Post-doctoral position within the RTE/IPSL framework program

New mathematical and statistical physics approaches to study future scenario and the resilience of the electric system

Supervised by *Freddy BOUCHET*.
Where: École Normale Supérieure ENS/PSL Paris and IPSL – CNRS - Laboratoire de Météorologie Dynamique (LMD).
When: Starting date is flexible.
Duration: A two-year post-doctoral position with a possible extension.

Scientific description:

To mitigate climate change, future energy transitions will need to focus on key areas, including electrification, the integration of high shares of renewable energy (such as solar PV and wind power), and transformations on the demand side. These changes will fundamentally reshape the electric system, which will need to become more resilient to both the increased variability in energy production and consumption, as well as the growing impacts of extreme weather events driven by climate change.

The primary aim of this postdoctoral position is to develop innovative methodologies based on mathematics, statistical physics, and machine learning to study a range of rare and extreme events that are critical to ensuring the resilience of the electric system.

This position is part of a collaborative research framework, jointly supervised by IPSL (the federation of climate laboratories in the Paris area) and RTE (the French electricity network operator). Our team leverages state-of-the-art statistical tools, machine learning techniques [4], and statistical physics approaches to analyze the impact of weather and climate variability on the electric system, as well as the effects of rare and extreme weather events.For instance, recently, we demonstrated that rare event algorithms can significantly reduce computational costs—by a factor of 100 to 1000—in computing rare events in climate models, such as extreme heatwaves [1,2], or extremes in renewable energy production and residual load [3] on the electric grid.

Depending on the skills and interests of the postdoc, the project may focus more on theoretical and methodological development or be more oriented toward key applications aimed at understanding future mitigation scenarios and enhancing electric system resilience.

[1] F. Ragone, J. Wouters and F. Bouchet, 2018, Computation of extreme heat waves in climate models using a large deviation algorithm, Proceedings of the National Academy of Sciences, vol 115, no 1, pages 24-29, [pdf].
[2] F. Ragone and F. Bouchet, 2021, Rare event algorithm study of extreme warm summers and heat waves over Europe, Geophysical Research Letters, 48, e2020GL091197., *arXiv:2009.02519*, [pdf].
[3] B. Cozian, 2023, Computing climate extreme events and extremes of production of renewable energy using rare events algorithms, PhD of ENS-Lyon, [pdf].
[4] G. Miloshevich, B. Cozian, P. Abry, P. Borgnat, and F. Bouchet, 2023, Probabilistic forecasts of extreme heatwaves using convolutional neural networks in a regime of lack of data, Phys. Rev. Fluids 8, 040501, doi.org/10.1103/PhysRevFluids.8.040501 and *arXiv:2208.00971*, [pdf].

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Profile: Applications are invited from candidates with a PhD degree, either in the fields of physics, energy systems, climate, mathematics, or computer and data sciences. The motivation of the candidate for climate studies within a multidisciplinary environment will be essential.

Application process: Applications must include a cover letter, a CV, 2 recommendations letters and be sent directly to Freddy.Bouchet@cnrs.fr.