Multi-point monitoring of nitrous oxide emissions and aeration efficiency in a full-scale conventional activated sludge tank

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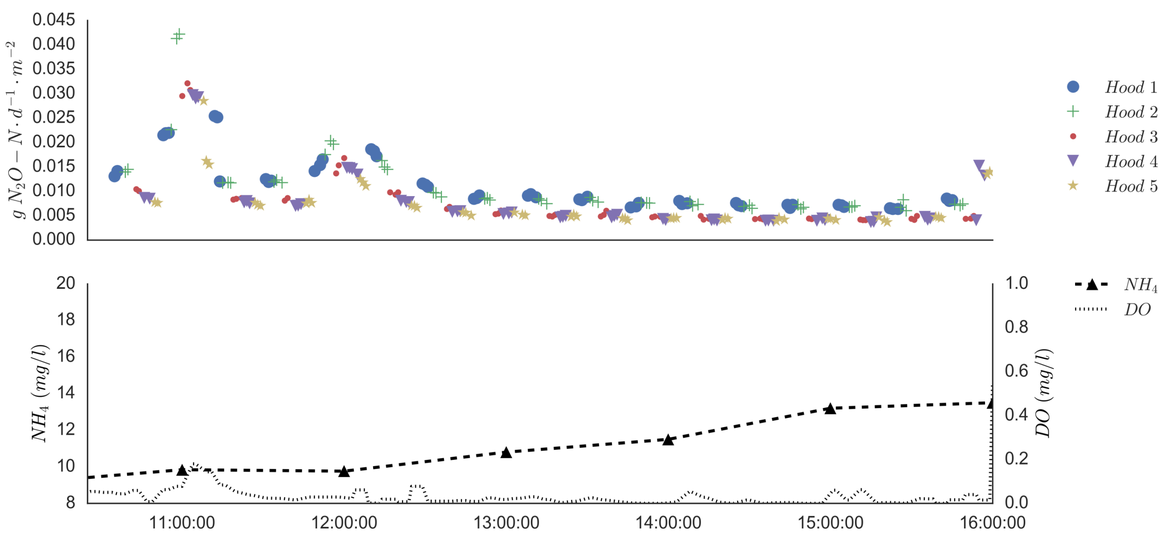
Introduction

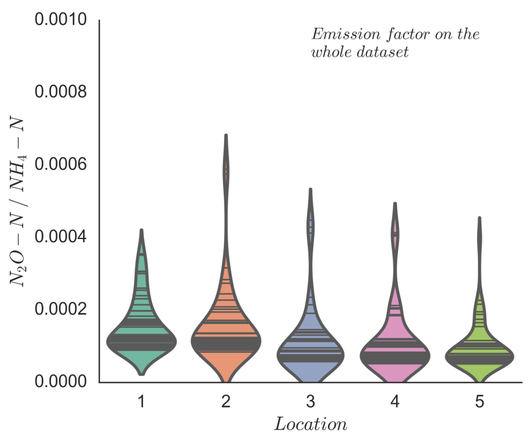
N_2O is a potent greenhouse gas (GHG) that can be produced during biological N removal. In WRRFs using activated sludge (AS) technology it can represent by itself 78% of the plant carbon footprint (CFP). However, emissions have high spatial and temporal variability (due to mixing problems and influent dynamics).

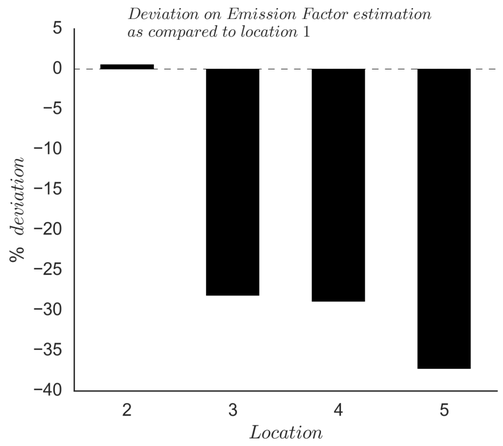
Aeration efficiency can account for up to 50% of the plant CFP. Assessment of aeration performances needs careful planning and the generally accepted 2% coverage not always

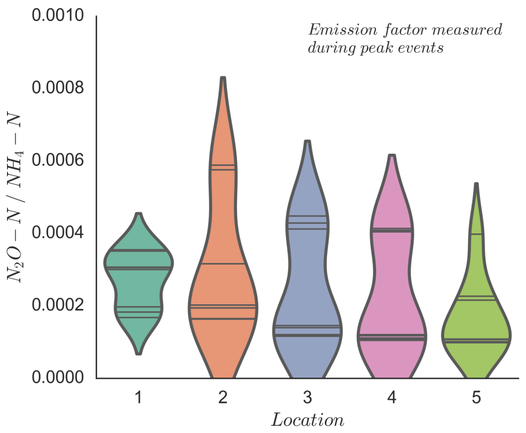
A proper spatial and temporal coverage of the tank is needed for a reliable assessment of emissions and aerators performances.

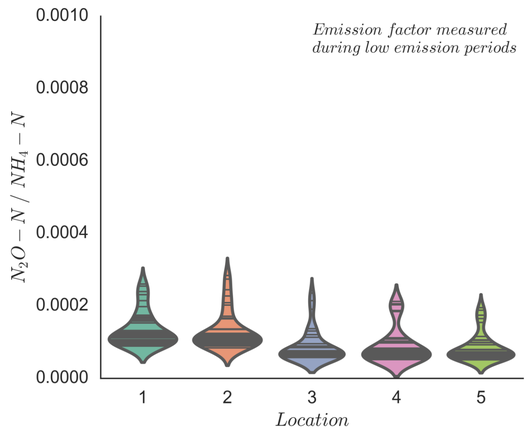
N_2O emissions







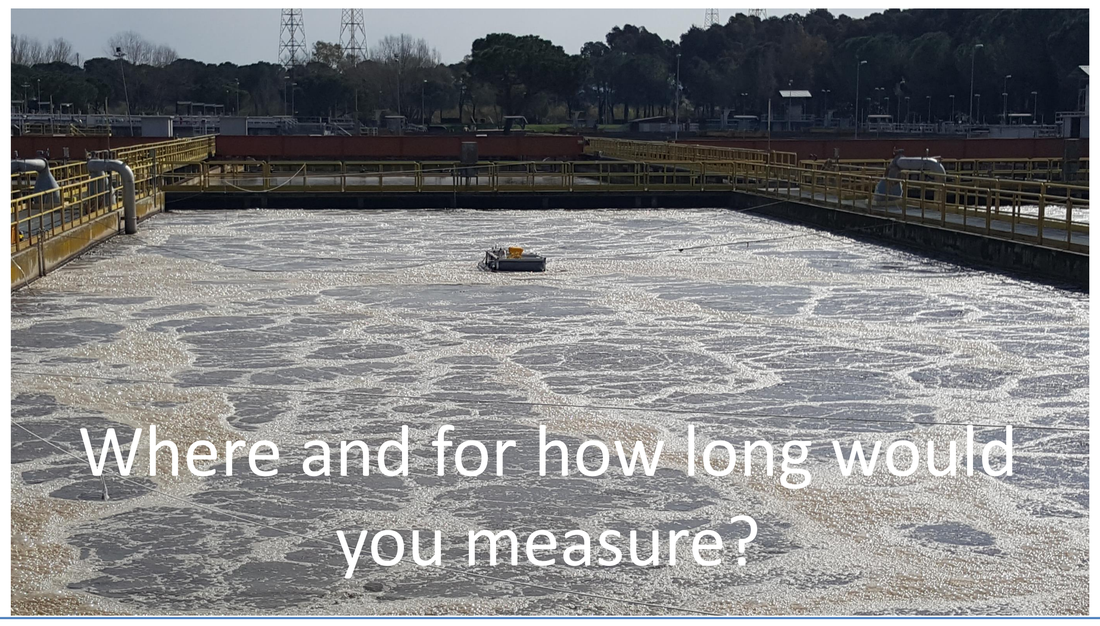




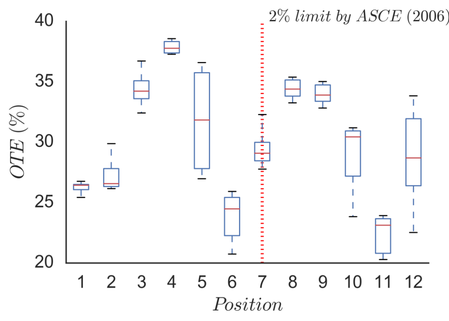
Full-scale measurements

N_2O was measured with an IR analyzer using 5 hoods in parallel to understand spatial and temporal dynamics and their effect on the emission factor.

Aeration efficiency was measured using an off-gas analyzer and a floating hood positioned to cover 3.4% of the area of the tank

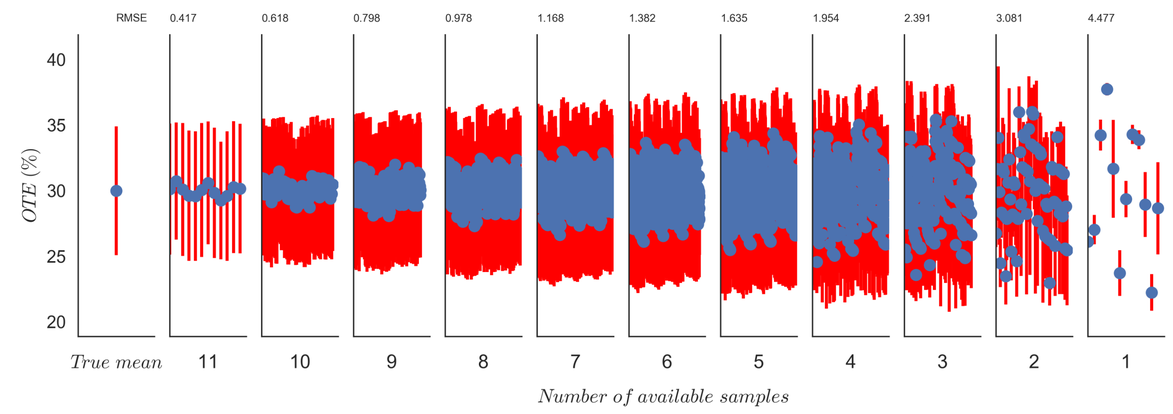


Aeration efficiency



While measuring on each location there is local and temporal variability playing a role on efficiency values.

Increasing the number of samples drops the uncertainty around the *true mean* of more than ±5% in OTE



Conclusions

- The measurement strategy plays an important role on N_2O emission and aeration efficiency assessment. Both the spatial and temporal variability of the plant need to be taken into account.
- Current general guidelines need to be adjusted according to available knowledge.
- Plant-specific and dedicated strategies must be defined for each different plant.

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