

Date

Dear <Salutation>:

As the recipient of the <Fund Name>. I wish to thank you for your generous support for my research, students, and enhancement of our Department’s contribution to the Wisconsin Idea. Over the last year we have used the support from this award to purchase a 120-node server, housed in UW-Madison’s Center for High-Throughput Computing (http://chtc.cs.wisc.edu), to run a high- resolution, real-time numerical forecasting system over the continental US with an inner grid centered over Wisconsin and continued support for the undergraduate student [*Redacted*] who has realized the development of this system with my guidance. Additionally, we have used the server to run case-studies of extreme weather events and developed new diagnostics to understand the development of these weather events – leading to the submission of a peer-reviewed publication. The primary software used for this project includes the Weather Research and Forecasting model (WRF model) and the WRF adjoint software

– readily available to the atmospheric sciences community.

[*Redacted*], majoring in both our Department and in Computer Sciences, has created a real-time model page (https://[www.aos.wisc.edu/~ischluesche)](http://www.aos.wisc.edu/~ischluesche)) using far more modest computing resources as part of his work in my group. Our immediate plans are to move to a more high-resolution set-up, further increase the products available on the webpage, and incorporate the model output in our weekly “Weather Watch” discussions on Friday afternoons during the academic year. Additionally, my intent remains to make the model output and our modeling capabilities more widely known to help weather-impacted industries across the state as part of my commitment to the Wisconsin Idea. I further note that having the support to do this modelling work with a highly capable undergraduate student has allowed me to identify him as an exceptional student for consideration of NOAA’s highly sought after Ernest Hollings Scholarship. Mr. Schluesche was, in fact, selected this summer as part of the 2021 cohort of Hollings Scholars: https://[www.noaa.gov/education/news/announcing-2021-noaa-undergraduate-scholars](http://www.noaa.gov/education/news/announcing-2021-noaa-undergraduate-scholars) - the only from our state! His familiarity with modeling and operating systems for scientific computing made him a highly sought-after choice for placement in the National Hurricane Center for his Hollings internship next year.

Your support has allowed us to conduct several high-resolution runs of “explosive” cyclogenesis events and investigate the sensitivity of these events to changes in the initial atmospheric state. Specifically, we have developed a novel approach to deriving an analytical expression for the sensitivity to quasi- geostrophic vorticity (QGPV) from sensitivities to the horizontal wind-field and potential temperature. The method is built by linking well-understood relationships between adjoint-derived sensitivity gradients, the Lagrange multiplier-based construction of optimal perturbations minimizing an energy norm, and the energy attributed to a perturbation QGPV distribution. This new technique allows us to focus on the dynamically salient aspects of what changes to the initial conditions of a model forecast change the final- time forecast.

This continues to be an exciting time for my research. I am thrilled with the software infrastructure developed over the last year and eager to expand our ambitious modeling effort described above. I appreciate sincerely your support.

Many thanks,

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