The Speed of Heat
in collaboration with Alliander

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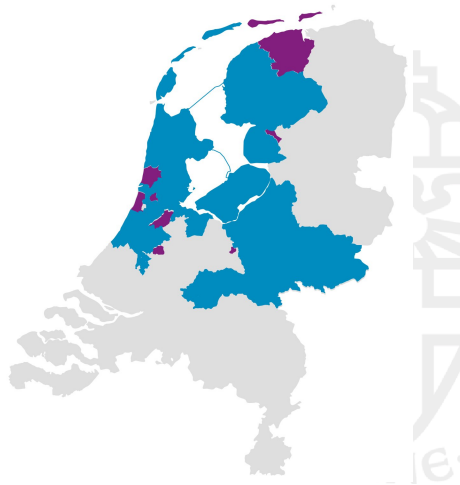
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12th April 2022

About Alliander

- Liander: distribution network operator (DNO)
  - Active in 5 provinces $\rightarrow$
- Qirion: high voltage network

Smart Cable Guard

$$T_{\text{cable}} = CI^2 + T_{\text{ground}}$$

$$T_{\text{cable}} = \alpha_1 P(t) + \alpha_0$$

Research question

1. In cases where the load on the cable is sufficiently low, we can assume that the cable is always at soil temperature. In particular the correlation between soil temperature and propagation time will be very high. How can we recognize such cases quickly?

2. Suppose we assume a very simple model for cable temperature, for example $T_{\text{cable}}(t) = CP(t) + T_{\text{soil}}$ where $I(t)$ is the current through the cable and C is a constant. What can you say about the error (bias and variance) of this model? Is this model realistic? Can you propose an improvement?

3. Can you propose a method to estimate the model uncertainty of the temperature estimate? A method that seems promising is Bayesian linear regression, which yields a confidence interval around models estimates.

4. Smart Cable Guard measures noise, expressed as a sensitivity time series. This is likely to affect the accuracy of the propagation time measurement. Can you show this from the data? How does the error $\varepsilon(t)$ depend on the sensitivity?

Our progress so far: question 3

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