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Vertical seismoelectric profiling - dependence on hydrogeological parameters

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Seismic compressional waves can cause electric and electromagnetic signals in porous saturated media via electrokinetic coupling. These seismoelectric signals are created by a relative flow between pore fluid and rock matrix and could provide valuable hydrogeophysical information.

As the validity of the current seismoelectric theory has not been sufficiently proved in field, it is difficult to use the seismoelectric technique to determine any parameters from field measurements. Since according to theory, seismoelectric signals depend on a lot of parameters, e.g. porosity, zeta potential, viscosity etc., it is important to study which of them actually influence the seismoelectric amplitudes under real field conditions and how strongly they do so.

We compare borehole seismoelectric, seismic, resistivity, pH, and porosity data from the Segeberg Forest (Northern Germany) and observe a strong dependence of the seismoelectric amplitude on the pH value. The seismoelectric amplitudes are not or only very weakly dependent on dipole length which has been reported ambiguously in literature up to now. There also seems to be a dependence on porosity but the error bars are rather large. The results are interesting because the electrical resistivity does not seem to have the strongest impact on the seismoelectric signals but the pH value via the zeta potential. Seismoelectric data which we collected in forests generally have quite bad data quality. The low pH commonly found in coniferous forests could have contributed to this.