**An Overview of the CLDERA Grand Challenge LDRD Project: Developing a Novel Foundational Approach for Attributing Climate Impacts**

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The ability to distinguish the impacts of intervention, anthropogenic climate change, and natural variability, as well as to quantify the proportion of impacts attributable to each, will become increasingly important as the effects of climate change compound and decision-makers must plan for future mitigation and adaptation scenarios. Due to the innate complexity of the climate, enough data must be available to overcome large sources of variability and un cover complex, often nonlinear, correlations [1]. This is an underlying hurdle to the successful discovery of source-impact relationships. Addressing this challenging problem requires integrating foundational research to improve the intelligibility of Earth System Models (ESMs) and fusing disparate observational data sources in order to bridge the gap between observations and models and enable reliable attribution. In this talk, we will provide an overview of the CLDERA (CLimage impact: Determing Etiology thRough pAthways) Grand Challenge LDRD, a project that is developing methods to enable the discovery of pathways between sources and impacts in simulated and observational data. The uncovered pathways elucidate connective relationships, enabling a deeper understanding of cause and effect in the climate, and offer much needed constraints for the inverse attribution problem. Using the 1991 eruption of Mt. Pinatubo, a Stratospheric Aerosol Injection (SAI) event, as an exemplar, we are developing novel computational modeling techniques using the U.S. Department of Energy's Energy Exascale Earth System Model (E3SM) [2] in combination with multivariate statistical techniques applied to large-scale observational data in order to provide constraints for the attribution of impacts from the eruption. A brief overview of the aims of CLDERA along with descriptions of analytical techniques we are pursuing and some initial results will be provided.

## References

1. I.P.C.C. . Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. P´ean, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelek¸ci, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.

2. J.-C. Golaz and et al. The DOE E3SM Coupled Model Version 1: Overview and Evaluation at Standard Resolution. Journal of Advances in Modeling Earth Systems, 2019. 11(7): p. 2089-2129.