Shoreline Feature Extraction from Remotely-Sensed Imagery

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Abstract - **Different methods of delineation were used to extract shoreline features from images with different spatial and spectral resolutions acquired by airborne and spaceborne sensors. The exact location of the shoreline is difficult to obtain from the images and therefore the definition of shoreline was based upon the geomorphological and oceanographic characteristics of the area of study. Extracted shoreline vectors were then compared to existing official shoreline vectors to assess their accuracy and software efficiency. It is expected that the generation of shoreline vectors with a high accuracy will greatly improve the time of work and number of specialised personnel, and allow for the integration of the resulting shoreline vectors into cartographic databases.**

I. Introduction

The coastal zone can be simply described as the area where land and sea meet. Despite covering a very small area on global scale, it is the most widespread boundary on the planet, extending along all continental margins. The observation of changes along the coasts using aerial photography began in the early 1930's and since then methods for studying these variations have substantially improved through the analysis of data acquired by satellites [1].

The use of satellites has enabled the acquisition of imagery for virtually the entire globe. Observing coasts and shorelines with the help of remotely-sensed images has expedited updating maps and charts, enabling analysts and researchers to detect changes and extract information directly from images onto the maps.

The improvement of mapping procedures has led to the investigation of automated and semi-automated methods of feature extraction. Computers have made it possible to gather information from imagery in order to generate new shoreline vectors and to update existing maps. Great care must be taken when deciding on what features to consider as part of the shoreline. This is a key issue in the area of digital feature extraction.

II. Objective and Area of Study

The purpose of this project was to develop an algorithm to facilitate semi-automated shoreline feature extraction from remotely-sensed images. Other image processing programs were also used for further image manipulation.

The area of study covers 350,000 ha of Clayoquot Sound, located on the west coast of Vancouver Island, British Columbia. It extends approximately from 49°40'N, 126°35'W to 49°N, 125°35'W. The area provides habitat for a wide variety of wild animals and is known for its vast, old-growth forests. Several different types of coasts can be found in the area, including gently-sloping sand beaches, rocky coasts, estuaries, barrier islands and tidal flats, thus making it an ideal area for testing the performance of the shoreline extraction algorithm.

III. Shoreline Determination

The process of determining shorelines from remotely-sensed images is not simple. This is due to the gradation between land and sea, and the change of forms, which make separating and following features very challenging. Boundaries would be best described by checking them in the field, but information can be extracted much faster and with less expense using remote sensing techniques [2].

The difficulty in tracing the shoreline may be due mainly to the slightly different spectral responses of water and land in some specific wavelengths. However, even when it is possible to make a clear distinction between land and water, there is a certain lack of confidence about the real position of the shoreline due to tidal movement and wave action. In general, it might be simpler to adopt the vegetation line or high-water level as the shoreline, rather than try to account for tidal variations.

IV. Data Description

The images used for this research were acquired in different years and at different times of day. Initially, efforts were made to keep some sort of time consistency between images in order to minimise the influence of tides. However, due to time constraints, data availability and a lack of tide information, tidal influence would only be considered a direct factor in the determination of shorelines when it could be visually verified on the images. At this stage, only optical sensors were used. Radar data will be used when the expected

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