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Evaluating surface GPR measurements on a layered soil model using a ray path approach and the full solution of Maxwell's equations

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A 20m x 4m x 2m sand tank with multiple horizontal and inclined layer-boundaries was constructed and instrumented with TDR probes. The tank is subject to atmospheric forcing.
Multi-channel GPR measurements were performed periodically and analyzed with (i) a ray path approach and (ii) the full solution of Maxwell's equation. The performance of these inversive evaluation methods is investigated by direct comparison to the in-situ measurements.
We find that the ray path method performs well for sufficiently simple geometric settings but fails for more complicated architectures. We discuss and demonstrate how the latter can be handled with the full Maxwell solution.