

Magnetic Resonance Sounding
(MRS/RMP) available for the CRITEX
community: how it works and how to use it

Anatoly Legtchenko,
IGE-UGA-IRD

Subject

“Knowledge itself is power”

(F.Bacon)

To inform CRITEX community about:

- MRS (RMP) method
- Available equipment
- Possibility to use it

Plan

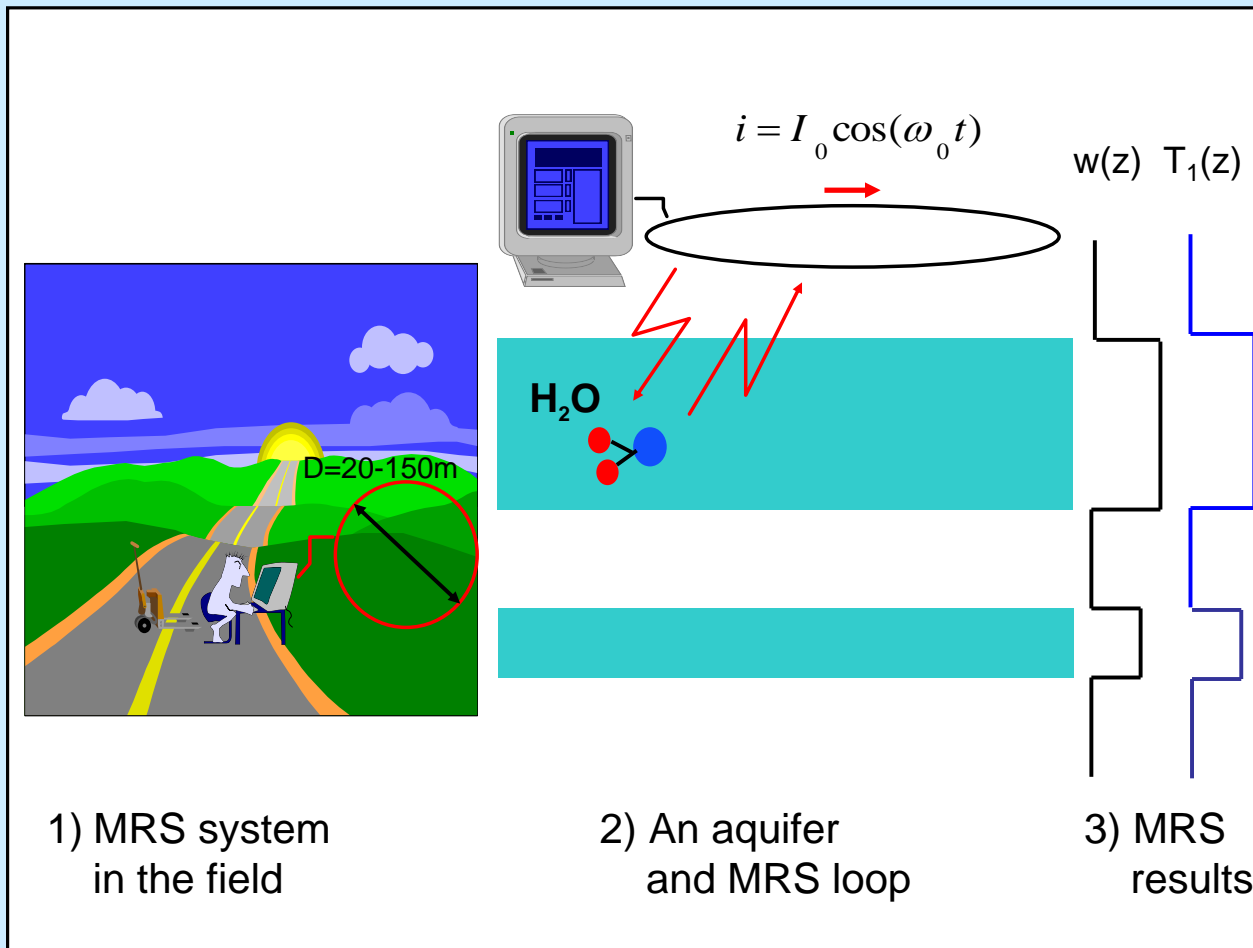
1. Presentation of the MRS (RMP) method
2. Place of MRS in the geophysical toolbox
3. Particularity of application
4. Limitations
5. Available equipment
6. Availability for using

Introduction

CRITEX - WP 6.2 – RMP

1. Commercial NUMIS_{POLY} instrument has been bought in the framework of CRITEX project (29/10/2014).
2. Two years of CDD in electronics allowed developing the prototype of a new instrument for measuring in the unsaturated zone and in boreholes.
3. One year postdoc contributed to development of advanced data processing.
4. MRS has been applied in Benin (BV of Ara) and in Alsace (Vosges) (BV of Strengbach).

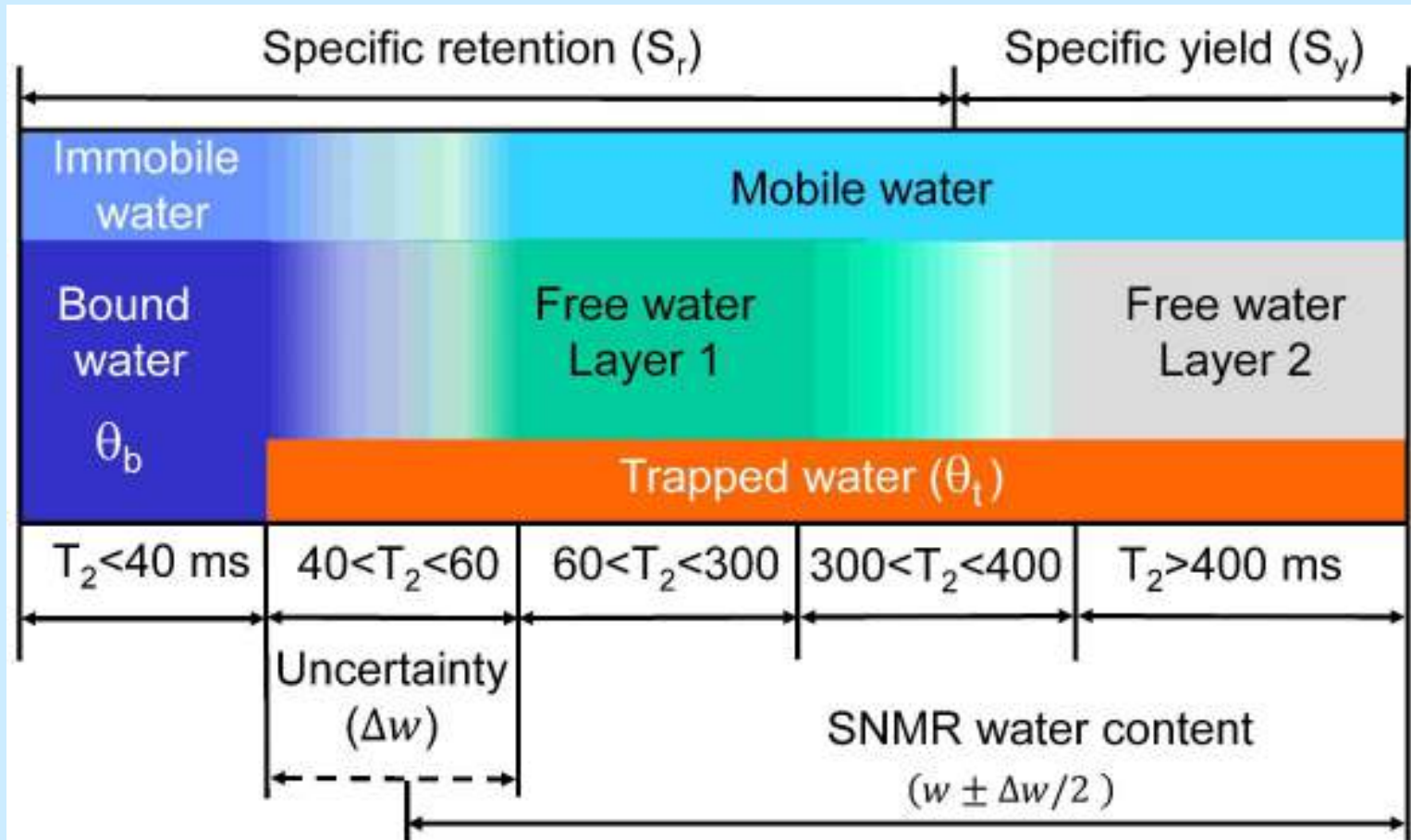
MRS method measures EM signal generated by water molecules in response of excitation pulses of alternating current generated in the surface loop, which renders selectively sensitive to groundwater



Example: MRS contribution to hydro-geophysical study

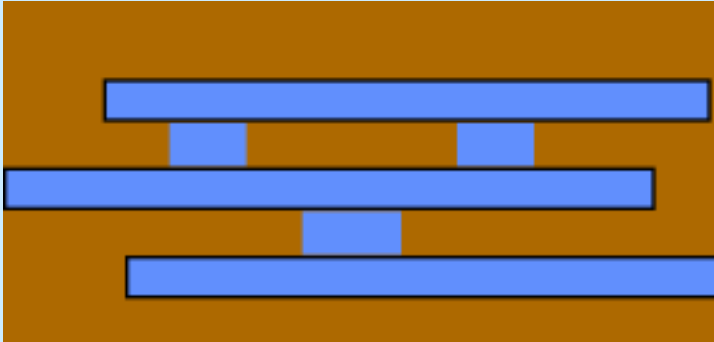
Parameter	MRS	Comments
Geometry of the water-saturated formation	●	Calibration is advised
Estimation of the water volume	●	Calibration is advised
Estimation of the water content distribution	●	Inversion can be constrained
Estimation of the hydraulic conductivity	●	Aquifer test for calibration is advised
Estimation of the total porosity		Borehole for clay content is necessary
Geometry of the geological formation		Inversion can be constrained

What water is measured with MRS?

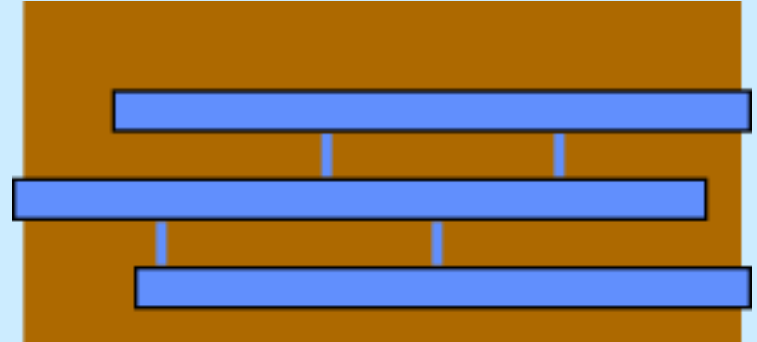


What hydraulic conductivity is measured with MRS?

MRS estimate will be accurate



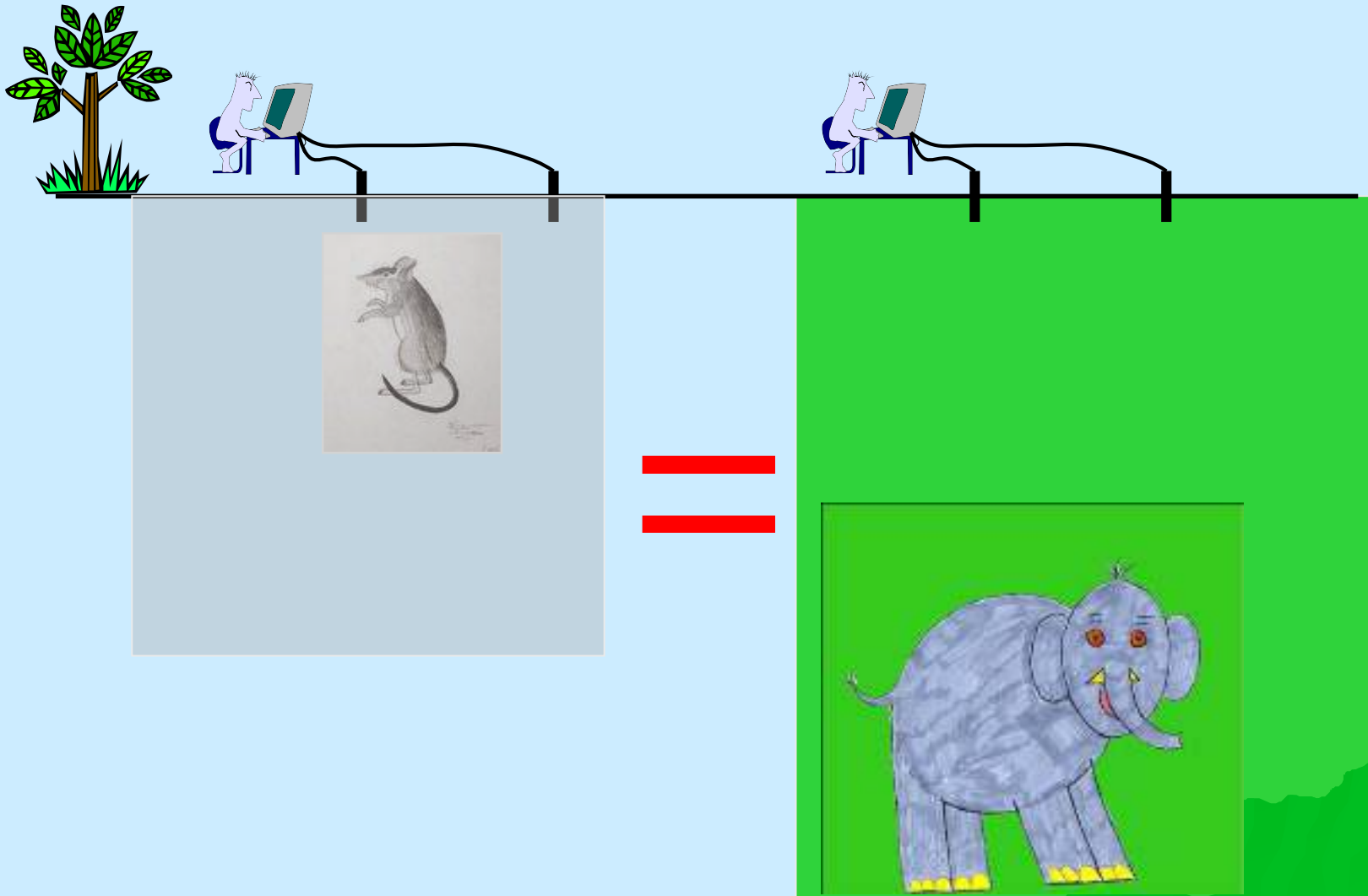
Calibration is required



Direction of water flow

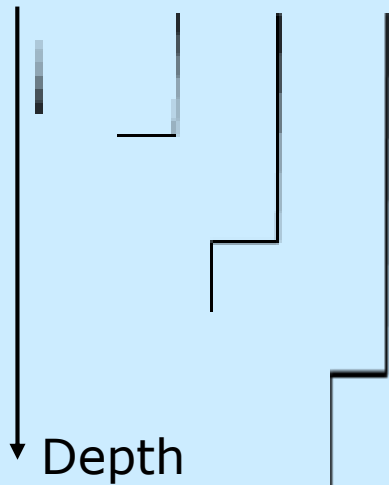


Resolution of surface geophysical methods

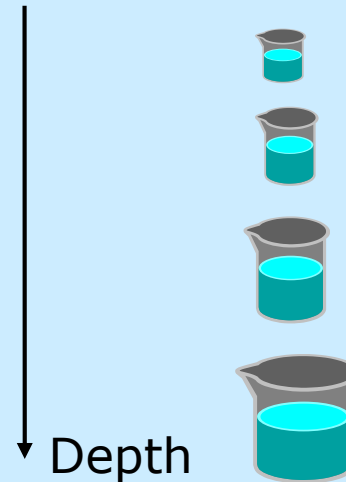


Comparison of MRS and local measurements of the water content

Local measurements



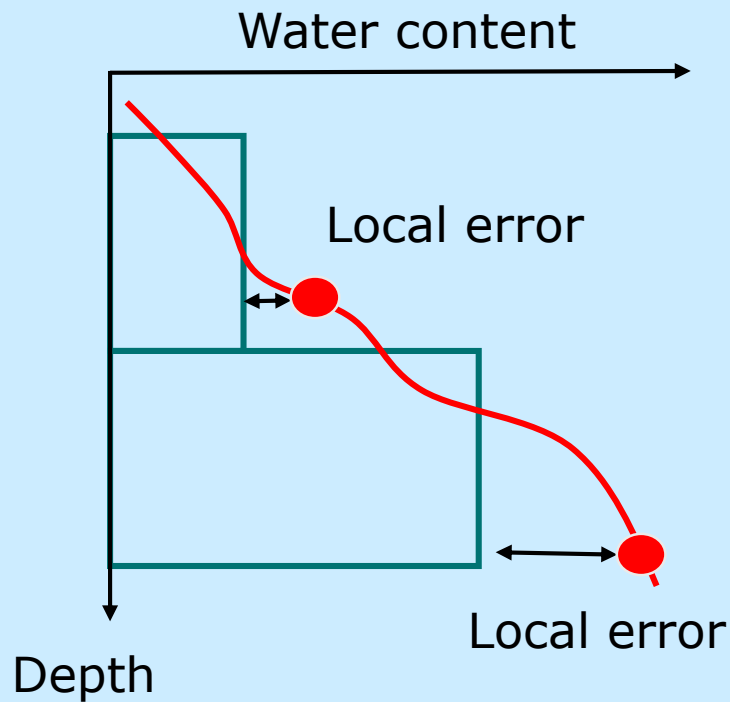
MRS measurements



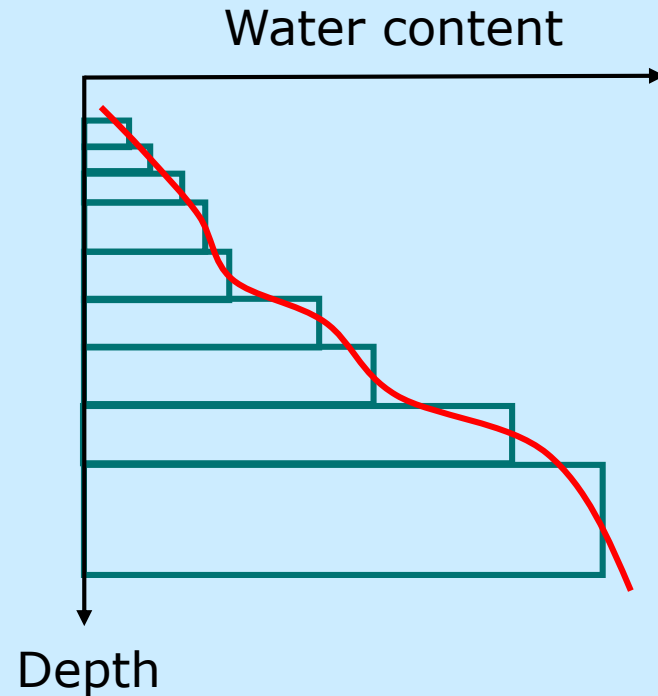
With local measurements one observes the progress of the infiltration front and MRS sees the volume of accumulated water.

Comparison of MRS and local measurements of the water content

Local measurements



MRS measurements



At larger scale local errors can be neglected and MRS provides an approximation averaged over the loop area

Equipment available for CRITEX community

Instrumentation	State	Efficiency of application
MRS at a large scale (1-D,2-D,3-D)	Operational	Proved
MRS for investigating rock samples at different scales	Working prototype	To develop
In borehole	Pre-prototype proving the feasibility	All to develop

How to use it?

Actually, only test measurements made by the development team are foreseen and the logistics of using these measurements routinely merit a serious discussion

Thank you for your attention

