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Low cost Evaporimeters

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Research of the evaporation from the water surface is curtailing for measuring the water balance in small catchments.

An ongoing project aims to develop a simple and reliable, easy to reproduce evaporation measuring device. A core part of the device is measuring the water level in the field in cheap form. 3D printed design in combination with open-source cheap electronics is utilized. Methodology and results of the ongoing research project will be presented. The project investigates the affordable and simple technical measures that have the potential to increase the number of opportunities for the measuring of evaporation.

Continuously the theories are developed and tested, subsequently, conclusions are implemented into the next generation of the device. Five generations of 3D printed part have been done, and now the research focus on the electrical and software part of the device. Durability and reliability of the device are tested in the field, in three locations. All plots are also frequently checked by research staff and data is saved and later compared with data measured by the device. Refilling of the evaporation pan is also done by research staff.

Prototype 3 used the experience of all previous prototypes. The construction is equipped with 5 sets of electrodes, each with a measuring range of 10 mm. The total measuring range is 50 mm. The whole structural part of prototype 3 is designed as a printout on a 3D printer, electrodes are printed from a conductive material. Above the electrodes, there is a printed circuit board carrying the microelectronics control module.

The principle of measurement consists of gradual interrogation of the set of electrodes, a subsequent reversal of polarity and repeated interrogation. This cycle is repeated several times and the result is averaged, then the next set is measured. The polarity reversal is controlled by the relay. Thanks to the use of printed circuit board it was possible to simplify the device, so only 7 wires, one analog output, polarity reversal control and supply wire to 5 sets of electrodes are led from the whole device.

An important step in the evaluation of the obtained data (the values of current passed through the water), is its analysis. Because values are read very often they differ only slightly. A commonly used vapor unit is mm of water column per day. It is, therefore, necessary to analyze a long time series, at least longer than one day, and covering the entire day from 00:00 to 23:59.

The testing sites are the grounds of the CTU Faculty of Civil Engineering in Dejvice, the experimental sites of the CULS in Prague Suchdol and the Water Research Institute in Prague Podbaba.

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