Can we measure evaporation using commercial microwave links?

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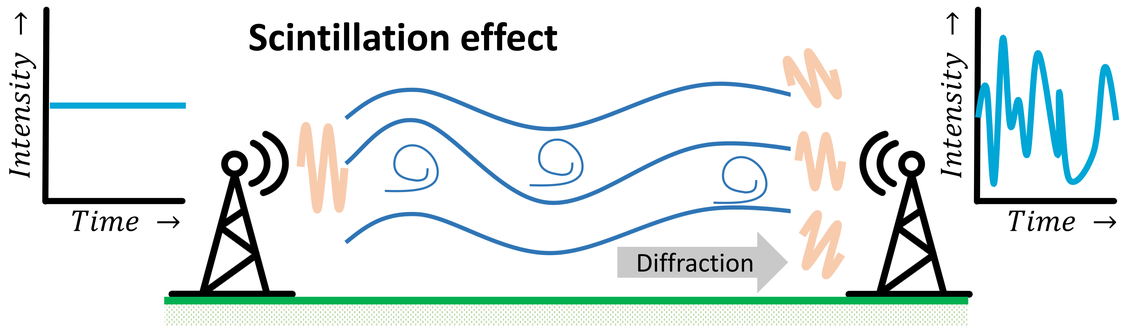
OSPP:

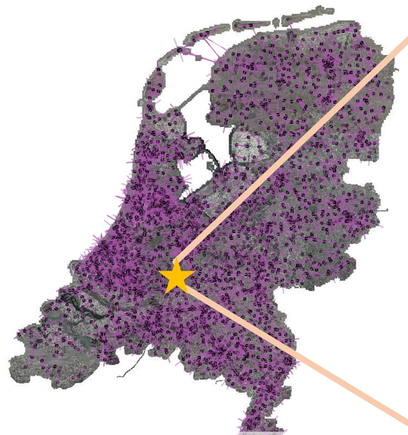
Motivation

- Signals transmitted by microwave links are perturbed by turbulence, causing refractive index fluctuations, known as **scintillation effect**.
- Purpose-built microwave links, called **scintillometers**, capture the **full spectral range of the signal intensity fluctuations** (~0.1 – 100 s) caused by the scintillation effect. These fluctuations can be linked to **evaporation**: e.g., Kohsiek and Herben (1983), Green et al. (2001), Meijninger et al. (2002), Leijnse et al. (2007), Foken et al., (2021).
- Signals between **commercial microwave links** (CMLs), employed in telecom networks, are also affected by the scintillation effect.

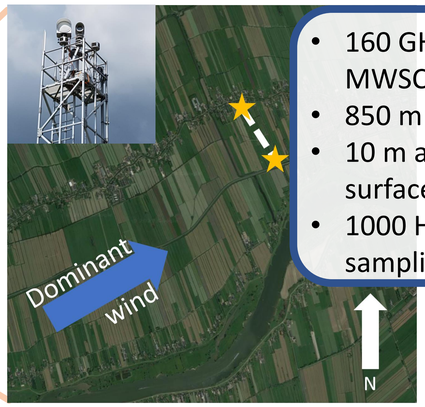
How do we go from commercial microwave link data to evaporation?



CML stations around the world



Study site and T-Mobile NL CML network in the Netherlands. ©Antennekaart.nl



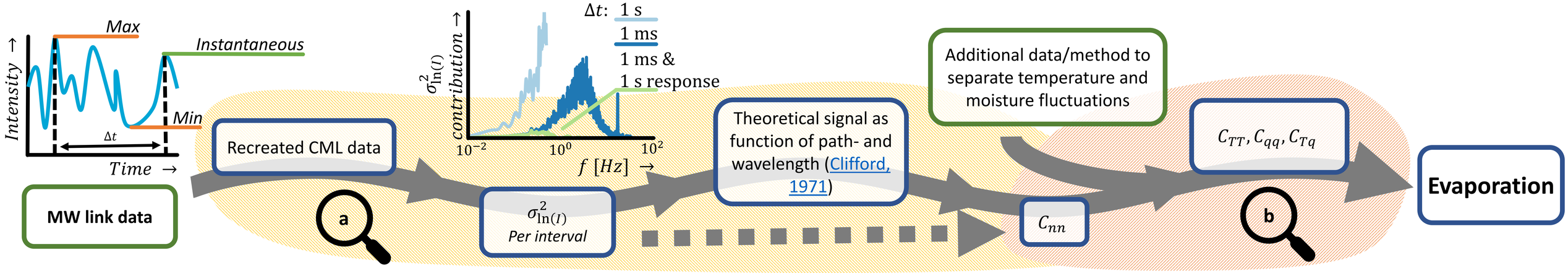
MW scintillometer path at the Ruisdael Observatory, Cabauw, the Netherlands

- 160 GHz RPG MWSC
- 850 m path
- 10 m above surface
- 1000 Hz sampling

Any suggestions? Take a sticky note!

Download this poster (incl. URLs) here!

Want to reach out? Send me an email: l.d.vandervalk@tudelft.nl



a) How to obtain C_{nn} using commercial microwave link data?

CMLs are usually sampled at **too low temporal resolution and don't have fast enough response times** to capture all the relevant scintillation fluctuations and directly obtain **the required structure parameter of the refractive index, C_{nn}**. Typical observations of the received signal intensity are:

- Minimum and maximum per 15 min
- Instantaneous sampling up to 1 s

b) How to obtain C_{TT} & C_{qq} from C_{nn}?

C_{nn} is **affected** by both **temperature** *(C_{TT})* and **moisture** *(C_{qq})* fluctuations. Therefore, we need to separate this with the help of other **data sources or methods**. In scintillometry, this usually is a large aperture scintillometer, sensitive to C_{TT} (e.g., Meijninger et al., 2002).
At Cabauw, a lot of meteorological data is available, but this does not hold for all CMLs.

Data minimally required: ***u, T, q*** Examples: PWS, ECMWF