

EXTREME CLIMATE EVENTS PREDICTION

Scientific Context

Low-probability, high-impact events are one of the blind spots of climate science. Indeed, while events such as heat waves, storms and extreme precipitation already have major financial and human impacts, our ability to predict them ahead of time and to make projections of their evolution in future climate still suffers from large uncertainties [2], stemming from the fact that such events are rare. Perhaps even more so, the study of potential “tipping points” [1] is hindered by the same fundamental problem. The goal of the project is to develop new tools, based on statistical learning, to improve predictions of such events.

Recently, a hierarchy of statistical models ranging from Gaussian processes to Neural Networks has been shown to be skillful in the case of heat waves [3, 4]. The simpler models in this hierarchy can be trained on small datasets and carry a notion of physical interpretability of the predictions. As part of this post-doctoral position, two directions will be explored to extend this work:

- ▶ Methodological developments to improve the statistical tools (increase skill, leverage interpretability properties) and to extend their application to a broader class of events.
- ▶ Investigating the possibility to transpose these tools for prediction of tipping points. The example we will study is that of cold-to-warm transitions of ice-shelves in Antarctica [5].

Practical Information

- ▶ **Profile:** Candidates with a PhD in Climate or Atmospheric Sciences, Physical Oceanography, Geophysical Fluid Dynamics, Statistical Physics, Applied Mathematics or related fields are encouraged to apply. The project involves both numerical and theoretical aspects. Prior experience with climate models is not strictly required but willingness to work with numerical data generated from GCMs is necessary.
- ▶ **Scientific Environment:** The post-doctoral researcher will work within the [Climate Physics Group](#), part of the [Laboratoire de Physique](#) at *ENS de Lyon*, France. The main supervisor will be [Corentin Herbert](#) (CNRS, ENS de Lyon). In the second part of the project the post-doctoral researcher may also interact with [Louis Couston](#) and [Irena Vankova](#).
- ▶ **Appointment term:** Two-year post-doctoral position subject to annual renewal.
- ▶ **Application process:** Interested candidates should apply on the [CNRS jobs portal](#). The application material should include a CV, list of publications and short statement describing how their past research experience, interests and future plans match the topic of the position. Questions about the position can be directed to Corentin Herbert at corentin.herbert@ens-lyon.fr. Review of applications will start October 19 and continue until the position is filled. Start date is flexible.

References

- [1] D. I. Armstrong McKay et al. “Exceeding 1.5°C Global Warming Could Trigger Multiple Climate Tipping Points”. *Science* **377**, eabn7950 (2022).
- [2] D. I. V. Domeisen et al. “Prediction and Projection of Heatwaves”. *Nat Rev Earth Environ* **4**, 36–50 (2022).
- [3] A. Lovo, A. Lancelin, C. Herbert, and F. Bouchet. “Tackling the Accuracy–Interpretability Trade-Off in a Hierarchy of Machine Learning Models for the Prediction of Extreme Heatwaves”. *Artif. Intell. Earth Syst.* **4**, 1–19 (2025).
- [4] V. Mascolo, A. Lovo, C. Herbert, and F. Bouchet. “Gaussian Framework and Optimal Projection of Weather Fields for Prediction of Extreme Events”. *J. Adv. Model. Earth Syst.* **17**, e2024MS004487 (2025).
- [5] L. Saddier, C. Herbert, C. Y. S. Bull, and L.-A. Couston. “Irreversible Transitions of the Ocean Circulation in Antarctic Ice-Shelf Cavities”. *Geophys. Res. Lett.* **53**, e2025GL118278 (2026).