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

HTT09-P01 Room:Convention Hall Time:May 20 18:15-19:30

Classification of shallow-water bottom features by using DEM obtained by airborne LiDAR bathymetry

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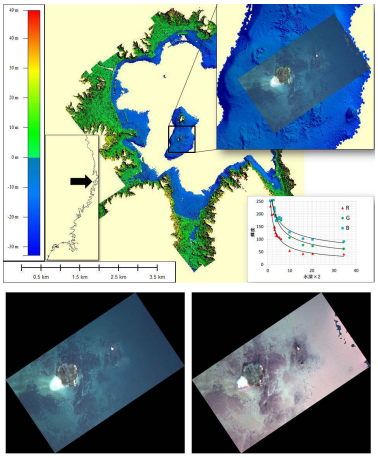
The distribution of sea grass habitats is an important and basic piece of information for understanding shallow sea environments. Supervised and unsupervised classification of aerial photographs and satellite imagery is an effective method to assess the state of shallow-water bottom features. For accurate classification, it is important to measure the topography of the seabed extensively and at high resolution, because each band brightness should be corrected by depth. This is difficult, as the depth of the water restricts the movements of survey vessels.

In this study, we generated a Digital Surface Model (DSM) of shallow-water bottom features via airborne LiDAR bathymetry. We and then used the DSM and aerial photographs to classify the bottom features. Airborne LiDAR systems can measure the depth of shallow water of $<$ ˜30 m depth using 532 nm wavelength laser pulses. As part of the research project ”Evaluation of multiple geological risk for giant earthquakes and tsunamis, - comprehensive geological approaches for the Great East Japan Earthquake” conducted by the National Institute of Advanced Industrial Science and Technology (AIST), we conducted simultaneous bathymetry and aerial photography of several bays in the east coast of Tohoku, Japan. We used a Fugro LADS Mk III system for bathymetry and a Redlake image sensor for aerial photography. A 5 m grid (max. 2.5 m) DSM and 0.4 m resolution orthophotograph can be obtained (Matsunaga et al., this meeting) with these instruments.

We classified the Redlake imagery, satellite imagery, and other aerial photograph after absorption corrections at each band by using topographic data. The M7000 series 1 m interval isobath data compiled by the Japan Coast Guard were also used for the topographic analysis.

Keywords: Airborne LiDAR, supervised classification, shallow-water bottom features, absorption correction



Japan Geoscience Union Meeting 2013
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Morphometric analyses of Danxia landforms in China using GIS and DEMs

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We conducted DEM-based geomorphometric analyses to assess the influence of lithology and geologic structures in shaping the morphology of sub-tropical mountain stream channels in the Chishui, Mt. Danxia and Longhu areas, the typical Danxia landforms in China. The areas show different stages of erosion: young, mature and old. Basic properties of drainage structure such as stream order, drainage density, the bifurcation ratio, hypsometry and the stream length ratio, as well as slope angle data for sub-watersheds were obtained from DEMs. Then relationships among the morphometric properties were investigated. The relationship between drainage density and slope angle for each sub-watershed can be divided into four types that correspond to the different stages of channelization. Stream longitudinal and transverse profiles for the watersheds were then examined, and anomalous points where the morphometric characteristics change abruptly were identified. The locations of ca. 80% of the identified anomalous points correspond to the knickzones where relative steep river segment were identified based on analyses of stream gradient. The geomorphic indices of concavity and steepness were calculated from stream slope?area data. concavity is a measure of stream-profile curvature and is a function of channel substrate properties Transition from incision to deposition and lithology are responsible for the change in concavity. A prominent knickzones may represent the upstream propagation of base level lowering is accommodated by headward erosion. Some knickzones are also related to the boundaries of lithology and flow perturbation around major stream confluences. We suggest that the relative location of the watersheds play a significant role in the evolution of morphology of the landscape for the early stage region; whereas, the shape of the topographic profile in the old and mature stage regions mainly corresponds to lithologic contrasts and relief structures.

Keywords: Danxia Landform, DEM, Knickzone, Concavity and steepness, Longitudinal and transverse profiles

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Estimation of land use maps considering spatial dependence in a spatial filtering framework

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The present study builds a spatial statistical model that estimates land use maps. We use the land utilization database of the National Land Numerical Information published by the Ministry of Land, Infrastructure, Transport and Tourism, in Japan, as the data source. Of the many approaches to modeling land use maps thus far proposed in the literature, representative method is using a multinomial logit model, in which the likelihood of placing each land use category into each zone is explained by selected attributes such as population and elevation. Because neighboring zones tend to be categorized into the same land use classes, considering spatial dependence among zones is important when applying a multinomial logit model for modeling land use maps. Although previous studies have attempted to take account of spatial dependence using spatial econometrics techniques, such methods require a computationally burdensome iterative calculation in order to estimate the parameters, for example the expectation-maximization algorithm or Markov chain Monte Carlo method. On the contrary, the present study employs a spatial filtering framework, based on a spatial statistical approach, in which the parameters are estimated using the standard maximum likelihood method in order to model spatial dependence. The obtained results suggest that compared with conventional non-spatial multinomial logit models, the predictive power in terms of the AIC is substantially improved when using spatial filtering.

Keywords: land use, spatial filtering, spatial dependence, multinomial logit model

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Spatial clustering for property valuation with hedonic pricing

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Many real estate studies have pointed out the importance of market segmentation in formulating the hedonic price function for property valuation or understanding market structures. While previous studies have suggested certain segmentation criteria, there continues to be a lack of consensus on the same. Most existing works defines segments depending on administrative districts or place-names. Few studies have also attempted searching for and optimizing segments with certain cost functions. Moreover, some studies have noted that segments should be geographically continuous. Spatial clustering or regionalization is a method used to determine the optimized geographic segment applying a certain criterion or cost function. Usually, the segmentation criterion points to the homogeneity of a certain attribute, and samples belonging to a same segment have similar attribute values. The segments have often been used to capture spatial heterogeneity. Segments based on administrative districts might not fulfill the intended role in this purpose. In this study, we consider spatial heterogeneity or lack of uniformity in price structure using a geographically generated heterogeneity. Geographically Weighted Regression (GWR) has often been used for coping with a spatial heterogeneity that obeys a spatially smooth function. However, such assumption of smoothness might be erroneous, because there could be abrupt geographical changes in the price structure.

In this study, we propose a new segmentation method, using price functions dealing with spatial heterogeneity on property valuation. This segmentation approach allows local updating of segments so as to capture the spatial heterogeneity, starting from a given initial segment solution. In addition, this segmentation method is constrained geographically (in terms of spatial continuity of each segment). Finally, we conduct an empirical study using the proposed segmentation method. The results indicate the effectiveness of the proposed method, in terms of capturing spatial heterogeneity.

Keywords: spatial clustering, regionalization, hedonic pricing method, spatial heterogeneity