Declan A. Valters

Scientific Software Engineer

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Personal Statement

I am 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.

Education

- **PhD in Earth, Atmospheric, and Environmental Science**   **University of Manchester**
  Thesis: Modelling catchment sensitivity to rainfall resolution   *September 2013 – March 2017*
  and erosional parameterisation in simulations of flash floods in the UK

- **Master in Earth Science (Hons., 1ˢᵗ Class)**   **University of Edinburgh**
  Thesis: Extracting tectonic information using statistical methods of river profile analysis   *2009 – 2013*

Experience & Software Projects

- **Met Office – Weather Science IT**   **metoffice.gov.uk**
  Scientific Software Engineer   *March 2017 – Present*

  - 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**   **dvalters.github.io/HAIL-CAESAR**
  PhD software project   *September 2013 – 2017*

  - 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**   **lsdtopotools.github.io**
  Open source developer/contributor   *2012 – Present*

  - 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**   **nwpsaf.eu**
  Full-stack web developer   *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.

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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Selected Conference Proceedings

- **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.

Technical Skills

Programming Languages

- 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.

Software packages and numerical modelling

- **ArcGIS** 9 & 10, **GRASS-GIS** and **QGIS** (Geographical Information System software).
- The Weather-Research and Forecasting Model (WRF)   NCAS/NCAR - October 2013
- Met Office NWP Unified Model   NCAS/University of Reading - December 2014

Other Roles and Service

- British Society for Geomorphology Web Officer   2015–2017

- Journal of Open Source Software Reviewer   2016 – Present

Professional Development

- **Professional development training**   **2-3 day courses, various locations**
  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*

Professional Memberships

- British Society for Geomorphology
- UK Research Software Engineers Network

Awards

- 5th Intel Xeon Phi Access Programme   STFC, Hartree Centre – 4 months trial

- Mackay Greenland Scholarship   UoE Award for Greenland-based research project – £1000

- Undergraduate Class Medal

Referees

Available on request.