



# 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?



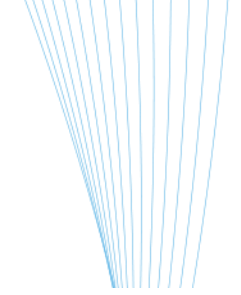
# Snow depth (HS)

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

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

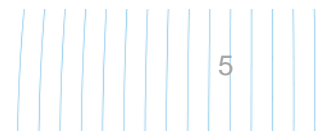


# SWE and density



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

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





# Snow presence

Visual	<b>27</b>	45 %
Snow depth sensor	<b>22</b>	36.7 %
Camera or web-cam	<b>16</b>	26.7 %
Thermometer	<b>7</b>	11.7 %
Infrared sensor	<b>4</b>	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

- 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?
- <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	<b>25</b>	<b>59.5 %</b>
Rulers	<b>16</b>	<b>38.1 %</b>
Stakes	<b>16</b>	<b>38.1 %</b>
Snow probe	<b>10</b>	<b>23.8 %</b>
Terrestrial and air-borne Laser Scanner	<b>8</b>	<b>19 %</b>
Time-lapse photography	<b>4</b>	<b>9.5 %</b>
Photogrammetry	<b>3</b>	<b>7.1 %</b>
MagnaProbe	<b>2</b>	<b>4.8 %</b>

- 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 people 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?