

Technical Brief

Saltwater intrusion monitoring – SAMOS

output go-CAM project, February 2021

What is saltwater intrusion?

Saltwater intrusion is a process by which saltwater displaces freshwater in surface water or groundwater bodies. This risk exists particularly in coastal areas due to the proximity to seawater, but also in the area of the salt structures that are common in northern Germany. Human intervention in natural processes, e.g. excessive groundwater extraction, can set saltwater intrusion in motion.

Why do we have to monitor this?

Our water supply is based on groundwater. With wells we take water from deeper layers of the earth, this leads to a flow of groundwater towards the well and the saltwater is also mobilized. If the withdrawal of water is too high, it can happen that saltwater reaches the well and is pumped. By monitoring we want to recognize this early and control the water withdrawal in good time.

How does the system work?

Our saltwater monitoring system SAMOS works like a regular geoelectrical measurement, but instead of running horizontally on the earth's surface, the measurement setup is turned by 90 degree and shifted vertically into the ground. An electric current is fed into the earth and the potential field is measured. The electrical resistance determined from this is an indicator of the salinity of the groundwater.

With SAMOS, using the example of Spiekeroog, the electrical resistance in the transition area from fresh to saltwater is continuously recorded over a vertical distance of 25 m at a depth of approx. 30 to 55 m. This is a novelty compared to individual observations in e.g. two selected depths. With SAMOS, we record the entire dynamics of the fresh-saltwater boundary including the seasonal course.

Where does an installation make sense?

For a representative monitoring, the observation sites must be carefully chosen. SAMOS should be placed in the well catchment area in the fresh-saltwater transition zone.

What's the benefit?

In contrast to the groundwater flow, the transport of saltwater (by advection and diffusion) is a very slow, creeping process. If saltwater intrusion is not recognized in time and a tipping point is exceeded, wells are spoiled forever. If upcoming saltwater is detected in good time, the well field can continue to be operated by means of suitable groundwater management.

How high are the costs?

The costs relate to the measurement system installed underground (electrodes, cables, possibly temperature sensors), the measurement technology installed above, as well as the drilling and installation costs - together approx. 45,000 €. Monitoring is long-term (at least 10 years).

Conclusion

SAMOS is an innovative development and early-warning system against well salinization. This can ensure long-term and sustainable operation of groundwater extraction systems.

References

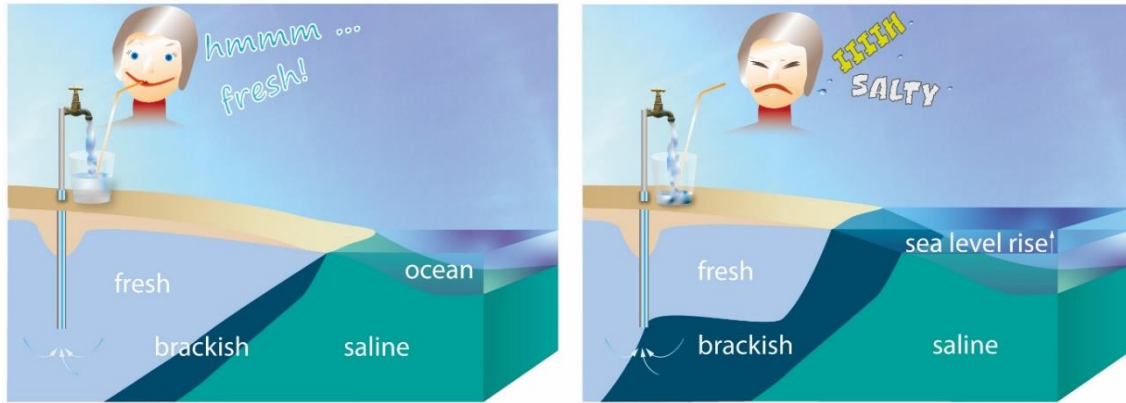
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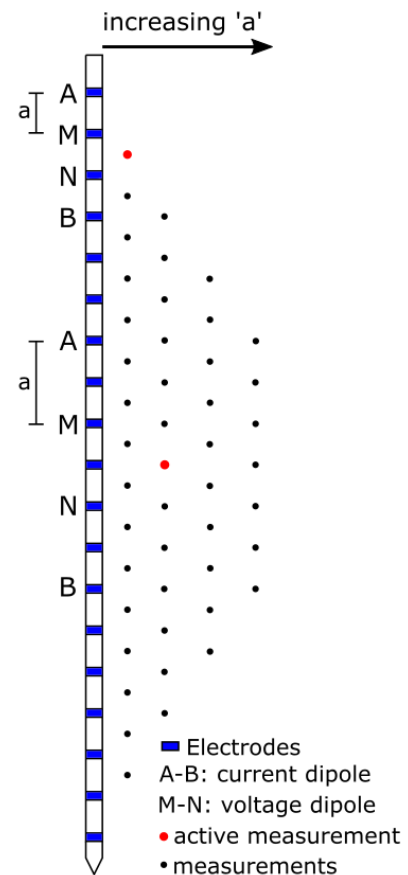
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The problem



The early-warning system



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