Report of the External Review for the Cooperative Institute for Modeling the Earth System

Panel members

Zhaoxia Pu (co-Chair), University of Utah, NOAA SAB
David Grimes (co-Chair), World Bank Group, NOAA SAB
Elizabeth A. Barnes, Colorado State University
Bruce D. Cornuelle, University of California, San Diego
Qiang Fu, University of Washington
L. Ruby Leung, Pacific Northwest National Laboratory
William H. Lipscomb, National Center for Atmospheric Research
James T. Randerson, University of California, Irvine

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SUMMARY

An external review of the research, education, and outreach programs of the Cooperative Institute for Modeling the Earth System (CIMES), based at Princeton University, was conducted on May 17 and 18, 2022. CIMES is a collaboration between Princeton University and the National Oceanographic and Atmospheric Administration's (NOAA) Geophysical Fluid Dynamics Laboratory (GFDL) to carry out research in earth system sciences. CIMES and its predecessors have been founded on a long collaborative relationship between Princeton University and NOAA's GFDL since 1967, when GFDL was relocated from Washington, DC to the Princeton campus. Princeton University's current five-year Cooperative Agreement award for CIMES covers the period July 1, 2018 through June 30, 2023.

Guidance for conducting the review was provided by the Cooperative Institutes Administration Office within the National Oceanic and Atmospheric Administration (NOAA) Office of Oceanic and Atmospheric Research (OAR). The review was conducted under the auspices of the NOAA Science Advisory Board (SAB), which ensures the review team meets the requirements of a subcommittee under the Federal Advisory Committee Act. A list of review panel members is provided in Appendix I. The agenda for the review meeting is provided in Appendix II.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The Science Review Panel rates CIMES as "**Outstanding**". The key observations and findings include:

- Well-articulated and defined science objectives. CIMES's science plan closely aligns with GFDL's research interests and meets GFDL's goals and needs. CIMES's three science themes - [I] earth system modeling; [II] seamless prediction across time and space scales; and [III] earth system science analysis and applications - contribute greatly to NOAA's mission.
- Impressive accomplishments in science, particularly in earth system modeling and applications. CIMES's science achievements are laudable as evidenced by the quantity and quality of their publications, improved/new modeling capabilities added to the various GFDL model components, and the relevance of the science outcomes to NOAA's priorities.
- Strong management with a clear organizational structure, mechanisms for resource distribution, thoughtful attention to the needs of students and postdocs, and staff development and training.
- Successful research and education efforts, as demonstrated by the research alignment and productivity of the CIMES postdocs and students. CIMES produces excellent research and provides training for students and postdocs, creating a pipeline of scientists supporting GFDL, other NOAA laboratories, universities, and beyond. CIMES students and postdocs have successful career paths in universities and national labs.
- Impressive educational outreach and DEI (diversity, equity, and inclusion) efforts, given the limited resources for these activities.
- Dr. Syukuro Manabe was awarded the 2021 Nobel Prize in Physics, providing more evidence for a world-class program in climate research from the GFDL - Princeton

collaboration and attesting to CIMES's scientific leadership.

To further the work of CIMES moving forward, the Panel offers the following recommendations:

A. Realign funding to increase support for Task III (Individual Projects funded by GFDL and Princeton) to strengthen multi-disciplinary science contributions to support applications of earth system modeling for important decision-making processes and relevant policy measures, which are essential for NOAA's Climate Ready Nation priorities.
B. Strengthen guidance and mentoring for postdoctoral researchers; we invite NOAA to consider a stronger and more formal role for the relevant supervisory staff in GFDL to contribute to the performance evaluation of graduate students and postdoctoral researchers. Ensure there is a systematic approach for postdoctoral researchers in developing skills needed for attaining academic or laboratory early-career principal investigator positions.
C. Strengthen mentoring for graduate students to ensure that mentors for students are responsible and provide high-quality mentorship. Princeton University should provide a larger variety of internship opportunities for students who may be interested in exploring new research areas not directly related to their dissertation.
D. Add resources for Princeton's high-performance computing system (Stellar) including software/hardware/staff support to improve computational efficiency.
E. Optimize outreach investments by considering a pipeline approach to get more underrepresented minority students to apply to AOS, to track and foster the development of these students, and provide incentives for them to participate in the CIMES (or other NOAA) postdoctoral scholars programs.
F. Increase support for Task I (Administration/Outreach) to strengthen outreach and administration. Princeton could also consider means of increasing administration support to reduce the workload of the current CIMES director.

I. OVERVIEW OF CIMES

The Cooperative Institute for Modeling the Earth System (CIMES) is a collaboration between Princeton University and the National Oceanographic and Atmospheric Administration's (NOAA) Geophysical Fluid Dynamics Laboratory (GFDL) to carry out research in earth system sciences.

CIMES builds upon the strengths of GFDL in modeling the atmosphere, oceans, sea ice, ice sheets, terrestrial surface, biogeochemistry, and chemical constituents for seasonal to centennial predictions and projections, as well as the strengths of Princeton University in atmospheric sciences, biogeochemistry, physical oceanography, paleoclimatology, hydrology, ecosystem ecology, climate change mitigation technology, economics, and policy. CIMES is an extension of a highly successful 55-year collaboration, and the previous Cooperative Institute on Climate Science (CICS) between Princeton University's Atmospheric and Oceanic Sciences (AOS) Program and GFDL. This collaboration has proven valuable in advancing the development of oceanic and atmospheric models, performing research on climate and biogeochemical cycling, and educating several generations of postdoctoral researchers and graduate students.

CIMES is engaging Princeton University faculty in the AOS Program, GeoSciences, Civil Engineering and those affiliated with the interdisciplinary High Meadows Environmental Institute

(HMEI). This is promoting a more multidisciplinary approach, drawing expertise from the sciences, engineering, and policy domains, for which Task III funding is the primary means of supporting this engagement.

Princeton University's current five-year Cooperative Agreement award for CIMES began on July 1, 2018, with a funding ceiling of $50M. Total funding for the first four years of CIMES was $32,129,322, of which $6,006,570 is designated as Research Supercomputing funding to be used for high performance computing and related costs. Princeton University's total cost sharing and funding is $3,076,760 to CIMES, which includes actual funding of $1,200,000 by the university, the waiver of indirect costs on Task I ($658,101) and Task III ($834,542), and cost-sharing of graduate student tuition ($384,117).

II. CIMES STRATEGIC SCIENCE PLAN

CIMES has a well-articulated vision and science plan, well aligned with the strategic priorities of GFDL and more broadly with NOAA.

A. CIMES VISION AND MISSION STATEMENTS

CIMES's vision is to "Be a world leader in understanding and predicting the earth system, across time scales from days to decades, and from local to global spatial scales, with particular focus on extreme events, and integrating physical, chemical, and biological components."

To achieve this vision, CIMES has a mission statement as follows: "Focus the scientific talent of Princeton University at all levels from graduate students, through postdocs, and faculty, to address key questions related to climate science and earth system modeling, providing a bridge between NOAA-GFDL and Princeton University, and the wider academic community."

In reaching for this vision, it is evident that CIMES has been highly successful in the engagement of graduate students and postdocs, particularly in the working relationship with GFDL. However, it appears that the caps on CIMES funding (Task III) may limit the potential for broader engagement from the relevant Princeton faculty and the wider academic community, including GFDL.

B. RELATIONSHIP OF CIMES TO THE NOAA STRATEGIC PLAN

CIMES's activities are well aligned with the Department of Commerce/NOAA Strategic Plan 2018-2022. CIMES has contributed to:

- Strategic Objective 3.3, the Reduction of Extreme Weather Impacts, by enhancing NOAA's prediction capabilities through better data gathering and modeling technology.
- Enhanced Modeling technology, working with GFDL to develop earth system models for seasonal to centennial predictions and projections at regional to global scales.
- Development of a comprehensive earth system model, in collaboration with GFDL, contributing to the understanding of the many different processes involved in the climate system, including information from observational campaigns, theoretical studies, and

studies of the complicated interactions between processes.

C. CIMES GOALS

From the initial proposal, CIMES identified five goals:

- To develop the world leading earth system model, in collaboration with GFDL, by providing expertise in key processes, physical and biological components, and software development.
- To apply this model to the problem of prediction across time and space scales, from high-resolution simulations of extreme events to prediction of climate phenomena from seasons to centuries.
- To apply this model to understand impacts of a changing climate on societally relevant problems, including marine ecosystems, weather extremes, droughts, and air quality.
- To train the next generation of leaders in earth system science, through the world-leading Atmospheric and Oceanic Sciences graduate program, and the AOS postdoctoral program.
- To develop a more diverse workforce by broadening participation in earth system science training, through summer internships, visiting faculty exchange fellowships, and increasing research collaborations with diverse institutions.

CIMES activities have been and are well aligned with these goals.

D. CRITERIA FOR MEASURING SUCCESS

CIMES employs three categories of performance measures in gauging the impact of its research efforts:
(1) the contribution of ongoing CIMES research to NOAA's and, specifically, OAR/GFDL's mission;
(2) the publication of scientific results in refereed journals, and their impact on the field; and
(3) the success of CIMES postdocs, associate research scholars, and graduate students in obtaining research, faculty, public policy, or other positions in this field upon completion of their stay at Princeton University.

CIMES has performed strongly on these criteria.

E. CIMES RESEARCH THEMES

The three CIMES scientific themes are focused on the development and application of numerical models for understanding and predicting changes in the Earth system:

- **Earth System Modeling**: Developing and improving Earth System Models (ESMs), numerical models which simulate the climate and earth system, and allow prediction of the future evolution of this system. These models include the dynamical, physical, chemical, and biological components of the atmosphere-ocean-land system and the coupling between them.

- **Seamless Prediction Across Time and Space Scales**: Applying the ESMs to predictions

on timescales from days to centuries and over spatial scales from those of extreme events to global scales, making use of the same flexible code base. They focus on two different aspects of prediction across time and space scales: the very high-resolution modeling necessary to resolve extreme weather phenomena, and the predictability of different weather and climate phenomena.

- **Earth System Science: Analysis and Applications**: Using ESMs to understand the impacts of environmental variations and changes on pressing problems of relevance to society, including marine ecosystems, weather extremes, drought, and air quality.

F. SCIENTIFIC PARTNERSHIPS WITH NOAA ENTITIES

CIMES's research interests are intimately intertwined with those of NOAA and GFDL. In addition to its collaborations with GFDL, CIMES scientists working on global carbon cycle issues under the Biogeochemistry theme have extensive interactions with scientists at the Earth System Research Laboratory (in the former Climate Monitoring and Diagnostics Laboratory), Pacific Marine Environmental Laboratory, and Atlantic Oceanographic Meteorological Laboratory. Recent activities also include collaborations with the National Marine Fisheries Service and the Climate Program Office. There are collaborations with the Ocean Observations program in OAR to strengthen model-observation relationships based on ARGO and ENSO-related observations. Model development and research on severe weather (such as hurricanes) is carried out in close collaboration with the National Weather Service (for example, the Storm Prediction Center), the Weather Program Office, OAR/NSSL, and OAR/AOML.

G. COOPERATIVE PLANNING

Joint planning is carried out through regular interactions between CIMES and GFDL Directors and their scientists. The CIMES Director is advised by an Executive Board which provides advice on the development of basic scientific themes as well as the preparation of proposals and the allocation of resources. Members of this committee include the Director of AOS, representative faculty members from the AOS Program, the CIMES Director and Deputy Director, and representative faculty members of Departments at Princeton University with close connections to climate research.

The Associate Director chairs the Visiting Scientist Selection Committee, which evaluates applicants to the collaborative post-doctoral program. Each year, about 50 Princeton University postdocs and associate research scholars, and about 10 Princeton University graduate students work or learn at GFDL in partnership with government scientists.

Joint planning and determination of climate science and modeling goals are achieved through discussions and meetings throughout the year. These policy-level discussions then shape the decisions made by the Visiting Scientist Selection Committee and guide the types of research initiatives to be undertaken. These plans are reflected in GFDL's contribution to NOAA's annual planning and budgeting process, by which NOAA prioritizes and funds its research activities.

H. CIMES BUDGET ALLOCATION

The CIMES budget is managed based on both tasks and research themes. In the first four budget years (totaling $33,329,322), the allocations for Task I (Administration/Outreach), Task II (AOS/GFDL Cooperative Research & Education), and Task III (Individual Projects funded by GFDL and Princeton) are $1,701,573, $28,777,527, and $2,850,222, respectively. Based on research themes, the allocations are $14,171,599, $5,600,969, $5,590,406, and $6,264,775, respectively, for Theme 1 (Earth System Modeling), Theme 2 (Seamless Prediction across Time and Space Scales), Theme 3 (Earth System Science: Analysis and Applications), and Multi-Theme (Themes 1-3).

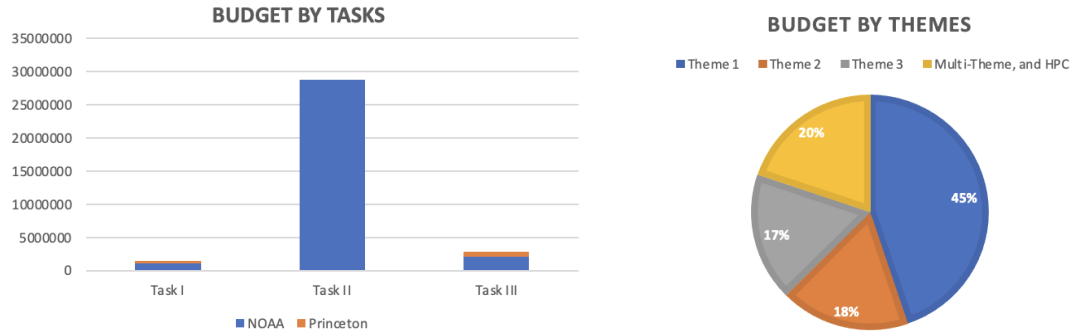

Figure 1. Diagrams of CIMES budget distribution by tasks (left) and themes (right).

III. SCIENCE REVIEW

CIMES researchers contributed to the development of the recent suite of GFDL models for the Climate Model Intercomparison Project 6 (CMIP6). This includes state of the art atmospheric, ocean, sea-ice, and land-surface models, coupled together to form GFDL-CM4. CIMES researchers have also contributed to the "Seamless system for Prediction and EArth system Research" (SPEAR), GFDL's next generation seasonal-to-decadal prediction system, and the "System for High-resolution prediction on Earth to Local Domains" (SHiELD), GFDL's new unified weather prediction system. Apart from contributions to these major modeling systems, some recent advances in earth system model development led by early career CIMES researchers include process studies in climate and weather extremes, and the use of machine learning tools to improve and diagnose ocean climate models.

CIMES researchers have applied GFDL earth system models to many different societally-relevant problems, including forecasts of estuarine systems; tropical heat stress; impacts of climate-biosphere feedbacks on ozone air pollution; wildfire impacts on air pollution extremes; large-scale environmental impacts of tropical cyclones; drought risk; coastal ecosystem responses to increasing river nitrogen loads; impacts of land nitrogen input and drought on water pollution; increased risk of wildfires due to anthropogenic activity; enhancement of precipitation in the Sahel by remote irrigation; and ground fish stock assessments.

CIMES scientists published a total of 384 peer-reviewed publications over the period 2018 to Spring 2022, many of which appeared in high-impact journals. CIMES scientists are co-authors on about 50% of all NOAA/GFDL peer-reviewed publications. CIMES scientific leadership and

research have been acknowledged as well as frequently highlighted in the public media. Notably, CIMES/AOS Senior Meteorologist, Dr. Syukuro Manabe, was awarded the 2021 Nobel Prize in Physics. CIMES senior scientist and GFDL director, Dr. V. Ramaswamy, won the 2022 Carl-Gustaf Rossby Research Medal, the highest honor of the American Meteorological Society.

The Review Panel concludes that CIMES has well-articulated and well-defined science objectives. CIMES's science plan closely aligns with GFDL's research interests and supports NOAA's mission. The Review Panel also recognizes CIMES's impressive science accomplishments, particularly in earth system modeling and application. CIMES science achievements are evident from the quantity and quality of their publications, improved/new modeling capabilities added to the various GFDL model components, and the relevance of the science outcomes to NOAA's priorities. The science presentations given during the review were of high quality, especially considering that all the presenters were early-career scientists. It is particularly impressive that most of the studies involve the development and use of sophisticated models, which require high levels of scientific and technical skill to apply to new science questions.

A consensus of the review panel members is that in reality, CIMES is an integrated part of GFDL, in terms of its vision, goals, and objectives. This is a reflection that a vast proportion of CIMES funding supports projects in GFDL. Princeton University should consider how to better leverage the benefits of CIMES for broadening the participation of Princeton University faculty. Both NOAA and Princeton University should also consider ways to increase the level of administrative support to CIMES. This will be further detailed in Section VI.

IV. EDUCATION/OUTREACH

CIMES supports a graduate program, a postdoctoral and visiting scientist program, an intern program, scientific workshops, and broader outreach, including K-12 outreach events. The Review Panel noted that the Princeton University AOS graduate and postdoctoral programs (through CIMES support) are extremely successful, in spite of there being no undergraduate program in AOS. Princeton gives significant support to CIMES' students and postdocs, who have gone on to successful careers in universities and national labs.

The internship program is focused on providing exposure to world-class science to students who are generally under-represented and less privileged. The program prioritizes students who have not had research experiences before, and who have good academic preparation but not necessarily the highest grades. They are given competitive stipends and living allowances to accommodate students who need to earn money in the summer. The program motivation and execution were very impressive, a model for implementing NOAA's goals to diversify their future workforce.

The panel noted that CIMES's gender and ethnic diversity reflects the general makeup of the geoscience/climate science community, which lags other scientific disciplines. In addition, there are recommendations to improve the management of education/outreach activities, as detailed in Section VI.

V. SCIENCE MANAGEMENT

The Review Panel appreciated meetings with the GFDL and CIMES leadership, postdocs and associate research scholars, AOS faculty, CIMES graduate students, and the Stellar high-performance computing manager to learn more about the science management of CIMES. Overall, CIMES is well managed with a clear organizational structure (Figure 2), a board of directors composed of GDFL and Princeton faculty (Figure 3) that meet regularly, mechanisms for resource distribution, and staff development and training. The CIMES leaders and management team are excellent. However, their workloads, especially that of Director Stephan Fueglistaler, seem extremely high. There is a concern about sustainability and potentially succession given the workload demands. CIMES has assembled and maintained an excellent supporting staff, and it is important for Princeton University to recognize their contributions. The panel recommendations are detailed in the next section.

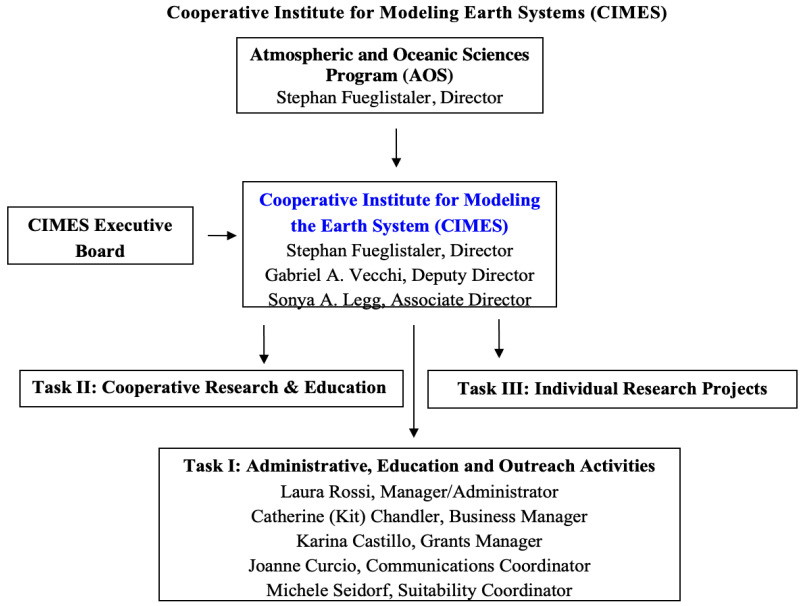

Figure 2. CIMES organization.

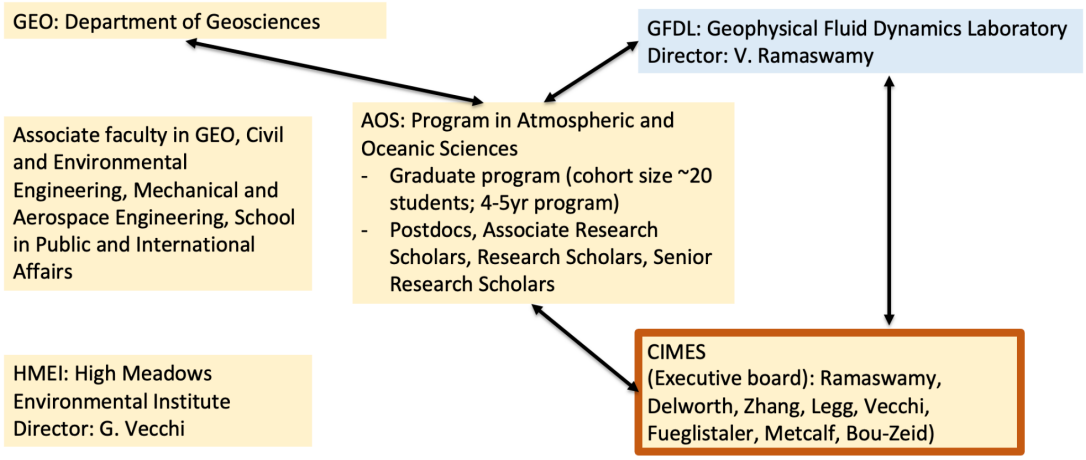

Figure 3. CIMES governance.

VI. RECOMMENDATIONS

The Review Panel offers the following observations and recommendations as a means to maintain and strengthen CIMES's structure:

A. Realign funding to increase support for Task III

Task III funds are dedicated to new opportunities. They can also serve as a vehicle to bridge/encourage collaboration between faculty at Princeton University and GFDL. The current task III funds are $2,050,222 from NOAA for 4 years. An increase of these funds would be very helpful for GFDL/CIMES to maintain their leadership in important areas by grasping new intellectual opportunities quickly. To accommodate the increase of funds for Task III, CIMES should develop strategies for resource distribution, considering the desire to grow emerging areas such as climate impacts and policy. CIMES should also consider increasing connections with other Princeton departments/centers to further advance research leadership in emerging areas (e.g., machine learning, climate change with high societal impact, weather and climate extremes and their influence on policy and decision-making, etc.) and training for students. Task III funding should serve as an opportunity to further extend the multi-disciplinary science contributions to support applications of earth system science for important decision-making processes and relevant policy measures and instruments, which are essential for NOAA's Climate Ready Nation priorities.

B. Strengthen guidance and mentoring for postdoctoral researchers, with a stronger and possibly a more formal role for the relevant supervisory staff at GFDL to evaluate and mentor students and postdoctoral researchers

It was evident in the review that while postdocs are assigned to university faculty, their primary engagement is with their host supervisors at GFDL. While postdocs are gaining valuable experience and making strong contributions to the science advances at GFDL, the degree to which their advisors provide opportunities for career training and workforce preparation may be variable. The opportunity to participate in the broader university environment is a key part of their research experience, and it is not evident that this is a reality for all postdocs. GFDL is not at the main campus, which can limit these experiences. Some postdocs, while enthusiastic about their research, expressed concerns about their futures and career opportunities. There is an important need to improve transparency of the possible (albeit limited) opportunities, selection criteria, and process for postdocs to pursue a career at GFDL after their tenure, and for GFDL leadership to provide guidance with respect to job placement at other NOAA and US laboratories. In addition, Princeton University needs to encourage and facilitate postdocs to garner experiences that strengthen their position for career advancement.

Performance evaluations are an important part of career development. This is not the responsibility of GFDL staff and ultimately falls to the CIMES/AOS Director. Given the large number of postdocs supported through CIMES, it may not be possible for the Director to be directly aware of everyone's progress. It was not evident that a formal review committee structure (with multiple committee members) is in place to monitor postdoc performance, but this should be established

where reviews are conducted at regular intervals (e.g., at least once per year).

C. Strengthen mentoring for graduate students

Both Princeton University and NOAA/GFDL should consider mechanisms for improving checks and balances to ensure that mentors for students are responsible and provide high-quality mentorship. In addition, Princeton University should provide a larger variety of internship opportunities for students who may be interested in exploring new research areas not directly related to their dissertation.

D. Improve Princeton's capacity to support its high-performance computing system

To fulfill the needs of computer resources for Earth system modeling, especially for new international students and postdocs, Princeton has started to build for CIMES a high-performance computing system, named Stellar, with primary funding from NOAA OAR and the Office of the Chief Information Officer (OCIO). The panel recommends adding resources for Stellar software/hardware/staff support to improve computational efficiency, and to ensure continuity of the resource and access to model simulation capacity over multiple years.

On the time scale of the next renewal, GFDL and CIMES also may wish to consider increased support for CIMES alumni (both postdoctoral scholars and Ph.D. student graduates) using the latest generation of the GFDL model. Software and technical support for getting GFDL models working on high performance computing systems at universities and other laboratories in the US may increase the science impact of NOAA's investments and the success of CIMES alumni. This could be done through additional support to Stellar. Some CIMES alumni switch to the Community Earth System Model, E3SM, and other modeling systems after leaving Princeton because of better technical support for those models.

E. Optimize outreach investments

Princeton AOS (which hosts CIMES) does not have an undergraduate program to feed its graduate program, and therefore outreach is very important for attracting new PhD graduates and building its science reputation to attract "the best of the best" early-career scientists. The potential is significant with the colocation of GFDL and Princeton.

The review panel noted that while the undergraduate outreach programs supported by CIMES looked to be important and effective, they were somewhat disconnected from building a pipeline to increase diversity and inclusion in the AOS-CIMES student pool or the CIMES postdoctoral scholar pool. The panel recommends, moving forward, that CIMES consider a pipeline approach with respect to its investments in outreach. A key goal might be to get more underrepresented minority students to apply to AOS, to track and foster the development of these students, and provide incentives for them to participate in the CIMES (or other NOAA) postdoctoral scholars programs. Providing support for underrepresented minorities (URM) undergraduate students from the broader Princeton community to participate in CIMES (summer, school year fellowships) might be one path for enhancing DEI in CIMES and enhancing diversity in the AOS / CIMES

Ph.D. community. Similar consideration could be given to the Ph.D. to postdoctoral scholar transition with respect to recruitment and retention.

F. Increasing support for administration

With the AOS Director and CIMES Director being one and the same, workloads may be excessive. Currently there are three full-time Princeton faculty supporting CIMES (Prof. Stephan Fueglistaler - Director; Prof. Gabriel A. Vecchi - Deputy Director; and Sonya A. Legg - Associate Director, University Lecturer). Princeton should give further consideration to the appropriate level of administrative financial and human resources necessary to fulfill these responsibilities. Realigning the funding envelope to increase support to Task I, along with appropriate contributions from Princeton, would reduce workloads and allow the Princeton University AOS faculty and lecturer more time for science research. This would also facilitate the CIMES faculty to have more time to make added science contributions.

VII. SUMMARY AND CONCLUSIONS

The Science Review Panel rates CIMES as "**Outstanding**," given its scientific excellence, productivity, focus on critical issues, and collaborative nature. In the interest of further strengthening its critically important work and focus on Earth system modeling and sciences, a series of recommendations are offered above, focused on Science Review, Education and Outreach, Science Management, and the three themes that characterize CIMES's current focuses (i.e., Earth System Modeling, Seamless Prediction Across Time and Space Scales, and Earth System Science: Analysis and Applications).

Appendix I - Review Panel Members

Co-Chairs (NOAA SAB)

Zhaoxia Pu, Ph.D.
Professor, Department of Atmospheric Sciences, University of Utah
Zhaoxia.Pu@utah.edu

David Grimes
Member of the Order of Canada
President, Grimes Consulting Group
Senior Consultant at World Bank Group, Washington, DC
Email:dgrimes@bell.net

Panel Members

Elizabeth A. Barnes, Ph.D.
Professor, Department of Atmospheric Science, Colorado State University
Email: eabarnes@colostate.edu

Bruce D. Cornuelle, Ph.D
Research Oceanographer, Physical Oceanography Research Division
Scripps Institution of Oceanography, University of California, San Diego
Email: bcornuelle@ucsd.edu

Qiang Fu, Ph.D
Professor, Department of Atmospheric Sciences, University of Washington
Email: qfu@uw.edu

L. Ruby Leung, Ph.D.
Battelle Fellow, Earth Science, Earth Systems Analysis & Modeling
Pacific Northwest National Laboratory
Email: Ruby.Leung@pnnl.gov

William H. Lipscomb, Ph.D.
Senior Scientist, Climate and Global Dynamics Laboratory
National Center for Atmospheric Research (NCAR)
Email: Lipscomb@ucar.edu

James T. Randerson, Ph.D.
Ralph J. and Carol M. Cicerone Professor of Earth System Science
Department of Earth System Science
University of California, Irvine
Email: jranders@uci.edu

Appendix II – CIMES Review Agenda

CIMES leadership: Stephan Fueglistaler (Director); Gabe Vecchi (Deputy Director); Sonya Legg (Associate Director); Laura Rossi (AOS/CIMES Manager).

GFDL leadership: V. Ramaswamy (Director), Whit Anderson (Deputy Director).
NOAA Deputy Assistant Administrator for Science: Gary Matlock.

CIMES review co-chairs: Zhaoxia Pu (Zhaoxia.Pu@utah.edu), David Grimes (dgrimes@bell.net).

CIMES review panel members: Qiang Fu (qfu@atmos.washington.edu), Elizabeth Barnes (eabarnes@colostate.edu), James Randerson (jranders@uci.edu), William Lipscomb (lipscomb@ucar.edu), Ruby Leung (Ruby.Leung@pnnl.gov), Bruce Cornuelle (bdc@ucsd.edu)

Participating CIMES researchers: Full list will be distributed before the meeting.

Location: All events are fully virtual. Co-Chairs are on site in Princeton, and will be with Fueglistaler.

Note: Access to sessions is controlled via the "waiting room" feature of zoom. We thus can use one zoom session throughout the day, and make sure that only authorized people are admitted. The color code below (blue and yellow) indicates that the session is for the panel and CIMES leadership (former), or for a broader range of participants (latter). Note that the review panel discussion meetings will be only attended by the review panel (one or more from the panel will be made Co-Host); and the meetings with postdocs, graduate students, and GFDL AOS faculty will only be attended by these specific groups and the panel.

Tuesday, May 17 Location: Zoom / Guyot Hall, Princeton University			
	https://princeton.zoom.us/j/98182930001 / Meeting ID: 981 8293 0001		
11:00-11:10		Review panel meet & greet	Review panelists only
11:10-11:30		Opening remarks by G. Matlock (NOAA), V. Ramaswamy (GFDL)	Matlock/Ramaswamy
11:30-11:45		Welcome AOS/CIMES Director, overview organization CIMES and AOS	Fueglistaler/Legg/Vecchi
11:45-12:00		Dean of Research, address and overview Princeton perspective	Debenedetti
12:00-12:45		Overview cntd.: Visiting scientist & intern program; progress and outlook	Legg/Fueglistaler/Vecchi
12:45-1:00pm		Break	
	https://princeton.zoom.us/j/98182930001 / Meeting ID: 981 8293 0001		
1:00-2:00pm		Theme 1: Earth System Modeling: Science	Alistair Adcroft, Pu

		projects and highlights	Lin + researchers
2:00-2:15pm		Checkpoint	Fueglistaler/Legg/Vecchi
2:15-3:00pm		Lunch break	
3:00-4:00pm		Theme 2: Seamless Prediction Across Time and Space Scales: Science projects and highlights	Feiyu Lu/Kun Gao + researchers
4:00-4:15pm		Break/buffer	
4:15-5:00pm		Meeting with postdocs / Associate Research Scholars	Kai-Yuan Cheng, Akshaya Nikumbh, Noemi Vergopalan, Khaled Ghannam, Yi-Hsuan Chen, Yong-Fei Zhang, Hyung-Gyu Lim, Youngji Joh, Elise Olson, Bor-Ting Jong
5:00-5:15pm		Break/Buffer	
5:15-6:00pm		Meeting with GFDL AOS Faculty	GFDL AOS faculty
	https://princeton.zoom.us/j/98182930001 / Meeting ID: 981 8293 0001		
6:00-7:00pm		Review panel: discussion	Review panel only

Wednesday, May 18 Location: Zoom / Sayre Hall / GFDL			
	https://princeton.zoom.us/j/96601954504 / Meeting ID: 966 0195 4504		
11:00-11:15		Review panel / CIMES Director	Fueglistaler/Legg/Vecchi
11:15-12:15		Theme 3: Earth System Science: Analysis and Applications: Science projects and highlights	Minjin Lee/Kai-Chih Tseng + researchers
12:15-12:30		Break/buffer	
12:30-1:15		Meeting with CIMES Graduate students	Grad students (Cindy Wang, Xinyue Wei, Lingwei Meng, Juho Iipponen, Glen Chua)
1:15-2:15pm		Lunch break	
	https://princeton.zoom.us/j/96601954504 / Meeting ID: 966 0195 4504		
2:15-3:00pm		Task III / Stellar	Fueglistaler, Merlis
3:00-3:30pm		Review panel: coordinate Q&A with CIMES leadership	Review panel only
3:30-4:30pm		Discussion with CIMES Leadership	Legg, Vecchi, Fueglistaler
4:30-5:30pm		Review panel: discussion & next steps	Review panel only