

## 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 third application for renewal of the SIAG charter.

This SIAG had 396 members as of December 31, 2019; 265 were students and 131 were not students.

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:

- A biennial SIAM Conference on Mathematics of Planet Earth, to be held in even-numbered years;
- One or more mini-symposia at the SIAM Annual Meeting in years when there is no SIAG conference and/or at the SIAM Conference on Geosciences;
- At least once every seven years, a track of at least six mini-symposia at the SIAM Annual Meeting or an Activity Group meeting in conjunction with the Annual Meeting.

In addition, the SIAG/MPE may engage in specialized workshops or meetings, special sessions at SIAM meetings, and special one- or two-day meetings immediately before or after a regular SIAM meeting.

SIAG/MPE Officers:

Chair: Eleanor Jenkins

Vice-chair: Arjen Doelman

Secretary: Georg Gottwald

Program Director: Beth Wingate

There are 12 members of the advisory board: Pete Ashwin, Luc Doyen, Daryl Holm, Suzanne Lenhart, Simon Levine, John Maclean (early career liaison), Doug Nychka, Fred Roberts, Christiane Rousseau, Gerard Tost, Abdul Aziz Yakubu, and Mary Lou Zeeman. Members of the advisory board have provided

guidance when requested. Specifically, they have been actively involved in providing input on committees needed for the MPE Prize selection, the nominations for the 2020 slate of officers, and the organizing committee for the MPE conference.

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.

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?*

The current problems associated with the mathematics of planet earth and the resolution that research provides for them remains critical. In late 2019, several members of the activity group worked with SIAM to respond to a request for information from the US Select House Committee on the Climate Crisis. AMS also endorsed this response, further expanding the support base.

The activity group continues to encourage collaboration between mathematicians, statisticians, social scientists, and practitioners of climate science. A one-day workshop on "Sustainability in the Digital Age I: Resilience facing Global Changes" was held at CIRANO, Montreal, Canada in May 2019. This workshop preceded the World Conference on Natural Resource Modelling, also in Montreal. MPE members were present at both the workshop and the conference.

Scientific needs arising from occurrences of extreme weather events and related, ongoing regional crises influenced the general area of interest of the activity group. Natural disasters continued to make headlines in 2019 and 2020, as hurricanes and floods battered the East Coast of the US; forest fires raged through Europe, Australia, and the Western US; and sea level rise increased at a pace surpassing original estimates.

MPE20 was scheduled to co-locate with the bi-annual meeting of the Life Sciences SIAG. This co-location enabled members of the activity groups to network and discuss mechanisms for resolving joint problems of interest. We hope to co-locate with Life Sciences in a future conference. We are looking for partners to co-located for the 2022 meeting.

Topics in MPE remain at the forefront of the latest scientific advances, and the field continues to grow. While earth system properties are a strong topic in MPE, we see more research dedicated to connecting changes in these earth system properties. COVID-19's emergence in the latter quarter of 2019 saw MPE-related research brought to the forefront in multiple media outlets. Models for disease spread consistently appeared in news articles and in daily briefings from health officials. Information on the environmental impact of worldwide shutdowns also made headlines. The MPE SIAG recruited articles on COVID-19 research for a special edition of SIAM News. The articles appeared in the May 2020 magazine.

The mathematical and statistical analysis of extreme weather events, and the management of the large datasets containing measurements of earth system properties, was a topic for multiple sessions slated for MPE20. The reduction in travel and the associated environmental impacts will hopefully be a topic at the MPE track at SIAM Annual in 2021 and MPE22.

Funding agencies continue to solicit proposals to resolve Planet Earth problems. The USDA, a nontraditional source of funding for mathematicians, issues proposal requests well-suited to members of the MPE community. A recent solicitation asked for proposals focused on ensuring water quality and quantity along with sustainable ecosystems. Resolution of these problems will require effective mathematical and statistical modeling, along with the developing associated simulation tools, for comprehensive scenario discovery.

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?*

The size of our activity group has increased by roughly 20% since 2018, with membership numbers still strongly driven by student members. We are seeing student members transition into dues-paying members upon graduation, but we should put more effort towards retaining these members in addition to recruitment of non-student members, particularly those in industry.

The activity field is extremely vibrant, especially with COVID-19's appearance in the global community. The activity group solicited the membership and obtained articles for a special issue of SIAM News on MPE research as it relates to COVID-19. As the phenomenon is truly a global, and as it encapsulates several aspects of earth systems as opposed to simply biological systems, research in the activity group is especially relevant.

A side area of research which may become relevant as society is able to move beyond disease spread and remedies is the environmental impact of the global shutdown. While the atmosphere is benefitting from the reduction in carbon output, it is not clear what is happening with the waste created by disposal of the equipment required to protect members of the medical community. These topics are likely to produce interesting talks at future MPE conferences. We are in the middle of a large scientific experiment.

The members of the SIAG are heavily engaged in resolving consequential problems which promote the future life of the planet and its inhabitants. It is well-poised to take advantage of vital connections between academia and industry. Mathematics and statistics in particular have come to the forefront in numerous COVID-19 articles which have appeared in all media outlets. The SIAG has solicited its membership to contribute articles to a special issue of SIAM News related to COVID-19 research. These articles will further establish mathematics and statistics as two of the most relevant fields for fighting pandemics.

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.*

MPE20, Orange County, CA, June 2020 (postponed)

The conference was slated to have 4 plenary talks, 33 mini-symposia with 42 sessions, 7 contributed paper sessions, 2 mini-tutorials, and the poster session. This is an increase in participation from MPE18, which had 28 mini-symposia sessions and 5 contributed paper sessions, in addition to the same number of mini-tutorials and plenary talks. The conference organizers heavily recruited the mini-symposia sessions, which is one reason for the increase.

Registration was in progress when the conference was postponed. The conference organizers heavily recruited mini-symposia organizers, which led to an impressive list of speakers. The past two conferences have not had receptions at the poster sessions, which we believe increase the participation at those events. This is especially relevant for our activity group, since we have many student members who tend to submit posters instead of papers. In addition, our conference was already tightly scheduled, due to the increase in both mini-symposia and contributed papers. The conference may need to extend to a 3 or 3 1/2 day schedule in 2022.

The meeting was scheduled to be held together with the biannual meeting of the SIAG on Life Sciences. This would still be an extremely important collaborative conference for the future. The research engagements between the two SIAGs, especially as it pertains to COVID-19, would be extraordinary.

The list below contains activities associated with the MPE activity group. Some of the connections were formalized through sessions tagged as MPE sessions. Other connections were informal, with MPE activity group members presenting.

a) Sustainability in the Digital Age I: Resilience facing Global Changes, May 2019

One-day workshop, CIRANO, Montreal, Canada

MPE activity group members participated in the one-day workshop, including the activity group chair and several members of the advisory board.

b) World Conference on Natural Resource Modelling, May 2019

HEC Montreal

MPE Activity group members were associated with conference organization and several members presented at the conference. A member of the advisory board is the Chair of the Resource Modeling Association, which organizes the conference.

c) World Conference on Natural Resource Modelling, January 2020

Universidad de Chile, Valparaiso, Chile

The former secretary of the MPE SIAG served as a conference organizer. One of the members of the advisory board was a plenary speaker at the conference.

d) AAAS Annual Meeting, February 2020

Resilience in the Digital Age, Seattle, WA

This was an MPE-based scientific session chaired and organized by members of the MPE SIAG.

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

The officers of the activity group did not organize any tracks for the 2020 Annual Meeting. However, members of the SIAG may have organized tracks of which we are not aware.

The SIAG is slated to organize a track at the 2021 annual meeting.

5. *Please indicate other activities sponsored by the activity group, to include newsletters, prizes and web sites. Have each of these been active and successful?*

The MPE prize was established in 2019. It is awarded biennially, starting in 2020. The award carries a cash stipend, and the awardee is invited to present a plenary address at the bi-annual conference. According to the prize specification document, MPE award's the prize "to one individual for significant scientific work in topic areas that are relevant to MPE or for sustained or seminal contributions to the scientific agenda of the SIAG/MPE". The first MPE prize was awarded in May 2020 to Professor Christopher K.R.T. Jones from UNC-Chapel Hill. The SIAG is planning to apply for the ability to award an Early Career Prize at future meetings. This is especially significant for this activity group because of the large percentage of early career members.

The SIAG has launched a quarterly newsletter, and the MPE blog has been relaunched. The Twitter account is also now active. The blog site will be very beneficial as researchers in the SIAG continue to work on COVID-19 related issues.

The SIAG solicited articles for a special issue of SIAM News on COVID-19 related research which appeared in May 2020.

The secretary of the SIAG approved 50 messages for distribution to the mailing list from January 2019 until April 2020. Approximately 70% of these messages correspond to event announcements (conferences, workshops, seminars, summer schools, etc.) and the other 30% correspond to job position announcements.

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

The emergence of COVID-19 has delayed to 2021 our plans for an annual publishing effort with SIAM News to ensure the April issue highlights MPE's research, aligning with Earth Day. However, the SIAG is soliciting articles for a special issue of SIAM to appear in May or June of 2020.

The first MPE prize was to be awarded at MPE 2020. We look forward to awarding the second prize in MPE 2022.

The SIAG will sponsor a track at AN21. The SIAG is also looking to partner with another SIAG for a joint conference in 2022. The SIAG will recruit sessions for conferences organized by other SIAGs (e.g., Geosciences, Life Sciences, UQ, Dynamical Systems) to highlight the work of members of the SIAG.

The SIAG continues to work to establish a stronger social media presence. The SIAG plans to appoint an outreach coordinator; this position appoints a member dedicated to outreach via MPE's social media channels. This officer will coordinate with SIAM staff and the SIAG to get MPE information out to the community.

We are planning to relaunch the MPE blog to highlight and report on the research of members of the SIAG. Soliciting content is a major effort associated with launching the blog. One possible plan is to solicit blog posts at each conference and during MPE tracks run at the Annual Meeting.

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

SIAM can help the SIAG by working with officers to establish the dedicated April issue of SIAM News, establish new officers beyond those currently in existence to broaden outreach efforts, and work on efforts to transition post-graduation students into full SIAM members.

As noted in the 2018 charter renewal, students comprise roughly 2/3 of the SIAG membership. The student members need to remain active in SIAM and the SIAG after graduation. SIAM needs to help the SIAG with career information for student members. This effort is currently underway in coordination with the Applied Math Education activity group and needs to continue. The SIAG continues to solicit advice from SIAM on the best ways to engage these members of the SIAG and improve communication.

SIAM can help the SIAG by working with the SIAG to form joint conferences. Relevant activity groups holding joint conferences with MPE help increase the exposure for MPE and benefit both groups. However, coordinating a joint conference is difficult when our SIAG is not aware of planning activities for other SIAGs. The SIAG could use SIAM's help in organizing joint conferences.

Finally, the SIAG could still benefit from information SIAM might have on talks at other SIAM conferences with MPE themes. It isn't clear MPE members realize the benefit to the SIAG of tagging their sessions as MPE-related.

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

Members of the SIAG work closely with scientists in areas outside of mathematics and statistics, ensuring the research has relevant application. The members of the SIAG are extremely dedicated to interdisciplinary research.

The SIAG is working to enhance its social media presence, especially with Twitter. If we can get the blog up and running, we can direct traffic to those posts through Twitter feeds. We will need to ensure some early posts are interesting and relevant to encourage followers early in the process.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2021.

Signed,

Eleanor Jenkins, SIAG/MPE Chair

11 May 2020