

Researchers use new technology to measure groundwater

Groundwater resources are under pressure all over the world due to overexploitation, pollution and climate change. In some places – the most severely affected areas – the groundwater table is drawing back more than one metre per year and many coastal areas are severely affected by saltwater intrusion.

More precise detection of groundwater

In a new project, researchers from Aarhus University (AU) will develop a technology, which will make it possible to detect and measure groundwater more accurately without any expensive drillings.

"If we are to continue to have access to sufficient amounts of groundwater also in the future, we must as soon as possible ensure a sustainable transformation of the way in which we exploit the resources. For this purpose, we need new technology that can measure the groundwater resources more precisely", Jakob Juul Larsen, Assistant Professor at the Department of Engineering at Aarhus University says.

The researchers will apply a technology called surface-NMR (nuclear magnetic resonance), which will make it possible to determine the groundwater content in the upper 100 m of the soil. When working with surface measurements of groundwater, the challenge is to develop instruments, which are suitably mobile and sufficiently precise.

"A groundwater measurement based on the NMR technology requires a 400 metre long cable laid out on the ground surface in a 100 x 100 metre square to obtain some really unique data about the soil below us", Jakob Juul Larsen says.

The NMR technology is regarded as one of the most advanced geophysical measuring methods. It determines very precisely the water content in the subsurface while at the same time describing the porosity of the soil layers and thus their potential for transporting water.

"It is of utmost importance to us to acquire this knowledge, because we can use it to build computer models of the groundwater and predict how much groundwater we can pump up in a sustainable way", Jakob Juul Larsen says.

Mathematical solutions to noise problems

The NMR technology is only used to a limited extent to detect groundwater, as the technological instruments are very sensitive to noise from the surroundings. Signals from the groundwater are very weak and thus easily drowned out.

In the course of the project, the researchers will design and build a receiving system, which will reduce the noise by means of a special antenna and subsequent data processing of the measurements.

"We expect that the new system will be able to take NMR measurements both faster and in a much more noise-affected environment than is possible today", Jakob Juul Larsen says.

The project is called "Faster surface NMR groundwater measurements by means of new receiver technology" and is a collaboration between the Department of Engineering and the Department of Geoscience at Aarhus University.

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