How to make an ocean planet habitable

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Since the first discovery in 1995, over 3,500 exoplanets have been identified so far. Some of them are known to have the similar sizes as the Earth and be located in the “habitable zones” around the central stars. These exoplanets could have water on the surface—they are called “ocean planets.” Even though we have found many ocean planets, however, we do not know whether they are *really* habitable or not. Earth, the only planet known to harbor life, has ocean on the surface, but the amount of water is subtle (~0.023 wt% of the Earth). Recent studies insisted that the proper amount of water—not too much, not too little—is essential to generation and evolution of life. Therefore, it is important to understand why Earth has got such a small amount of water to answer the question “how to make an ocean planet habitable?” I will review the general water supply process to terrestrial planets, and discuss the existence and observability of habitable exoplanets.

Keywords: Earth, ocean, exoplanet, habitable

Near-Surface Salinity Stratification from Satellite SSS Observations and Numerical Models

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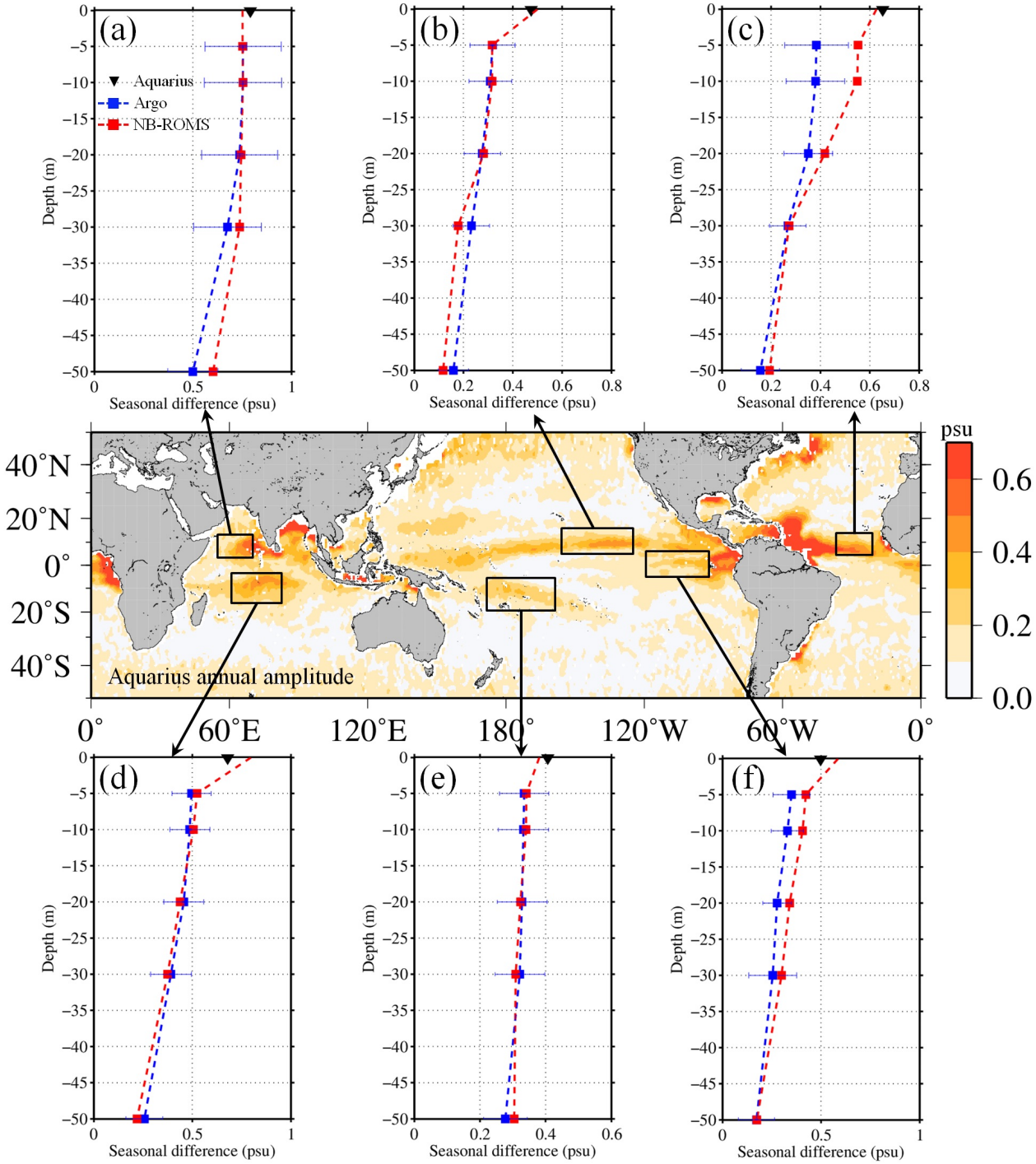
Using a recently developed ESSL (extended surface-salinity layer) model [Song et al., JGR, 2013], we have examined the near-surface salinity stratifications with emphasis on understanding of the dynamical processes that differ from one region to another. It is shown that the seasonal SSS variability at skin layer differs/agrees regionally in their amplitude from/with Argo-measured salinity at 5 m depth and model salinity at the top layer, indicating various characteristics of near-surface salinity stratifications. Our model-data comparisons show that for regions with river runoff and/or surface freshwater, significant differences due to near-surface stratification can be found between the Aquarius, Argo and model. Differently for well-mixed regions, like the southern Arabian Sea due to seasonally reversing currents driven by monsoons, the surface water can be mixed down quickly to the depth of 5 m, resulting in an agreement among the datasets. The modeling study suggests that dynamical differences can lead to different vertical salinity stratifications locally.

Keywords: Satellite observation , Sea surface salinity, River runoff



The role of vegetation as feeder of precipitation on a continental scale

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Precipitation in a continent reduces with increasing the distance from the ocean. However, there is an exception; in the continents covered with forests as in Amazon, Congo and the northern Eurasia precipitation is constant or increases with the distance from the ocean over a few thousands of kilometers. Makarieva and Gorshkov (2007, HESS) and Makarieva et al. (2013, Theor Appl Climatol) hypothesized that forest transports water vapor from the ocean to inland continents (the biotic pump), although they did not specify the hydrological processes.

Evaporation of canopy interception, CI, typically some 20% of annual precipitation, makes forest the greatest evaporative surface on the earth. CI is proportional to the amount of rainfall due to evaporation of splash produced by raindrops impacting onto the canopy (Murakami, 2006, J Hydrol; Murakami and Toba, 2013, HRL).When it is raining around 20% of rain water on the forest cover gets back into the atmosphere in the form of water vapor that can feed constant amount of rainfall over the continents.

Nevertheless, CI is not peculiar to forest, and some studies show ca. 20% of CI was observed in field crops and artificial trees with heights of about 2 m. Though most studies reported that CI declined after thinning of forest stand, on the contrary, Murakami and Toba (2013) observed increase in CI after thinning of an artificial tree stand with a height of 1.1 m (2.3 m above the ground).

These results imply that not only forest but also field crops or shrubs can work as the biotic pump, though it is unknown how the vegetation structure affects CI. Even such short vegetation may contribute increase in precipitation if the vegetation coverage is large enough.

Keywords: canopy interception, biotic pump, vegetation, rainfall, precipitation, splash droplet

Impact of extreme river discharges on coastal ocean environment on example of the North-Eastern Pacific coast of Japan in JCOPE-T ocean model

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As show simple estimations (Troselj et al., submitted), extreme outflow of Japanese rivers caused by passing typhoons and related precipitations can bring monthly climatological amount of fresh water to the oceans just in 2-3 days. Impact of discharged fresh water masses on the coastal ocean environment was analyzed by us using the regional JCOPE-T ocean circulation model nested to the basin scale JCOPE2 model and forced by tides, realistic meteorological fluxes and different presentations of freshwater discharges. In the "base" case the monthly mean climatological river discharges were used. It was compared with the “extreme" case when real-time hourly fresh water discharges from rivers flowing to the north-eastern Pacific coast of Japan for the period of typhoon Roke passage over this part of Japan in September 2011 were applied. Comparison showed significant differences in simulation results for the “extreme" case. Differences could be considered as local and remote. For example, the salinity in proximity of river mouths dropped quickly (in couple of hours) on up to 10-12 PSU and then slowly restored to mean climatology (base case) during more then 15-20 days of model integration. It generated peculiarities in local ocean circulation. Further, lowered salinity waters spread all along the north-eastern coast of Japan, were transported southward and traced along the Kuroshio extension current. Considering an importance of information on detailed realistic river discharges, the Kyoto University group developed hydrological model for selected rivers which would be coupled with the JCOPE real-time ocean prediction systems for improvement of ocean forecasting.

Keywords: Extreme river discharges, Ocean modeling, Coastal ocean environment

Basin scale coupled ocean-shelf ecosystem modelling

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The biogeochemistry and ecosystems of the open-ocean and shelf seas are intimately connected. For example, continental shelves can receive a substantial fraction of their nutrients from the wider ocean, while exporting carbon at depth, sequestering it from atmospheric exchange. Similarly rivers transport substantial quantities of terrestrial nutrients and dissolved organic carbon into the coastal zone. The ultimate fate of this material is dependent on its recycling within and transport across the continental shelves. In both cases the open-ocean to shelf sea coupling is mediated by the complex dynamical processes at the shelf-break and on-shelf. Basin scale, hydrodynamic ecosystem models that merge the modelling approaches of the global scale and the coastal ocean scale, provide an important window into these processes. We draw of results from a 1/12° basin-scale NEMO-ERSEM model of the Northern North Atlantic (Holt et al 2014) with specific features relevant to shelf seas (e.g. tides and advanced vertical mixing schemes). This model is eddy resolving in the open-ocean, and well resolves barotropic scales on-shelf. We use this model to explore the ocean shelf nutrient transport and its relation to wider scale oceanic and atmospheric variability (e.g. sub-polar gyre variability and the North Atlantic Oscillation). We compare the performance of this model with its parent global ocean model and global climate models from the CMIP5 ensemble; demonstrating a marked improvement. We go beyond this North Atlantic work to introduce new basin-scale and global-scale coupled ecosystem modelling efforts focusing in the western Indian Ocean and South East Asian seas, and we explore how the capabilities developed in this context can be translated to global models (Holt et al 2017).

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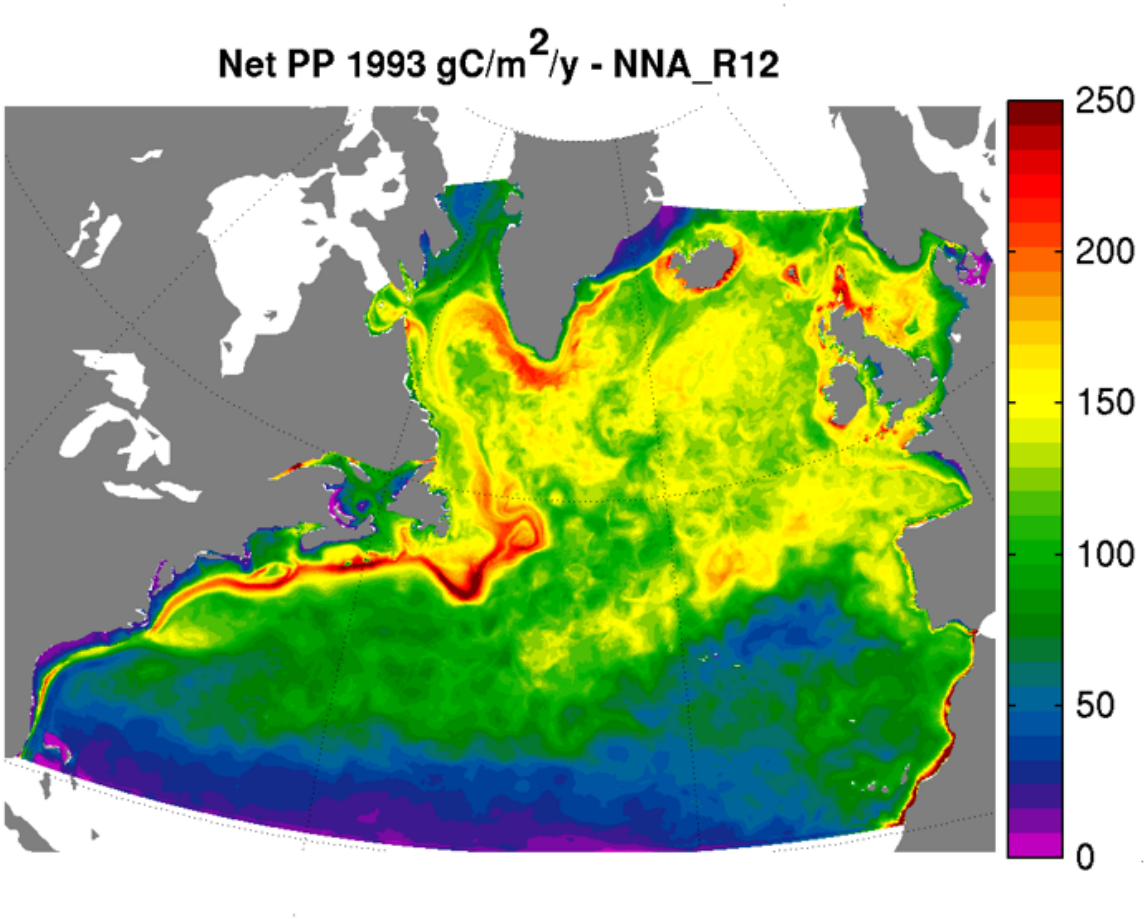
Holt, J., Hyder, P., Ashworth, M., Harle, J., Hewitt, H.T., Liu, H., New, A.L., Pickles, S., Porter, A., Popova, E., Allen, J.I., Siddorn, J., Wood, R., 2017. Prospects for improving the representation of coastal and shelf seas in global ocean models. Geosci. Model Dev., 10, 499-523.

Keywords: ocean-shelf coupling, coupled hydrodynamic-ecosystem modelling, shelf edge and shelf sea processes, Global coastal ocean modelling



Relationship between pollen distribution and marine environment in Northern South China Sea

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Then pollen records from the tropical West Pacific indicate that the tropical vegetation is much sensitive to the environment and climate change. But, for the marine pollen record, the source area and distribution of pollen grains is the key information for data analysis. Through the high density sample collection in the northern South China Sea, the distribution of the pollen grains show that, much high concentration is mainly along the coast line within 30 km away from the land, especially the estuary area. Then, with the distance between the land and the deposition point increasing, the value of the pollen drops sharply. Among that, the content of the *pinus* and spores is much high when the deposition points is 40-100 km range and 80-110 km range offshores, respectively. That indicates the very different transport path and ability among the pollen groups. Combined the topography and the grains size analysis result, it present that the pollen grains deposit in the terrain slope break and the less hydrodynamic areas when they are transported by the sea current.

Keywords: pollen distribution, marine environment, northern South China Sea

Possibility of water on the surface of the Moon

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When we see the Moon by ground-based telescopes or photos of the Moon taken by spacecraft or the Apollo astronauts, we just see very dry desert. However now we have some evidences of existence of water on the surface of the Moon by lunar explorations. It is a very interesting issue that whether water exists on the surface of the Moon or not, from the point of not only the planetary science but also the utilization of the lunar surface such as lunar-base. In this presentation, we will review the results obtained by previous lunar explorations, and show some possibilities for future explorations.

The possible existence of ice in the permanently shadowed craters at the Moon's poles has been said for long time. Chandrayaan-1, which was launched by India in 2008, observed spectral absorption by water molecule or hydroxyl group mainly in the polar region of the Moon. This indicated the existence of water on the surface of the Moon. In the mission of LCROSS (Lunar Crater Observation and Sensing Satellite) launched by NASA in 2009, the attached tank was separated and it hit the surface of the Moon. Then a debris cloud was made and the spacecraft observed it. Also water or hydroxyl group was confirmed to exist. However, there are many unknown things such as in what form the water exists or how much water exists.

Several theories are put forward to explain the origin of the water on the Moon: (1) originated from the interior of the Moon, (2) brought by asteroids or comets, (3) created by protons in the solar wind by colliding to oxygen in the regolith. Anyhow, since it is indicated that water exists on the surface or the Moon, there are some discussions for future explorations to study the water on the Moon both in Japan and in abroad. We hope such missions will be realized in the near future.

Keywords: water, Moon, exploration

First True Gamma-ray Spectroscopic Imaging of Contamination near Fukushima Plant and Extension to the Whole Area in Fukushima

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We have developed Electron-Tracking Compton Camera (ETCC), which provides a well-defined Point Spread Function (PSF) by reconstructing a direction of each gamma as a point, and hence can measure both brightness and energy of incoming gammas within PSF simultaneously. Then obtained images give the emissivity and energy-spectrum of any point, independently of its distance, which no other instruments can give.
Here we present the results of our on-site pilot gamma-imaging-spectroscopy with ETCC, carried out at several contaminated and decontaminated areas around the Fukushima Daiichi Nuclear Power Plant in Japan in 2014, after the major accident of the plant. Obtained brightness (or radioactivity) distributions were directly transferred to the dose on the ground with no ambiguity. The dose distribution was quantitatively consistent with that taken by mapping measurements with a dosimeter, which verifies the complete reproducibility of radioactivity in observed area by ETCC. In addition, imaging spectroscopy reveals quantitatively the complex radioactive features around each target point under intense background of scattered gammas. Notably, the ETCC imaging spectra free of Compton edges enabled us to spot both a “micro hot spot” of remaining caesium, even in a decontaminated area and dominant scattered low-energy gammas from sky in all areas. Thus, ETCC provides the performances expected from geometrical optics completely, which guarantees the universality and general versatility of ETCC. This success enables us to measure directly a distribution of the essential parameter of the radioactivity, which can be coarsely inferred from the dose distribution so far.
Here using this excellent feature of the ETCC, we have simulated the possibility of the detailed spectroscopic imaging for whole contaminated area in Fukushima Prefecture using the improved ETCC which is being developed for the balloon experiment for astronomy in 2018, and will show the possible survey using the airship at the altitude of 100 with a 10 m x 10 m resolution. Then the whole contamination area in Fukushima prefecture (about 20 km x 50 km) may be be mapped with this area resolution during a few months, assuming the working time of 8 hours per day. Some of the spectra obtained in this survey might be found out to be generated by the gammas scattered by something, such as trees in woods, within the grid. Our survey will efficiently detect a hint for those areas, which can be then studied in more detail with on-site measurements, such as ones by backpacks. No successful large-scale survey has been yet performed to monitor the radioactivity in Fukushima. Our upgraded ETCC will be capable of revolutionizing the situation.

Keywords: gamma-ray imaging spectroscopy, Fukushima, Nuclear Power Plant

Effect of irrigation water withdrawals on water and energy balance in the Mekong River Basin using an improved VIC land surface model

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We present a detailed analysis of the effect of agricultural irrigation water abstraction on surface water, energy state and flux, using a model simulation to predict changes in Bowen Ratio, surface temperature and water resources within the Mekong River Basin. Using the Variable Infiltration Capacity (VIC) macroscale hydrological model including the infiltration, surface runoff, subsurface runoff, drainage from the soil layer, and irrigation scheme, together with the most recently available and accurate geophysical, geological and meteorological forcing datasets, we carried out the hydrological simulation on three calibration parameters. The multi-objective complex evolution (MOCOM-UA) optimizer was used to calibrate the model, which revealed a significant decrease in Bowen Ratio due to irrigation water withdrawal: this in turn affected surface temperature. We conclude that (1) the performance of the improved
model was generally good, with an overall Nash–Sutcliffe Efficiency of 0.86 for the validation period 1986–1993; (2) the volume-based total Net Irrigation Water Requirement was about 24×109m3/year for the period 1979–2000; (3) including the irrigation water withdrawals from runoff, river channels and dams decreases the total monthly runoff by 32% compared to the “no irrigation” baseline; (4) the period-averaged Bowen Ratio decreased by 6.8% in the dry season as a result of irrigation effects; (5) this significant decrease in Bowen Ratio resulted in a decrease in average surface temperature of 9.3×10−2% and a maximum of 4.8% over irrigated areas during the dry season.

Keywords: Irrigation water withdrawals, Runoff, Mekong River

Numerical simulations of debris flow by the smoothed particle hydrodynamics

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The debris flows are an important phenomenon since it can threaten the human lives.
Since the laboratory experiment of debris flows in real scale is hard to perform, numerical simulations play an important role to evaluate their impact.
Among several candidates, the smoothed particle hydrodynamics (SPH) is an attractive numerical method for this purpose.
SPH is a particle-based numerical hydrodynamic method, which is originally developed in the astrophysical field and then extended to elastic bodies.
Several works have been already published which tested the applicability of SPH to the debris flow.
We, however, state that the accurate treatment of the elastic bodies tends to be computationally expensive.
Thus, we have developed a massively parallel SPH code with various state-of-the-art numerical flavours.
Our code can work on up to the full nodes of Japanese supercomputer K.
We will show the comparison between numerical simulations and laboratory experiments.

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 with necessary arrangement, 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.

Keywords: Isopycnal-layered model, Canopy model

High-Resolution Radiation Mapping to Evaluate Fukushima Derived Contamination Migration.

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In March 2017, the accident at the Fukushima Daiichi Nuclear Power Plant (FDNPP) will have reached its sixth anniversary. Over these six years, close to 160,000 people that were initially displaced by the radiological release have yet to return to their homes within the vast plume-affected region. Whilst much work studying the nature of the contamination has occurred, alongside its environmental behaviour, in addition to the remediation of parts of this contaminated zone –much detail is still to be understood with regards to the physical transport of the contributing radiocesium, the rate at which it occurs and the total environmental “budget”.

To assess this evolving distribution of radiocesium, high-resolution radiation mapping conducted over a three year period has been performed on a site within the heavily contaminated Iitate Village. This time-resolved radiation mapping, coupled with various modelling scenarios, has provided information on the mobility of material within the environment, its residence time as well as the rate of input into the Abukuma River network that dissects the region.

Through the use of an unmanned aerial vehicle (UAV) developed at the University of Bristol (UK), the radiation distribution across the site was determined without the effects of any operator induced attenuation. The aerial platform also permitted the mapping of radiological contamination over portions of the site not physically possible, or with considerable access limitation.

The results of the radiation mapping over time highlighted the changes in activity apparent on the 100 × 150 meter site. Remediation of the majority of the northern extent has proven to be effective in significantly reducing the dose-rate measured –with the waste material relocated to a single point (“Bail Store”), for subsequent removal.

Radioactivity levels to the south of the site, are shown to still exhibit elevated levels of radioactivity attributable to contamination from radiocesium. Whilst no remediation efforts were observed to have occurred here, the value anticipated to exist (as a result of a reduction entirely from radioactive decay) was greater than that measured. Through the application of a model to simulate previously measured depth dispersion (and associated attenuation) [1] [2] the value measured was still significantly less than that predicted. This loss is attributed to transport away from the site via the stream that dissects it –hence providing a budget to the riverine flux of radiocesium contamination.

As well as work on monitoring and modelling contamination on sites such as this in Iitate Village, the system has also been applied to studying the transport of contamination away from the large storage sites containing the surface materials removed as part of the remediation works. The impact of precipitation and groundwater flow in these scenarios is of significant importance to the safe, long-term storage of these wastes.

Figure: Results of the time-resolved radiation mapping over the Iitate Village site; the effectiveness of the

remediation is apparent, as is the increased activity brought about by the location of the radiological wastes forming the Bail Store. The reduction in activity to the south of the site is apparent, but lower than that achieved through either remediation or expected solely as a result of radioactive decay or ground infiltration (and induced attenuation).

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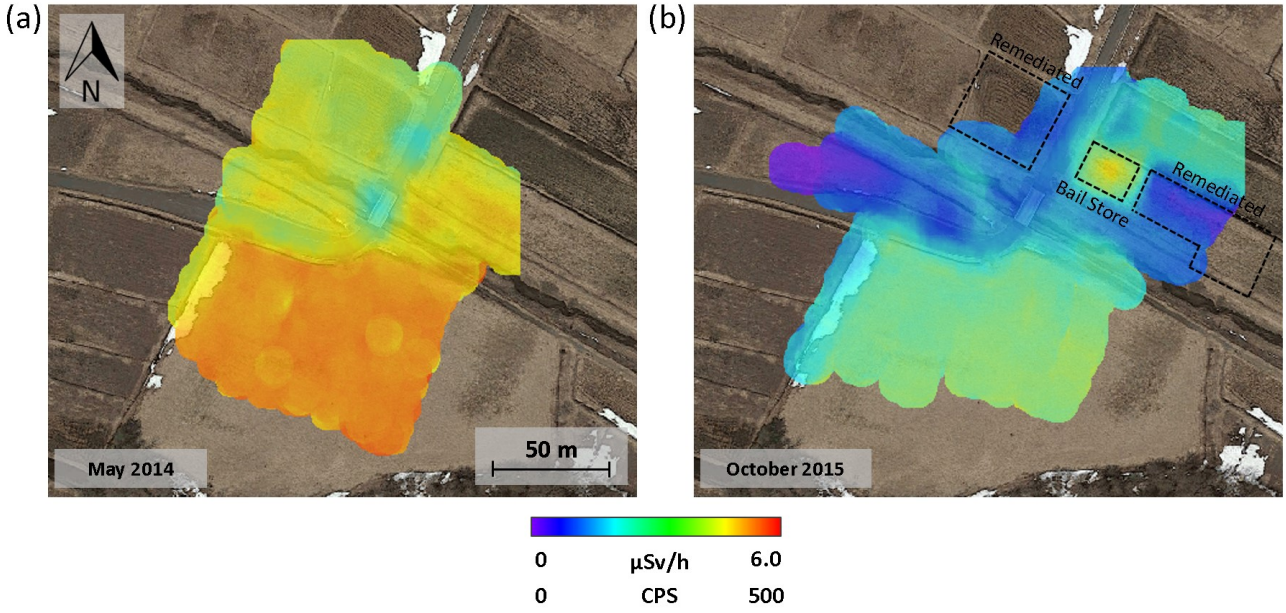
[2] T. Ohno, Y. Muramatsu, Y. Miura, K. Oda, N. Inagawa, H. Ogawa, A. Yamazaki, C. Toyama, and M. Sato, "Depth profiles of radioactive cesium and iodine released from the Fukushima Daiichi nuclear power plant in different agricultural fields and forests," *Geochem. J.*, vol. 46, no. 4, pp. 287–295, Nov. 2012.

Keywords: Fukushima, contamination, migration, radiation mapping, gamma-spectrometry



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.
The water quality of those lakes including ecological status is to be assumed by using satellite remote sensing. Only limited application is now applied into the reference lake.

Keywords: GLR, Reservoirs, Satellite Remote Sensing

Freshwater balance of the Indonesian Seas

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The seas surrounding the Indonesian Archipelago receive one of the largest freshwater input around the globe. Where does this freshwater go? Our knowledge on the mass balance of the Indonesian Seas has significantly progressed over this decade or so but the freshwater balance remains an open question. Numerical model experiments that focus on the Indonesian Archipelago will be presented and they show that significant part of the precipitated water exits to the Indian Ocean as part of the Indonesian Throughflow. The monsoonal winds play a major role through Ekman transport. The Sunda strait is also found to play a comparable role as the other major straits, which matches well with recent satellite observations showing significant freshening at the surface near the Sunda strait. The origin of the freshwater for this outflow through the Sunda strait, however, appears to be the South China Sea or the Java Sea rather than the Indonesian Seas. Part of the freshwater input over the Indonesian Seas is likely exported to the Indian Ocean through Ekman transport or mixed down to subsurface water due to tidal mixing and exit as part of the Indonesian Throughflow.

Hydrological Simulation of Vallay formation in Hesperian Marsian Surface

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It is considered that the Mars in Noachian ecoch was much warmer temperature than current condition, with atmosphere and ocean supported by its magnetic actiity. Several valley which seems to be developed by ancient hydrological processes are obsered in Marsian surface, is being considered to be built long time before. Some fluvial fun was formed during the following Hesperian epoch, which is considered as much cooler and drier than Noachian epoch. In this study, we applied Hydro-debris 2D model into Marsian surface in Hesperian epoch in order to try develping surface vallay formation throughout hydrological processes.

Keywords: Mars, Hesperian epoc, Hydro-Debris 2D

Water and sediment discharge from four small mountainous rivers in Zhejiang province: The roles of basin area, rainfall and human activities

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As a separate area whose water system flowing into sea, Zhejiang Province discharging water and sediment into sea is mainly through mountainous rivers and has different characteristics from other parts of China. Variations of water and sediment discharge from 4 small mountainous rivers were examined and compared from 1957 to 2008 at the monthly and yearly scales. The results showed that the 4 mountainous rivers presented a similar variability. High/low sediment discharge was always coupled with high/low water discharge in both scales of monthly and yearly. And high water and sediment discharge occurred in the flood season. Rainy season and typhoon season were the main period of flood in Zhejiang Province, with a mean water discharge of 75.4% and sediment discharge of 92.2% into sea. The more sediment discharge than water is caused by the high-increasing sediment yield during the huge flood. The total water and sediment discharges of the 4 individual rivers depend on the areas of the 4 river basins, while the variation trends of the water/sediment discharge are controlled by the rainfall. The human activity, principally the construction of reservoirs, significant increased the water discharge in the dry season and decreased it in the flood season, and decreased the total sediment discharge in addition.

Keywords: water discharge, sediment discharge, mountainous river

Modeling of Extreme Freshwater Discharge from the Kyushu-Region First-Class River Basins

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We investigated the effects of extreme fluvial outflow events on river months to salinity distribution in the coastal zone of the Kyushu-district Japanese coast. We created a set of hourly simulated river outflow data from first-class Japanese river basins flowing to the Pacific Ocean for targeted a event of typhoons from 16/09/2011 to 22/09/2011, and used it with a coupled hydrological-oceanographic model for estimation of the circulation and salinity distribution in coastal zones. The coastal ocean circulation was simulated by using a coupled hydrological oceanographic model JCOPE-T by inputting freshwater from our model “Cell Distributed Runoff Model Version 3.1.1 (CDRMV3.1.1)”, which simulated discharges for the case of the typhoon passage of real time freshwater input from the rivers. By using Shuffled Complex Evolution method developed by University of Arizona (SCE-UA method), that is one of the optimization method for hydrologic model, we could success to optimize 5 parameters, soil roughness coefficient, river roughness coefficient, effective porosity, saturated hydraulic conductivity, and effective rainfall, and successfully reproduced peak discharge prediction of extreme typhoon events on river months.

Keywords: SCE-UA method

An Ultra-high Resolution Ensemble Numerical Weather Prediction: Case Study of the Hiroshima Heavy Rainfall Event in August 2014

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This study aims to examine whether ultra-high resolution ensemble numerical weather predictions are able to produce a more accurate forecast. A case study was a heavy rain event that induced massive debris flow in Hiroshima, August 2014. The Japan Meteorological Agency non-hydrostatic model was run on the “K” computer.
The forecasts with 51 ensemble members were performed on two domains: an inner domain (500 km square) with 500 m grid spacing one way nested inside an outer domain (1600 x 1100 km) with 2 km grid spacing, each with 51 ensemble members. Each member on the inner domain receives boundary conditions from the corresponding member on the outer domain.
The best result of the 2km grid spacing model showed an intense rain band at the similar position to the observed rain band. However, in the worst result of the 2 km grid model, the weak rainband appeared northeast of the observed rainband. In contrast, all of the 51 ensemble member of the 500 m grid spacing model showed the rainband at the similar position to the observation. These results demonstrate that the high-resolution ensemble forecast has the ability to better prediction.

Keywords: heavy rain forecast, high-resolution, K supercomputer

Mutual Interaction of Human-Impacted River Runoff under Risks of Eutrophication and ENSO Extremes at the Scales of Lakes and Reservoirs

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Human-impacted ecosystems affect both river runoff and inherent risks to society. At significant spatiotemporal scales, lakes and reservoirs gather a complexity of multiple risks with opportunities for decision-making under uncertainty. However, a reminder for classical and novel challenges of whichever-scale model addressing these problems is needed. In this contribution, we discuss some theoretical and practical problems, with solutions, related to the mutual interaction of both human-impacted river runoff with risks. Ranging feedbacks from local-to-global water-systems, we here mainly enhance yardsticks at the scales of lakes and reservoirs. We introduce sections, extracted from Japan-Brasil research partnership programs, adapted to the needs of international initiatives like UNESCO-IHP-IIWQ, ILEC and Pantha Rei. Firstly, eutrophication and climate-driven extremes like ENSO hazards are becoming as relevant as problem-oriented hotspots of classical approaches in poor or ungauged systems. Updating from a former review (i.e. Mendiondo, 2008***), on the one hand, we depict how eutrophication-under-ENSO risk stressors, multiple restoration measures, treatment costs, and planning scenarios do help to better model and manage those inherent risks under different adaptation strategy options. On the other hand, we present example of demonstrative pilot programs, viable to be replicated under regional and global approaches, to control and mitigate eutrophication of urban-affected reservoirs. Finally, we share resilience matrix of indicators and variables which help allied global management initiatives towards stakeholder`s empowerment.

*** Supplementary Material:
http://wldb.ilec.or.jp/ILBMTrainingMaterials/resources/eutrophication_challenges_presentation.pdf,
http://wldb.ilec.or.jp/ILBMTrainingMaterials/resources/eutrophication_challenges.pdf

Keywords: Reservoir, Eutrophication, Extremes

Modeling of Extreme Freshwater Outflow from the North-Eastern Japanese River Basins to Western Pacific Ocean

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We investigated the effects of extreme fluvial outflow events on river mouths to salinity distribution in the coastal zone of the north-eastern Japanese coast. We created a set of hourly simulated river outflow data from 9 first-class Japanese river basins flowing to the western Pacific Ocean for targeted two events of typhoons (Chataan and Roke) and used it with a coupled hydrological-oceanographic model for estimation of the circulation and salinity distribution in coastal zones. The coastal ocean circulation was simulated by using a coupled hydrological oceanographic model JCOPE-T, comparing the case with using climatological mean monthly discharges as freshwater input from rivers with the case using our hydrological model CDRMV3.1.1 simulated discharges for the case of typhoon Roke passage as freshwater input from the 9 rivers. By using SCE-UA method we successfully reproduced peak discharge prediction of extreme typhoon events on river mouths. The results show an importance of detailed information on extreme river outflows for developing accurate nowcasting coupled river-ocean models for real time prediction of extreme flood events. The results suggest that our models that were calibrated on typhoon Roke and Chataan can be successfully used to predict runoffs from other extreme precipitation events. The salinity reproduction prediction in the coastal zone became more realistic than without including total river outflow. The proper simulation of extreme discharge events can be used to improve coastal and ocean modeling, especially modeling which is sensitive to reproducibility of the salinity distribution in coastal areas.

Keywords: salinity distribution, extreme discharge, coastal zone, SCE-UA method, river-ocean coupled model, nowcasting