アムール川からの流出水がオホーツク海北西陸棚海域に広がることができるのはなぜか？
How does the Amur River discharge spread over the northwestern continental shelf in the Sea of Okhotsk?

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Iron is a micro-nutrient that is necessary for photosynthesis of the phytoplankton. It is now well known that the iron transported by the Amur River is deposited on the continental shelf in the northwestern shelf of the Sea of Okhotsk, and is then transported out to the intermediate layer of the Sea of Okhotsk; it further spreads to the western North Pacific and supports phytoplankton bloom there. Despite their significance in transporting dissolved and particulate iron, however, the paths of the Amur River discharge on the continental shelf in the Sea of Okhotsk are still unknown. In this study, we conduct a coupled ice-ocean simulation for the northern Sea of Okhotsk from June 1998 to September 2000 to answer a question: Can the Amur River discharge deposit materials to the pathway of the dense shelf water? In a series of numerical experiments, we identified two routes (the western and eastern routes) that could transport the river water more than 100 km offshore over the northwestern continental shelf. The two routes share the clockwise gyre in the Sakhalin Gulf and the northeastward flow on the northwestern continental shelf. These features are connected through the westward jet along the slope from the Sakhalin Gulf (the western route), and the northward transport over the shelf break canyon (the eastern route). The river water, the dense shelf water, and the easterly wind are in a fine geophysical balance for those features, and all are required for the formation of the two routes. The model results show these unique joint effects in the Sea of Okhotsk that allow the Amur River discharge to be effectively transported over the northwestern continental shelf, unlike a general river discharge that flows along the coast, and can deposits materials into the pathway of the dense shelf water.

キーワード：アムール川、海氷生成、高密度陸棚水、沿岸捕捉波
Keywords: Amur River, Sea Ice Formation, Dense Shelf Water, Coastally Trapped Waves

火星の水理学・地形学的な視点による変遷史と、現在のハビタブル環境
Geomorphological view of the aqueous history of Mars and candidates of current habitable environments

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Ancient Mars is now considered to have had an environment similar to that of Earth. This is often discussed in terms of the existence of large bodies of water, a wide range of surface oxidation states, an active dynamo and associated magnetic field, magmatism and tectonism including mountain building and basin formation, and a variety of chemical components that are potential building blocks of life. Similar to Earth, ancient Mars had hydrological cycling among atmosphere, ocean, and landmass (southern cratered highlands). Endogenic activities continued until recently, and recent water-related geological features indicate the prolonged existence of aquifer systems, where habitable environments may exist for a significant period. Occasional releases of volatiles from such aquifer systems may ultimately account for Curiosity rover detecting methane in the Gale crater and inconclusive results obtained with metabolism-detection instruments onboard Viking landers. Unequivocal evidence of the existence of subsurface aquifers or extant endogenic activity is, however, still lacking possibly due to the existence of homogeneous regolith materials covering the surface of Mars. Besides, even if a habitable environment exists at depth, accessing the environment with a spacecraft (either a lander or a rover) has been challenging because such an environment is generally thought to exist more than several kilometers below the Martian surface. Recent findings of a recurring slope lineae (RSL) point to traces of possible seasonal liquid water flows along slopes, findings that are likely to change the above prevailing view; some of these features might result from the partial discharges from an aquifer. In other words, RSLs might provide a natural bridge between a subsurface aquifer and the surface accessible by a rover. Thus, subsurface structures near such features are prime targets to be explored by future missions. Once the presence of groundwater is confirmed, especially an aquifer, mapping and characterizing the distribution of subsurface water would significantly help address the ever-important question of whether life exists on Mars.

キーワード：火星、水環境、地形学
Keywords: Mars, aqueous environment, geomorphology

SINTEX-F2季節予測システムについて
The SINTEX-F2 seasonal prediction system

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The SINTEX-Frontier coupled general circulation model version 1 (SINTEX-F1) was developed within the EU-Japan collaborative framework to study global climate variability and its predictability. The seasonal prediction system based on the SINTEX-F1 has demonstrated its outstanding performance of predicting El Niño/Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD) since 2005. However, there is much room for improvement in predicting mid-latitude climate variations. To deal with this, we have developed a prototype of a new high-resolution version of SINTEX-F embedded with a dynamic sea-ice model, which we call SINTEX-F2. Similar to the SINTEX-F1 system, we have adopted the SST-nudging coupled initialization scheme as in the SINTEX-F2 system; model SSTs are strongly nudged toward daily observations by applying three large negative feedback values to the surface heat flux. Concerning large uncertainties in ocean vertical mixing estimations, ocean physics is perturbed in two different ways by considering or neglecting ocean vertical mixing induced by small vertical scale structures (SVSs) within and above the equatorial thermocline. Therefore, our ensemble prediction system takes into account uncertainties of both initial conditions and model physics. Preliminary analysis has shown that the SINTEX-F2 system shows the high skill in predicting ENSO just like the SINTEX-F1 system. In addition, we have found that the SINTEX-F2 system is much more skillful in predicting the Indian Ocean Subtropical Dipole. This may contribute to improving prediction skills of the regional rainfall distribution in Southern Africa.

キーワード：季節予測、大気海洋結合モデル
Keywords: Seasonal prediction, Coupled general circulation model

海洋ー河川ー表面流出の結合モデルの開発
Development of an ocean-river-surface runoff seamless model

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The ocean receives significant amount of freshwater through river discharges. One of the challenges of regional-scale numerical ocean models is to capture this input of freshwater that often occurs spontaneously. Weather events are not well captured by monthly data sets that are publically available. The boundary between river water and oceanic water masses are also difficult to capture with a lateral boundary condition that is physically fixed in space. In order to simulate the movement of freshwater cycle from land to the ocean, we have developed an ocean-river-surface runoff seamless model based on an oceanic isopycnal model. This approach enables simulations of river discharge events based on precipitation data, which is more publically available in space and time, compared to river discharge data. The movement of water based is also solved with a same dynamical core. We previously demonstrated the capability of this new approach through validation of Abukuma river discharge event during a typhoon. We now extend this model to solve the rivers of main Japanese islands for various other rivers. Preliminary results show promising results, with multiple freshwater plumes forming at various river mouths of Japan, small to large, as the center of the typhoon moves from south to north.

キーワード：表面流出、河川流出、海洋モデル
Keywords: surface runoff, river discharge, oceanic model

Role of central Pacific in Typhoon characteristics

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In this study, we have investigated the roles of climate variations in some of the typhoon characteristics of northwest Pacific. The influence of El Nino/La Nina on the east-west shift of the typhoon genesis region is well known. In El Niño years, stronger typhoons tend to approach Japan traveling long distances over warm oceans since the genesis region shift eastward during those years. Interestingly, it is also noticed here that the genesis region shifts northward during El Nino Modoki years (such as 2004) as compared to El Nino years. Therefore, it is found that more number of typhoons approach Japan during the El Nino Modoki years. On the other hand, composite analyses about oceanic conditions in the years of less number of typhoon genesis have indicated La Niña Modoki. It is also found that the distance of movement, lifetime and lowest pressure of typhoons are more related to central Pacific heat content compared to conventional ENSO indices.

Keywords: Typhoon, ENSO Modoki, Central Pacific

熱帯域における沿岸降水気候学
How much is the precipitation amount over the tropical coastal region?

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Motivated by observational evidence of rainfall concentration near tropical coastlines with diurnal cycle, we quantified annual mean precipitation amount in the tropics (latitudes lower than 37º) obtained as a function of coastal distance, and compared them between land and ocean sides (Ogino et al., 2016). The data is from the Tropical Precipitation Measurement Mission (TRMM).
Precipitation amount peaks at the coastline and decreases rapidly over a distance of 300 km from the coastline on both sides of the coastline (Fig. 1). The precipitation inside the “coastal region” (defined by distance <300 km from the coastline) accounts for approximately 34% of the total over the whole tropics, while that outside the coastal region accounts for 52% and 14% on the ocean and land sides, respectively. Since the coastal regions are about 29% of the total tropical areas, the precipitation per unit area inside the coastal regions is higher than that outside. Examining the grid number variation in the coastal regions with respect to the annual precipitation amount resulted in the finding that more than 90% of the annual precipitation with the amount of 3500 mm/yr or more occurs exclusively in the coastal regions, indicating that precipitation systems unique to coastal regions are needed for producing the highest annual precipitation on the Earth. The results above were obtained from the precipitation data over the whole tropics. The regional difference will be discussed in the presentation.

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キーワード：降水、熱帯、沿岸域
Keywords: Precipitation, Tropics, Coastal region

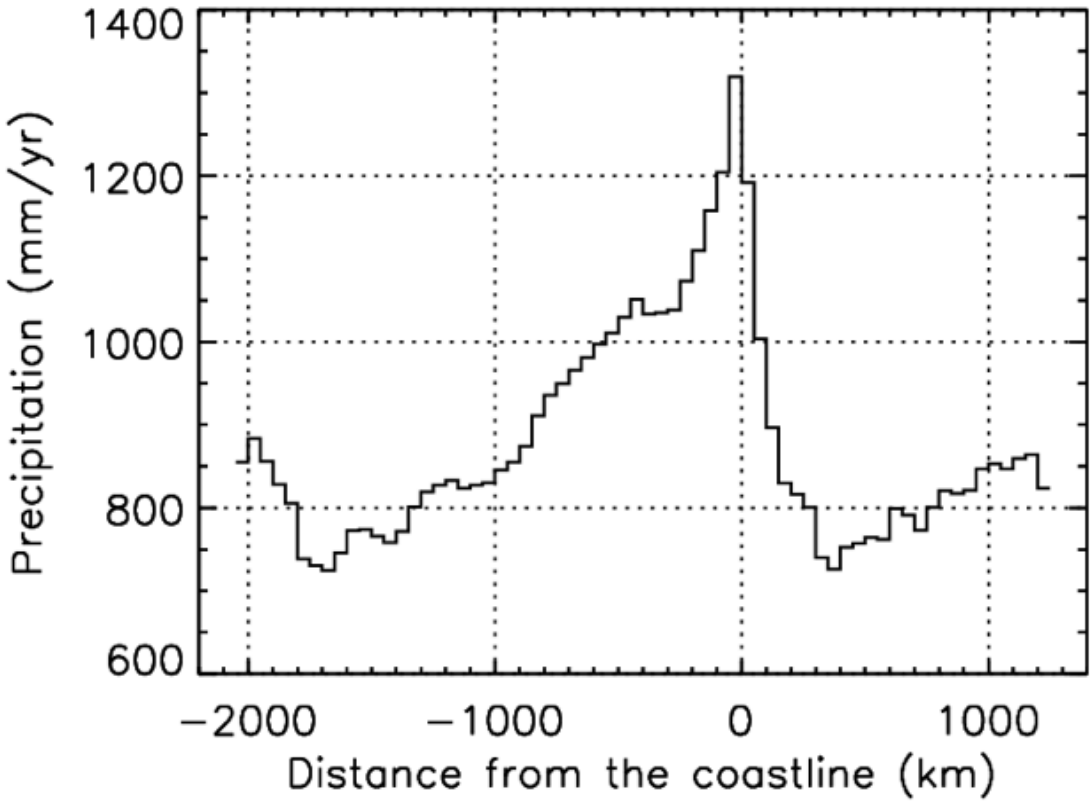

Figure 1. Relationship between precipitation amount and distance from the coastline.

宇宙活動と国連宇宙応用プログラム
Space Activities and the United Nations Programme on Space Applications

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Space exploration fires people’s imaginations. Since the first human spaceflight in 1961, over 500 explorers from different nations have ventured into space, motivated by curiosity, the drive for knowledge, and the belief that space exploration could benefit people on Earth. The involvement of a growing number of countries means that space exploration and the use of outer space are now truly global undertakings. Given the great importance of international cooperation in the peaceful exploration and use of outer space, the Committee on the Peaceful Uses of Outer Space (COPUOS) fills the need for an intergovernmental platform at the global level in this regard.
The United Nations Programme on Space Applications was established in 1971 and has made substantial progress in fostering knowledge of and experience related to space applications around the world. The activities of the Programme are carried out by the Office for Outer Space Affairs, with the annual endorsement of COPUOS. The mission of the Programme is to enhance the understanding and subsequent use of space technology for peaceful purposes in general, and for national development in particular, in response to expressed needs in different geographic regions of the world.
The overall strategy of the Programme is to focus on selected areas that are critical for developing countries. Those priority areas of the Programme are: (a) environmental monitoring; (b) natural resource management; (c) satellite communications for tele-education and telemedicine applications; (d) disaster risk reduction; (e) development of capabilities in the use of global navigation satellite systems; (f) the Basic Space Science Initiative, including the International Space Weather Initiative; (g) climate change; (h) the Basic Space Technology Initiative; (i) the Human Space Technology Initiative; and (j) biodiversity and ecosystems.
The docking of the Apollo and Soyuz spacecraft in 1975 was the first international human space mission. Since 2000, a multinational permanent human presence in outer space has been maintained onboard the International Space Station (ISS). Since the beginning of the construction of the ISS, the Programme has invited experts to address topics such as the utilization of the ISS to provide benefits on Earth, and to discuss opportunities for developing countries to participate in research activities conducted on the ISS.
In addition, the need for capacity-building in space science and technology and their applications has increased in many non-spacefaring countries. In response to the interest expressed by many countries, the Programme considered activities related to human space flight and exploration, which led to the launch of the Human Space Technology Initiative (HSTI) in 2010.
HSTI is aimed at raising awareness among countries of the benefits of utilizing human space technology and its applications and at involving more countries in activities related to human space exploration through international cooperation, to make space exploration a truly international effort. The role of HSTI in these efforts consists of providing a platform to exchange information, to foster collaboration between partners from spacefaring and non-spacefaring countries and to encourage emerging and developing countries to take part in space research and to benefit from space applications.

キーワード：宇宙活動、国連宇宙応用プログラム、国際宇宙ステーション
Keywords: Space Activities, United Nations Programme on Space Applications, International Space Station

Forcing mechanism controlling the variability of circulations and associated larval transport in the Seto Inland Sea, Japan

Forcing mechanism controlling the variability of circulations and associated larval transport in the Seto Inland Sea, Japan

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Oceanic currents in the Seto Inland Sea (SIS), Japan, are mainly driven by tides, density and sea-surface wind. It has been reported that fluctuating Kuroshio path situated south of the SIS also plays a significant role in development of the mean circulation in the entire SIS. Hence dispersal patterns of material, such as larvae, nutrient and toxic substances, are substantially influenced by this overall circulation. Evaluation of effects of the circulation on material transport leads to further elucidation of the marine ecosystem and desirable marine environment in the SIS. In the present study, seasonal and interannual variability of larval dispersal in the entire SIS and effects of each forcing factor on the dispersal patterns are examined in detail with a multiple-year oceanic reanalysis based on a JCOPE2-ROMS double nested downscaling system along with a Lagrangian particle tracking submodel. The model results are compared with observations of temperature and salinity, tidal elevation and current in the SIS, and the Kuroshio path to demonstrate a good agreement.
Lagrangian PDFs are exploited to illustrate larval dispersal. In summer, the larvae in several regions are trapped by convergent cyclonic gyres locally-developed around dome-shaped bottom cold water mass, referred to as cold dome. In winter, southwestward Ekman transport have a prominent influence on dispersal of the larvae released from Iyo Sea, whereas the clockwise circulation associated with northwesterly monsoon rather than the transient Kuroshio path predominantly transports the larvae released from Harima Sea towards Kii Channel. However, the fluctuating Kuroshio is found to largely affect inter-annual variability of larval dispersal. When the Kuroshio path is located close to Cape Ashizuri, the clockwise mean circulation is enhanced in the entire SIS, promoting eastward transport of larvae in Harima Sea.

キーワード：瀬戸内海、黒潮励起通過流、浮遊幼生分散、JCOPE2-ROMS海洋ダウンスケーリング
Keywords: Seto Inland Sea, Kuroshio-induced through flow, larval dispersal, JCOPE2-ROMS oceanic downscaling

降雨中の森林からの蒸発：海洋から森林で覆われた大陸奥地への水蒸気輸送の基本原理
Evaporation from forest during rainfall: a basic principle of moisture transport from the ocean to inland continent

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Introduction

Evaporation of canopy interception I accounts for some 20% of rainfall. Because of I, evapotranspiration ET from forest is larger than any other surfaces on our planet. However, the amount of I estimated by the heat balance equation sometimes severely underestimates the observed values, which has been an enigma. Murakami[1)] proposed that I is not evaporation from wet canopy surface but evaporation of splash droplets of raindrops. The objective of the present study is 1) to try to prove splash droplet evaporation (SDE) hypothesis based on measurements, and 2) to combine I with the biotic pump theory[2)] that presumes precipitation in the inland of a forested continent is driven by ET of forest.

Methods

Artificial Christmas trees were arranged on a tray and were placed outside under the natural rainfall[3)]. Drainage from the tray as net rainfall P_N and the weight of a single tree to calculate water storage on canopy S were measured. Gross rainfall P_G and P_N were measured with a 5-minutes interval and S was a 1-minute interval. Separation time of rainfall *Spt* that divides rainfall into each individual rain event was set at 6 hours. The storm break time *Sbt* is defined as an intra-storm separation time and was set at 20 minutes, which divides a rain event into sub-rain events, i.e. 20 minutes ≤*Sbt* < 6 hours ≤*Spt*. I during *Sbt* is defined as I_{Sbt}, I after rainfall ceases as I_{Aft}, and I during rainfall when rainfall is observed as I_R. I_R and I_{Sbt} can be calculated using P_G, P_N and S, while I_{Aft} is derived from S only.

Results and discussion

Figure shows ΣI_R, ΣI_{Sbt}, and I_{Aft} against P_G on a rain event basis for a Christmas tree stand. I_R and I_{Sbt} are shown as the sum of the values since the rain event usually consists of plural sub-rain events. For P_G > 5 mm I_{Aft} ≈0.5 mm, while ΣI_{Sbt} is almost zero. It is clear that ΣI_R is proportional to P_G. For the largest rain event in Figure (below is called Rain event A) P_G, ΣI_R, ΣI_{Sbt} and I_{Aft} were 84.9 mm, 16.6 mm, 0.5 mm and 0.4 mm, respectively. The largest sub-rain event in Rain event A recorded during nighttime with P_G of 59.6 mm, ΣI_R of 11.6 mm and an evaporation rate of 1.91 mm/h. The results strongly suggest that rainfall *per se* drives evaporation during rainfall, i.e. SDE. Makarieva et al. (2013)[2)] showed precipitation does not decline with increasing distance from the coast in the continent over thousands of kilometers, if it is covered with forest, and vice versa. They presume that large ET of forest sucks water vapor from the ocean, which is called “the biotic pump”. They also proposed a principle that condensation of water vapor circulates air due to reduction in volume. Their theory can explain removal of water vapor from the canopy and supply of latent heat for I_R. As is well known the cause of large ET in forest is I and SDE is the main mechanism of I. That is to say, SDE is the basic principle of the biotic pump.

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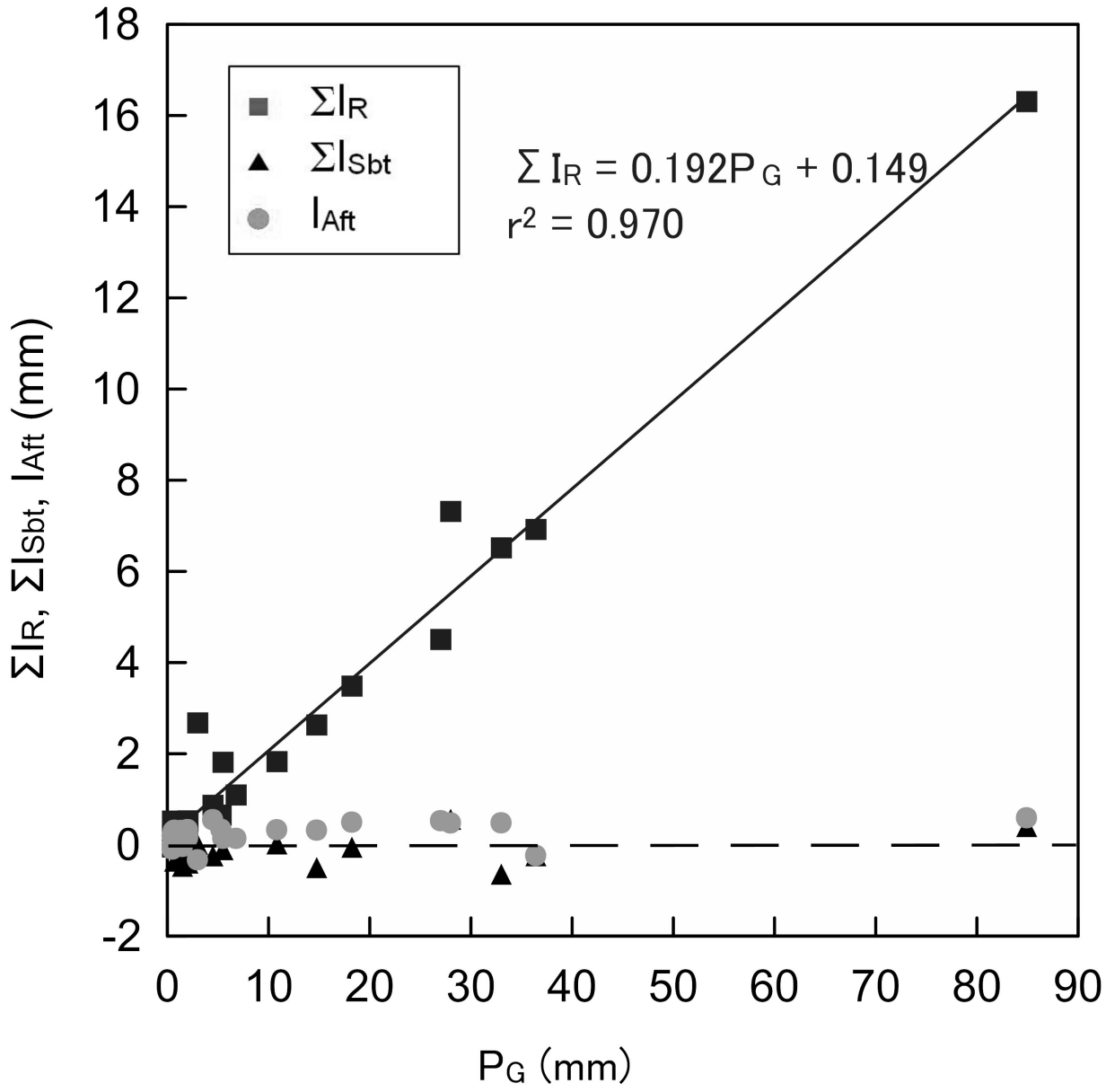
キーワード：樹冠遮断、飛沫、生物ポンプ
Keywords: Canopy interception, Splash droplet, Biotic pump



放射性物質の分散に寄与する沿岸海洋変動過程: 瀬戸内海と遠州灘のケーススタディ
Coastal ocean processes responsible for radionuclide dispersion: A case study for Seto Inland Sea and Enshu-nada

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Results from four different numerical models of radiocesium dispersion are compared in terms of key physical processes responsible for the dispersion. Two regions are selected as typical oceanic conditions of coastal region around Japan. One is the Seto Inland Sea, which can be considered as a semi-closed basin connecting to the open ocean through several passages, and the other is Enshu-nada, where open ocean influences may directly affect coastal region. Results indicate that, in addition to tidal residual currents, local wind forcing and isolated cold water in the deeper layer affect surface flow pattern and radiocesium dispersion in the Seto Inland Sea. On the other hand, intrusion of Kuroshio and a narrow eastward flow along the coast play important role in dispersion processes in the Enshu-nada area.

キーワード：沿岸海洋過程、放射性物質の分散
Keywords: coastal ocean processes, radionuclide dispersion

当密度面層モデルへのキャノピーコンポーネントの組み込み
Introduction of canopy component into Isopycnal-layered model for hydrological calculation

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Isopycnal-layered model (Kida and Yamashiki, 2014) was proven to be an innovative river-ocean interactive model capable for handling both land-ocean and ocean-land interaction without creating specific physical component. According to their modeling, calculated discharge at each subbasin showed good agreement with gauged data without making any specific adjustment. At the same time, the original model was, since established for oceanographic usages, no component was prepared to trace hydrological processes.
In this study, we introduced how to develop basic hydrological component in the model and performed several testing calculation comparing the original model output and revised model scheme. The infiltration ratio and storage ratio in each canopy is set and included in hydrological processes in forest zone.
By introducing this basic hydrological component, this Isopycnal-layered model can be applicable for all different basins with minimum requirement (DEM and Land-use), which may facilitate significantly for the continental-oceanic integrated calculation.

キーワード：当密度層モデル、キャノピーモデル
Keywords: Isopycnal-layered model, Canopy model

Density Independent Smoothed Particle Hydrodynamicsを用いた衝突・クレータリングの数値計算
Numerical Simulations of Impact and Cratering with Density Independent Smoothed Particle Hydrodynamics

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Impacts of meteorite are important phenomenon for the planetary geology. Since these processes cannot be experimented
in laboratories, numerical hydrodynamical simulations of the impact process play important role. For these processes,
particle based numerical hydrodynamical simulations have several advantages over grid-based methods, because these
processes often involve large deformation of target and oblique impacts.
The Smoothed Particle Hydrodynamics (SPH) is a widely used particle based numerical hydrodynamical scheme.
It is first developed in astrophysical field. Recently, it was adopted to the impact cratering. However,
it has been pointed out that the standard SPH formulation has difficulties in the treatment of contact
discontinuity; an unphysical repulsive force acts between two different materials, such as rock and water.
Thus, we have developed new particle based hydrodynamical, Density Independent SPH (DISPH), which overcomes
this difficulty.
We have developed a new massively parallel particle based numerical hydrodynamical simulations code by means of
DISPH. We adapted Framework for Developing Particle Simulator (FDPS), which enables us to perform high-performance
parallel particle simulations easily. We will show the results of impacts of the tuff to the water with both DISPH
and SSPH.

キーワード：衝突数値計算
Keywords: numerical simulations of impact

全球湖リポジトリの開発と地球環境変化による水質への影響評価

Development of Global Lakes & Reservoirs Repository (GLR) and their application for predicting estimating water quality changes in lakes and estuaries induced by global climate changes.

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Global Lakes & Reservoirs Repository (GLR) was developed in order to promote better comprehension of the status of lakes & reservoirs on a global scale. Basic information for each lake is stored, together with the whole surface shape of each lake & reservoir. For some lakes, bathymetry data is stored, which enables three-dimensional numerical simulations using Biwa-3D. Using this, data three lakes (Lake Biwa, Lake Tahoe and Lake Toba) are calculated by their vertical mixing structure. The whole database is used to apply basic parameters; it is also used with simpler ecological models in order to discuss potential impacts on lakes & reservoirs of global-scale climate change. Fluxes like continental hydrological fluxes from international rivers, associated with large-scale successive reservoirs, such as the La Plata river basin, are being estimated by combining GRL with continental-scale hydrological models.

キーワード：全球湖リポジトリ、地球環境影響、貯水池
Keywords: GLR, Global Climate Changes, Reservoirs

マルチGCMデータとパラメータを最適化した作物モデルによる気候変動が全米のトウモロコシ収量に与える影響

Effects of climate change on corn yield in the U.S. using a parameter optimized crop model with muliple general circulation models

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A detailed analysis was conducted of the effects of climate change and increased carbon dioxide (CO_2) concentrations on corn yield in the United States of America by a crop model using outputs from multiple general circulation models (multi-GCMs). To find the best attainable calibrated model parameters, the automatic multi-objective complex evolution algorithm was applied to the Environmental Policy Integrated Climate model. Corn yield was simulated for 1999–2010, the 2050s (average for 2041–2060), and the 2070s (average for 2061–2080) under representative concentration pathways 4.5 (RCP4.5) and 8.5 (RCP8.5).
Results indicated a shortening of the growing periods (GP), decreased water use efficiency in almost all regions, and increased crop available water and evapotranspiration during GP in almost all regions except for the Southern U.S. Using multi-GCMs, the simulations under both climate scenarios resulted in negative effects of climate change on yield in almost all regions during both future periods. Especially strong negative impacts were reported south of latitude 40°N due to less optimal growing conditions. On the other hand, there were relatively smaller negative impacts in high-latitude regions due to more optimal growing conditions because of larger temperature changes and less water stress compared to low- and mid-latitude regions. However, temperature stress which interferes with corn growth was notably present in almost all regions for the 2070s under RCP8.5. Higher CO_2 concentrations have the potential to increase corn yield. CO_2 effects were approximately 0.04–0.05% increase in yield per 1 ppm increase in CO_2 concentration under both future climate scenarios, but the negative impacts of increased temperatures fully outweighed the CO_2 -fertilization effects. Assessments of climate change impacts using multi-GCMs are essential for synthetic studies of uncertainties in GCMs and not just for considering particular or bounding-case scenarios. Development of an integrated crop model that includes information and mechanisms related to crop physiology, breeding, biotechnology, agronomy, climate change, and resource use efficiency is needed to address more accurately the effects of climate change, CO_2 effects, and technology development and their interactions on crop yield.

キーワード：気候変動、多目的最適化、トウモロコシ収量、マルチGCM
Keywords: Climate change impacts, Multi-objective complex evolution, Corn yield, Multiple GCMs

Estimation of total river flux from Japanese basins to Pacific ocean and its numerical prediction using cell distributed runoff model

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1. Introduction
The demand for having simulated freshwater outflow data on the river mouths is especially conspicuous in coastal modeling where fluvial influence often makes big difference in results and in climatological modeling where fluvial influence is needed to join the oceanographic, meteorology and hydrology cycle into bigger comprehensive closed cycle to be used for more accurate climatological models. Coastal and climatological models do not usually use freshwater outflow data from river's estuaries because they either neglect the data as insignificant or have difficulties to implement these data into their models.
2. Objective and motivation
The main objective of the study is to create complete set of river outflow data from Japanese basins to western Pacific ocean, in order that the data can be used in bigger and more complex coastal and climatological models, so that these models can develop more precise calculations and expand its purposes to wider range.
Secondary objective of the study is to predict sediment runoff at the catchment scale near river mouth, in order that it can be used in river basin management for sediment related disaster risk reduction.
River discharge data likely represent the most accurate quantitative information about the global terrestrial water cycle, but this information has not been uniformly adopted in Earth Systems studies, such as GCMs or terrestrial productivity models (Fekete et al., 2002). To estimate continental discharge using the runoff fields, a river transport model that routes the terrestrial runoff into the correct river mouths is needed (Dai and Trenberth, 2002).
3. Methods and data collection
We have used cell distributed water and sediment runoff model (Sasaki, 2014) (Apip et al., 2011) to make numerical prediction of freshwater outflow and suspended sediment transport from each basin. A conceptual diagram of the sediment runoff model is shown in Figure 1.
All data was collected from online source of Ministry of Land, Infrastructure, Transport and Tourism (http://www1.river.go.jp/). For all rivers, we tried to collect the most downstream daily discharge and water level data station which was available. Our goal was to collect discharge and water level data for period 2008-2015 for all rivers, and for period 2000-2015 for two the biggest rivers Tone and Abukuma.
4. Discussions
The overview of all the collected data from 9 first class rivers on Japanese eastern Pacific coast will be discussed. Takase river had average discharge 23 m^3/s with peak 388 m^3/s. Mabechi river had average discharge 94 m^3/s with peak 1246 m^3/s. Kitakami river had average discharge 304 m^3/s with peak 3409 m^3/s. Naruse river had average discharge 45 m^3/s with peak 2198 m^3/s. Natori river had average discharge 292 m^3/s with peak 1340 m^3/s. Abukuma river had average discharge 202 m^3/s with peak 4822 m^3/s. Kuji river had average discharge 18 m^3/s with peak 1575 m^3/s. Naka river had average discharge 385 m^3/s with peak 2533 m^3/s. Tone river had average discharge 253 m^3/s with peak 7055 m^3/s.

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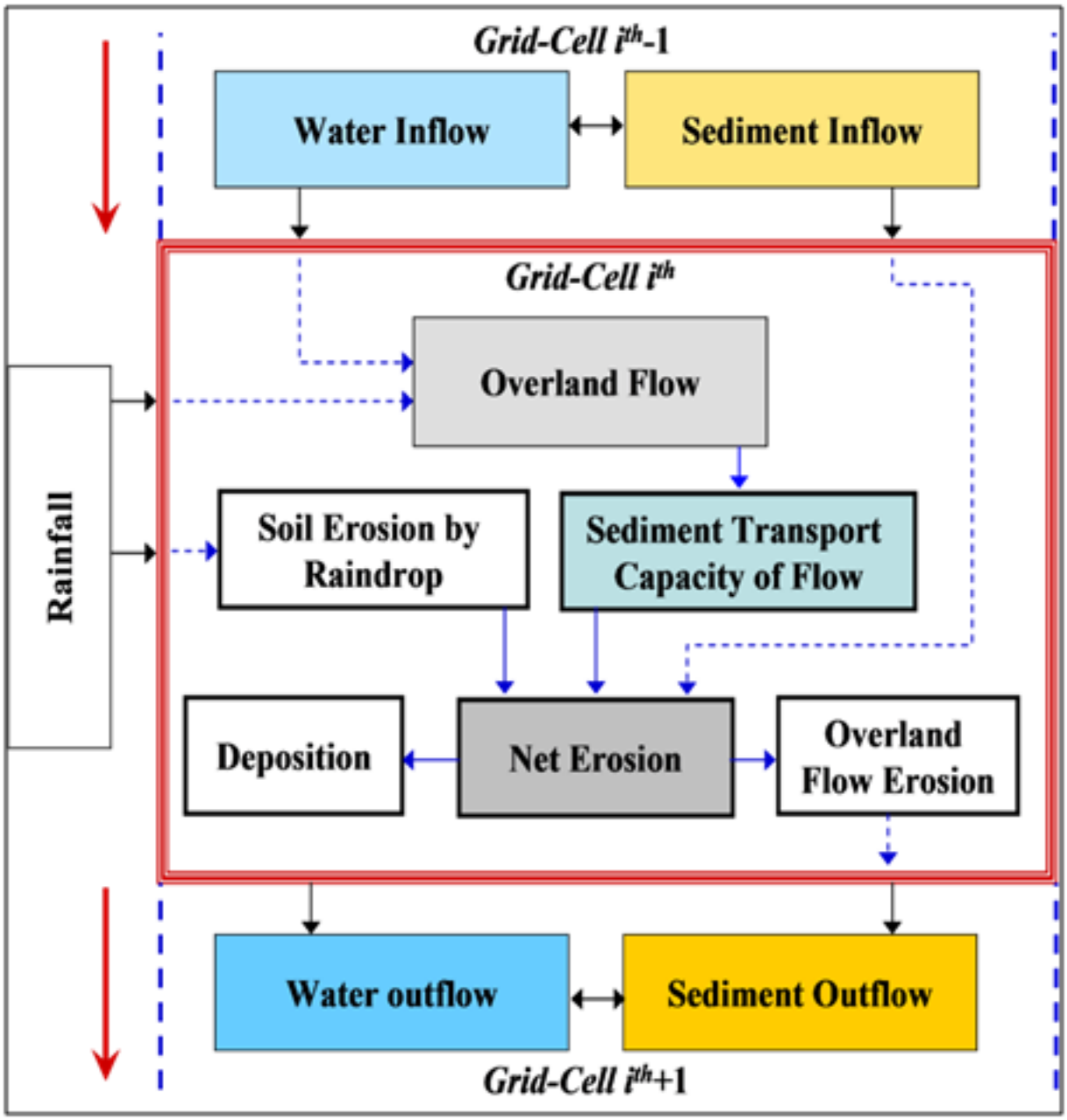
Keywords: fluvial outflow, estuary , coastal modeling, sediment runoff



An Observing System Simulation Experiment for Lake Biwa, Japan; Test on Cyclone Man-Yi in 2013.

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Fourteen million people drink water supplied from Lake Biwa, in the Osaka-Kyoto region of Japan. Sewage treatment plants surround the lake, atomic power stations lie within 40 km on the Japan Sea, and tropical cyclones hit the region every year. Thus there is significant risk of pollution triggered by earthquakes and/or typhoons.
The North Basin's dimensions of roughly 20x40 km, and maximal depth of 104 m, facilitate geostrophic gyres during the stratified season. If continuously available nowcasts were available for the three-dimensional circulation of the lake, and associated pollutant or nutrient motion, they could support management of water quality both during emergencies, and in normal times. Accordingly, our group is developing a nowcasting system to track the fields of flow, temperature, etc in Lake Biwa. Simulations are performed by the unstructured-mesh ocean model SUNTANS. The Local Ensemble Transform Kalman Filter (LETKF) scheme assimilates available data streams. The forecast system integrates an ensemble of seven state vectors: one unperturbed state plus six perturbed states generated using bred vectors.
We will present the assessment of performance of the nowcasting during typhoon Man-Yi, which struck our region in September 2013. We chose this event due to the strong wind and sediment discharge associated with record rainfall.
To quantify the forecast skill, we first performed a "Nature Run", i.e. a fine-scale simulation of the Lake Biwa’s circulation. The consistency of the simulation was confirmed by in-situ temperature data at six depth levels for the vertical consistency, and space borne satellite estimates of SST. We also used near-infrared satellite data to analyse the propagation of turbidity after the typhoon.
After confirming in this way that the original simulation was consistent with observations, we performed an Observing System Simulation Experiment (OSSE), in which artificial data streams from the simulation are assimilated into a virtual nowcasting system. We will show the results of the reanalysis of the typhoon ManYi using the nowcasting system. We will also discuss instabilities identified during and after the typhoon by the bred vectors.

Keywords: Lake Biwa, Typhoon, Nowcasting, Data Assimilation

阿武隈川河口域に堆積した放射性セシウムの起源と沈積プロセス
The origin of radioactive cesium deposited in the Abukuma River estuary and its sedimentation process

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Abukuma River was through contaminated area by radiocesium released from the Fukushima Daiichi Nuclear Power Station accident, flows into Pacific Ocean at Miyagi Prefecture. Abukuma River plays an important role in the transport process of radioactive material into the ocean from the radioactive contamination area. In this study, spatiotemporal distribution of radiocesium in the sediment collected from the Abukuma River estuary was investigated. We have estimated the spill source and transport process of radiocesium absorbed onto sedimentary material deposited in Abukuma River estuary.
Sampling site was set up 22 points in the 500 m mesh in the Abukuma estuary. The sediment samples were collected from 19 sites on March 20, 2013, and 22 sites on September 2, 2013, and 6 sites on January 26, 2014. It was to evaluate the depositional environment of the sediment from the time change of the water quantity in the Abukuma River estuary. Water level of Abukuma River in past 3 months from March 2013 and January 2014 was almost constant. On the other hand, water levels were varied drastically by “Heisei 25 Yamagata Heavy Rain” before 2 months from September 2013. In this result, it is assumed that the sediment collected on March 2013 and January 2014 was deposited in Abukuma River estuary during steady-state. Although the sediment collected on September 2013 was precipitated in the estuary are probably transferred from the land by flood. The concentration of radiocesium of sediment that may have precipitated at the flooding was high. On the other hand, that in steady-state showed a lower. Therefore, we investigated the relationship between the particle size of sediment and radiocesium concentration. The flood sediment had a small particle size, but particle size of steady-state sediment was large than flood sediment. Relationship of the concentration of radiocesium and the particle size of sediment in Abukuma River estuary was in accordance with the inverse square law.
This suggest the radiocesium is absorbed on the specific surface area of the sediment particle. It is not contradictory that the radiocesium penetrate to the surface layer of particle such as clay mineral and absorbed with ion exchange. The particle size of typical flood sediment was 10-70 μm and the concentration of radiocesium was 300-10000 Bq/kg. On steady-state sediment, it was 100-600 μm and 10-800 Bq/kg. From the result, the atom numbers of radiocesium adsorbed on the sediment particle was calculated. The values were $0.8\text{-}8\times10^{10}$ n/m^2 in the particle of 10-20 μm average diameters, and $0.2\text{-}3\times10^{10}$ n/m^2 in 100-200 μm. The atom numbers of radiocesium adsorbed for the individual particles was also calculated. The number was 3-500 atoms in the particle of 10-20 μm average diameters, and 300-10000 atoms in 100-200 μm particle. The adsorption atom numbers of radiocesium per the specific surface area of the sediment particles differed clearly in the steady-state sediment and the flood sediment. It means that the outflow origin of the flood sediment and the steady-state sediment deposited in the Abukuma River estuary is different. The outflow origin of radioactive contaminated particles from the catchment area of Abukuma River was estimated by the geochemical method. The concentration of some major and minor elements such as

iron, calcium, titanium, mercury and lead between the flood sediment and the steady-state sediment was much different. It was considered that this difference reflects the difference of outflow source in comparison with the Geochemical Map. The major source of radiocesium accumulated in the Abukuma River estuary was estimated to be highly contaminated particles in the middle basin in which was transferred in the flood caused by heavy rain. In the steady state, a highly contaminated particles is blocked in many dams in the river.

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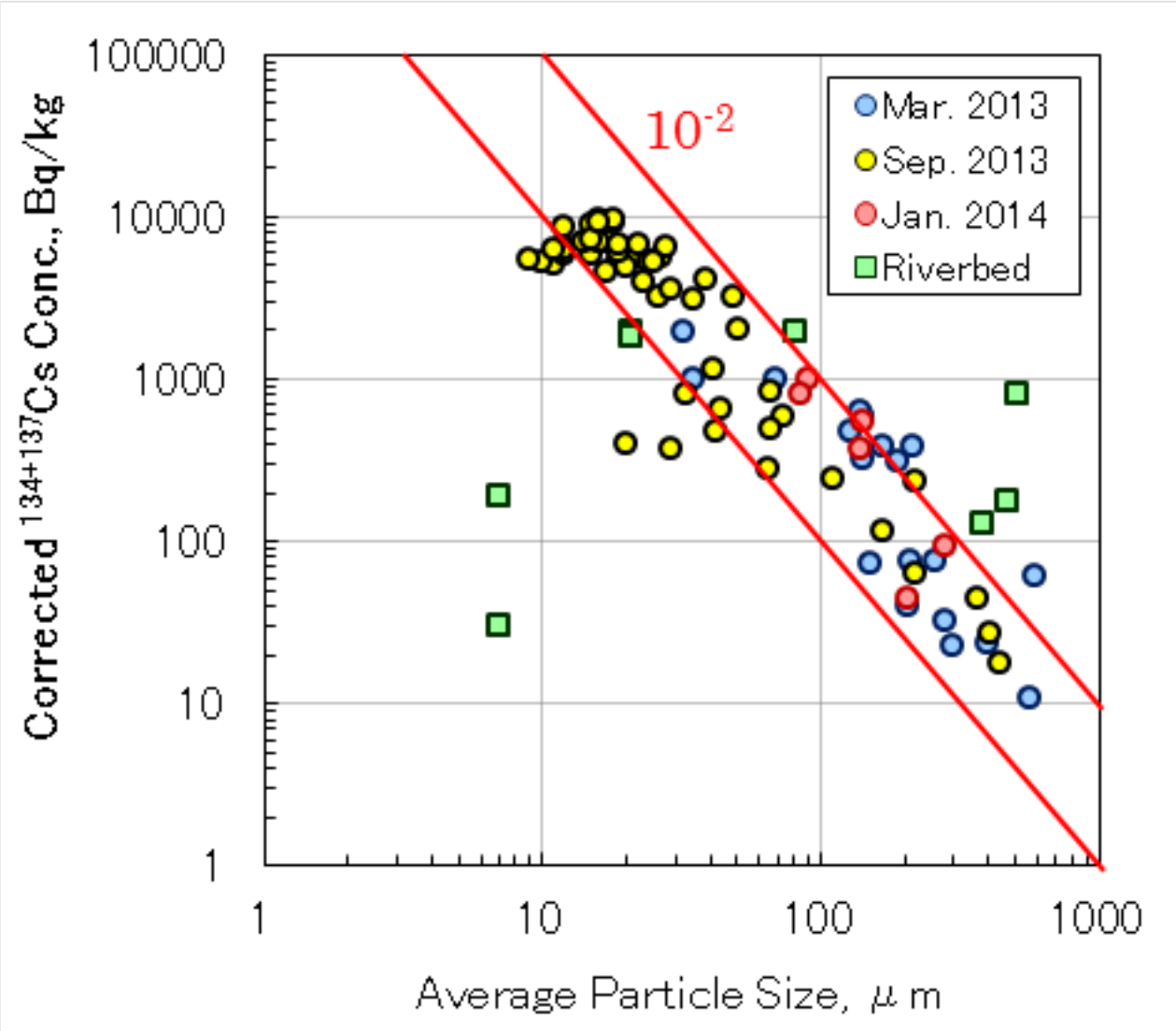
キーワード：放射性セシウム、粒径、堆積物、阿武隈川、福島第一原子力発電所
Keywords: Radioactive Cesium, Particle Size, Sediment, Abukuma River, Fukushima Daiichi Nuclear Power Station



スーパコンピュータ京を用いた豪雨の高解像度実験

High resolution simulation of heavy rainfall event with the super computer K

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In Japan, heavy rainfalls cause severe disaster every year. To mitigate these disasters, a collaboration between a numerical weather prediction (NWP) model and a hydrological model is very important.
Generally, many of hydrological models require precipitation data that horizontal resolutions are several 10 to 100 meter scales. On the other hand, many of NWP models employ several kilometers scales horizontal resolutions because finer resolution NWP models require huge computational resources such as the K computer. Therefore, it was difficult for hydrological models to use NWP models precipitation data directly.
The authors conducted high-resolution experiments with the Kcomputer and the Japan Meteorology Agency Non-hydrostatic model (JMA-NHM). In this study, an impact of grid spacings (up to 250 m), different model domain sizes (1600x1100 km, and 200 km square), and terrain data were tested in two heavy rain events in Izu Ohisma 2013 and Hiroshima 2014.
The results showed that 250-m resolution model with large domain showed the best performance in both of the heavy rain events. The precipitation data of the 250-m models have been provided to a debris flow research using the Hydrodebris-2D, the research may presents in a different session.

キーワード：豪雨、数値予報モデル、京コンピュータ
Keywords: Heavy rain, Numerical Wheater Prediction Model, the K computer

Gaining novel insight into Fukushima Daiichi Nuclear Power Plant derived fallout.

Gaining novel insight into Fukushima Daiichi Nuclear Power Plant derived fallout.

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It has now been five years since the events at the Fukushima Daiichi Nuclear Power Plant (FDNPP) contaminated a large portion of eastern Japan with a range of radionuclides. Despite the wide assortment of reactor products released by the incident - the medium-lived fission product isotopes of caesium; ^{134}Cs and ^{137}Cs, with half-lives of 2.065 and 30.2 years respectively have been the subject of the most scientific study due to the significant yield produced and their contribution to the activity measured. Lesser studied have been the longer-lived fission and activation products as well as the actinide fuel material itself. With the levels of caesium in the environment declining rapidly, it is expected attention will shift to these “more exotic” or “frequently forgotten” radionuclides.
Work at the University of Bristol has focused on the analysis of surface materials contaminated with these species from the FDNPP. Sediment and other organic material (mosses and grass) from various locations around Fukushima Prefecture have first been analysed using automated high-resolution scanning electron microscopy and energy dispersive spectroscopy (EDS) to identify particles of interest. Fragments of material found within these samples were then individually removed using a nano-manipulation system onto supporting tungsten or glass capillary needles, attached via an electron-beam hardening adhesive (described fully in Martin et al, 2016 [1]). With samples removed from the bulk material it has been possible to conduct a range of analytical techniques on these particles. Of primary interest currently are those particles containing the chemically toxic and slowly decaying alpha emitter, uranium. Results from X-ray absorption spectroscopy (XAS) conducted at the Diamond Light Source Synchrotron (UK) have confirmed the nano- and micron-scale particulate to be analogous to uraninite (UO_2) with a sub-angular appearance. These fragments are comparable in size to those analysed in work by Abe et al [2] found to exist at the centres of spherical cesium-bearing particles, suggesting their common provenance from the Fukushima Daiichi plant.
Currently undertaken are a range of dissolution experiments on these extracted particles to assess their stability and behaviour within the natural environment. Through the use of high resolution-transmission electron microscopy (HR-TEM), additional current work will seek to examine the physical structure of the ejecta material and how this will impact on its environmental behaviour. Results of these current analyses will be presented. The analysis of initial particles sourced from Iitate Village (Grid Ref) via ICP-MS has highlighted a non-natural compositon of material, strongly supporting its provenance from one of the FDNPP reactors.
The small size of these uranium particles has strong implications for both humans and animals in the affected regions, with their size being conducive to inhalation and the internal exposure. Future work will seek to analyse material sourced from additional areas as well as the other radionuclides present within the samples. As for the case at Chernobyl, as the levels of radiocesium begin to subside, the focus will turn to the other, longer lasting, but still concerning isotopic species.

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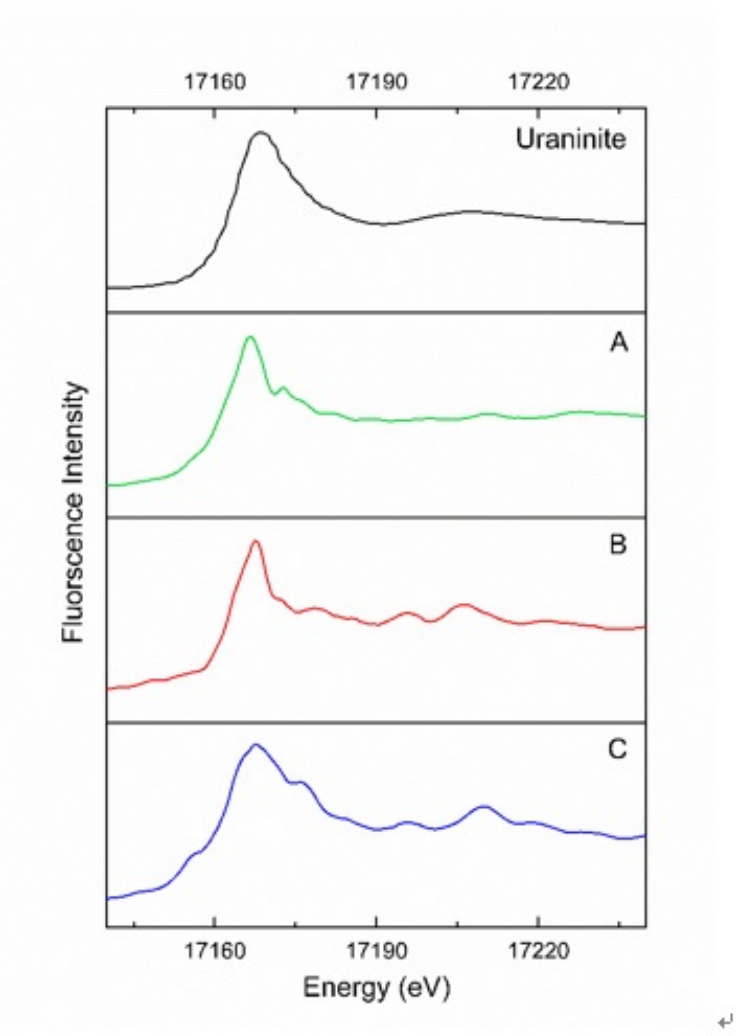

Results of μ-XANES analysis of three particles (A, B and C) at the uranium L_3 edge demonstrating the presence of uranium in all three particles. A reference spectra for uraninite (UO_2) is shown for comparison [1].

The Unusual wet summer of 2014 in Southern Europe

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Southern Europe (Italy and the surrounding countries) experienced an unusual wet summer during 2014. The monthly total rainfall in July 2014 was 84% higher (about three standard deviation) than normal with respect to the 1982-2013 July climatology. This caused heavy damages to agriculture, tourism and overall economy of the region. In this study, we tried to understand the mechanisms for such abnormal weather using various datasets. The anomalously high precipitation over Italy is related to the sea surface temperature (SST) anomalies in the tropical Pacific through the atmospheric teleconnections. Rossby wave activity flux analysis of the upper-level circulation shows an anomalous tropospheric quasi-stationary Rossby wave from the Pacific reaching to southern Europe and maintaining there an anomalous cyclonic circulation. This anomalous cyclonic circulation is barotropic in nature so it extends to lower atmospheric levels, weakening the seasonal high and causing heavy precipitation over the Southern Europe.

Keywords: Wet summer, Southern Europe, Pacific Ocean, teleconnection

