FINNISH METEOROLOGICAL INSTITUTE

Questionnaire Summary

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Summary

- **67** answers from 23 countries: **Iceland, Russia, Portugal, Finland, Slovakia, Estonia, Bulgaria, Spain, Turkey, Andorra, France, Austria, UK, Switzerland, Italy, Hungary, Canada, Poland, Sweden, France, Bosnia and Herzegovina, Germany, Cyprus**

- **90.9%** measures **macrophysical** snow parameters
- **38%** measures also/only **microphysical** parameters
- **36.4%** measures **electromagnetic** properties
- **16.7%** measures snow **composition**

Macrophysical properties

- Most commonly measured macrophysical parameters are **snow presence, snow depth, SWE, and snow density**
- Most of the listed methods were utilized (only for liquid water content, snow density, and snow strength some methods were not applied by anybody)
- 15% put “other” in measured snow macroscopic parameters. What is it?

Snow depth (HS)

Ultrasonic and laser depth sensors	**34**	56.7 %
Stakes	**32**	53.3 %
Rulers	**22**	36.7 %
Snow probe	**19**	31.7 %
Terrestrial and air-borne Laser Scanner	**12**	20 %
Time-lapse photography	**8**	13.3 %
Unmanned Aerial Vehicle & Photogrammetry	**7**	11.7 %
Ground Penetrating Radar	**6**	10 %
MagnaProbe	**3**	5 %

- What is difference between stake, ruler and probe?
- Fixed stick or in hand

SWE and density

Snow sampling tube	**29**	48.3 %
Snow cutters & scale	**9**	15 %
Snow gauge	**6**	10 %
Snow pillow	**5**	8.3 %
Scale (i.e. Sommer scale)	**4**	6.7 %
Gamma and cosmic rays sensors	**4**	6.7 %
Snowpack analyzer	**4**	6.7 %
Ground penetrating radar	**2**	3.3 %
Passive snow water equivalent sensor	**1**	1.7 %
Acoustic sensor	**1**	1.7 %

Snow sampling tube	**32**	53.3 %
Snow cutter & scale	**18**	30 %
Scale (i.e. Sommer scale)	**2**	3.3 %
Snow MicroPen	**3**	5 %
Neutron probe	**0**	0 %

Snow presence

Visual	**27**	45 %
Snow depth sensor	**22**	36.7 %
Camera or web-cam	**16**	26.7 %
Thermometer	**7**	11.7 %
Infrared sensor	**4**	6.7 %

- How snow presence is defined?
  - More than 50% covered by snow
- Snow depth sensor can give NaN value also for some error in measurement
- Spatial variability?

Macrophysical properties

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- 15% put “other” in measured snow macroscopic parameters. What is it?
- https://docs.google.com/forms/d/12tmJ0mep9t7-pMsDhjlOgZKhzJJkqN8b6MdNP53dAJo/viewanalytics

Microphysical properties

- Most commonly measured snow microphysical parameters are grain size, grain shape and SSA
- 12% (3 people) answered “other”: what is it?
- https://docs.google.com/forms/d/12tmJ0mep9t7-pMsDhjlOgZKhzJJkqN8b6MdNP53dAJo/viewanalytics

Other

- Snow electromagnetic properties
  - Most commonly measured parameter is broadband albedo measured with pyranometers (66.7%)
  - 2 people answered “other”: what is it?
- Snow composition.
  - Most people measure snow impurity
  - Again, what “other” stands for (2 people selected it)?
- Solid precipitation
  - Most commonly measured parameter is height of new snow
  - Again, what “other” stands for (2 people selected it)?

Height of new snow

Ultrasonic and laser depth sensors	**25**	59.5 %
Rulers	**16**	38.1 %
Stakes	**16**	38.1 %
Snow probe	**10**	23.8 %
Terrestrial and air-borne Laser Scanner	**8**	19 %
Time-lapse photography	**4**	9.5 %
Photogrammetry	**3**	7.1 %
MagnaProbe	**2**	4.8 %

- What ”height of new snow mean”?
  - Height of newly precipitated snow
- Usually depth sensors measure depth of whole snowpack instead of only new snow

Summary

- Landscape
  - Most measurements are done in mountain area
  - 9 pepole selected “other”: we definitely missed some relevant landscape from the list (taiga? artificial snow?)
- Most apply a written protocol only for some of the measured snow parameters. 6 people (9.1%) answered “other”… what does it mean?
- Most do snow measurements for research purposes (climatology, meteorology, and hydrology)

Future plans

- Write a paper/report on the results of the questionnaire
- Who will do that?
  - SLF postdoc?
- Aim: How to harmonize these measurements?
- Which measurements needs harmonization?
  - Snow depth
  - SWE
  - Density
  - Snow precense
  - Grain size/ SSA
- How to apply that in the field?