APPLICATION OF AIRBORNE REMOTE SENSING TO THE SURFACE SEDIMENT CLASSIFICATION IN A TIDAL FLAT

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1. INTRODUCTION

For an achievement of surface sediments distribution in tidal flats, remote sensing techniques based on the in-situ dataset have been widely used [1], [2], and many studies on the relationship between spectral characteristics and the tidal sedimentary environments have been also attempted [3], [4]. However, precise classifications of tidal surface sediments have been little successful due to the limitations of the spatial resolution of the remote sensing system. So more recently, airborne remote sensing has been applied to the mapping of the surface sediments facies in tidal flats [5], [6]. A great advantage of airborne remote sensing with high spatial resolution is that we can identify the spectral and textural differences which are represented in the image, so the accomplishment of the accurate mapping is possible. In this paper, mapping of the surface sediment distribution in a tidal flat is achieved based on field works and a tuning of classification using an airborne remote sensing is attempted. In the process, the distribution of tidal channels is related to the surface sediments facies as an important factor influencing the sediments distribution in the tidal flat. This study is carried out in Geunso Bay, Korea (Fig. 1a), which is characterized by 70 % of its tidal flat being exposed at ebb tide and the shallow water depth of about 2 – 4 m at flood tide.

2. DATABASE AND METHODOLOGY

A total of 45 grain samples (Fig. 1a) were acquired at gridded intervals by the grab sampler using a ship at flood tide on February, 2009. For each sample, the percentage of grains that are larger than very fine sand (0.0625 mm) was analyzed according to the Folk's criteria [7]. The samples were classified into three types of facies such as sand flat which included more than seventy percent of fine sand grains, mixed flat (30 – 70 %), and mud flat (0 – 30 %). Based on these in-situ dataset, a map of surface sediments distribution was produced by an interpolation method. The surface sediments in the study area was classified as 3 facies such as mud flat, mixed flat and sand flat (Fig. 1b).

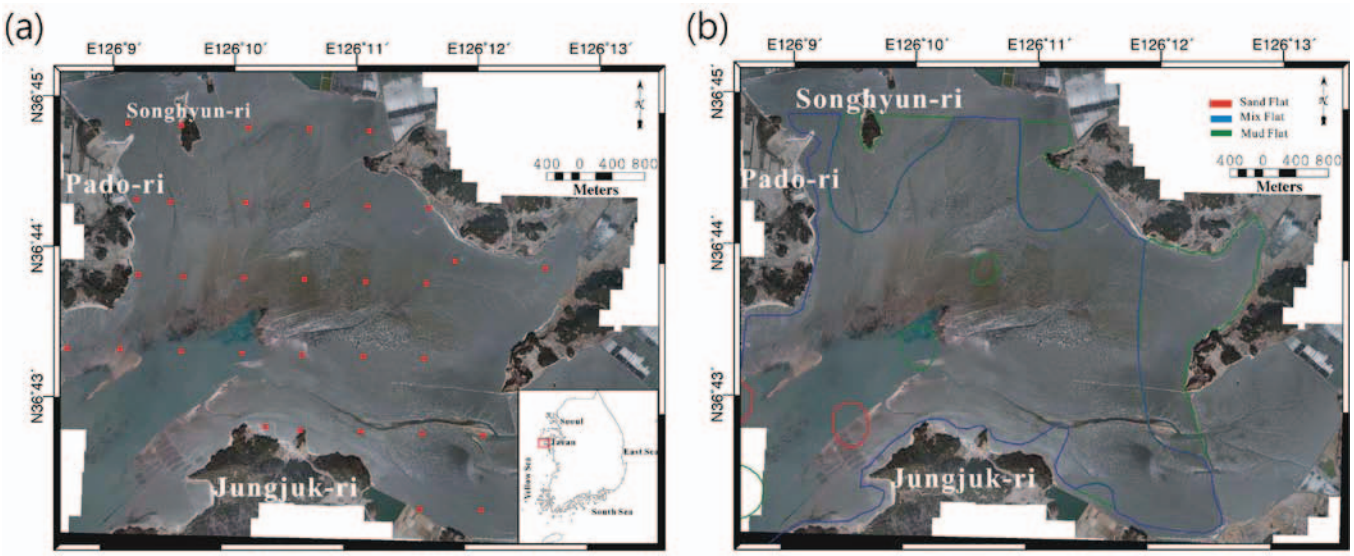

Fig. 1 (a) Aerial photo image of the study area acquired at Feb., 2008 overlaid with the sampling points collected at Feb., 2009 and (b) the distribution of surface sediments facies induced from the in-situ data of Feb., 2009

An aerial photo image of the study area was acquired at February, 2008 of which spatial resolution was 50 cm. This airborne remote sensing was used for the extraction of tidal channel by a visual inspection. The extracted tidal channel database was applied to the fractal analysis for a quantitative estimation of the tidal channel distribution. The density of the tidal channel and the distance from tidal channel were also constructed as grid maps, respectively. Those data about tidal channel were used for the calculation of quantitative relationship with the distribution of surface sediments facies by GIS (geographical information system) analysis. The results of these analyses were compared with the map of surface sediments distribution which was induced by the field work (Fig. 1b) for the tuning of boundary of sediments facies.

3. RESULTS

Fig. 2a shows the distribution of tidal channels with a digital elevation model (DEM) of the study area. The mixed flats were characterized by simple tidal channel patterns of relatively low density. By contrast, the mixed flats showed a dendritic pattern with a relatively high channel density. According to these characteristics, tuning of boundary of sediments facies was attempted for the map of surface sediments distribution induced by in-situ dataset. As shown in Fig. 2b, tidal channel existed along the boundary of sand ripples, so the boundary of mud flats was extended to the area where sand ripples existed (Fig. 2e). In Fig. 2c and 2d, the area having the same tidal channel pattern as in the mud flats were classified into mixed flats. Therefore, the boundary was adjusted considering the tidal channel pattern as in Fig. 2f. For more quantitative adjustment of sediment facies distribution, estimations of spatial relationship between the sediment facies and the tidal channel distribution will be carried out. In addition, reliability is supposed to be validated through an additional field work in the area of adjusted facies.

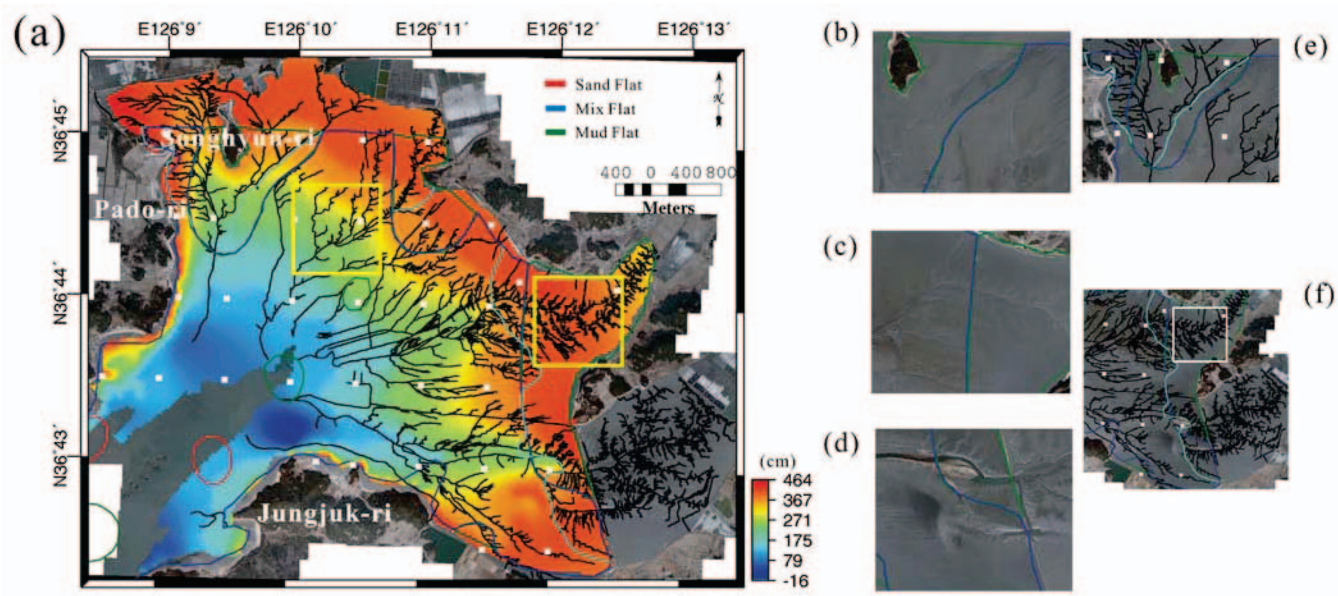

Fig. 2 (a) The distribution of tidal channels with a digital elevation model (DEM) of the study area overlaid on the aerial photo image. and (b)-(f) the area of sediment facies adjustments.

4. DISCUSSIONS

In this study, tuning of the surface sediment distribution in a tidal flat was attempted based upon the tidal channel pattern represented on an aerial photo image with a high spatial resolution. The differences in tidal channel pattern according to the sediment facies in the tidal flat can be successfully identified through the airborne remote sensing. Consequently, the characteristics of tidal channel pattern can be effectively applicable to the mapping of surface sediment facies in the tidal flat.

5. REFERENCES

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