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Integrated database of oceanographic observation cruise -Toward the ”One-Stop Data Shop” in JAMSTEC-

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JAMSTEC has performed many research cruises using its research vessels and submersibles for about 30 years, and the abundant data and samples obtained from these observations and researches have been opened on JAMSTEC’s web sites. DrC (Data Research Center for Marine-Earth Sciences) in JAMSTEC manages data in diverse data fields such as oceanography, meteorology, geophysics and biology, and in various data forms (e.g. numerical value, image, movie, figure, document and sample). These data are opened in the respective data sites corresponding to their fields and forms. In case researchers were going to analyze related interdisciplinary data, they might have to search and collect data from many data sites. In order to overcome this barrier, DrC has provided some data research services; ”JAMSTEC Data Search Portal[1]” in which users can search data in the area identified on a map, and ”JAMSTEC Data Catalog[2]” in which users can search data sites from a category tree system composed of science keywords. Currently, DrC is constructing a new data dissemination system to support efficiently searching, visualizing and providing the data toward the ”One-Stop Data Shop” that enables users to handle data comprehensively. In this presentation, we report the outline of this on-going project.

The data obtained from JAMSTEC’s research cruises and managed by DrC is opened in ”JAMSTEC Data Site for Research Cruises[3]”, which consists of an aggregate of html pages. We are now developing a database (named as Data Research System for Whole Cruise Information in JAMSTEC (DARWIN)) for data and sample information form research cruises and dives. This enables users to search the data by various terms of metadata, and to overview the cruises, dives and data arranged in order of categories such as name of research vessels or submersibles, data types, research period, etc. Also users are able to keep data files in the data basket and download them at a time, to visualize data contents on demand, to search data on a map and to extract data within an area of interest. Automatic linking to the other databases in JAMSTEC helps users to access easily to the related data from this database. DrC expects this system to be a possible basis of the ”One-Stop Data Shop” of the data in JAMSTEC.

1: http://www.godac.jamstec.go.jp/dataportal/
2: http://www.godac.jamstec.go.jp/catalog/data_catalog/
3: http://www.godac.jamstec.go.jp/cruisedata/j/

Keywords: database, One-Stop Data Shop, data management, oceanographic observation

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A new framework to integrate the marine biodiversity information around Japan

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Occurrence records of organisms (when and where an individual of an organism occurred) are essential information to understand the distribution of each species as well as to assess the local and global biodiversity. In the last decade, a global database for marine species, the Ocean Biogeographic Information System (OBIS, http://www.iobis.org) constructed by the Census of Marine Life and now working under the International Oceanographic Data Exchange (IODE) in the International Oceanographic Commission (IOC) of UNESCO, was established, and the integration and accumulation of occurrence records of marine organisms have greatly progressed. Currently, OBIS holds 32.2 million records from 1014 datasets, and covers 145 thousand species in 200-250 thousand known species from world oceans. As the results, OBIS became a major marine component of the Global Biodiversity Information Facility (GBIF) and the data contributed to researches challenging the assessment and prediction of the global biodiversity. However, several data biases are present on OBIS. For example, most occurrence records come from shallow waters, and the data from deeper regions (particularly over 2,500 m depth) is quite scarce. Additionally, OBIS data covers only 4.8 thousand species against 33 thousand species known from Japanese waters. These data gaps may affect the accuracy in estimating and predicting local and global marine biodiversity.

The Japan Agency for Marine-Earth Science and Technology (JAMSTEC) is holding specimens of marine organisms collected through the deep-sea researches and expeditions and has archived videos/photographs taken by submersibles such as the DSRV Shinkai 6500. A considerable amount of occurrence records based on the collection and observation by JAMSTEC may be able to compensate for a part of the scarceness of deep-sea data from on OBIS. Therefore, JAMSTEC start to provide the data to OBIS since 2010, through the data system named the Biological Information System of Marine Life (BISMaL, http://www.godac.jamstec.go.jp/bismal) constructed and operated by JAMSTEC. Furthermore, JAMSTEC decided to host the Japan Regional OBIS Node (J-RON) and to start collecting data held by researchers as well as institutions in Japan. Although J-RON is not formally launched yet because the organization including non-JAMSTEC researchers/officers is now ongoing, a nation-wide research program supported by the Ministry of Environment, Japan, covering a variety of marine habitats from shallow to deep, already plans to provide data to J-RON and publish it through BISMaL as well as OBIS. Furthermore, the Tohoku Marine Science project ,assessing effects of the great tsunami on 11 March 2011 on the marine ecosystem of the disaster area and evaluating the recovery process, by the Ministry of Education, Culture, Sports, Science and Technology, Japan, has just started, and the possibility to publish biological data through BISMaL/J-RON is discussed in JAMSTEC responsible to the data management and data publishing. The integration and accumulation of the marine biodiversity information around Japan must be not easy and take a long way, however, the new framework consisted of BISMaL/J-RON and OBIS is sure to make a robust baseline to analyze the biodiversity profiles in the adjacent waters of Japan and further contribute the better understanding of the global marine biodiversity.

Keywords: Biodiversity information, Ocean Biogeographic Information System, Biological Information System for Marine Life, Japan Regional OBIS Node, OBIS, BISMaL

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GPS Preciptable Water Research Project (GRASP)

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A novel project (GPS pRecipitable wAter reSearch Project) GRASP has been launched to investigate variations of precipitable water vapor caused by the climate change. The water vapor is one of the greenhouse gases, which is more effective than CO2, so it is important to observe water vapor change for a long period.

More than 1,000 points stationary data of GPS were collected globally from International GNSS Services and GPS Earth Observation Network System (GEONET) in Japan over 15 years from 1996 through 2010. Atmospheric zenith total delay (ZTD) caused by refractivity of pressure, temperature, and water vapor pressure is estimated by the GPS processing software RTNet (Rocken et al 2006, Iwabuchi et al. 2006), where fiducial coordinate of GPS position is estimated periodically in a month to absorb any un-modeled and site-specific biases. Sophisticated seamless processing is performed every month to prevent jumps of ZTD solution in day boundary as observed in historical ZTD database. The estimated ZTD is converted to precipitable water vapor by metrological data derived from Japan Meteorological Agency or reanalysis data of NOAA with high-temporal resolution (CFSR) that have been performed altitude correction. The temporal resolution of some product is relatively high with 10 min, which is applicable to climate research within a day such as diurnal circulation of water vapor.

The greatest advantage of GPS precipitable water includes high temporal resolution and high accuracy of absolute value, comparing with other data of water vapor (Radiosonde, water vapor radiometer, lidar, SSM/I, etc.). Furthermore, the dataset of GPS precipitable water will be released to public by WWW. It could not only be important information to understand behavior of long-term water vapor variability and circulation, but also to be helpful to further explain mechanism of heavy rainfall cases affected by the climate change with addition of the high quality precipitable water vapor information.

Keywords: Dataset, GPS precipitable water vapor, Climate change

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Towards A System of Data Systems in geoscience: Marussi Tensor and Invariants of the New Earth Gravity Field Models

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Global combined gravity field models of the Earth, based on satellite and terrestrial data, have today worldwide high resolution (for example 5x5 arcmin for EGM2008) and precision (of order 1 miliGal). They are subject of intensive international data exchange with a feedback in an extensive palette of geo-applications, namely in geodesy, geophysics, geology and physical geography. In our paper two modern gravity field models are applied, both combined from recent satellite and extensive terrestrial data; EIGEN 6C comprises already GOCE data while EGM2008 has only older GRACE data.

With the gravity field models, which consist of the harmonic geopotential coefficients or Stokes parameters to high degree and order in spherical harmonic expansion (e.g., to 2160 in the case of EGM2008), detailed geoid undulations and gravity anomalies (or disturbancies) can be computed. Moreover, we computed the full Marussi tensor of the second derivatives of the disturbing potential, namely Tzz, the invariants of the gravity field I2, I3 and a ratio of them. These quantities give much more evidence about details of near-surface (not deep) structures and can be used in local scales (few kilometers) for petroleum, metal, diamond, ground water etc. explorations and in regional scales (˜100 km), e.g., for studies of large impact craters and active tectonic zones. Using EGM2008 we have a resolution ˜ 9 km half-wavelength on the Earth surface: it is not sufficient for studies of local details, however, it is very valuable for regional and large-scale surveys.

In the presented paper are studied selected regions where the second derivatives and the invariants are valuable for geo-applications, that is in the Arctic and Antarctic areas, in the Himalaya and similar mountain belts and in further localities, such as are impact craters. For example, they are demonstrated our results of the correlation of Tzz values computed from EGM2008 with morphogenetic and orographical patterns of the Nepal Himalaya. Very variable values of Tzz display significant gravitational signatures of extensive differences and changes in mass density and/or rock massif and regolith distributions which occurred during very dynamic landform evolution of the Nepal Himalaya in the late Cenozoic. Variable large-scale configurations of values of Tzz give evidence of the long-term operation of certain complexes of morphogenetic processes producing the evolution of not only distinctive topographic features, but also, especially, of specific relief types of the Earth.

Our primary interest in this study is to compute abovementioned quantities for the territory of Japan and surrounding seas/ocean for possible application and further investigation by Japanese geophysicists. This may lead to exchange of data and results and to an extension of application of the gravity field models in various specializations (which would be nice feedback for us).

Keywords: gravity field of the Earth, Marussi tenzor, gravity invariants, System of Data Systems in geoscience, satellite GRACE, satellite GOCE