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PLUME DEVELOPMENT IN LONG ISLAND SOUND OBSERVED BY REMOTE SENSING (ERTS-1)

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ABSTRACT

As the Connecticut River flows into Long Island Sound, large plumes are developed during the mixing of ocean and estuarine waters. Plumes were delineated for July 28, October 8, October 27, and December 2, 1972, by analyzing ERTS-1 imagery with the SRI Electronic Satellite Image Analysis Console (ESIAC). Insertion of MSS band 5 into the ESIAC produced the best result in this analysis. The four plumes that have been delineated provide the first input to a time-lapse analysis of circulation patterns at the eastern end of Long Island Sound.

INTRODUCTION

All plans for water and land resources management in Connecticut must consider the ultimate effect of these plans on the estuarine, coastal, and ocean environment of Long Island Sound. One such plan "to preserve and enhance Long Island Sound"--is under preparation by New England River Basins Commission. Basic to development of this plan is an understanding of the hydrology of Long Island Sound area. (See fig. 1.)

The non-tidal system of water movement in the study area is fairly well understood and documented; however, the movement of estuarine and ocean water is not as well documented or understood. This deficiency, combined with the relatively short study time available, dictated that new approaches be tried to achieve the knowledge necessary for proper planning. This report suggests a new technology, remote sensing, to achieve an understanding of ocean dynamics.

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Estuaries that empty into Long Island Sound carry a relatively large volume of material in suspension that is ultimately discharged into the ocean environment. Large plumes are formed as this suspended material mixes with the ocean; this formation is a function of the hydrodynamic conditions encountered. In an effort to understand this phenomenon, delineation of the plumes by analysis of ERTS imagery is in progress, and the delineations will be displayed ultimately in time-lapse form for further analysis. For this report, only those plumes emanating from the Connecticut River are discussed.

IMAGERY DATA SELECTED

The time period covered by this report is from July 23, 1972, to December 2, 1972, and eight (8) potential scenes are available for analysis. The study procedure was to visually review the data in Hartford, Connecticut, and then subject the scenes to close scrutiny using the Stanford Research Institute (SRI), Electronic Satellite Image Analyses Console, (ESIAC), which is described in a report by Evans. Of the 8 scenes examined visually, only the scenes taken on July 28, October 8, October 27, and December 2, 1972, appear to be suitable for ESIAC analysis.

ESIAC ANALYSIS

Input to the ESIAC was in the form of 70 mm transparencies of MSS bands 4, 5, 6, and 7. Film positives were inserted into the console and fairly good results were obtained for July 28 and October 27. By utilizing film negatives and comparing with the film positives, and a color enhanced display, it was possible to obtain fair results for October 8 and December 2. The four scenes were analyzed and yield plume delineations that are compatible to hydrodynamic conditions that prevailed at the time of scanning. Figures 2a, 2b, 2c, and 2d are the plumes as traced from the imagery analysis.

Figure 2a is a tracing of the plume on July 28, 1972. This plume was delineated using a film positive of band 5 made by SRI from a NASA furnished negative. In this instance, step 1 of the gray scale was expanded to penetrate through the haze and fog.

Figure 2b is a tracing of the plume on October 8, 1972. This plume was delineated using band 5 transparencies furnished by NASA, and a color enhanced display of the band 5 transparencies.

Figure 2c is a tracing of the plume on October 27, 1972. This plume was delineated using bands 5 and 6 positive and negative transparencies furnished by NASA.

Figure 2d is a tracing of the plume on December 2, 1972. This plume was delineated from a band 5 positive transparency furnished by NASA, and a color enhanced display. This plume delineation may be suspect because band 5 negative and band 4 were not available at the time of analysis. In this case the color enhancement was the key to delineation of the plume.

SUMMARY

Plumes that have their origin in a fresh-water estuarine river system were identified in the ocean environment of Long Island Sound by using ERTS multi-spectral scanning data. It is not always possible to delineate these plumes using simple lantern type projection equipment, because the chemical and physical composition of the plume and ocean water are sometimes very similar. In this analysis, the ESIAC was utilized to expand the scenes and subject the transparencies to varying combinations of viewing techniques to identify and delineate the plumes. Best results were obtained when using band 5 transparencies. Indications are that when the scene being analyzed is predominantly in the first two steps of the gray scale it is best to use the negative transparencies. When the analysis is being done above the first two steps of the gray scale, it is best to use the positive transparencies.

REFERENCE

Evans, W. E., (in preparation), Time-lapse analysis of ERTS imagery using special electronic viewing/measuring equipment: Proc. 2d Annual Remote Sensing of Earth Resources Conference, University of Tenn. Space Inst., Tullahoma, Tenn.

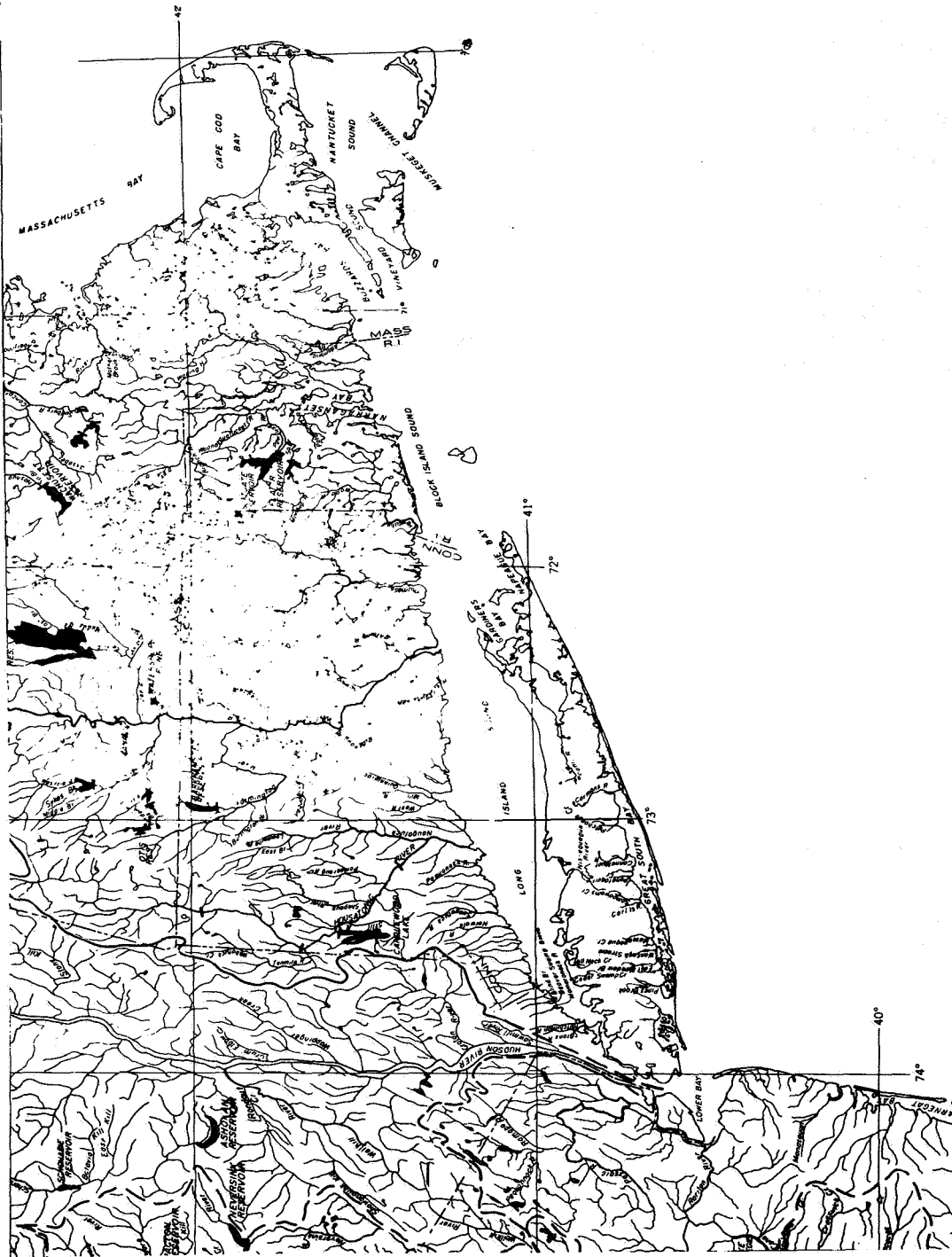


Figure 1-- Location map of Long Island Sound Area.

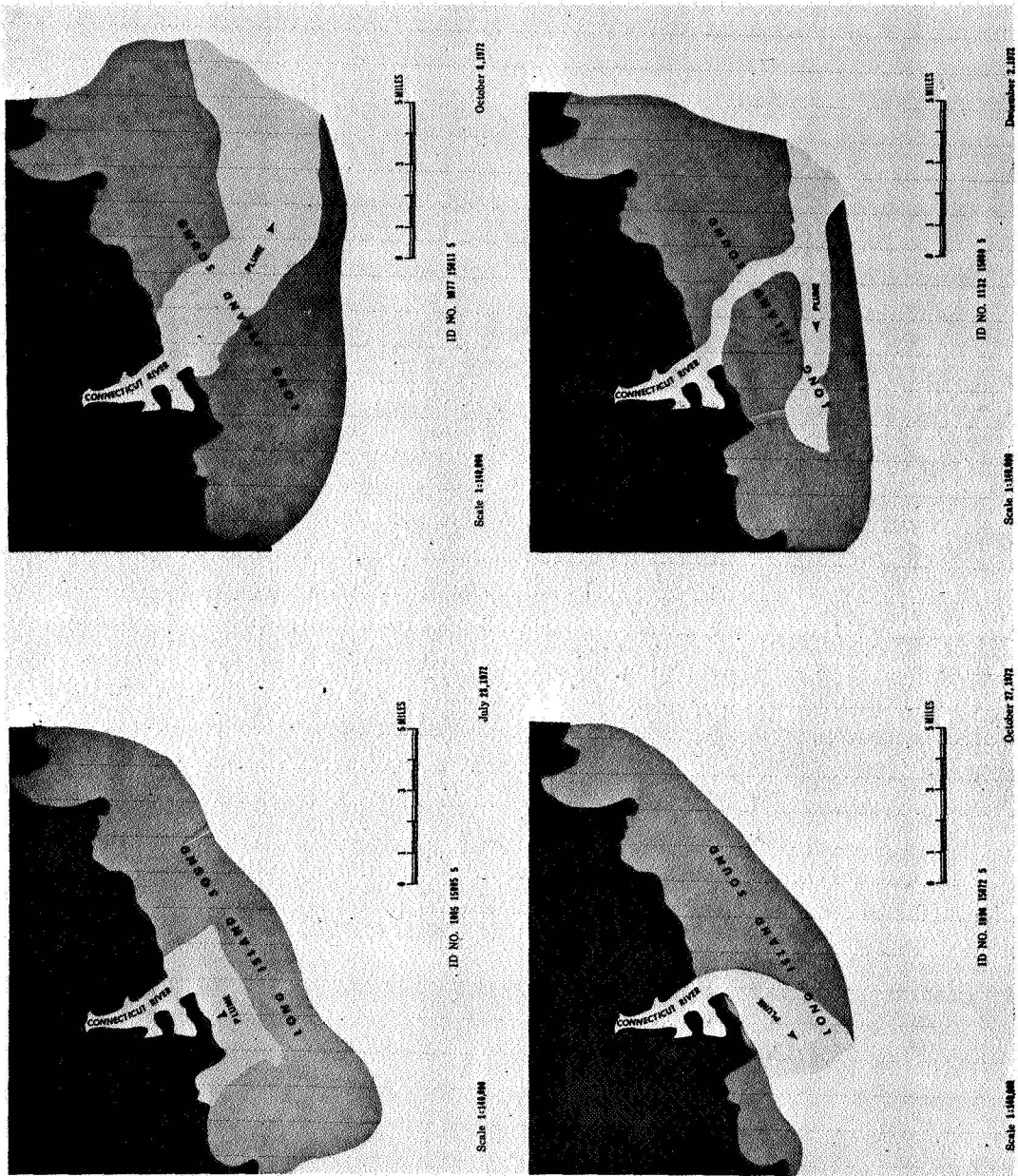


Figure 2-- Plume delineation at the mouth of the Connecticut River in Long Island Sound.