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Cover: Infrared (3.55 to 3.53 μm) image of the Gulf of Oman, Arabian Sea, obtained by NOAA-6 Satellite on 30 May 1980 and enhanced in the Scripps Institution of Oceanography Remote Sensing Facility.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) <p>A technique was developed for determining the mesoscale features of the Arabian Sea, and reported on in ONRWEST Report 81-3. A method for assembling composites of images in mosaic form is presented. Enhanced images are presented with surface interpretations for the spring and fall transition periods related to the Northeast and Southwest Monsoons, respectively.</p> <p>This supplement to ONRWEST Report 81-5 provides larger images for Figures 36 through 45.</p>		

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ONRWEST 81-5SUP

SUPPLEMENT TO
ARABIAN SEA PROJECT OF 1980--COMPOSITES
OF
INFRARED IMAGES

This report was prepared by
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and
Mr. Robert Whritner, Scripps Institution of Oceanography.

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Western Regional Office
1030 East Green Street
Pasadena, CA 91106

December 1981

APPROVED:

Lewis Larmore
LEWIS LARMORE
Scientific Director



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EXPLANATION

It became apparent, by feedback from the distribution of ONRWEST Report 81-5, that the composites of infrared images of the Arabian Sea should be reproduced in a larger size. The larger size permits some improvement in spatial details. Also, an effort has been made to improve the contrast in grey shades representing the ocean features, which were the subject of the original report. Figures 1 and 36 through 45 of ONRWEST Report 81-5 are reproduced herein.

The reader is referred to ONRWEST Report 81-5 for explanations of the data contained herein.

(P1)

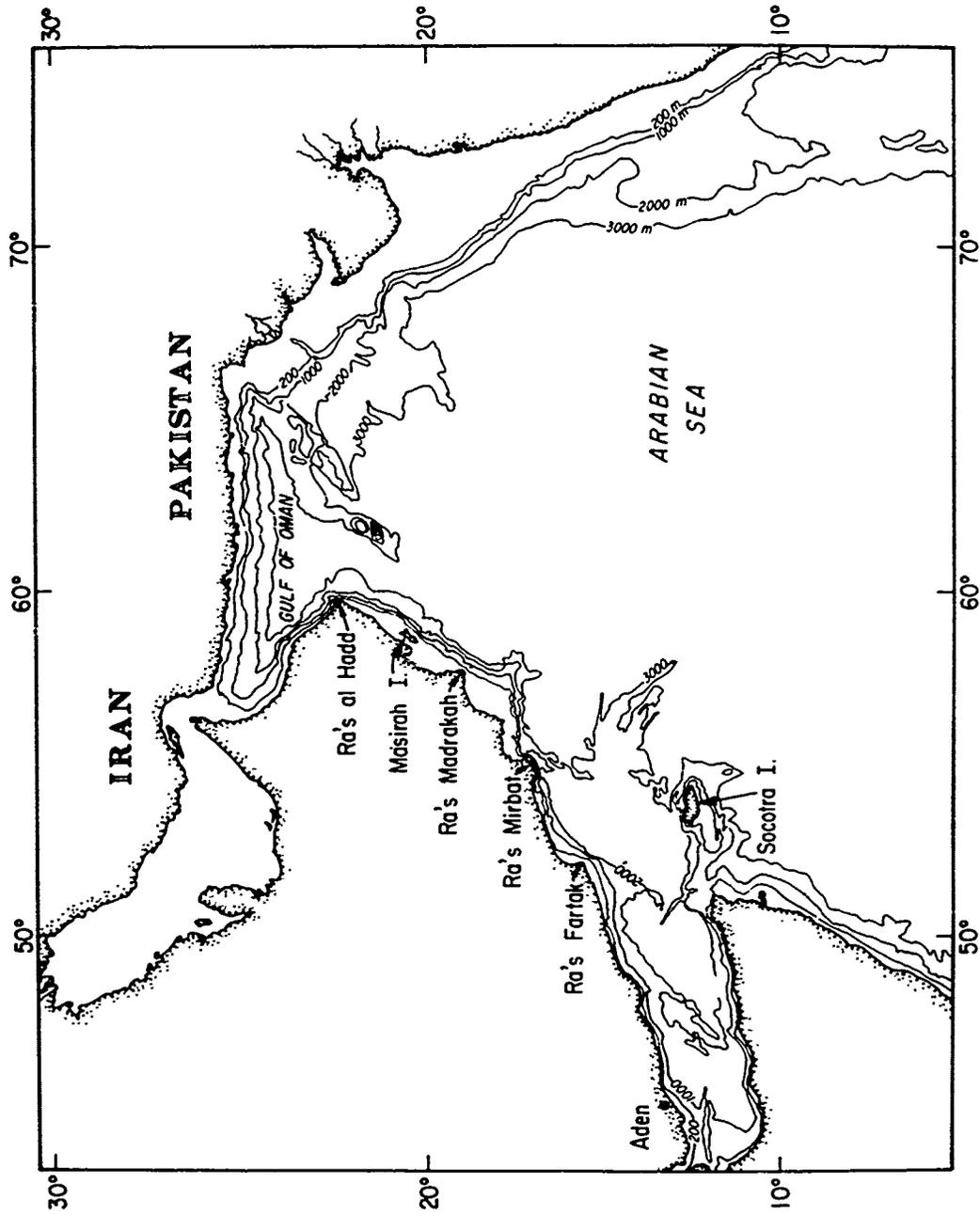
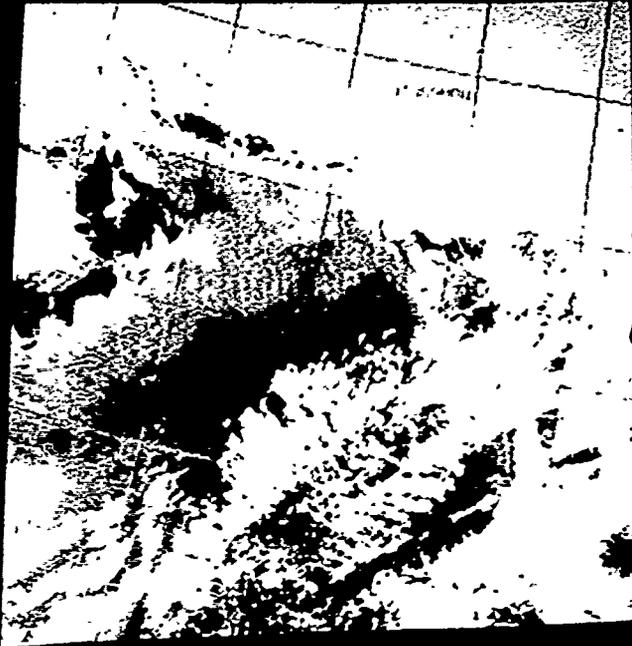


Figure 1. Map of Arabian Sea.

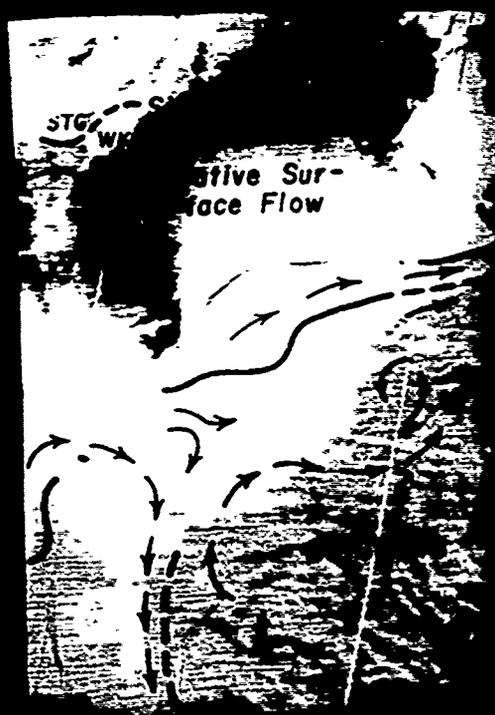
The Arabian Sea is bounded on the west by the Arabian Peninsula, on the north by the coasts of Iran and Pakistan, and on the east by the coast of India. Bathymetry is provided down to 3000 meters to illustrate the rapid fall-off of the shelf in some areas. The Oman Basin is partially closed by the Murray Ridge with an opening to the Arabian Sea near the Arabian Coast.

1



SATELLITE VIEW

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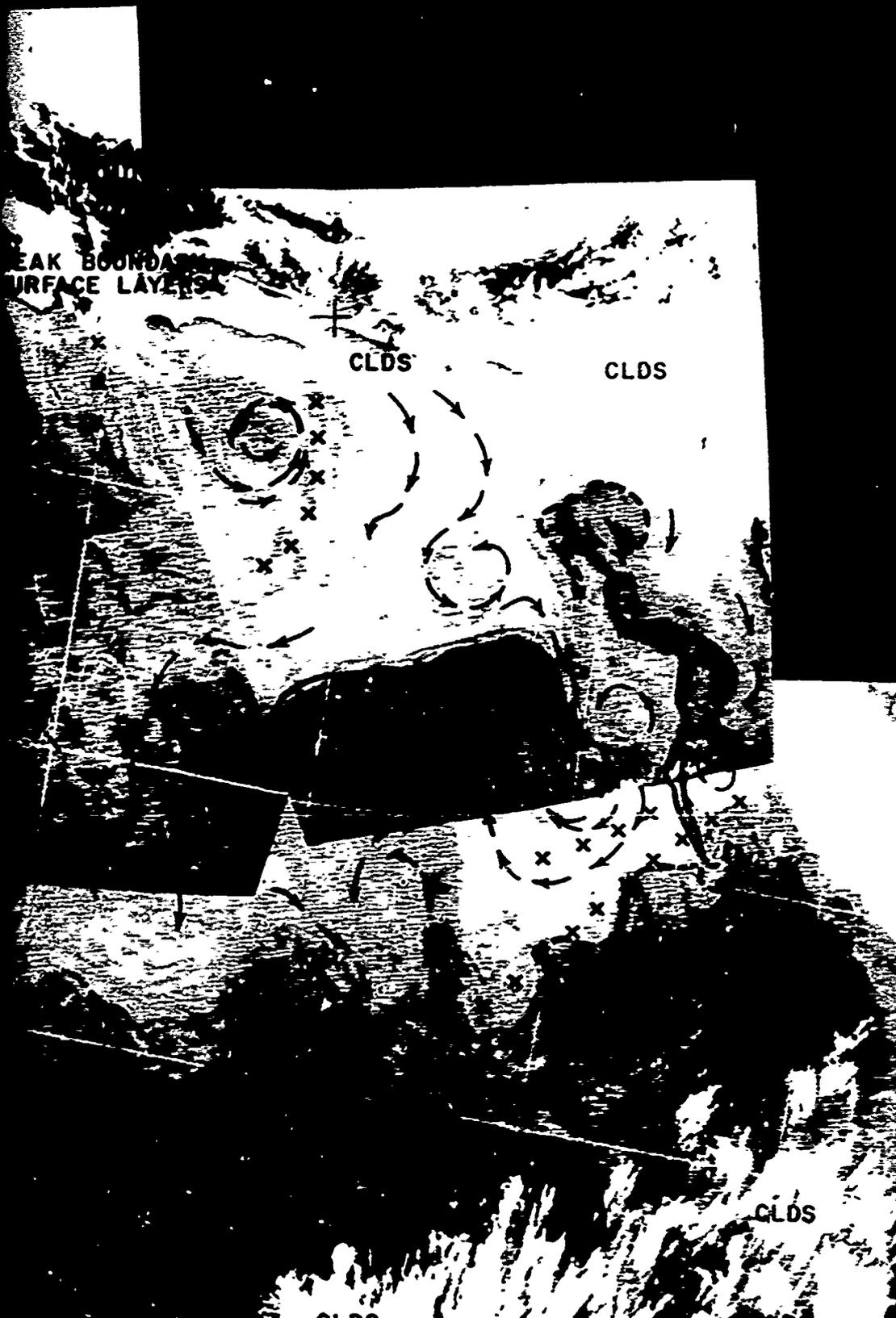
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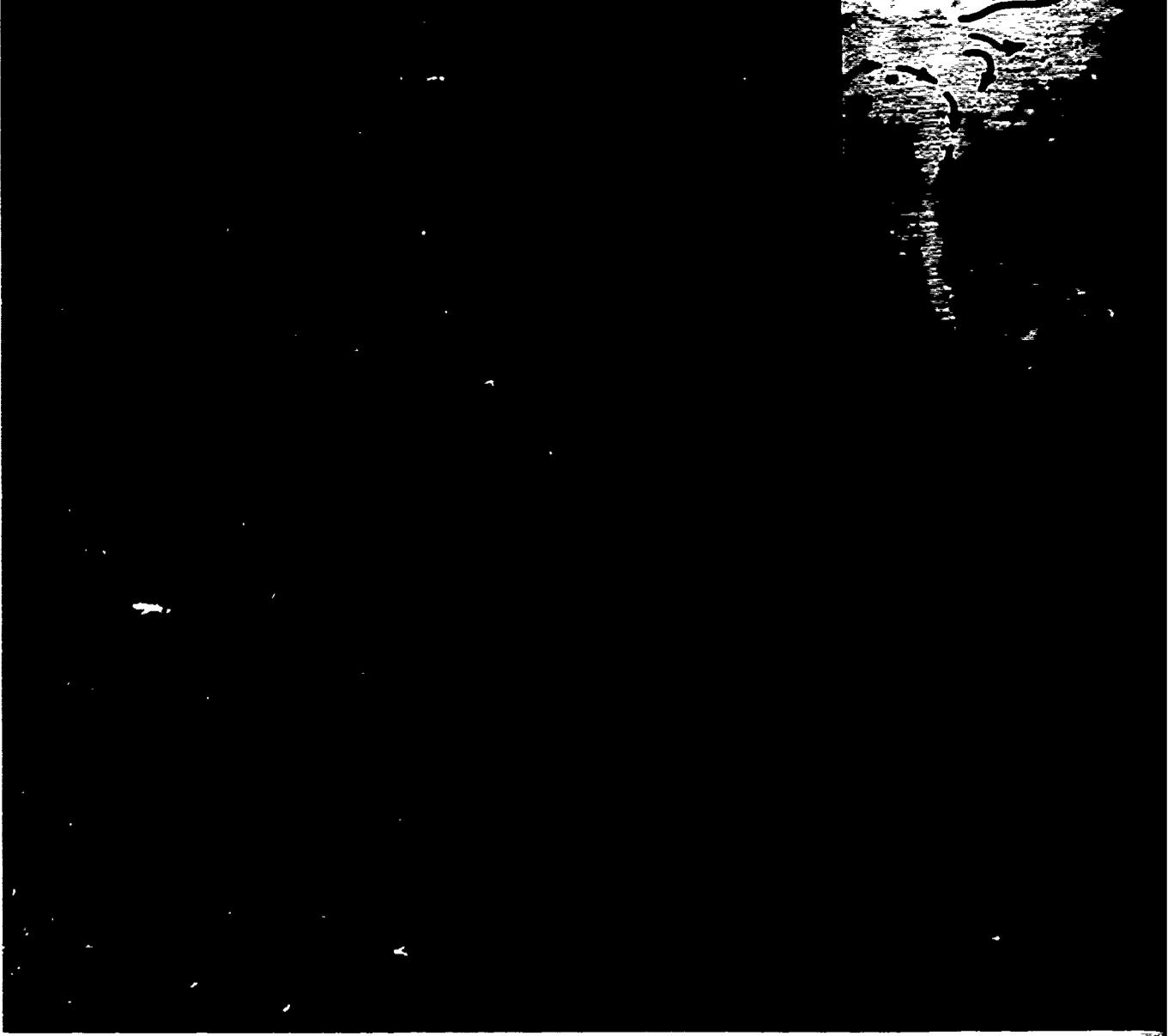


ARABIAN SEA

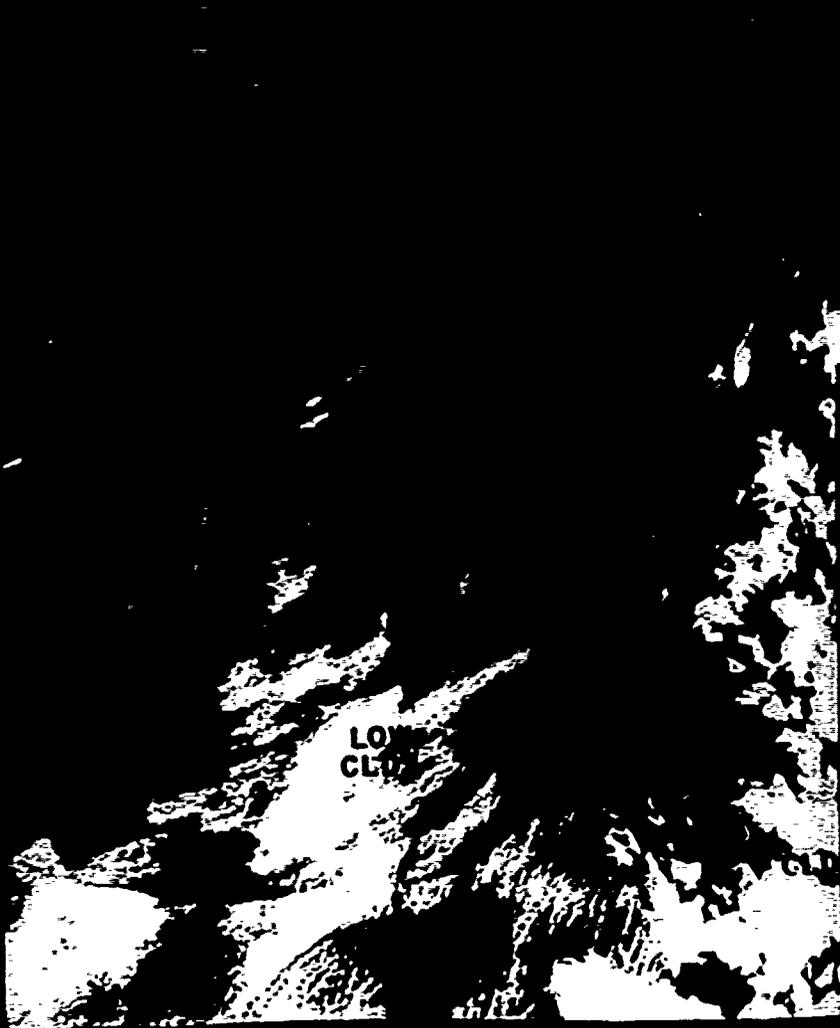
MAR 28, 1980



SURFACE INTERPRETATION



4



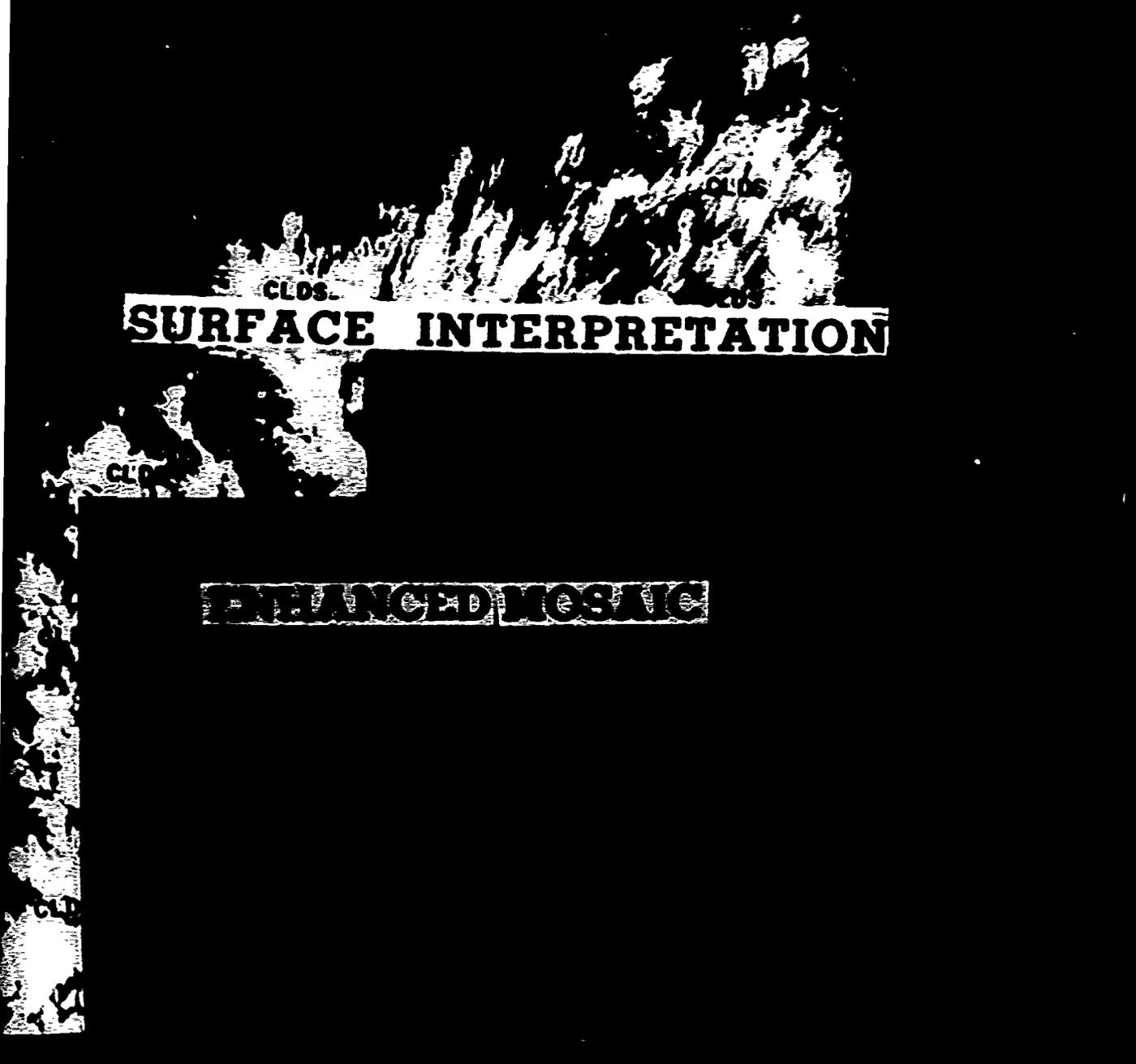
CLOS.
SURFACE II

CLOS.

SURFACE I

LOW
CLOS

5



CLOS

SURFACE INTERPRETATION

ENHANCED MOSAIC

6

Figure 36. Arabian Sea Mosaic with Interpretation,
28 March 1980.

The composite of enhanced images shown in Figure 26 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. Shear flow is indicated by a series of "x's". Slicking from daytime heating appears where there has been little surface mixing.



SATELLITE VIEW



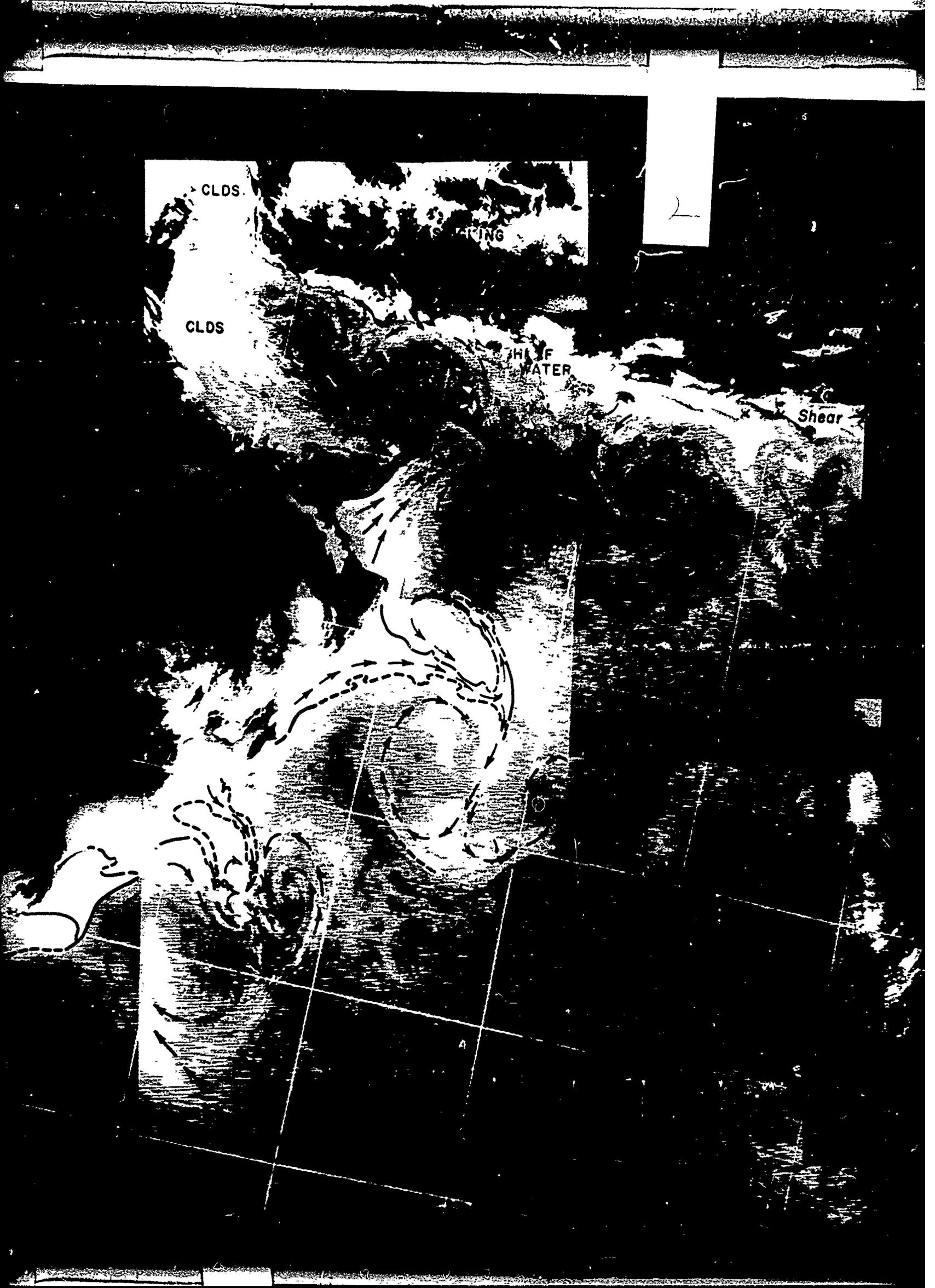
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CLDS

...F
...WATER

Shear

2



ARABIAN SEA

3

APR 15, 1980

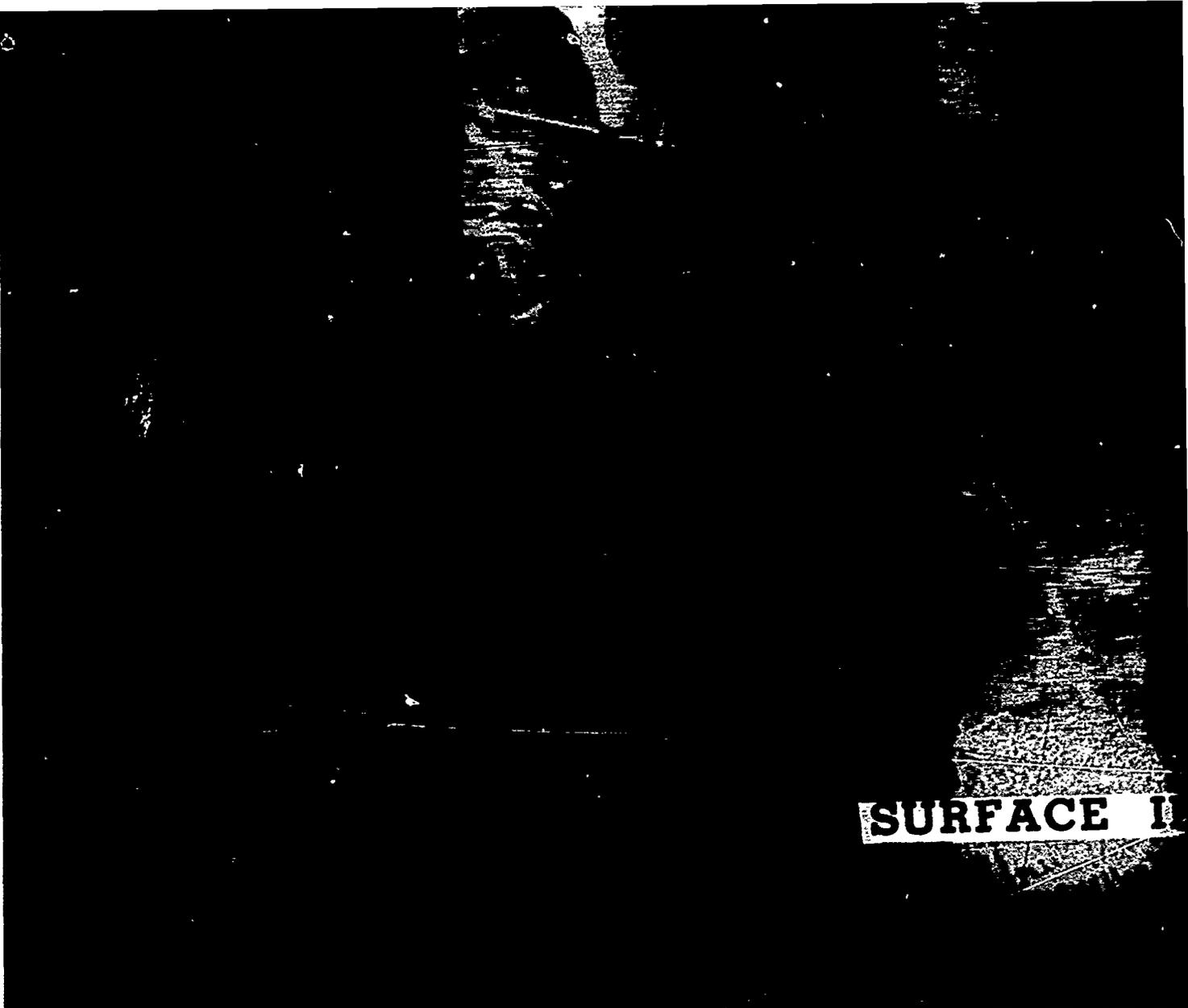
Shear

SHELF
WATER

CLDS

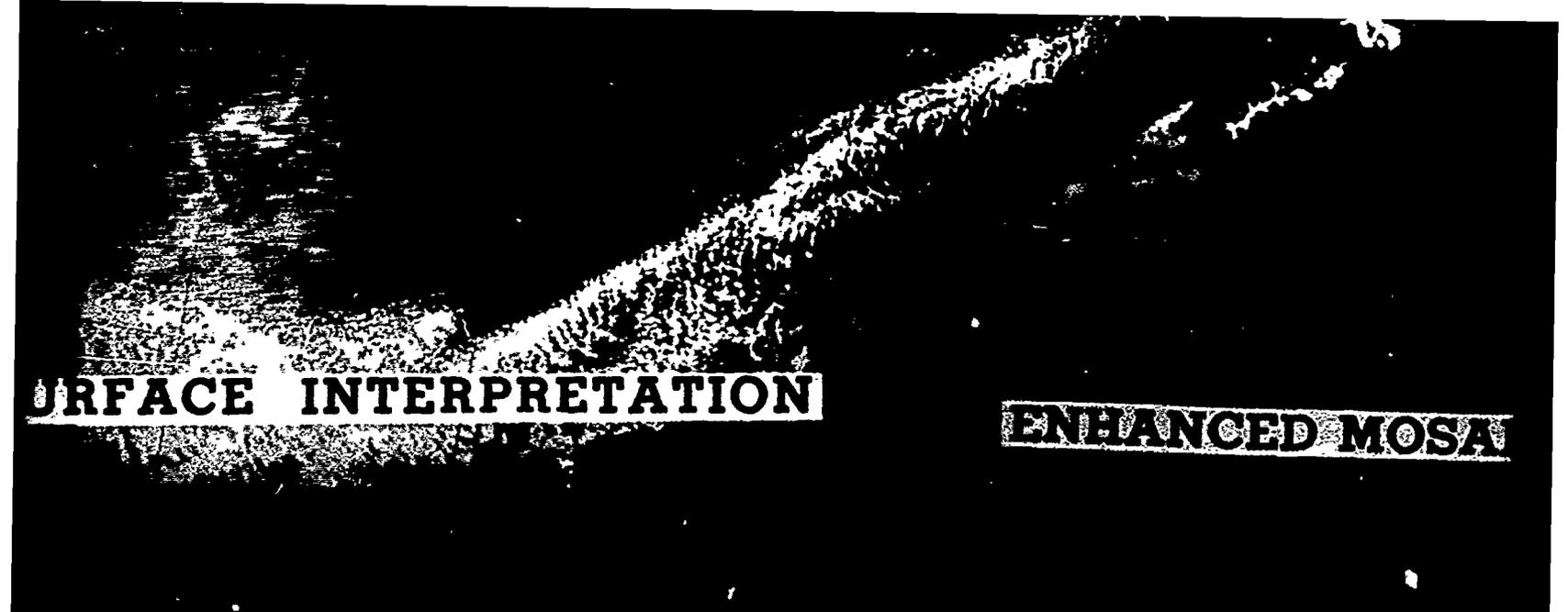
CLDS

SHELF
WATER



SURFACE I

4



URFACE INTERPRETATION

ENHANCED MOSAIC

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SHELF
WATER

HANCED MOSAIC

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Figure 37. Arabian Sea Mosaic with Interpretation,
15 April 1980.

The composite of enhanced images shown in Figure 27 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. (A poor alignment of lines indicating fronts occurred in the printing process.)

NOAA 6
80-142

WEAK
SE
DRIFT

UPWELLING

SHEAR
VORTEX
LINE

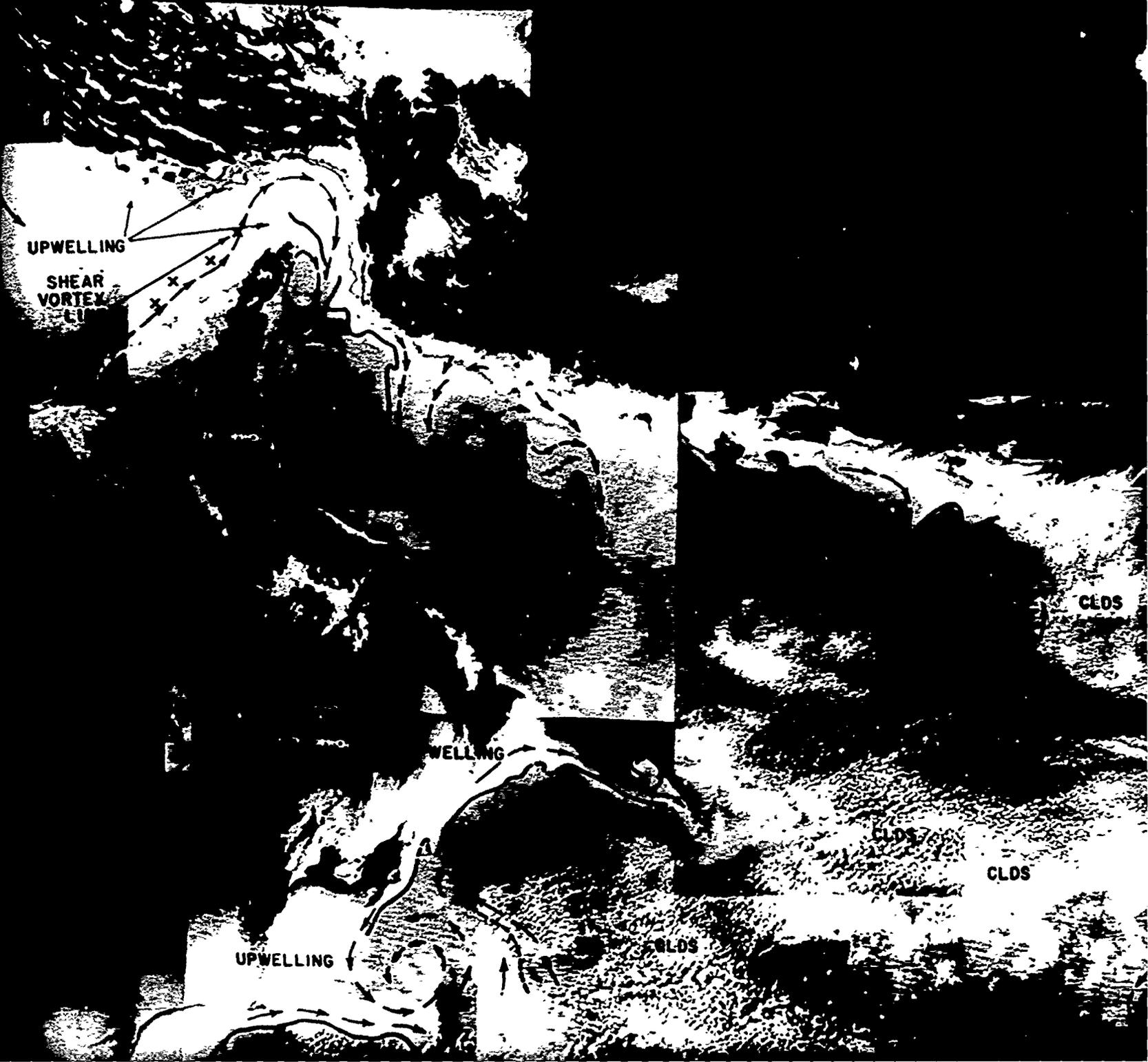
UPWELLING



ARABIAN SEA

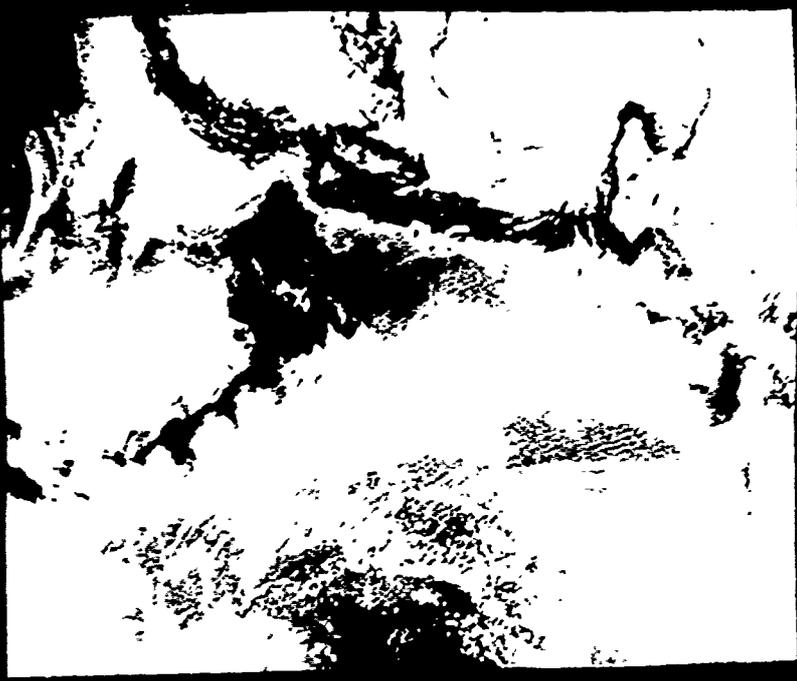
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AN SEA

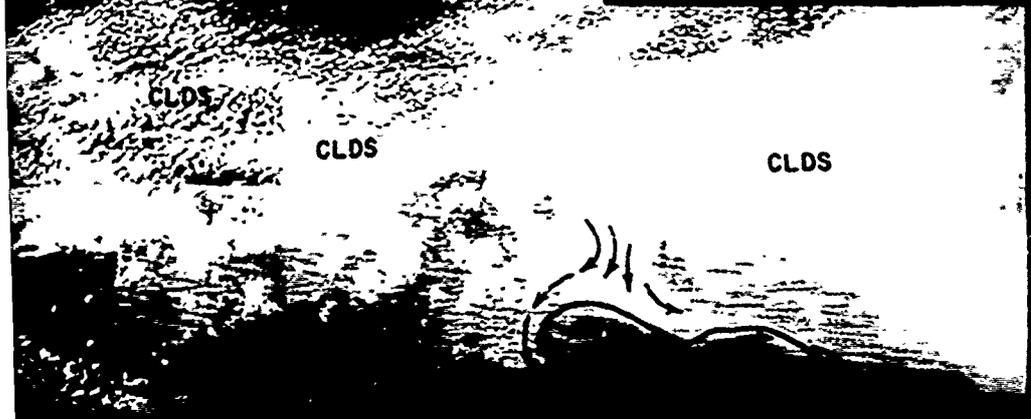
1, 1980



SATELLITE VIEW



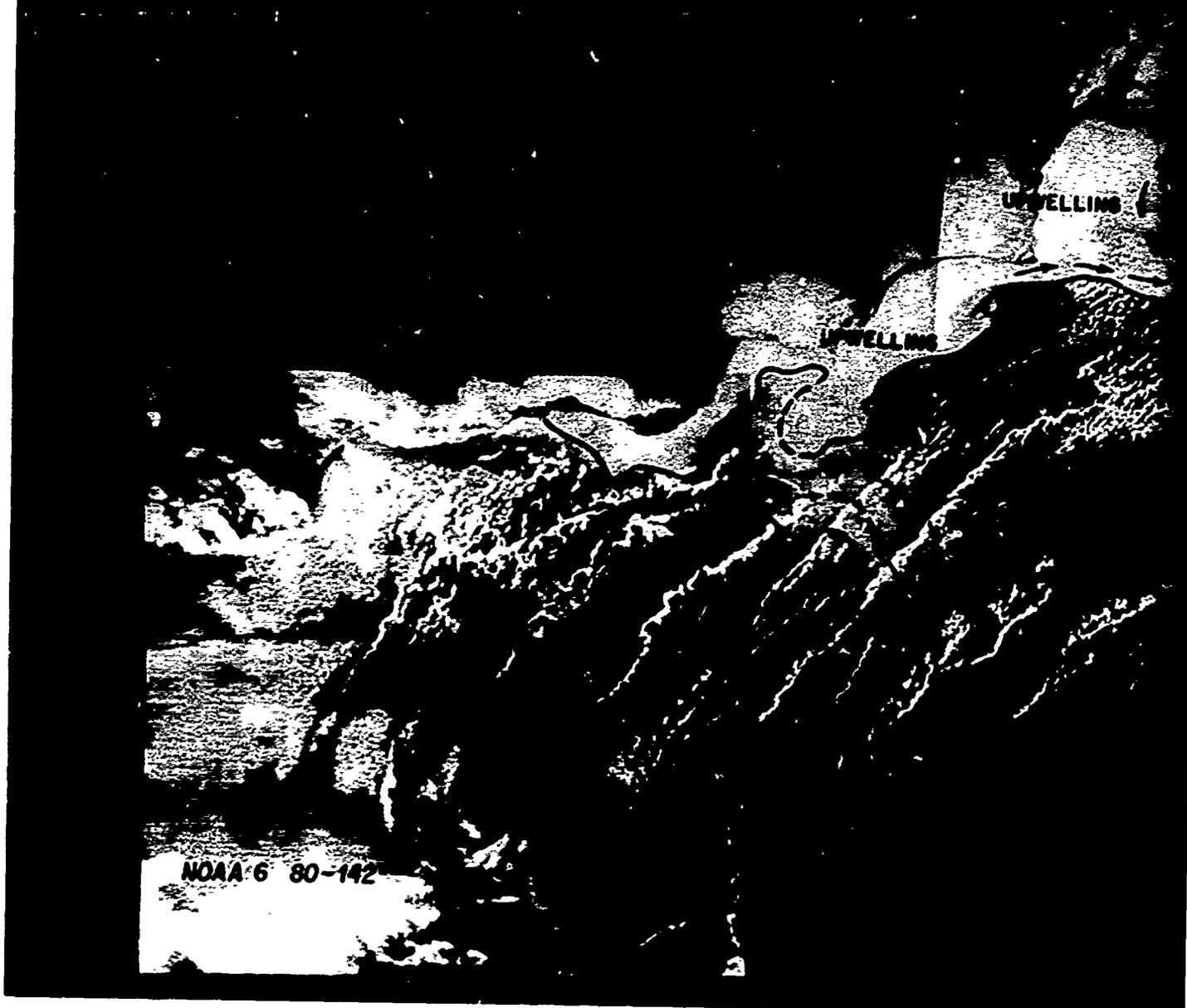
CLDS



CLDS

CLDS

CLDS



4

UPWELLING

CLOS

CLM

SURFACE INTERPRETATION

ENHANCED MOSAIC

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CLOS

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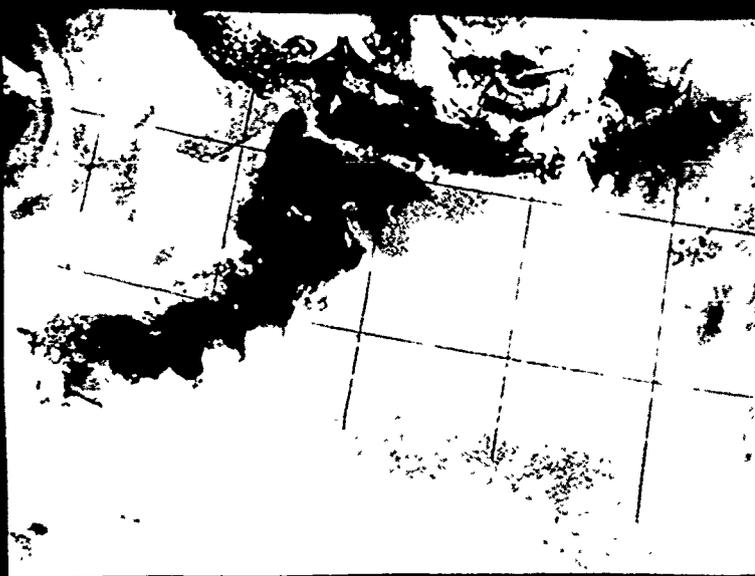
MOSAIC

6

Figure 38. Arabian Sea Mosaic with Interpretation,
21 May 1980.

The composite of enhanced images shown in Figure 28 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. Shear flow is indicated by a row of "x's". Upwelling regions are designated.

1



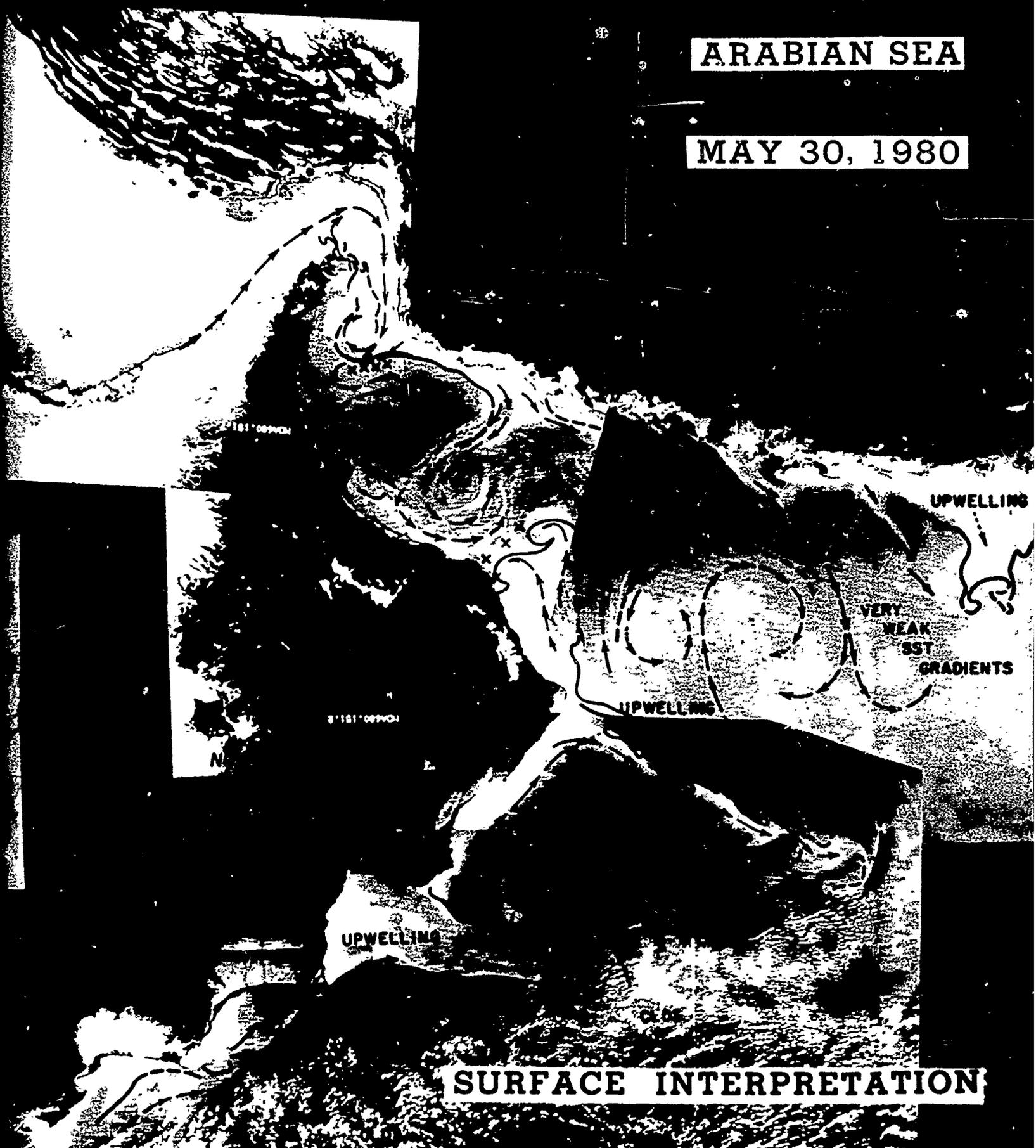
SATELLITE VIEW



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ARABIAN SEA

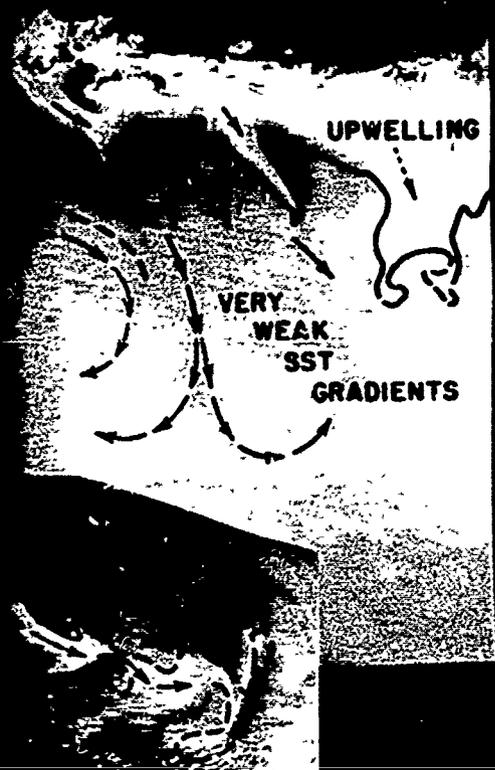
MAY 30, 1980



SURFACE INTERPRETATION

RABIAN SEA

MAY 30, 1980



SATELLITE VIEW



4

CL01

ENHANCED MOSAIC

5

Figure 39. Arabian Sea Mosaic with Interpretation,
30 May 1980.

The composite of enhanced images shown in Figure 29 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. Shear flow is indicated by a row of "x's". Upwelling is designated. (A poor alignment of lines indicating fronts occurred in the printing process.)

OIL REFINERY
FIRES AFTER
BOMBING

POSSIBLE
OIL SLICK

STG WK Significant
Fronts

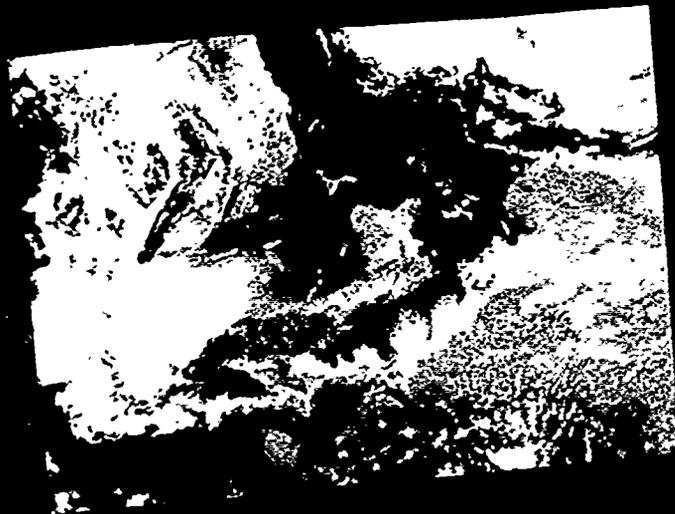
Relative Sur-
face Flow

VERY WEAK TEMPERATUR
CONTRAST

GENTLE SOUTHWARD DRIFT
OF SFC WATERS

Significant
Fronts
Relative Sur-
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FRONTS THROUGHOUT
PERSIAN GULF



SATELLITE VIEW

POSSIBLE
OIL SLICK

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ARABIAN SEA

SEP 28, 1980

ATU
DRIFT

Significant
Fronts
Relative Sur-
face Flow
FRONTS THROUGHOUT
PERSIAN GULF

SURFACE INTER

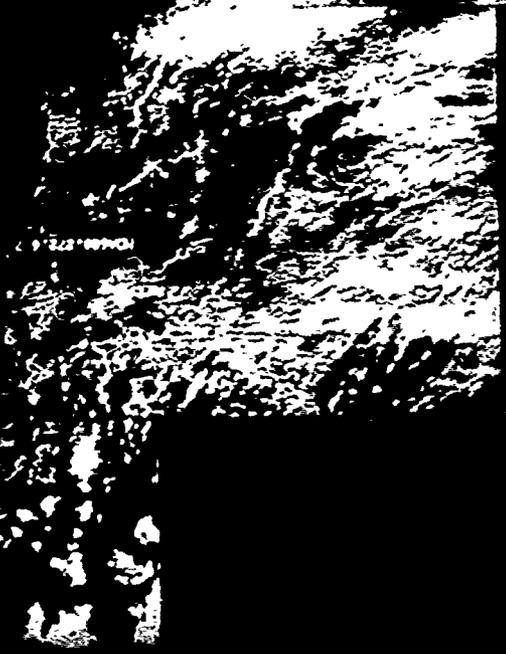
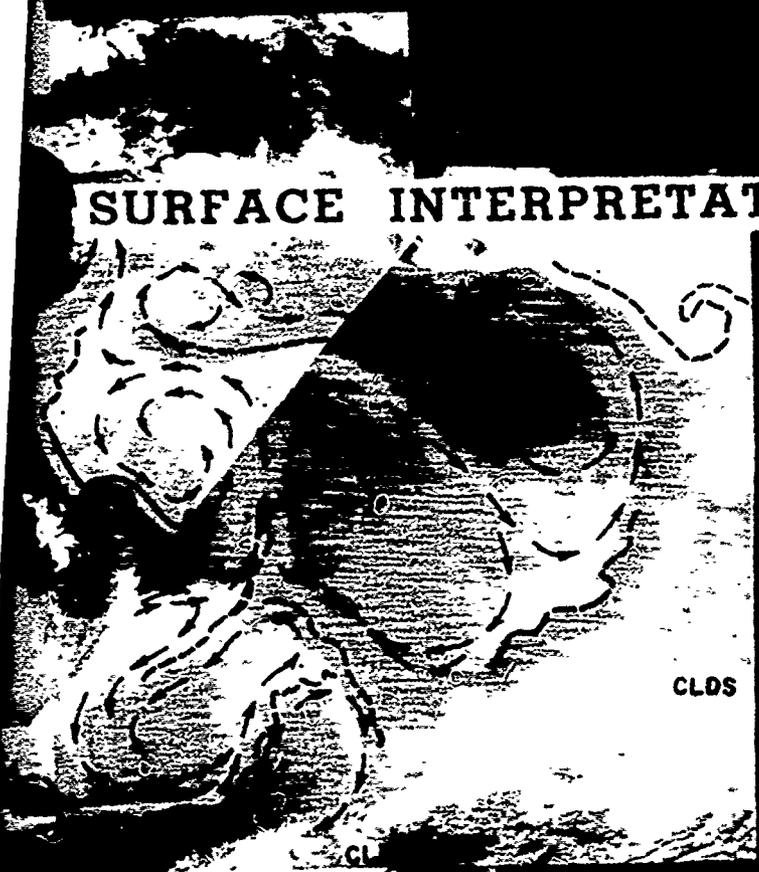
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ARABIAN SEA

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SURFACE INTERPRETATION



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Figure 40. Arabian Sea Mosaic with Interpretation,
28 September 1980.

The composite of enhanced images shown in Figure 30 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively.



SATELLITE VIEW



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SURFACE INTERPRETATION

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ARABIAN SEA

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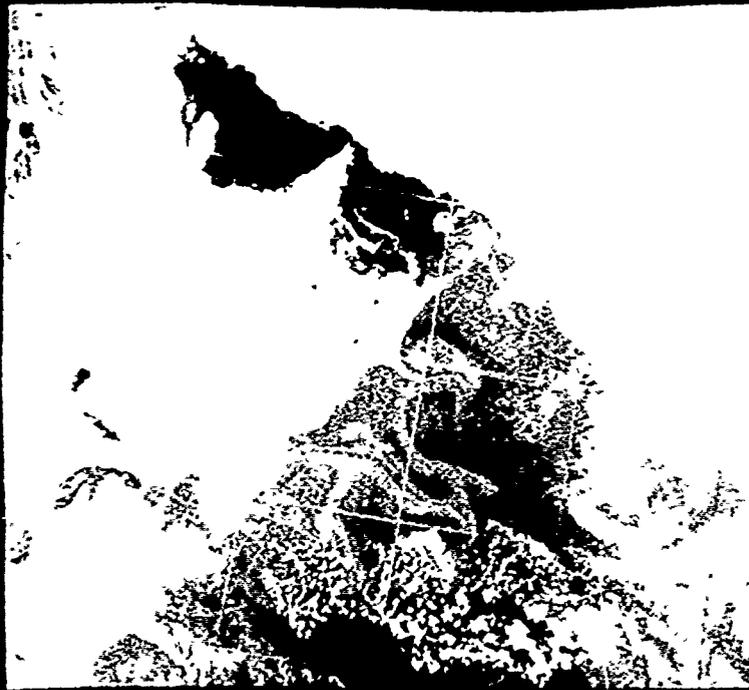
SURFACE INTERPRETATION

ENHANCED MOSAIC

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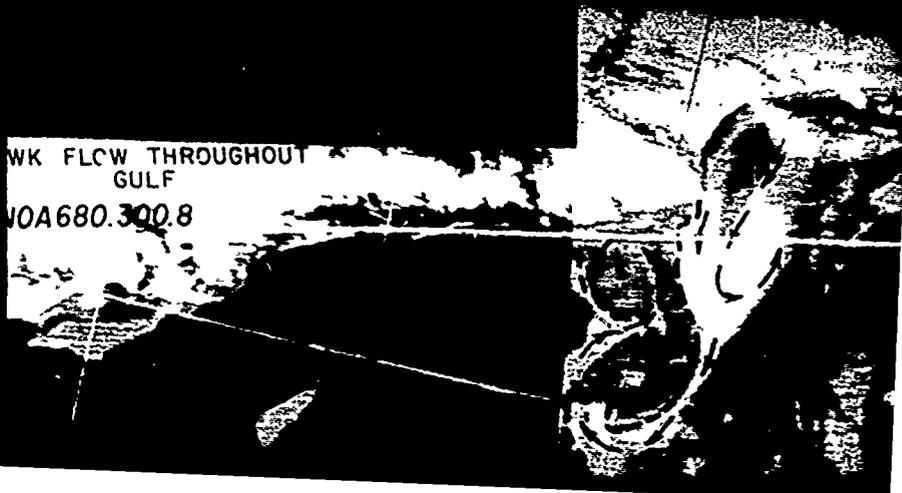
Figure 41. Arabian Sea Mosaic with Interpretation,
30 September 1980.

The composite of enhanced images shown in Figure 31 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively.



SATELLITE VIEW

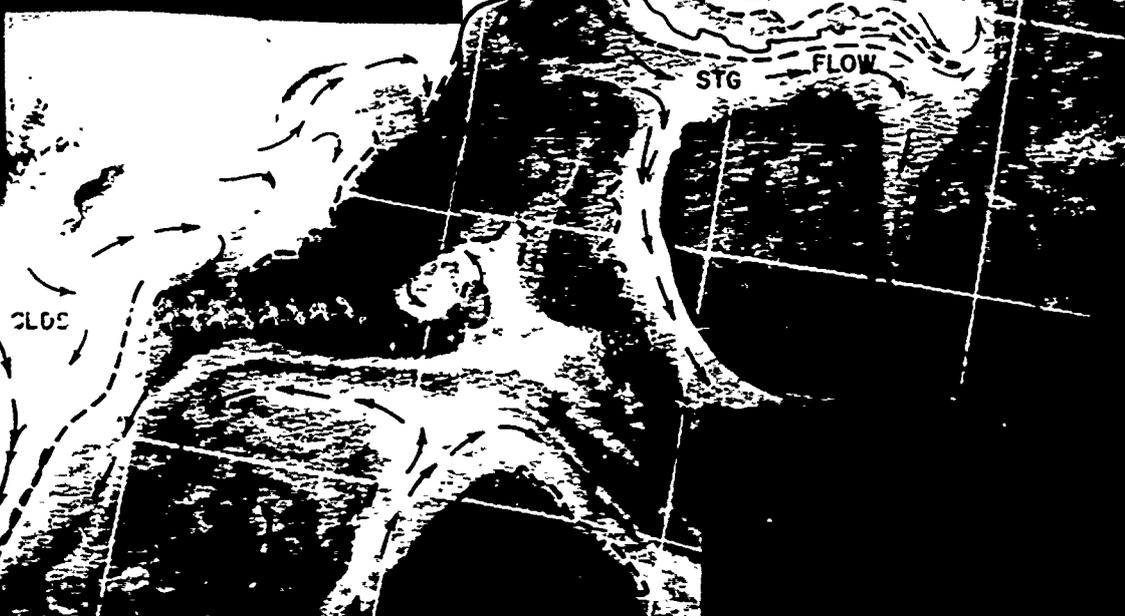
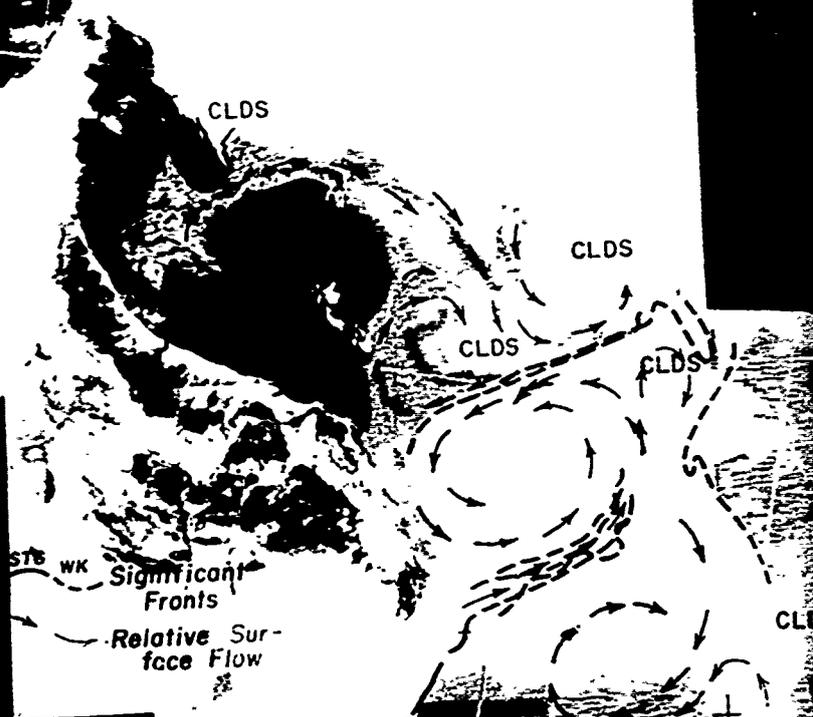
WK FLCW THROUGHOUT
GULF
VOA680.300.8



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SATELLITE VIEW

WIDE FLOW THROUGHOUT
GULF
NOA680.3008

UPWELLING

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SURFACE INTERPRETATION

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RETENTION

ENHANCED MOSAIC

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Figure 42. Arabian Sea Mosaic with Interpretation,
26 October 1980.

The composite of enhanced images shown in Figure 32 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. The interpretations in this mosaic are described in more detail in Figures 15 through 25.



SATELLITE VIEW

ARABIAN

NOV 25



SHELF WATER

CLD

CLDS

VERY WEAK
THERMAL
CHANGES

CLDS

CLDS

CLDS

SURFACE INTERPRETATION

ARABIAN SEA

NOV 25, 1980

3

SHelf WATER

CLD

CLOS

VERY WEAK
THERMAL
BARRIER

CLDS

CLDS

CLDS

INTERPRETATION



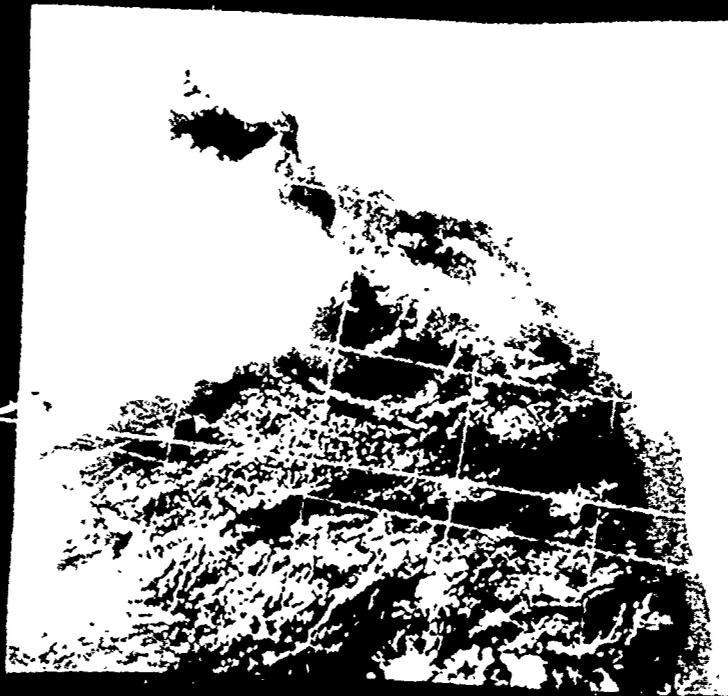
CLOS
CLOS

SURFACE INTERPRETATION

ENGINEERING

Figure 43. Arabian Sea Mosaic with Interpretation,
25 November 1980.

The composite of enhanced images shown in Figure
33 is shown here with a composite of surface
interpretations for each image. Only weak surface
features are indicated.



SATELLITE VIEW



**SOME SLICKING
VERY WEAK GRA
WEAK FLOW**

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SHELF WATER

CIRRUS
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CIRRUS
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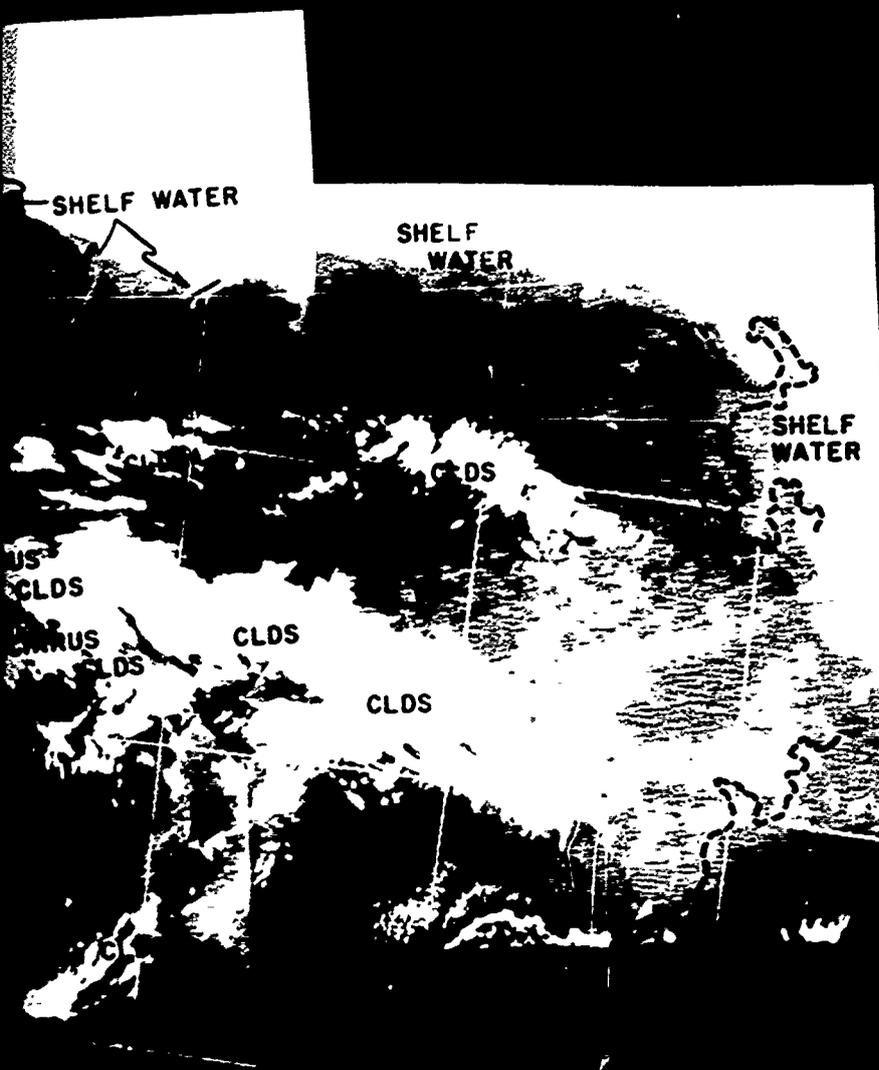
VERY WEAK
GRADIENTS

SOME SLICKING
VERY WEAK GRADIENTS
WEAK FLOW

SURFACE INTERPRETATION

ARABIAN SEA

NOV 27, 1980



INTERPRETATION

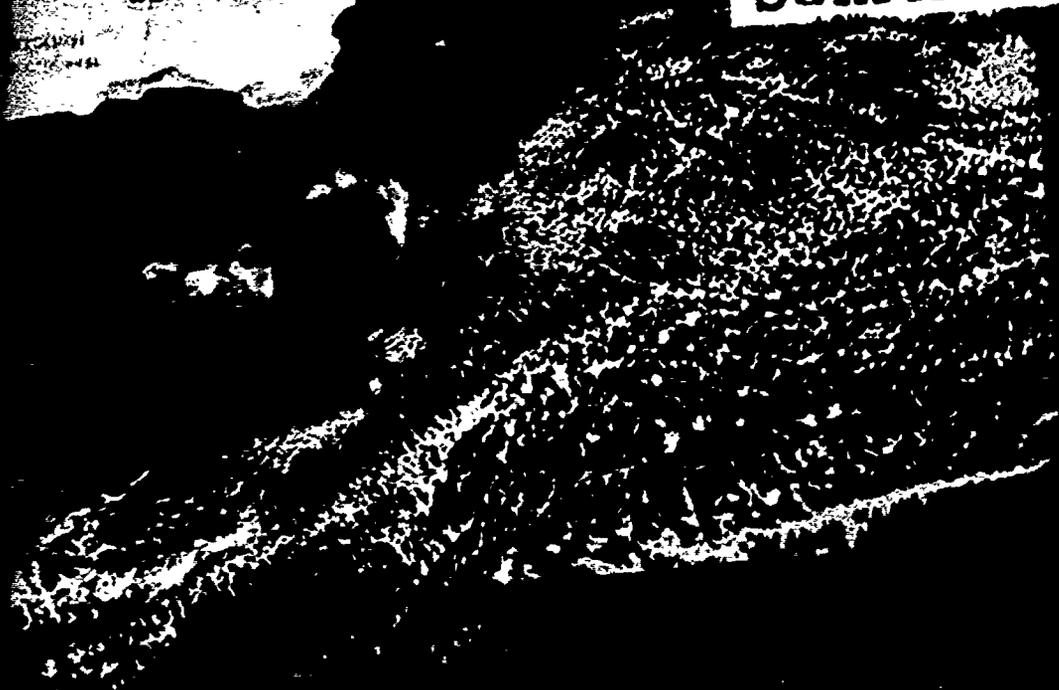
NOV 27 1980

VERY SLIGHT
VERY WEAK
WEAK FLOW

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SOME SLICKING
VERY WEAK GRADIENTS
WEAK FLOW

SURFACE INTERPRETATION



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INTERPRETATION

ENHANCED MOSAIC



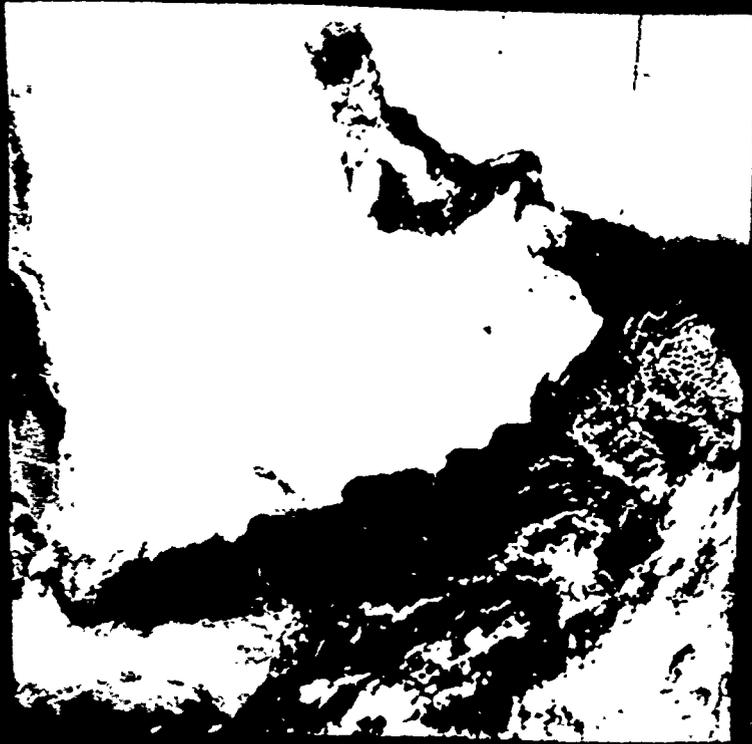
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Figure 44. Arabian Sea Mosaic with Interpretation,
27 November 1980.

The composite of enhanced images shown in Figure 34 is shown here with a composite of surface interpretations for each image. Clouds dominate the field of view with some weak thermal features indicated on the ocean surface.

ARABIAN SEA

NOV 30, 1980



SATELLITE VIEW

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WEAK FRONTAL BOUNDARIES

ST₂ WK
Significant
Fronts

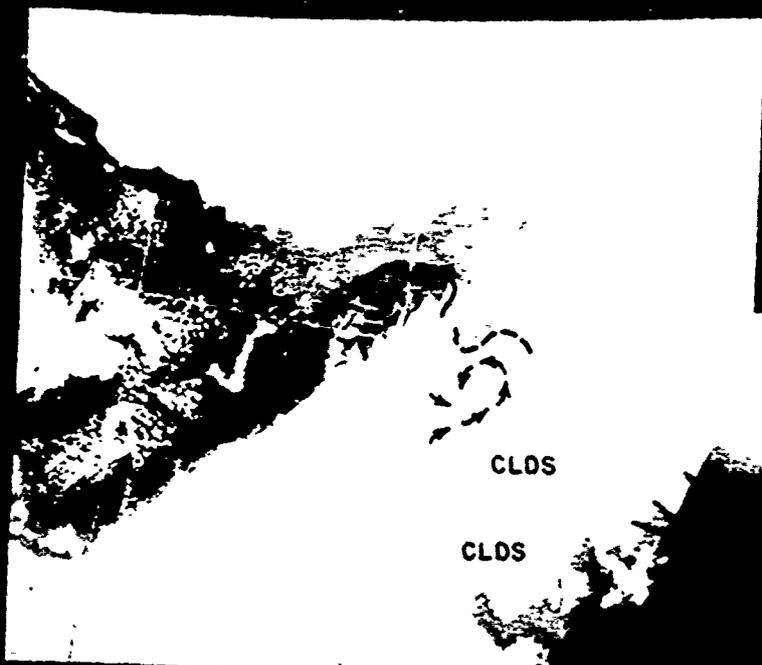
Relative Surface
Flow

COMPLEX EDDY PATTERN

CLPS

ARABIAN SEA

NOV 30, 1980



VERY WEAK SST CHANGES

Significant Fronts

Relative Surface Flow

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WEAK FRONTAL BOUNDARIES

Significant Fronts

Relative Surface Flow

SURFACE INTERPRE



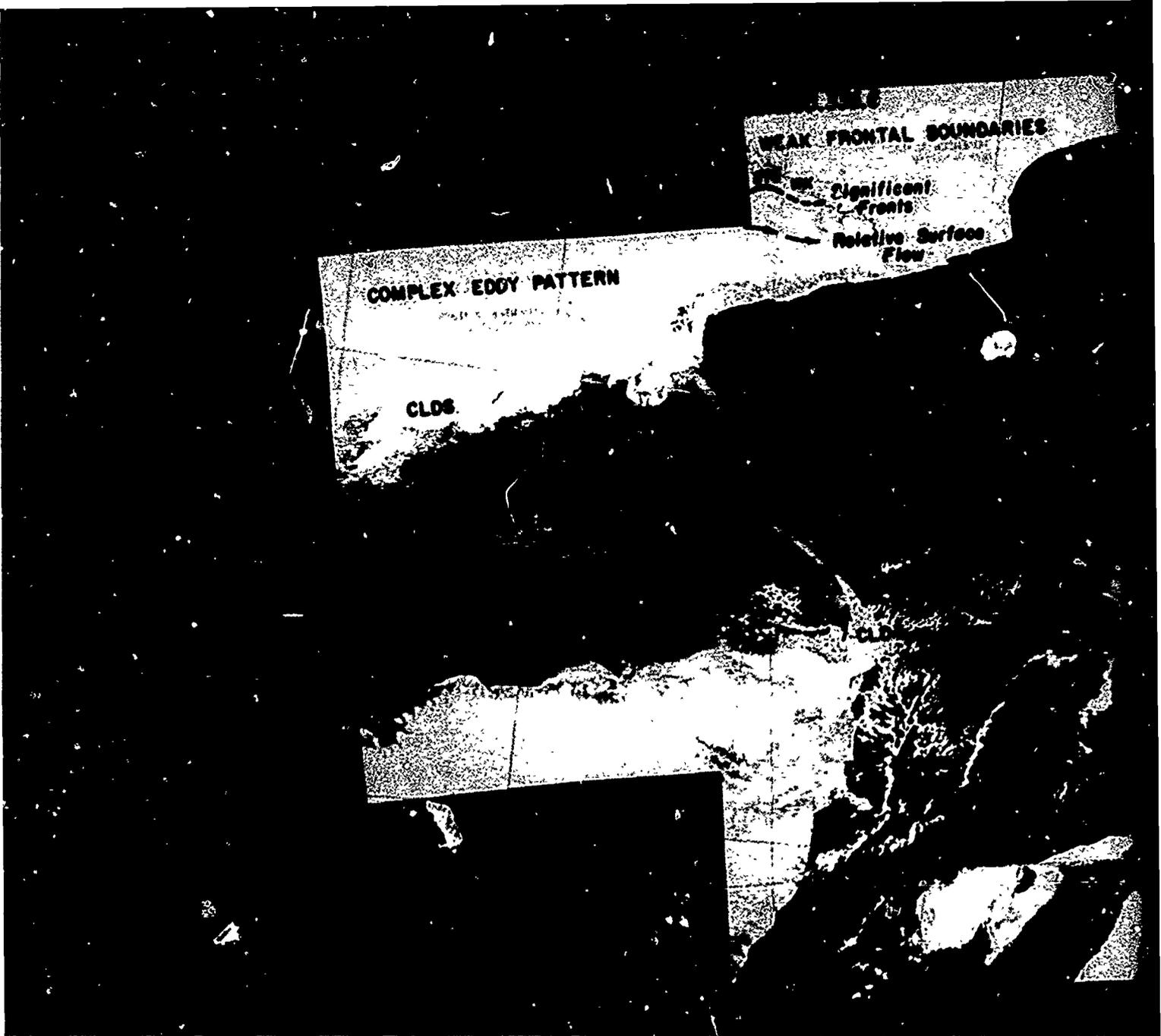
ST CHANGES

Recent
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CLDS

FACE INTERPRETATION



COMPLEX EDDY PATTERN

CLDS.

WEAK FRONTAL BOUNDARIES

Significant Fronts

Relative Surface Flow

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Flow

SURFACE INTERPRETAT



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MOSAIC

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Figure 45. Arabian sea Mosaic with Interpretation,
30 November 1980.

The composite of enhanced images shown in Figure 35 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. (A poor alignment of lines indicating fronts occurred in the printing process.)