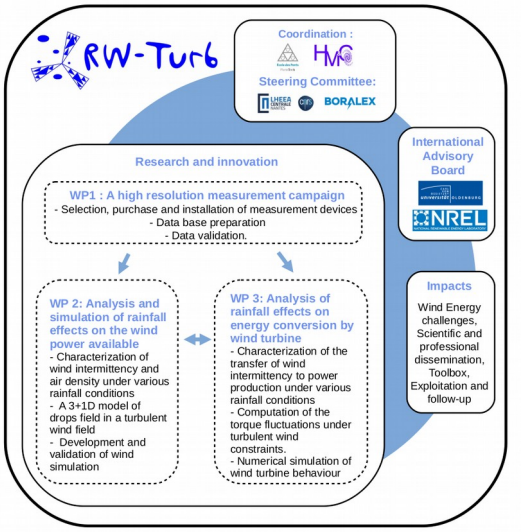
PhD opportunity on wind energy @ Ecole des Ponts ParisTech in the framework of the RW-Turb ANR project

If interested by this PhD opportunity : please contact auguste.gires@enpc.fr with CV and cover letter

Overview of the RW-Turb project :

The RW-Turb (Rainfall, Wind and Turbulence) is a project funded by the French National Research Agency. RW-Turb will rely on the expertise of HM&Co (the Hydrology, Meteorology and Complexity laboratory) in measurement and modelling across wide range of spatio-temporal scales of atmospheric turbulence and rainfall to quantify the impact of the latter on wind power production. This project will benefit from an industrial partnership with Boralex, a wind power producer. RW-Turb will open new paths to improve nowcasts of power production, a major challenge in a framework of increasing use of renewable energies in France and Europe.
More details are available on the projects website https://hmco.enpc.fr/portfolio-archive/rw-turb/



PhD topic :

The PhD project is related to numerical simulations. More precisely, the PhD will:
(1) improve existing tools based on continuous Universal Multifractal cascades to create numerical simulations of scalar and vector spatio-temporal wind fields for scales ranging from few cm to wind turbine size over few tens of seconds. Multifractal tools have been widely used to characterize and simulate geophysical fields extremely variable over wide range of scales such as wind and rainfall. Comparison with state of the art models will be carried out.
(2) develop two numerical modelling chains with increasing complexity to simulate and quantify the effect of wind turbulence on power production. The simulated wind fields will be used (i) to compute available torque fluctuations, and (ii) as input in a multi-disciplinary model for numerical simulation of wind turbine behaviour. The FAST – TurbSim modelling chain developed by the NREL – US (https://nwtc.nrel.gov/FAST) will be used as basis. These tools enable simulating the behaviour of wind turbines under varying wind conditions. More precisely the FAST model uses wind-inflow data, and accounts for blade behaviour (Blade Element Momentum theory) as well as potential wind turbine controllers. This model already accepts fluctuating wind input generated by TurbSim thanks to the AeroDyn module (https://nwtc.nrel.gov/AeroDyn). Ensembles of possible inputs will be used to quantify the sensitivity of the modelling chains to various input parameters corresponding to the different rainfall conditions. Multifractal tools will be used for this characterization.

The PhD will be involved in the RW-Turb project and benefit from exchange with the International Advisory Board (notably a NREL experts) and steering committee.

Supervision:
Supervisers : Ioulia Tchiguirinskaia and Auguste Gires (HM&Co-ENPC)
Co-supervisor: Sandrine Aubrun (Laboratory on Hydrodynamics, Energetics and Atmospheric Environment - Centrale Nantes / CNRS UMR6598)