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Time-domain CSEM modelling

using frequency- and Laplace-domain computations

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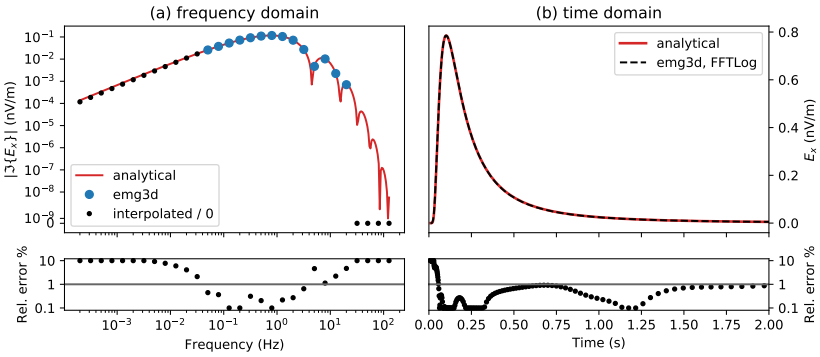
Time-domain modelling with a frequency-domain code

⇒ (1) Frequency selection (2) Gridding ⇐

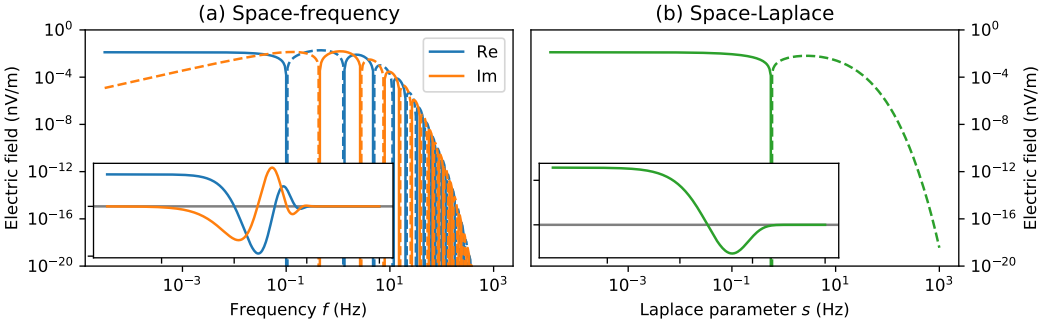


Werthmüller et al., 2021, *Fast Fourier transform of electromagnetic data for computationally expensive kernels*, GJI; DOI: 10.1093/gji/ggab171.

Laplace-domain computation

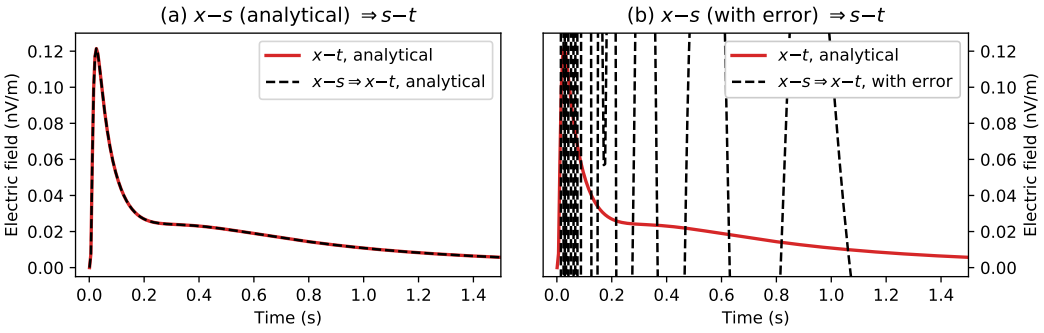
$$\mathrm{i}\omega \to s: \qquad s\sigma\mathbf{E} \;+\; \nabla \times \mu^{-1}\nabla \times \mathbf{E} \;=\; -s\mathbf{J}_{\mathrm{s}}$$

$\Rightarrow$ Faster (1) Computation (2) Convergence $\Leftarrow$



Laplace-to-time domain transformations

1. Design digital linear filters for the transform
2. Carry out transform for semi-analytical (layered) responses
3. Test stability



ePoster – Outlook

- Time-domain modelling with a frequency-domain code:
  15–25 frequencies are usually enough
- Laplace-domain computation
- Laplace-to-time domain transformation
- Laplace-to-frequency domain transformation

Used open-source codes:
`empymod` (layered models) & `emg3d` (3D models), see emsig.xyz.