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IMPORTANCE OF GEOSCIENCES INFORMATION IN CASE OF NATURAL HAZARD

Abstract
With increasing interest to geosciences information in case of natural hazard its procedure should be discussed more carefully. The general information processing is a straight flow from the real world to the logical world composed of four steps of observation, evaluation, analysis and simulation. The stepwise verification is necessary to examine each step before moving to the next process, and if necessary the process may be repeated by adding data, using another technique, applying another models, etc. The final model is verified by comparing with the real event mainly from technical and logical view points, and the next cycle of the information processing will start with the updated plan. The cycle is well organized for the pure scientific data which have no social/political/economical element. However, geosciences information have complex structure with various elements including natural, social, political, economical, technological, and others, and it is usual that a geosciences information processing has more than two purposes. The verification of the final model may differ according to the specified purpose, and it is necessary to determine which verification should be approved for the next cycle. Geoethical view points is important and urgent for this selection on the geosciences information, especially for those on natural hazards.
Key Words: *Geosciences, Information Processing, Knowledge, Evaluation, Verification, Geoethics*

Introduction

The importance of geosciences is recognized for the global and local environmental problems. Many natural hazards in recent years (earthquake, volcanic eruption, flood, tornado, etc.) increased the role of geosciences for the prediction of natural hazards and the prevention and mitigation of disasters. It has shocked to the world that the earthquake has damaged Japan which is a most developed country in science and technology.

The M9.0 earthquake attacked the northeast Japan on March 11th, 2011, followed by the tremendous tsunami hazard and the accidents of nuclear power plants. There are many discussions on the risk management and information control by Japanese government and the power company. It is necessary for geoscientists to re-consider the role and utilization of geosciences information, not only for academic research, but also for the sake of human society.

Academic societies and associations in Japan are continuing investigation on the research process of natural hazards after the earthquake, such as, what is insufficient in the past research activities, is there any problem in the past standpoint of research, was the research results properly published to society etc.

The author has discussed the importance of geosciences information on natural hazards (Nishiwaki, 2011, 2012) and evaluation and responsibility (Nishiwaki, 2013). In this paper the geosciences information on natural hazards is examined focusing on its verification for the improvement of geosciences information process.

Geosciences Information at Natural Hazards

The geosciences information is very important before the natural hazard to construct the safeguard system to prevent and reduce the damage. Also it is important after the hazard to rescue the suffered persons, recover and revive the damaged area.

The primary responsibility of geoscientists is to obtain detailed and advanced information through continuous research on natural hazards. It is also necessary to prepare the guidelines in advance who and how to decide the content, direction, level, method, timing and others for dispatching the information on time and on cite of the natural hazard.

We must examine the following questions on the geosciences information for disaster mitigation.
Was there correct and sufficient information?
Was the information clearly and timely published?
Was the information properly accepted and utilized?
Was there any improvement required for the information processing flow?

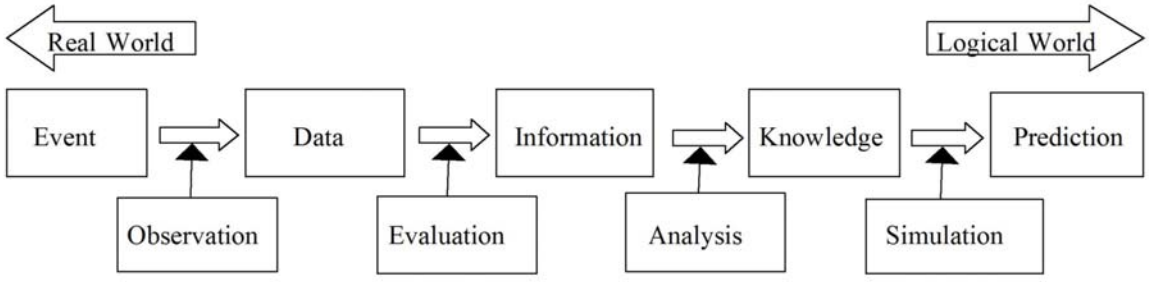
We have the two basic standpoints as the premises of discussion.

One is the positive evaluation for geosciences, and past contributions and achievements should not be denied. That is, each filed has developed with much achievement, each researcher has seriously studied, each research result has been properly published and used, and, geosciences have contributed to develop the advanced disaster prevention system.

The other is the positive evaluation for Japan. That is, Japan is a most developed country of science and technology including geosciences, a stable society with developed industry and economy, and a democratic country where the human right is highly respected. It means that the disaster in 2011 is not a specific problem to Japan, which should be discussed from a general and global view points.

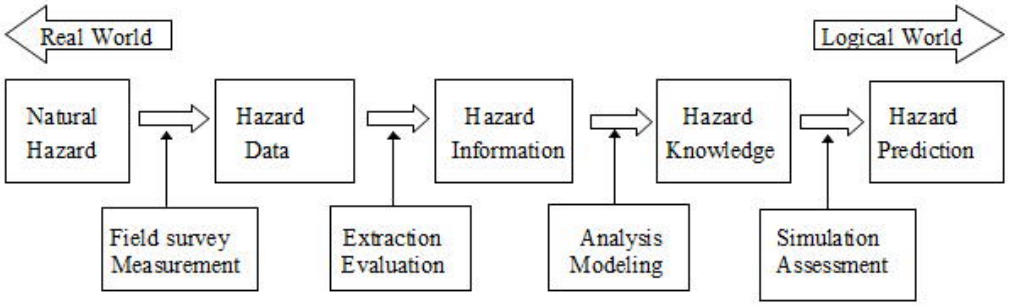
Information Flow on Natural Hazards

The basic information processing model is composed of four steps of actions: observation, evaluation, analysis and simulation. It is generally accepted in various scientific researches as a standard flow from the real world to logical world.



Basic Model of Information Processing

It is possible for the natural hazard to approve this basic model of information processing. The hazard data are obtained by the field survey, analysis of remote sensing data and geophysical data, laboratory work, etc. The hazard information are extracted a by correlation, evaluation, standardization, and other processing of hazard data. The knowledge is synthesized to the hazard model by mathematical and statistical analysis and numerical modeling of hazard information. The natural hazard is simulated - based on the hazard model, and the hazard map from the predicted hazard is produced.



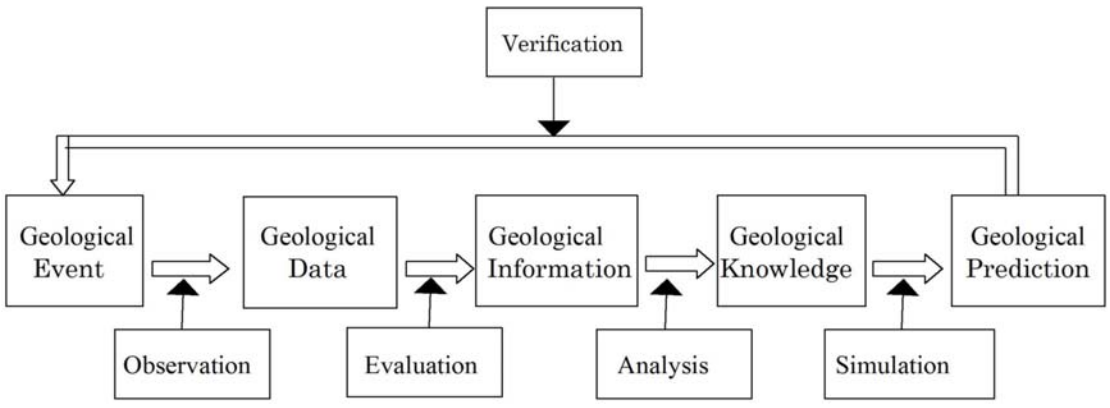
General Flow of Geosciences Information Processing

Improvement of Geosciences Information Processing

The system is generally accepted by information scientists, and contributed in many fields of sciences. The importance is recently recognized to examine the verification process of the resulted prediction by comparing with the actual event.

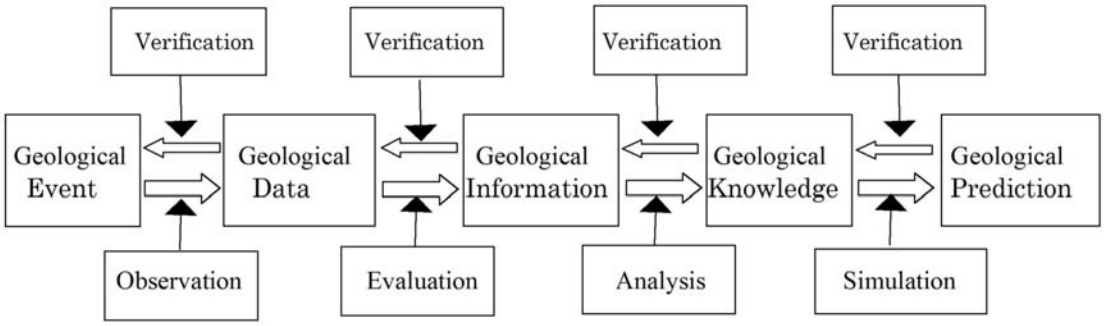
If the information is used only for limited purpose, it is easy to verify the result. On the other hand, if the information may be used for different purposes, such as that of natural hazards, there may be different verifications according to the targets, and the next stage of processing may differ.

The final prediction is verified by comparing with the real event mainly from technical and logical view points, and the next cycle of the information processing will start with the updated plan. The cycle is effective for the pure scientific information which has no heterogeneous element, such as social/political/economical element.



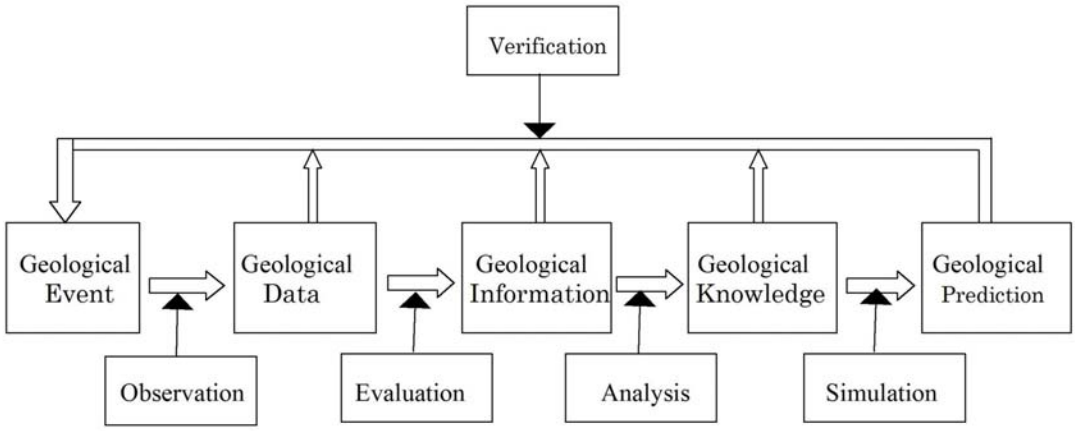
Geoscience Information Processing Cycle

The stepwise verification is necessary to examine each step before moving to the next process, and if necessary the process may be repeated by adding data, using another technique, applying another models, etc.



Stepwise Verification in Geoscience Information Processing

The multiple verification is the combination of the final verification and the stepwise verification, and it is possible to go back the first step from any step if any insufficiency is found at any step. This process is effective for information with different purposes.



Multiple Verification in Geoscience Information Processing

The geosciences information have complex structure with various elements including natural, social, political, economical, psychological, and other elements, and it is usual that the geosciences information processing has more than two purposes. The verification of the final prediction may differ according to the specified purpose, and it is necessary to determine which verification should be approved for the next cycle.

Geoethical points of view are important and urgent for this selection on the geosciences information, especially for those on natural hazards.

Discussion

In spite of positive condition, the disaster could not be predicted, safeguard system did not sufficiently work, and a terrible disaster occurred. Even if there were some insufficiency and/or error in individual processes, it might mitigate the disaster only partly, and it is not the fundamental solution. We should accept the fact that, irrespective our maximum effort, we could not prevent the disaster, and it is the start of our discussion on geoethics.

It is a fundamental duty of geoscientists for preventing disasters from natural hazard to continue the research in each field of geosciences and develop higher knowledge and technology on the safeguard system. It is important to introduce the verification based on its purpose into the geosciences information processing cycle, especially information concerning the natural hazard, where geoethical points of view should be included. In this course we should consider the specific characteristics of geosciences information, such as size, time, stochastic element, incompleteness, etc.

Conclusion

The information concerning natural hazards anywhere in the world should be considered as a common knowledge of the whole human kind as well as an unavoidable support for responsible decision of public authorities at any level.

It is important to introduce the proper verification system to the information flow in the research on natural hazards to obtain the most accurate and concrete information as possible.

It is also necessary for geoscientists to explain the significance and tolerances of the information, including possible excesses of prediction. Geoethical guidelines should be followed for planning safeguard systems to protect population against natural hazards by reducing and minimizing occurring damages.

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