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# Sound propagation from wind turbines under various weather conditions

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# Outline

- Human response to wind turbine noise
- Sound propagation effects
- Results
  - Long time measurements
  - Comparison with SEPA sound propagation model
  - Amplitude modulation
- Conclusions

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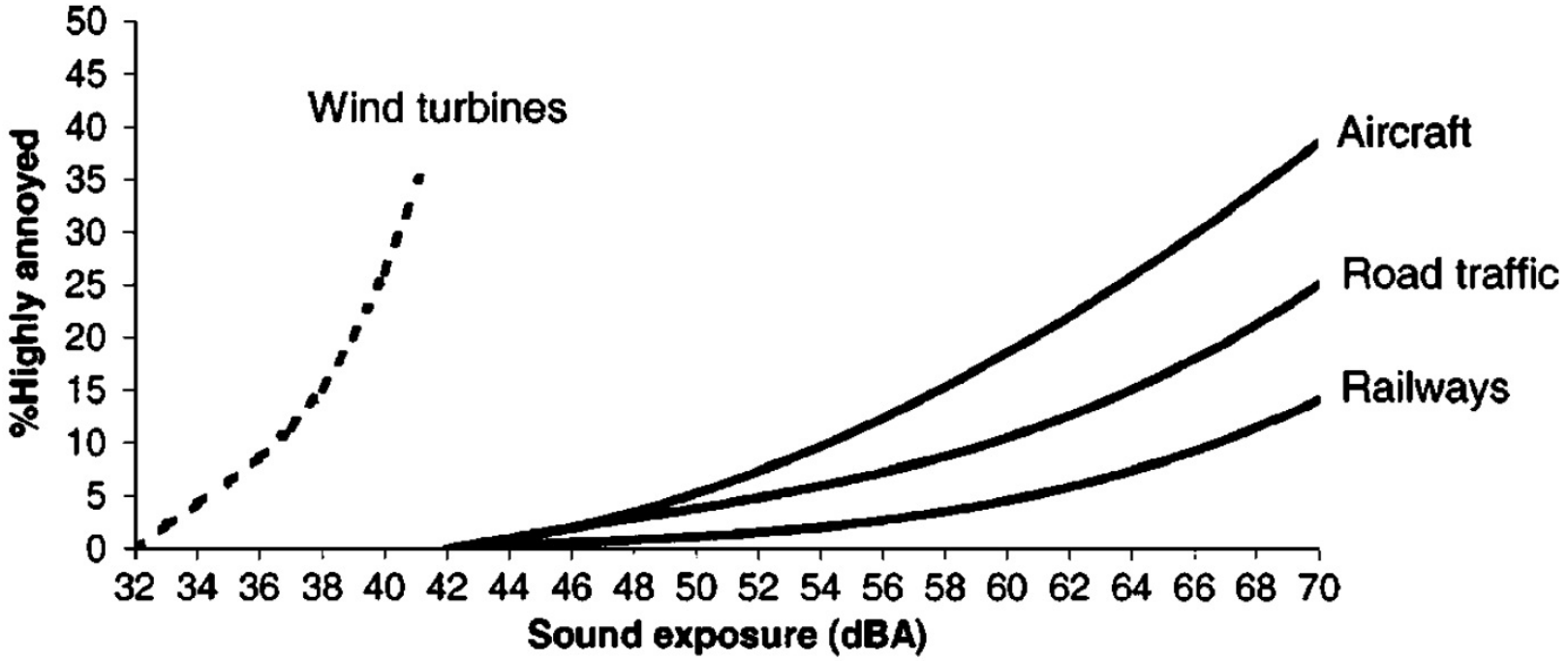
# Human response to wind turbine noise




Pedersen,Persson Waye 2004

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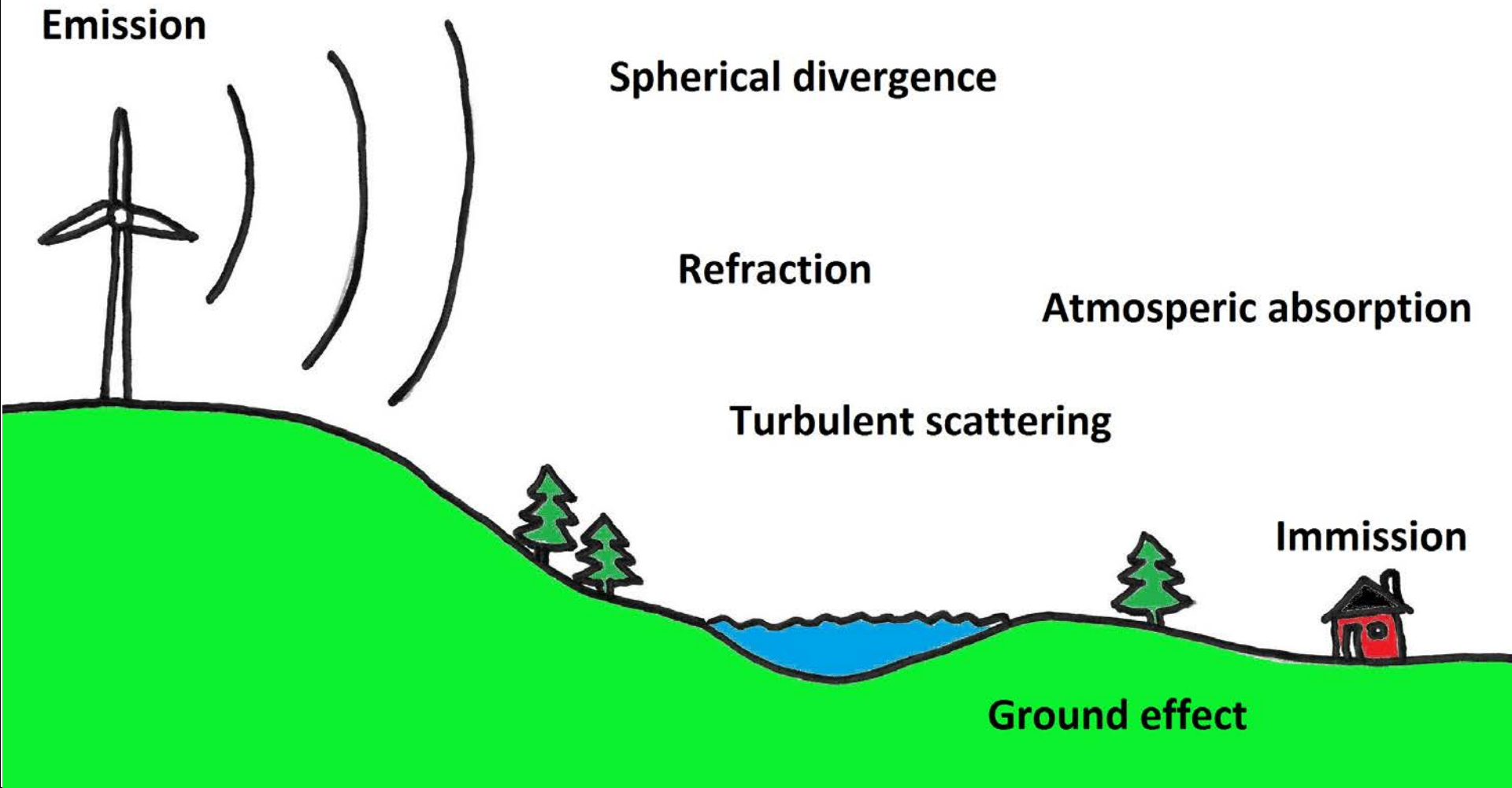
# Sound propagation effects



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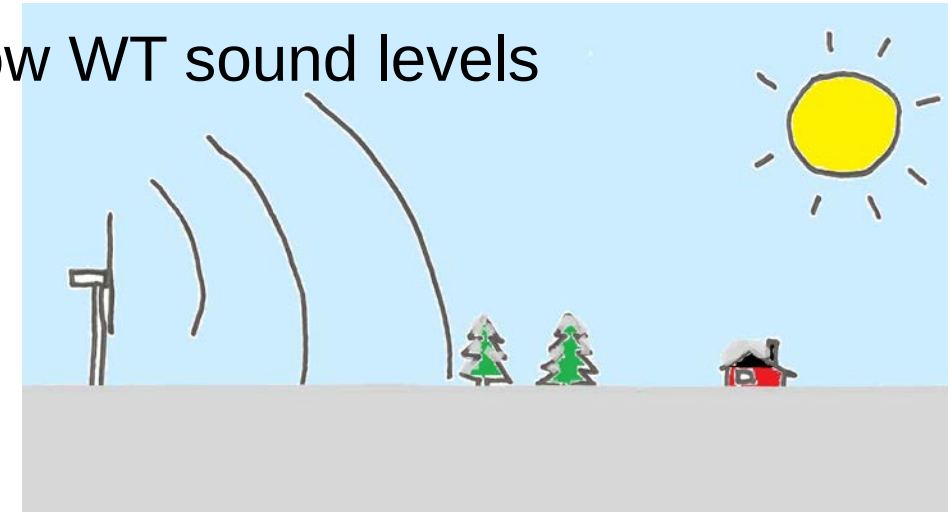
# Sound propagation effects

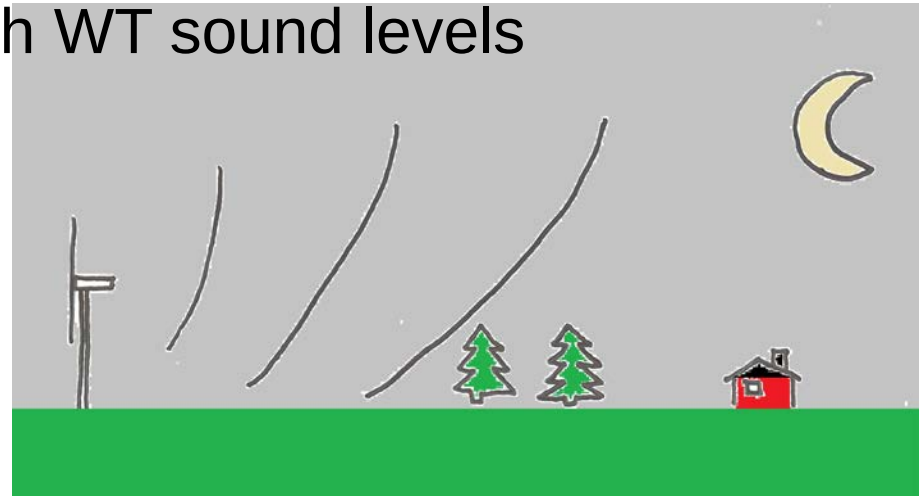
Low WT sound levels

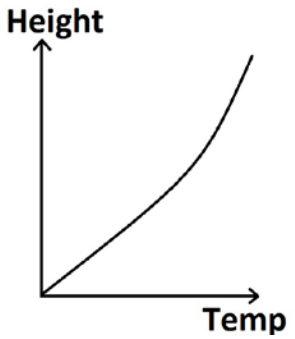


Wind

High WT sound levels

Wind





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# Measurement sites


Site Ryningsnäs

2 WTs

~ 400 m


Site Dragaliden

12 WTs

~ 1200 m

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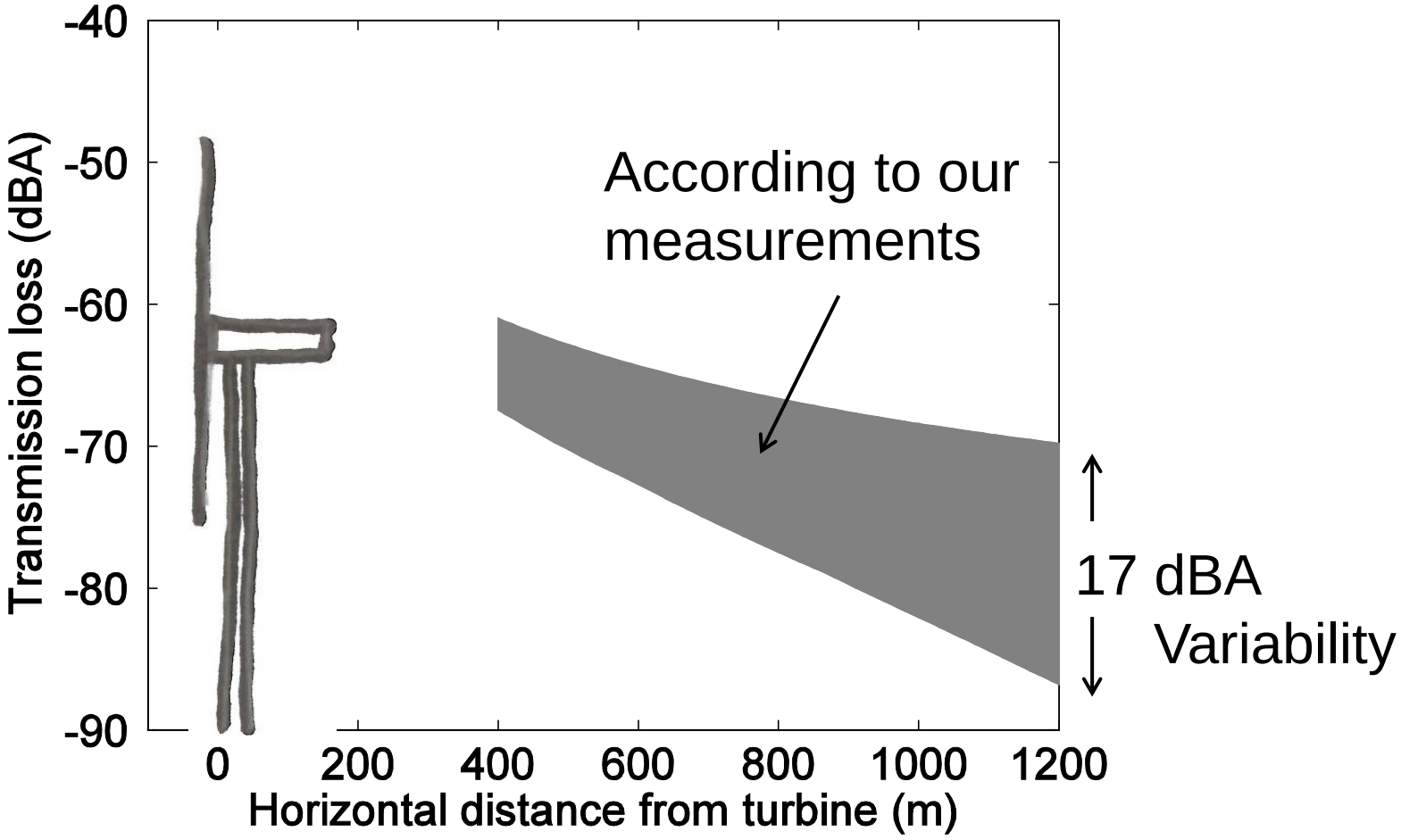
# Results – Long time measurements



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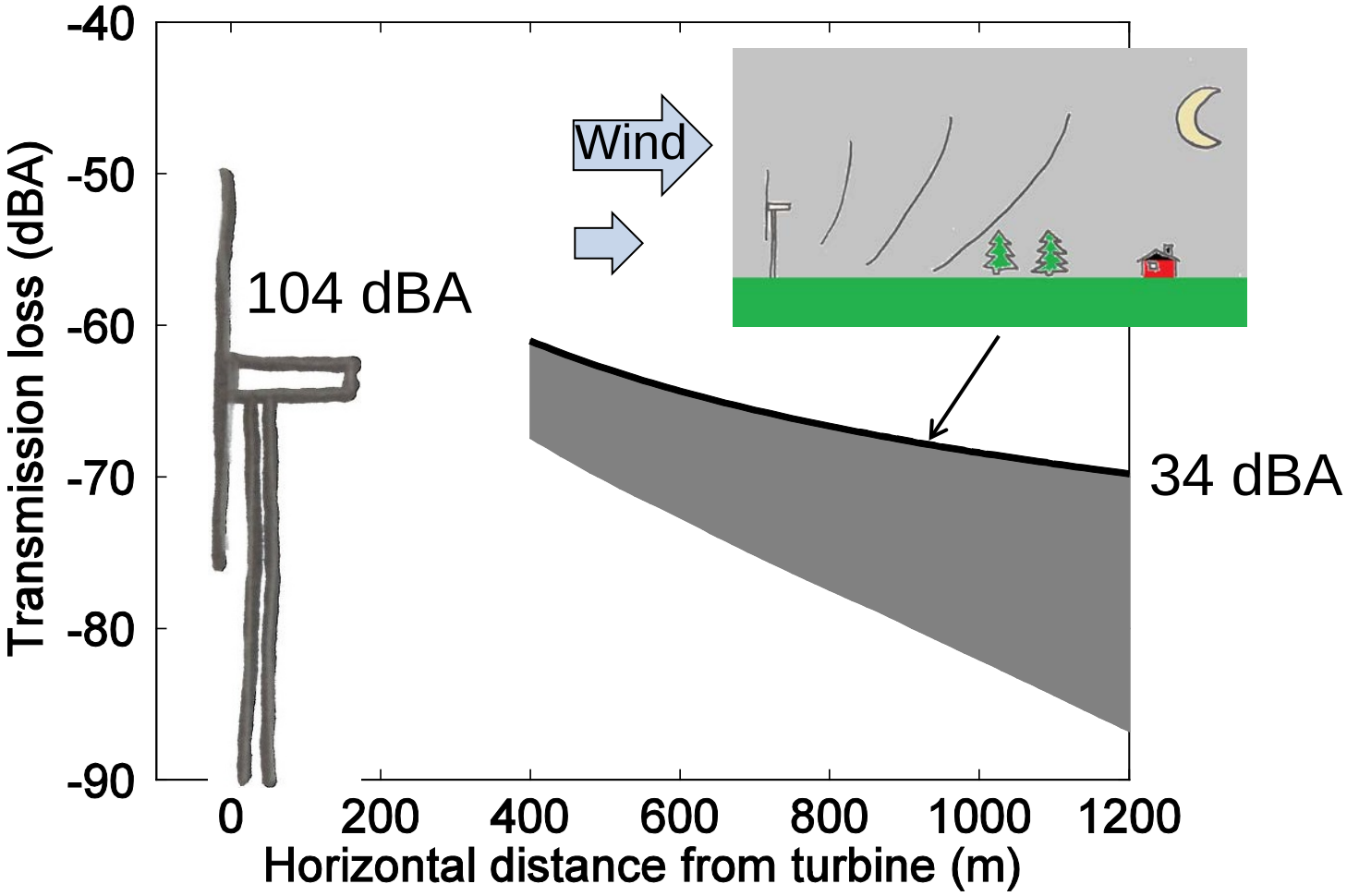

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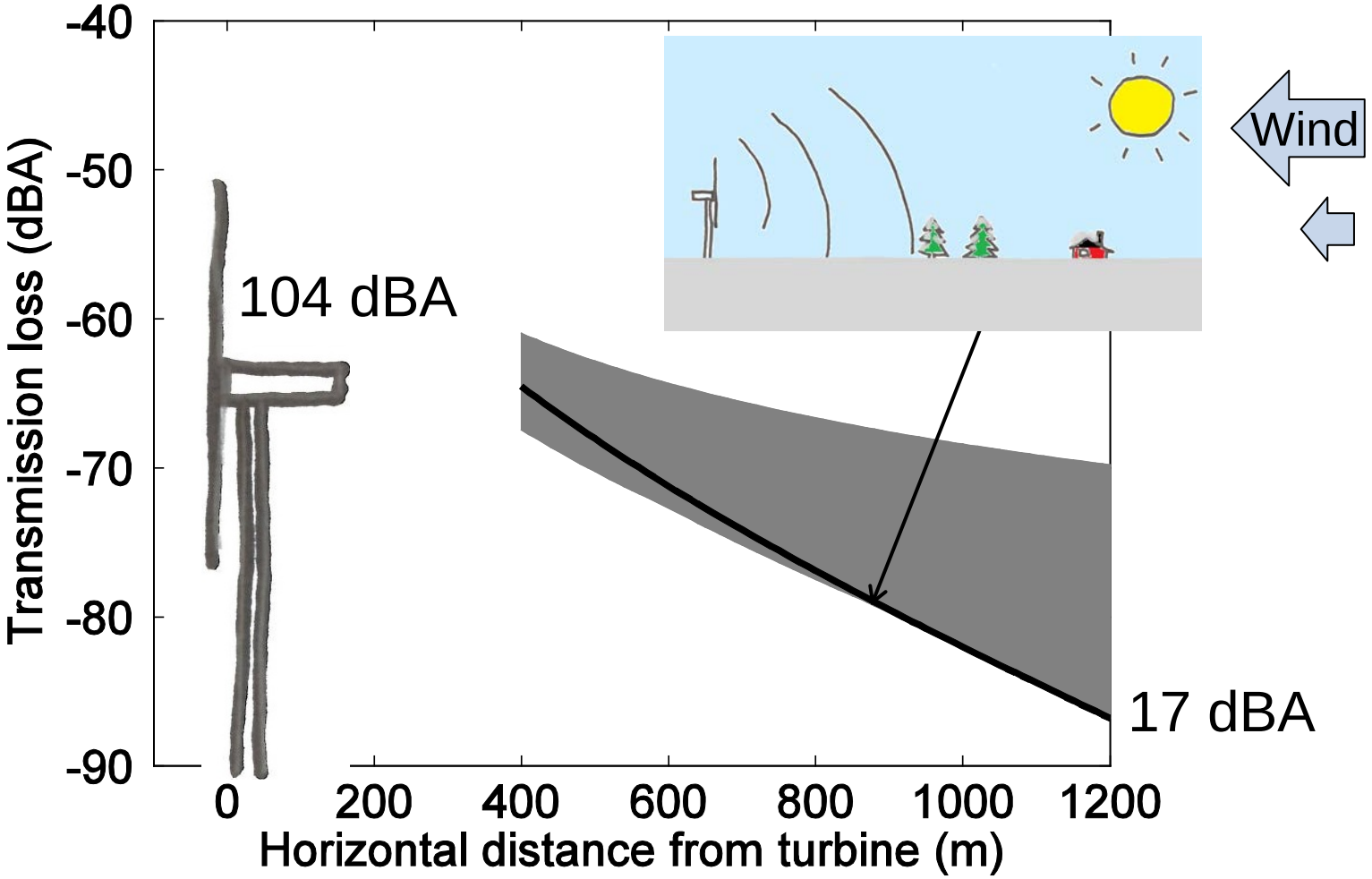

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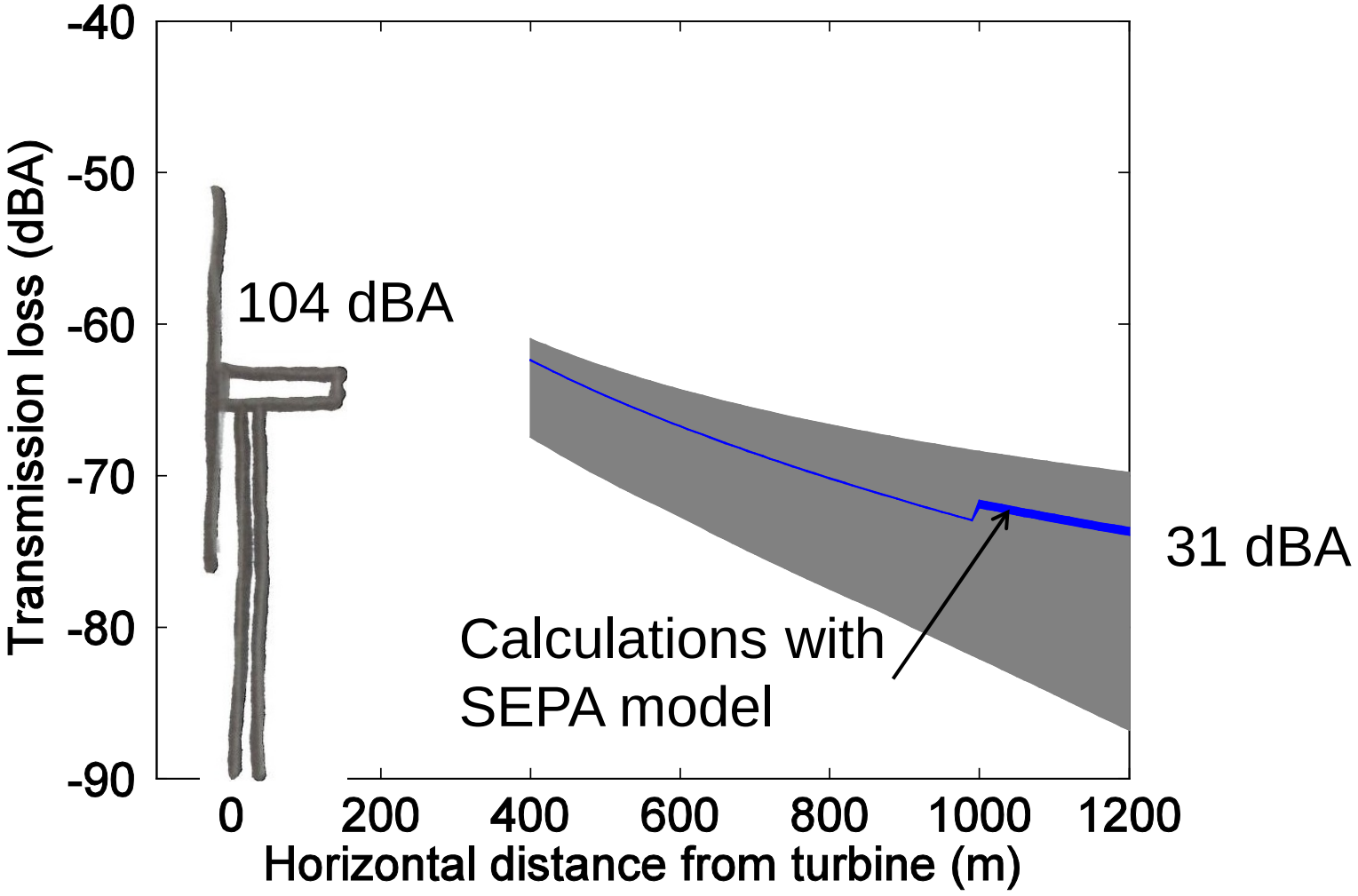
# Comparison with SEPA model



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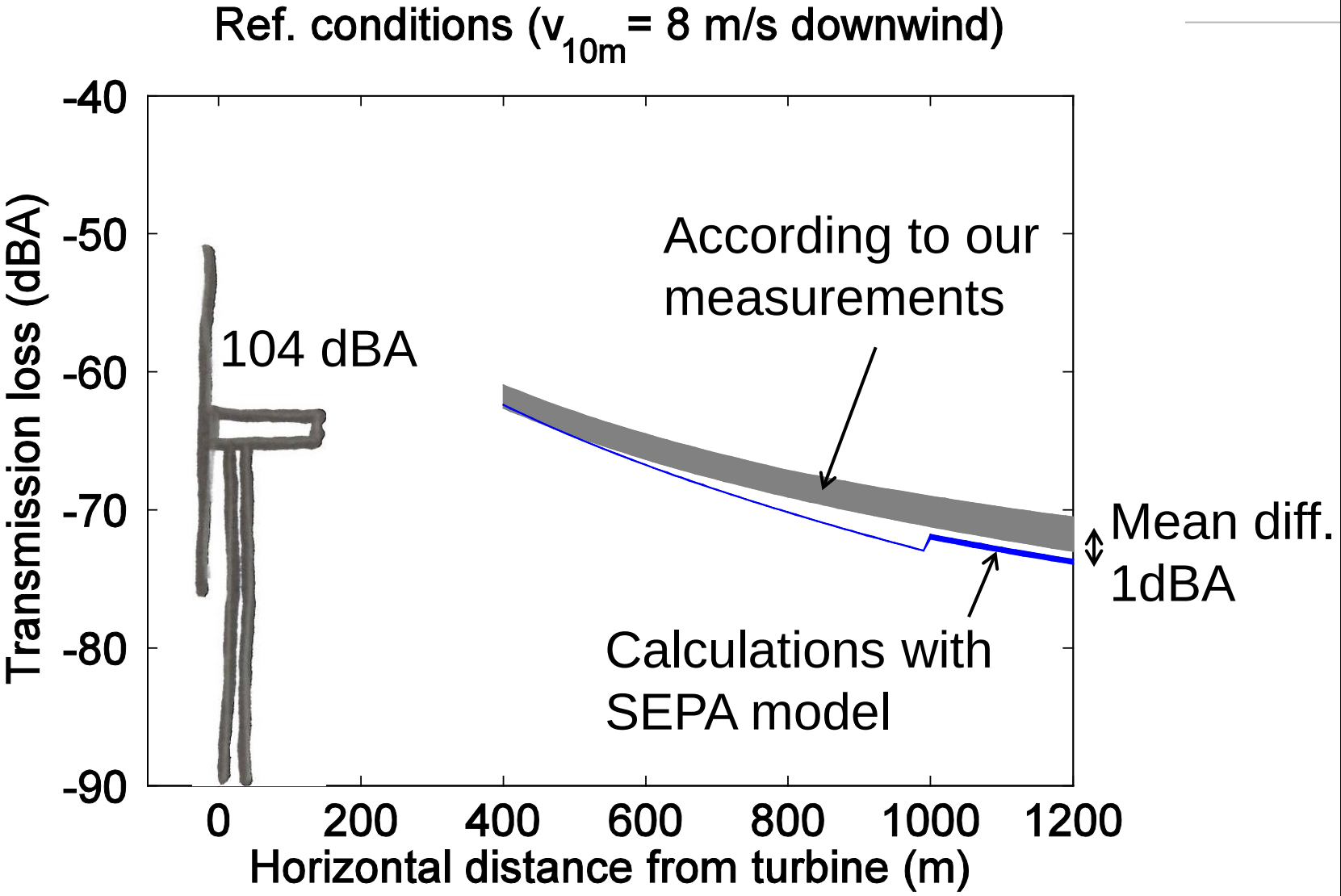

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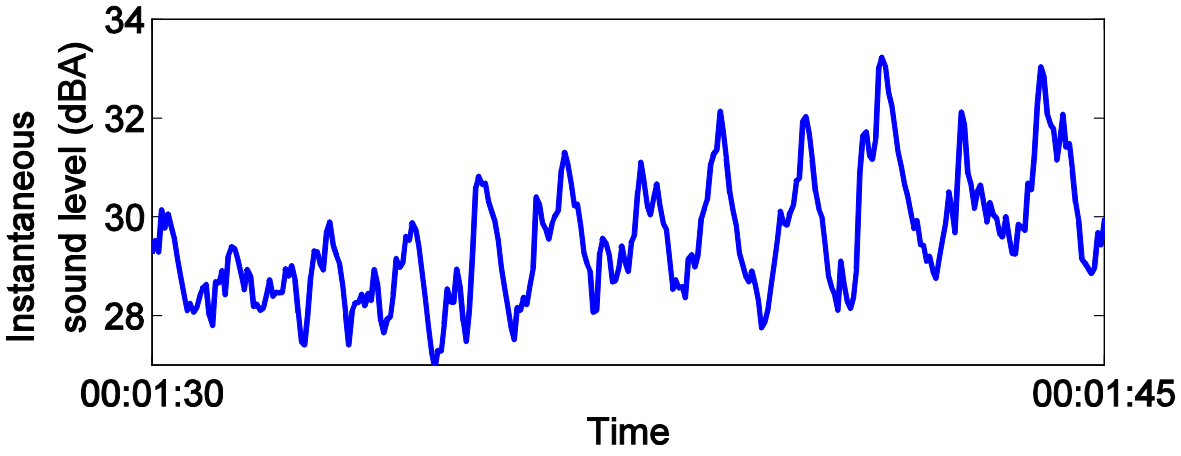
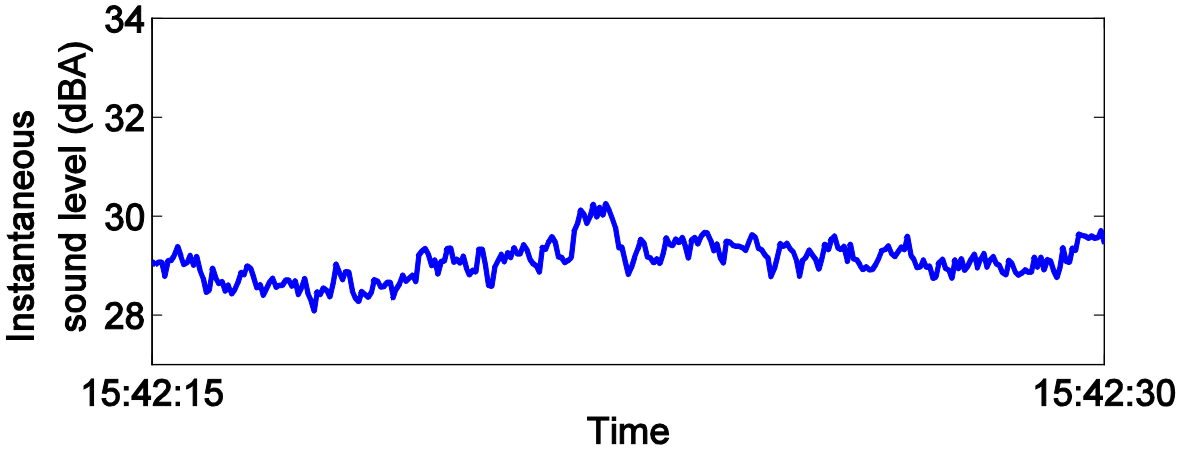
# Amplitude modulation (AM)

Night
AM




Day
No AM



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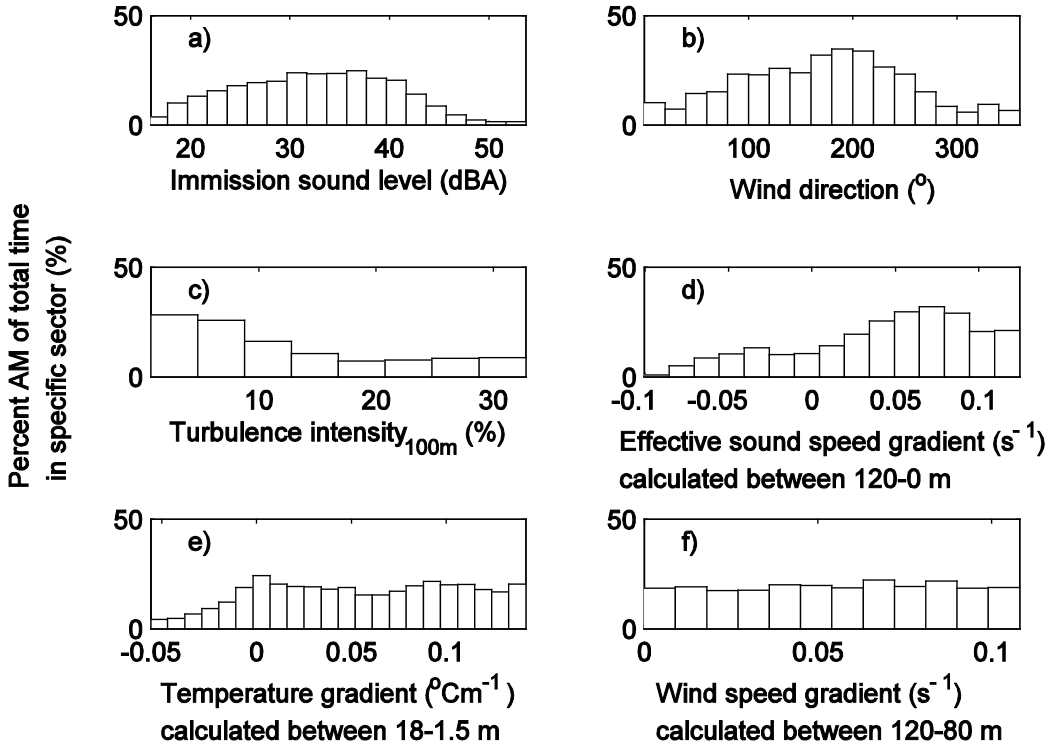
# Results – AM during 1 year

Propagation distance ~ 1200 m




AM more common during specific meteorological conditions!

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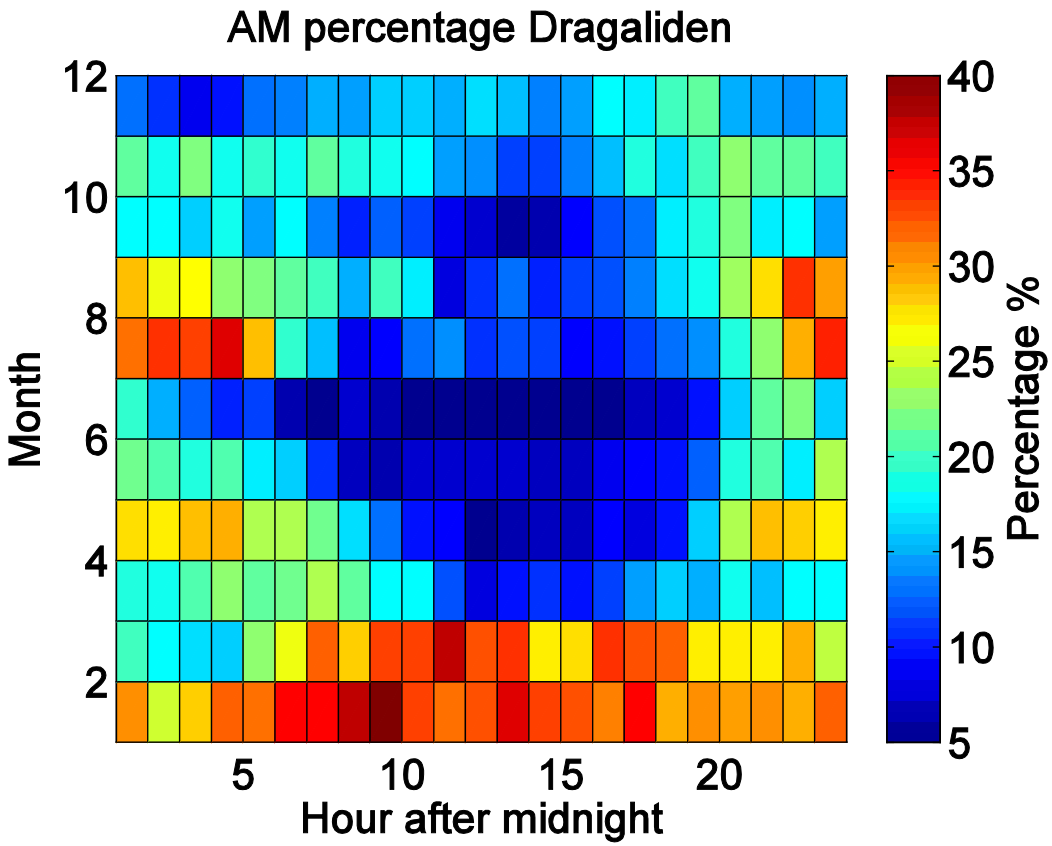


AM more common during specific meteorological conditions

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# Conclusions

- Weather conditions can give a 15 dBA variability in an expected WT sound level
- SEPA sound propagation model underestimates the ”worst case” SPL with some dB.
- AM may increase annoyance and is more common during evenings and nights
  - Detected 20 % - 30 % of total time WTs operating depending on distance