

Robust attribution and projection of extreme heat events to human influence on the climate

Nicholas J. Leach

St. Cross College
University of Oxford

*A thesis submitted for the degree of
Doctor of Philosophy*

Trinity 2022

Abstract

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Personal

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Institutional

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List of Abbreviations

SST Sea surface temperatures.

Quote

— author

1

Introduction

In this chapter I introduce the problem of attribution of individual extreme weather events to anthropogenic climate change. I review the current methodologies and frameworks that address this problem, in particular the contrasting storyline and probabilistic approaches to attribution. Although these frameworks are gaining acceptance and maturity, I suggest that a weather forecast-based approach could further increase the trustworthiness of attribution studies. Finally, I provide a conceptual sketch of these various attribution frameworks within a simple non-linear dynamical system.

Author contributions: This chapter is based on the the following publication *

Surname, I1. I2., Surname, I1. I2. (year). **Title.** *Journal*, **vol**(issue), pages. DOI

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*with the author contributions as follows.

1.1 Section

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Quote

— author

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Chapter 1

Here I present a conventional probabilistic extreme event attribution of the 2018 European heatwave.

Author contributions: This chapter is based on the the following publication *

Leach, N. J., Li, S., Sparrow, S., van Oldenborgh, G. J., Lott, F. C., Weisheimer, A., & Allen, M. R. (2020). **Anthropogenic Influence on the 2018 Summer Warm Spell in Europe: The Impact of Different Spatio-Temporal Scales.** *Bulletin of the American Meteorological Society*, **101**(1), S41-S46. <https://doi.org/10.1175/BAMS-D-19-0201.1>

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2.1 Section

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Quote

— author

3

Chapter 2

Chapter description.

Author contributions: This chapter is based on the the following publication *

Leach, N. J., Watson, P. A. G., Sparrow, S. N., Wallom, D. C. H., & Sexton, D. M. H. (2022). **Generating samples of extreme winters to support climate adaptation.** *Weather and Climate Extremes*, **36**(), 100419. <https://doi.org/10.1016/j.wace.2022.100419>

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*with the author contributions as follows.

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Quote

— author

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Chapter 3

Chapter description.

Author contributions: This chapter is based on the the following publication *

Leach, N. J., Weisheimer, A., Allen, M. R., & Palmer, T. (2021). **Forecast-based attribution of a winter heatwave within the limit of predictability.** *Proceedings of the National Academy of Sciences*, **118**(49), . <https://doi.org/10.1073/pnas.2112087118>

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Quote

— author

5

Chapter 4

Chapter description.

Author contributions: This chapter is based on the the following publication *

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*with the author contributions as follows.

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Quote

— author

6

Discussion

Chapter description.

Author contributions: This chapter is based on the the following publication *

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Appendices

*The first kind of intellectual and artistic personality
belongs to the hedgehogs, the second to the foxes*

...

— Sir Isaiah Berlin [1]

References

- [1] Isaiah Berlin. *The Hedgehog and the Fox: An Essay on Tolstoy's View of History*. English. Ed. by Henry Hardy. 2nd. Princeton University Press, June 2013.