Starting Journal of the Earth Simulator

— Dawning of New Era in Simulation Science —

Journal of the Earth Simulator is started with an aim of stimulating and promoting an intrinsic simulation science. The Earth Simulator is a really beneficial and viable scientific tool that enables us to design the future life as symbiotically with nature, productively in technology, and creatively in science as desired.

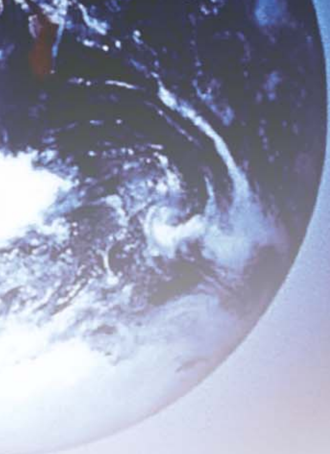
Modern western science based on reductionism has revealed most of the fundamental principles and laws that have been creating our universe from its birth. Utilizing and applying those principles and laws, humans have ever been developing and creating devices and products that unlimitedly expand and widen human's activities and welfares. Reductionism is indeed a beautiful and immeasurable paradigm for not-almighty humans to comprehend the way nature works. By the end of twentieth century, to my knowledge, history of our universe has been almost unveiled by this reductionism. Reductionism, however, is by nature weak at forecasting the future.

Computer simulation was born shortly after the World War II. Since then, nonlinear evolution of things, which is untouchable to reductionism, becomes a tractable target of science.

With evolution of science and technology based on reductionism, the capability of computers has exponentially grown and it now has developed into an indispensable scientific tool to solve nonlinear processes. Suppose, for example, observation discovers a disruption phenomenon in tokomak and galaxy collision, then simulation scientists go on stage and demonstrate how the observed phenomenon could be formed. Computer simulation has established its right as a nonlinear solver of an individual nonlinear phenomenon towards the end of the twentieth century.

However, it remained to be an auxiliary tool to observation and experiment. As soon as the new century dawned, an epoch-making simulator 'the Earth Simulator' came into existence. Its most prominent feature is that it makes possible to simulate an evolution of an entire system, which has never been touched by the conventional supercomputer. The fact that it becomes possible to study the whole system without dividing into pieces is indeed amazing and incredible for us humans. This is because humans have at last acquired a real tool that can reveal the future evolution of the whole system based on natural laws.

Accordingly, one can now make a reliable prediction of global environmental changes such as global warming and seismic wave propagation. Not only predicting environmental changes, but also designing new technological products such as bio-chemical medicines and automobiles are now in our hands. Also, one has obtained a scientific method that can in a



quantitative fashion attack complexity such as life. This indicates that a new challenging science field arises in front of us.

With a strong hope that the Earth Simulator Project could play a decisive role in spreading the culture of simulation science to ordinary people in the world, I have planned to publish Journal of the Earth Simulator, and have adopted a new editorial system that avoids the conventional refereeing system in which a submitted paper is to be rejected if referee(s) disagrees for publication. Sometimes, it happens that a really innovative paper is rejected with simple reason that referee(s) can not see into the real value hidden in it. Also, often it takes a formidably long time for a paper to be finally accepted. Furthermore, in the case of the works done by using the Earth Simulator, it is quite difficult for the third party to redo simulations to reexamine the results. With these and other reasons such as spreading the culture of simulation to public, I take a rule that in principle editors select the authors or subjects and reviewed. In this reviewing, unless there is an evident scientific mistake or misconception, it should be accepted. And, editors try to give the authors constructive advises with which its presentation can get a big improvement and readers, including non-scientists, can easily understand how big return can simulation give to society in welfare and benefit.

At the moment, I have neither determined how often issues will be published yearly, nor determined yet the concrete plan of the next issue. Now I am indistinctly thinking to publish semiannually. Therefore, I would be happy if the next one will appear in the autumn of 2004.

At present I assume that the scientific subject may well be categorized into the following four groups, i.e., climate science, solid earth science, computer science and technology, and other fields including nano-science, bio-science, space engineering, energy science and technology, lattice QCD, etc.

I have strongly requested Professor Julia Slingo (CGAM of NERC), Dr. Horst D. Simon (LBNL) and Dr. Yukutake (JAMSTEC) to kindly accept to be editors of Journal of the Earth Simulator. All of them have kindly accepted my request, despite the fact that I explained only simply my plan about this Journal to them.

Regarding the title of the Journal, there were candidates such as Journal of Earth Simulation and Journal of Simulation Science. But finally I chose Journal of the Earth Simulator because the Earth Simulator has already received some popularity worldwide and for the time being contents would be limited to the products by the Earth Simulator.

Essays about the Earth Simulator and post Earth Simulator are welcome, and recommendations and advises about the journal are also solicited to make the journal more readable and familiar to public. I am planning to include technical and scientific information about the Earth Simulator as much as possible.

I hope that the journal will be your journal. Thank you.

Sato, Tetsuya, Editor-in-Chief

Editor's Profile

Tetsuya Sato
The Earth Simulator Center

My first encounter with so-called electronic computer was 1962 when I chose the vowel recognition using it as the graduation study at Electronics Department of Kyoto University. This machine was developed by a doctoral candidate who was a senior in the same group as I belonged to. I was deeply fascinated by the ability of electronic computers. Physics was at that time yet glamorous to young students and mathematics was the primary tool to elucidate undiscovered properties of nature. I realized myself that electronic computer must be destined for the most powerful future tool to unveil the way how nature works, which is always in nonlinear and non-equilibrium state. Since then, I have ever been devoted myself to computer simulation at Electronics Department (graduate student), Physics Department of Kyoto University, Boulder Aeronomy Laboratory of NOAA, Garching Extraterestrische Physik Max-Planck Institute, Geophysics Research Laboratory of University of Tokyo, Plasma Physics Laboratory of Princeton University, Murray Hill Bell Laboratories, Institute for Fusion Theory of Hiroshima University, Theory and Computer Simulation Center of National Institute for Fusion Science. In all these institutes the target subjects were in space, plasma, fusion, polymer, and so forth, but always common was the challenging tool, that is, Computer Simulation. Speaking in other words, development and promotion has been my life work.

The present position, Director-General of The Earth Simulator Center, was in the autumn of 2001 offered by Hajime Miyoshi who was the developer of the Earth Simulator and passed away shortly after my acceptance. This was an unexpected and decisive moment to me. I believe this must be a destiny given to me to establish computer simulation as the unequalled scientific tool to challenge the 21st century science. So far computer simulation has played a decisive role in revealing nonlinear causal relationship of an individual local nonlinear phenomenon and established a firm position as a nonlinear solver. However, its position is nothing but an auxiliary tool to experiment (observation) and theory, because only an individual or local nonlinear phenomenon already known can be the target to be solved because of its limit of performance.

The destiny of computer simulation is far beyond such an auxiliary role. The intrinsic role is to be a leading tool to cultivate a new field in science and technology, which is to comprehend the future evolution of human life and design how humans and environments can symbiotically evolve.

My role, I believe, is to play a leading part in spreading the Simulation Culture.

Julia Slingo
Centre for Global Atmospheric Modelling

I am currently Professor of Meteorology, Director of the NERC Centre for Global Atmospheric Modelling (CGAM) at the University of Reading, and Coordinator of the UK Universities' Global Atmospheric Modelling Programme (UGAMP). I have had a long-term career in climate modelling, working at the Met Office, ECMWF and the US National Center for Atmospheric Research (NCAR) in Boulder. My personal research is in tropical climate variability and predictability, and I lead an active research group in various aspects of tropical variability, its influence on the global climate and its role in subseasonal to interannual predictability. Particular research interests include the diurnal cycle, convectively coupled equatorial waves, the Madden Julian Oscillation, El Ninõ and Monsoons. Increasingly my work involves considering the coupling between the atmosphere and the ocean and how that influences tropical variability on all timescales. I am also developing an active programme on the relationship between tropical climate variability and crop productivity as part of my long-term interest in the role of the land surface in climate variability and predictability.

My approach to climate system science emphasises the regionality of climate variability and change, the role of weather systems in defining the statistics of the climate system, and the key physical processes that determine these weather systems. This requires models of the climate system that are capable (i) of capturing regional variations and interactions, and (ii) of representing correctly the weather phenomena whose statistics make up the mean climate. So CGAM's modelling strategy focuses on enhancing model resolution in both the horizontal and vertical, and on using a hierarchy of models, from hypothesis-testing idealised configurations to fully coupled state-of-the-art earth system models, and from global configurations down to mesoscale and cloud resolving models. I am currently leading a major NERC-funded National Programme in 'Grand Challenge' High Resolution Modelling of the Global Environment (UK-HiGEM)' which is working with the Hadley Centre to develop the next generation earth system model and is a key part of our collaboration with the Earth Simulator Centre.

Takesi Yukutake

Institute for Frontier Research on Earth Evolution

Professor Emeritus, University of Tokyo. Dr. Yukutake worked at the Earthquake Research Institute, University of Tokyo, over thirty years on geomagnetism, including tectonomagnetism, volcanomagnetism and on the electrical conductivity structure of the crust and mantle as well as the geomagnetic secular variations. He extended his research over the thermal evolution of the Earth at Department of Earth and Planetary Sciences, Kyushu University. For the past four years he has served for Japan Marine Science and Technology Center as the Director General of Frontier Research Program for Subduction Dynamics and Executive Assistant to the Director General of Institute for Frontier Research on Earth Evolution. During the period he contributed in coordination of the Japanese simulation group of solid Earth sciences for the Earth Simulator. Regarding editorial business, he has served for Journal of Geomagnetism and Geoelectricity as an editor for about twenty years.

Horst D. Simon

National Energy Research Scientific Computing Center

Dr. Horst D. Simon is Associate Laboratory Director for Computing Sciences at Lawrence Berkeley National Laboratory. He has been Director of the National Energy Research Scientific Computing (NERSC) Center since 1996. Dr. Simon is also the founding Director of Berkeley Lab's Computational Research Division, which conducts applied research and development in computer science, computational science, and applied mathematics.

Dr. Simon received a Ph.D. in mathematics from the University of California, Berkeley in 1982. His recursive spectral bisection algorithm is regarded as a breakthrough in parallel algorithms for unstructured computations, and his algorithm research efforts were honored with the 1988 Gordon Bell Prize for parallel processing research. Dr. Simon was member of the NASA team that developed the NAS Parallel Benchmarks, a widely used standard for evaluating the performance of massively parallel systems.