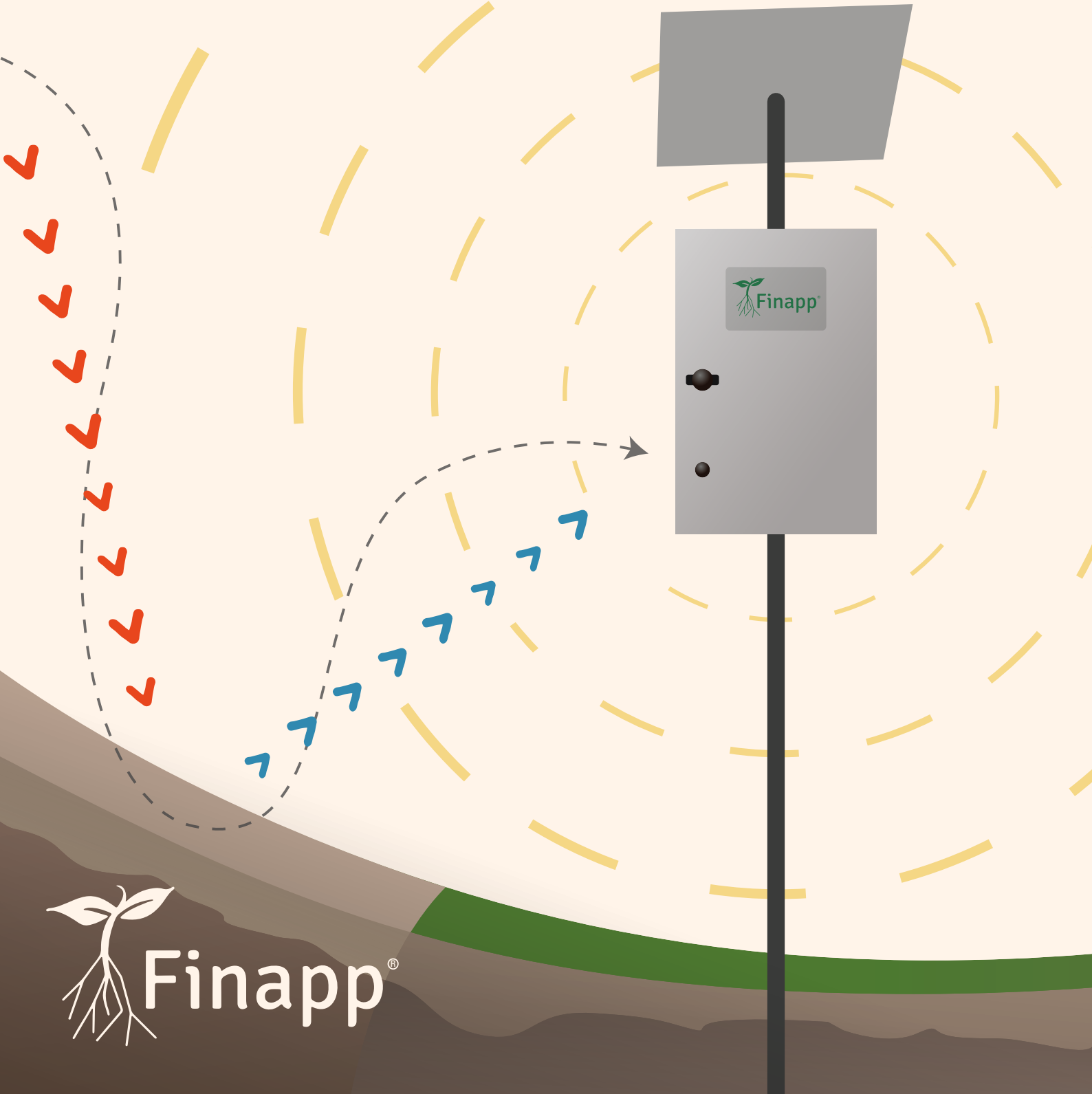
Finapp®

PRODUCTS OVERVIEW



Finapp®

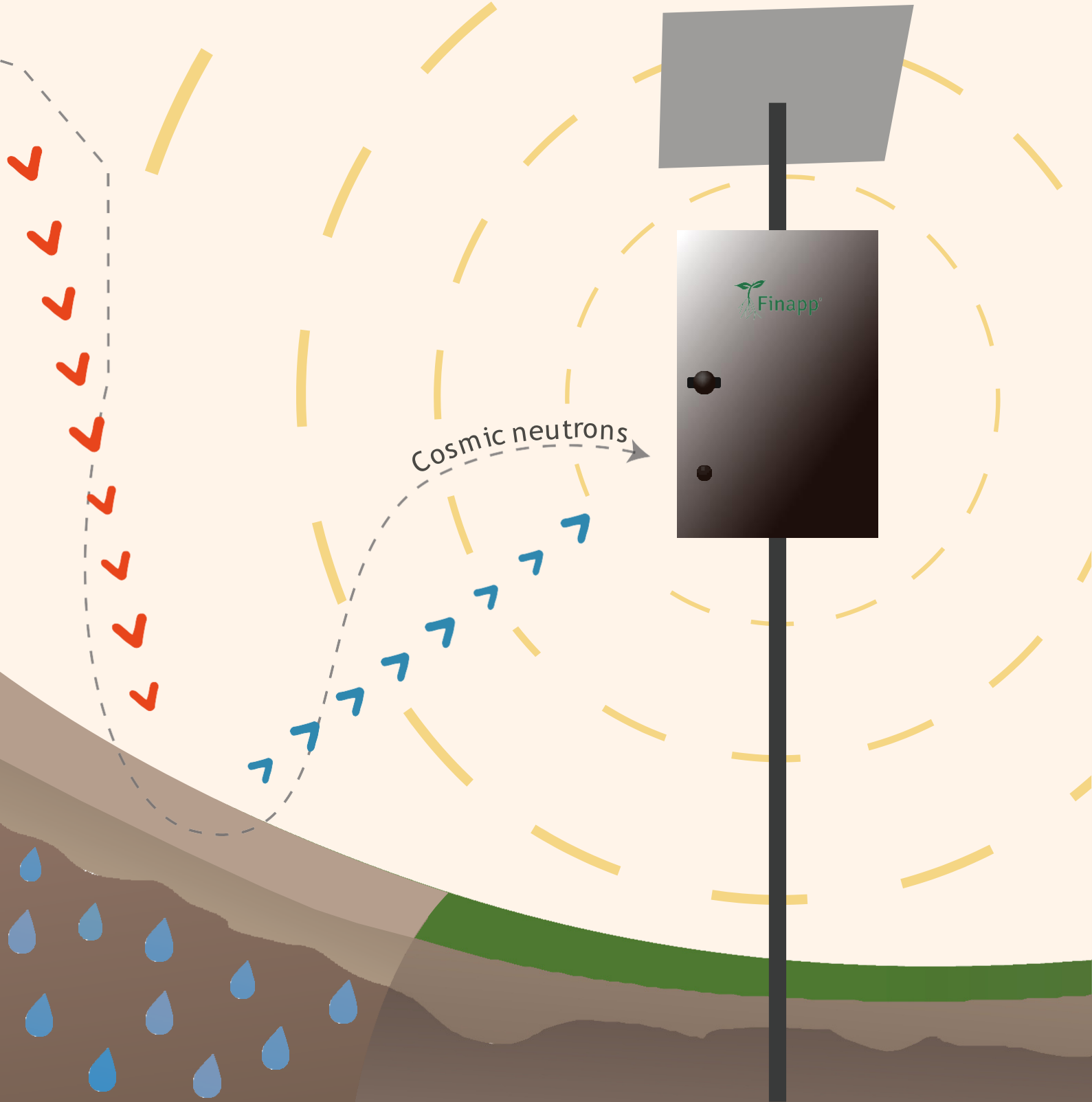
Summary

Finapp probe.
How does it work?

Finapp produces **CRNS probes** *(cosmic ray neutron sensing technology)* **able to count neutrons** generated by the **interaction between cosmic ray and water** present in the soil, in the biomass, in the snow.

Thanks to CRNS technology Finapp can provide **real time, large scale, in deep** measurements of:

- Soil moisture
- BWE: biomass water equivalent
- SWE: snow water equivalent



Finapp probe
Models

Finapp offers **one single hardware** – able to cover all kinds of applications – equippable with **three differents versions**, based on the required needs, and **additional modules.**

Table 1.
Finapp probes

Probe	Neutrons count per hour[1]	Mouns count per hour[1]	Gamma count per hour[2]
Finapp-3	1'000	6'000	none
Finapp-4	1'200	7'500	none
Finapp-5	3'000	14'000	none
Finapp-Monitor	none	5'000	40'000

1. At sea level, with a soil moisture <5%, with a cutoff rigidity of 5GeV
2. In the range between 200 and 3'000 keV

Table 2.
Additional modules

Module	Compatible with	Features
Gamma	Finapp-3-4-5	2'000 mouns[1]/h and 30'000 gamma[2]/h
GPS	Finapp-3-4-5	Global positioning
Thermo-hygrometer	Finapp-3-4-5	External temperature and humidity

1. At sea level, with a soil moisture <5%, with a cutoff rigidity of of 5GeV
2. In the range between 200 and 3'000 keV

Finapp probes
Technical info

Solar panel & battery

A **20W solar panel and a 7Ah backup battery** (included) power the probe which consumes 0.4Wh – 0.5Wh depending on the models.

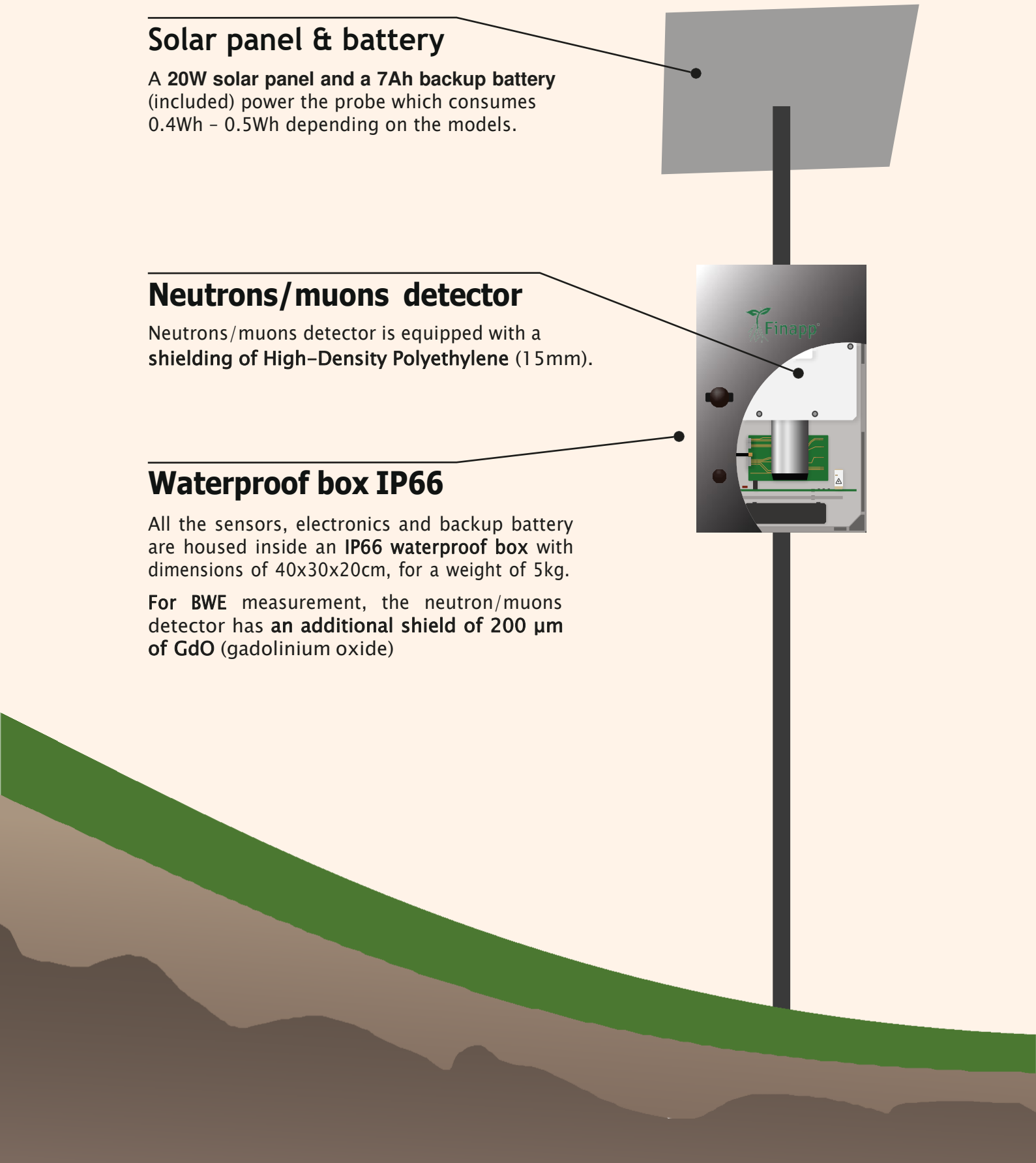
Neutrons/muons detector

Neutrons/muons detector is equipped with a **shielding of High-Density Polyethylene** (15mm).

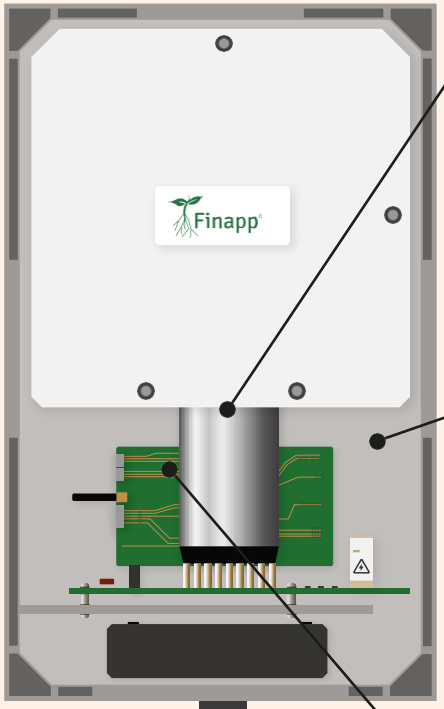
Waterproof box IP66

All the sensors, electronics and backup battery are housed inside an **IP66 waterproof box** with dimensions of 40x30x20cm, for a weight of 5kg.

For BWE measurement, the neutron/muons detector has **an additional shield of 200 µm of GdO** (gadolinium oxide)



Finapp probes
Technical info



Internal Datalogger

The probe is already **equipped with a datalogger made up of**:

a. Custom electronic board
b. Firmware and all necessary software to discriminate neutrons and muons from other particles and noise
c. Atmospheric pressure sensor
d. Internal temperature sensor
e. External temperature sensor – optional
f. External relative humidity sensor – optional
g. Auto diagnostic system

Internal SD storage

Measured data are **saved locally on an SD** card. The stored parameters are:

a. Time stamp (UTC)
b. Counting of neutrons – according to models
c. Counting of muons – according to the models
d. Counting of gamma – according to models
e. Atmospheric pressure (hPa)
f. Internal temperature (°C)
g. External temperature (°C) – according to models
h. External humidity (%) – according to models
i. GPS position – according to models
j. Voltage (V)

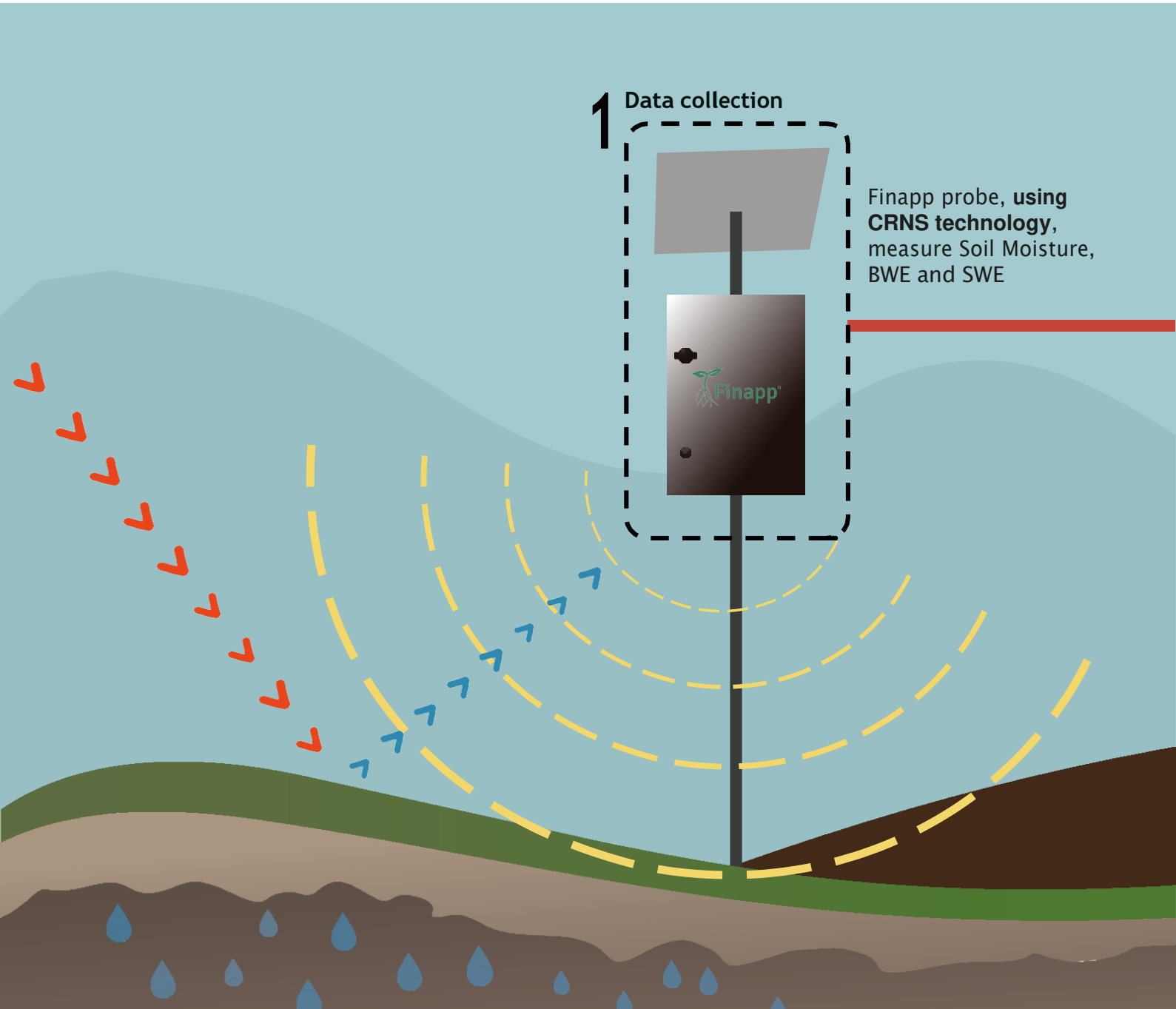
GSM modem

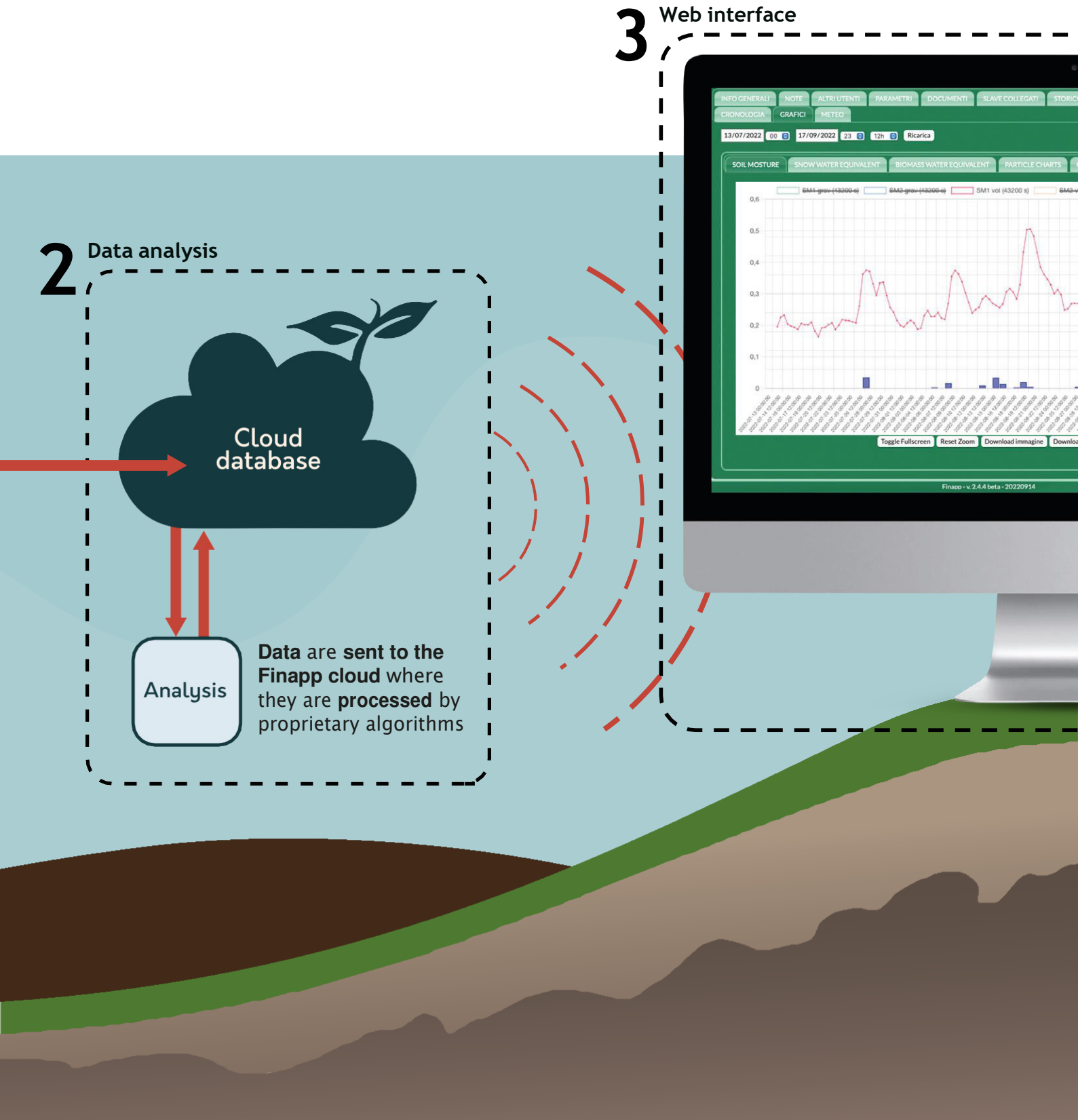
The probe is equipped with a GSM modem (prepaid SIM card included) **for data transmission to the Finapp Cloud.**

Data supplying
How does it work?

Finapp **provides areal values of soil moisture, BWE-biomass water equivalent, SWE-snow water equivalent**, through the installation of one or more probes, and **cloud based post processing of the raw data** collected by the probes.

Soil moisture, BWE and SWE can be calculated directly by the probe and transmitted via SD-12 or RS-232 port to pre-existing data loggers.




3
Web interface
INFO GENERALI
NOTE
ALTRI UTENTI
PARAMETRI
DOCUMENTI
SLAVE COLLEGATI
CRONOLOGIA
GRAFICI
METEO
13/07/2022
17/09/2022
Ricarica
SOIL MOSTURE
SNOW WATER EQUIVALENT
BIOMASS WATER EQUIVALENT
PARTICLE CHARTS
Toggle Fullscreen
Reset Zoom
Download immagine
Finapp - v. 2.4.4 beta - 20220914
2
Data analysis
Cloud database
Analysis
Data are sent to the Finapp cloud where they are processed by proprietary algorithms

a. Soil moisture

Output:

Soil moisture *(gravimetric or volumetric ifsoil density is known)* averaged *(1 value)* over a circular **area of 5 hectares**, up to a **depth of 30-50cm** in standard conditions.

Possible hardware:

Probe	Integration time*
Finapp-3	6 hours
Finapp-4	5 hours
Finapp-5	2 hours

**Soil moisture is updated every hour and is calculated as the rolling average of the last 6h – 5h – 2h depending on probe's model*

Installation:

About 2m above the ground

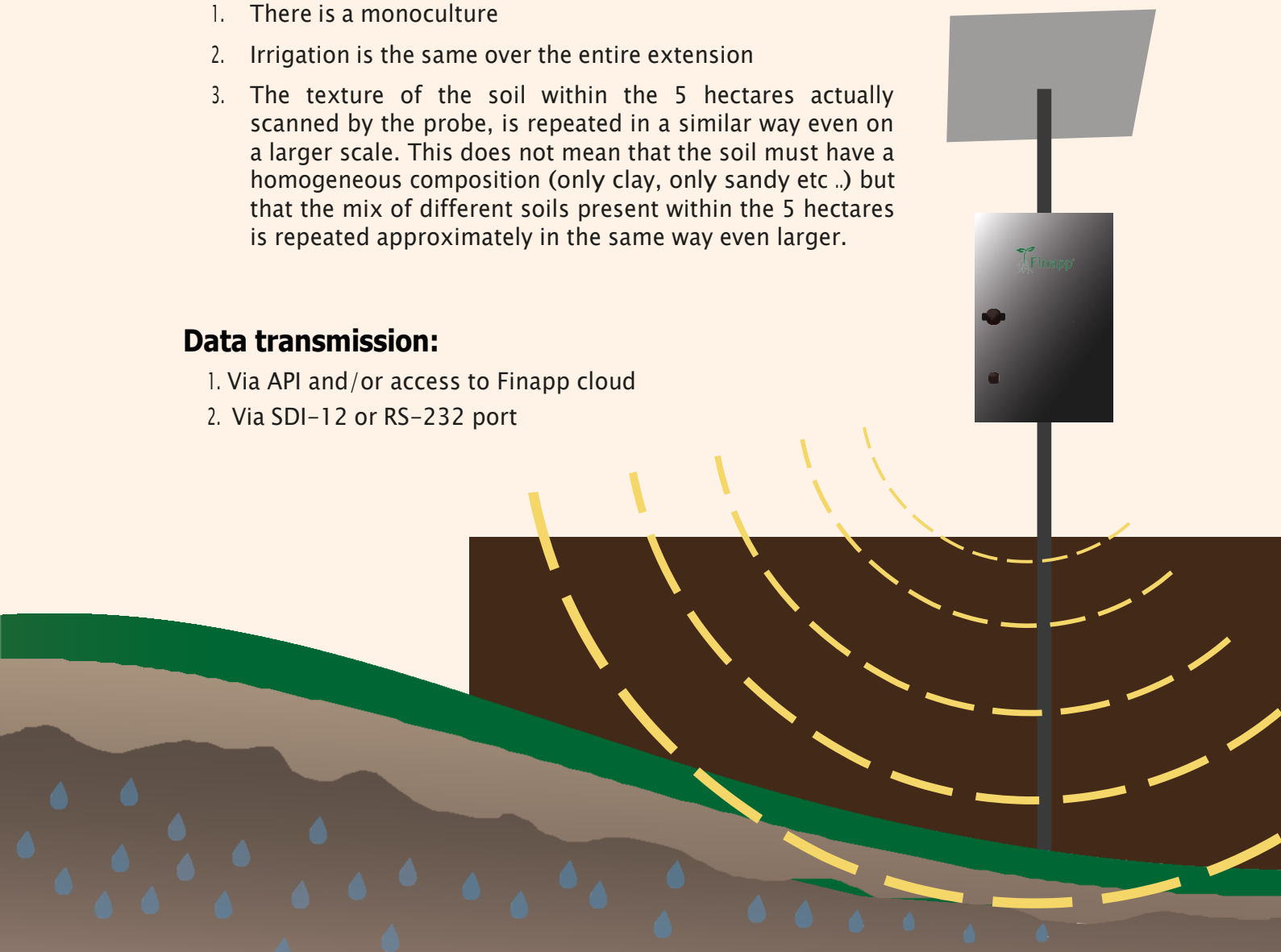
Measurements validity:

Up **to 100 hectares** if these conditions are valid:

1. There is a monoculture
2. Irrigation is the same over the entire extension
3. The texture of the soil within the 5 hectares actually scanned by the probe, is repeated in a similar way even on a larger scale. This does not mean that the soil must have a homogeneous composition (only clay, only sandy etc ..) but that the mix of different soils present within the 5 hectares is repeated approximately in the same way even larger.

Data transmission:

1. Via API and/or access to Finapp cloud
2. Via SDI-12 or RS-232 port



b.BWE- biomass water equivalent

Output:

BWE (mm) averaged (1 value) over acircular **area of 5 hectares.**

Soil moisture (gravimetric or volumetric if soil density is known) averaged (1 value) overa circular **area of 5 hectares**, up to a **depth of 30-50cm** in standard conditions.

Possible hardware:

Probe	Integration time*
A pair of Finapp-3	48 hours
A pair of Finapp-4	24 hours
A pair of Finapp-5	12 hours

**BWE is updated every 3 hours and is calculated as the rolling average of the last 48h – 24h – 12h depending on probe's model.*

Installation:

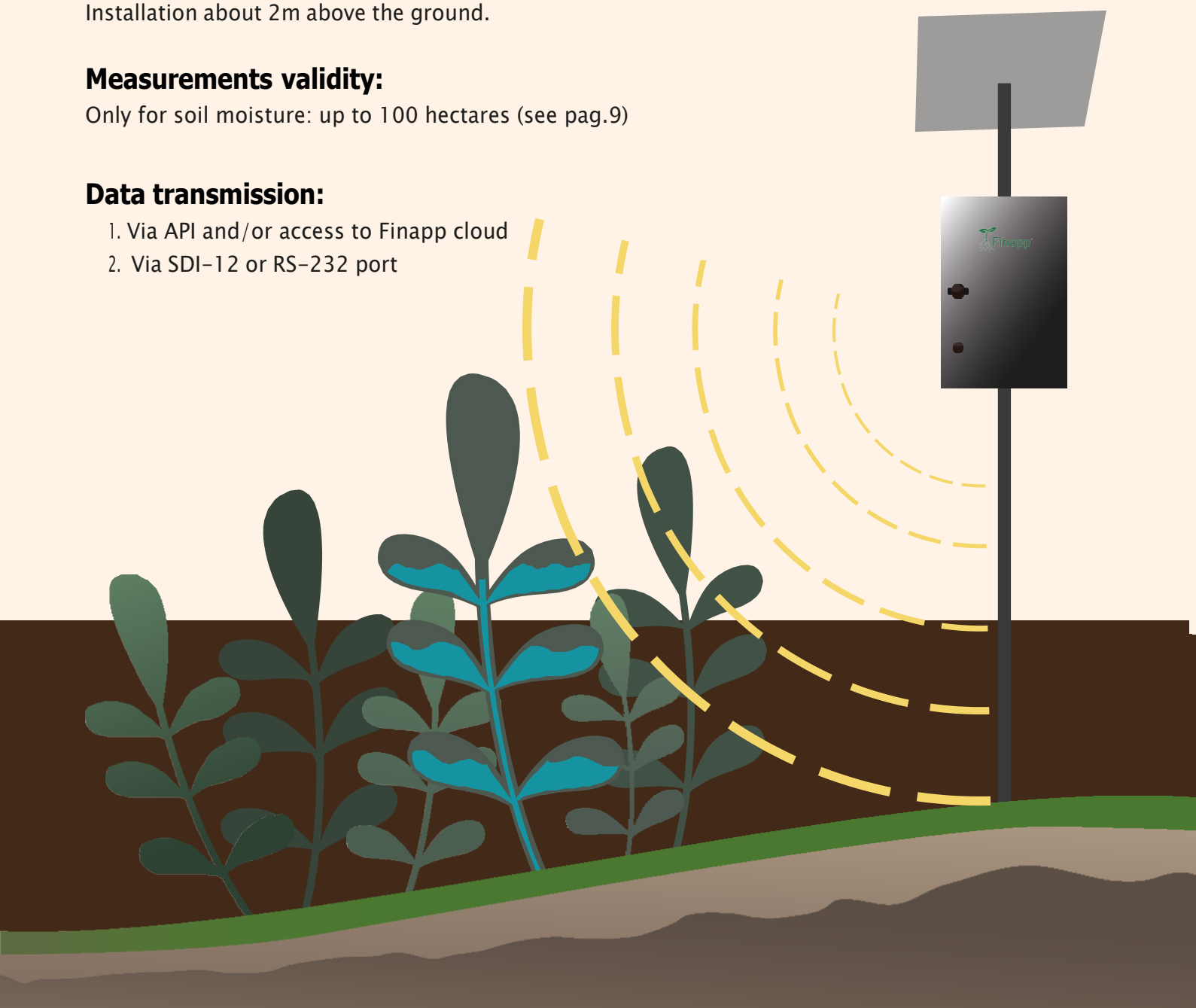
Both probes on the same pole or on two adjacent poles.
Installation about 2m above the ground.

Measurements validity:

Only for soil moisture: up to 100 hectares (see pag.9)

Data transmission:

1. Via API and/or access to Finapp cloud
2. Via SDI-12 or RS-232 port



c. SWE- snow water equivalent

Possible hardware:

Probe	Integration time*
Finapp-3 + Finapp-Monitor	12 hours
Finapp-4 + Finapp-Monitor	10 hours
Finapp-5 + Finapp-Monitor	6 hours

**SWE is updated every hour and is calculated as the rolling average of the last 12h – 10h – 6h depending on probe's model*

Output:

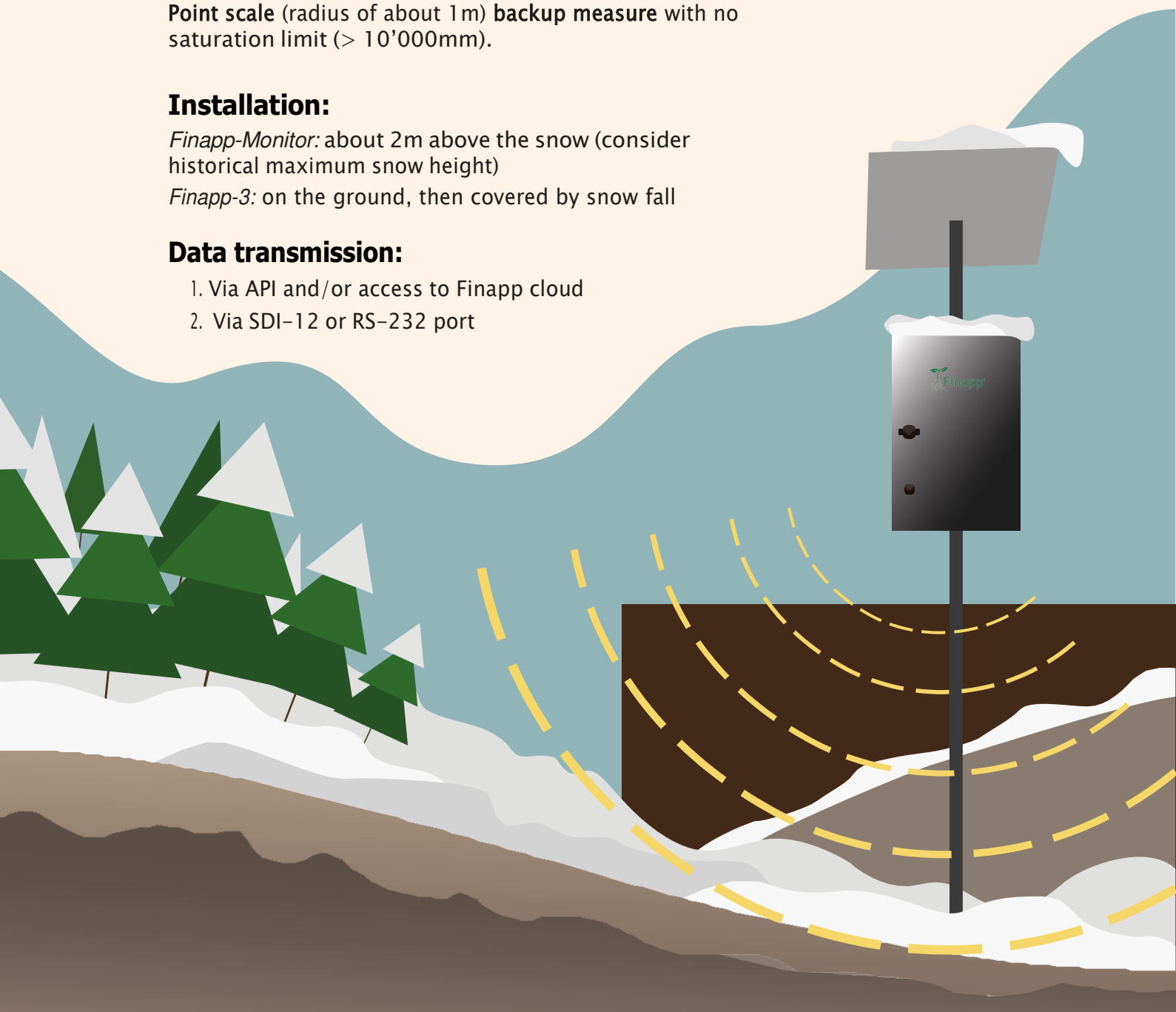
SWE (mm) averaged (1 value) over a **circular area of 20m,** with a saturation limit of about 2'000mm.
Point scale (radius of about 1m) **backup measure** with no saturation limit (> 10'000mm).

Installation:

Finapp-Monitor: about 2m above the snow (consider historical maximum snow height)
Finapp-3: on the ground, then covered by snow fall

Data transmission:

1. Via API and/or access to Finapp cloud
2. Via SDI-12 or RS-232 port



Soil moisture maps*

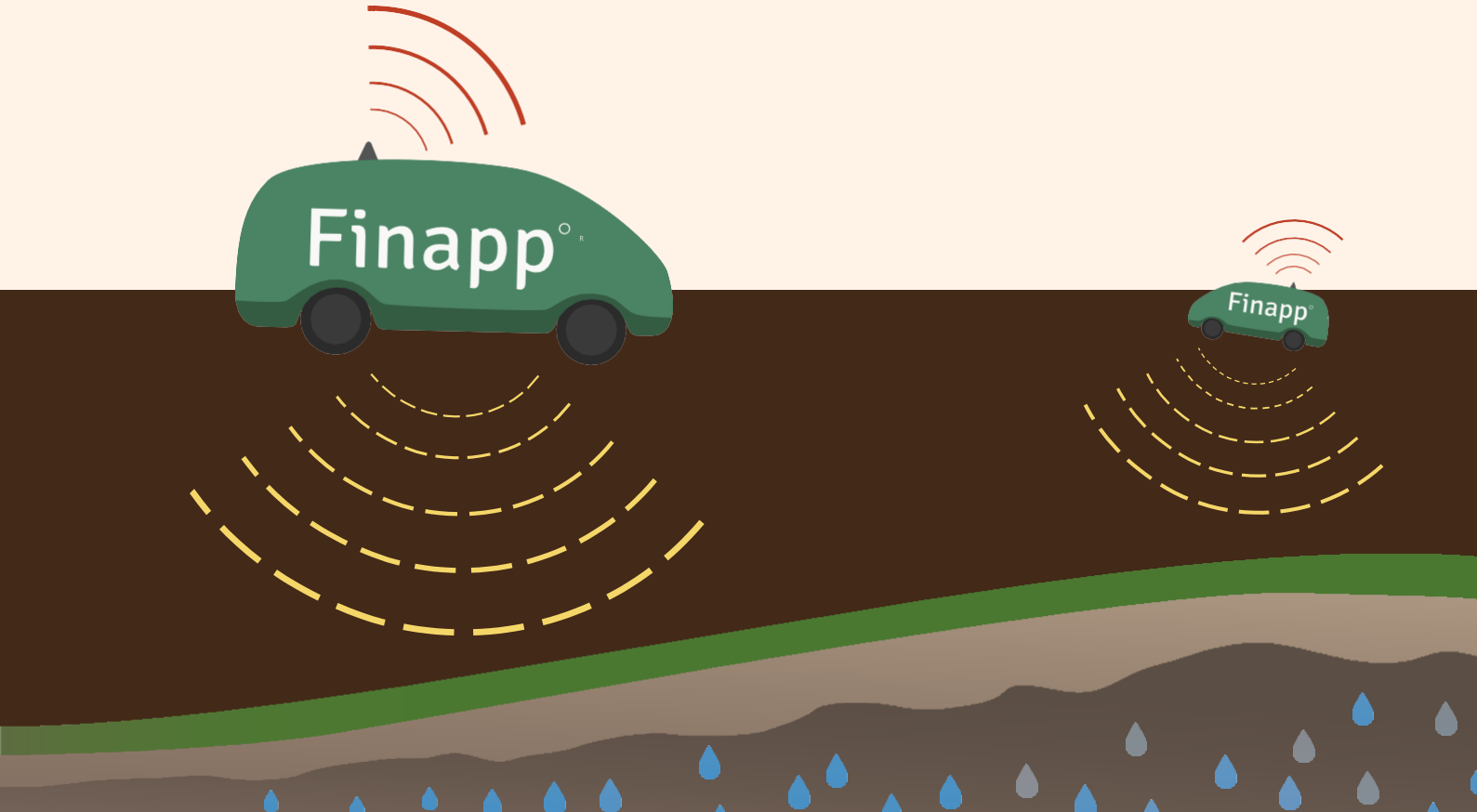
*2023

The **integration of the GPS module** allows to georeference the neutron and muon counts. This translates into the **possibility of having maps in near real time** of soil moisture by **installing** one or more Finapp **probes on a moving vehicle.**

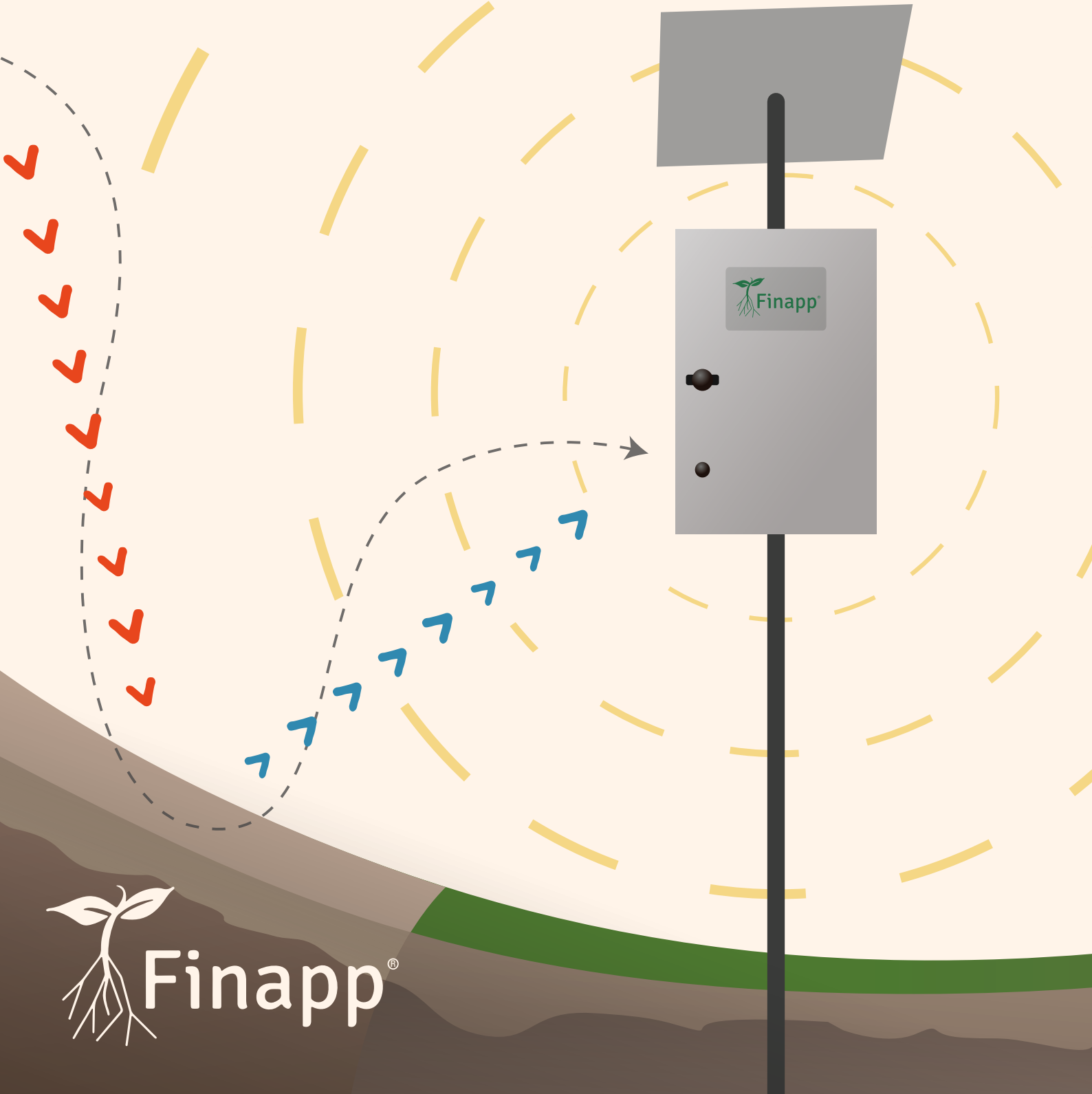
The range of action of the probe can go down to about 10m (compared to the usual 5 hectares) thanks to two measures:

1. A particular shielding of the detector
2. Installing the probe as close as possible to the ground.

! **The probes used will always be the same**; it will be the post processing of the data and the output that will change.



Finapp®



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