

Reducing tip speed during heavy rain to prevent erosion

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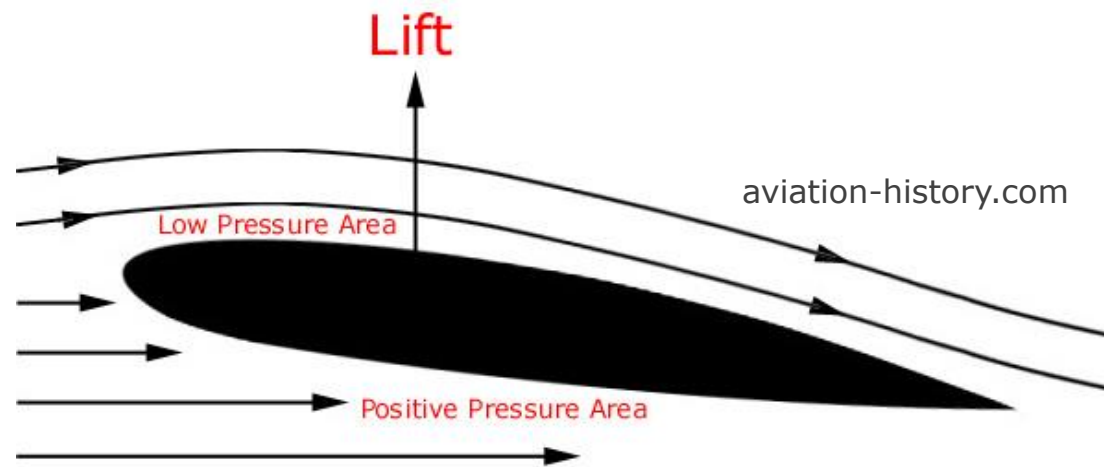
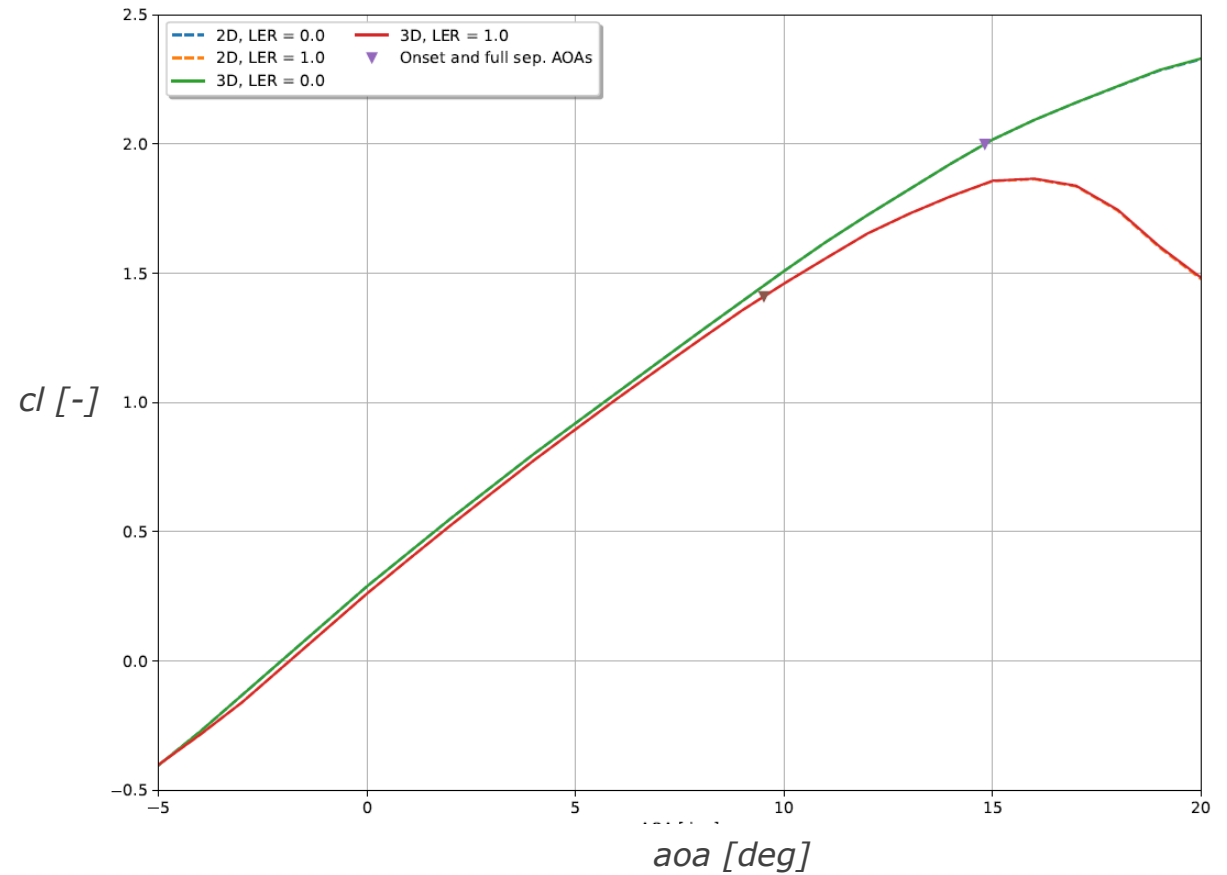
Anna-Maria Tilg



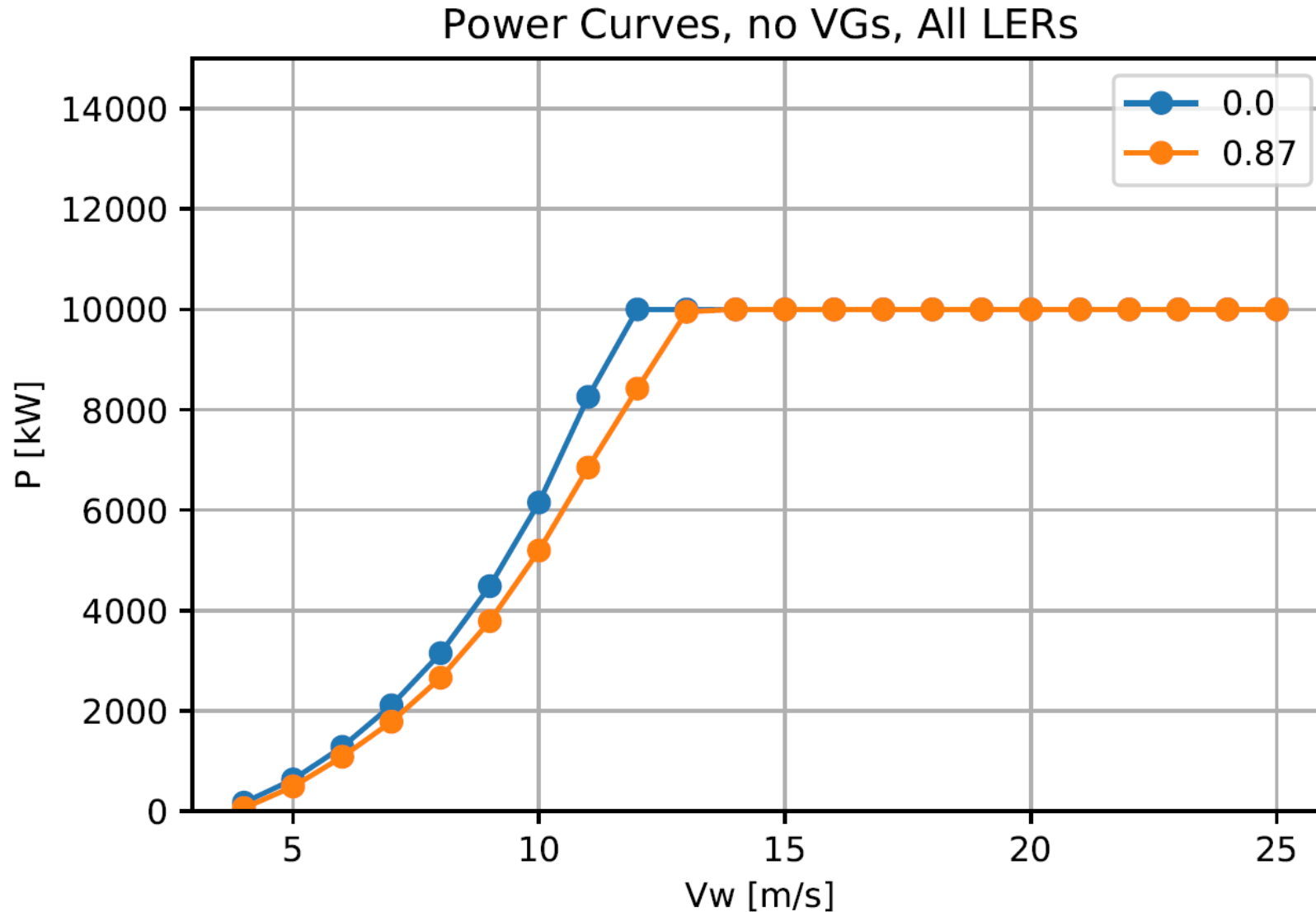
Outline + What is *Erosion Safe Mode*?

- Engineering modelling of turbines
- Focus on energy production and erosion
- Introduction of the Erosion Safe Mode
 - Tip speed reduced during rare heavy precipitation events
- The modelling relies on
 - Real-life long-term historical weather data
 - The results of accelerated rain erosion tests
 - Wind tunnel measurements of airfoils with leading edge roughness
- Testing of the method on modern megawatt-sized wind turbines.

Wind tunnel measurements of airfoils with leading edge roughness



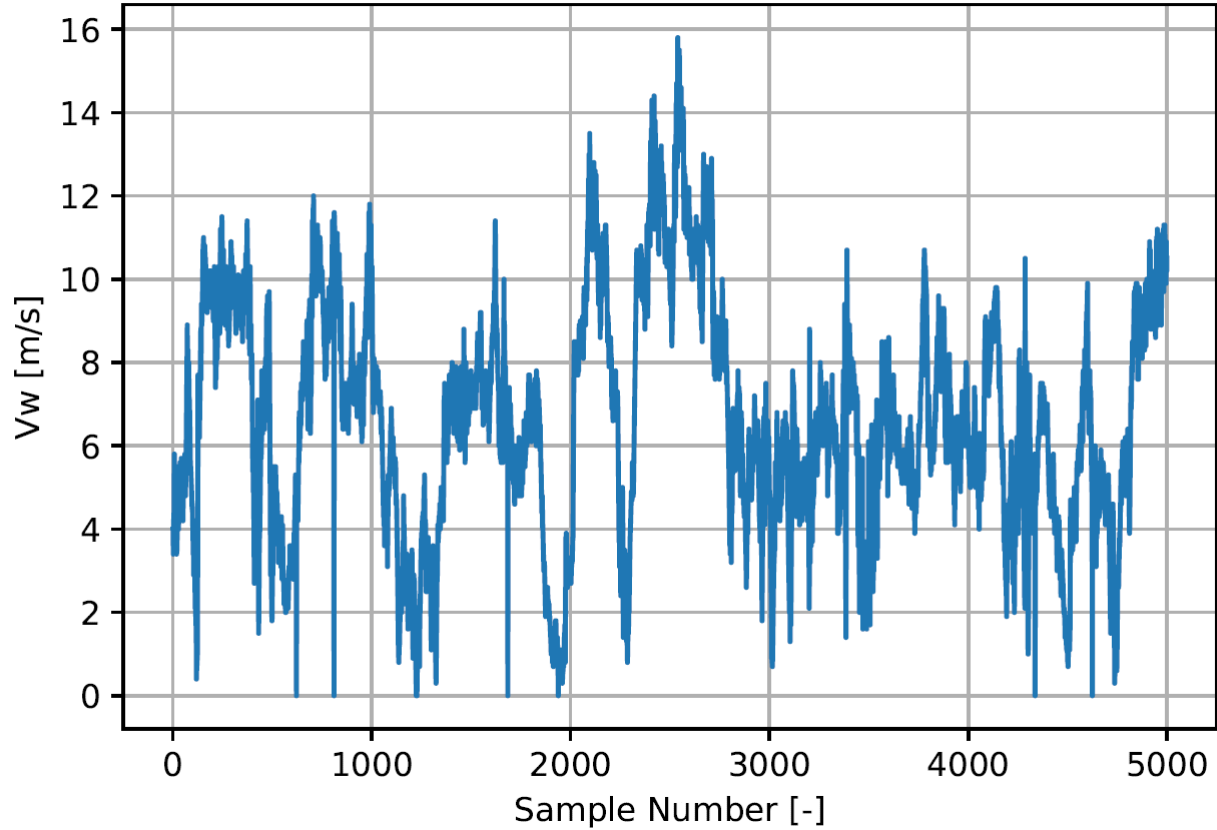
Wind tunnel measurements of airfoils with leading edge roughness



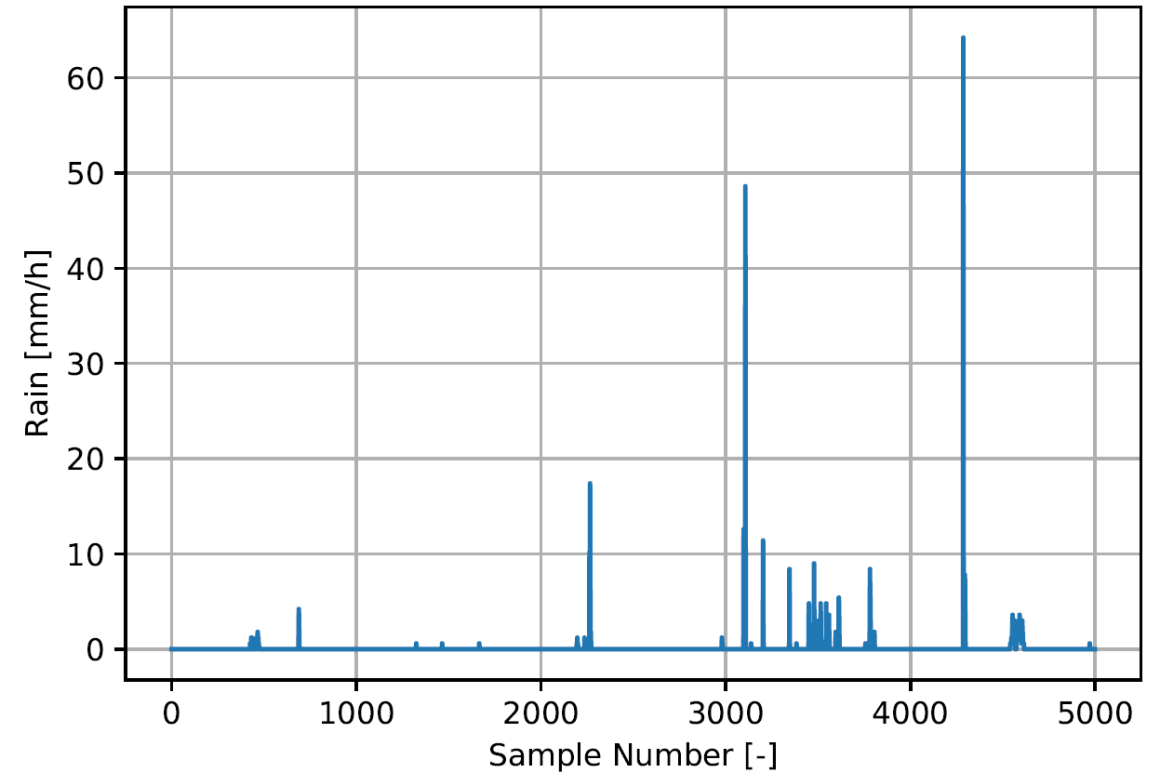
Real-life long-term historical weather data



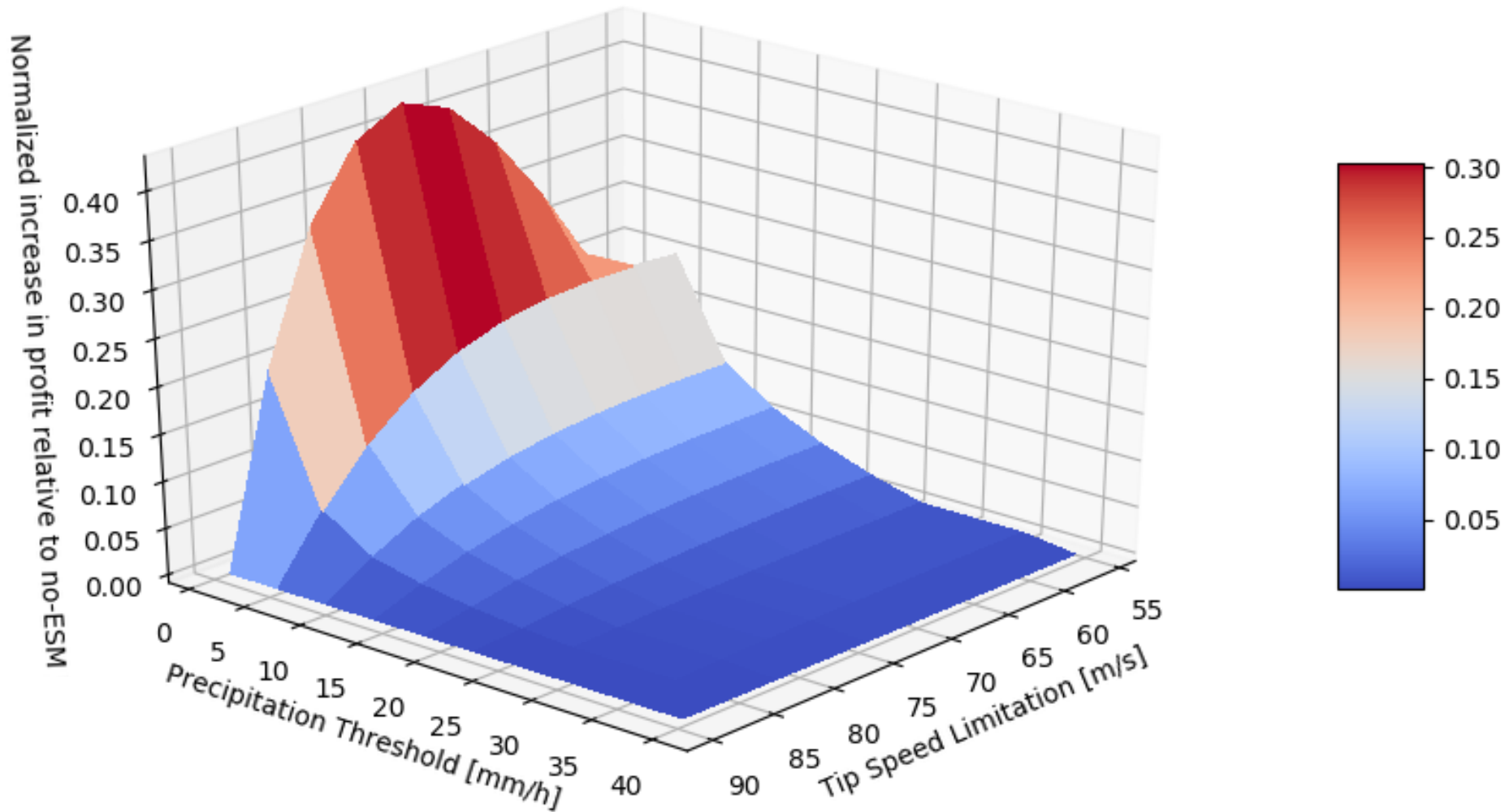
Wind Speed Time Series [m/s]

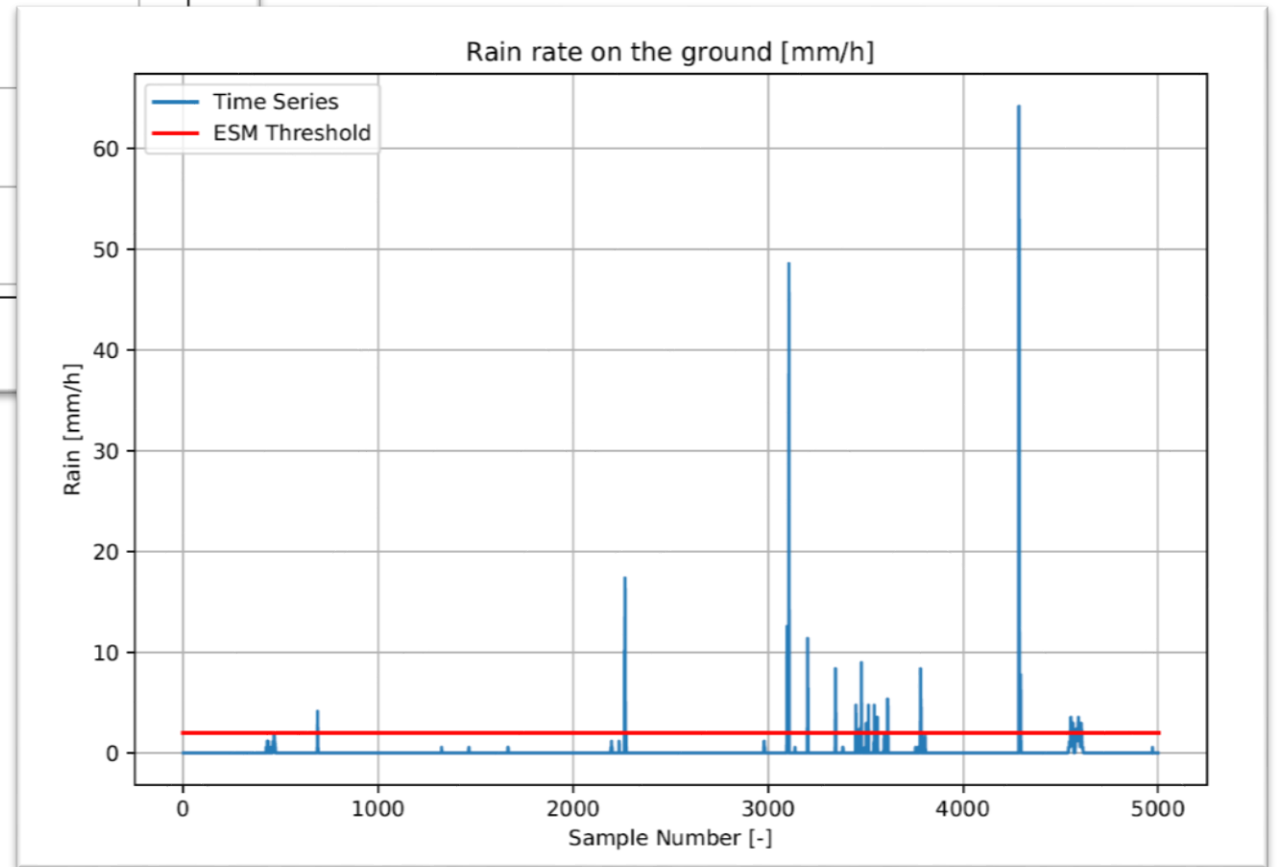
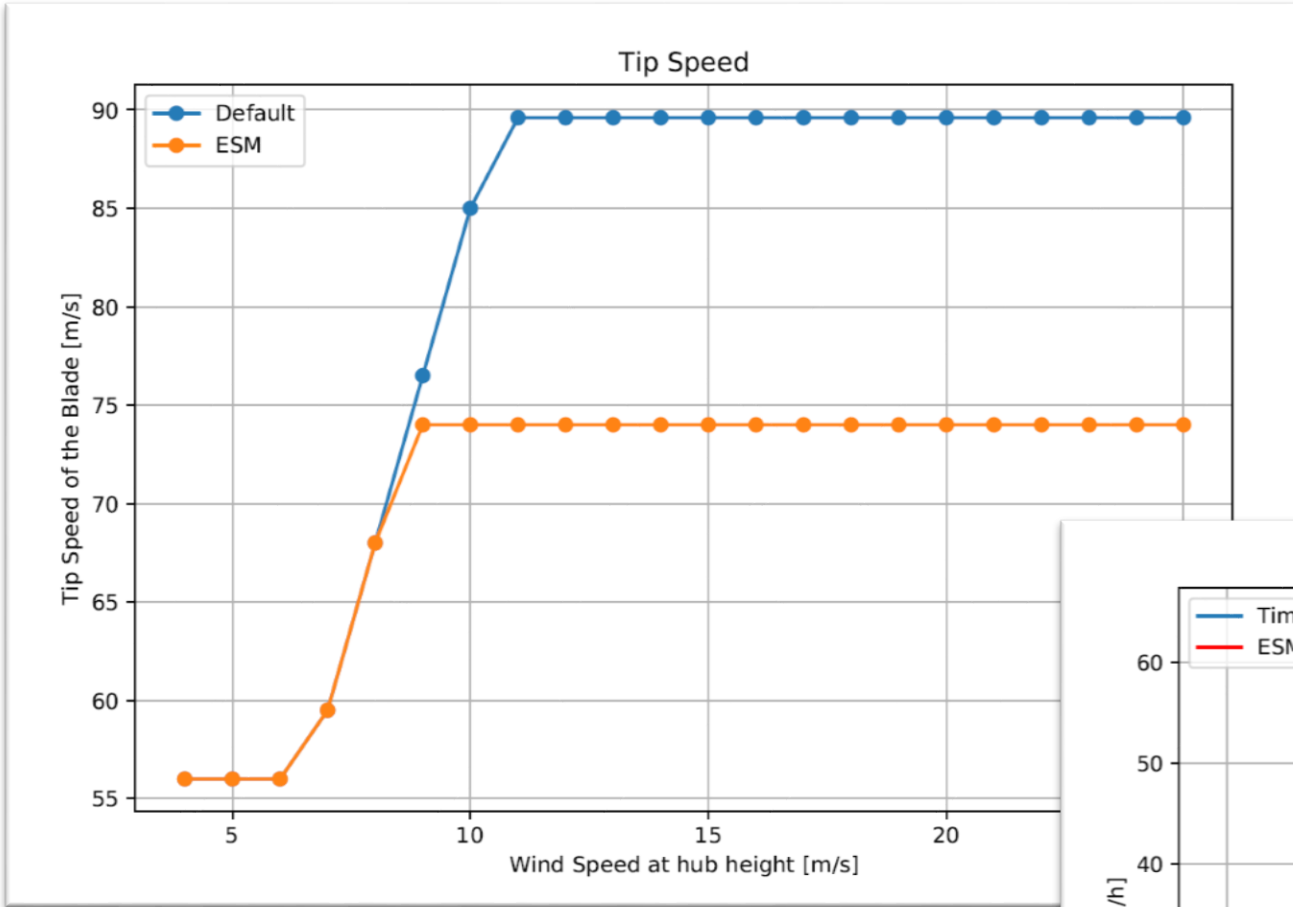


Rain rate on the ground [mm/h]

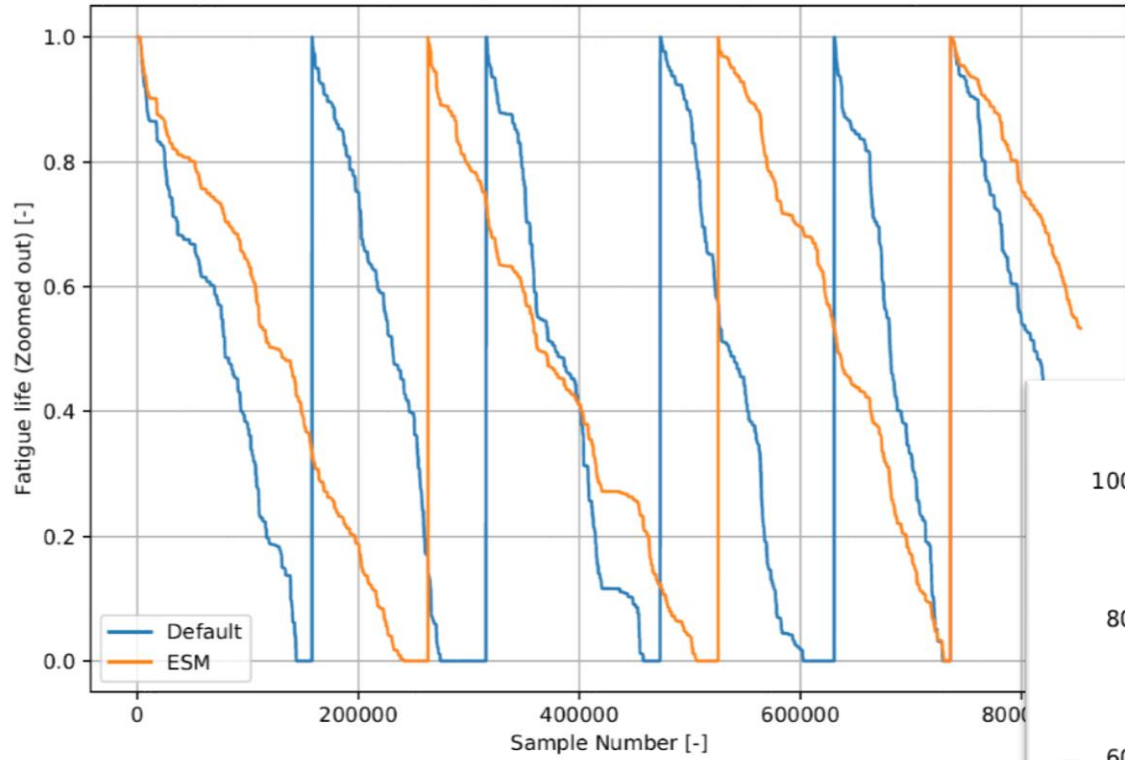


Erosion Safe Mode

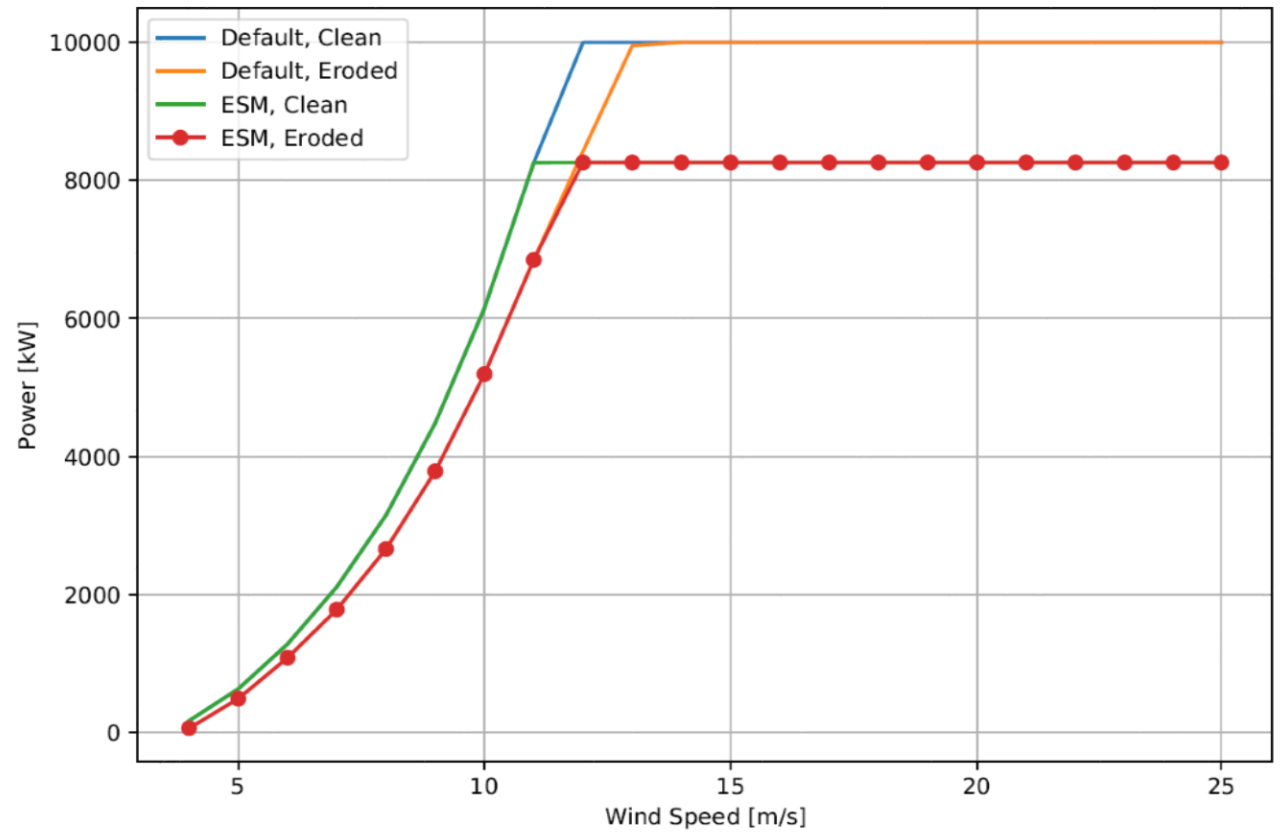




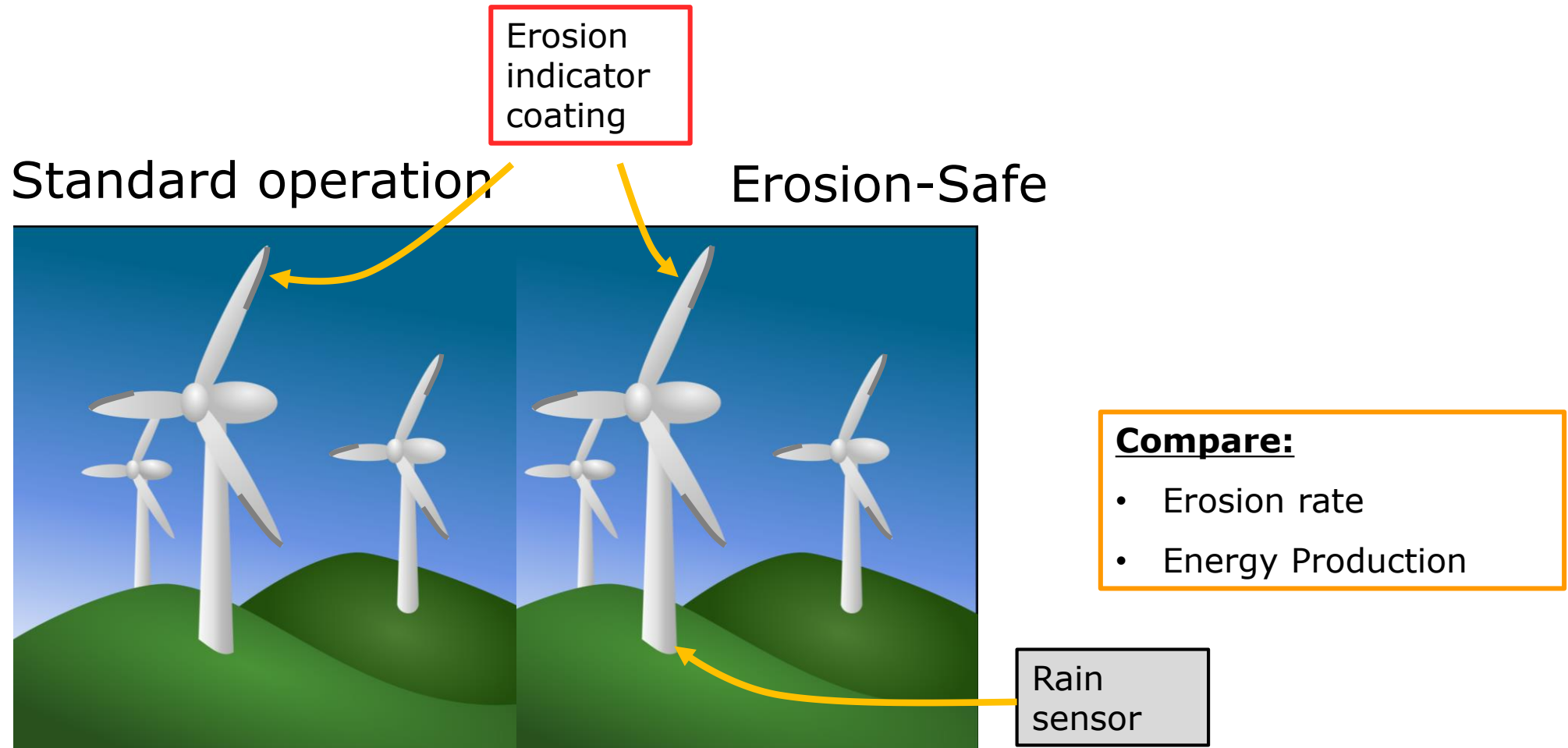
Fatigue life (Zoomed out) [-]



Power curves [kW]



Erosion-Safe Mode Demonstration Campaign



Thank you.