

**SIAM Activity Group Mathematics of Planet Earth  
Charter Renewal Application**

This Charter Renewal Application applies to the SIAM Activity Group on Mathematics of Planet Earth (hereafter referred to as SIAG/MPE). The SIAG/MPE to which this renewal application applies was formed under the aegis of SIAM and approved by the SIAM Council and SIAM Board of Trustees on December 19, 2014 for an initial operating period beginning on January 1, 2015 and ending on December 31, 2016. This is the fifth application for renewal of the SIAG charter.

This SIAG has 303 members, including 135 student members, as of December 31, 2023.

The purpose of the SIAG is to provide a forum for mathematicians and computational scientists to study Planet Earth, its life-supporting capacity, and the impact of human activities. By opening up a new area of applications, the SIAG shall stimulate interesting research in the mathematical sciences. The SIAG shall conduct its activities within the framework of SIAM.

To implement its purpose, the SIAG/MPE shall organize the following activities:

1. Organize minisymposia at the SIAM Annual Meeting and ICIAM in years where there is no SIAG conference.
2. At least once every seven years either organize a track of at least six minisymposia at the SIAM Annual Meeting or have an activity group meeting held jointly with the annual meeting. The VP for Programs and the VP at Large will coordinate the scheduling with the SIAG chair.
3. Organize a biennial SIAM Conference on Mathematics of Planet Earth. The SIAG will consider dovetailing specialized workshops and conferences with the SIAM Annual meeting or other SIAG conferences. The chair of the conference organizing committee shall be either the program director or the chairperson of the SIAG or their designee. The organizing committee must be approved by the VP for Programs at least 16 months before the conference.
4. With the approval of the SIAM Program Committee, the SIAG may organize special sessions at SIAM meetings. Other SIAG meetings may be organized only with the approval of the SIAM president and vice president for programs.

The SIAG has complemented SIAM's activities and supported its proposed functions. The answers to the questions below indicate how this was accomplished and what the officers propose as the future directions for the SIAG.

List all current officers of the activity group (including the advisory board, if relevant).

Chair: Pierre Lermusiaux

Vice-chair: Irina Tezaur

Secretary: Gerardo Hernandez-Duenas

Program Director: Julie Bessac

**1. *How is the field covered by the activity group doing? Is it growing, is the focus shifting? What have been the significant advances over the last two years?***

Many aspects of Planet Earth are among the most important challenges facing humankind. The research activities and the societal and industrial applications covered by the Mathematics of Planet Earth (MPE) are growing. This growth is the largest in areas related to Data Science, as in other fields of study, but is also occurring in other SIAM topics. This is because a mathematical, computational, and data-driven approach is indeed essential to understand, observe, model, predict, and protect our environment, atmosphere, ocean, and climate; to supply sustainable clean air, water, food, and energy; to limit the impact of human activities on the environment and biodiversity and develop new sustainable and resilient practices, and to innovate in the economic and social dimensions of these issues. The inherent complexity of Planet Earth's challenges demands truly interdisciplinary research and education.

The study of the Earth System is a field based on observations and modeling. Our SIAM community has made significant advances in the past two years. This includes new data-driven deep learning capabilities for weather, ocean, land, ice, and climate analyses and forecasting. Other important progress related to SIAM occurred in theoretical modeling, GPU computing, digital twins, machine-learned discoveries, data management, autonomous observations, and intelligent systems.

For the SIAM MPE 24 conference, our emphasis is on fundamental and applied questions in earth system modeling, hurricanes, erosion, earthquakes, sea ice, sea level rise, earth system sensing, carbon sequestration and storage, earth resources, agriculture, geoengineering, renewable energy harvesting, sub-seasonal forecasting, weather, ocean and climate dynamics, ecosystem modeling, sustainability, conservation, adaptation, mitigation, hazards, pollution events and clean-up, disasters, water and food security, transportation, and infectious diseases. For all these Planet Earth topics, we encouraged sessions and presentations on the development and utilization of applied mathematics and new quantitative methods in deep learning, data-driven modeling, numerical analysis, dynamical systems, probabilistic modeling, uncertainty quantification, reduced-order-modeling, Bayesian estimation, data assimilation, closure modeling, rare events theory, optimization, control and decision theory, autonomy, risk management, visualization, supercomputing, and system theory and engineering. Our community has increased the number of submissions compared to past conferences and we hope SIAM MPE24 will be successful.

In the last decade, a significant portion of the research funding from US agencies (NSF, DoE, DoD, etc.) has either remained constant or decayed in constant dollars. Funding in MPE-related topics has done fine relatively, mainly due to the funding from philanthropies and industry. However, the US and the world should strengthen their attention to Planet Earth research and applications, and provide much more support for finding solutions for our future on Earth.

**2. How is the activity group doing? Is it remaining vibrant? Is the size of the SIAG stable or increasing? How is the SIAG keeping up with the changes in the field? How are the broader interests of SIAM reflected in the activities of the SIAG?**

SIAM MPE is a unique group of people with a noble mission. The MPE SIAG is doing well and is vibrant. To further increase connections among members, we created and organized the new virtual Community Meetings for the SIAG. The meetings have occurred monthly and have been well attended. We had an average of about 35 attendees each time, with a minimum of 23 people and a maximum of more than 60 people. We also created new social media presences including a new LinkedIn site, [siam-activity-group-on-the-mathematics-of-planet-earth](#), which already has more than 170 followers. We helped organize the MPE24 conference planned for June 10 - 12, 2024, in Portland, Oregon, USA. We also encouraged submissions for the MPE24 prizes in many different ways. This led to a much larger number of candidates than MPE ever had before and allowed the MPE24 prize committee to award both prizes which was a first. We also pushed for the creation of a SIAG MPE wiki-like website. This effort was delayed as SIAM was working on updating all websites, but we just learned that the SIAG websites can now proceed which is wonderful news. Finally, we also started the application for creating a new SIAM MPE journal or new journal section on MPE.

*Virtual MPE Community Meetings.* When we started our officers roles, we believed that the SIAG MPE community was not as strong as the large flagship SIAM groups and MPE members didn't know each other that well. However, as we mentioned above, SIAM MPE is important for the future of our Planet. By organizing virtual meetings more frequently than the SIAM MPE conference every 2 years, we hoped to address this community issue and strengthen our SAIG and its activities. After all SIAM approvals were achieved and the virtual Zoom meetings were set up and organized, we kickstarted the SIAG MPE virtual meetings and they have been a success. The attendance numbers were summarized above. Attendees are from all continents and diverse backgrounds. They include students, postgraduates, and retirees, from academia, laboratories, and industry. The monthly meetings are recorded and made available by SIAM, see [SIAM MPE Community Meetings - YouTube](#). We are planning an open discussion session with breakout rooms on different topics, and we hope to increase inclusion and belonging in research, education, and industry and to help early career researchers in MPE in various ways.

The SIAM memberships have decayed in most SIAGs, mainly due to COVID. However, the decay in the SIAG MPE in the past four years is smaller than in some of the other SIAGs and has slowed down this past year. We hope that the upcoming MPE24 conference will help numbers. We also expect some increase due to our new activities such as our virtual MPE community meetings and LinkedIn site. Membership numbers are always the highest in December, as membership expires on Jan 1.

As officers, we have met biweekly on Zoom. This was necessary to plan and organize existing and new activities such as the MPE24 conference, the MPE24 prizes, the monthly MPE community meetings, the new MPE sites, and the possible SIAM MPE journal or special section. The SIAG chair thanks the other SIAG officers for all their contributions and efforts.

**3. Please list conferences/workshops the activity group has sponsored or co-sponsored over the past two years, and give a brief (one sentence or phrase) indication of the success or problems with each.**

In collaboration with SIAM, we suggested the leaders and organizing committee of the MPE24 conference, and helped organize it, a major effort for our Program Director. It is planned for June 10 - 12, 2024, in Portland, Oregon, USA, [SIAM Conference on Mathematics of Planet Earth \(MPE24\)](#). The program consists of 5 invited plenary speakers, 29 mini-symposia with 4 lecture presentations each, 2 mini-tutorials, 31 contributed lecture presentations, 12 contributed poster presentations, and the two MPE prize lectures. We have a large number of authors and co-authors, [Organizer and Speaker Index \(siam.org\)](#)

As described above, we created and organized new monthly Virtual MPE Community Meetings, with an average of about 35 attendees each time:

- Navigating the Era of Environmental Prediction with Antonio Busalacchi
- Advancing Earth System Predictability with Dan Lu
- Calibrating Noise in GFD Models with Dan Crisan
- Time-integration Strategies for Non-hydrostatic Atmospheric Models with Francis X. Giraldo
- Lagrangian Data Assimilation and Uncertainty Quantification with Nan Chen
- Computational Methods in Ice-sheet Modeling: From Large-scale Calibration to Multi-fidelity Uncertainty Propagation with Mauro Perego

These events have been a promising success. We are planning another community meeting in the form of an open discussion session with breakout rooms on different topics.

**4. Please indicate the number of mini-symposia directly organized by the activity group at the last two SIAM Annual Meetings. When did the SIAG last organize a track of mini-symposia at an annual meeting?**

*\*Because of the number of Activity Groups, the current guidelines are that an Activity Group should organize a track about every seven (7) Annual Meetings or meet jointly with the Annual Meeting within a seven (7) meeting period.\**

At the SIAM 2021 Annual Meeting, prior officers helped organize three mini-symposia in the area of MPE, and two had multiple sessions: MS29/40, MS31, and MS37/50/60/85. In addition to the mini-symposia, one SIAG officer presented a plenary at the SIAM 2021 Annual Meeting. The first biannual MPE conference meeting in 2022 was also co-hosted with the SIAM 2022 Annual Meeting and SIAM Conference on Life Sciences.

Several SIAG members and officers also co-organize mini-symposia at different SIAM annual meetings and conferences.

**5. Please indicate other activities sponsored by the activity group, including newsletters, prizes, and websites. Has each of these been active and successful?**

We utilize SIAM Engage often. We created new social media presences including a new LinkedIn site, [siam-activity-group-on-the-mathematics-of-planet-earth](#), which already has more than 170 followers. We also helped organize the SIAM Activity Group on Mathematics of Planet Earth Prize and the SIAM Activity Group on Mathematics of Planet Earth Early Career Prize. Each had many applications and could be awarded for the first time jointly this year, see [MPE24 Special Events](#).

SIAM has updated its website templates for SAIGs in the past year and this SIAM effort is in completion. As a result, we will soon be able to create a SIAG MPE wiki-like website which is wonderful news. Finally, we started the application for creating a new SIAM MPE journal or journal section on MPE, and we plan to work with SIAM on this topic.

**6. What activities are planned and proposed for the next period of the charter? Please describe scheduled and suggested future activities in detail.**

We plan to continue all of the SIAG MPE activities that existed before we started our officer roles (e.g., biennial MPE conference and MPE prizes). We will also continue the new activities we created: i) MPE Monthly Community Meetings diversifying their format based on the needs, feedback, and suggestions from the SIAG members, ii) MPE LinkedIn site social media news, iii) SIAG MPE wiki-like website, and iv) work towards a new SIAM journal or new journal section on MPE.

**7. How can SIAM help the activity group achieve its goals?**

We are very grateful for all the help SIAM has provided us and our MPE SIAG so far. SIAM has several outstanding staff and expert executives, and their excellence should be rewarded.

Many low-hanging fruits would help our SIAG and SIAM achieve our goals. They include:

- In collaboration with SIAM webmasters, the SIAG officers should be able to add announcements of their SIAG activities on the SIAM MPE website, [SIAM Activity Group on Mathematics of Planet Earth](#). These SIAG websites are too hidden (they don't show up high in web searches) on the SIAM website and load too slowly compared to other SIAM subpages.
- In the future, the officers should organize and own the MPE conference from the start of their term. Planning the conference with SIAM could be the first item of business for the new officers in collaboration with SIAM experts. Officers should also be involved in deciding where the next MPE conference should be within their term. This would also enable all officers to help with the conference organization and organizing committee, and provide more efficient synergies.
- The SIAG should investigate co-organizing the MPE conference with the Geosciences conference, these two SIAGs may be much closer to each other than MPE and life sciences.
- More funding should be provided to the presenters of mini-tutorials; right now, they receive much less than plenary speakers and the funds they receive are insufficient to cover their costs. The officers could work more closely with sponsoring and thus help SIAM.
- Allow SIAG officers to reward SIAM staff members for their excellence. For example, SIAM could organize staff spot awards and SIAG officers could vote for the top SIAM staff of the year.

**8. How can the activity group help SIAM in its general role of promoting applied mathematics and computational science?**

Here are some thoughts:

- The officers could work more closely with sponsoring and thus help SIAM.
- We are happy to invite SIAM executives to our virtual community meeting. It would be a good opportunity for the SIAM leaders to interact directly with its members, from students to professionals.
- A new SIAM journal or journal section on MPE could be useful to SIAM.
- We could work with SIAM and organize a special issue of SIAM Unwrapped on the Mathematics of Planet Earth.
- We can also organize a Golub School on MPE.

We are happy to discuss other ideas and opportunities with SIAM committees and leadership teams.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2025.

A handwritten signature in black ink, appearing to read 'Pierre Lermusiaux', with a long horizontal stroke extending to the right.

Pierre Lermusiaux, SIAG/MPE Chair

June 1, 2024