External Review of the Cooperative Institute for Modeling the Earth System (CIMES)

A Presentation to the
NOAA Science Advisory Board

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Science Review Panel

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University of Utah, NOAA SAB

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CIMES Overview

- The Cooperative Institute for Modeling the Earth System (CIMES) is a collaboration between **Princeton University** and the **NOAA Geophysical Fluid Dynamics Laboratory (GFDL)** founded in 1967.

- Princeton University's current five-year Cooperative Agreement award for CIMES covers the period from July 1, 2018, through June 30, 2023.

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

- **CIMES Mission**: "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."

CIMES Science Management Plan

Task I: Administrative, education, and outreach activities. *Includes interns and outreach activities.*

Task II: Cooperative research projects and educational activities. *Direct collaborations with GFDL scientists, often through targeted funding.*
Includes postdocs and graduate students working with GFDL scientists.

Task III: Principal investigator-led research projects. *Competitive cooperative research (call for proposals from Princeton faculty, reviewed); annual call for proposals for novel, innovative research, also encouraging new co-operations in the areas of social sciences, public affairs, health, and more.*

CIMES Science Themes
 (1) Earth System Modeling
 (2) Seamless Prediction Across Time and Space Scales
 (3) Earth System Science: Analysis and Applications

Criteria of success

- The contribution of ongoing CIMES research to NOAA's and, specifically, OAR/GFDL's mission;
- The publication of scientific results in refereed journals, and their impact on the field; and
- 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.

Science Review Panel Methodology

Guided by the Cooperative Institutes Administration Office within the NOAA OAR and conducted under the auspices of the NOAA SAB.

- Panel member selection
- Review of CIMES history, strategic plans, reports and other documents
- Review focus areas: Science Plan, Science Accomplishments, Science Management, Education/Outreaches.

- **Panel Review Meeting May 17 – 18, 2022**
  - Meetings with CIMES leadership
  - Science meetings (3, one for each theme)
  - Meeting with Graduate students
  - Meeting with Postdoc/Associate Researchers
  - Meeting with GFDL AOS Faculty

- Writing assignments/findings and recommendations
- Report drafting, refinement, and submittal

Overall Review Fundings

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.
- Impressive accomplishments in science, particularly in earth system modeling and applications. CIMES's science achievements are laudable as evidenced by the quality and quantity 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.

Overall Review Fundings (cont.)

- 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.
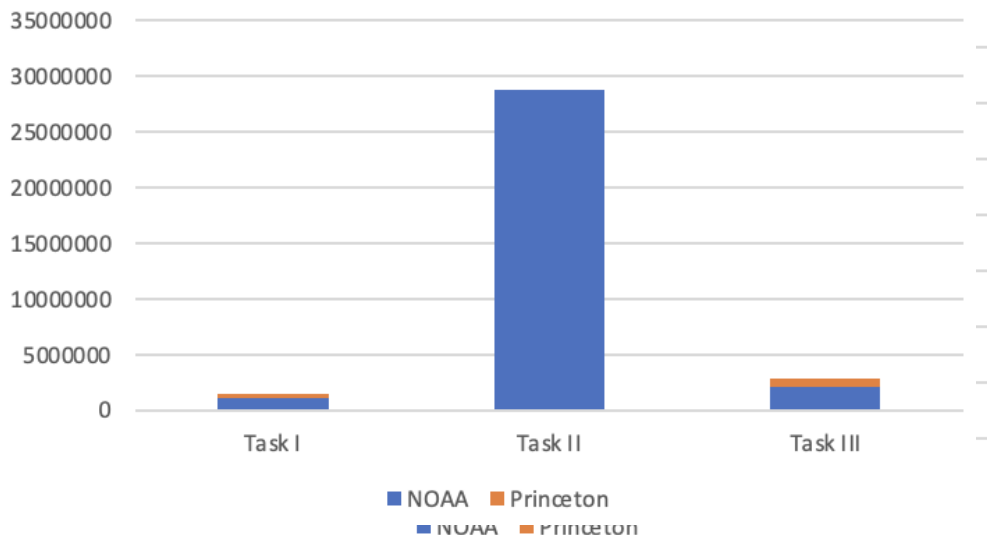
Science and CI Tasks Recommendations

- 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.
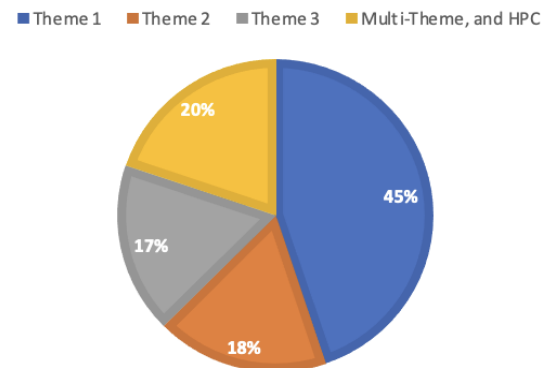
Education and Outreach Recommendations

- 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.

- 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.

Education and Outreach Recommendations (cont.)

- 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.
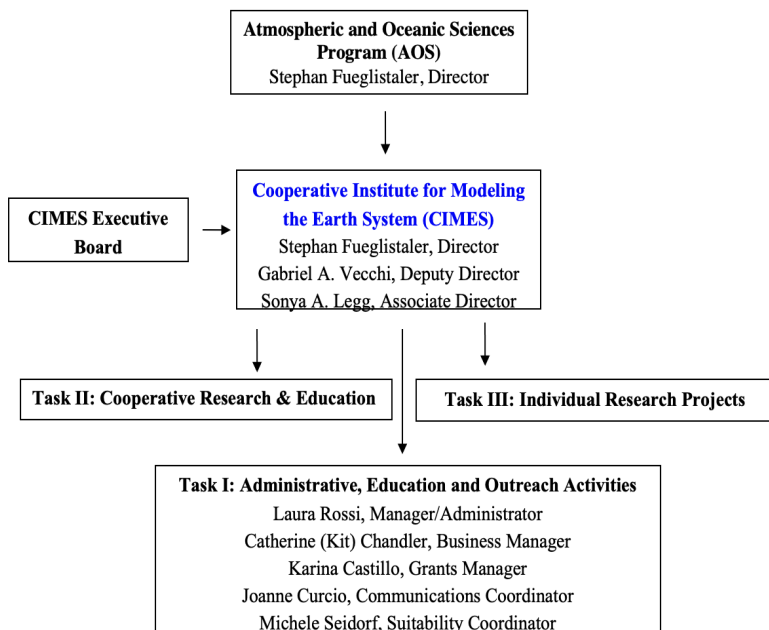
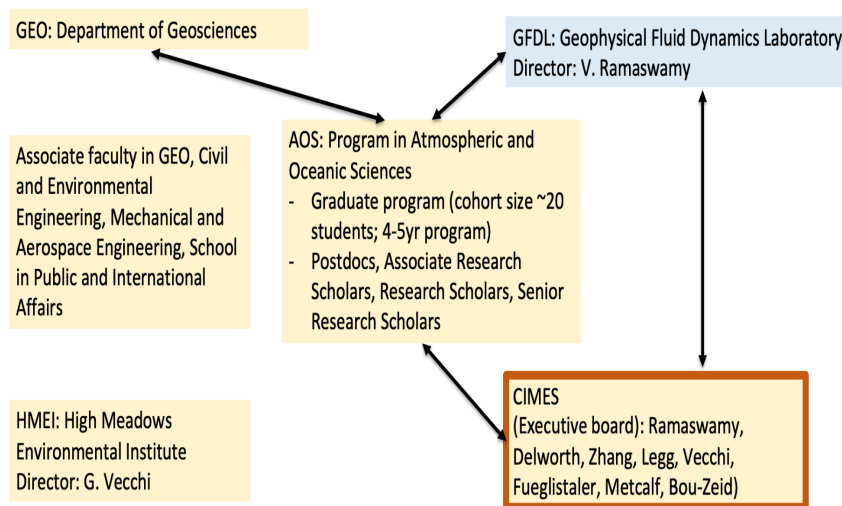# Science Management Recommendations

- 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.

CIMES Organization

CIMES Governance

Science Management Recommendations

- Add resources for Princeton's high-performance computing system (Stellar) including software/hardware/staff support to improve computational efficiency.

Final Comments

- The Science Review Panel rates CIMES as "**Outstanding**," given its scientific excellence, productivity, education and outreach efforts, 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, focused on Science Review, Education and Outreach, Science Management, and the three themes that characterize CIMES's current focuses.

Questions?