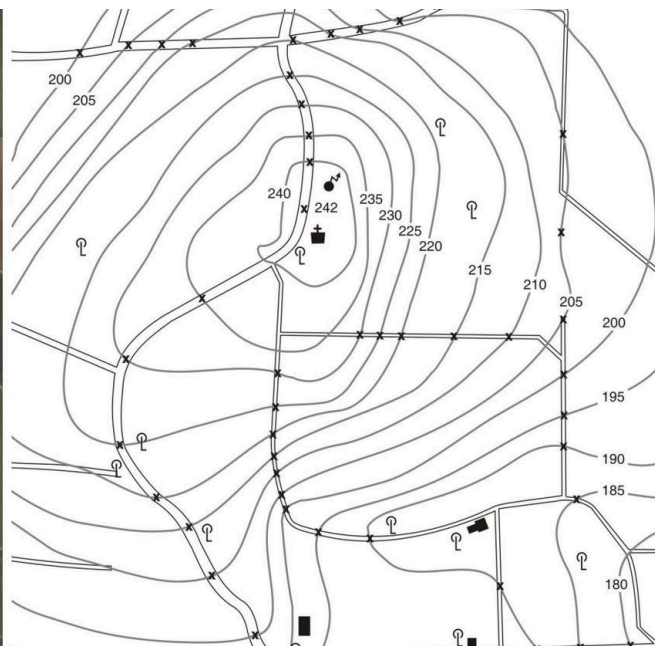


Terrain mapping with Cobra SMARTsense



In this experiment, students will learn how terrain mapping works with the SMARTsense weather station.

Biology

Ecology & environment

Ecosystems



Difficulty level

easy



Group size

2



Preparation time

10 minutes



Execution time

45+ minutes

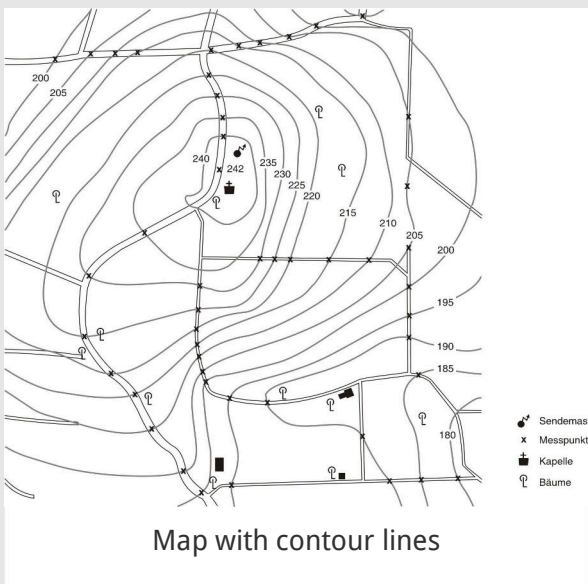
PHYWE
excellence in science



Teacher information

Application

PHYWE
excellence in science



Drawing maps is very popular with students in geography classes and is of high didactic value.

The GPS function of the Cobra SMARTsense Weatherstation can be used to determine altitude, latitude, longitude, speed and compass direction.

Beyond the basic requirement of this task - drawing a map by hand with contour lines - the GPS functions of the weather station can be used to perform other additional tasks.

Other teacher information (1/4)

PHYWE
excellence in science

Prior knowledge



Students should already be familiar with the use and interpretation of analog maps.

Scientific principle



The SMARTsense weather station records GPS data, allowing contour lines to be plotted on a self-drawn map and an elevation profile to be created in the measureLAB PC software.

Other teacher information (2/4)

PHYWE
excellence in science

Learning objective



Students will learn how terrain mapping works with the SMARTsense weather station.

Tasks



Students should use the SMARTsense weather station to plot contour lines on a map and optionally create an elevation profile.

Other teacher information (3/4)

PHYWE
excellence in science

Measurements

With the weather station it is possible to make various recordings. The easiest are the snapshots, where the values can be read comfortably in the display of the Cobra SMARTsense Weatherstation.

Another option is to connect the weather station to measureLAB via Bluetooth. The measurement can then be started, stopped, saved and evaluated in the program.

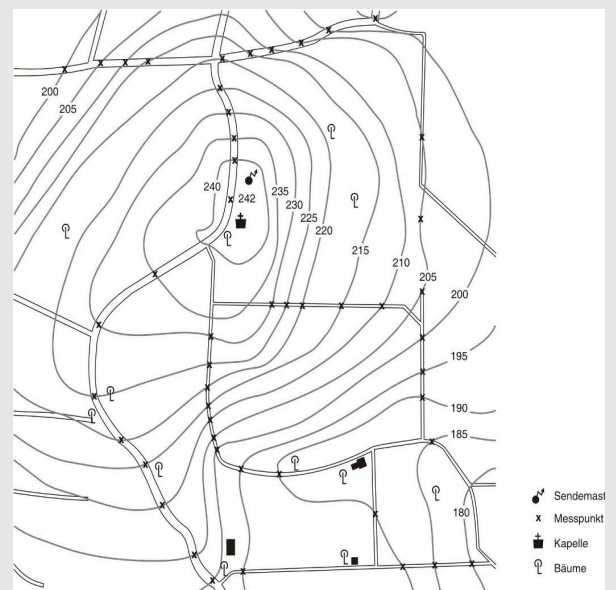
As a last, comfortable possibility of the measurement the Weather Station offers the option to carry out a so-called "Offline measurement". For this, the desired weather parameter is selected via the arrow keys in the menu and the measurement is started by pressing the power key three times. The Bluetooth LED then flashes green. The measurement is ended by pressing the power button twice, the LED then flashes red. These measurements can then be easily read into a PC via measureLAB.

Other teacher information (4/4)

PHYWE
excellence in science

Result contour lines

- The figure to the right shows a map in which contour lines and other terrain features have been plotted.
- When measuring over a longer period of time, it should be taken into account that an air pressure deviation of 1 mbar corresponds to a difference in altitude of approx. 8 m.
- The altitude measurement with the Cobra SMARTsense Weatherstation is very accurate and therefore also allows an altitude measurement in less profiled terrain. However, the more profiled a terrain is, the less time is required. Already with 25 to 50 measuring points maps with meaningful contour lines can be produced.



Safety instructions

PHYWE
excellence in science

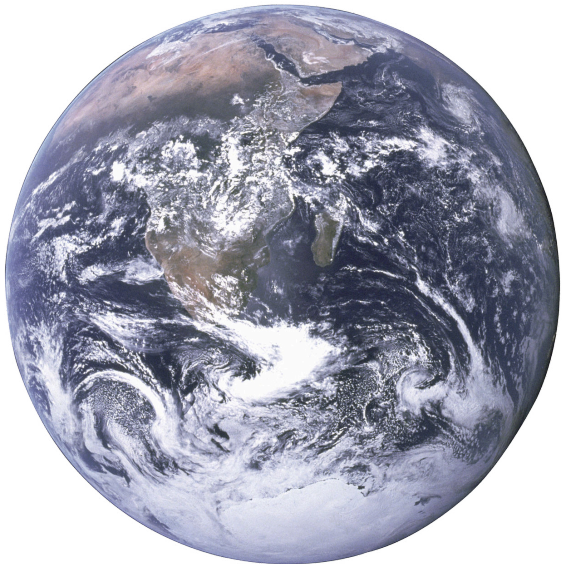
- The general instructions for safe experimentation in science lessons to be applied to this experiment.

PHYWE
excellence in science

Student Information

Motivation

PHYWE
excellence in science



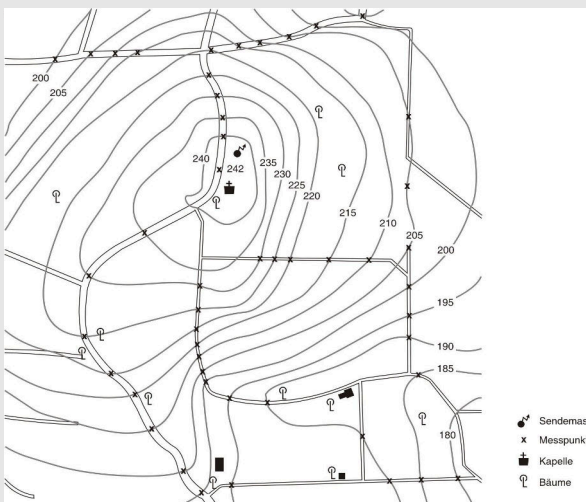
Maps are indispensable even in times of navigation systems, as these are based on maps. It is all the more important that the art of terrain mapping continues to be preserved.

Simple satellite images can now be obtained conveniently via the Internet. Good sources for this are Google Maps or Google Earth. However, since no contour lines are drawn in these maps, this experiment is intended to complete a map or a map section in your surroundings with contour lines.

While you're on the road and plotting the individual measurement points on the map, you can also create an elevation profile and determine at what speed and in what direction you're traveling.

Tasks

PHYWE
excellence in science



Map with contour lines

Use the SMARTsense weather station to

1. Create a map of a section of the terrain and draw the contour lines on it.
2. Create an elevation profile from a hike (optional).

Equipment

Position	Material	Item No.	Quantity
1	Cobra SMARTsense - Weatherstation (Bluetooth + USB)	12946-00	1
2	measureAPP - the free measurement software for all devices and operating systems	14581-61	1



Set-up and procedure

Set-up (1/4)

The SMARTsense weather station and measureAPP are required for terrain mapping. Check whether "Bluetooth" is activated on your device (tablet, smartphone) (the app can be downloaded free of charge from the App Store - QR codes below). Now open measureAPP on your device.



measureAPP for

Android operating systems



measureAPP for

iOS operating systems

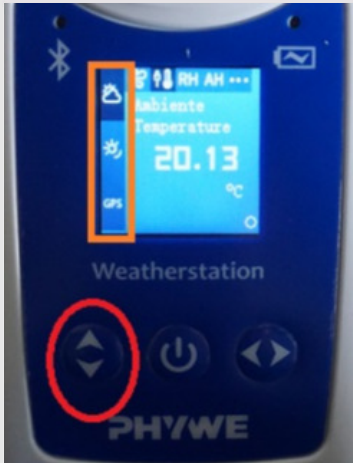


measureAPP for

Tablets and PCs with Windows 10

Set-up (2/4)

PHYWE
excellence in science



Orange = Weather parameters, Red = Select buttons

- Turn on the SMARTsense weather station.
- Select the parameter "GPS" using the arrow keys up/down. To activate the GPS, the arrow key "left/right" must be pressed for at least 3 seconds.
- Start the measurement by pressing the "Power"-button three times. The Bluetooth LED on the top left of the device flashes green to confirm.
- Let the measurement for the elevation profile run as long as you are on the way. On the way, you can read off the measurement points for the terrain mapping in between.
- Afterwards you end the measurement by pressing the "Power"-button twice. The Bluetooth LED flashes red.

Procedure (3/4)

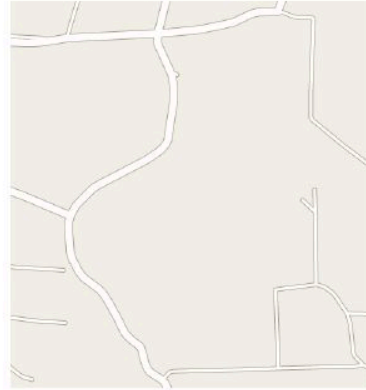
PHYWE
excellence in science



- In GPS mode, you can display the elevation value above sea level of your location to create the contour lines (leftmost image).
- For further study of the subject beyond this experiment guide, you can also view the GPS coordinates (right image).

Procedure (4/4)

PHYWE
excellence in science



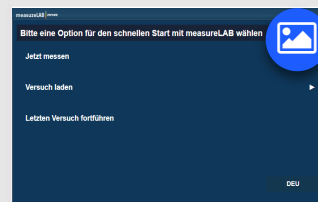
Satellite image (Google Maps) and map of the same section

- Determine the height of prominent points, e.g. along paths, and enter them on a map you have created yourself or taken from Google Maps or Google Earth.
- Connect the points with identical heights to form meaningful contour lines.

Additional information

PHYWE
excellence in science

- Now connect the SMARTsense weather station to your computer via the included USB cable or via Bluetooth.
- Then start the measureLAB software and select "Measure now" in the first window and select the "GPS" in the next window.
- To transfer the offline measurement data for the altitude profile, select the SMARTsense weather station in the top right window and then click on the folder icon.
- In the window that opens, you can select the files you want to import and then click on "Import".



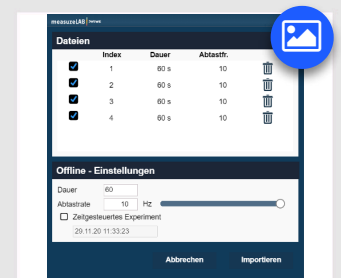
Measure now



Select weather parameters



Select the folder icon





Report

Task 1

What does an air pressure deviation of about 1 mbar mean for the altitude?

- An air pressure deviation of 1 mbar results in a difference in altitude of about 20 m.
- An air pressure deviation of 1 mbar results in a difference in altitude of about 25 m.
- None of the answers are correct.
- An air pressure deviation of 1 mbar results in a difference in altitude of about 8 m.
- An air pressure deviation of 1 mbar results in a difference in altitude of approximately 1 m.

✓ Check

Task 2

What is the abbreviation "GPS"?

- "GPS" stands for "General Pioneer Sonar", as the terrain is scanned by means of a sonar system.
- "GPS" stands for "Terrain Position Location" because it can be used to determine the position or the current location in the terrain.
- None of the answers are correct.
- "GPS" stands for "Global Positioning System" and is a globally operating satellite navigation system.

✓ Check

Task 3

How many measurement points can be used to create meaningful contour lines in map sections like ours?

- Already with 25-30 measuring points maps with meaningful contour lines can be produced.
- For meaningful contour lines, at least 200 measuring points per contour line are required.
- None of the statements are correct.
- For meaningful contour lines, at least 20 measuring points per contour line are required.

✓ Check

Slide	Score/Total
Slide 19: Altitude and air pressure	0/1
Slide 20: GPS	0/1
Slide 21: Measuring points	0/1

Total  0/3

 Solutions

 Repeat