

Measuring and Modelling Noise Emissions of Tidal Turbines

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28th April 2016, <http://tethys.pnnl.gov/>

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Noise emissions of tidal turbines

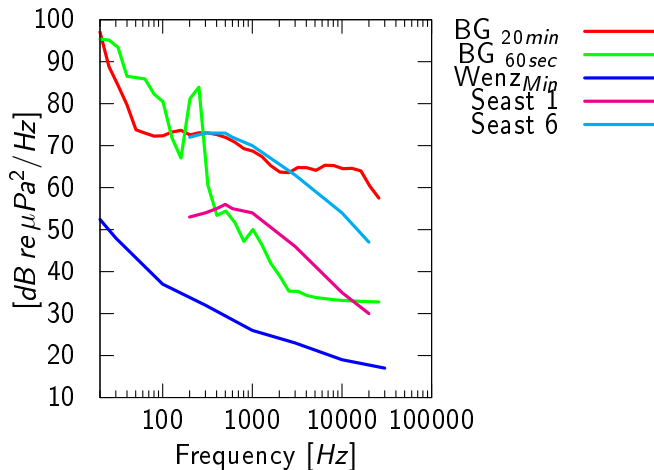
- Noise emissions are an important aspect of environmental impact assessment studies
- Must be assessed in the context of natural background noise, considerable uncertainty!
- Effect on flora: Evasion of device? Loss of habitat? Change of migration paths? Health?

Example: Schottel IST@ QUB

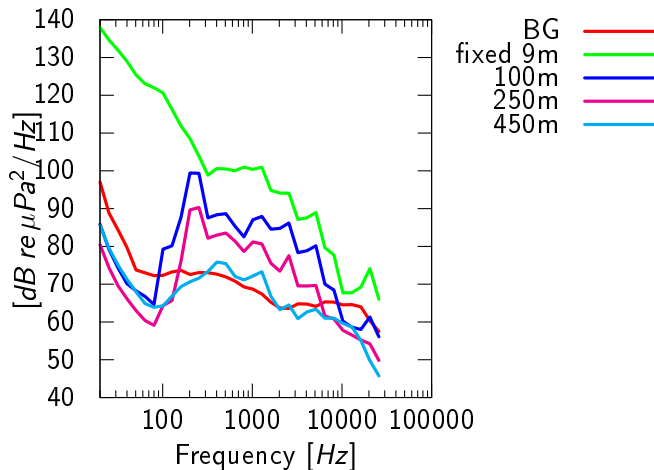
Environmental conditions:

- Hub depth 3.4m
- Seabed: boulders on bedrock base layer
- Sea state: 1-0

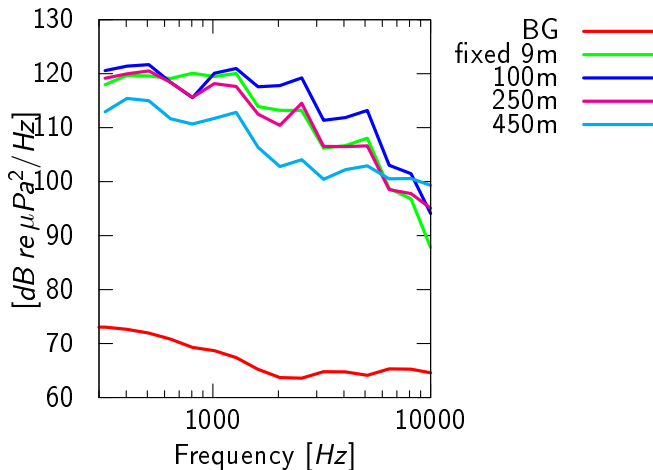
Ambient Noise Levels



Turbine Noise



Turbine Noise @ 1m



Environmental noise in tidal channels

Location	Depth [m]	Flow velocity [m/s]	PSD dB
Strangford Lough	20-60	4	65-73
Shapinsay Sound	25-70	4	95-127
Puget Sound	65	3	80-90

Noise Level estimates/measurments of tidal turbine (prototypes?)

- Schottel, Strangford Lough, 120dB @ 1 m
- MCT, Bristol Channel, 166dB @ 1 m
- Verdant Power, 145dB @ 1 m, broken blades?
- OpenHydro, 159dB @ 1m ???

Numerical Model

$$RL = SL - TL \quad (1)$$

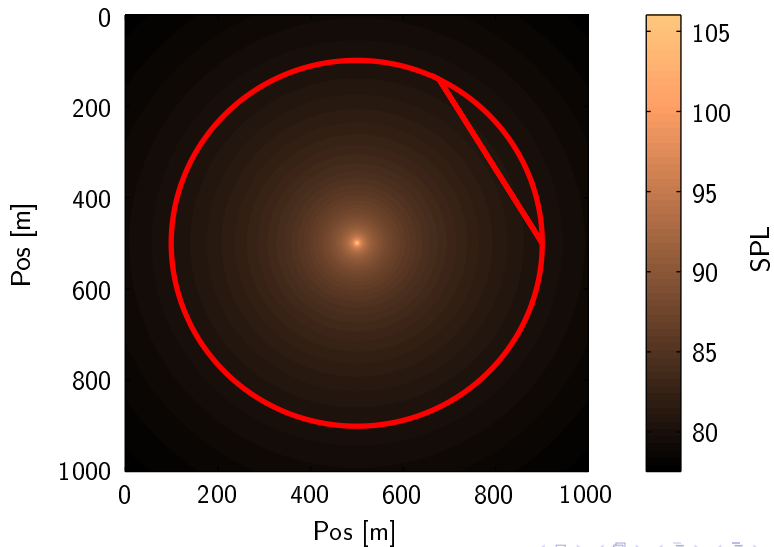
$$TL = 20 \log_{10}(D) + 10 \log_{10}(range) - 10 \log_{10}(D) \quad (2)$$

$$SPL_{Comb} = 10 \log_{10} \sum 10^{\frac{SPL}{10}} \quad (3)$$

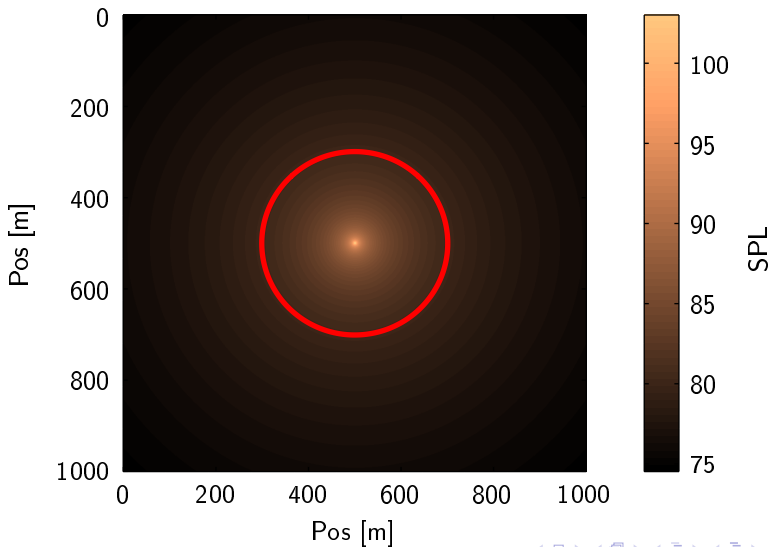
Default Values

- Environmental: 80dB
- Turbine: 120dB

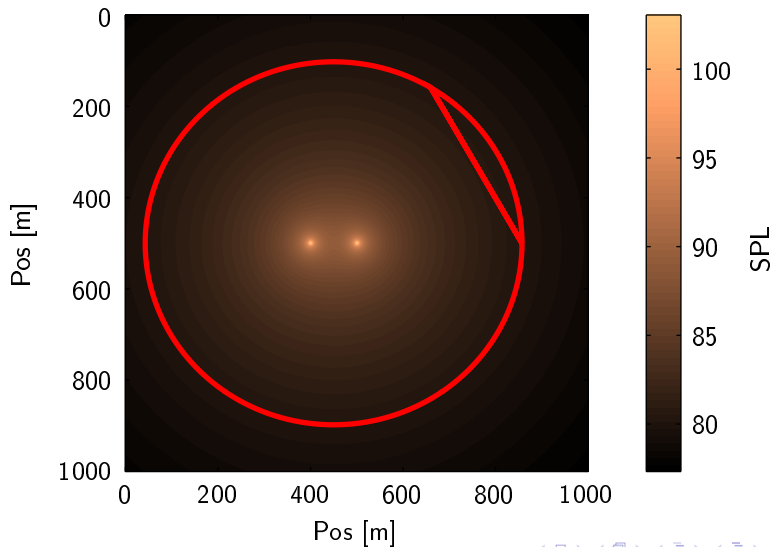
25m Depth



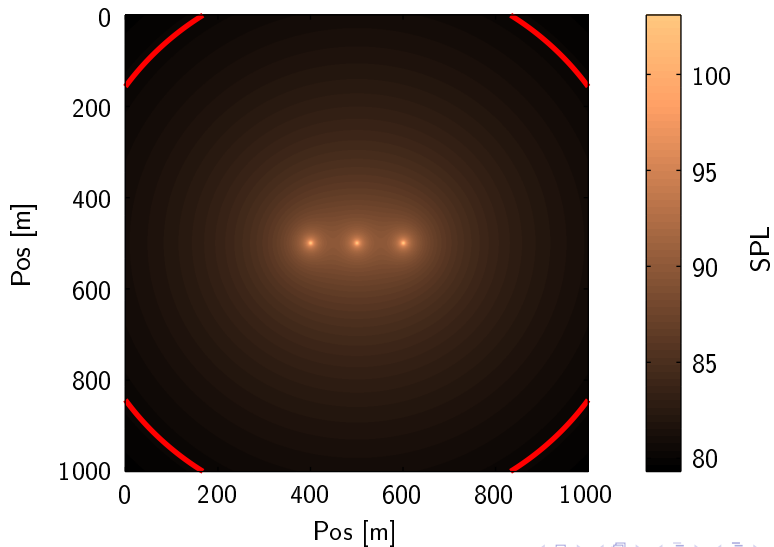
50m Depth



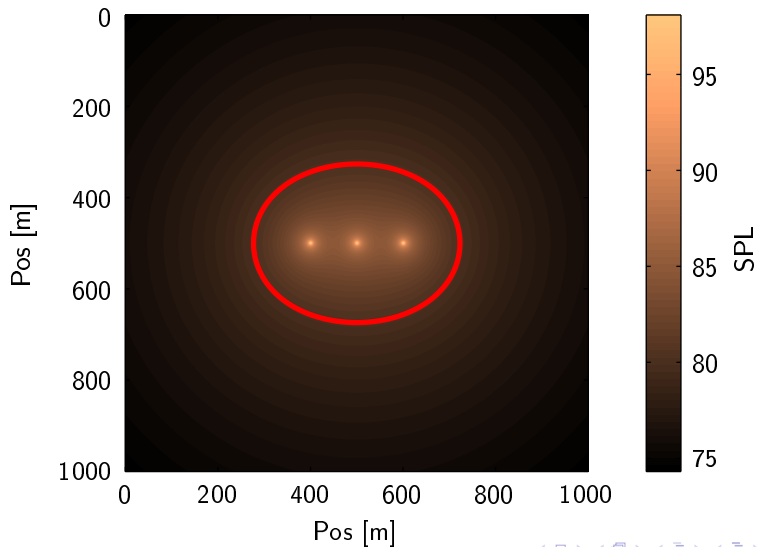
50m Depth



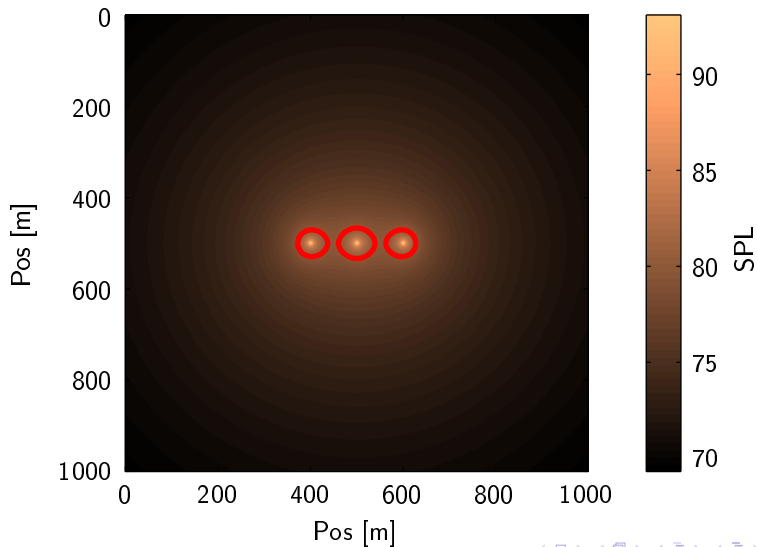
50m Depth



50m Depth, 115dB



50m Depth, 110dB



Conclusions

- Noise emissions seem to be relevant over 100-1000m.
- Typical turbine spacing of less than 100m (?) limits options
- Deeper water decreases affected area (Ignoring significant losses in shallow water!)
- Lack of data biggest issue!