

Dr Declan A Valters

Research Software Engineer – Global Change Research Institute – University of Edinburgh
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Research Software Interests

I am a scientific software engineer interested in atmospheric, hydrological, and geomorphological modelling, as well as topographic data analysis. I am interested particularly in the links between weather and land surface processes and the development of numerical models that underpin research in land surface dynamics using high-performance computing.

Employment

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| • Research Software Engineer
<i>School of Geosciences</i> | University of Edinburgh
<i>November 2017 – present</i> |
| • Scientific Software Engineer
<i>Modelling Infrastructure Support Systems</i> | Met Office
<i>March 2017 – October 2017</i> |
| • Software Developer (PhD work placement)
<i>Satellite Applications</i> | Met Office
<i>June 2015 – October 2015</i> |
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Education

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| • PhD in Earth, Atmospheric, and Environmental Science
<i>Thesis: Modelling catchment sensitivity to rainfall resolution and erosional parameterisation in simulations of flash floods in the UK</i>
<i>Supervisors: Prof David Schultz, Dr Simon Brocklehurst</i> | University of Manchester
<i>September 2013 – March 2017</i> |
| • Master in Earth Science (Hons., 1st Class)
<i>Thesis: Extracting tectonic information using statistical methods of river profile analysis</i>
<i>Supervisor: Prof Simon Mudd</i> | University of Edinburgh
<i>2009 – 2013</i> |
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Software Projects

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| • Cylc and Rose
<i>Scientific workflow management and configuration software</i> | cylc.github.io/cylc
<i>March 2017 – November 2017</i> |
| <ul style="list-style-type: none">– Development of the Cylc software package, a scientific workflow manager and scheduler.– Development of the Rose software framework for configuration of meteorological applications. | |
| • HAIL-CAESAR: A numerical landscape evolution model for HPC
<i>PhD software project</i> | dvalts.io/HAIL-CAESAR
<i>September 2013 – 2017</i> |
| <ul style="list-style-type: none">– A C++ cellular automaton model ported to HPC (High performance computing) facilities through a shared-memory parallelism model (OpenMP).– I translated and developed the CAESAR-Lisflood numerical model from a C#/.NET application into a platform-independent code suitable for high-performance computer use such as ensemble simulations and sensitivity analyses. | |
| • Land Surface Dynamics Topographic Toolbox
<i>Open source developer/contributor</i> | lsdtopotools.github.io
<i>2012 – Present</i> |
| <ul style="list-style-type: none">– Object-oriented C++ topographic analysis and modelling package developed with the Land Surface Dynamics research group at Edinburgh. The continuing aim of the project is to implement state-of-the-art algorithms as they are published in academic literature. A key aim of LSDTopoTools is to facilitate reproducible scientific data analysis for large topographic datasets.– My specific role was to develop the statistical analysis tools (C++), visualisation (Python), and automation scripts (Python) for task-farming sensitivity analyses. | |

- **Met Office – Satellite Applications**

Full-stack web developer

nwpsaf.eu

July - October, 2015

- Redevelopment of the Met Office/European Meteorological Satellite facility website. A public website used for the retrieval of post-processed satellite data and imagery.
 - Designed and implemented a MySQL database for satellite image metadata, integrated with a Javascript front-end for retrieval and rendering of data and imagery.
 - I wrote several tools for keeping the database maintained automatically (Shell scripts/Python/PHP) as new data were added.
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Publications

- **In preparation**

- **Valters, D.A.**, et al. (in prep.) *HAIL-CAESAR: A cellular automaton hydrodynamic landscape evolution model parallelised for shared-memory computing architectures*. Geoscientific Model Development
- **Valters, D.A.**, et al. (in prep.) *Sensitivity of a flood-inundation model to rainfall distribution and erosional parameterisation*. Hydrology and Earth System Sciences.

- **2017**

- Clubb, F.J. , Mudd, S.M., Milodowski, D.T., **Valters, D.A.**, Slater, L.J., Hurst, M.D., and Limaye, A.B (2017) Geomorphometric delineation of floodplains and terraces from objectively defined topographic thresholds, *Earth Surf. Dynam.*

- **2016**

- **Valters, D.A.** (2016). *Modelling Geomorphic Systems: Landscape Evolution*. In: Cook, S.J., Clarke, L.E. & Nield, J.M. (Eds.) *Geomorphological Techniques* (Online Edition). British Society for Geomorphology; London, UK. ISSN: 2047-0371.

- **2014**

- Mudd, S.M., Attal, M., Milodowski, D.T., Grieve, S.W.D. and **Valters, D.A.** (2014). *A statistical framework to quantify spatial variation in channel gradients using the integral method of channel profile analysis*, *Journal of Geophysical Research: Earth Surface*
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Conference Presentations and Abstracts

- **2016**

- **Valters, D.A.** (2016) *Frontiers in geomorphological computing*. 1st annual Research Software Engineers conference, Manchester, UK.
- **Valters, D.A.**, & Brocklehurst, S. H. (2016) *Topographic signatures of spatially-limited storm morphologies revealed from numerical landscape evolution modelling*. Geophysical Research Abstracts, EGU General Assembly, Abstract 18-14328.
- Clubb, F.J., Mudd, S.M., Milodowski, D.T., and **Valters, D.A.** (2016) Geomorphometric delineation of floodplains and terraces from slope and channel relief thresholds, AGU Fall Meeting, Poster.

- **2015**

- **Valters, D.A.**, Brocklehurst, S. and Schultz, D., (2015). Sensitivity of hydro-geomorphic processes to catchment-scale variations in rainfall distribution. In EGU General Assembly Conference Abstracts (Vol. 17).
- Mudd, S.M., Grieve, S.W.D., Milodowski, D.T., Hurst, M.D., Clubb, F.J., **Valters, D.A.**, (2015) *LSDTopo-ToolBox: Open source geomorphology*. Presented at the BSG Annual General Meeting, Southampton.

- **2014**

- **Valters, D.A.** (2014). *Modelling landscape sensitivity to stormier climates*, British Society for Geomorphology Annual Conference, BSG Annual General Meeting, Manchester

- **Valters, D.A.** and Mudd, S.M. (2014). *Extracting tectonic information using the integral method of river profile analysis: applications along the Wasatch fault, Utah*, Geophysical Research Abstracts, EGU General Assembly, Abstract EGU2014-16074-1.
- Mudd, S.M., Attal, M., Milodowski, D.T., Grieve, S.W.D. and **Valters, D.A.** (2014). *A statistical technique for identifying channels of different steepness in transient landscapes*, Geophysical Research Abstracts, EGU General Assembly, Abstract EGU2014-15780.

Technical Skills

Programming Languages & Software

- My current working languages are **C++** and **Python** (including NumPy, Matplotlib). I've experience in writing object-oriented and procedural style code.
- Experience in HPC applications including implementing **OpenMP**-style parallelism, as well as **MPI** approaches to parallelisation.
- Experience in using **subversion** and **git** version control systems.
- Previously I've worked on projects using **Javascript** and **PHP** for web development.
- Basic knowledge of **Fortran**, **Matlab**, **C**, and shell scripting in Linux.
- **ArcGIS 9 & 10**, **GRASS-GIS** and **QGIS**.
- Experience in using and modifying the **WRF** numerical weather prediction model and familiarity with the Met Office **Unified Model (UM)**.

Professional Development

- **Programming/Technical courses** **2-3 day courses, provided by ARCHER/EPCC**
 - Fortran Modernisation *February 2017*
 - Writing scalable parallel applications with MPI *December 2016*
 - Advanced MPI *September 2016*
 - Advanced OpenMP *August 2016*
 - Message-passing programming with MPI *July 2016*
 - Single-node performance optimisation *December 2015*
 - Shared Memory programming with OpenMP *December 2015*
 - Extended introduction to CUDA *November 2015*
- **Numerical Weather Prediction Model training**
 - The Weather Research and Forecasting Model (WRF) *NCAS/NCAR – October 2013*
 - Met Office Unified Model (UM) *NCAS/University of Reading – December 2014*
- **Scientific training**
 - NERC/JBA Extreme Flood Forecasting and Management *5 days – January 2015*
 - NCAS Atmospheric Science Summer School *2 weeks – September 2013*
- **Professional memberships**
 - British Society for Geomorphology
 - UK Research Software Engineers Network

Other Roles and Service

- Journal of Open Source Software – reviewer *2016 – Present*
 - British Society for Geomorphology – Web Officer *2015 – 2017*
 - Teaching Assistant – University of Manchester *2013 – 2016*
 - Courses taught:
 - Fortran and Matlab for engineers
 - Earth Surface Processes (Geomorphology)
 - Engineering Geology
 - Earth Resources
 - Our Earth (Open Online Course Moderation)
 - Global tectonics
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Grants and Awards

- 5th Intel Xeon Phi Access Programme
- Mackay Greenland Scholarship
- Undergraduate Class Medal

STFC, Hartree Centre – 4 months trial
UoE Award for Greenland-based research project – £1000