Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

ACG06-01 会場:304 時間:5 月 19 日 11:10-11:25

スーパーフレアとその地球環境への影響
Superflares and Their Possible Impact on on Terrestrial Environments

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Supeflares are very big flares that release total energy much greater than that of the biggest solar flares with energy of ~ 3 x 10^32 erg. If such superflares will occur on our Sun, we would have extreme space weather events, which might lead to big hazards of terrestrial environments and our civilization. Recent observations of solar type stars with Kepler satellite have revealed existence of superflares (with energy of 10^34-10^35 erg) on the Sun-like stars with similar surface temperature (5600-6000 K) and slow rotation (< 10 km/s) (Maehara et al. 2012, Nature). From the statistical analysis of these superflare observations, it is found that superflares with energy 10^34 erg occur once in 800 years and superflares with 10^35 erg occur once in 5000 years on the Sun-like stars. These observations suggest that we may not be able to avoid the frightening possibility that superflares with 10^34-10^35 erg would occur once in 800-5000 years on the present Sun. Finally, I will argue possible impact of such solar superflares on the terrestrial magnetosphere, atmosphere, and infra-structure of our mocern civilization such as power-grids, radio communication, and artificial satellites.

キーワード: 太陽フレア, 恒星フレア, 宇宙天気, 磁気嵐, 太陽高エネルギー粒子
Keywords: solar flares, stellar flares, space weather, geomagnetic storm, solar energetic particles

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

ACG06-02 会場:304 時間:5 月 19 日 11:25-11:40

Role of air-sea interactions in the simulation of southern Africa summer climate
Role of air-sea interactions in the simulation of southern Africa summer climate

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The importance of air-sea interactions in the simulation of southern Africa summer climate is studied by coupling Advanced Research Weather Research and Forecasting (WRF) regional model to a simple mixed layer Price-Weller-Pinkel Ocean model. The coupled model was run for twelve austral summer seasons, DJF 1998/99 to DJF 2009-10 using the boundary conditions derived from the NCEP reanalysis data. Analysis shows the coupled WRF model to have smaller biases in the spatial distribution of precipitation over southern Africa landmass compared to the standalone WRF. Also, an improvement in the simulation of number of wet and dry days is seen in the coupled model. The improvement in the simulation of precipitation in the coupled WRF model is mainly due to improvement in the representation of moisture fluxes compared to WRF model. Experiments with boundary conditions derived from SINTEX-F forecasts also showed similar improvements in the coupled WRF forecasts compared to standalone WRF model, showing that air-sea interactions play an important role in the simulation/forecast of austral summer climate of southern Africa.

キーワード: WRF model, southern Africa, PWP mixed layer Ocean model
Keywords: WRF model, southern Africa, PWP mixed layer Ocean model

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

ACG06-03 会場:304 時間:5 月 19 日 11:40-11:55

統計的ダウンスケーリングによる四国域の将来降水予測
Assessment of future precipitation change in Shikoku region using statistical downscaling

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The objective of this study was to downscale large-scale atmospheric variables from GCM outputs to produce climate variables at a regional- and local-scale using statistical downscaling methods and investigate the impact of future climate change scenarios on hydrological and agriculture. Statistical downscaling methods were evaluated to simulate local-scale mean and extreme precipitation indices such as number of days greater than 10 mm/day (R10), maximum total precipitation accumulated over 5-days (R5d), max dry-spell length (MaDSL) and max wet-spell length (MaWSL) in the Shikoku region of Japan. We obtained the following conclusions.

1. The performance of downscaling methods is compared for both the calibration period (1961-1990) and the validation period (1991-2000). The overall R2 and SE of each month during the calibration period have clear seasonal variation, and that the simulation results were better in the winter than in the summer. In modeling the monthly precipitation, the annual mean R2 values are over 0.20. The overall trend was revealed successfully and SDSM was adaptable in Shikoku region. In validation periods, the simulation results by NCEP, HadCM3 are largely underestimated MDP in autumn, and almost overestimate it in winter. However, it demonstrates that the validate model reproduces the monthly and annual MDP values well.

2. For tadotsu, matsuyama, shimizu, murotomisaki, tsurugisan and tokushima, the representation less than 10 mm/day in the distribution will increase, and for rainfall maxima are also more decreased in the future. In contrast, the distribution at takamatsu, uwajima, sukumo and kochi shows the opposite trend. The summer and annual MDP in future compared to present precipitation would be consistently negative across models for stations of northern Shikoku, but were positively for kochi and sukumo. In addition, for most locations, absolute annual change MDP values in precipitation across HadCM3 were larger than that of CGCM3.

3. The future change of annual R10 would increase in southern and western part of Shikoku and decrease in northern Shikoku. The future change of annual R5d would decrease under H3A2 and H3B2 in north-eastern Shikoku. MaDSL would increase in the northern Shikoku and MaWSL would decrease in north-eastern Shikoku. It found that the future change of extreme precipitation indices provide a potential to cause an increase in the drought events across the north-eastern Shikoku, especially A2 and A1B scenario. On the other hand, it is suggested that future precipitation indices change is increasing the risk of flood in kochi. The regional difference of extreme precipitation indices cannot be markedly seen in the B2 scenario compared to the other scenarios. These results would provide important scientific base and practical information for agricultural, hydrological field and water resources management in this region.

キーワード: 気候変動, GCM, 降水, 統計的ダウンスケーリングモデル, 四国
Keywords: Climate change, GCM, Precipitation, Statistical downscaling model, Shikoku

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

ACG06-04 会場:304 時間:5 月 19 日 11:55-12:10

Variability of Kuroshio nitrate flux and transport in the western North Pacific: A model study
Variability of Kuroshio nitrate flux and transport in the western North Pacific: A model study

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An eddy-resolving coupled physical-biological ocean model has been employed to examine the interannual variability of nitrate flux and transport mechanism by the Kuroshio during 1995-2010. The Kuroshio provides an advective flux of nitrate carried in subsurface waters, redistributing nitrate from the tropics to the mid-latitude. Some observed data capture the nitrate flux and transport in the subsurface layers by the Kuroshio. The model reproduces the maximum nitrate flux core in the subsurface layer from the eastern side of Luzon (16N) to the Kuroshio Extension (36N) with the downstream. High phytoplankton blooms along the south of Japan (subpolar region) in the winter and spring seasons appear in the model, and the advective flux of nitrate with the downstream to the subpolar region contributes to the high blooms. Because the downstream of nitrate transport by the Kuroshio appears under the winter mixed layer in the south of Japan, the high blooms are enhanced. The model also reproduces the interannual variability of nitrate flux and transport by the Kuroshio in the North Pacific. The change of Kuroshio speed and structure are major causes for interannual variability of nitrate flux and transport. The simulated nitrate concentration in the Kuroshio shows interannual variation.
Keywords: Nitrate transport, Kuroshio, Interannul variability, High-resolution ocean physical-biological model

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

ACG06-05 会場:304 時間:5 月 19 日 12:10-12:25

東京大都市圏におけるセシウム輸送についての予測
Evaluation of Radioactive sediment transport in Tokyo Bay released from TMR

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東京電力福島第一原子力発電所所湖により主に 2011 年 3 月 21/22 日に東京大都市圏に降り注いだ放射性核種は水文プロセスにより蓄積され、東京湾に注ぎ込む。江戸川・荒川など主な河川で懸濁態物質による輸送がなされると予想され、河道において河床に堆積し、河口まで輸送される。本研究においては、流域・閉鎖性水域統合モデル Hydro3D を用いての数値計算を紹介する。3 つの主な核分裂生成物質 FP(Cs137, Cs134, I131) について、文部科学省が 9 月に実施した航空機による空間線量計測結果を元に初期条件を逆推定して計算を行なった。FP の輸送にはオイラー型表面流溶存態・懸濁態輸送モデル（地表水・土壌）と、ラグランジュ粒子 FP 輸送モデルの両者を用いて計算を行なった。結果それぞれの流域において放射性核種の集積が見られた。河口における粒子の凝集沈殿に関しては塩分濃度と代表粒径を用いたモデル化を行なった。東京湾に流入した FP は三次元閉鎖性水域モデルと底泥輸送モデルにより移送される。数値計算によると 3 年間の間に主に Cs137/Cs134 の影響により東京湾の放射性核種は増加する（I131 は 2 ヶ月以内に環境影響が極端に減少する）。江戸川・荒川河口の高線量地においては、平均濃度 300 Bq/kg、局所的には 4,000 Bq/kg 以上の高濃度域が見つかった。また小櫃川河口において 150-300Bq/kg 前後の底泥が予測された。
現状における海域での底泥の濃度変化は概ね計算結果をサポートしているが、底泥の圧密の効果がモデルでは十分に入っていない為、観測される濃度変化と今後のモデルへの導入が重要となる。

キーワード: 東京湾, 放射性セシウム, 底泥, 汚染, 河川
Keywords: Tokyo Bay, Radiocesium, Bottom sediment, contamination, River inflow

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

ACG06-06 会場:304 時間:5 月 19 日 12:25-12:40

GEMS/Water データセットを用いた国際河川流域からの流出評価
Impact assessment of flux estimation from international river basin using GEMS/Water dataset

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In this study, we aim to estimate nutrient loading from Land Zone throughout international river basin using the GEMS/Water (Global Environment Monitoring System / Water) Dataset for the purpose of estimating the gross nutrient loading to the marine environment to provide dataset necessary for assessment of the current status of the coastal zone, especially for the water quality of Bays and Estuary zone. In this procedure we have used the set of discharge data obtained from GRDC (Global Runoff Data Centre) as to be used for the loading estimate based on the ”observed” data. The locations of GEMS/Water and GRDC station have been compared to identify appropriate station set to calculate loading. The characteristics land use of each target river basin has also been analyzed using the Global Land Cover Characterization dataset prepared by USGS.

Monthly average fluxes for 14 international river streams are estimated using above dataset. As a result, fluxes of NH4-N and BOD of those rivers that flow into the Arctic Ocean are higher than other 13 rivers, which might be caused either by livestock cultivation in the basin or by deoxidization of Nitrogen associated with permafrost melting.

In addition, we have estimated Suspended Solid (SS) and NH4-N Loading from Rhine River using both GRDC discharge datasets. Rhine River has significantly decreased from 1980’s to 1990’s by loading estimation using GRDC and GEMS/Water Dataset. The Rhine basin is mostly covered with Dry land Cropland and Pasture, which is generally considered as high nitrogen compounds loading throughout the livestock farming. The decrease in concentration may have introduced by strict nutrient control in the basin.

キーワード: 栄養塩負荷量, GEMS/Water, 土地利用, 水質
Keywords: Nutrient loading, GEMS/Water, Land Use, Water Quality

Japan Geoscience Union Meeting 2013
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ACG06-07 会場:304 時間:5 月 19 日 14:15-14:30

Saline contamination and its mitigation in groundwater at a coastal watershed, north-east Tunisia

Saline contamination and its mitigation in groundwater at a coastal watershed, north-east Tunisia

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We investigated surface water and groundwater interaction under a saline contamination due to oil field brine and sea water intrusion by using tracer hydrological approach, geophysical approach and numerical simulation approach at a coastal watershed facing Mediterranean sea, north-east Tunisia. We present dynamics of groundwater flow and saline contaminants behavior, and propose a mitigation way of saline contamination by artificial groundwater recharge using a treated domestic waste water based on a numerical simulation.

キーワード: saline contamination, oil field brine, sea water intrusion, groundwater and surface water interaction
Keywords: saline contamination, oil field brine, sea water intrusion, groundwater and surface water interaction

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

ACG06-08 会場:304 時間:5 月 19 日 14:30-14:45

放射性物質の海洋分散モデル比較
Oceanic dispersion model intercomparison: The Fukushima case

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There are several attempts to simulate oceanic dispersion of radionuclides discharged into the ocean after the accident of Fukushima Daiichi Nuclear Power Plant on March 11, 2011. Together with monitoring observations of radionuclides in the sea water and bottom sediments, some crude ideas on distributions and magnitude of radioactivity within the ocean, particularly for Cesium 134 and 137, and on estimations of the leakage amount from the power plant were derived from the dispersion simulations. However, there are significant differences, as well as the similarlities, among the simulated results, whose causes should be investigated in more detail. A model intercomparison project under the Oceanographic Society of Japan Working group and Japan Science Councile is now trying to compare results from several downscaling dispersion models focusing on the Fukushima case. This presentation introduces the model intercomparison activities and discuss some preliminary results of the comparisons.

キーワード: 海洋分散, 放射性物質, 福島第一原子力発電所, 数値モデル
Keywords: Oceanic dispersion, radionuclide, Fukushima Daiichi Nuclear Power Plant, numerical model

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

ACG06-09 会場:304 時間:5 月 19 日 14:45-15:00

沿岸から放出された放射性物質に与える海洋循環と物質移行の影響
The impact of oceanic circulation and phase transfer on the dispersion of radionuclides from the coast

木田 新一郎 [1*], Youngjin Choi[1], 高橋 桂子 [1]
Shinichiro Kida[1*], Youngjin Choi[1], Keiko Takahashi[1]

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The processes behind the dispersion of radionuclides released from the coast of Fukushima are investigated using a numerical ocean model and Lagrangian particle tracking model. This coupled model solves the concentration of radionuclides for those dissolved in seawater and those adsorbed in particulates and bottom sediments while advecting the particles based on the oceanic flow field. Many radionuclides are found to remain near the coast. We find the spatial pattern to depend strongly on the oceanic circulation during the first month of the release because this is when most of the adsorption to bottom sediments occurs. We also find vertical mixing to play an important role since it enables the radionuclides to be carried to the sea floor. This suggests that oceanic dispersion of radionuclides is likely to change with season and whether it was introduced to the ocean through river input or directly into the ocean waters.

キーワード: 海洋モデル, 放射性物質, 海底土
Keywords: Ocean Model, Radionuclides, Sediments

Japan Geoscience Union Meeting 2013
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ACG06-10 会場:304 時間:5 月 19 日 15:00-15:15

Internal tide variability around Japan revealed by modeling and observation
Internal tide variability around Japan revealed by modeling and observation

Yasumasa Miyazawa[1*], Xinyu Guo[1], Kaoru Ichikawa[2], Toru Miyama[1], Sergey Varlamov[1], Takuji Waseda[1], Sourav Sil[1]
Yasumasa Miyazawa[1*], Xinyu Guo[1], Kaoru Ichikawa[2], Toru Miyama[1], Sergey Varlamov[1], Takuji Waseda[1], Sourav Sil[1]

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Recent development of ocean modeling allows concurrent simulation of the ocean circulation and tide. Investigation of possible occurrence of their interactions is of importance for deeper understanding of the oceanic phenomena. Internal tide is one of key processes that are responsible for the interactions between the ocean circulation and tide. The Izu-Ogasawara Ridge south of Japan is considered as an active generation site of internal tide. We try to detect M2 internal tide signals there from products of the operational tide-resolving ocean circulation model (JCOPE-T) and satellite altimeters (Topex/Poseidon, Jason-1, 2). The amplitude of simulated M2 internal tide harmonics agrees with the observed one, while the simulated phase structure is not much similar to the observation. The model result indicates standing wave features associated with remote propagation of the M2 internal tide south of Japan. We discuss possible modulation of the M2 internal tide variability due to mesoscale eddies and its implications on the vertical mixing and river runoff processes.

キーワード: Eddies and mesoscale processes, Internal and inertial waves, Surface waves and tides
Keywords: Eddies and mesoscale processes, Internal and inertial waves, Surface waves and tides

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

ACG06-11 会場:304 時間:5 月 19 日 15:15-15:30

福島から海洋へ漏洩した放射性核種の初期分散メカニズム
Initial oceanic dispersion mechanism of radionuclides released from Fukushima

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The 2011 earthquake off the Pacific coast of Tohoku, Japan, and the subsequent tsunami caused a severe nuclear accident at the Fukushima Daiichi Nuclear Power Plant (FNPP), leading to radionuclides leaking into the coastal ocean. A retrospective, double-nested high-resolution numerical model at 1 km horizontal resolution based on the JCOPE2-ROMS downscaling framework (Uchiyama *et al*., 2012) is utilized to evaluate oceanic/coastal dispersion of the released cesium-137 (^{137}Cs) from FNPP. A rational leakage submodel proposed by Tsumune *et al*. (2011) based on the iodine-cesium ration is employed for the realistic cesium-137 release. Among several oceanic radionuclide dispersal models including the present one, there still is a discrepancy in the prevailing direction of initial dispersion (for the first several weeks) of the leaked materials, which remains an open question.

The present model successfully reproduces the overall oceanic structure as well as the dispersal of cesium-137, according to an extensive model-data comparison exploiting the satellite altimetry, the *in situ* cesium-137 concentration monitored by TEPCO and MEXT, and the aerial snapshot taken by NSSA. Alongshore distribution of the concentrations is found to be highly inhomogeneous with diluted patterns distributed widely in the south of FNPP, while medium concentration appears in the north. The initial dispersion predominantly occurs in the northward direction for the first 30 days, followed by the southward cesium-137 transport down to the Kuroshio extension to be drifted far to the North Pacific. The model also demonstrates that an isolated, anti-cyclonic mesoscale eddy persists off Kashima Coast (south of Fukushima) shed around Cape Inubo where the Kuroshio separation takes place. This standing anti-cyclone enhances the poleward coastal jet about less than 50 km from the shore, especially 3-4 weeks after the accident. A cross-spectral analysis exhibits a prominent correlation between northward wind and along-shelf oceanic currents in a fairly broard period band of 72 - 240 hours peaked at 168 hours. The highest coherence ($coh^2 > 0.92$) is most evident in the nearshore area within about 10 km from the shore, while it exponentially decreases offshore. This result strongly suggests the presence of wind-driven shelf waves as a potential agent of the alongshore cesium transport as argued by Miyazawa *et al*. (2012). In contrast, a positive buoyancy input through four major rivers discharging into Sendai Bay (about 80 km north of FNPP) is found to be substantial to the southward cesium transport. This buoyancy input is attributed to a prevailing equatorward flow contracted in a quite narrow coastal strip within about 10 km from the shore.

In summary, the initial dilution and dispersal of the leaked radionuclide from FNPP are primarily constrained in the nearshore area around Fukushima Coast with reduction of the equatorward transport. The narrow coastal strip of the predominant alongshelf transport is characterized by the ”three-layered system” in the cross-shelf direction consisting of (1) the innermost southward transport by the positive buoyancy (about 0-10 km off the shore), (2) the prevailing poleward coastal jet associated with a standing anti-cyclonic mesoscale eddy formed off Kashima Coast that most likely influenced by wind-driven shelf waves, and (3) the overall equatorward transport in the offshore farther than about 50 km.

キーワード: セシウム 137, 海洋分散, 中規模渦, 陸棚波, 海洋モデル
Keywords: cesium 137, oceanic dispersal, mesoscale eddy, shelf wave, ocean model

Japan Geoscience Union Meeting 2013
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ACG06-12 会場:304 時間:5 月 19 日 15:30-15:45

大湖沼水位変動からもとめた強降雨時における河川流入量の評価
Evaluation of river discharge due to heavy rain using water level data in a large lake

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We aimed to evaluate the river discharge due to heavy rain in Lake Biwa, the largest lake of Japan. For this purpose, we analyzed high-resolution water level data measured at the lake. We then calculated the response of the water level of Lake Biwa to the river inflows. The fluctuations in the water level of Lake Biwa were investigated during the period 2010?2012. These fluctuations were attributed to precipitation in a catchment area in the southwest region of Shiga Prefecture, Japan; a river flowed through this catchment area into Lake Biwa. A water level instrument with a resolution of 1 mm was used, and the sampling interval for the data logger was 2 min. Given that many factors control the water level in Lake Biwa, we performed multiple time scale analysis. This allowed us to separate the effect of inherent oscillations on the water level of the lake.

The change in the water level of the lake is balanced by inflow and outflow. The factors affecting the water level in the lake include seiches, wind, waves, precipitation (on the surface of a lake, via a drainage basin, and via groundwater), evaporation, and outflow, which have different spatiotemporal scales. Surface seiches can lead to short-term changes in the water level, whereas precipitation results in the greatest changes in the water level. Precipitation that directly occurs over a lake results in an increase in the water level, whereas precipitation over the catchment area flows into the lake through a river or as groundwater. However, the amount by which the water level of a lake can increase because of rapid precipitation has not been discussed in detail thus far. Hence, we evaluated the contribution of precipitation flowing into Lake Biwa through a river; for this purpose, we used high-resolution water level data of Lake Biwa. We then calculated the response of the water level of Lake Biwa to the river inflow. As a result, if the amount of riverine precipitation increases, and particularly if the precipitation exceeds 100 mm, it turned out that the volume of riverine input increases 40 to 60 % of precipitation sharply that flow into Lake Biwa.

キーワード: びわ湖, 水位変動, 河川水への寄与率, 降水
Keywords: Lake Biwa, Water Level, contribute ratio of river flow, precipitation