Mathematics of Planet Earth 2013

Christiane Rousseau

Under the acronym MPT2013, the project is to hold a special year under the theme *Mathematics of Planet Earth* in 2013 (www.mpe2013.org).

The initiative was initially launched by 13 North-American institutes in 2010. Since then, it has attracted many partners from all around the world. MPE2013 is now a true world initiative, with partners from all continents, and new partners join regularly. It is endorsed by the International Mathematical Union, the International Council of Applied and Industrial Mathematics and the International Commission of Mathematical Instruction. The mission is to increase the engagement of mathematicians — researchers, teachers, students — as well as the public, with the role of mathematics in issues affecting our Planet Earth and its future.

The strategies are to

- Encourage research to identify and address fundamental questions that have to do with our planet to which mathematics can contribute to a solution, including understanding its climate and environment, and addressing its sustainability.
- Encourage mathematics teachers at all levels to communicate issues related to our Planet Earth through their instruction and their curriculum development.
- Encourage mathematics students and beginning researchers to pursue research areas related to our Planet Earth.
- Inform the public about roles that mathematics can play in addressing questions related to our Planet Earth.

The theme *Mathematics of Planet Earth* is interpreted in a very broad sense, which leaves room for many institutes and societies around the world to organise related activities. Earth is a planet with dynamic processes in the mantle, oceans and atmosphere creating climate, causing natural disasters, and influencing fundamental aspects of life and life-supporting systems. In addition to these natural processes, humans have developed systems of great complexity, including economic and financial systems; the world-wide web; frameworks for resource management, transportation and health-care delivery; and sophisticated social organisations. Human activity has increased to the point where it influences the global climate, impacts the ability of the planet to feed itself and threatens the stability of these systems. Issues such as climate change, sustainability, man-made disasters, control of diseases and epidemics, management of resources, and global integration have come to the fore. Mathematics is poised to play an essential role in the study of planetary issues, both as a fundamental discipline, and as an essential component of multidisciplinary research.

Without claiming to be exhaustive, four subthemes have been identified:

- **A complex planet.** Earth is a planet with dynamic processes in the mantle, oceans and atmosphere creating climate. Mathematics provides tools to understand these dynamical processes, explore its underground for new resources and measure the variation of its dynamics due to human or natural interaction. The planetary motion of the Earth inside the solar system is chaotic, but the moon stabilises the axis of the Earth, thus allowing for the season system.
- **A biologically diverse planet.** Earth is the home of life supporting systems which, through evolution, have generated biodiversity. Living species interact with ecosystems, new species appear or disappear and spread spatially.
- **A planet structured by civilisation.** Humans have developed systems of great complexity, including economic and financial systems; the World Wide Web; frameworks for resource management, transportation, and energy production and utilisation; health care delivery; and social organisations.
- **A planet at risk.** Human activity has increased to the point where it influences the global climate, impacts the ability of the planet to feed itself and threatens the stability of these systems. Issues such as climate change, sustainability, man-made disasters, control of diseases and epidemics,

management of resources, and global integration have come to the fore.

Mathematics of Planet Earth 2013 will focus mathematical research in these fields, provide a platform to showcase the essential relevance of mathematics to planetary problems, coalesce activities currently dispersed among institutions, and create a context for mathematical and interdisciplinary developments that will be necessary in order to address a myriad of issues and meet the global challenges in the future.

The activities will take place everywhere on the planet. The scientific activities will include thematic terms or semesters on subthemes related to the main theme, workshops, collaborative research groups, summer schools and special issues of scientific journals. Several learned societies will hold a meeting on the theme or will publish related articles in their newsletter. Collaboration and joint activities are much encouraged.

In parallel with the scientific side outreach activities developing awareness of the role of mathematics in the study of the planet and in the planetary issues will be organised everywhere on the planet, targeting the public, the medias and the schools. These could include public lectures, panels on the mathematical challenges coming from sustainability issues, radio or television programmes, exhibitions, articles in the newspapers, etc. Activities will be organised in the schools: posters, special issues of magazines, websites; exhibitions; invitation to associations of teachers that they hold their annual congress on the theme; lectures in the schools; special projects for the classrooms. International collaboration is encouraged to maximise the visibility of the initiative. For instance, posters produced in one country can be distributed in another country. The same can be done with magazines distributed in the schools.

Mathematics of Planet Earth Competition for an Open Source Exhibition of virtual modules. Starting from an idea of José Francisco Rodrigues (Lisbon), the Museum Committee has launched a competition of virtual modules that could be reproduced and utilised by many users around the world, from science museums to schools. The realisation of the Open Source Exhibition will not be centralised, but will rather be split among many partners from different countries. The exhibition will have a virtual part, as well as several material parts. Modules can be submitted from January 2012 to May 15 2012, and the winners will be announced in summer 2012. The modules will then be available on the web to be used by scientific museums, schools, and the mathematical community. Oberwolfach, with the active participation of Andreas Matt, has accepted to provide the platform for the exhibition.

The theme is so rich that it allows the members of the mathematical community and the different organisations to contribute to the initiative in a creative way. Indeed, *Mathematics of Planet Earth* is much broader than sustainability issues. It includes many subjects related to the knowledge of our planet, its origin and history, its soils, its ecosystems and living species, its social organisations, etc., which may be covered by activities.

We hope to get the participation of many mathematicians and organisations, as well as their help in promoting the event.

Christiane Rousseau
University of Montreal, Canada
rousseac@dms.umontreal.ca