TECHNISCHE UNIVERSITÄT DRESDEN

Department of Electrical- and Computerengineering Communications Laboratory
Chair for RF Engineering

SEBIMO
Microwave-based Measurement of Soil Parameters

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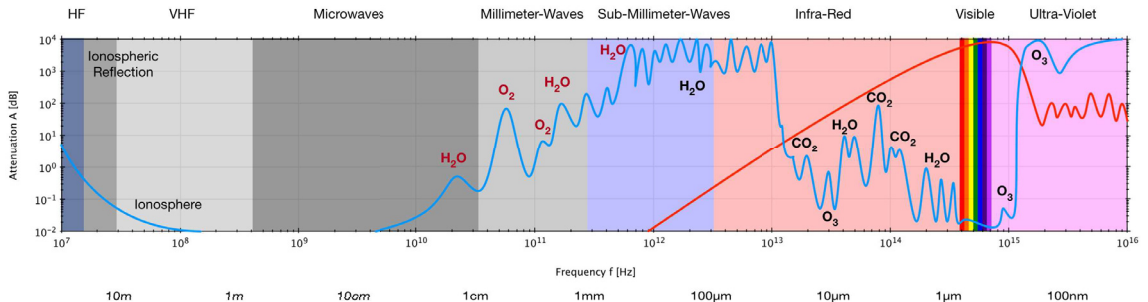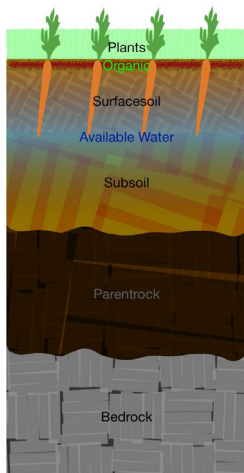
Cologne, 2017/12/09

Soil Monitoring
Measurement of Electro-Magnetic Properties

Many in-situ and non-invasive sensors are based on the measurement of electro-magnetic properties.

Soil Monitoring
Models and Relevant Parameters

Questions with regard to the soil models and measurable quantities:

Which parameters are of interest?

How can these parameters be measured?

Accuracy vs. sensitivity vs. specificity vs. frequency.

Measurement range and location?

Quantities of interest may be:

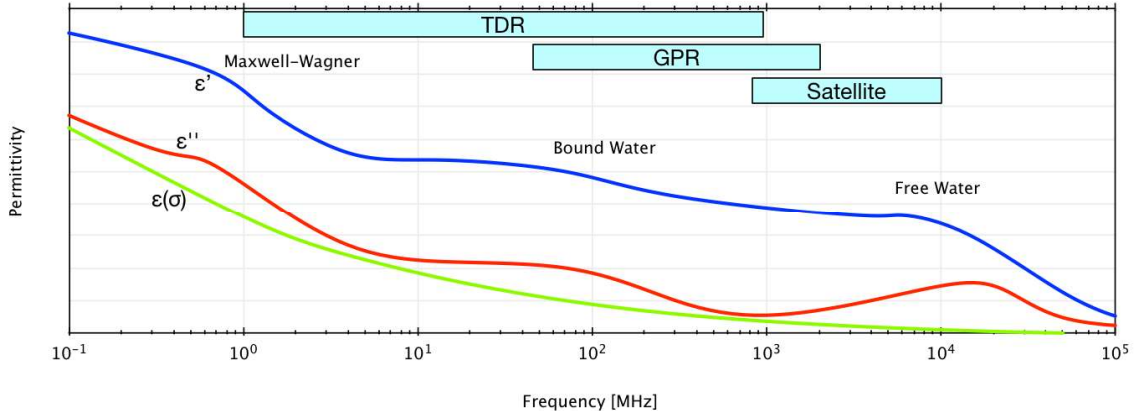Fieldcapacity.

Moisture.

Grain- and pore-sizes.

Topsoil depth.

Soil Monitoring
Measured Quantities vs. Quantities of Interest
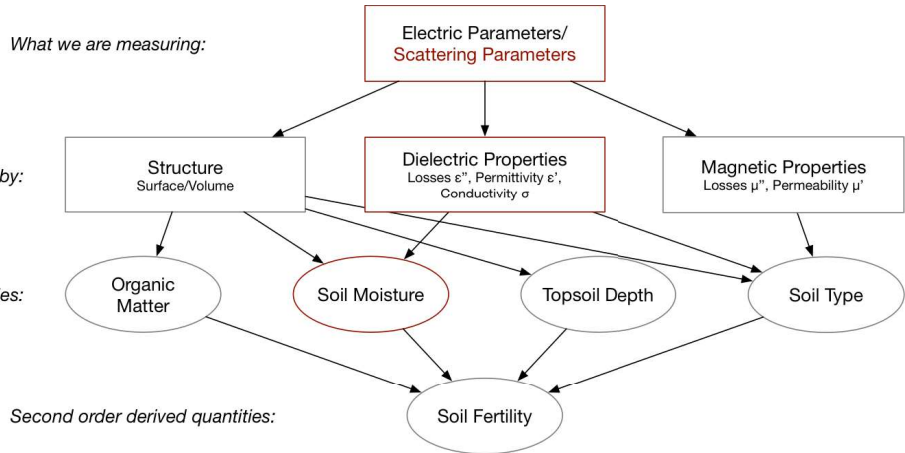
Soil Monitoring
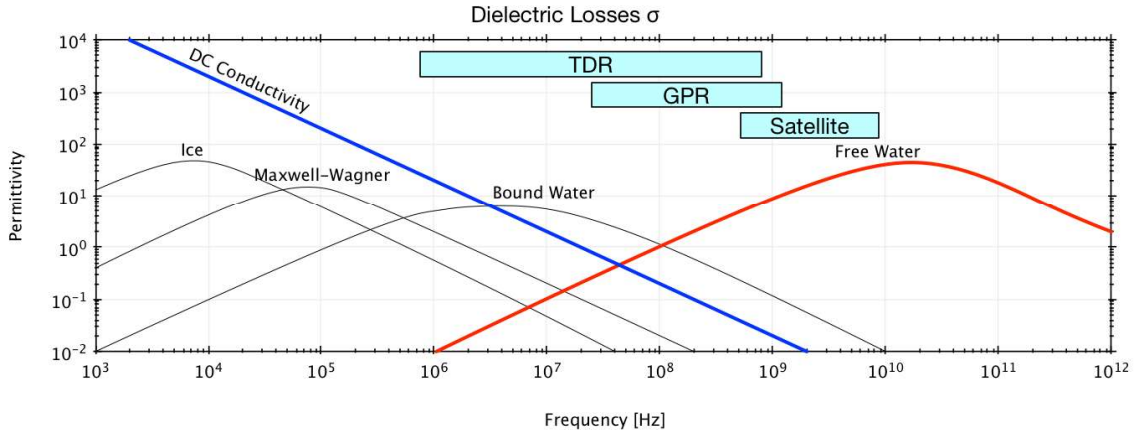### Dielectric Properties of Soils: Example

Complex frequency dependence of permittivity and conductivity in soils.

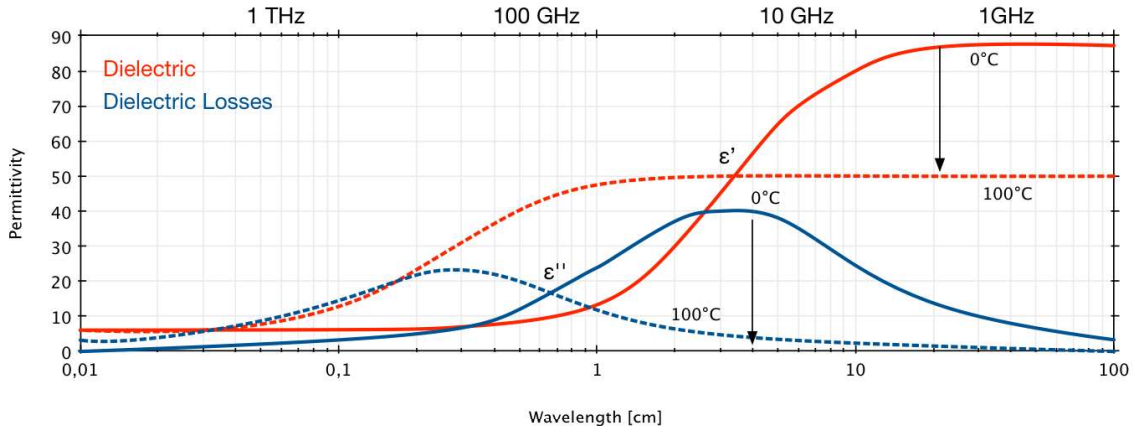With increasing frequency permittivity decreases.

Soil Monitoring
Dielectric Properties of Soils: Mechanisms

Different mechanisms are at play.
What is measured by the sensor?

Soil Monitoring
Dielectric Properties of Soils: Temperature Dependence

Permittivity of water is temperature dependent.

Soil Monitoring
Conclusions

Which parameters are of interest: elimination of cross-sensitivies using hyper-spectral approach (combine different parts of the EM spectrum: e.g. NIRS, visible, and radar in the microwave range).

Data-fusion with other measurement principles/physical quantities (e.g. Gamma-spectroscopy) can be an approach to obtain reliable results.

Sampling and TDR using a well defined setup and radar/GPR measurements are suitable measurement methods.
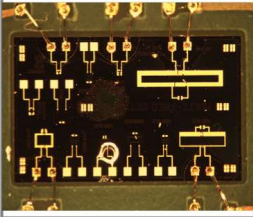
Structural parameters (measurements geometry, surface structure, roughness) have significant influence on the measured parameters and need to be accounted for.
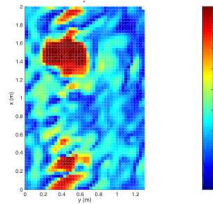
SEBIMO
Thank you for your attention!

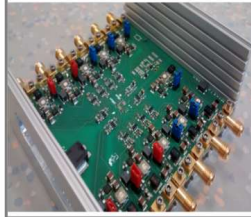| Antennas	Remote Sensing	RF Systems	Microwave Photonics
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