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CALIFORNIA COAST NEARSHORE PROCESSES STUDY
ERTS-A EXPERIMENT #088

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16. Abstract:

This Type I report contains a resume of the accomplishments of the California Coast Nearshore Processes Study for the period 1 November thru 31 December 1972. During this period an aircraft data flight took place in the San Pedro Test Cell. ERTS-A imagery of the San Francisco and Santa Barbara Test Cells was studied using several automatic processing techniques which were used to enhance suspended sediment. Sediment transport as affected by complex tidal currents in San Francisco Bay were analyzed. Computer analysis of Monterey Bay ERTS-A precision tapes continue. Ground truth data continues to be collected.

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PROGRESS REPORT TYPE I, NO. II
CALIFORNIA COAST NEARSHORE
PROCESSES STUDY

1. OBJECTIVES OF STUDY

Multiple elements under the broad topic of nearshore processes will be studied with airborne and spaceborne sensor data coincident with sea truth. These elements include (1) nearshore currents, (2) estuarine flushing, (3) season river discharges, and (4) nearshore sediment dispersion. These processes will be studied primarily along the central and southern California coast. Sophisticated data processing techniques will be utilized to obtain the maximum information from available data, and to provide correlation and comparison when possible.

2. WORK PERFORMED DURING THE REPORTING PERIOD

A. The first test flight took place on December 14, 1972, in the San Pedro Test Cell area simultaneous with the ERTS-A overpass. The survey consisted of flying the test cell lines at both 5000 and 10,000 feet with the following sensor/recording medium/filter combinations:

Hasselblad 70 mm Camera/Ektachrome/W12

I²S Multispectral Camera/9" Tri X/.45 u, .50 u, .55 u, .58 u (.02 u wide)

Emside Scanner/14 Channel Mag Tape/ .38-.44 u, .44-.50 u, .50-.56 u, .56-.62 u, .62-.68 u, .68-.74 u, .74-.86 u, .86-1.0 u, 1.0-1.2 u

Preliminary interpretation of this data has indicated small amounts of sediment and various amounts of industrial effluent being transported by coastal currents. Also several patches of fluorescein tracer dye dropped by the USACE was monitored as a current movement indicator. Some of the major areas of effluent that were studied include the White Point sewage outfall, the Terminal Island sewage outfall, and the Newport Bay entrance. The ERTS imagery from December 14 have not yet been received.

The Emside Scanner data shows details of rip currents, longshore sediment movement and fluorescein tracer dye. The sediments in the nearshore zone and the rip currents moving sediments offshore are most apparent in channels 3 to 5. The peak reflectance for the sediments is in channel 5 in the .62 to .68 micron range.

B. San Francisco Bay

Several frames of ERTS-A MSS data of the San Francisco Test Cell were analyzed for sediment movement and deposition features. Densitometer and additive color enhancements were utilized in conjunction with photographic interpretation techniques (enlargements and special processing techniques). The major results include the detection and delineation of the San Francisco Bar, the location and movement direction of suspended sediment in San Francisco Bay, and the ability to differentiate morphologic units within the San Francisco Bay tidelands. The observation identifier for the scenes used in the analyses is 1075-18173 M. A brief description of the techniques and result follows.

- Several densitometer line traces seaward of the Golden Gate Bridge on scene 1075-18173-4 outline the San Francisco Bar and give evidence of water penetration. Three traces of the negative were analyzed, two over the Bar and one through the natural channel that cuts the southwest portion of the Bar. The Bar itself, although scarcely visible with the eye in the channel 4 scene, can be brought out in detail using this line densitometer trace system. The traces show a characteristic amplitude increase in density across the Bar and a decrease across the natural channels cut in the Bar. This technique represents a possible means of using the ERTS imagery for generalized bathymetric mapping which could be of significant value in remote areas. The sediments in the San Francisco Bar are not composed of Bay system sediment but of coastal sand. The Bar is maintained by a dynamic balance of coastal currents, tidal force and the outflow of the Bay system.

- A data color system using a standard 525 line video camera to scan the ERTS transparencies was used to assign color codes to various density levels in the scene. The resulting picture is recorded on 35 mm film and utilized for interpretation. Enhancements of scene 1075-18173-5 present a technique for tracing sediment transport and tidal patterns as indicated by patterns shown in the Bay. The complex tidal patterns in the Bay are caused by the tidal surge which has access to the Bay through the narrow Golden Gate and then moves into a series of embayments of total water surface of 435 square miles. This system is not an estuary in the usual sense of the word since the Sacramento-San Joaquin estuary is lost in the reaches of Suisun, San Pablo and Central Bay, bringing about a varying range of salinity, sedimentation and shoaling effects.

The study of the Bay environment, which changes by the minute, presents a problem which the ERTS data partially solves. The surface parameters are recorded at one instant for the entire Bay resulting in information impossible to collect through aircraft or ship sampling methods.

This scene of the Bay was taken 48 minutes after maximum tidal current and 30 minutes before high tide on October 6, 1972. This is shown on the enhancement of channel 5 by the density patterns. Ocean waters are obviously moving northward into San Pablo Bay, but in the South Bay the coloration changes in the enhancement indicate south-moving water with mixing taking place just east of Treasure Island.

The many complex current patterns are due to the configuration of the several bays and straits and the geometry of the underwater areas wide and shallow in places, and deep and like a ravine in places. These variations which bring about peculiarities of tidal phasing are indicated by the patterns on the data color enhancements of the Bay. The contact between the major classifications of waters (ocean, brackish and fresh) are also indicated by coloration changes representing a possible means for the study of the tidal prism and nodal points within the Bay. These water type contacts are also clearly indicated on several additive color ehnahcements which were programmed to bring out these contacts in detail.

C. Santa Barbara Test Cell

Scene 1109-18073 of the Santa Barbara area shows longshore movement of sediment from the Goleta area eastward past Port Hueneme. In the Santa Barbara area sediment transport is visible to approximately 4 miles off the coast. As sediment from the Ventura and Santa Clara Rivers join this longshore sediment offshore movement increases to over 18 miles. A large triangular-shaped lobe of material is clearly visible (1109-18073-4) reaching from Punte Gorda 25 miles to Mugu Lagoon and seaward almost to Anacapa Island. In addition, a large lobe of material stretches in a crescent shaped pattern 25 miles south of Point Conception and around the north side of Santa Cruz Island.

The large triangular-shaped lobe of suspended particulate matter that stretches almost to Anacapa Island is disrupted approximately halfway (10 miles) out in the channel. This disruption forms a spike or peak on the western side of the triangle which points toward Point Conception. This peak is the result of the Anacapa Current which forms a northwest flow from the Santa Monica Basin through the Anacapa-Oxnard Passage. This current forms a hydrologic blockage of the passage to southward escape of locally contributed particles and influences the shelf circulation in the Santa Barbara Channel.

The large lobe of material off Point Conception results from suspended particulate matter which is carried by the California Current water moving from the west around Point Conception.

3. SCHEDULE

The work is progressing on schedule.

4. WORK PROGRESS

During this reporting period two aircraft flights scheduled for the San Francisco and the Monterey Bay Test Cells were cancelled because of poor weather and rescheduled for February 9 and 10. However, the San Pedro Test Cell flight on December 14, 1972, resulted in good data for use in interpretation technique analysis. The new precision digital tape scenes arrived for use in CCT processing. One scene is in the Humboldt Bay area and shows a great deal of suspended sediment. The second scene which arrived was found to be located in the San Joaquin Valley with no coastal features and so it won't be analyzed.

Several techniques are being used during interpretation of the ERTS-A imagery including data color enhancement, line densitometer tracing, additive color processing and CCT enhancement. To date the results are most encouraging in meeting the study objectives.

5. RELIABILITY

Effort is being made throughout the various phases of this study (data collection, processing, interpretation, analysis) to achieve useful and scientifically correct results.

6. FUNDS

As of the time of this report, the scheduled funding for this study is adequate to complete the tasks required.

7. PERSONNEL

There have been no changes in personnel involved in this study.

8. WORK NEXT PERIOD

The investigators have three aircraft underflights planned for San Francisco, Monterey, and Santa Barbara during the next reporting period (January 1 thru February 28, 1973). In addition to these flights and associated ground truth collection, tape and photo analysis will be performed on imagery provided by Goddard.

9. OTHER

ERTS-A Data Log to date.

CALIFORNIA COAST NEARSHORE
PROCESSES STUDY

PROGRESS REPORT TYPE I, NO. II, 31 December 1972

PROPOSAL NO. 088

DOUGLAS M. PIRIE, DE324

SIGNIFICANT RESULTS

In the Santa Barbara Channel the effect of the California and the Anacapa Currents are clearly seen in image 1109-18073M. The large triangular shaped lobe of suspended particulate matter that stretches almost to Anacapa Island from the Ventura River area is disrupted approximately midchannel by the east-moving Anacapa Current. In the Point Conception area a lobe of suspended material approximately 20 miles long can be seen moving eastward as a result of the California Current.

In the San Francisco Bay area (image 1075-18173M) the major results include the detection and delineation of the San Francisco Bar, the location and vector of suspended sediment in the San Francisco Bay, and the ability to differentiate morphologic units within the San Francisco Bay tidelands. Several densitometer line traces seaward of the Golden Gate Bridge on image 1075-18173-4 outline the San Francisco Bar and give evidence of good water penetration.

ERTS-A DATA

OBSERV. ID	BAND	DESCRIPTION	DATE	PRINCIPAL POINT OF IMAGES	FORMAT
1002-18134	R 4 5 7	Dark Monterey	7-25-72	N37.17 W120.56	M,9
1002-18140	R 4 5 7	Dark Monterey Bay to Morro Bay	7-25-72	N35.52 W121.24	M
1004-18224	R	Dark Clouds Pt. Reyes	7-27-72	N38.42 W122.49	M
1004-18230	R	Dark SF-Monterey	7-27-72	N37.16 W123.17	M
1005-18271	R	Dark	7-28-72	N42.14 W122.58	M
1005-18274	R	Dark	7-28-72	N40.48 W123.29	M
1006-18331	R	Dark	7-29-72	N41.39 W124.36	M
1006-18333	R	Dark	7-29-72	N40.13 W125.07	M
1006-20080	M	Tuktoyaktuk	7-29-72		M
1018-18003	6 7	Dark	8-10-72	N35.45 W118.01	M
1018-18010	M	Dark	8-10-72	N34.19 W118.27	M
1018-18012	4 5	Dark	8-10-72	N32.53 W118.54	M
1019-18062	M	Dark	8-11-72	N35.47 W119.25	M
1019-18064	M	Dark Clouds	8-11-72	N34.22 W119.52	M
*1020-18115	M	Dark	8-12-72	N36 W120	M
1020-18121	M	Dark Clouds Morro Bay	8-12-72	N35 W121	M
1020-18124	M	Dark	8-12-72	N33 W121	M
1021-18172	4 5 6 7	Dark	8-13-72	N37.24 W121.46	M

OBSERV. ID	BAND	DESCRIPTION	DATE	PRINCIPAL POINT OF IMAGES	FORMAT
1021-18174	M	Dark Monterey Pt. Sur	8-13-72	N35.59 W122.13	M
1022-18223	M	Dark	8-14-72	N39.13 W122.36	M
1022-18230	M	Dark Pt. Arena	8-14-72	N37.47 W123.05	M
1034-17500	4,5	Dark Salton Sea	8-26-72	N33 W116	M
1034-17502	6,7	Dark	8-26-72	N31 W116	M
1035-17554	M	Dark 5.D	8-27-72	N33 W117	M
1036-18010	M	Dark LA Newport	8-28-72	N34 W118	M
1036-18012	M	Dark	8-28-72	N33 W118	M
1037-18064	M	Dark Santa Barbara Pt. Conception	8-29-72	N34.34 W119.51	M
1038-18120	M	Dark Clouds	8-30-72	N36.01 W120.50	M
1041-18283	M	Clouds	9-2-72	N38 W124	M
1052-17495	M	Dark Salton Sea	9-13-72	N33 W115	M
1053-17554	M	Clouds Long Beach San Diego	9-14-72	N33 W117	M
1053-17560	M	Dark Tijuana	9-14-72	N31 W117	M
1054-18010	M	Dark Clouds Pt. Dume	9-15-72	N34 W118	M
1055-18064	5 6 7	Clouds Santa Barbara Channel Island	9-16-72	N34 W119	M

OBSERV. ID	BAND	DESCRIPTION	DATE	PRINCIPAL POINT OF IMAGES		FORMAT
1055-18071	4 5 6	Dark Clouds	9-16-72	N33	W120	M
1056-18120	4 5 6	Dark Morro Bay Piedras Blancos Point	9-17-72	N35	W120	M
1056-18123	M	Dark Pt. Conception	9-17-72	N34	W121	M
1057-18170	M	Dark Clouds	9-18-72	N38	W121	M
1057-18172	M	Dark Monterey SF (Clouds)	9-18-72	N37	W121	M
1057-18175	M	Dark Carmel Pt. Sur	9-18-72	N35	W122	M
1058-18224	M	Clouds Pt. Arena Russian River No (Seds)	9-19-72	N38	W122	M
*1058-18230	M	Clouds SF Bolinas Bay	9-19-72	N37	W123	M,S
1059-18273	M	Good Crescent City Patrick Pt.	9-20-72	N41	W123	M
*1059-18280	M	Good Humbolt Bay Cape Mendocino Eel River	9-20-72	N40	W123	M,S
1059-18282	M	Partial Clouds Ft. Bragg Pt. Arena	9-20-72	N38	W124	M

OBSERV. ID	BAND	DESCRIPTION	DATE	PRINCIPAL POINT OF IMAGES		FORMAT
1060-18332	M	Dark	9-21-72	N41	W124	M
1070-17495	M	Good Salton Sea	10-10-72	N33	W115	M
1071-17554	M	Clouds L.B. Newport SD Bay - Silver Strand	10-2-72	N33	W117	M
1072-18010	M	Clouds	10-3-72	N34	W118	M
1072-18012	M	LA-Dana Pt.	10-3-72	N33	W118	M
1073-18064	M	Good Channel Island Pt. Mugu Santa Barbara Pt. Hueneme	10-4-72	N34	W119	M
1075-18173	M	Good SF Monterey	10-6-72	N37	W121	M,S
1076-18225	M	Dark Clouds SF	10-7-72	N38	W122	M
1076-18231	M	Clouds Moss Bay Pt. Ano Nuevo	10-7-72	N37	W123	M
1077-18274	M	Clouds	10-8-72	N41	W123	M
1077-18281	M	Clouds Humboldt Bay	10-8-72	N40	W123	M
1078-18333	4,6,7	Clouds	10-9-72	N41	W124	M
1078-18335	5,6,7	Clouds	10-9-72	N40	W125	M
1089-17563	M	Clouds	10-20-72	N31	W117	M

OBSERV. ID	BAND	DESCRIPTION	DATE	PRINCIPAL POINT OF IMAGES		FORMAT
1090-18012	M	Good - Santa Barbara, Newport Bay, Anacapa Is., SMB, San Andreas Fault, Garlock F., Mojave Desert Fan Deposits, few Seds.	10-21-72	N34	W118	M,S
1090-18015	M	Good - Palos Verdes, Catalina, Dana Pt. No Seds.	10-21-72	N33	W118	M,S
1094-18231	M	Good - Russian R. Pt. Reyes	10-25-72	N38	W122	M
1094-18233	M	Good - SFB, Bolinas Bay, Pt. Reyes	10-25-72	N37	W123	M
1095-18280	M	Good - Crescent City Clouds - Trinidad Head	10-26-72	N41	W123	M
1095-18283	M	Good - Eureka, Cape Mendocino, Humboldt Bay, Seds.	10-26-72	N40	W123	M
1096-18335	M	Good - Crescent City Klamath River (Seds) Trinidad Head	10-27-72	N41	W124	M
1096-18341	M	Good - Cape Mendocino, Punta Gorda, Humboldt Bay - (Seds)	10-27-72	N40	W125	M
1109-18070	M	Good - Bakersfield	11-9-72	N35	W119	M,S
1109-18073	M	Good - S.B. Pt. Conception Pt. Mugu (Seds)	11-9-72	N34	W119	M,S
1111-18181	M	Clouds Monterey Bay	11-11-72	N37	W121	S
1112-18233		Good- Russian Riv. Pt. Reyes - Seds Bodegg Bay, Tomales Bay	11-12-72	N38	W122	M,S

OBSERV. ID	BAND	DESCRIPTION	DATE	PRINCIPAL POINT OF IMAGES		FORMAT
1112-18235	M	Clouds	11-12-72	N37	W123	S
1113-18291	M		11-13-72	N38	W124	S
1114-18340	M	Good - Klamath River, Trinidad Head	11-14-72	N41	W124	S