

10 September 2018

Dear Dr Bauer

**ExtremeEarth: Letter of Support**

The University of Reading is extremely supportive of the vision of *ExtremeEarth*, and shares its ambition to combine the best science with new and untested next-generation technologies to transform forecast skill for weather, climate and weather-driven natural hazards, and so radically improve disaster risk-reduction strategies. We share the view that delivering this vision demands the highly co-ordinated efforts of multiple scientific and technological communities on a pan-European and wider international scale; to construct the next-generation of Earth system models which will perform effectively on the next-generation computing platforms. The international technical and scientific leadership of *ExtremeEarth* clearly has the potential to develop such a system.

The University of Reading is very well placed to contribute to *ExtremeEarth* from a number of perspectives, given our world-leading expertise and strategic focus on: understanding and modelling the dynamics of interactions between weather and climate; developing of Earth system models; developing synergies between mathematics, computer science and the environment; and identifying improved risk-reduction strategies. This capability exists as a connected research community across the University, largely in the Department of Meteorology, Department of Geography & Environmental Science, Department of Computer Science, National Centre for Atmospheric Science (NCAS) and the National Centre for Earth Observation (NCEO).

By way of outlining more explicitly the relevance of our expertise and potential contribution to *ExtremeEarth*:

- (i) The Department of Meteorology at Reading is widely regarded as one of the top university departments worldwide spanning the range of weather and climate research, and is the largest such department in Europe. Exploiting the synergy between weather and climate, for example for the understanding of climate risk associated with extreme weather events, is a strategic priority for the Department and the University, and is also a focus of the NCAS and NCEO research groups that are embedded within the Department. Experience in weather science has shown that explicit simulation of the atmosphere at the km scale leads to a step-change in the accuracy of the modelled phenomena, because many of the key processes such as convection no longer need to be parameterized. However this is currently only feasible for limited domains and time horizons, as in weather prediction.

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Climate models still require parameterizations, and this places a fundamental limitation on their accuracy. By allowing climate simulations to be performed at weather-resolving spatial scales, *ExtremeEarth* would finally bridge the gap that has long existed between weather and climate; a game-changing capability.

- (ii) The Department of Geography & Environmental Science has world-leading expertise and experience in the development of Earth System models for disaster risk-reduction, and in the co-production of land-surface forecasting systems for natural hazards (including floods, droughts and heatwave health hazards, with national and international partners). There is a strong focus on bridging research-community boundaries to provide demonstrable Earth System capabilities, for example as demonstrated in the work on flood forecasting with numerical weather prediction models for humanitarian support. The research approach challenges practice in the weather and climate modelling community, for example blending hyper-resolution modelling concepts with uncertainty representation to advance impacts research.
- (iii) *ExtremeEarth's* ambitious technology goals require advances in fundamental computational (and computer) science and the development and exploitation of a range of computational technologies. The University of Reading is well placed to contribute to this spectrum of activities, having recently made structural changes in its organisation to better enable the synergies between mathematics, computer science, and the environment. As well as bringing together the relevant Departments together into the school of Mathematical, Physical and Computational Sciences, we have established a research group in "Advanced Computing for Environmental Sciences" (<https://aces.cs.reading.ac.uk>), to complement expansions in existing strengths in data science. Academic competencies of direct relevance to *ExtremeEarth* include the necessary data systems, high performance computing, cloud computing, and exascale computational techniques.

As well as having potential for contributing to the science and development of *ExtremeEarth*, the University also sees itself as one of the stakeholders in the success of the project. The proposed technology advances are likely to revolutionise the ability to conduct environmental science, and so the University would expect to benefit directly. We would also plan to use *ExtremeEarth* developments in our teaching and training programmes, enabling the further dissemination of the benefits downstream to graduates in mathematics, computer science, geography and meteorology. Given the immense potential value of a successful *ExtremeEarth* programme, the University of Reading is keen to provide in-kind support to this preparatory project. As Dean for Environmental Research, I will support and facilitate the engagement of our connected research community outlined above, to harness a focused contribution that helps to develop the *ExtremeEarth* proposal and approach.

Yours sincerely



Phil Newton  
Research Dean (Environment)