PhD Advert Template

Your advert (including section headings) should **not** exceed **550** words.

An example can be found here: [OP2304 Solving the Leaky Barrier Conundrum: Nature Based Solutions to reduce flooding at Newcastle University on FindAPhD.com](https://www.findaphd.com/phds/project/op2304-solving-the-leaky-barrier-conundrum-nature-based-solutions-to-reduce-flooding/?p149997)

Please complete the following sections:

Project title: New early warning and forecasting systems for unprecedented rainstorms

Project ID *(optional)*: *Please leave blank*

Accept all year-round applications

Funding information: Self-funded students only

Project description:

Summer 2021 has brought a change in society’s relationship with extreme weather, witnessing a record four $20 billion-plus weather-driven disasters. Better understanding of the local and large-scale ‘ingredients’ of intense rainstorms is important to improve

their forecasts and predictions of future change. Changes to rainfall intensities depend on processes that range from the microscale to synoptic and planetary scales. Storms intensify with increases in latent heat release, with increases in updraft velocities and moisture-convergence producing larger rainstorms (Fowler et al., 2021a,b). However, these increases are dampened by enhanced atmospheric stratification in a warming climate, which increases static stability. Work with Paul Davies (UKMO) has identified the atmospheric configuration that produces life-threatening rainfall extremes: for example, this process occurred in New York, Sep 2021 producing 80mm/h, in Liguria, Italy, Oct 2021, where a European record of 181mm/h was recorded and in Zhengzhou, China in July 2020, producing a near world-record 201.9mm/h! However, the links to synoptic and meso-scale features are not well defined.

In this PhD project we will take advantage of the new quality-controlled Global Sub Daily Rainfall Dataset (Lewis et al. 2019, 2021) and high-resolution reanalyses such as ERA5 to identify the synoptic and mesoscale features that increase the likelihood of short-duration extreme rainfall, identifying the types of atmospheric regimes/setups that can produce severe, often unprecedented, rainstorms. These will be used to develop a causal network (e.g. Shepherd et al. 2018) which identifies dynamical situations with raised potential for severe rainstorms, with concept mapping methods used to pair these to identified local-scale triggering ‘ingredients’.

New early warning and forecasting systems are needed for these unprecedented rainstorms, with the World Meteorological Organization calling for “extreme weather warning systems for all” within five years, and a recent report by the Joint Committee on the National Security Strategy suggesting that there is overwhelming evidence that climate change is already having an impact on UK infrastructure; part of improving the resilience of critical national infrastructure is to develop better early warning systems. The PhD student will run a sandpit trial during year 3 of the project to test the new forecasting system on real weather situations and against current forecast methods collaborating with Prof Paul Davies, Chief Meteorologist at the UK Met Office (UKMO).

Newcastle University is committed to being a fully inclusive Global University which actively recruits, supports and retains colleagues from all sectors of society.  We value diversity as well as celebrate, support and thrive on the contributions of all our employees and the communities they represent.  We are proud to be an equal opportunities employer and encourage applications from everybody, regardless of race, sex, ethnicity, religion, nationality, sexual orientation, age, disability, gender identity, marital status/civil partnership, pregnancy and maternity, as well as being open to flexible working practices.

References (optional):

**Fowler, H.J.,** Lenderink, G., Prein, P., Westra, S., Allan, R.P., Ban, N., Barbero, R., Berg, P., Blenkinsop, S., Do, H.X., Guerreiro, S., Haerter, J.O., Kendon, E., Lewis, E., Schaer, C., Sharma, A., Villarini, G., Wasko, C., Zhang, X. 2021a. Anthropogenic intensification of short-duration rainfall extremes. Nature Reviews Earth and Environment, 2, 107–122, DOI: 10.1038/s43017-020-00128-6.

**Fowler, HJ.,** Ali, H., Allan, R.P, Ban, N., Barbero, R., Berg, P., Blenkinsop, S., Cabi, N.S., Chan, S., Dale, M., Dunn, R.J.H., Ekström, M., Evans, J.P., Fosser, G., Golding, B., Guerreiro, S.B., Hegerl, G.C., Kahraman, A., Kendon, E.J., Lenderink, G., Lewis, E., Li, X.-F., O’Gorman, P.A., Orr, H.G., Peat, K.L., Prein, A.F., Pritchard, D., Schär, C., Sharma, A., Stott, P.A., Villalobos-Herrera, R., Villarini, G., Wasko, C., Wehner, M.F., Westra, S., Whitford, A. 2021b. Towards advancing scientific knowledge of climate change impacts on short-duration rainfall extremes. Phil. Trans. Roy. Soc. A., 379, 20190542, DOI: 10.1098/rsta.2019.0542.

Lewis, E., **Fowler, H.J.,** Alexander, L., Dunn, R., McClean, F., Barbero, R., Guerreiro, S., Li, X-.F., Blenkinsop, S. 2019. GSDR: A global sub-daily rainfall dataset. Journal of Climate, 32(15), 4715-4729, DOI: 10.1175/JCLI-D-18-0143.1.

Lewis, E., Pritchard, D., Villalobos-Herrera, R., Blenkinsop, S., McClean, F., Guerreiro, S., Schneider, U., Becker, A., Finger, P., Meyer-Christoffer, A., Rustemeier, E., **Fowler, H.J.** 2021.Quality control of a global hourly rainfall dataset. Environmental modelling and software, 144, 105169, DOI: 10.1016/j.envsoft.2021.105169.

Shepherd, T.G., Boyd, E., Calel, R.A., Chapman, S.C., Dessai, S., Dima-West, I.M., **Fowler, H.J.,** James, R., Maraun, D., Martius, O., Senior, C.A., Sobel, A.H., Stainforth, D.A., Tett, S.F.B., Trenberth, K.E.B., van den Hurk, J.J.M., Watkins, N.W., Wilby, R.L., Zenghelis, D. 2018. Storylines: An alternative approach to representing uncertainty in physical aspects of climate change. Climatic Change, 151, 555–571, DOI: 10.1007/s10584-018-2317-9.

Application enquires: *Professor Hayley J. Fowler,* *h.j.fowler@ncl.ac.uk**;* [*https://www.ncl.ac.uk/engineering/staff/profile/hayleyfowler.html*](https://www.ncl.ac.uk/engineering/staff/profile/hayleyfowler.html)

**We will also need to link your PhD advert up to the subject keywords below so that your PhD studentship can be found on findaphd.com. Please highlight up to three relevant keywords from the lists provided below.**

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You can select up to **10 subject areas**.

PhD Disciplines & Subject areas

Agriculture

[ ]  agricultural sciences

[ ]  agricultural technology

[ ]  arable farming

[ ]  livestock farming

[ ]  forestry & arboriculture

[ ]  other

Anthropology

[ ]  biological anthropology

[ ]  social anthropology

[ ]  other

Architecture, Building & Planning

[ ]  architecture

[ ]  built environment

[ ]  construction management

[ ]  landscape architecture

[ ]  rural planning

[ ]  surveying

[ ]  urban planning

[ ]  other

Biological Sciences

[ ]  bacteriology

[ ]  behavioural biology

[ ]  biochemistry

[ ]  biodiversity

[ ]  bioinformatics

[ ]  biophysics

[ ]  biotechnology

[ ]  cancer biology

[ ]  cell biology

[ ]  developmental biology

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[ ]  entomology

[ ]  environmental biology

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[ ]  microbiology

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Business & Management

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Chemistry

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Communication & Media Studies

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Computer Science

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Creative Arts & Design

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Economics

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Education

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Engineering

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Environmental Sciences

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Finance

[ ]  actuarial science

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Food Sciences

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Forensic and Archaeological Sciences

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Geography

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Geology

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History & Archaeology

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Information Services

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Languages, Literature & Culture

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Law

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Linguistics & Classics

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Materials Science

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Mathematics

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Medicine

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Nursing & Health

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Philosophy

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Physics

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Politics & Government

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Sociology

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Sport & Exercise Science

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Theology & Religious Studies

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Veterinary Sciences

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