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Hidrometrija - Merjenje globine snega in višine snežnih padavin na kraju samem

Hydrometry - On-site measurement of snow depth and depth of snowfall

Vor-Ort-Messung der Schneehöhe und der Schneefalltiefe

Mesurage sur site de la profondeur de neige et de la profondeur de la chute de neige

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English Version

Hydrometry - On-site measurement of snow depth and depth of snowfall

Mesurage sur site de la profondeur de neige et de la profondeur de la chute de neige

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (CEN/TR 17909:2023) has been prepared by CEN/TC 318 “Hydrometry”, the secretariat of which is held by BSI.

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Introduction

Snow depth, representative within a given area, is one of the most difficult weather parameters to be measured in an accurate and consistent manner. Together with snow density it is the most important factor in the estimation of snow water equivalent and thus of crucial importance for the assessment of threatening hazards such as flooding, snow avalanches and building collapses. Preventive measures due to the knowledge of snow amounts can save lives, properties and infrastructure. The data has a wide variety of users, including national weather and hydrological services, waterpower industry, snow avalanche forecasters, climate researchers, water resource managers, construction engineers, winter resort managers, farmers, and many others.

In addition to weather forecasts, measurements of depth of snowfall (also called new snow height) are essential in the preparedness of winter road plowing and airport snow removal. Resources can be adapted to the current weather situation and serious traffic break downs can be reduced.

Much of the information in this document is based on the World Meteorological Organization (WMO) Guide to Meteorological Instruments and Methods of Observation, Volume II – Measurement of Cryospheric Variables, published in 2018.

1 Scope

This document defines the requirements for on-site measurements of snow depth and depth of snowfall. This document provides guidance on manual and automatic measuring techniques, and information about sources of errors and measurement uncertainty.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
ablation
combined processes (such as sublimation, fusion or melting, evaporation and movement due to wind and avalanches) that remove snow or ice from the surface of a glacier or from a snow field

[SOURCE: EN ISO 772:2022, 10.1]

3.2
blowing snow
snow being transported by wind high (approximately 2 m) above a *snowpack* (3.27) surface, where visibility is noticeably reduced

Note 1 to entry: See also *drifting snow* (3.3).

[SOURCE: EN ISO 772:2022, 10.2]

3.3
drifting snow
snow being lifted from the snow surface and transported by wind just above the *snow surface* (3.23), where visibility is not noticeably reduced

Note 1 to entry: See also *blowing snow* (3.2).

[SOURCE: EN ISO 772:2022, 10.6]

3.4
new snow
snow layer that is not transformed, densified or settled, from current or recent precipitation having characteristic grain size range of 1 mm to 3 mm

Note 1 to entry: New snow height can be measured by use of a *snow board* (3.8).

[SOURCE: EN ISO 772:2022, 10.11]

3.5
old snow
snow layers deposited from earlier precipitation, prior to fresh fallen snow, composed of metamorphosed snow crystals

[SOURCE: EN ISO 772:2022, 10.12]

3.6
snow accumulation
all processes that add mass to the *snowpack* (3.27)

EXAMPLE Solid and liquid precipitation, ice deposition from atmospheric water vapor, snow deposited by wind, avalanches, etc.

Note 1 to entry: Snow accumulation is the opposite of *ablation* (3.1).

[SOURCE: EN ISO 772:2022, 10.19]

3.7
snow avalanche
rapidly moving snow masses in volumes exceeding 100 m^3 and with a minimum length of 50 m

Note 1 to entry: Large snow avalanches may contain rocks, soil, vegetation, and/or ice.

[SOURCE: EN ISO 772:2022, 10.20]

3.8
snow board
specially constructed board used to measure *new snow* (3.4) height manually

[SOURCE: EN ISO 772:2022, 10.21]

3.9
snow course
established line, or transect, of measurements of *snow water equivalent* (3.25) across a snow-covered area in a representative terrain, where *snow accumulation* (3.6) is not homogeneously distributed in the terrain

[SOURCE: EN ISO 772:2022, 10.23]

3.10
snow cover
accumulation of snow on the ground in its natural consistency

Note 1 to entry: See also *snowpack* (3.27).

[SOURCE: EN ISO 772:2022, 10.24]

3.11
snow cover extent
areal extent of snow-covered ground in relation to the total catchment

Note 1 to entry: It is usually expressed as per cent of total area in a given region.

[SOURCE: EN ISO 772:2022, 10.25]

3.12
snow creep
internal deformation of the *snowpack* (3.27) due to gravity- and metamorphism-driven densification

[SOURCE: EN ISO 772:2022, 10.26]

3.13
snow density
mass per unit volume of snow

Note 1 to entry: Sometimes total and dry snow densities are measured separately. Total snow density encompasses all constituents of snow (ice, liquid water, and air) while dry snow density refers to the ice matrix and air only.

[SOURCE: EN ISO 772:2022, 10.27]

3.14
snow depth
total height of *snowpack* (3.27) measured vertically from the base to the *snow surface* (3.23)

Note 1 to entry: The slope-perpendicular equivalent of snow depth is the *snowpack thickness* (3.28).

[SOURCE: EN ISO 772:2022, 10.28]

3.15
snow distribution
spatial and temporal variability of *snow cover* (3.10) affected by snowfall, wind speed, elevation, topography, vegetation and *ablation* (3.1)

[SOURCE: EN ISO 772:2022, 10.29]

3.16
snow glide
downhill movement of the *snowpack* (3.27) relative to the ground

[SOURCE: EN ISO 772:2022, 10.51]

3.17
snow height
vertical distance from a base to a specific level in the snow, or to the *snow surface* (3.23)

Note 1 to entry: Ground surface is usually taken as the base, but on firn fields and glaciers it refers to the level of either the firn surface or glacier ice. The snow height is used to denote the location of layer boundaries but also measurements such as snow temperatures relative to the base. Where only the upper part of the *snowpack* (3.27) is of interest, the snow surface may be taken as the reference. This should be indicated by using negative coordinate values. *Snow depth* (3.14) is the total height of the snowpack.

[SOURCE: EN ISO 772:2022, 10.32]

3.18
snow layering
stratification of the *snowpack* (3.27), where each layer is characterized by grain shape, grain size, layer hardness, temperature, water content and density

[SOURCE: EN ISO 772:2022, 10.33]

3.19
snow probe
instrument to manually measure large *snow depths* (3.14)

[SOURCE: EN ISO 772:2022, 10.40]

3.20
snow redistribution
distribution of previously deposited snow that was eroded and transported by the wind

Note 1 to entry: Redistribution features such as snowdrifts are usually formed from densely packed and friable snow.

[SOURCE: EN ISO 772:2022, 10.17]

3.21
snow season
time period when the ground usually is covered by snow

[SOURCE: EN ISO 772:2022, 10.54]

3.22
snow stake
instrument for manual measurements of the *snow depth* (3.14)

[SOURCE: EN ISO 772:2022, 10.44]

3.23
snow surface
uppermost part of the *snow cover* (3.10), forming the interface to the atmosphere

[SOURCE: EN ISO 772:2022, 10.55]

3.24
snow survey
process of determining snow parameters, most often depth and density, at representative points, usually along a *snow course* (3.9)

[SOURCE: EN ISO 772:2022, 10.45]

3.25
snow water equivalent (SWE)
height of the water layer, which would develop after the melting of the *snowpack* (3.27), if the melting water remained without infiltration or evaporation on a given horizontal surface

Note 1 to entry: It can represent the *snow cover* (3.10) over a given region or a confined snow sample over the corresponding area. The snow water equivalent is the product of the *snow height* (3.17) and the *snow density* (3.13) divided by the density of water. It is typically expressed in millimetres of water equivalent, which is equivalent to kilograms per square metre or litres of water per square metre.

[SOURCE: EN ISO 772:2022, 10.47]

3.26
snowmelt
change of the physical state of *snowpack* (3.27) from solid to liquid phase, mainly affected by various meteorological factors (e.g. temperature, air humidity, radiation, wind, rain)

[SOURCE: EN ISO 772:2022, 10.36]

3.27
snowpack
accumulation of snow on the ground at a given site and time

Note 1 to entry: It often consists of various layers with different physical and mechanical properties.

Note 2 to entry: See also *snow cover* (3.10).

[SOURCE: EN ISO 772:2022, 10.49]

3.28
snowpack thickness
total height of the *snowpack* (3.27) measured perpendicularly from the base to snow surface

Note 1 to entry: See also *snow depth* (3.14).

[SOURCE: EN ISO 772:2022, 10.53]

4 Symbols

Symbol	Description	Unit
φ	Slope angle	°
DS	Snowpack thickness (slope-perpendicular measurement)	cm
DN	Thickness of new snow (slope-perpendicular measurement)	cm
D	Snow thickness (slope-perpendicular measurement)	cm
L_P	Snow layer thickness (slope-perpendicular measurement)	cm
HS	Snow depth, height of snowpack (vertical measurement)	cm
HN	Depth of snowfall, new snow height, (vertical measurement)	cm
SOURCE: The International Classification for Seasonal Snow on the Ground, IACS-UNESCO 2009.		

5 Principles

5.1 General

Snow depth and depth of snowfall are measured vertically from a base level up to the snow surface. Snow depth measurements normally have the ground surface as the base, while depth of snowfall is measured on a snow board placed on the old underlying snow surface. Depending on the type of instrument, measurements can be obliged to be performed perpendicularly to the ground. The vertical component, though, is calculated through the ground slope angle.