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APPLICATION OF ECOLOGICAL, GEOLOGICAL AND OCEANOGRAPHIC ERTS-1 IMAGERY TO DELAWARE'S COASTAL RESOURCES PLANNING

Applicability of ERTS-1 Satellite Imagery to the Study of Coastal Processes

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Summary of Significant Results
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APPLICABILITY OF ERTS-1 SATELLITE IMAGERY TO THE STUDY OF COASTAL PROCESSES

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SUMMARY

Images of the Delaware Coast obtained in the four multispectral scanner bands during ERTS-1 Orbit No. 333 on August 16, 1972, have been correlated with aircraft imagery and ground measurements of suspended sediment patterns and frontal systems. The ground truth was gathered from boats, shore installations and low altitude aircraft over the last seven months, including the day of the satellite overpass. Band 5 (0.6 to 0.7 microns) is shown to give the most accurate representation of suspended sediment patterns. The red band has proven in the past to be effective for enhancing suspended sediment boundaries during low and high altitude aircraft overflights, as well. Atmospheric effects, such as non-uniform haze, show up sufficiently in band 4 (0.5 to 0.6) to make interpretation of water features more difficult. On the other hand, band 6 (0.7 to 0.8 microns) and band 7 (0.8 to 1.1 microns) clearly delineate the shoreline and discriminate water from land in the marshes, yet fail to penetrate sufficiently into the water to give a clear definition of suspended sediment patterns.

The following patterns and boundaries of suspended sediment are visible in the preferred satellite image of band 5 near the mouth of Delaware Bay:

A). The sharp boundary curving around Cape Henlopen.

B). A long boundary one third the distance from Cape Henlopen, N.J., towards Cape May, Delaware.

C). A boundary extending Southeast from the Coast between Cape Henlopen and Indian River Inlet, Delaware.

D). A considerable number of patches of suspended sediment near the tip of Cape May.

Due to the high turbidity of bay water, none of the boundaries or patterns represent bottom features. Boundary A is generally found in the same location and changes only its shape as a function of tidal cycle. It is closely related to bottom topography, showing heavy sand particles stirred up by breaking waves and tidal currents sweeping over the Hen and Chicken Shoal. During ebb tide, it frequently turns into a multiple plume which also contains silt leaving the bay. In addition, the prevailing littoral drift causes heavier sand particles to move north and deposit on the northwest side of Cape Henlopen, with the result that the Cape is growing rapidly in that direction. Boundary B is less predictable, appearing only during portions of some tidal cycles and changing its positions by several miles along the Cape May - Cape Henlopen axis during a fraction of a tidal cycle. It is similar to boundaries extending for miles along the New Jersey and Delaware Coasts of the bay. These boundaries change

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their distances from shore in response to river flow and tide stage, but are otherwise remarkably sharp and stable. Boundary C usually moves rapidly inland during flood tide, and several miles southward, till it joins the Indian River Inlet sediment plume. Storms tend to destroy these boundaries and cause strong mixing.

Secci disc measurements across boundaries A and B have generally given Secci depths of about 0.6 to 1.2 meters on the turbid side of the boundary and 1.4 to 2.2 meters on the clearer side. This compares well with a visibility change from about 0.5 to several meters, estimated by divers setting up wave towers 250 feet off the coast, as boundary C moved past the towers. Away from shore, the suspended particles consist primarily of silt coming out of Delaware Bay. Near Cape May where the bay is shallow, bottom sediment gets picked up by the tidal currents and waves breaking over the numerous shoals, resulting in the multitude of smaller sediment plumes designated as region D.

The conclusions in this paper are supported by measurements and a large number of photographs taken from various altitudes and on the ground. The results show, that ERTS-1 imagery can be of value to investigations of coastal processes, particularly synoptic studies of major shoreline changes and suspended sediment patterns over large areas, if one selects the proper band for best discrimination of the features to be analyzed.