The student study about the origin of the sea

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I have instructed the student study about the experiments of rock weathering and the changing in rocks at a junior high school in Tokyo for 25 years. And I am instructing the experiment of the rock weathering about the origin of the sea now. In this experiment students soak six kinds of the representative igneous rock into hydrochloric acid. After hydrochloric acid is neutralized, students measure the degree of neutralization and check materials which produced by neutralization. Students obtained results that there are many materials dissolving in water in the case of the basalt especially. and the basalt can greatly neutralize hydrochloric acid.
Basalt is said to be a main rock to prepare the earth crust of the sea into, and it might be in one of the big factors that the past sea was neutralized.
I think that the weathering experiment of the rock is not studied by an expert very much and can give the result that contribute to development of the planet science depending on the interest of a student and the instructor.

Keywords: student study, rock weathering, basalt, hydrochloric acid, neutralization

Report on the earth science education prpgram specializing activities for elementary and lower middle school students

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The author had developed a half-year science education program for lower middle school students, which had experiments and observations especially focusing on geoscience. The class had not only basic but also advanced physics, chemistry, biology and geoscience so that the students could get scientific conceptions related to geoscience.

Keywords: earth science education, lower middle school student, scinece class focusing on experiments and observations

Learning Geophysical Phenomena by Numerical Simulations: A Curriculum of Geophysics Education in High School

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In this study, we have developed a new curriculum for high school students to learn the complicated geophysical phenomena. The geophysical phenomena treated in the curriculum are the projectile motion of volcanic rocks, the motion of Foucault pendulum, and the propagating motion of tsunami waves. A special feature of the curriculum is that students try to perform numerical simulations to understand the physics and behavior of these geophysical phenomena. The curriculum is composed of two successive physics classes for second or third grade high school students (each class is 45 minutes in length). In the first class, we lecture the basic physical laws, the formulation of differential equations, and the basics of numerical simulation approach. In the second class, every student plays the numerical simulations by using PC. In the current study, we have conducted questionnaire surveys to all the students after the classes to investigate how performing numerical simulation improves the understanding of the geophysical phenomena.

Keywords: High School Physics, Geophysics Education, Marine Education, Numerical Simulation

Web service for active learning in Geoscience

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It gets more important to educate about the Earth's environment as the global warming and following unusual meteorological phenomena become serious problems every year. On the other hand, the recent education gives weight 'active learning': not only provide new knowledge, but also make students find problems and come up with the conclusion. So, we made a new web service, C3 (Cross-Cutting Comparisons/; http://www.darts.isas.jaxa.jp/C3/). The feature of the C3 is interactive interface. Even for a beginning student can check various geoscience data because of the leading input form. It also provides free scale adjustment, group working by using URL query and pseud 3d display (Dagik Earth; http://www.dagik.net/english/), which help in understanding various phenomena on Earth. In this presentation, we introduce the practice of the active learning by using C3.

Keywords: Geoscience, Active learning, Web service, Cross-Cutting Comparisons, Dagik Earth

Radio Telescope Observation for Multi-GNSS Satellites Using Android Smartphones

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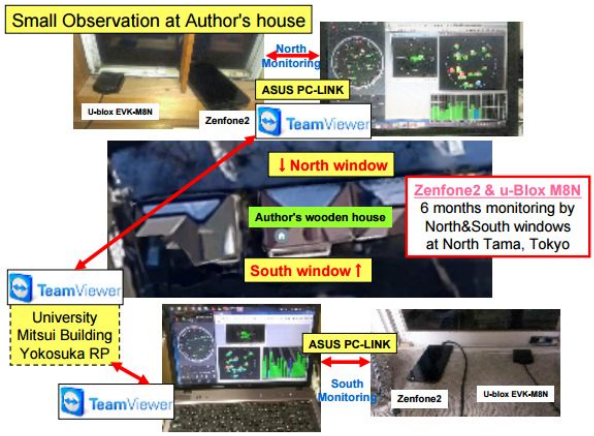
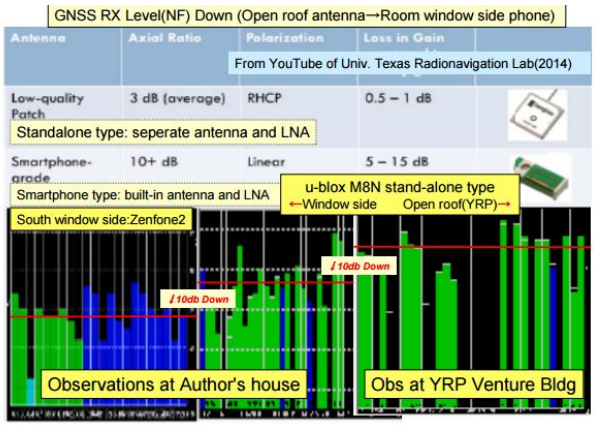
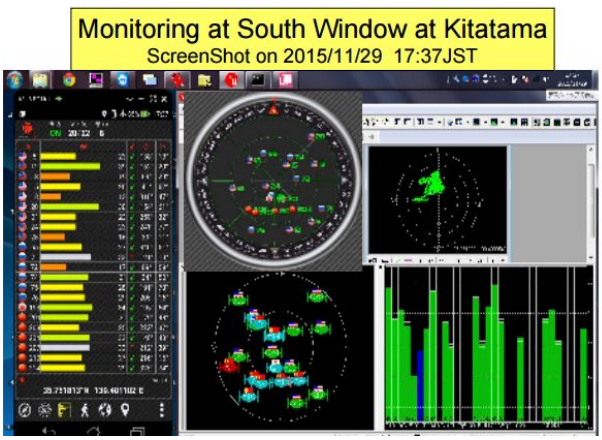
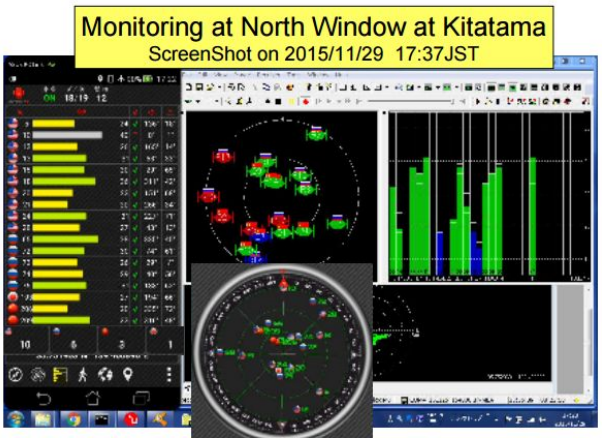
Nearly 30 global navigation satellites (GNSS) are orbiting over East Asia since 2014. They were launched by US(GPS), Russia(Glonass), China(Beidou) and Japan(QZSS). Android smartphones can use the applications to receive them and show the skyplots of their orbits. Though the number of the smartphone-navigation-applications users increase remarkably, most users are mainly interested in the network connections but they have very low interest in orbiting satellites over them. Using the android smartphones themselves we can get the measured GNSS data and use the real-time applications to draw the observed data without the expensive separate instruments. We introduce how to use the smartphone as the radio telescope to observe the orbital motions or the signal levels of the celestial radio sources GNSS. We are very sorry but we could not find the GNSS measuring applications for iPhones.

Keywords: GNSS, Radio telescope, smartphone









Study of winter lightning by TLE observation network operated by high school and university

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A various investigation of sprites, one of frequent observable transient luminous events (TLEs) in the region from mesosphere to lower ionosphere, has been reported. Sprites are induced by a strong electric field attributed to the neutralization of a large amount of positive charges at the upper part of thunderstorm when positive cloud-to-ground (CG) lightning occurs. Many papers have suggested that the complex physics of sprite-induced CG lightning, termed parent CG lightning, causes various morphologies and lifetime of sprites and the time delay of sprite occurrence, which have been some of unsolved issues in the TLEs' studies. In addition, the major issue might be the largely different locations in horizontal between sprites and parent CG lightning, which often reaches about 50 km. On the other hand, sprites occur just above the luminous center of parent CG lightning according to satellite observations. It is expected that the luminous center of parent CG lightning over the thunderstorm is equivalent to the positive charges at the upper part of thunderstorm where the positive CG lightning starts. Few study, however, discusses the horizontal differences among the sprites, the luminous center of parent CG lightning over the thunderstorm, and the strike point of the parent CG lightning. Thus, we investigate the differences among them through an optical measurement, assuming that the position of positive charges at the upper part of thunderstorm is the luminous center of parent CG lightning over the thunderstorm in cooperation with high-school sprite observation network.

Keywords: Sprite, Winter Lightning, Thunderstorm

Some reasons why pupils learn Earth Science in schools

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After World War II, the subject known as Earth Science in upper secondary school was established as one of the ‘science’ subjects alongside Biology, Chemistry and Physics. However, the number of pupils enrolling in Earth Science courses has decreased due to revisions in the Course of Study.There are some reasons why Earth science is not popular with pupils of upper secondary schools compared with other science subjects. For example, one of the main problems is the lack of suitable science teachers, and pupils seem not to feel attracted to learn Earth Science. However, the most important reason is that not only people in general but also science teachers believe without any doubts that Earth Science is taken for granted as one of the four science subjects. Therefore science teachers and policy makers have missed the opportunity to discuss deeply and publically why pupils learn Earth Science in schools. Generally science education is required to contain an explicit statement of its aims and objectives –making clear why we consider it valuable for pupils to learn science, and what we would wish them to gain from the learning experience of science (Millar & Osborne, 1998).

In this research, the author refers to the notion by J. Osborne (2000), and I examine the aims and objectives of Earth Science education. The first argument for the value of learning Earth Science is ‘the utilitarian argument’, which is the view that pupils might benefit by acquiring scientific knowledge and skills from learning Earth Science. The second is ‘the economic and state argument’ claiming that advanced technological and knowledge-based societies need a sufficient supply of scientists and engineers relating to Earth Science in order to sustain their status in the world, and be winners in international economic competition based on high-technology. The third is ‘the cultural argument’, which claims that Earth Science along with the other sciences is one of the great achievements of human culture in the course of history. The fourth one, ‘the democratic argument’, is that we, as scientifically literate citizens, have to make decisions based on scientific evidence about the socio-scientific issues relating to Earth Science such as energy resources and global warming. Especially, the ‘cultural’ and ‘democratic’ values of learning Earth Science should be emphasized over other arguments from the perspective of ‘scientific literacy’. Of course, these four values of Earth Science have both advantages and disadvantages according to the times.

As a result of analyzing these arguments about the value of learning Earth Science in schools, I argue that ‘the pedagogical argument’ - that the learning experience of Earth Science will encourage pupils to become future citizens with scientific literacy and give them direct contact with natural materials, phenomena and environment of the real world, developing an attitude of respect for life, promoting a scientific insight to socio-scientific issues and acquiring an interest in nature conservation, and to make important careers’ decisions (Isozaki, 1996) - should be added to the above-mentioned arguments. To emphasize the cultural, democratic, and pedagogical values of Earth Science, a context-based/led approach should be adequately combined with a content-based/led approach in teaching.

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Keywords: Earth Science, values of learning Earth Science, scientific literacy, context-based/led approach

Importance of educational support in earth and planetary sciences

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Natural Science is most popular subject in elementary school. However, children who like natural science decrease in junior high school. Changing the situation is important for developing scientific literacy in Japan.
One of the serious problems is that many school teachers in elementary school and junior high school are not good at teaching topics in earth and planetary sciences. Teachers who specialize in earth and planetary sciences are few comparing to physics, chemistry and biology.
Therefore, educational support from the specialists is necessary. In particular, the support in outdoor activity plays a key role in geological topics. The collaboration among schools, museums, geoparks including academic and public sectors might improve the quality of education of earth and planetary sciences at school.

Keywords: educational support, museum, geopark, collaboration

The way to overcome problems associated with technical terms in textbooks within the Earth Science

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There are several problems associated with technical terms in textbooks of "RIKA" (similar to natural science) within the Earth Science which are used at primary and secondary schools in Japan. The several problems are as below;
(1) Use of "misused words (tentative)"
ex.: noble gas in Japanese (noble: rare or precious in Chinese characters)
(2) Use of "several words (tentative)"
Several words are used for one meaning.
ex.: S-P time, S-P lag time, S-minus-P time, P-S time, lag time, P-S lag time
(3) Use of "two or more meanings words (tentative)"
There is a case in which a technical term has two or more meanings. However, only one meaning is used by the word in the textbook.
ex.: asperity
(4) Use of "extinct words (tentative)"
Some extinct technical terms are written in extinct figure in some textbooks.
ex.: Figure of classic classification of igneous rocks
(5) Use of "mispronounce words (tentative)"
ex.: lithosphere (The word is written in textbook not "***fI(upside down e)(r)" but "***fea" in Japanese Characters, Katakana, which are used for writing foreign words in Japanese.)
We, for instance, need to write several words for such as university entrance examination papers like S-P time (= S-P lag time, S-minus-P time, P-S time, lag time, P-S lag time), if we would like to use "several words (tentative)". The Subcommittee of Nurturing of Human Resources (tentative name), the Committee of Earth and Planetary Sciences at the Science Council of Japan (SCJ) and the Committee of School Education at the Japan Geoscience Union (JpGU) start a working group in order to solve these problems.
In this presentation, we would like to discuss how to solve the problem through we will show our road until completion which is to make recommendation by this study.

Keywords: Earth Science, textbook, technical term

Reconsideration about the model experiment of the liquefaction in schools

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In this study, we indicated the simple method for the science experience of the liquefaction in school. We examined the making of the shaking table by the manual operation, the quantity of sand and the water, and the way of shaking table. As the results, we decided the quantity of the water is about 470ml and the number of vibration per 30 sec is 100. Furthermore, we discussed the soil and sand of other place, and we report the examination whether or not a similar phenomenon is occurred. In these examinations, we can express a liquefaction resemblance phenomenon clearly, and it will be to help for the experiment.

Keywords: liquefaction, model experiment

Formation of Lateral Faults in Powder Utilizing the Prefabricated Experimental Apparatus

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The authors developed a prefabricated model experiment device of deformation in powder which can form lateral faults. In a science class for high school students, the students could assemble and make lateral faults in powder. The device will be a good teaching material for studying deformation land surface and beds.

Keywords: fault, model experiment, teaching material

How to teach soil in high school and junior high school

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In high school, world soil distribution can be learned in geography class. However, information is not updated by recent knowledge. I hope that education of soil in geography can be more interesting. For example, textbook describes that northern soils include podzol, permafrost soil, and peat soils. However, distribution of these soil types may not co-exist. Podzols typically develop in non-permafrost soils (e.g., Europe) under coniferous forests, permafrost soils are widespread in tundra and forests in the area where ice-sheet did not cover land surface in glacial period (e.g., Alaska, Siberia). We can know news of mammoth emerging from permafrost soil. Peat soils are widespread in flat landscape, irrespective of climate (e.g., Tropical peat). These knowledge need to be educated in systematic way, rather than remembering specific terms. We would also like to report the experience of class about soil in high school.

Keywords: Soil, Permafrost, Peat

The Sharing of Information and Data using Cloud Computing Services in Field Research in School Club Activity

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In recent years, there has been increasing strong public interest in natural disasters and global environmental issues. The promotion of science education using field research has become more and more important. In secondary schools, field research generally takes half a day or several days and has to be carried out as a school club activity out of the customary class schedule. For preparation of field research, communication between teachers and students is necessary especially in arranging of schedules and sharing data. It usually takes much time and labor, and thus tends to prevent teachers from engaging students in field research.

In this study, common cloud computing services were adopted so that communicating information, the arrangement of schedules, and the sharing of data for field research in an earth science club activity at Kaijo Junior & Senior High School could be facilitated. Membership of the club has been 45 (2012), 47 (2013), 45 (2014) and 42 (2015), respectively. They successfully reduced teachers' time and labor for preparation, whereas a few students had certain problems in using the cloud.

The project have been partially supported by grants-in-aid from Japan Science and Technology Agency (JST).

Keywords: earth science education, field research, cloud computing services

Remote Laboratory in Distant Education I: Scanning Electron Microscope

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Importance of practical experience and observational components of the science education have been emphasized, and several attempts have been made to include those components in the distant education. We will introduce our first application of scanning electron microscope to a remote laboratory in distant education of the Open University of Japan.

Keywords: Distant education, Remote laboratory, Scanning electron microscope

Terminological comparison on "Geography" and "Earth Sciences" of high school textbooks

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Both physiography and geoscience in the high school curriculum have a lot of similar content. These similarities may function more effectively in education systems, when these contents are taught in a coordinated way. However, there are some problems with the terminology use in textbooks, such as the same meaning but in different terms and the same word but different meanings. These problems may cause confusion among students. It might be difficult to rid these differences immediately, but if we are aware of these problems, teachers can deal with these terms adequately.
In this study, terms and their meanings in textbooks are compared. All the textbooks of geography and geoscience are referred: 3 books of Geography B, 6 of Geography A, 2 of Geoscience, 5 of Basic geoscience, 5 of Science and Human Life. With regard to geographical content, we compared the definition of macro-morphology, alluvial plains and the development process of landform. Concerning meteorological and climatological content, we compared the definitions of atmospheric circulation and Köppen-Geiger Klassifikation.

Keywords: terminology, textbook of high school, geographical education, geoscience education

The Posture that is demanded from the Leader of the Science Research Activities of the Senior High School Students

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At various opportunities, it is argued about the way of the science research activities of the high school students. Is it necessary to change the method of the evaluation in a group study and a personal study? Is a study of the engineering and agriculture study easy to get a high evaluation than fundamental researches? Do you evaluate it only based on study contents or increase the appearances of the presentation and the article in an evaluation standard? Do you make much of enthusiasm and sense of cooperation whether you make much of originality and priority? How much do you accept the participation of the leader? For a student researching activities for the first time, the role of the leader is serious. I consider it how a leader should be concerned with a student.
I instructed Earth Science Club in Hyogo Prefectural Kakogawahigashi Senior High School that was SSH school for ten years, and I moved in Nishiwaki Senior High School in 2014, and I instruct Earth Science Club in the principal school. The Earth Science Club continues a national higher winning prize in a Ministry of Education, Culture, Sports, Science and Technology authorization meet in succession for 12 years. It is to always ask a student saying "it is why" that I keep in mind in instructing a student study, and I watch still it after teaching told the basic technique and foam. For example, I ask a student why it must be the theme. The student must show a motive concretely to answer this question. In addition, the student cannot explain a purpose to me definitely if he does not check a precedent study properly. I do not let a student only study it for the reason to seem to be interesting. Such a student comes to a deadlock on the way and often abandons a study. For a leader achieves a purpose to a student, a thing important next is to ask what kind of experiment and observation are necessary. If a purpose is clear and learns the precedent study, I think that a student greatly deviated from appropriate experiment and observation method. I try to let a student do it without saying a careful thing at the beginning.
When a result became clear, I hold a briefing session and let a student explain a policy and the result of the study. In many cases, the condition of the experiment is divided, and an error is not handled properly, and the data does not have the result. I point it out and let you do the fresh start of the experiment some other time to be concrete. I let a student learn that it must be the thing that an experiment and observation go to the study purpose linearly. After an experiment and observation is finished, I let consider it between students. Even if a good result is given with much effort, because a student lacks in both the knowledge and the experience, he cannot evaluate it definitely and summarize it in generalization. I explain the cause that a discussion comes to a deadlock to a student, and I show the article that I should read to a student or the chart which I should compile. I strongly instruct a student to consider it only from a result. Most of students confuse the story that he heard somewhere and the results, and they are considering it which he cannot arrive at from a result. Of course I instruct it about the rule in the chart making strictly. For example, I do not use the graph which looked at the bar graph from a slant in the science. The student finally summarizes results of research in an article, and I teach the style of the scientific article properly. First, the student writes the article such as the letter. He distributes one's result and a precedent study properly and does not show the consideration separates a precedent study and his results of research definitely. I instruct a student about these, and entrust a student afterward.

The student finishes writing a surprisingly wonderful scientific article by a leader instructing it. The article that the student wrote may be judged as a leader wrote it.

Keywords: Earth Science Club, "it is why", instruct, entrust

