

**Early-stage researcher: CRITICS (Delay effects in palaeoclimate time series)**

College: Engineering, Mathematics and Physical Sciences <http://emps.exeter.ac.uk/>

Post: Early Stage Researcher

Reference No: P48243

Grade: D

Reporting To: Jan Sieber

The above full-time fixed-term post is available for 36 months (starting summer 2015) in the College of Engineering, Mathematics and Physical Sciences.

Job Description

This appointment is funded by the Research Executive Agency as part of a Horizon 2020 Innovative Training Network.

Main purpose of the job:

This position is offered as part of the CRITICS Marie Curie Innovative Training Network, which aims to understand critical transitions in complex systems. The research on this post will study delay effects in palaeoclimate time series and palaeoclimate models, and their early-warning signals. Most intense collaboration will be with University of Copenhagen (Denmark) and University College Cork (Ireland).

In the climate system processes on many different time scales are at play and often the response to a forcing or perturbation has a long delay. One example is the uptake in the cold surface ocean of a pulse of CO₂ from the atmosphere. The CO₂ rich water disappears from the surface by subduction, reappears at a much later time, releasing the CO₂ to the atmosphere again. Another example of a delayed reaction is the so-called Atlantic seesaw [1] description of the phase delay between the climate variations observed in Greenland and Antarctic ice core records. In this case the hypothesis is that a rapid climate change in the North is signalled to the South through the oceanic heat transport. These types of processes play a key role in understanding the dynamics of the climate changes observed in the paleoclimatic records. They call for a description in terms of time delay models, which due to the mathematical complexity has only had very limited applications in the field.

The research on the post aims to develop low-dimensional models treating the long response times of the climate subsystems as delays and explore their explanatory power for observed palaeoclimate time series. The presence of the delay makes the model in principle infinite-dimensional as the system response depends on the history of its physical state. If the delay is large compared to the time scales of instantaneous processes then this high-dimensionality shows itself through a large number of coexisting attractors and relaxation oscillations [2,3]. Some open questions are:

- how can one identify central parameters (such as the delay) from time series of irregularly forced time-delay systems where the forcing is known;
- what is the influence of noise on time series from these systems;
- how are precursors (such as variance or autocorrelation), commonly used for anticipating impending transitions, affected by the mixture of delay and irregular forcing.

Mathematical areas related to the research are bifurcation analysis, analysis of delay-differential equations, timeseries analysis (specifically tailored for problems with delay), and stochastic processes. Depending on the interests of the candidate the project will also have a modelling component. Key references:

- [1] T. F. Stocker & S. J. Johnsen, PALEOCEANOGRAPHY, 18, 4, 1087, 2003
- [2] AC Fowler & MC Mackey, SIAM J. Appl. Math. 63(1) 2002.
- [3] S. Yanchuk & P. Perlikowski, PRE 79(046221) 2009; Sieber et al, DCDS A, 33(7), 2013
- [4] P Ditlevsen, GRL 37(L19703) 2010, GRL 26, 1999.

Main duties and accountabilities:

- To perform original research, at a level suitable for a PhD, under the supervision of the project managers, in the general area of Applied Mathematics.
- Meet with the supervisor on a regular basis.
- To participate in the activities of the “CRITICS” Innovative Training Network: attending training courses, collaborating with scientists from other sites in the network, exchanging scientific data, participating in visits to other sites.
- To take responsibility for furthering your personal knowledge of the research area in which you will work.
- To write up the results of your own research and contribute to research reports/publications. This will often be an iterative process, building in advice and guidance from others as appropriate.
- To present findings of research e.g. prepare papers, make presentations with guidance and advice as appropriate.
- Keep records of activities undertaken (including any leaves of absence).

Person Specification

Competency	Essential	Desirable
Attainments/Qualifications	Undergraduate degree in mathematics or related area at 2:1 or above	Postgraduate degree in mathematics or a related area
Skills and Understanding	Knowledge in the discipline and ability to learn research methods and techniques	Basic programming with a high-level programming language
Behavioural Characteristics	Excellent written and verbal communication skills. Able to communicate material of a specialist or highly technical nature.	

	<p>Able to liaise with colleagues.</p> <p>Able to build contacts and participate in internal and external networks for the exchange of information and collaboration.</p> <p>Actively participate as a member of a research team</p> <p>Engage in continuous professional development.</p> <p>Understand equal opportunity issues as they may impact on areas of research content</p>	
--	---	--

Informal Enquiries

Before submitting an application you may wish to discuss the post further by contacting Jan Sieber, Senior Lecturer, telephone (01392) 723973 or email j.sieber@exeter.ac.uk.

Additional Information Relating to the Post

Salary

All candidates will receive a salary plus living and mobility allowances. A family allowance may also be available, subject to eligibility of candidates.

Salary and allowances will be paid in sterling (the GBP value of salary plus allowances will vary over the period of employment according to the GBP:EUR exchange rate). At the exchange rate of GBP 0.72: EUR 1 (at date of advertising), salary plus allowances would be: £19,632 (salary); £3,549 (living allowance); £5,648 (mobility allowance). (Salary and allowances are subject to employee's tax/NI/pension deductions as applicable).

An increment will be payable on 1 August each year until the top of the scale is reached (subject to being in post for 6 months and satisfactory performance). The scale will be subject to a cost of living review each year.

Hours of work

Hours of work will be 36.5 hours per week (full-time).

Overtime

When overtime is worked, by prior arrangement with your Manager time off in lieu will be given or (provided you have worked more than 36.5 hours) will be paid at time-and-a-half.

Annual Leave

The annual leave entitlement for full-time appointments is 39 days (pro rata for part-time appointments) – see our website <http://www.admin.ex.ac.uk/personnel/leave.shtml> for more information.)

Probationary Period

The appointment will normally be subject to a probationary period of one year.

References & Medical Clearance

All appointments are subject to satisfactory reference and medical checks and individuals will be required to complete a medical assessment form before appointment is confirmed. Applicants should note that the University normally contacts referees for short-listed applicants without further advice to applicants. When advising of referees, if they are resident overseas, please ensure you supply fax numbers and/or email addresses enabling us to contact them (if necessary) without delay.

Right to Work in the United Kingdom

If you do not have the right to work in the UK, this appointment will be subject to the University successfully obtaining a Certificate of Sponsorship under the UK's Points Based System for migrant workers and to you obtaining Entry Clearance/Leave to Remain.

For further information, see the Home Office website at <http://www.ukba.homeoffice.gov.uk/>. In particular you are encouraged to undertake a self assessment of your eligibility to work in the UK using the link to www.ukba.homeoffice.gov.uk/pointscalculator.

Terms & Conditions

The Terms and Conditions of Employment can be viewed on line by visiting <http://www.exeter.ac.uk/staff/employment/conditions/terms/>

Pensions

Membership of the University of Exeter Retirement Benefits Scheme (ERBS) is automatic provided that you meet the qualifying criteria for membership.

The ERBS is a contracted-out scheme and the employee's contribution is 7.5% of gross salary; the University, as your employer, contributes such sums as will be required to maintain the full benefits of the scheme. This scheme is a Career Average Revalued Earnings scheme, for further information please visit <http://admin.exeter.ac.uk/personnel/pensions>. You may opt out of the scheme: if you wish to do so, you should contact the Pensions Manager, Mrs Alison Rose (01392 263088/email a.j.rose@exeter.ac.uk) for further information and to complete the necessary documentation.

The University now operates a Pension Salary Exchange scheme. Under the rules of the scheme, new employees who become members of the pension scheme become eligible to participate in Pension Salary Exchange after three full calendar months of employment. You will automatically participate in the Pension Salary Exchange scheme from the 1st of the month following this date. However, you also have the right to opt-out of Pension Salary Exchange at any time up to the completion of three full calendar months of employment. In the event that you do not wish to participate in Pension Salary Exchange, you should request an opt-out form by contacting the Pensions Office on extension 3088 (or email a.j.rose@exeter.ac.uk).

Further information about Pension Salary Exchange is available from the Human Resources website www.admin.exeter.ac.uk/personnel or from the Pensions Office.

Short-listing Information

We will acknowledge your application by email. The University of Exeter recognises the time and effort taken to apply for a position and will contact you by email to inform you of results of shortlisting.

Application Procedure and Interview Information

The closing date for completed applications is **Tuesday 28 April 2015**.

Data Protection Act (1998)

The information contained within your application is being requested to enable the University to make employment decisions and meet statutory obligations. Any information provided to the University in this context will be treated confidentially and used only by manager(s), member of the University, Human Resources, Superannuation and Payroll during the course of your employment. Where the application relates to a post which is externally funded this information may be passed onto the relevant funding body.