

Renewal Proposal for the Penn State Earth System Science Center 2017

1. Name of Center: Earth System Science Center (ESSC)

2. Director: Michael E. Mann,

Distinguished Professor of Meteorology and Atmospheric Science w/ joint appointments in EESI and Department of Geosciences (CV attached)

3. Participants: There are currently 24 faculty and research staff affiliates of the ESSC as listed below:

Director:

Michael Mann (Dept. of Meteorology and Atmospheric Science; joint appointments in Dept. of Geosciences and EESI)

Assistant Director:

Sonya K. Miller (Dept. of Meteorology and Atmospheric Science)

Affiliates:

Richard Alley (Dept. of Geosciences)

Sridhar Anandakrishnan (Dept. of Geosciences)

Michael Arthur (Dept. of Geosciences)

Timothy Bralower (Dept. of Geosciences)

Robert Crane (Dept. of Geography/AESEDA)

Ken Davis (Dept. of Meteorology and Atmospheric Science)

Jenni Evans (Dept. of Meteorology and Atmospheric Science; Director, Institute for CyberScience)

Steve Feldstein (EESI)

Chris Forest (Dept. of Meteorology and Atmospheric Science)

Kate Freeman (Dept. of Geosciences)

José Fuentes (Dept. of Meteorology and Atmospheric Science)

Bernd Haupt (EESI)

Gregory Jenkins (Dept. of Meteorology and Atmospheric Science)

Jim Kasting (Dept. of Geosciences)

Klaus Keller (Dept. of Geosciences)

Lee Kump (Dept. of Geosciences)

Sukyoung Lee (Dept. of Meteorology and Atmospheric Science)

Paul Markowski (Dept. of Meteorology and Atmospheric Science)

Ray Najjar (Dept. of Meteorology and Atmospheric Science)

David Pollard (EESI)

Yvette Richardson (Dept. of Meteorology and Atmospheric Science)

Tim White (EESI)

4. Rationale for Center:

The Penn State Earth System Science Center (ESSC) serves to nurture, develop, and publicize Penn State's historic strength in the area of Earth System Science. ESSC interests emphasize climate dynamics, paleoclimate, climate change research, and public outreach and education. The ESSC mission serves the larger priorities of both the Earth and Environmental Systems Institute (EESI) and Penn State Institutes of Energy and the Environment (PSIEE) to support Penn State's position as a leading institution both nationally and internationally in the areas of energy and environmental sciences.

The ESSC seeks to foster interdisciplinary Earth system research through encouraging collaboration among scientists, supporting a seminar series (the ESSC brown bag climate dynamics seminar) that highlights topics at the forefront of climate research and brings together Penn State students, faculty, and researchers engaged in climate research, and leveraging visits from leading scientists in the field. The modest ESSC financial resources have supported several high profile joint speakers in the ESSC and departmental colloquium series. For example, over the past three years, the ESSC has hosted two "surprise" talks by Bill Nye "The Science Guy", and talks by Greg Fishel Chief Meteorologist at WRAL, Dr. James Fleming of Colby College, and Dr. Mark Guishard of the Bermuda Institute of Ocean Sciences. The ESSC has co-sponsored several special talks and forums, including a forum moderated by Associated Press Science Writer Seth Bornstein that featured Dr. Rush Holt (CEO of AAAS and former Congressman) and ESSC Director Michael Mann, and a talk by Dr. Roger Wakimoto, Director of Geosciences at NSF.

While the research agenda of the ESSC has adapted over time to address changing needs and priorities of Penn State researchers, the scientific community and funding agencies, areas of specific focus over the past few years have been:

- Value-added use of existing state-of-the-art climate simulations:

ESSC scientists continued to use output from coupled model simulations from the Coupled Model Intercomparison Project archive to examine many aspects of the climate system including, but not limited to, the likelihood of recent global temperature records, the expected return rate of damaging storm surges, ocean warming rates over the past several decades, and increasing frequency of extreme weather due to jet stream variability.

- Targeted use of state-of-the-art coupled models:

Dr. David Pollard continued his work with collaborators on refining ice sheet models coupled with climate models to project sea level rise for both past climates and future climates under various scenarios. His recent sea level rise projections were used in research by ESSC scientists looking at climate change impacts and adaptation.

- Leveraging expertise for graduate education:

The ESSC seminars have been offered for graduate credit as the *Climate Dynamics Seminar* (METEO 575) for the past several years. Graduate students are able to use these

credits toward their degrees. The Climate Dynamics Seminar will soon be a *required* course with the launch of the new dual-degree Ph.D. program in Climate Science.

• Public Outreach & Education:

ESSC scientists continue to be featured prominently in public discussions of climate change, especially ESSC director Dr. Michael Mann and Dr. Richard Alley. Dr. Mann does hundreds of media (TV, Radio, and print) interviews, writes for popular venues as *Scientific American* and the *New York Times*, and does more than 50 public lectures and events every year. In addition, he has written a few popular books. He also edits and writes for the popular *RealClimate* blog, participates in online forums and engages actively in social media-based communication efforts. Dr. Alley frequently participates in media interviews and testifies before Congress. Both individuals are involved in a number of government-funded and private-sector campaigns aimed at educating the public on climate change.

The ESSC web page (<http://www.essc.psu.edu>) averages roughly 1,000 visits per month over the past 3 years, many of which come from relevant search engine queries. The ESSC also maintains a presence on social media including both twitter (@PSUClimate, 299 followers) and Facebook (<https://www.facebook.com/PSUClimate> , 147 followers).

5. Funding Opportunities:

The ESSC leverages research funding opportunities within EESI, the individual EMS departments (Meteorology, Geosciences, and Geography), and larger inter-college collaborations, in a number of ways. Primary among these is extramural grant funding raised by ESSC principals and affiliates whose research has been leveraged by the interdisciplinary collaborative atmosphere fostered by ESSC activities such as the brown bag seminar series and support for special joint ESSC/departmental colloquium outside speakers.

Quantifying the precise funding raised by the ESSC is challenging, since the accumulated grant funding raised by all two dozen ESSC affiliates likely overstates the funds solely attributable to ESSC activities. It is nonetheless reasonable to state that ESSC activities have directly or indirectly supported several million dollars of extramural funding within EESI and EMS over the past 6 years, including several million dollar+ grants.

ESSC research efforts remain within core areas of high priority for funding by the major granting agencies including NSF, NOAA, NASA, and DOE. We therefore have every reason to believe that ESSC research activities will achieve similarly successful levels of extramural funding over the next 3 years.

6. Center Needs:

ESSC has a long history as a vital unit within EESI and EMS at Penn State. We hope to maintain its status as such for the foreseeable future.

With the current proposal, we seek continued EESI funding for the ESSC for an additional 3-year term, with the hope of continuing this in future cycles.

We request a continuing budget at the level of 5K per year. This budget will provide for:

- Roughly 4K to support partial salary of ESSC associate director Sonya Miller
- Roughly 1K to support ESSC brown bag refreshment budget and modest travel support for visiting scientists and speakers.

7. Management Structure:

M. Mann serves as director, and S. Miller serves as assistant director of the ESSC.

An Advisory Board consisting of Robert Crane, Jenni Evans, Chris Forest, James Kasting, and David Pollard serves as a sounding board concerning Center and resource allocation.

There are currently 24 EMS faculty and research scientists in total that remain affiliated with the ESSC. This includes individuals from the departments of Meteorology, Geosciences, and Geography, and from EESI. PSICE is a separate center that remains directly affiliated with the ESSC.

Significant decisions regarding direction, allocation of resources, etc. are generally put before the Advisory Board during annual/semi-annual meetings, or before the full membership where appropriate.

The EESI weekly 'This Week' email distribution, the ESSC email list, Department email distribution lists, the ESSC twitter and Facebook accounts, and the EESI and ESSC websites all serve as conduits to advertise ESSC talks and events, and to provide announcements to ESSC affiliates and their students and post-docs.

8. Past Budgets and Work:

a. Past Budgets

2014-2015

Income		Expenses	
EESI	\$5,000.00	Salaries	\$5,004.00
Carryover from 2013/14	\$174.00	Salary Fringe	\$1,756.41
EMS - salary fringe	\$1,756.00	Seminar Refreshments	\$156.92
TOTAL for 2014/15	\$6,930.00		\$6,917.33

Difference \$12.67

2015-2016

Income		Expenses	
EESI	\$5,000.00	Salaries	\$4,000.00
Carryover from 2015/16	\$13.00	Salary Fringe	\$1,480.00
EMS - salary fringe	\$1,480.00	Seminar Refreshments	\$386.28
		Speaker Meals	\$174.11
TOTAL for 2014/15	\$6,493.00		\$6,040.39

Difference \$452.61

2016-2017 (as of 14 April 2017)

Income		Expenses	
EESI	\$5,000.00	Salaries	\$4,000.00
Carryover from 2016/17	\$452.61	Salary Fringe	\$553.89
EMS - salary fringe	\$553.89	Seminar Refreshments	\$202.36
		Science Policy Society Sponsorship	\$500.00
		Speaker Travel	\$300.64
TOTAL for 2014/15	\$6,006.50		\$5,556.89

Difference \$449.61

b. Past Work:

Key areas ESSC sponsored/facilitated research during the past three years were summarized in section 4 above. A discussion of funding opportunities and successes were described in section 5 above. Resulting publications are listed below.

The ESSC Brown Bag/Climate Dynamics Seminars have continued over the past three years as a mechanism for informal conversations with visiting or local experts as well as

opportunities for graduate students to get feedback on research from the wider community. Notable speakers include: Bill Nye (CEO of the Planetary Society and television personality, twice), Greg Fishel (Chief Meteorologist at WRAL), Dr. John Mashey (Techviser for DeSmog Blog), Dr. Stan Benjamin (Chief, Assimilation and Modeling Branch, NOAA/ESRL), Dr. James Fleming (Colby College), Dr. Mark Guishard (Bermuda Institute of Ocean Sciences and Penn State Alumnus), and Brian Bastian (Assistant Vice President of JLT Re North America and Penn State Alumnus).

In addition, the ESSC has co-sponsored several special talks and forums, including a forum moderated by Associated Press Science Writer Seth Bornstein featuring Dr. Rush Holt (CEO of AAAS and former Congressman) as well as a talk by Dr. Roger Wakimoto (Director, NSF Geosciences).

Selected Publications (past 3 years):

- Bannon, P.R., Najjar, R.G., 2014. Available energy of the world ocean. *Journal of Marine Research*, 72, 219-242.
- Cowtan, K., Hausfather, Z., Hawkins, E., Jacobs, P., Mann, M.E., Miller, S.K., Steinman, B.A., Stolpe, M.B., Way, R.G., [Robust comparison of climate models with observations using blended land air and ocean sea surface temperatures](#), *Geophys. Res. Lett.* 42, 6526–6534, doi:10.1002/2015GL064888, 2015.
- Cui, Y., Kump, L.R., and Ridgwell, A., 2015. Spatial and temporal patterns of ocean acidification during the end-Permian mass extinction - an Earth system model evaluation. In: Schmidt, A., Fristad, K.E., and Elkins-Tanton, L.T. (eds.), *Volcanism and Global Environmental Change*. Cambridge University Press, Cambridge, UK, pp. 291-306.
- Frankcombe, L.M., England, M.H., Mann, M.E., Steinman, B.A., [Separating internal variability from the externally forced climate response](#), *J. Climate*, 28, 8184-8202, 2015.
- Fyfe, J.C, Meehl, G.A., England, M.H., Mann, M.E., Santer, B.D., Flato, G.M., Hawkins, E., Gillet, N.P., Xie, S.-P., Kosaka, Y., Swart, N.C., [Making sense of the early-2000s global warming slowdown](#), *Nature Climate Change*, 6, 224-228, 2016.
- Gleckler, P.J., P.J. Durack, R.J. Stouffer, G.C. Johnson, and C.E. Forest, Industrial Era Global Ocean Heat Uptake Doubles in Recent Decades, *Nature Climate Change*, doi:10.1038/nclimate2915, 2016.
- Gomez, N., Pollard, D. & Holland, D. Sea-level feedback lowers projections of future Antarctic Ice-Sheet mass loss. *Nature Commun.* 6, 8798, <http://dx.doi.org/10.1038/ncomms9798> (2015)
- Halpern, M., Mann, M., [Transparency Versus Harassment](#) (editorial), *Science*, 479, 348, 2015.
- Lewandowsky, S., Mann, M.E., Brown, N.J.L., Friedman, H., [Science and the Public: Debate, Denial, and Skepticism](#), *Journal of Social and Political Psychology*, 4, 1-99, doi:10.5964/jspp.v4i2.604, 2016.

- Lindeman, K.C., Dame, L.E., Avenarius, C.B., Horton, B.P., Donnelly, J.P., Corbett, D.R., Kemp, A.C., Lane, P., Mann, M.E., and Peltier, W.R., [Science needs for sea-level adaptation planning: comparisons among three U.S. Atlantic coast regions](#), *Coastal Management*, 43, 555-574, 2015.
- Mann, M.E., Gleick, P.H., [Climate Change and California Drought in the 21st Century](#), *Proc. Nat. Acad. Sci.*, 112, 3858-3859, 2015.
- Mann, M.E., [Must Try Harder](#), *New Scientist*, p. 29-30, Feb 20, 2016.
- Mann, M.E., Rahmstorf, S., Steinman, B.A., Miller, S.K., [The Likelihood of Recent Record Warmth](#), *Nature Sci. Rep.*, 6, 19831, 2016.
- Mann, M.E., Steinman, B., Miller, S.K., Frankcombe, L., England, M., Cheung, A.H., [Predictability of the Recent Slowdown and Subsequent Recovery of Large-Scale Surface Warming using Statistical Methods](#), *Geophys. Res. Lett.*, 43, 3459-3467, 2016.
- Mann, M.E., [The Serengeti strategy: How special interests try to intimidate scientists, and how best to fight back](#), *Bulletin of the Atomic Scientists*, 71, 33-45, 2015.
- Mann, M.E., [Two Degrees of Freedom](#), *Scientific American*, p.12, December 2015.
- Ogle, S. M., K. Davis, T. Lauvaux, A. Schuh, D. Cooley, T. O. West, L. S. Heath, N. L. Miles, S. Richardson, F. J. Breidt, J. E. Smith, J. L. McCarty, K. R. Gurney, P. Tans and A. S. Denning, 2015. An approach for verifying biogenic greenhouse gas emissions inventories with atmospheric CO₂ concentration data, *Environ. Res. Lett.* 10 034012 doi:10.1088/1748-9326/10/3/034012
- Oreskes, N., Carlat, D., Mann, M.E., Thacker, P.D., vom Saal, F.S., [Why Disclosure Matters](#), *Environmental Science & Technology*, 49, 7527-7528, 2015.
- Pollard, D. & DeConto, R. M. *Nature* <http://dx.doi.org/10.1038/nature17145> (2016).
- Pollard, D., DeConto, R. M. & Alley, R. B. Potential Antarctic Ice Sheet retreat driven by hydrofracturing and ice cliff failure. *Earth Planet. Sci. Lett.* **412**, 112–121 (2015)
- Rahmstorf, S., Box, J., Feulner, G., Mann, M.E., Robinson, A., Rutherford, S., Schaffernicht, E. [Evidence for an exceptional 20th-Century slowdown in Atlantic Ocean overturning](#), *Nature Climate Change*, 5, 475–480, 2015.
- Reed, A.J., Mann, M.E., Emanuel, K.A., Lin, N., Horton, B., Kemp, A.C., Donnelly, J.P., [Increased threat of tropical cyclones and coastal flooding to New York City during the anthropogenic era](#), *Proc. Nat. Acad. Sci.*, 112, 12610-12615, 2015.
- Reed, A.J., Mann, M.E., Emanuel, K.A., Titley, D.W., [An analysis of long-term relationships among count statistics and metrics of synthetic tropical cyclones downscaled from CMIP5 models](#), *J. Geophys. Res.* 120, 7506-7519, doi:10.1002/2015JD023357, 2015.
- Ross, A.C., Najjar, R.G., Li, M., Mann, M.E., Ford, S.E., Katz, B., [Influences on decadal-scale variations of salinity in a coastal plain estuary](#), *Estuarine, Coastal and Shelf Science*, 157, 79-92, 2015.

- Ross, A.C., Najjar, R.G., Li, M., Mann, M.E., Ford, S.E., Katz, B., 2015. [Sea-level rise and other influences on decadal-scale variations of salinity in a coastal plain estuary](#). *Estuarine Coastal and Shelf Science*, 157, 79-92.
- Schulte, J., Duffy, C., Najjar, R.G., 2015. [Geometric and topological approaches to significance testing in wavelet analysis](#). *Nonlinear Processes in Geophysics*, 22, 139-156.
- Steinman, B.A. Frankcombe, L.M., Mann, M.E., Miller, S.K., England, M.H., [Response to Comment on “Atlantic and Pacific multidecadal oscillations and Northern Hemisphere temperatures”](#), *Science*, 350, 1326, 2015.
- Steinman, B.A., Mann, M.E., Miller, S.K., [Atlantic and Pacific multidecadal oscillations and Northern Hemisphere temperatures](#), *Science*, 347, 998-991, 2015.
- Zhang, F., Li, W. Mann, M.E., [Limits to Regional-scale Climate Predictability over North America](#), *Advances in Atmospheric Sciences*, 33, 905-918, 2016.

9. Letters of Support:

Letters of Support have been provided (attached) from the following individuals:

- Richard Alley, Evan Pugh Professor, Department of Geosciences
- Timothy Bralower, Professor, Department of Geosciences
- Robert Crane, Professor, Department of Geography; Director of AESEDA
- Jenni Evans; Professor, Department of Meteorology

MICHAEL E. MANN

Pennsylvania State University, Department of Meteorology, University Park, PA 16802

Tel: (814) 863-4075; FAX (814) 865-9429; email: mann@psu.edu

website: <http://www.michaelmann.net>

Professional Preparation:

- 1989 A.B. (Physics w/ honors; Applied Math), University of California-Berkeley
- 1991 M.S. Department of Physics, Yale University
- 1991 M.Phil. Department of Physics, Yale University
- 1993 M.Phil. Department of Geology & Geophysics, Yale University,
- 1998 Ph.D., Department of Geology & Geophysics, Yale University,
- 1996-98 Alexander Hollaender Distinguished Postdoctoral Research Fellow (DOE)

Appointments:

- 2013- *Distinguished Professor*, Pennsylvania State University, Department of Meteorology
- 2009- *Professor*, Pennsylvania State University, Department of Meteorology
- 2005- *Associate Professor*, Pennsylvania State University, Department of Meteorology [joint appointments in Department of Geosciences and Earth and Environmental Systems Institute]
- 2005- *Director*, Earth System Science Center (ESSC), Pennsylvania State University
- 1999-05 *Assistant Professor*, University of Virginia, Department of Environmental Sciences
- 1998-99 *Research Assistant Professor*, University of Massachusetts, Department of Geosciences
- 1997-98 *Adjunct Assistant Professor*, University of Massachusetts, Department of Geosciences

Publications (out of 190+ total; reprints available at: www.michaelmann.net):

Five Publications Related to Proposed Project:

- Fyfe, J.C, Meehl, G.A., England, M.H., **Mann, M.E.**, Santer, B.D., Flato, G.M., Hawkins, E., Gillet, N.P., Xie, S.-P., Kosaka, Y., Swart, N.C., Making sense of the early-2000s global warming slowdown, *Nature Climate Change* (in press).
- **Mann, M.E.**, Rahmstorf, S., Steinman, B.A., Tingley M., Miller, S.K., The Likelihood of Recent Record Warmth, *Nature Scientific Reports*, 6, 19831, 2016.
- Frankcombe, L.M., England, M.H., **Mann, M.E.**, Steinman, B.A., Separating internal variability from the externally forced climate response, *J. Climate*, 28, 8184-8202, 2015.

- Steinman, B.A., **Mann, M.E.**, Miller, S.K., Atlantic and Pacific multidecadal oscillations and Northern Hemisphere temperatures, *Science*, 347, 998-991, 2015.
- **Mann, M.E.**, Steinman, B.A., Miller, S.K., On Forced Temperature Changes, Internal Variability and the AMO, *Geophys. Res. Lett.* (“Frontier” article) 41, 3211-3219, doi:10.1002/2014GL059233, 2014.

Five Other Significant Recent Publications:

- Reed, A.J., **Mann, M.E.**, Emanuel, K.A., Titley, D.W., An analysis of long-term relationships among count statistics and metrics of synthetic tropical cyclones downscaled from CMIP5 models, *J. Geophys. Res.*, 120, 7506-7519, doi:10.1002/2015JD023357, 2015.
- Cowtan, K., Hausfather, Z., Hawkins, E., Jacobs, P., **Mann, M.E.**, Miller, S.K., Steinman, B.A., Stolpe, M.B., Way, R.G., Robust comparison of climate models with observations using blended land air and ocean sea surface temperatures, *Geophys Res. Lett.*, 42, 6526–6534, doi:10.1002/2015GL064888, 2015.
- Blanford J.I., Blanford S., Crane R.G., **Mann, M.E.**, Paaijmans K.P., Schreiber, K.V., Thomas, M.B., Implications of temperature variation for malaria parasite development across Africa, *Nature Scientific Reports*, 3, 1300, doi: 10.1038/srep01300, 2013.
- **Mann, M.E.**, Fuentes, J.D., Rutherford, S., Underestimation of Volcanic Cooling in Tree-Ring Based Reconstructions of Hemispheric Temperatures, *Nature Geoscience*, 5, 202–205, 2012.
- Ning, L., **Mann, M.E.**, Crane, R., Wagener, T., Probabilistic Projections of Climate Change for the Mid-Atlantic Region of the United States - Validation of Precipitation Downscaling During the Historical Era, *J. Climate*, 25, 509-526, 2012.

Selected Synergistic Activities over Past Five Years:

- 2015 Invited Science Foo Camp ("Sci Foo") participant, event organized by *Nature*, O'Reilly Media, and Google, GooglePlex, Mountain View, CA, Jun 26-28, 2015.
- 2015 Co-convener/organizer (w/ S. Hassol), Science Communication Workshop, Global Change Center/Interfaces of Global Change Interdisciplinary Graduate Education Program, Virginia Tech, Blacksburg, VA, Mar 20, 2015.
- 2015 Co-convener/organizer (w/ D. J. Wuebbles and M. Wehner), Session on “Severe Weather in a Changing Climate: Informing Risk”, *AAAS Annual Meeting*, Feb 13, 2015.
- 2015- Committee on Academic Freedom and Tenure, *American Association of University Professors* (AAUP)
- 2014- Advisory Council, National Center for Science Education (NCSE)



Department of Geosciences, and PSICE
(Penn State Ice & Climate Exploration Center)
517 Deike Building
The Pennsylvania State University
University Park, PA 16802, USA
Ph. (814) 863-1700; Fax (814) 863-7823
Email rba6@psu.edu

April 17, 2017

Dr. Susan Brantley, Professor
Director, Earth and Environmental Systems Institute
The Pennsylvania State University
University Park, PA 16802

Dear Director Brantley:

The Earth System Science Center, under the direction of Prof. Michael Mann, continues to serve an important role in generating collaboration among Institute-affiliated faculty and others interested in climate change.

The speaker series brings in fascinating people, and promotes interactions. The enhanced modeling effort is welcome.

Climate change is a long-standing strength of Penn State in general, and of EESI in particular. ESSC strengthens our position, our recruiting, and our interactions. And, with the return of Eric Barron as president of the university, having ESSC within EESI is a good idea.

I've enjoyed interactions informally, and these have helped lead to formal interactions on thesis committees and in other ways.

For these and additional reasons, I am happy to support the application from Director Mann for continuation of the ESSC. Should you require further information, please contact me.

Yours truly,

A handwritten signature in black ink that reads "Richard B. Alley".

Richard B. Alley
Evan Pugh University Professor of Geosciences



Dr. Susan Brantley, Director
Earth and Environmental Systems Institute
Penn State Campus

14th April, 2017

Dear Sue,

This letter is in support of Dr. Michael Mann's proposal to continue the Earth System Science Center under EESI. ESSC serves a critical purpose in the College, assembling and integrating research and education of a multitude of topics, concerning both modern and ancient climate that takes place in the Meteorology, Geoscience and Geography Departments.

I have not been an active participant in the center activities, however, I keep up with seminars and events and it is clear that ESSC has been doing its job, bringing folks together to collaborate and stimulating scientific discussion and discovery with a vibrant agenda.

But the largest impact ESSC has is clearly external. Through Michael Mann's leadership, the ESSC is the most visible program within EESI, promoting the correct interpretation of climate data at a time when such expertise is in dire need. Mike is one a handful of scientists who is actively providing a clear message related to climate change at the highest government levels today. There is no more critical time for research and education in the climate field than the present (I know I said close to the same thing three and six years ago, but it is even more true now!).

I am very much in support of continued funding for the Earth System Science Center.

Sincerely,

Timothy Bralower
Professor
Department of Geosciences



15 April, 2017

Dr. Sue Brantley, Director
Earth and Environmental Systems Institute
The Pennsylvania State University
University Park. PA 16802, USA

Dear Sue,

I would like to offer my continuing support of the Earth System Science Center within EESI. As I noted in the last round of center proposals, Mike, through the ESSC, has been continuing to promote multi-disciplinary Earth System Science within the College and helping to focus climate change research at the University.

Following on from the downscaling workshop organized by Mike and Jenni Evans several years ago, there has been continuing discussion with the University of Cape Town and new partnerships developing in West Africa. This type of international collaboration, promoted through ESSC, is closely aligned with the strategic objectives of the University and with Global Programs.

I look forward to ESSC's continued success and I would be happy to assist in any way that I can in promoting ESSC programs with our international partners.

Yours sincerely,

A handwritten signature in purple ink, appearing to read 'R. Crane', with a stylized flourish at the end.

Robert G. Crane, Professor of Geography
Director for Strategic Initiatives, Office of the Vice Provost for Global Programs