別紙様式 8

研　究　主　論　文　抄　録

論文題目　（和文）：衛星リモートセンシングによる塩類集積域の時空間変化抽出と塩害化進行の要因分析
-中国タリム盆地北部をケーススタディとして-

（英文）：Spatio-Temporal extraction of Salinized Soils and Causes of the Salinization based on Satellite Remote Sensing
-A Case study in the Northern Part of the Tarim Basin, China-

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主論文要旨
《本文》

ABSTRACT

It is estimating that the areas of the salt accumulated lands including salinized soils are 300 million to 900 million ha on the Earth. This accounts for about 10 % of the total usable land resources. Leakages from the soil waterway, improper irrigation, and incomplete drain system have raised the groundwater levels in arid areas and caused salinization, i.e. accumulation of salts in the top soils. Recently, because of the salinization abundant farmlands and desertified lands have been increasing continuously.

This paper addresses an environmental remote sensing algorithm to extract the salt accumulated areas by using the visible and infra-red portions of the radiation energy reflected from the soil surfaces. In addition, we proposed an algorithm to retrieve desertification and salinization mechanisms in terms of spatio-temporal changes. The northern part of the Tarim basin, namely the northern part of the Taklimakan Desert, has been selected the study area. This paper organized as follows:

Chapter-1 contains a description of the background of the study and existing methods of the Environmental Remote Sensing methods related to the topic.

Chapter-2 contains analyses including environmental changes, status of the desertified lands and our unique approach to solve the issues in study area.

Chapter-3 contains retrieving necessary parameters and data by using the satellite images. In order to obtain the status of the desertification and vegetation coverage, SAVI (Soil Adjusted Vegetation Index) has been applied. Seasonal and annual variations of the vegetation index has been calculated by using data observed for nearly 30 years until 2006. The obtained results show that the vegetated areas have been increased in the upper reaches of the rivers along with the cultivation activities. However, the vegetated areas have been decreased in the middle and lower reaches of the rivers because of the soil salinization and desertification.

In Chapter-4, an algorithm to extract the salinized soils (salt accumulated area) in terms of time and space has been proposed based on the analyses of 40 scenes of the ASTER images. First, several satellite data derived indices SAVI, NDSI, NDVI have been calculated by using the observed satellite images in order to extract vegetation status, soil properties and soil moisture information in the study area. Using the extreme values of the indices above, a new index, NDXI, has been proposed. The NDXI index derived from the ASTER data of 2004 indicated that in the rain season it is not possible to extract the salt accumulated area since the soil moisture value might be higher. However, the salt accumulated area might be increased in the summer season because of the strong vegetation activities. We found that the mechanisms of the salinization or salt accumulation are different based on the amount of the soil moisture content of the soils. Furthermore, the salinized soils were found to have extended in the lower reaches of the rivers, and their area increased monotonously with the time while the area of fixed dunes decreased largely. We proposed a Salinity Index to extract correctly the salinized soil areas from the ASTER images by refereeing to the reflectance spectra of the soil samples. This Salinity Index clarified that the salinized soils have high salt concentrations over 30 ppt and the concentrations of the moving sands are also high. In addition, the high salinity accumulation in the downstream of farmlands was identified, which implied a strong effect of agricultural development on the salinization.

Chapter-5 contains soil surface temperature estimation in the arid areas based on the Law of Plank by using the Landsat TM/ETM+ and ASTER data. As a result, the soil surface temperatures are relatively low in the vegetated areas and farmlands. Thus, the relationship between the land coverage and soil surface temperature has been correctly extracted. On the other hand, soil surface temperatures are high, even so surface temperatures are lower on the bare soils with higher moisture contents. Therefore, the soil surface temperature is a key parameter when evaluating the degree of the salt accumulation in the arid areas. High accuracy estimation of the salinization and desertification can be expected by combining this method and reflection spectra method in the previous chapter.

Chapter-6 contains conclusions and results of the each chapter.
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