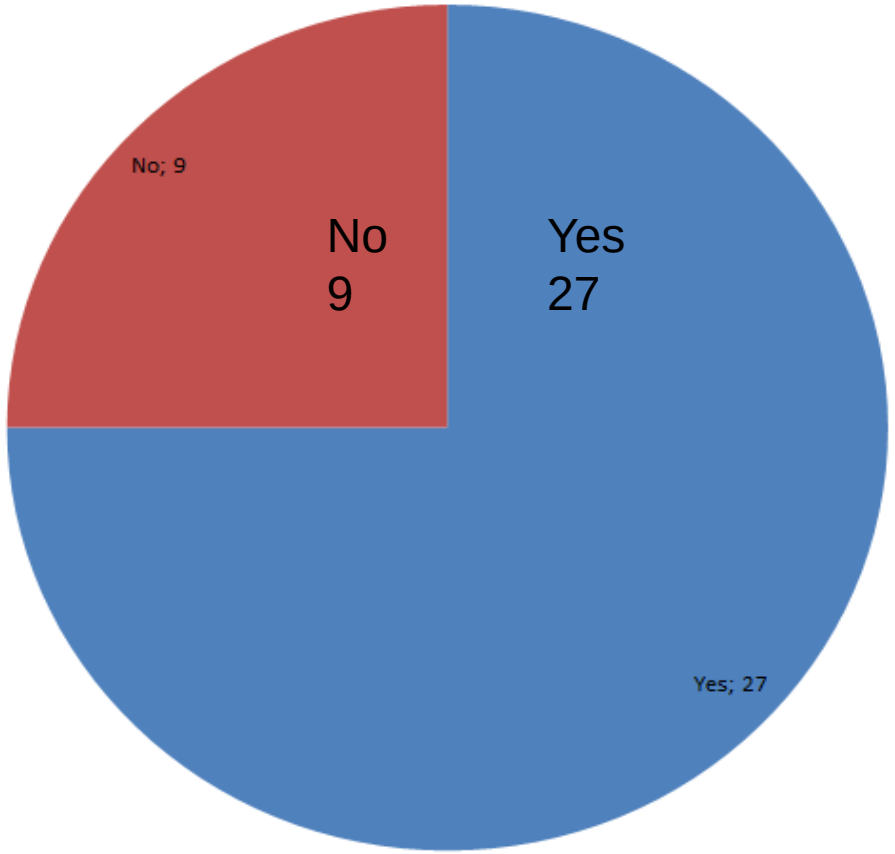
Data assimilation
Preliminary results

Describe snow data sources used for the model application



Data assimilation
Preliminary results

Is it possible to exchange snow data used in your modeling environment with other groups?



Data assimilation
Conclusions

Preliminary results:

- 85 % of answers uses snow data in their modeling environment
- Snow observation data was mostly used for **numerical weather prediction and hydrology**
- Model horizontal resolution was **below 5 km** in most of the answers
- Most common update frequency is 1 day
- Mostly used data sources **SYNOP and non-SYNOP ground-based**

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Conclusions

- WG 1&2 questionnaire about snow measurement practices
  - 115 (118) answers from European countries
  - Aim is to collect measured parameters and techniques in various applications in Europe
  - Open until 3 November 2017
- WG 3 questionnaire about data assimilation
  - 34 answers in preliminary analysis
  - Aim is to identify and enhance the usage of snow data in numerical models
  - Open until end of December 2017
- http://harmosnow.eu/index.php?page=Questionnaires

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