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MIS023-P01

Room:Convention Hall

Time:May 22 16:15-18:45

The role of prokaryotes in the oceanic carbon cycle

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Over the past three decades, several studies have examined the abundance, biomass, and production rate of prokaryotes in various marine environments. These studies have revealed that prokaryotes consume, on average, 50% of primary production in pelagic ecosystems and play important roles in major biogeochemical processes, such as nutrient cycling and organic matter fluxes. In addition, studies have shown that prokaryotic biomass is comparable to, or even exceeds, phytoplankton biomass in oceanic environments, with prokaryotes representing an important trophic link in marine pelagic food webs. Moreover, studies, which are based on novel molecular biology analyses, have revealed surprisingly diverse prokaryotic communities in marine environments. And these studies have revealed spatiotemporal patterns in prokaryotic community composition. However, our knowledge of the role of individual prokaryotic subgroups in biogeochemical cycles remains limited. To examine the internal dynamics of prokaryotic communities and their implications for biogeochemical cycling in marine systems, it is important to understand 1) the spatiotemporal variation in individual bacterial subgroups; 2) mechanisms underlying community structure controls; 3) contributions of individual groups to carbon flow in microbial food webs. In this presentation, I discuss recent progress in microbial oceanography, emphasizing the importance of prokaryotes in determining the oceanic carbon cycle.

Keywords: prokaryotic community, oceanic carbon cycle

MIS023-P02

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Linkage of sulfur and nitrogen cycling in a sulfur high-content ecosystem-Nitrate reduction coupled to sulfur oxidation-

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[Introduction] While most studies have focused on organic carbon as the electron donor for denitrification, reduced sulfur can also provide energy to support denitrification. Pyrite (FeS₂), which is composed of a reduced sulfur of sulfide mineral, is easily oxidized to SO₄²⁻ and can be coupled to reduce NO₃⁻ when NO₃⁻ contacts with pyrite in anoxic condition. Recent study indicated NO₃⁻-driven SO₄²⁻ production could be widespread and biogeochemically important in fresh water sediments (Burgin and Hamilton, 2008). Therefore, NO₃⁻ reduction coupled to SO₄²⁻ production might be superior in Akita prefecture which has the stratum that called 'Kuroko' which contains a lot of sulfide minerals. [Aim] In this study, we focused on the linkage of sulfur and nitrogen cycling through denitrification. The purpose of this study was to evaluate NO₃⁻ reduction and N₂O emission coupled to sulfur oxidation by a long-term incubation of soil from a sulfur high-content ecosystem in Akita prefecture, Japan. [Materials and Methods] Study site is the nature trail of Goshogake (N39.970, E140.801) at Akita prefecture in Towada-Hachimantai National Park, Japan. The sediments used in the incubation experiment were sampled from mudflat (A) and riverside (B) from the 10-20 cm depth. Fresh sediments corresponding to approximately 20 g dry weight and 400 ml each treatment water were added to 550 ml glass bottles and closed with butyl rubber septa and aluminum crimp. Four treatment water were prepared in this study; 1. Deionized water, CT; 2. KNO₃ (100 mg N L⁻¹), N; 3. KNO₃+Glucose, N+Glu; 4. KNO₃+CaCO₃, N+CaCO₃. Bottles were incubated at 25 deg C for 220 days. To achieve anoxic condition in bottles, the solution and headspace of the bottles were sparged with N₂ gas for 30 min. Immediately after water sampling, pH and EC were measured by a portable pH and EC meter. Concentration of NO₂⁻, NO₃⁻, SO₄²⁻ were measured by an ion chromatograph. Concentration of NH₄⁺ was determined by colorimetry using the indophenol blue method. Nitrous oxide concentration in the headspace of the bottles was measured by a gas chromatograph with ECD. Easily oxidizable-S content in the sediments was measured by the difference between H₂O₂-S and H₂O-S (Murano et al., 2000). [Result and Discussion] In the N treatments, NO₃⁻ concentration decreased by 57-100% after 208 days from the incubation started. In the N+CaCO₃ treatment of the B sediment, NO₃⁻ concentration decreased to 0 mg N L⁻¹ after 208 days. Concentration of SO₄²⁻ increased in all the treatments, and the maximum concentration was observed in the N+CaCO₃ treatment of the B sediment. Both NO₃⁻ consumption and SO₄²⁻ production rate tended to be larger in the B sediment than that in the A sediment. Nitrate consumption rate significantly correlated with SO₄²⁻ production rate during the incubation period ($r=0.990$, $p<0.01$, $n=8$), which indicated NO₃⁻ reduction coupled to sulfur oxidation. Easily oxidizable-S content in the B sediment was higher than that in the A sediment, which would caused the difference of the NO₃⁻ removal rates among the sediments. In this session, we would like to discuss a stoichiometry of this biogeochemical reaction based on the present results. Ammonium were detected in all the N treatments but were considerably low. Therefore, NO₃⁻ reduction by dissimilatory nitrate reduction to ammonium (DNRA) would be negligible. Nitrous oxide production was observed in all the N treatments, however, the significant difference among the treatments or the sediments was not observed. In the B sediment, the SEM photographs showed a framboidal form which represent pyrite. X-ray analysis also showed clear peaks corresponding to pyrite and marcasite both of which the chemical composition were FeS₂. Therefore, NO₃⁻ reduction was coupled to pyrite and marcasite oxidation to SO₄²⁻. This study indicated the linkage of sulfur and nitrogen cycling through denitrification in a sulfur high-content ecosystem.

Keywords: sulfur denitrification, nitrate reduction, sulfur oxidation, pyrite, N₂O, DNRA

MIS023-P03

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Syntrophic nitrogen exchange between zooxanthellae and host corals as viewed from amino acid nitrogen isotopes

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The reef-building coral is one of the most prominent animal-plant symbiotic systems, exhibiting extremely high primary production in oligotrophic tropical oceans. As an essential factor behind this, the existence of conservative internal recycling pathways of nutrients such as nitrogen (N) and phosphorus has been supposed; however, exact mechanisms of nutrient recycling still remain to be clarified. In normal animal-plant interactions, animals acquire N from plants through grazing, and plants can reuse N once animals excrete N as urea or ammonium. Are similar trophic linkages operating between zooxanthellae and host corals within the symbiotic associations? To address this question, we used compound-specific N isotope analysis of amino acids. Using amino acid N isotope signature ($d^{15}\text{N-AA}$) of animal tissues, one can evaluate simultaneously the apparent trophic level (ATL) of the animal, and the $d^{15}\text{N-AA}$ of plants at the basis of food chain on which the animal depends. From the latter, the $d^{15}\text{N}$ of dissolved inorganic nitrogen (DIN) on which the plants depend can also be estimated and used for N source evaluation. We collected specimens of *Acropora pulchra* and some other hermatypic corals from fringing reefs around Ishigaki Island and Sekisei Lagoon, southwestern Japan, separated zooxanthella cells and host coral tissues using centrifugation, and measured bulk and amino acid $d^{15}\text{N}$ values using EA/IRMS and GC/C/IRMS, respectively. The $d^{15}\text{N-AA}$ patterns of zooxanthellae and host tissues from single colonies were quite similar to each other, and ATL mostly ranged between 0.9 and 1.5 (ATL of primary producers being defined as 1.0) with no significant difference between zooxanthellae and the host. There was no evidence that host corals graze on zooxanthellae. The bulk $d^{15}\text{N}$ values of both zooxanthellae and host tissues were low in pristine sites and got higher in polluted sites, indicating that they directly reflected $d^{15}\text{N}$ of external N sources available at each site. While pieces of *A. pulchra* colonies were incubated with *Artemia* as food source for 2 weeks, the bulk $d^{15}\text{N}$ and $d^{15}\text{N-AA}$ s gradually increased towards those of *Artemia*, and the increase rates were similar between zooxanthellae and host tissues. ATL also increased from 0.97 to 1.33 (zooxanthellae) and 1.37 (host tissues), which indicates that zooxanthellae did not simply reuse excreted metabolites from the host. Our results suggest that zooxanthellae and the host share a common reservoir of amino acids, from which they synthesize proteins for their biomass. Sources of amino acids for this reservoir would depend on origins: DIN may be incorporated and synthesized into amino acids primarily by zooxanthellae, while external food sources may be caught and digested into amino acids primarily by the host. Irrespectively of origins, the most part of acquired N seems to be stocked in the common amino acid reservoir before being used further for biomass synthesis. Thus, N exchange pattern between zooxanthellae and the host coral would be different from those found in non-symbiotic plant-animal interactions, and can not be regarded as simple recycling. It rather seems to be an effective system for sharing resources from several different origins between zooxanthellae and the host, to enhance their survival and growth under high-energy, low-nutrient conditions.

Keywords: coral, symbiosis, amino acids, nitrogen cycle, stable isotopes

MIS023-P04

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Nitrogen availability and natural abundance of ^{15}N of soil microbial biomass

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Nitrogen (N) availability in forest is a strong driver controlling net primary production of plant. Soil microbes regulate the N availability since they are responsible for the production of available N (inorganic and some organic N) for plants and soil microbes. Thus, balance of N and carbon (C) availability to soil microbes is quite important for the understanding of N cycle in terrestrial ecosystems and soil C/N ratio has been used as a parameter for that. However, C/N ratio of bacteria and fungi differs greatly and relative importance of them to the total soil microbes can differ among different soils, simple C/N ratio cannot determine the actual balance of C and N availability.

Recently, natural abundance of ^{15}N ($d^{15}\text{N}$) of the soil microbe has been proposed as a new parameter that can provide the information on relative C and N availability to the soil microbes (Dijkstra et al. 2006, 2008). Enrichment in $d^{15}\text{N}$ ($\text{Dd}^{15}\text{N}_{\text{MB-Soil}}$) of the soil microbes from the substrate (bulk soil N or extractable soil N) should be high when N availability is high because the soil microbes would extrete the excess N with low $d^{15}\text{N}$ due to the isotopic discrimination during the N metabolism. Even this new parameter r of $\text{Dd}^{15}\text{N}_{\text{MB-Soil}}$ is expected to provide new insights into the actual C and N availability of the soil to the soil microbes, the measurement of $\text{Dd}^{15}\text{N}_{\text{MB-Soil}}$ is tedious due to the low concentration of soil microbial N. We explored the potential of $\text{Dd}^{15}\text{N}_{\text{MB-Soil}}$ in a temperate forest in Japan with denitrifier method that can allow us to measure $d^{15}\text{N}$ with small sample size (20-50nmol-N).

We collected the soil samples (Ao, 0-10 and 10-20cm depth) from Kamigamo Experimental Forest, Kyoto Univ, Japan from two plots located in upper part and lower part of a mountain slope. We measured $d^{15}\text{N}$ the extractable N (NH_4^+ , NO_3^- , TDN and DON) in 0.5M K_2SO_4 soil extract. We also used the fumigation-extraction method to measure C and N content, and the $d^{15}\text{N}$ of soil microbial biomass. DOC concentration in the 0.5M K_2SO_4 soil extract and $d^{15}\text{N}$ of bulk soil N were also measured for the reference.

$d^{15}\text{N}$ of soil microbial biomass was significantly correlated with that of bulk N ($P < 0.001$) but always higher than that of bulk N. Actually, $d^{15}\text{N}$ of soil microbial biomass was quite similar with $d^{15}\text{N}$ of DON, suggesting that the soil microbial biomass N is the source of soil DON as previously suggested (Koba et al. 2010). $\text{Dd}^{15}\text{N}_{\text{MB-Soil}}$ significantly correlated with soil C/N ($P < 0.01$), which suggested that $\text{Dd}^{15}\text{N}_{\text{MB-Soil}}$ should reflect the C and N balance for soil microbes. However, the intercept of the regression lines obtained from two sites differed greatly. This difference in the relationship between $\text{Dd}^{15}\text{N}_{\text{MB-Soil}}$ and soil C/N strongly suggested that the same soil C/N does not indicate the same balance of C and N availability to the soil microbes. We discuss the usefulness of the new parameter of $\text{Dd}^{15}\text{N}_{\text{MB-Soil}}$ in the presentation together with other parameters such as DOC/DON and $d^{15}\text{N}$ of inorganic N.

MIS023-P05

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Isotopomer analysis of nitrous oxide produced in a seasonally frozen soil

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Nitrous oxide (N₂O) is a potent green house gas of which radiative forcing is about 200 times larger than that of CO₂ and contributes to ozone depletion in the stratosphere. In seasonally frozen soil, it is known that more than 50% of the annual N₂O emission occurs during spring snowmelt period. In order to investigate the N₂O production/consumption mechanism under the soil thawing events, we performed isotopomer analysis of N₂O at an experimental agriculture field plot in northern Japan. It is suggested that intramolecular ¹⁵N site preference (SP) of N₂O, that is defined as difference in isotope ratios between central (N^a) and terminal (N^b) nitrogen in the N₂O (NNO) molecule, is a powerful tool to quantitatively analyze the contribution of important production pathways such as nitrification, fungal denitrification, chemo-denitrification and bacterial denitrification together with the presence of N₂O reduction, in addition to the isotope ratio of N (d¹⁵N) and O (d¹⁸O).

The diffusion chamber method using silicone tube, which is recently applied to gas sampling from each soil depth, is useful method for revealing biological processes in soils. In order to apply this method to isotopomer analysis, diffusion equilibrium of N₂O (concentration, d¹⁵N, d¹⁸O, SP) was confirmed by laboratory experiment. As a result, no significant difference in concentration and isotope ratios between outside and inside of the silicone tube was detected, suggesting the diffusion method can be applied to in situ soil gas sampling for N₂O studies.

We, then, investigated the isotopomer signatures of soil N₂O collected from the seasonally frozen soil under soil thawing events. Isotopomer ratios showed no significant variation during N₂O production peak in subsoil. Both SP and d¹⁵N of N₂O were within the range of the reported values for bacterial denitrification, suggesting that N₂O produced during spring snowmelt period was derived from bacterial denitrification and the contribution of N₂O reduction was likely to be very low.

Keywords: Nitrous oxide, Isotopomer, Frozen soil, Denitrification

MIS023-P06

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The effect of manure on nitrous oxide flux in agricultural soils

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Nitrous oxide plays important roles in atmospheric chemical processes. Nitrous oxide is known as a greenhouse gas, and is one of several gases responsible for global warming. In addition to its contribution to global warming, nitrous oxide plays the most important role in ozone depletion in the stratosphere.

Agricultural soils is major source of atmospheric nitrous oxide. Because N fertilizer stimulates these N oxide gases emission derived from both nitrification and denitrification processes in soils. However, the strength of its still have a large uncertainty. The rates at which nitrous oxide emission is induced by fertilization widely ranged 0.003 ? 0.03 (IPCC, 2007). Its variation was considered to depend on fertilizer types, plant species, soil types and the environmental factors during measurement period. However, there are fewer reports on nitrous oxide emission from organic fertilizer application than from chemical fertilizer application. To investigate the effect of organic fertilizer application on nitrous oxide flux, a wider variety of organic materials needs to be assessed.

In this study, to quantify the various organic materials and various nitrogen fertilization effect on nitrous oxide flux, we develop a hierarchical Bayesian model. We modelled N oxide gases flux assumed as lognormal distribution and incorporated random effect in block (chamber position) to take the variability of flux into account. By using this model, we quantify the response of nitrous oxide flux with various organic materials application from lysimeter field to the environmental factors. Also, this approach enables to quantify uncertainty, which is represented as probability density functions.

In the presentation, we will discuss about the difference in response of nitrous oxide flux among application of organic materials .

Keywords: Nitrous oxide flux, Hierarchical Bayes model

MIS023-P07

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Nitrogen dynamics in earthworm casts: possible hotspot of N₂O production in soil

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Introduction

Nitrous oxide (N₂O) has been recognized as a potent and long-lived green house gas. Its global warming potential (GWP) is 310 times greater than CO₂. N₂O is also linked to ozone depletion strongly. So increasing anthropogenic emission of N₂O is now pressing problem. To understand, estimate the effect of human activity on N₂O budget, correct estimation of N₂O production rates from relatively small scale, like regions, landscapes, and individual fields, are needed.

Earthworms change soil structure and influence nitrogen and carbon cycle in soil. Previous study shows that earthworm casts have high nitrification and denitrification rate. In the few studies N₂O emission from casts are measured but almost no study focus on the change of N₂O emission related to cast ageing.

We evaluated the change of pH, mineral N content, N₂O emission rate, C/N, total organic C, and microbial respiration related to cast ageing and investigate what causes the change of N₂O emission rate. We also use two different species of earthworm and check the species effect.

Materials and Methods

Earthworms (*Amyntas hupeiensis* and *Metaphire megascolidioides*) and soil are collected on Kamakura central park, Kamakura, Kanagawa and pre-incubated in laboratory during 3 days. The samples of fresh casts from each earthworms and soils (5.0g of wet matter) were placed into glass bial and incubated. We measured N₂O emission rate after 0,1,4, and 10 days of the cast formation. Subsequently, sample in the bial are separated and pH, C/N ratio, NH₄⁺, NO₃⁻, TDN (Total Dissolved Nitrogen), TOC (Total Organic Carbon) were measured.

Results and Discussion

N₂O emission from soils is almost constant during incubation period (-0.004 to 0.004 microgN/g/day). N₂O emission from *A. hupeiensis*'s casts decreased from 0.023 microgN/g/day (0-day cast) to 0.005 microgN/g/day (10 day cast). N₂O emission from *M. megascolidioides*'s casts also decreased from 0.147 microgN/g/day (0-day cast) to 0.027 microgN/g/day (10-day cast). Irrespective of species, N₂O emission from casts is significantly higher than soil, so casts may contribute to N₂O emission from soil in the actual field.

pH decrease and NO₃⁻ concentration increase with time are shown in casts from both species. NH₄⁺ and TDN concentration in *A. hupeiensis*'s casts increased in 4-day and 10-day cast. In *M. megascolidioides*'s casts, on the other hand, NH₄⁺ concentration is gradually decreased and TDN concentration are almost constant. Previous study shows decrease of NH₄⁺ concentration. So NH₄⁺ increase in *A. hupeiensis*'s casts may caused by ammonification, mucus secretion. Microbial respiration in casts are higher than soil in both species. TOC concentration shows sharp decline between 0-day and 1-day and fluent decline between 4-day and 10-day casts from both species.

N₂O emission from casts and TOC are related significantly (*A. hupeiensis*: r²=0.61, *M. megascolidioides*: r²=0.47), and it shows possibility that TOC decrease control N₂O emission from casts. It is known that microbial activity in earthworm casts decreases after cast formation. This decrease is thought to be caused by decrease of available carbon, antagonistic interactions between microbial communities, and so on. The results from this study support the limitation by available carbon.

Keywords: earthworm, cast, nitrogen dynamics, nitrous oxide (N₂O)

MIS023-P08

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Conversion of nitrate to dissolved organic nitrogen in stream water through serpentinite bedrock in a forested watershed

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The concentration of NO_3^- in stream water has been elevated in forested watersheds due to chronic atmospheric nitrogen (N) deposition over the last few decades. N saturation in forested ecosystems, defined as an excess of N deposition supply over biotic demand, results in significant N leaching from forested watersheds. Recent studies, however, indicated that chronic high N deposition has had variable effects on stream water NO_3^- concentrations across the northeastern United States. This is because many factors affect NO_3^- leaching from forested watershed.

In this study, to test the hypothesis that passing groundwater through different bedrock causes a marked difference in the nitrate (NO_3^-) concentration in baseflow stream water, two nearly adjacent watersheds, site O (serpentinite and chlorite schist: NO_3^- 55 $\mu\text{mol L}^{-1}$) and site S (amphibolite: NO_3^- 113 $\mu\text{mol L}^{-1}$), were investigated and the underlying mechanism affecting NO_3^- concentration as groundwater passes through bedrock was identified. The conversion of NO_3^- to dissolved organic nitrogen (DON) in groundwater as it through bedrock could be the primary reason for the lowered NO_3^- concentration at site O. Plausible mechanisms could be NO_3^- reduction to nitrite (NO_2^-) by reduced metals, such as iron, chromium, and nickel found in serpentinite bedrock and the subsequent reaction of NO_2^- with dissolved organic matter to produce DON. The results from this initial study showed that certain bedrocks can reduce NO_3^- concentrations in stream water by converting groundwater NO_3^- to DON.

Keywords: Nitrogen saturation, Nitrogen leaching, Conversion, Forested watershed, Serpentinite

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Changes in dissolved organic matters in streamwater during a stand development of Japanese cedar plantations

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In order to elucidate the regulating factors of dissolved organic matter in streamwater, we examined dissolved organic carbon and nitrogen (DOC and DON, respectively) concentrations and the 3-dimensional fluorescence in more than 30 watersheds covered with planted Japanese cedar of different stand ages. A remarkable increase in the DOC concentration was found 3 years after clear-cutting, and the DOC concentrations decreased from 3 to 38 year-old stands. Afterward, DOC concentrations re-increased accompanied with an increase in fulvic acid-like substances, suggesting that soil organic matters and humic substances accumulated during the stand development. We will discuss this change in stream DOM concentration and its quality during the stand development, and an implication for carbon and nitrogen cycling in this forest ecosystem.

Keywords: Dissolved organic matter, Fluorescence, Japanese cedar plantation, Stand age, Streamwater chemistry

MIS023-P10

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Distribution of dissolved iron concentration and optical characteristics of DOM in the estuarine water of Yura River

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The materials supplied from terrestrial areas through a river largely affect the biological activity in the estuarine and coastal region. Iron is an essential element for the phytoplankton that supports the primary production of aquatic ecosystems. However, in an aerobic environment, iron forms insoluble hydroxide and thus, biologically available dissolved iron can be limited. Most of the dissolved iron is complexed with dissolved organic matter (DOM). DOM not only influences the transportation process of materials by formation of the metal-organic complexes and absorption and desorption of elements but also influences bioavailability of the trace metals, such as iron. Therefore, it is important to characterize DOM composition as well as clarifying quantitative distribution of DOM. However, little has known about qualitative information on DOM, and the distribution and dynamics of DOM.

In this study, we investigated optical characteristics of DOM and the distribution of dissolved iron in the estuarine region that important as a place for the biological production. This study was conducted as a part of the Kibunka Project, Field Science Education and Research Center, Kyoto University.

The field sampling was conducted in the estuary region of the class A river, Yura river, located in the northern part of Kyoto Prefecture. Six sampling stations were set between the mouth of the river and about 16km upstream. River water at 2 or 3 depths were collected in each station on July 17th, August 19th, November 18th, 2010, and January 21, 2011. Polyethylene bottles were used for water sampling after thoroughly washed with the sample water. Sampled water were then filtered with the acid cleaned glass fiber filter (GF/F, Whatman), treated with HNO₃ conc. for pH adjustment, and refrigerated in the surface contamination control (SCC) polypropylene bottles until iron analysis. The dissolved iron concentration was measured by inductively coupled plasma atomic emission spectrometry (ICP-AES). For DOC analysis, sampled water was filtered with a combusted (450 degree, 4h) glass fiber filter (GF/F). Concentrations of DOC were determined with a total organic carbon analyzer (TOC-V CSH, Shimadzu). Three-dimensional excitation emission matrix (EEM) was measured by using the fluorescent spectrometer (F-7000, Hitachi). After EEM data were standardized by the Raman scatter correction, several peaks are extracted by the Parallel Factor (PARAFAC) analysis.

Keywords: Dissolved Organic Matter, Dissolved iron, EEM-PARAFAC analysis, Water quality, Salt-wedge intrusion

Characterizing the dynamics of dissolved organic matter by fluorescence spectroscopy

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Dissolved organic matter (DOM) comprises the largest pool of organic matter in a wide range of aquatic environments. DOM in the ocean is one of the largest bioactive carbon reservoirs with a stock of 680 PgC in the global basis. In terrestrial aquatic environments, even though stocks of DOM are small compared to the ocean, it has been recognized that a large amount of organic matter is processed in inland waters and must be considered in the global carbon cycle. In addition, DOM plays a key role in biogeochemical cycles affecting processes such as metal complexation, light attenuation, nutrient availability, and microbial and phytoplankton activity. Recent studies clearly show that dissolved organic carbon (DOC) concentrations in terrestrial aquatic environments change with environmental disturbances such as land management. However, fluxes and mechanisms controlling the DOM dynamics in aquatic environments, e.g., transport of organic matter from land to rivers, have not been well documented and we need to improve our knowledge of this subject. The role of DOM in biogeochemical cycles, e.g., as a driver for microbial loop, is strongly related to DOM chemical characteristics or quality. Thus, we need a better understanding of DOM dynamics in aquatic environments in terms of quantity and quality.

Fluorescence spectroscopy has been widely used for characterizing DOM dynamics in aquatic environments. This technique features high sample throughput and can evaluate the dynamics of at least two very different groups of DOM, namely humic-like and protein-like fluorophores. The protein-like fluorophores have been considered to be representative of fluorescent aromatic amino acids and consequently the biologically reactive components. On the other hand, humic-like fluorophores can be used to evaluate mainly soil-derived organic matter in aquatic environments. Thus, characterization of DOM using fluorescence techniques will provide a better understanding of DOM dynamics in aquatic environments. More recently, the combined techniques of excitation-emission matrix (EEM) fluorescence with parallel factor analysis (PARAFAC) have successfully evaluated the environmental dynamics of fluorescent DOM (FDOM) components in diverse aquatic ecosystems. This technique provides higher resolution on fluorescence components in DOM, and thus, may be ideally suited to detect small, but potentially significant variations in DOM composition in apparently similar aquatic environments.

In this presentation, we will introduce fluorescence techniques, especially EEM-PARAFAC, as a tool for characterizing the DOM dynamics in aquatic environments. As an example, we will present optical properties of DOM that dissolved from flocculent particulate organic matter (floc). This study shows that light exposure of floc from the Florida Coastal Everglades results in significant DOM generation through photo-dissolution processes. DOC concentration for samples incubated under dark conditions displayed a relatively small increase, suggesting that microbial processes and/or leaching might be minor but important processes for the generation of DOM from floc. On the other hand, DOC concentration increased substantially for samples exposed to artificial sunlight, indicating the release of DOM through photo-induced alterations of floc. The fluorescence intensity of both humic-like and protein-like components also increased with light exposure. Terrestrial humic-like components were found to be the main contributors (up to 70 %) to the FDOM pool, while protein-like components comprised a relatively small percentage (up to 16 %) of the total FDOM. While the photo-dissolution of suspended sediment organic matter in coastal regions has also been reported, the photo-dissolution of floc in wetlands can be an important source of DOM to these shallow aquatic environments, particularly after storm events, with the potential to influence nutrient dynamics in such system.

Keywords: Dissolved organic matter, Fluorescence characteristics

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Difference in sources of rare earth elements in plants depending on type of infected fungi

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Recently a number of papers have suggested plant induced chemical weathering of soil minerals. It is conceivable that plant-induced weathering is operative for plants to assimilate inorganic elements (nutrient elements) from soil minerals directly. Mycorrhizal fungi have been reported to play a role in this process.

In this study, Eu anomaly and Nd isotope ratio of plants were measured to understand the sources of REEs in plants, assuming that no biological selection of both the elements is operative. The rationale of the assumption is the similarity in chemistry the trivalent rare earth elements.

The uppermost Strengbach catchment is situated in the eastern part of the Vosges mountains (Northeastern France), where various species of plants (ex. Fern, Maple, Pine) were sampled.

In measurement, leaves of each plant sample were used. Plant sample was dissolved with HNO₃ and HF, then REEs in the solution were preconcentrated with solvent extraction (Shabani et al., 1990; Fu et al., 2001), and were determined by ICP-MS.

Nd isotope ratios were determined by TIMS after Nd was separated using LN resin.

The values of Eu anomaly and Nd isotope ratio of plant samples could be understood by mixing apatite, feldspar and soil solution of Strengbach.

If plants assimilated inorganic elements only from the soluble fraction of soil, value of Nd isotope ratio and Eu anomaly of plants can be similar to those of the fraction. However, the values of some plant species were rather close to those of the minerals than those of the soluble fraction of soil. This suggested that plants assimilated inorganic elements from minerals as well as the soluble fraction of soil.

The difference in the values was found to be well-related with types of infected fungi: EcM-infected plants gave the values close to silicate minerals, whereas AM-infected ones those close to the soluble fraction in soil. It is considered that a difference in symbiotic mycorrhizal fungi may produce a difference of weathered minerals.

Keywords: rare earth elements, plant - mycorrhizal fungi, chemical weathering, silicate mineral, Nd isotope ratio, Eu anomaly

Japan Geoscience Union Meeting 2011

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MIS023-P13

Room:Convention Hall

Time:May 22 16:15-18:45

Monitoring of mercury pollution by Carbonized tree trunk

Akihiro Okuma^{1*}, Nobuko Ono¹, Kenichi Satake¹

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This study shows carbonized tree trunk accumulates atmospheric mercury, and carbonized tree trunk to be used as an indicator of atmospheric mercury pollution.

Keywords: Mercury, Carbonized tree trunk, Monitoring

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MIS023-P14

Room:Convention Hall

Time:May 22 16:15-18:45

EM Sounding Characterization of Land Management toward Estimation of Potential Pollutant Load from Non-point Sources.

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A multi-frequency electro-magnetic (EM) sounding method was applied to the agriculture field to investigate the characteristics of non-point pollution load. Soil environmental properties such as differences in land management were analyzed with electrical conductivity (EC) maps. In addition, vertical EC profiles obtained from EM soundings were compared with EC in drainage ditch or river water. As results, surface soil EC maps successfully extracted the differences in land management affected by fertilizer application. Moreover, surface EC at the vertical profiles strongly related with drainage ditch or river EC, showing most of the EC in the drainage river was explained by surface EC maps at the EM sounding data. Therefore, obtained EC maps show potential load in drainage river before infiltration water was processed, which is beneficial for watershed survey, where river water is not always available and the effect of land management becomes sometimes black box.

Keywords: EM sounding, Soil environment, Pollution load, Watershed

MIS023-P15

Room:Convention Hall

Time:May 22 16:15-18:45

Hypothesis-driven field monitoring by using numerical experiments

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In order to understand biogeochemical responses and these temporal changes under the changing environment with global / regional scale, effectively combining field monitoring and numerical experiment using comprehensive process-based model is needed. Rapid improvement of computational power in the last decade allows us more effective monitoring research based on logical inference deduced by hypothesis-driven numerical experiments. We will report an under-going case study under the framework of "hypothesis-driven field monitoring".

We are focusing on temporal change of nitrate concentration in a headwater. We obtained two years discharge and water quality data (T-N, T-P, and NO₃⁻) of two adjacent watersheds that is different in vegetation: one is coniferous forest, and the other is deciduous forest. Two watersheds show clear difference both in discharge and water quality. Especially for nitrate concentration, coniferous forest has larger concentration than that in deciduous forest. Before proceeding to execute more detail field monitoring to clarify mechanisms of this difference, we tried to find possible hypothesis by using numerical experiments. TANKMODEL and TOPMODEL were applied to simulate discharge, and PnET model was used to simulate biogeochemical processes. By considering uncertainties inherent in each parameter by using Monte-Carlo simulations, we tried to narrow down possible dominant processes and to find important processes that are not considered in models.

Keywords: coniferous forest, deciduous forest, nitrate, numerical modeling