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Extended Abstracts

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Geophysical, geological and geochemical methods in groundwater exploration

title: New hydrogeophysical method for hydrogeologists called MRS for quantification of water in subsurface and groundwater management

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The new Magnetic Resonance Sounding (MRS) technique is probably the most exciting and certainly the most quantitative, non-invasive hydrogeophysical technology ever developed. This is because it applies NMR principle, known also in medical brain scanning as MRI that allows for better water selectivity and lesser ambiguity in subsurface water assessment than any other classical geophysical technique (Lubczynski, Roy, 2004).

The idea of the MRS originates from 60's in United States, while its first implementation from 70's in Russia (Siberia) where first MRS instrument called HYDROSCOPE was developed. In Europe the MRS method is known only since 80's when French MRS instrument called NUMIS was developed. Since 1996 NUMIS is commercially available in France at the BRGM associate called IRIS and recently also in USA.

Below there are listed selected current capacities of the MRS technology. The MRS can (Lubczynski and Roy 2007):

- quantify water content in subsurface (saturated and unsaturated) in depth-wise manner, maximally down to 150 m;
- evaluate extractability of water in subsurface; this extractability is correlated with hydraulic conductivity of the medium so MRS can distinguish and differentiate rocks having similar water contents but different hydraulic conductivities;
- provide hydrostratigraphy of subsurface;
- provide estimates of hydrogeological parameters such as aquifer storage and aquifer transmissivity after calibration;
- evaluate unsaturated zone conditions and contribute to recharge assessment;
- contribute to well siting;
- contribute to groundwater modelling.

MRS has already been tested by many researchers in various hydrogeological conditions. It proved to be quite accurate and cost effective in water resources assessment projects. However there are still sites where MRS surveys cannot be performed. This applies mainly to environments where signal-to-noise ratio is too low. Other MRS survey constrains and benefits will also be discussed.

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