**Japan Geoscience Union Meeting 2011**
(May 22-27 2011 at Makuhari, Chiba, Japan)


GHE024-P01 Room:Convention Hall Time:May 22 10:30-13:00

# Torahiko Terada's study on geomagnetism: Toward the expansion into engineering design education

Yasuhiro Nariyuki[1*], Takeshi Fukuda[1], Mitsuhiro Hosokawa[2]

[1]EE, KNCT, [2]IAS, KNCT

It is important for understanding of essence of science and technology to know about their history as with the present system. Learning about the accumulated knowledge in light of cultures, politics, and social situations at that time enable us to more deeply understand the state-of-the-art.

In the present study, Torahiko Terada's study on terrestrial magnetism is re-evaluated in light of science history with the aim of the expansion into the engineeringdesign education by integrating the humanities and science.

Torahiko Terada earned his place in history both as a scientist and a writer. In particular, so-called "Terada physics", in which phenomena in daily life was covered in depth, correlates well with his literary works. It is worth noting that such a direction of Torahiko is in contrast with those of most other Japanese scientists and engineers, who tried to use Western technologies without understanding their backgrounds. Actually, Torahiko studied the Western physics such as the X-ray physics during the early years of his careers. However, he subsequently changes his concern into geophysics etc with development of his original approaches and sights.

Keywords: Torahiko Terada, geomagnetism, engineering design

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)


GHE024-P02 Room:Convention Hall Time:May 22 10:30-13:00

# Models and Simulations in Geosciences

Hidenori Suzuki[1*], Shigeo Yoshida[2], Naotaka Naganawa[3], Kazuhisa Todayama[4]

[1]Nagoya University, [2]Kyushu University, [3]Nagoya University, [4]Nagoya University

In geosciences, since scientists can seldom intervene in their research objects, what can be experimented are limited. For example, intervention in past objects is impossible in principle, and intervention in macroscopic objects such as planets and the Earth's interior is (in most cases) technologically impossible. Such objects also can not be observed directly or their observational data are often insufficient. Therefore computer simulations play significant roles in geosciences.

Winsberg(1999) analyzed the processes in which simulationists construct the model of the phenomena from theory, and found that simulations are not simple deduction, have motley methodology, and do not admit full comparison with data from observations or experiments. He then stressed the importance of problems of why or when or to what extent simulation results are reliable, arguing for the need of "the epistemology of simulation" (after "the epistemology of experiment" of Franklin (1986)) as "the study of the means by which we sanction belief in the outcome of simulation studies".

In this presentation, we address this epistemology of simulation, and clarify the points simulationists should pay attention to and the tactics they use to justify their results.

We summarize the way geoscientists justify their simulation results. The justification has two steps; validation of models and verification of numerical computation. For validation of models, the points are such as (1) being formulated based on well-confirmed physical processes, and (2) grounded on past researches. As verification of numerical computation, simulationists use (1) agreement with strict solutions in simple cases, (2) high theoretical precision of numerical algorithms, (3) convergence to the extent that results do not change when the size of computational grid is reduced, and (4) agreement with other codes in benchmark computation. Justification which involves both is (1) consistency with observational results, (2) stability of results when parameters and initial conditions are changed.

We also analyze from case studies in geosciences, approximations and idealizations, or combination of simulations and observations, examining their implications to the problem "how should we consider the epistemological status of simulation (compared with observation and experimentation)?".

Keywords: philosophy of science, simulation, model