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JERS-1 および ALOS/PALSAR による海岸汀線の時系列評価
Shoreline change analysis using JERS-1/SAR and ALOS/PALSAR amplitude images

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Aerial photo analysis and bathymetric survey are commonly conducted to investigate the actual conditions and temporal variation in beach transformation. In recent years, satellite-based optical imagery has been more widely used to evaluate coastal erosion. However, defining shoreline edges using optical imagery is difficult because the sand under seawater near the shoreline can often be seen through clear water. On the other hand, synthetic aperture radar (SAR) imagery can be used to interpret the boundary between a sandy beach and seawater; this is possible because the incident radio waves are not transmitted through water, and SAR images can be compared to trace the shoreline. In this work, we examine the potential of shoreline change analysis by using Japanese Earth Resources Satellite 1 (JERS-1)/SAR and Advanced Land Observing Satellite/Phased Array type L-band Synthetic Aperture Radar (ALOS/PALSAR) amplitude images. We consider Kujy?kurihama beach in Chiba Prefecture as our test site; along this beach, the shoreline is almost perpendicular to the SAR antenna beam orientation for the descending orbit.

We propose a three-step automated shoreline-tracing method to assess the temporal variation of the shoreline in the study area; the HH-polarized JERS-1/SAR amplitude image captured on February 22, 1993, and the HH-polarized ALOS/PALSAR amplitude image captured on May 20, 2010 were used for this purpose. In our method, a shoreline is traced as vector data. In the first step, edge pixels in SAR images are identified by using the Laplacian of a Gaussian filter. In the second step, unwanted edge pixels are masked on the basis of a discriminant analysis in which candidate shoreline edge pixels are estimated by using statistical information within a moving window. The criteria for identifying shoreline edge pixels is decided on the basis of previously gathered data, the backscattering average, and the standard deviation, in the training area (30 by 10 pixels) encompassing the sea, shoreline, and land. In the third step, shoreline vector data are generated from continuous candidate shoreline edge pixels by an automated shoreline-tracing algorithm.

The results were verified in two ways. We first verified the location of the shoreline edge in the SAR amplitude images by overlaying multispectral images acquired on dates close to the acquisition dates of the earlier mentioned JERS-1/SAR data and ALOS/PALSAR data: the JERS-1/Optical Sensor (OPS) color composite image acquired on May 3, 1993, and the ALOS/Advanced Visible and Near Infrared Radiometer type 2 (AVNIR-2) color composite image acquired on January 8, 2011, were used for this analysis. Next, we calculated the statistical information of the backscattering data in the JERS-1/SAR and the ALOS/PALSAR amplitude images for our selected training area. It is noteworthy that the backscattering average and standard deviation in the shoreline training area is a unique than anything training area.

Our proposed method reproduces the temporal variation of the shoreline by using JERS-1/SAR and ALOS/PALSAR amplitude images. However, a part of the shoreline extracted using the JERS-1/SAR amplitude image was inaccurate. The speckle noise in the JERS-1/SAR amplitude image and the low spatial resolution of the raw data may have caused these errors. In our future work, we intend to improve the algorithm for JERS-1/SAR data and accumulate backscattering information of shoreline edge areas using SAR amplitude images.

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