Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

ACG004-01 会場:104 時間:5 月 26 日 16:30-16:45

Impacts of Tropical Modes of Climate Variations
Impacts of Tropical Modes of Climate Variations

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Natural modes of climate variations such as Indian Ocean Dipole (IOD), El Nino/Southern Oscillation (ENSO) and recently identified ENSO Modoki have huge impacts on many parts of the world. For example, some of the extreme flooding events in East Africa and droughts in Australia are associated with the positive IODs. The impact was severe when in a rare turn of the history three positive dipole events evolved back to back during 2006, 2007 and 2008. In addition, more number of El Nino Modoki (which causes a different teleconnection pattern as compared to that of ENSO) events are observed in recent decades. These climate phenomena also influence high-frequency weather events by either anchoring or destroying the triggering mechanisms. Furthermore, these climate variations influence the coastal securities by modulating coastal sea level variations on interannual to decadal time scales. Therefore, it has become an essential task to understand these changes in the characteristics of the Indo-Pacific climate variations, apparently related to changes in the background conditions under the global warming stress.

キーワード: Ocean, Atmosphere, Climate, Variations, IOD, ENSO Modoki
Keywords: Ocean, Atmosphere, Climate, Variations, IOD, ENSO Modoki

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ACG004-02 会場:104 時間:5 月 26 日 16:45-17:00

全球気候における南シナ海通過流の役割に関する大気海洋結合モデルを用いた研究
A coupled modeling study on roles of South China Sea Throughflow in the global climate

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Roles of the South China Sea throughflow (SCSTF) in the global climate system are investigated using a coupled general circulation model called the University of Tokyo Coupled Model. We have conducted two experiments with and without the SCSTF and shown that the sea surface temperature (SST) becomes cooler in the eastern and far western equatorial Pacific and south of Japan, but warmer in the South China Sea (SCS) and the Kuroshio Extension region, when the SCSTF is blocked. The cooling in the far western equatorial Pacific is due to a stronger southward flow in the warm surface layer of the Makassar Strait. The strong warming in the SCS occurs because the heat received from the atmosphere cannot be exported out of the SCS. These SST changes further modulate the Walker Circulation, SST field, and precipitation pattern over the equatorial Indian and Pacific Oceans such that the mean climate state becomes more La Nina-like and negative IOD-like without the SCSTF. Also, they affect the SST pattern on global scale through atmospheric teleconnections. Therefore, the SCSTF plays a more active role than previously thought in regulating the global climate system.

キーワード: 南シナ海, インドネシア通過流, 大気海洋結合モデル
Keywords: South China Sea, Indonesian Throughflow, Coupled general circulation model

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ACG004-03 会場:104 時間:5 月 26 日 17:00-17:15

Impact of Global Ocean Surface Warming on Seasonal-to-Interannual Climate Prediction
Impact of Global Ocean Surface Warming on Seasonal-to-Interannual Climate Prediction

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Surface air temperature (SAT) over the globe, particularly Northern Hemisphere continents, has rapidly risen over the last 2-3 decades, leading to an abrupt shift toward a warmer climate state after 1997/98. Whether the terrestrial warming might be caused by local response to increasing greenhouse gas (GHG) concentrations or by sea surface temperature (SST) rise is recently in dispute. The SST warming itself may be driven by both the increasing GHGs forcing and slowly-varying natural processes. Besides, whether the recent global warming might affect seasonal-to-interannual climate predictability is an important issue to be explored. Based on the JAMSTEC climate prediction system in which only observed SSTs are assimilated for coupled model initialization, the present study shows that the historical SST rise plays a key role in driving the intensified terrestrial warming over the globe. The SST warming trend, while is negligible for short-lead predictions, has substantial impact on the climate predictability at long-lead times (>1 year) particularly in the extratropics. The tropical climate predictability, however, is little influenced by global warming. Given a perfect warming trend and/or a perfect model, global SAT and precipitation could be predicted beyond 2 years in advance with anomaly correlation skill of above ˜0.6.

Without assimilating ocean subsurface observations, model initial conditions show a strong spurious cooling drift of subsurface temperature; this is caused by large negative surface heat flux damping arisen from the SST-nudging initialization. The spurious subsurface cooling drift acts to weaken the initial SST warming trend during model forecasts, leading to even negative trends of global SAT and precipitation at long-lead times and hence deteriorating the global climate predictability. Concerning the important influence of the subsurface temperature on the global SAT trend, future efforts are required to develop a good scheme for assimilating subsurface information particularly in the extratropical oceans.

キーワード: Global warming, sea surface warming, seasona-to-interannual climate prediction, climate model
Keywords: Global warming, sea surface warming, seasona-to-interannual climate prediction, climate model

Japan Geoscience Union Meeting 2011
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ACG004-04 会場:104 時間:5 月 26 日 17:15-17:30

Simulation of Indian Ocean Dipole and its Impacts with a High-resolution Regional Coupled Model
Simulation of Indian Ocean Dipole and its Impacts with a High-resolution Regional Coupled Model

Venkata Ratnam Jayanthi[1*], Swadhin K. Behera[1], Yukio Masumoto[1], Keiko Takahashi[3], Toshio Yamagata[4]
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A regional coupled ocean-atmosphere model was developed to study the role of air-sea interactions associated with the Indian Ocean Dipole (IOD) and its impact on the Indian summer monsoon rainfall. The coupled model includes the Weather Research and Forecasting (WRF) model as the atmospheric component and the regional ocean modeling system (ROMS) as the oceanic component. The two way coupled model system exchanges sea-surface temperature from the ocean to the atmospheric model and surface wind stress and energy fluxes from the atmosphere to the ocean model every six hours. The coupled model was run for a period 2001-2008. During the study period the Indian summer monsoon was affected by three positive IOD events of 2006, 2007 and 2008. From the comparison of the results between the stand-alone WRF model and the coupled model, it is found that the coupled model captures the main features of the Indian monsoon better than the WRF model during these years. The coupled model produces a substantially more realistic spatial and temporal distribution of the monsoon rainfall compared to the uncoupled atmosphere-only model. The intraseasonal oscillations are also better simulated in the coupled model. These improvements are due to a better representation of the feedbacks between the SST and convection and highlight the importance of air-sea coupling in shaping the Indian Ocean influence on summer monsoon rainfall during the IOD events.

キーワード: Indian Ocean Dipole, WRF, ROMS
Keywords: Indian Ocean Dipole, WRF, ROMS

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ACG004-05 会場:104 時間:5 月 26 日 17:30-17:45

インドネシア海の海面水温の季節変動メカニズム
The impact of the Indonesian Throughflow and tidal mixing on the Seasonal Sea Surface Temperature in the Indonesian Seas

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We utilize a numerical ocean model to investigate how the Indonesian Throughflow and tidal mixing may affect the Sea Surface Temperature in the Indonesian Seas. The Indonesian Throughflow is found to play a major role on the SST only during summer, especially on its spatial variability. This is because the Throughflow weakens the impact of coastal upwelling that is forced by the Northwestern Monsoonal wind. Without the Indonesian Throughflow, a cold SST region will establish along Nusa Tenggara in summer. The heat balance of the surface mixed layer shows the warming effect of the Throughflow comparable to the cooling effect of coastal upwelling and wind-induced mixing. The Indonesian Throughflow does not significantly impact the SST in other seasons. The seasonal variability of the Indonesian Throughflow transport is also found not to affect the seasonal SST variability significantly. The importance of the Throughflow on the seasonal SST variability is through its net presence throughout the year, not its seasonal variability.

The impact of tidal mixing on the SST is found to be trapped locally on the annual mean. However, this impact is found to contain large seasonal variability with cooling of the SST occurring mostly in summer and winter. This seasonality is induced because the Monsoonal winds force upwelling in summer and winter. Moreover, the Ekman transport is directed toward the interior of the Banda Sea during summer so the cold tidally mixed water is efficiently spread throughout the basin. Our model experiements suggest that the impact of tidal mixing is likely to be limited only where tidal mixing is strong without the wind-driven circulation. Tidal mixing on the shelves, on the other hand, is found to have only a limited impact along the shelf-break.

キーワード: インドネシア多島海, 海面水温, 潮汐混合, インドネシア通過流
Keywords: Indonesian Seas, Sea Surface Temperature, Tidal mixing, Indonesian Throughflow

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ACG004-06 会場:104 時間:5 月 26 日 17:45-18:00

Influence of the Indian Ocean Dipole on the interannual variability of precipitation over the southern part of Iran

Influence of the Indian Ocean Dipole on the interannual variability of precipitation over the southern part of Iran

Farnaz Pourasghar[1*], Tomoki Tozuka[2], Saeed Jahanbakhsh[1], Behrooz Sarisarraf[1], Hooshang Ghaemi[1], Toshio Yamagata[2]
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The interannual variability of precipitation in the southern part of Iran and its links with the Indian Ocean Dipole (IOD) during 1974-2005 rainy seasons (October to May) are examined using daily data from 183 meteorological stations. The Zagros Mountain in the west, Persian Gulf and Oman Sea to the south, and two very dry deserts in central Iran have helped to shape precipitation regimes in the southern part of Iran. For this reason, the region is first divided into four subdivisions based on six factors (standard deviation, skewness, kurtosis, mean, coefficient variation, and maximum precipitation) using principal component and cluster analyses. It is found that the interannual variations of rainfall in October and November in all four regions have significant positive correlations with the IOD and El Nino/Southern Oscillation (ENSO). However, if a partial correlation analysis is used to extract the sole influence of the IOD or ENSO, a significant positive partial correlation is found only with the IOD. Also, when composites of sea surface temperature (SST) anomalies are constructed for the wet (dry) years, SST anomalies associated with the positive (negative) IOD are captured. To investigate the mechanism, moisture flux anomaly is calculated. It was shown that the southeasterly anomaly over the Arabian Sea turns cyclonically and transports more moisture to the southern part of Iran from the Arabian Sea, Red Sea, and Persian Gulf during the positive IOD. In contrast, the moisture flux has a southward anomaly over Iran during the negative IOD, which indicates that the moisture supply from the south is reduced.

キーワード: Precipitation, Indian Ocean Dipole, Iran, Interannual variation
Keywords: Precipitation, Indian Ocean Dipole, Iran, Interannual variation

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ACG004-07 会場:104 時間:5 月 26 日 18:00-18:15

南大西洋亜熱帯ダイポールモードの形成
On the growth of the subtropical dipole mode in the South Atlantic

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Using observational data and outputs from an ocean general circulation model, the generation of the subtropical dipole mode in the South Atlantic is investigated. The subtropical dipole mode is the most dominant mode of interannual variability in the South Atlantic and its sea surface temperature (SST) anomaly shows a dipole pattern oriented in the northeast-southwest direction. Both positive and negative SST anomaly poles start to grow from austral spring, reach their peaks during summer, and decay during fall. To examine the evolution of these SST anomaly poles, the mixed-layer heat balance is calculated. The positive (negative) SST anomaly pole develops because the warming of the mixed-layer by the climatological shortwave radiation is enhanced (suppressed) by the thinner (thicker) mixed-layer than normal. This mixed-layer thickness anomaly is due to the suppressed (enhanced) latent heat flux loss associated with the variations in the subtropical high. This result is in contrast to the previous studies, which suggested that the latent heat flux anomalies directly cause the SST anomalies. The present study demonstrates that the interannual variations in the mixed-layer thickness play an important role in the growth of the subtropical dipole mode.

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ACG004-08 会場:104 時間:5 月 26 日 18:15-18:30

Recent SST trends and Natural Disasters in Brazil
Recent SST trends and Natural Disasters in Brazil

Yosuke Yamashiki[1*], Swadhin Behera[2], Satomi Inoue[3], Netrannada Sahu[1], Toshio Yamagata[4], Kaoru Takara[1]
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We analyzed recent variations in the sea surface temperature (SST) anomalies of Pacific Oceans to understand their roles in extreme discharge of Amazon River Basin. In general, higher than monthly average discharge appears when La Nina condition forms and lower than monthly average discharge appears when El Nino condition forms. We also investigated the relationship between SST anomalies and recent floods in Brazil during the period of 1980-2010. Severe floods (e.g. 2003 and 2010 Rio de Janeiro-Sao Paulo Flood) in austral summer occurred when El Nino Modoki appears in the Pacific Ocean. In addition, warm waters in tropical South Atlantic Ocean between American and African Coasts also helped the moisture convergence to the affected region. These warm temperatures sometimes together with La Nina or La Nina Modoki give rise to extreme flood events. For example, the extreme flood and sediment disaster that occurred in the beginning of 2011 is a typical case as it happened during an intense La Nina event together with extreme warm water in tropical South Atlantic Ocean. The occurrence of extreme SST in Atlantic Ocean may be a cause of the continuation of disasters in that region. That also explains the non-linearity in the tropical Pacific influences on the local rainfall extremes.

キーワード: SST, El Nino, La Nina, Modoki, Warm water, Atlantic Ocean
Keywords: SST, El Nino, La Nina, Modoki, Warm water, Atlantic Ocean

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ACG004-09 会場:104 時間:5 月 27 日 08:30-08:45

Decadal variations in the southern tropical Indian Ocean: A case study for 1990s
Decadal variations in the southern tropical Indian Ocean: A case study for 1990s

升本 順夫 [1*], 田辺　彩乃 [2]
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Decadal variations in the southern tropical Indian Ocean and their relation to variations of Southern Cell, a part of shallow meridional overturning circulations in the Indian Ocean, during 1990s are investigated, using outputs of a high-resolution OGCM, called OFES, and a simple reduced-gravity model. OFES reproduces mean conditions and interannual to decadal variations of the Southern Cell, which consists of southward surface Ekman flow and northward subsurface geostrophic currents. During 1990s, the Ekman flow is weakened in a northern part of the cell associated with weakening of the southeasterly Trade Winds, while it is strengthened south of 10S. The subsurface meridional currents at the depth of the thermoclline show the flows opposite to the surface in a region north of 20S. These results suggest that the Southern Cell weakened/strengthened during this particular period only partly and not the whole cell. Mechanisms responsible for this weakening in the northern part of the cell are related to a dipole structure in sea surface height and the thermocline depth anomalies, which are generated by wind stress curl over the southeastern tropical Indian Ocean and subsequently propagate westward as downwelling and upwelling Rossby waves. The simple reduced-gravity model well reproduces the thermocline depth anomalies during this period, supporting the importance of the baroclinic Rossby waves in the decadal variations there.

キーワード: インド洋, 十年規模変動, 南北循環セル
Keywords: Indian Ocean, Decadal variations, Shallow meridional circulation cell

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ACG004-10 会場:104 時間:5 月 27 日 08:45-09:00

農業モデルにおける気象入力条件と空間解像度がもつ不確実性について
Effect of uncertainty in temperature and precipitation inputs and spatial resolution on the crop model

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Tatsumi Kenichi[1*], Yosuke Yamashiki[1], Kaoru Takara[1]

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本研究では，気温・降水量などの気候値および計算時における空間解像度が農業収量計算結果に与える不確実性についての考察を行った．対象は，粗い解像度では国土における土地利用などを陽に表現することが難しく，かつ活発な農業生産が行われているハンガリーとルーマニアである．なお，対象とした作物は，とうもろこしと小麦である．計算は複数の気象データを用いて 1990-1999 年の 10 年間行った．その結果，同じ解像度（0.5 度）では，気温や降水量の値が農作物の生産量に大きな影響を与えることがわかった．また，同じ気候データを 0.5 度と 0.25 度にそれぞれ補間したデータを用いた場合，高解像度のデータを使ったものの方が，統計値との対応が良くなった．以上より，我々が行った計算条件下では，高解像度計算のメリットが大きいことがわかった．今後は，より多くの国を対象としてモデルの高解像度化による結果に与える影響評価を行っていく必要がある．

キーワード: 農業生産, 気候条件, 空間解像度, MRI-GCM20, 不確実性, 小国
Keywords: crop yield, climate conditions, spatial resolution, MRI-GCM20, uncertainty, small countries

Japan Geoscience Union Meeting 2011
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ACG004-11 会場:104 時間:5 月 27 日 09:00-09:15

太陽活動と宇宙天気
Solar Activity and Space Weather

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太陽はフレアに代表する秒単位の短時間変動から、黒点 11 年周期に代表する長時間変動まで様々な活動を起こしている。短時間変動による太陽地球環境変動は宇宙天気、長時間変動は宇宙気候と呼ばれ、その予測は現代文明にとって緊急の課題である。これらの地球環境の源としての太陽活動についてレビューするとともに、最後に現在我々が知っている最大級のフレアの 10 倍から 100 万倍のエネルギーを解放するスーパーフレアの発生の可能性とその地球環境への影響について述べる。

キーワード: 太陽活動, 宇宙天気, フレア, 宇宙気候, 黒点周期, スーパーフレア
Keywords: solar activity, space weather, flare, space climate, sunspot cycle, superflare

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ACG004-12 会場:104 時間:5 月 27 日 09:15-09:30

熱帯域雲活動への太陽活動と QBO の影響
Implications for the low latitude cloud formations from solar activity and the quasi-biennial oscillation

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Hiroko Miyahara[1*], Peng Hong[2], Yusuke Yokoyama[2], Yukihiro Takahashi[3], Mitsuteru Sato[3]

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We examined the effect of the 11-year solar cycle and quasi-biennial oscillation (QBO) on the 27-day solar rotational period detected in tropical convective cloud activity. We analyzed the data of outgoing longwave radiation (OLR) for AD1979-2004, dividing into four different cases by the combination of high and low solar activities in terms of the 11-year variation, and easterly and westerly stratospheric winds associated with QBO. As a result, 27-day variation has been most significantly detected in high solar activity period around the Indo-Pacific Warm Pool. Based on correlation analysis, we find that solar rotation signal can explain 10-20% of OLR variability around the tropical warm pool region during the high solar activity period. The spatial distribution has been, however, apparently different according to the phases of QBO. It is suggested that the 11-year solar cycle and stratospheric QBO have a possibility to cause large-scale oceanic dipole phenomena.

キーワード: 太陽活動, 成層圏準 2 年周期振動（QBO）, 西太平洋域, 雲活動
Keywords: Outgoing Longwave Radiation (OLR), solar activity, solar rotation, Quasi Biennial Oscillation (QBO), Western Pacific Region

Japan Geoscience Union Meeting 2011
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ACG004-13 会場:104 時間:5 月 27 日 09:30-09:45

Impact of ENSO Modoki in Paranaiba Catchment, Brazil
Impact of ENSO Modoki in Paranaiba Catchment, Brazil

Netrananda Sahu[1*], Yosuke Yamashiki[1], Swadhin Behera[3], Kaoru Takara[1], Toshio Yamagata[4]
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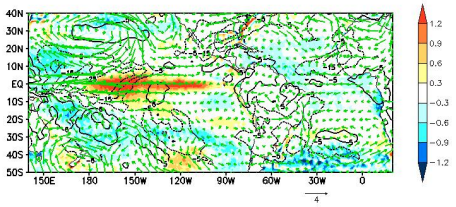
The climatology of stream-flow at the Fazenda Santa Maria gauge station of the Paranaiba River in Brazil shows significant flow during November to May and very less flow during June-October.. The variation in this seasonal stream-flow significantly affects the human population. So, it is important to understand the underlying mechanisms that cause that variation. Since the variability of climatic conditions in Pacific Oceans are main driver of the rainfall variability over the La Plata basin, their roles in river stream-flow is explored in this study. A scientific analysis is made to link the stream-flow variability with the rainfall and SST variations over the Pacific Oceans on daily time scale. The observed discharge data from 1974-2006 (33 years) at the Fazenda Santa Maria, the down most outlet of the upper catchment, shows a strong correlation with the El Nino/Southern Oscillation (ENSO) and recently recognized ENSO Modoki events. In the December-February low stream flow events are influenced by El Nino Modoki and high flow events are influenced by La Nina. In March-May seasons high stream flow events are La Nina and few events are also influenced by La Nina Modoki, whereas this rainy season low flow events are influenced by El Nino Modoki than El Nino.The climate change induced ENSO Modoki events needs scientific study for this La Plata basins for the societal benefits.



キーワード: Stream flow, ENSO, ENSO Modoki, Climate variability, Paranaiba
Keywords: Stream flow, ENSO, ENSO Modoki, Climate variability, Paranaiba

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ACG004-14 会場:104 時間:5 月 27 日 09:45-10:00

Response of nutrient concentrations and primary production over the shelf in the East China Sea to the changes in oceani

Response of nutrient concentrations and primary production over the shelf in the East China Sea to the changes in oceani

Xinyu Guo[1*], Liang Zhao[2]
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A three dimensional coupled biophysical model was used to examine the response of nutrient concentrations and primary production over the shelf in the East China Sea to the changes in oceanic and riverine nutrient input. The model consisted of two parts: the hydrodynamic module was based on a nested model with a horizontal resolution of 1/18 degree, whereas the biological module was a lower trophic level ecosystem model including two types of phytoplankton, three elements of nutrients, and biogenic organic material. The model results suggested that seasonal variations occurred in the distribution of nutrients and chlorophyll a over the shelf of the ECS. After comparison with available observed nutrients and chlorophyll a data, the model results were used to calculate response of nutrient concentrations and primary production over the shelf in the East China Sea to the changes in oceanic and riverine nutrient input with several additional calculations in which the nutrient concentrations in the Kuroshio water and in the Changjiang river water were artificially increased or decreased. Model results suggested that the oceanic nutrients were distributed in the bottom layer from the shelf break to the region offshore of the Changjiang estuary from spring to summer and appeared in the surface layer from autumn to winter. The calculations also implied that the supply of oceanic nutrients to the shelf can change the consumption of pre-existing nutrients from rivers. The influences of riverine nutrients on primary production were confined to the offshore of estuary.

キーワード: Oceanic nutrients, riverine nutrients, ecossytem model, East China Sea
Keywords: Oceanic nutrients, riverine nutrients, ecossytem model, East China Sea

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Seasonal and interannual ecosystem variability in the South East Asian region: Results of an eddy-resolving physical-bio
Seasonal and interannual ecosystem variability in the South East Asian region: Results of an eddy-resolving physical-bio

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An eddy-resolving coupled physical-biological ocean model has been employed to investigate physical influences on the marine ecosystem variability in the South East Asian region. The region is characterized by various temporal and spatial oceanic phenomena (e.g., mesoscale eddies, ocean currents, throughflow, coastal upwelling and tidal mixing). Additionally, the Asian-Australian monsoon, El Nino Southern Oscillation (ENSO), and the Indian Ocean Dipole (IOD) also affect this region. The model captures the seasonal and interannual variability of chlorophyll distribution associated with the mesoscale eddies, ocean circulation and upwelling generated by the monsoon. The model reproduces the high chlorophyll concentrations along the northwestern coast of Luzon and Kalimantan during the winter monsoon and along the southern coast of Java-Sumatra, along the coast of Vietnam and in the Arafura Sea during the summer monsoon. In these regions, the upwelling generated by the monsoon uplifts the nutrient-rich waters and increases biological production. During boreal summer-fall, the phytoplankton bloom along the southern coast of Java-Sumatra extends westward by the surface current and to offshore in the southeastern tropical Indian Ocean by the cyclonic eddy. The spreading of phytoplankton bloom is strongly linked to anomalous winds associated with the ENSO and IOD events.

キーワード: Indonesian archipelago, marine ecosystem, coastal upwelling, Asia-Australian monsoon, high-resolution ocean model
Keywords: Indonesian archipelago, marine ecosystem, coastal upwelling, Asia-Australian monsoon, high-resolution ocean model

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Rivers in Coastal Ocean Model
Rivers in Coastal Ocean Model

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Introduction

As resolution of regional ocean models is refined to hundreds of meters and less, it becomes possible and necessary accurately simulate interaction and impact of rivers on the coastal ocean circulation and environment. Ocean-rivers interaction includes a lot of complicated aspects; one of most important is modification of coastal waters salinity. Rivers also modify coastal circulation both directly, by momentum advection, and through the ocean water density modification. Rivers could transport a lot of suspended and dissolved materials that could significantly impact the coastal environment in river mouth proximity as well as on relatively large distance from it. To count for these processes, discharge of main Japanese rivers was included into the real-time tide resolving regional ocean model for the coastal waters of Japan (JCOPE-T) developed and operated by RIGC (JAMSTEC).

System structure

JCOPE-T system is based on the generalized vertical sigma coordinate model version of POM (Princeton Ocean Model) with 1/36 degree horizontal resolution and 47 vertical levels. It is nested to the North-Western Pacific (NWP) JCOPE real time modeling system. Later model provides weekly updated daily values for the open boundary conditions. Tidal processes are introduced in to the model at open boundaries using Japan National Astronomy Observatory model (NAO, Matsumoto) tidal elevation and volume fluxes. Astronomic tidal potential variations are also counted in the model; total up to 20 tidal harmonics could be simulated.

At the sea surface momentum, heat and water fluxes are estimated using latest available meteorological numerical weather analysis and forecast data.

At this moment, the freshwater discharge of major 35 Japanese rivers prescribed as monthly mean values is considered in the model. Depending on information availability, it is planned to replace it with the real-time daily information. As for many rivers model with employed horizontal resolution of order 3 km do not gives possibility to resolves directly river estuaries, the mouth depth is specified and if an adjacent coastal ocean model cells is deeper than river mouth, the fresh water is intruded into the upper model layers only.

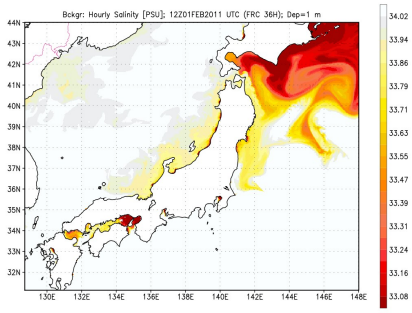
JCOPE-T system runs daily generating hourly ocean state forecasts for approximately one weekly. System operations are automated and simulation results are downloaded to the JCOPE web server at http://www.jamstec.go.jp/frcgc/jcope/vwp/

Some results

Figure 1 demonstrates modeled distribution of ocean water with salinity less then 34.1 psu at the sea surface around Japan for February 1, 2011. Except of significant intrusion of law salinity waters from the Okhotsk Sea along the eastern coast of Hokkaido, rivers discharge forms the lower salinity water belt along the Japan Sea coast as well as impacts salinity distribution along the northern Honshu and in almost all bays along the Pacific coast of Japan: Tokyo Bay, Ise Bay, Seto Inland Sea (especially in the Osaka Bay), and in the Ariake Sea near Kyushu island.

Apart of impact on salinity distribution, rivers discharge changes the coastal ocean density field and causes modification of local horizontal and vertical ocean circulation. For example, model reproduces upwelling zones adjacent to river discharge locations. Due to the induced pressure gradient, bottom waters are pushed to the river mouth direction forming bottom-concentrated coastline-directed current and coastal upwelling. In summer time this upwelling could be clearly seem in surface temperature distribution.

Compared with other ocean desalination processes like atmospheric precipitation, rivers discharge has fixed geographical location, it is continuous in time and, as result, its impact could have accumulative nature. Accounting for it seems to be important and necessary for the correct modeling of coastal circulation and environment.



キーワード: river discharge, coastal operational oceanography, ocean modeling
Keywords: river discharge, coastal operational oceanography, ocean modeling

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アムール川における鉄生成・輸送モデリング－1990 年代後半の急激な増加解明へ向けて－
Dissolved iron production and transport in the Amur River basin;toward complete understanding of late 1990s' increase

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近年の海洋研究により，北部北太平洋における一次生産量は鉄に律速されており，そのソースの重要な部分はアムール川であることが実証された．アムール川から供給される鉄は溶存態鉄であり，その大部分は有機物との錯形成により安定的に河川水中に存在している．この溶存鉄の生成には，湿地における未分解の有機物の生成と還元状態の形成による鉄還元プロセスが深く関与していることが実証的に示されている．中国とロシアの両国にまたがるアムール川流域は，20 世紀を通して人間活動が活発に展開した地域でもあり，多くの湿地が農地へ転換されてきた歴史を持つ．つまり，陸域における人間活動が鉄の生成に影響を及ぼし，さらに海洋における生物生産にも影響を及ぼしうることが明らかになってきた．そこで，本研究では，土地利用変化が溶存鉄生成量にどの程度の影響を及ぼしうるのかを評価することを目的として，アムール川流域における溶存鉄の生成と輸送のメカニズムを考慮した水文モデルを構築した．

構築した水文モデルは，流出計算モジュール，河道追跡モジュール，溶存鉄生成モジュールから構成されている．流出計算モジュールと溶存鉄生成モジュールの空間解像度は 1km であり，河道追跡モジュールのそれは 0.5 °である．また計算の時間ステップは流出計算モジュールと溶存鉄生成モジュールで 1 日，河道追跡モジュールで 10 分となっている．チューニングパラメータの数を極力抑え，1981 年～1983 年の期間でパラメータのチューニングを行い，1984 年～1990 年の期間でモデルのバリデーションを行った．検証データは，河川流量と溶存鉄濃度である．バリデーションの結果，流量，溶存鉄濃度データともに月流量，月平均溶存鉄濃度の時間解像度で，十分な精度の計算結果が得られることが確かめられた．ところが，1990 年代後半には，それ以前には観測されなかった急激な鉄フラックスの増加が観測されており，構築したモデルでは再現することができていない．現在，この増加に関与しうるプロセスとして，(1) 溶存鉄濃度の高い地下水灌漑，(2) 大規模な洪水氾濫による一時的な湛水，(3) 春先の融雪・土壌の凍結・融解プロセス，が考えられる．そこで，これらのプロセスをモデルに組み込むことを通じて，1990 年代後半における鉄フラックス増加のメカニズム解明を試みた結果を報告する．

キーワード: 溶存鉄, 洪水, 灌漑, 凍結融解
Keywords: dissovled iron, flooding, irrigation, freezing and thawing

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チュニジア東部沿岸地域における地下水と地表水の交流プロセス
Interaction between surface water and groundwater in a coastal region of east Tunisia

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Maki Tsujimura[1*], Anis Chekirbane[1], Mizuho Takahashi[1], Atsushi Kawachi[1], Wataru Yamada[1], Mitsuteru Irie[1], Hiroko Isoda[1], Jamila Tarhouni[2]

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チュニジア東部の Cap-Bon 半島沿岸域において、地表水と地下水の交流プロセスを明らかにするため、安定同位体、無機溶存成分等によるマルチ・トレーサー手法の適用、および地下水位、河川流量等の水文観測を実施した。

地下水および地表水の水質特性、安定同位体特性、ならびに河川流量の空間分布から、河川水・物質収支モデルを構築し、地表水から地下水への涵養量を推定したところ、当地域における地下水涵養において地表水の果たす役割が、無視し得ないことが示された。またこの推定結果は、地下水面の空間分布形状とも合理的に一致した。

さらに、海岸近傍では農業灌漑のための地下水揚水に伴い、地下水への海水侵入現象が明確に観測された。

キーワード: 地下水ー地表水連続系, 地下水涵養, 沿岸域, チュニジア
Keywords: Groundwater-surface water interaction, Groundwater recharge, Coastal region, Tunisia

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気候変動の影響を考慮した日本の河川における土砂負荷量の将来予測
Future projection of potential suspended sediment load in Japanese rivers under climate change

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Suspended sediment concentrations (SSCs) affect river water quality and can be a threat to aquatic life. Moreover, the annual rate of reservoir storage capacity loss to sedimentation in the world is 0.5?1%, and it varies dramatically for different river basins due to their forest cover and geological conditions. Therefore, estimation of SSCs is essential for characterizing water quality and water resources management. In this study, the total amount of suspended sediment load carried by Japanese streams is discussed. Firstly, the relationships between suspended sediment load and hydrogeography were examined by analyzing river water SSCs observation data at about 400 agricultural and forest watersheds in Japan. Suspended sediment transport was found to be importantly affected by changes in river discharge and watershed characteristics. Then, multiple regression models were built to test the national scale estimation for the indicator of SSCs. The resulted estimation of SSCs provided satisfactory simulations in terms of the selected performance criteria comparing well with the observed SSCs. Finally, the potential suspended sediment load in Japanese rivers under climate change was estimated by considering the future changes of river discharges simulated by a national scale distributed rainfall-runoff hydrological model. The temporal and spatial distribution of suspended sediment load in Japan was then evaluated under future climate change scenarios.

キーワード: 気候変動, 河川, 土砂
Keywords: Climate change, River, Sediment

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Development of a Regional Coastal Ocean Ecosystem Model for SEA-WP Regions
Development of a Regional Coastal Ocean Ecosystem Model for SEA-WP Regions

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We are developing a regional coastal ocean ecosystem model for SEA-WP (South East Asia and West Pacific) regions, which encompass the exceptionally dense and rich marine biodiversity area in the world. The ecosystem model is coupled with a high resolution regional ocean model, which can resolve complicated eddying motion of currents in SEA-WP regions. The model has been largely extended from a simple NPZD (Nutrient-Phytoplankton-Zooplankton-Detritus) ocean ecosystem model so that it can be applied to SEA-WP regions. One of our research concerns is to highlight some relevant aspects of coastal phenomena in the SEA-WP regions into the regional ecosystem model and thereby to demonstrate the complexity of coastal processes in the regions. Our preliminary results show that the surface chlorophyll-a values simulated by the model reproduced well to those detected by the ocean color satellite imagery showing high concentrations of surface chlorophyll in the coastal regions in SEA-WP, especially in Indonesian archipelago, and low concentrations in the subtropical ocean regions.

キーワード: coastal ocean ecosystem model, regional ocean model, SEA-WP regions
Keywords: coastal ocean ecosystem model, regional ocean model, SEA-WP regions

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Sensitivity analysis of a distributed hydrological model: application of SWAT model in the upper stream of Yoshino River

Sensitivity analysis of a distributed hydrological model: application of SWAT model in the upper stream of Yoshino River

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Due to the uncertainties of the hydrological model calibration associated with input-output data, model structure and parameters, the over-parameterization is a hot topic related to the hydrological model. Sensitivity analysis of those models is supported to set up least parameters for fitting with the input-output data in a best condition. This sensitivity analysis can identify parameters which do or do not have a significant effect on the model simulations. The purpose of this study is to understand the sensitivity of parameter when the model was calibrated under the present and future condition. Firstly, the Soil and Water Assessment Tool-Calibration and Uncertainly Programs (SWAT-CUP) model was used to analyze the global sensitivity of the Soil and Water Assessment model in a Japanese river catchment. Two approaches such as the Generalized Likelihood Uncertainty Estimation (GLUE) and the Sequential Uncertainty Fitting (SUFI-2) were used for the global sensitivity analysis. For calibrating and validating the SWAT model by using the observed stream flow data, we selected 10 parameters such as initial SCS runoff curve number (CN2), base-flow alpha factor (ALPHA_BF), groundwater delay time (GW_DELAY), Manning's "n" value for the main channel (CH_N2), effective hydraulic conductivity in main channel alluvium (CH_K2), base-flow alpha factor for bank storage (ALPHA_BNK), available water capacity of the soil layer (SOL_AWC), saturated hydraulic conductivity (SOL_K), moist bulk density (SOL_BD), and snowfall temperature (SFTMP). The calibration period is from 2003 to 2005, and the validation period is from 2006 to 2008. The calibration result by using GLUE shows better results than those by using SUFI-2. But the processing time of the GLUE approach was longer than the SUFI-2 approach when they were run in the SWAT-CUP. According to this global sensitivity analysis, it shows that CN2 and ALPHA_BF have the most sensitivity on the calibration of SWAT model for this catchment. The 5000, 10000 and 15000 samples of GLUE and 500, 1000, 5000 samples of SUFI-2 were tested in this study. Result shows the identifiability was increased with the increasing sample size of these two methods. Finally, the sensitivity analysis under the future condition was studied by using the output from Global Climate Model (GCM20).

キーワード: sensitivity analysis, SWAT, GLUE, SUFI-2, GCM
Keywords: sensitivity analysis, SWAT, GLUE, SUFI-2, GCM