Erosion-safe turbine operation

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As we know, erosion is a thing.
Erosion-Safe Operation

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Tip Speed

Power curves [kW]
Modelling of erosion-safe operation: Why and how?
(*) Modelling of erosion

Kinetic Energy Model

\[ N_{fall} = 18 \left( \frac{E}{E_0} \right)^{-4.7} E \sim a^3 \]

Accumulated Water Model

\[ h_{fall} = 1.5 \times 10^{19} \left( \frac{v}{v_0} \right)^{-9.3} \]
Optimization of Erosion-Safe Operation

4.8 mm/h
56 m/s
Profit = 3.3 %

Profit = 3.5 %
Optimization of Erosion-Safe Operation
We are preparing for a full-scale validation

- Vattenfall’s offshore MHI Vestas V164, Aberdeen Offshore Wind Farm, UK
References:

Bech et al.  10.5194/wes-3-729-2018

Hasager et al.  10.1016/j.renene.2019.12.043
Thank you.