SR No. 031

# MARSHES AND TURBID WATERS IN THE FRENCH ATLANTIC LITTORAL

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Translated by Ann Wellington.

15. Abstract

The MSS documents are of varying interest according to the quality of the image , the cloud cover and the area studied. The best documents provide a considerable amount of information in varied domains, notably :

- The geomorphology of the "Marais de Dol", "Marais Breton", "Marais Poitevin" and the "Marais de la Gironde". The documents permit identification of the wetlands, the peat bogs, and the silt zones.

- The geomorphology of the tidal flats of the "Bassin d'Arcachon", of the "Baie du Mont Saint-Michel", the beaches of the coast of Vendée and Bretagne.

-The detailed cartography of zones heavy in suspended sediments in the estuary of the Gironde and the estuary of the Loire; the cartography of the sedimentary plume of the Loire and that of the inlet of Fromentine were made possible by methods of analysis by isodensity, and by densitometric transects of the multispectral images.

Methods of visual observation in printing of composite images and especially of isodensity and densitometry have enabled the laboratory to perfect programs of computer cartography. This is why SYCI MSS DATA have been requested from NASA for the four bands of the best image provided.

**COLOR ILLUSTRATIONS REPRODUCED IN BLACK AND WHITE**

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# PREFACE

(1) Objectives : The FRALIT program's principal goal is to perfect methods of remote sensing in the domain of the coastal marshes, the coast line and the littoral. The investigations undertaken particularly concern the preparation of maps of the coastal region as well as the study of coastal sedimentary transport.

(2) Scope of activity : the 13 images received have been studied.

(3) Significant analyses, findings and techniques : Techniques of visual investigation, of printing in composit colors, of photographic isodensities, and of microdensitometric transects were utilized. Significant analyses were made of the physiography of the coastal plains in the coastal marshes, the tidal flats and the coastal sedimentary transport (estuary of Loire ; plume of the Fromentine - inlet).

(4) Conclusions : The multispectral information is very rich for the coastal regions, but the cloud cover, even when only partial, often cuts up the data, and lessens its practical value.

(5) Recommendations : The FRALIT program Investigators would greatly appreciate receiving SYCI MSS DATA for the best existing image.

## ( I ) OBJECTIVES

The Fralit program's principal goal is to perfect methods of teledetection in the domain of the coastal marshes, the coastline, and the littoral. The investigations undertaken particularly concern the preparation of maps of the coastal region, as well as the study of coastal sedimentary transport.

## ( 2 ) SCOPE OF ACTIVITY

The present report concerns the following frames :

| | | | |
|---|---|---|---|
| 1031 | 10350 | MSS | 4, 5, 7 |
| 1031 | 10352 | MSS | 4, 5, 6, 7 |
| 1031 | 10355 | MSS | 4, 5, 6, 7 |
| 1031 | 10361 | MSS | 4, 5, 6, 7 |
| 1064 | 10175 | MSS | 4, 5, 6, 7 |
| 1064 | 10190 | MSS | 4, 5, 6, 7 |
| 1066 | 10294 | MSS | 4, 5, 6, 7 |
| 1067 | 10355 | MSS | 4, 5, 6, 7 |
| 1101 | 10241 | MSS | 4, 5, 6, 7 |
| 1101 | 10244 | MSS | 4, 5, 6, 7 |
| 1102 | 10302 | MSS | 4, 5, 6, 7 |
| 1118 | 10181 | MSS | 4, 5, 6, 7 |
| 1118 | 10184 | MSS | 4, 5, 6, 7 |

These frames were received from October 26 1972 to January 26 1973 by the principal investigator.

These frames cover areas which are sometimes completely oceanic 1031 - 10355, sometimes completely continental, and sometimes coastal (Fig. 1 ).

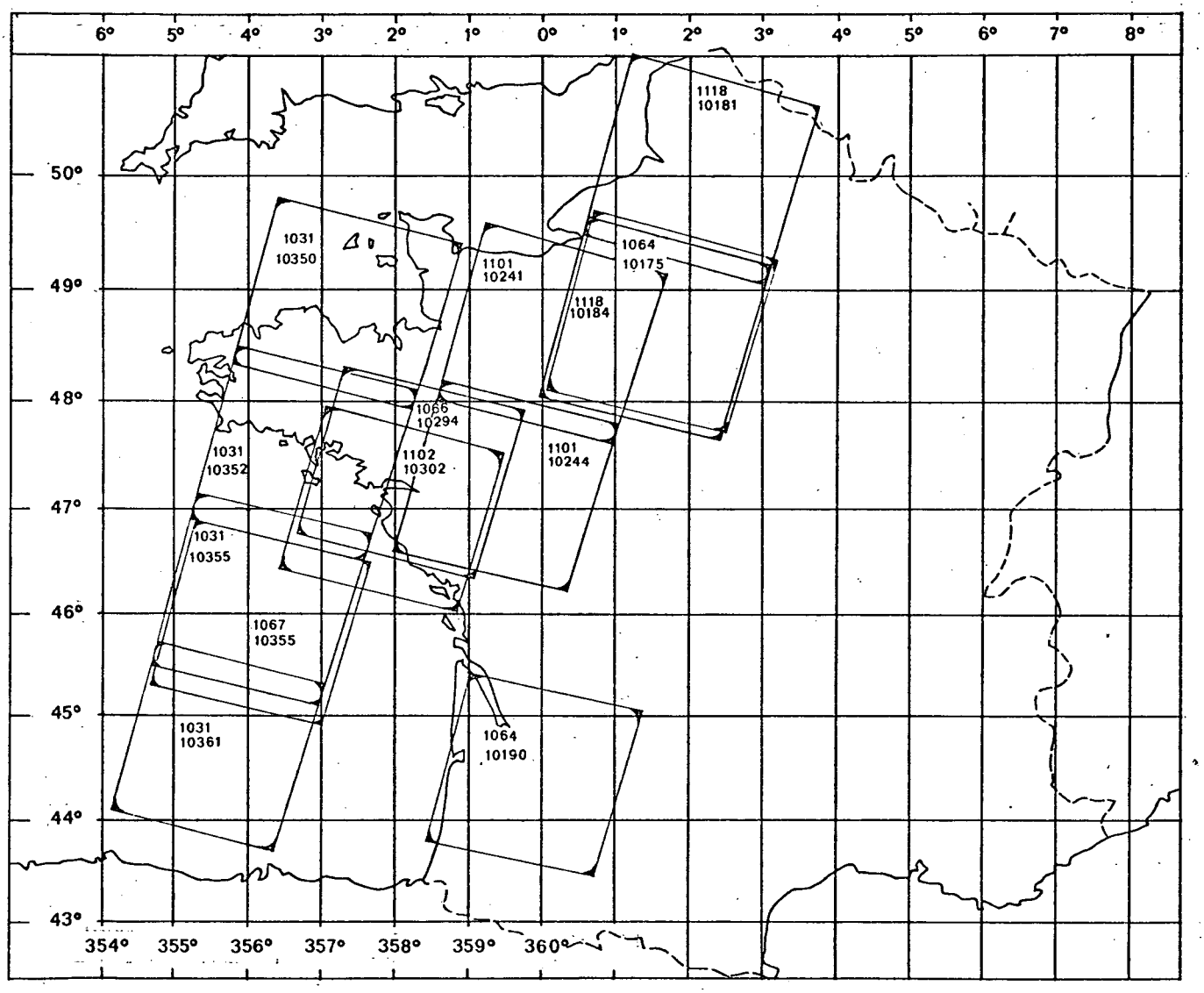



Fig. 1 : Location of received MSS imagery.

These documents are of varying interest according to the area covered, the cloud cover, and the quality of the images.

Brief Description of the Frames :

1031 - 10350

Characteristics of the frame taken August, 23, 1972 in three bands only, 4, 5, and 7.

The geometry is unsatisfactory: Incorrect skew direction.

The quality is not very good :

Spectral bands : 4 Fair but usable , 5 Poor image
7 Poor image

Cloud cover : 40 %

These clouds cover a part of the coastal region; the Cotentin but they do not hide the western part of the "Baie du Mont Saint-Michel".

Principal Usefulness of the Image :

This MSS image was interpreted in accordance with known ground truths in the hydrological sector ( water currents and tide ), at the time the ERTS 1 passed by. These hydrological data are represented in figure 2. The analysis of the MSS 4 data has made it possible to clearly underline the silt transport at low tide in the "baie du Mont Saint-Michel", and to eliminate, by comparison this time with the data of band 7 , certain marks which correspond to atmospheric phenomena .

In the " Marais de Dol " , the MSS data 4, 5, and 7 , have made possible cartography of the silt marshes and peat bogs ( Fig. 3 ).

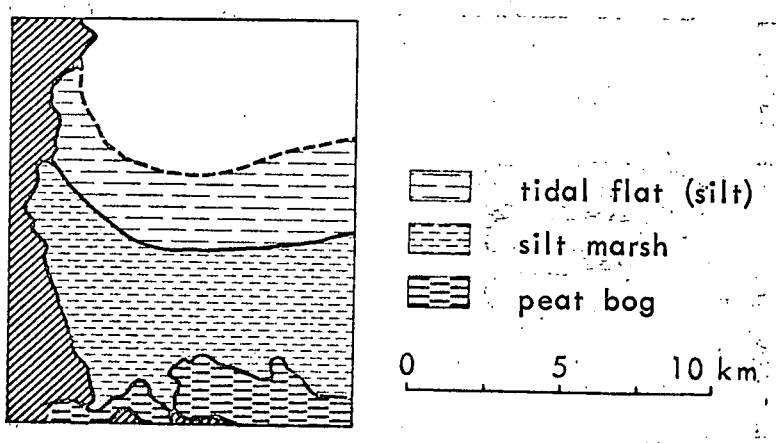



Figure 3

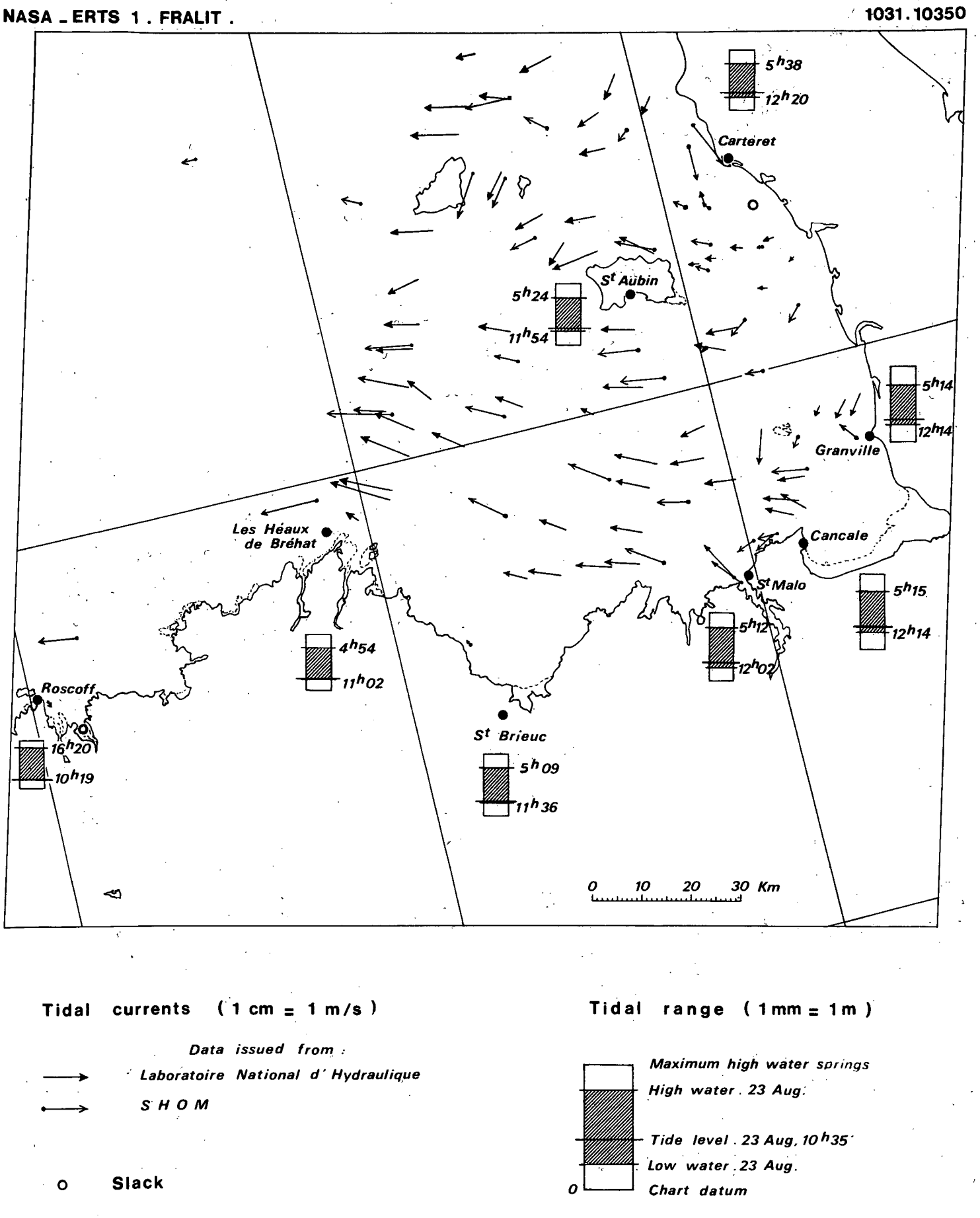



Fig. 2 : Hydrological ground truths for frame 1031 - 10350.

1031 - 10352 :

The quality of the image is not very good. MSS 4 : Fair but usable; 5 : Fair but usable; 6 : Fair but usable ; 7 : Fair but usable.
Cloud Cover : 30 % , however the clouds cover a large part of the coast.

Principal Usefulness of the image :

The coast line and the river system of the bassin de Chatelin is very clearly seen on this image. It was possible to determine the ground truths of the water conditions ( Fig.4), but these photos are not rich in data concerning the movement of coastal sediments which were either very weak or inexistant at the time ERTS-1 passed by.

1031 - 10355 :

Characteristics of the imagery taken August 23 , 1972. The quality of the image is not very good. Bands 4 : Fair but usable ; 5 : Fair but usable ; 6 : Fair but usable ; 7 : Fair but usable .
Cloud Cover : 0 %

Principal Usefulness of the image : Null for the investigators.

1031 - 10361 :

Characteristics of the imagery taken August 23, 1972. The quality is not very good. Bands 4 : Fair but usable; 5 : Fair but usable; 6 : Fair but usable, and 7 : Fair but usable.
Cloud Cover : 0 %

Principal Usefulness of this image : Null for the investigators.

1064 - 10175 :

Characteristics of the imagery taken Septembre 25, 1972. The quality is satisfactory. Bands 4 : Good ; 5 : Good ; 6 : Good ; 7 : Good .
Cloud Cover : 60 %

Principal Usefulness of this image :

This imagery reveals the rural pattern of la Brie, the lay-out of the Orléans forest, and renders possible a study of the urban areas. These features do not stand out in the Fralit program.

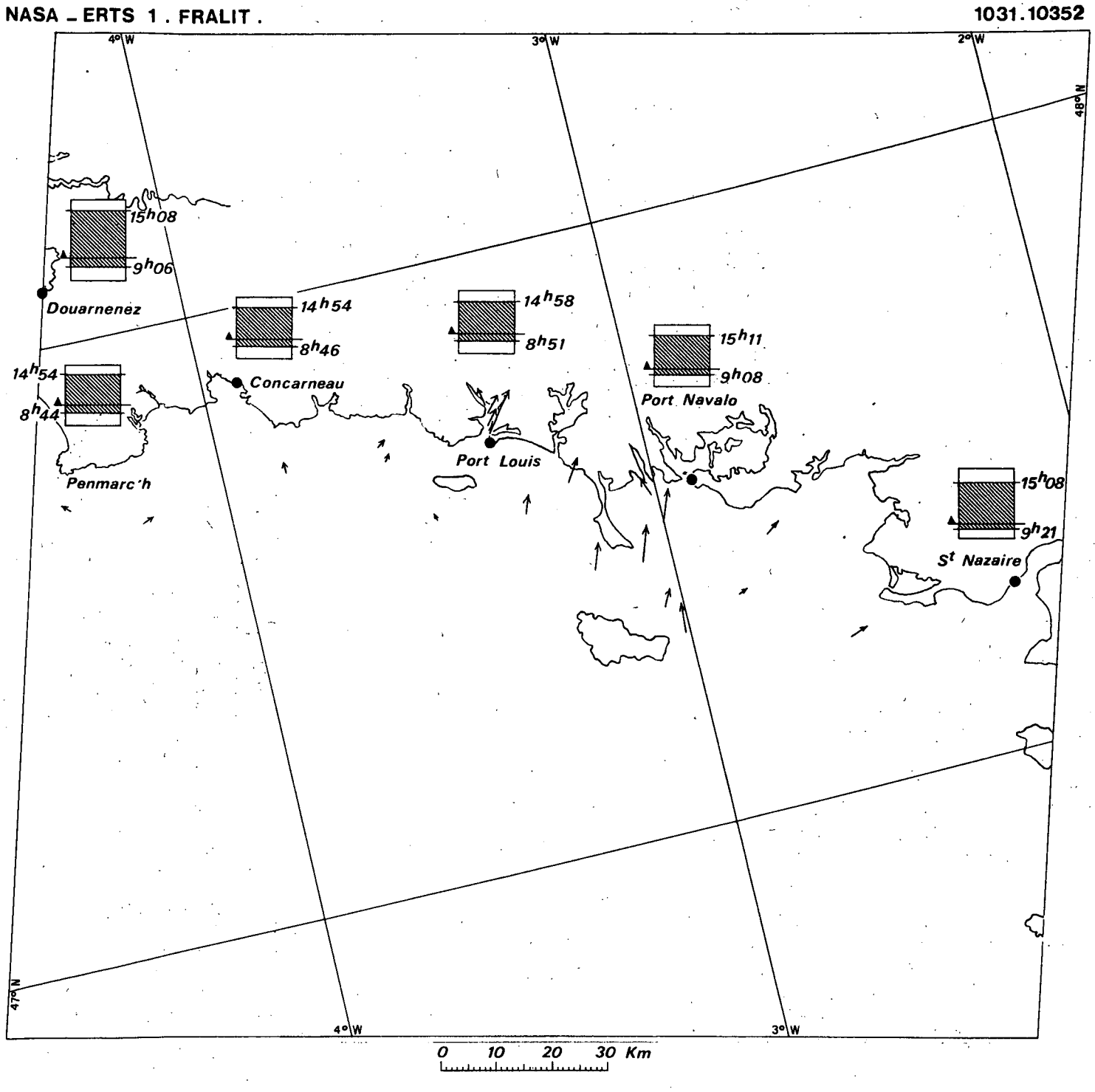



Fig.4 : Hydrological ground truths for frame 1031-10352.

1064 - 10190 :

Characteristics of the imagery taken Septembre 25,1972 , in four bands. The quality is satisfactory. Bands : 4 : Good; 5 : Good; 6 : Good; 7 : Good.

Cloud Cover : 40 %

Principal Usefulness of this image :

This image makes it possible to locate the tidal flats and tidal creeks of the Bassin d'Arcachon, and to determine their evolution. The image also provides diverse data concerning the inlet of the Bassin d'Arcachon and the sedimentary plume ( MSS 4, 5 ) as well as the lower part of the estuary of the Gironde : water movement and suspended matter ( MSS 4, 5, 6 and 7 ).

Humidity of the marsh lands :

The study was performed in accordance with the hydrological ground truths ( Cf. fig. 5 ).

In addition the MSS imagery provides abundqnt documentation on the Bordeaux wine region, the forest " des Landes " and its recent exploitation, the lakes of the Landes , and the greater Bordeaux urban area.

1066 - 10294

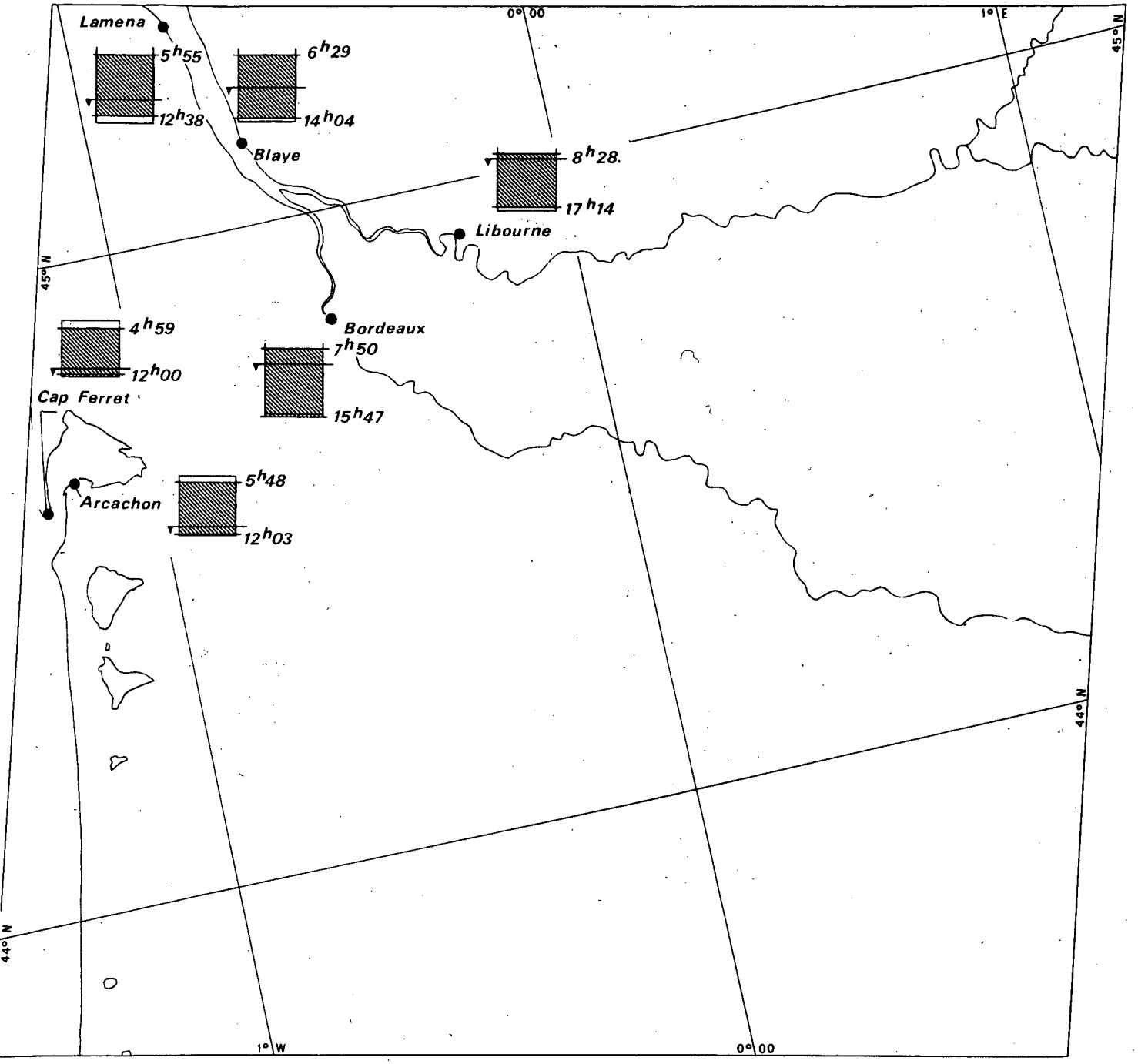
Characteristics of imagery taken September 27 1972.

Quality of the spectral bands : 4 : good; 5: good; 6 : good ; 7 : good.

Cloud cover : 0 %

Principal Usefulness of the image :

This image is extremely interesting due to its absence of cloud cover, its good quality and the hydrological conditions ( those of of ebb tide ) at the time the photograph was taken. The hydrological conditions are given in Fig. 6 .




**Tidal range and water level ( 2 mm = 1 m )**

0 10 20 30 Km

*Maximum high water springs*

*25 September 1972*

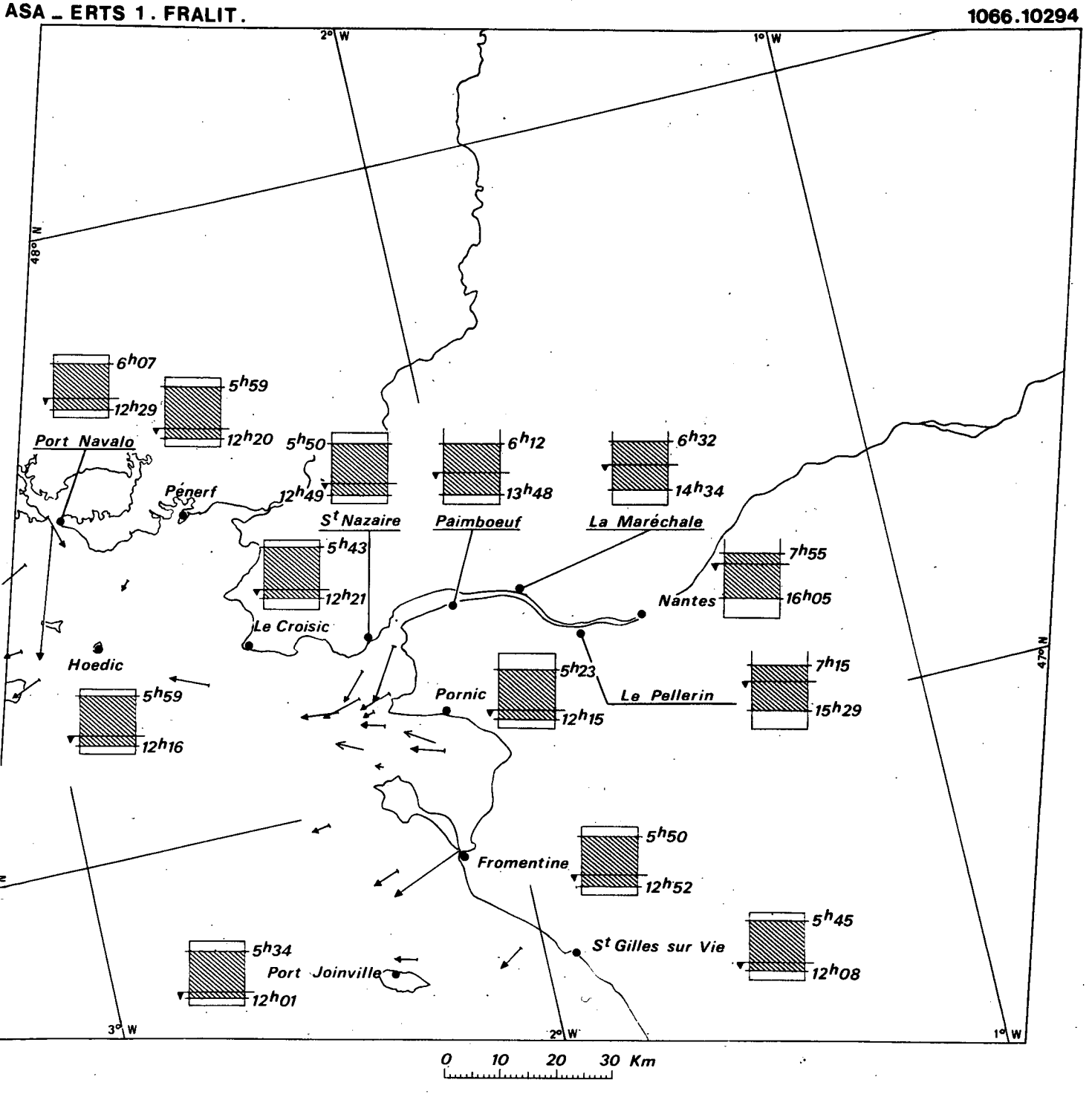
*High water*

*Tide level 10h19 TU* — *falling tide* / *rising tide*

*Low water*

*Chart datum 0*

Fig. 5 : Hydrological ground truths for frame 1064 - 10190.




Tidal currents . ( 1 cm = 1 m/s )

Surface

-10 m depth

Tidal range and water level ( 2 mm = 1 m )

Maximum high water springs

27 September 1972

High water

falling tide

rising tide

Tide level $10^h29$ TU

Low water

Chart datum 0

Fig. 6 : Hydrological ground truths for frame 1066 - 10294.



B

In the waters of the Loire the zone of maximum turbidity can be located in the western part of the estuary ( Paimboeuf ), and the turbidity of the sedimentary plume runs primarly south towards the bay of Bourgneuf. On comparison with the corresponding topographical profiles of the ocean floor, the microdensitometric transects obtained from the imagery show that the remote-sensing registered turbidity, and not the ocean floor. Isodensitometric maps for this area are in preparation. ( cf. Fig. 10 ).

In the bay of Bourgneuf and the inlet of Fromentine, it was possible to gain knowledge of the coastal sedimentary transport ( cf. Fig. 11 ).

This image permits also a study of the beaches (MSS 4 and 5 ), the tidal flats ( 4, 5, 6 and 7 ), the coastal marshes, and land reclamation. Finally the image renders possible a study of coastal coniferous forests ( bands 5 and 7 ), the vegetation of the salt marshes, and the coastal plains; and out of the scope of the Fralit program , the geological structure, the rural patterns ( wooded regions, open-fields), and the urban areas and zones of urban extension.

1067 - 10355

Characteristics of the image taken September 28,1972. The quality is satisfactory. Spectral bands : 4 : good ; 5 : good ; 6 : good ; 7 : good

Cloud cover : 10 %

Principal Usefulness of this image : Null for the investigators.

1101 - 10241

Characteristics of imagery taken november 1st, 1973. Quality of spectral bands : 4 : good; 5 : good ; 6 : good ; 7 : good

Principal Usefulness of this image :

This image is of little utility for the coastal area ( Fralit program ), but useful for gaining knowledge of the rural areas, and agriculture.

1101 - 10244

Characteristics of the image taken November 1st 1972. The quality is satisfactory. Spectral bands : 4 : good; 5 : good ; 6 : good ; 7 : good.

Cloud cover : 30 %

Principal Usefulness of this image.

This image is useful for gaining knowledge of the sandy coast of Vendée , and out of the scope of the Fralit program, for determining the geology and rural continental countryside.

1102 - 10302

Characteristics of the image taken November 2nd 1972.

The quality is satisfactory. Spectral bands : 4 : good ; 5 : good ; 6 : good ; 7 : good

Cloud cover : 50 %.

Principal Usefulness of this image.

This image is of limited usefulness due to cloud cover. However, some littoral transport can be underligned in the areas without clouds : "Pertuis breton" , and "baie de Bourgneuf". It was possible to determine the hydrological ground truths (cf. Fig. 7).

1118 - 10181

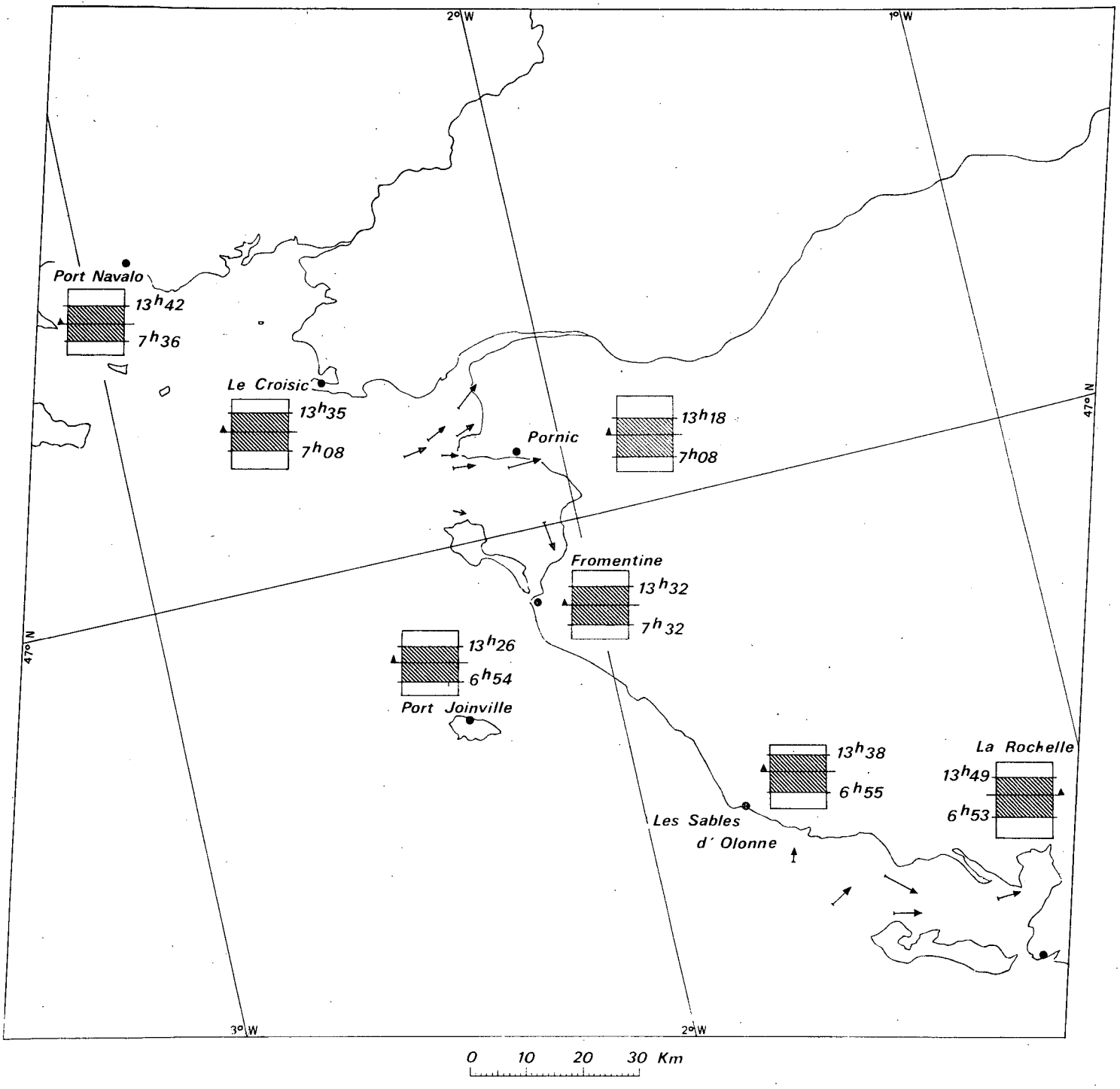
Characteristics of the image taken november 18 1972

The quality is satisfactory. Spectral bands : 4 : Good ; 5 : Good ; 6 : Good ; 7 : Good .

Cloud Cover : 10 %

Principal Usefulness of this image.

Clouds cover the coastal part of the marshlands. (FRALIT program.) However this image is nonetheless of great interest due to a blanket of snow apparent on the "plateau de Picardie". In addition a geological study of the sedimentary terrain (syncline, anticline) is very enriching.




**Tidal currents ( 1 cm = 1 m/s )**

Surface

-10 m depth

**Tidal range and water level ( 2 mm = 1 m )**

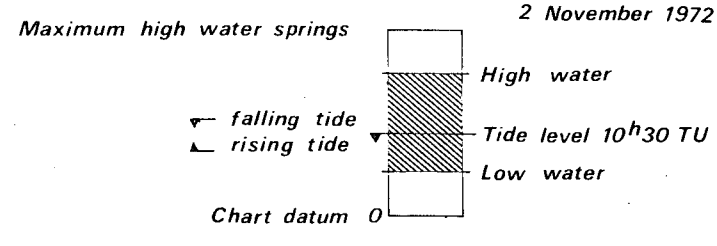



Fig. 7 : Hydrological ground truths for frame 1102 - 10302.

1118 - 10184

Characteristics of imagery taken November 18, 1972 in four bands.

Quality 4 : Good ; 5 : Good ; 6 : Good ; 7 : Good

Cloud Cover : 10%

Principal Usefulness of this image :

This image is of interest due to partial snow covering, and the geological structure revealed. Its' interest is null for study of the coastal zones.

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ORGANIZATION Ecole Pratique des Hautes Etudes

| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Littoral Transport | Tidal Flat | Coastal Marsh | |
| 1031 10350 4 | √ | √ | | Shallow Water ; Mud Flat ; Inshore Zone ; Sediment ; Island ; Advancing Shoreline ; Salt Marsh ; Stratus ; Cloud Streets. |
| 1031 10350 5 | √ | √ | √ | Shallow Water ; Mud Flat ; Inshore Zone ; Coast Line ; Island ; Advancing Shoreline ; Salt Marsh ; Dam ;Harbor ; Stratus ; Cloud Streets. |
| 1031 10350 7 | | EEO | √ | Mud Flat ; Coast Line ; Island ; Advancing Shoreline ; Harbor ; Stratus; Cloud Streets. |

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| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Coastal Marsh | Island | Tombolo | |
| 1031 10352 4 | | √ | √ | Shallow Water ; Sediment; Bay-Head Beach. |
| 1031 10352 5 | √ | √ | √ | Bay-Head Beach ; Forest; Vegetation ; Meander. |
| 1031 10352 6 | √ | √ | √ | Coast ; Coast Line. |
| 1031 10352 7 | √ | √ | √ | Lake ; Coast ; Coast Line. |

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|---|---|---|---|---|
| | Sea | | | |
| 1031 10355 4 | ✓ | | | |
| 1031 10355 5 | ✓ | | | |
| 1031 10355 6 | ✓ | | | |
| 1031 10355 7 | ✓ | | | |

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|---|---|---|---|---|
| | Sea | | | |
| 1031 10361 4 | ✓ | | | |
| 1031 10361 5 | ✓ | | | |
| 1031 10361 6 | ✓ | | | |
| 1031 10361 7 | ✓ | | | |

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|---|---|---|---|---|
| | Meander | Cropland | Forest | |
| 1064 10175 4 | √ | √ | √ | Corn ; Airfield ; Highway. |
| 1064 10175 5 | √ | √ | √ | Airfield ; Highway ; Agriculture ; Suburban Area ; Urban Area. |
| 1064 10175 6 | √ | √ | √ | Alluvial Plain ;Alluvial Terrace ; Cumulus ; Cloud Streets ; Deciduous ; Conifer ; City ; Urban Area ; Industrial Area. |
| 1064 10175 7 | EEO | √ | | Alluvial Plain ; Alluvial Terrace ; Marsh ; Deciduous ; Conifer ; City ; Urban Area ; Suburban Area ; Industrial Area. |

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| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Coast Line | Forest | Vineyard | |
| 1064 10190 4 | √ | √ | | Longshore Current ;Tidal Flat ; Dune ; Lake ; Alluvial Terrace ; Estuary; Conifer ; Railroad. |
| 1064 10190 5 | √ | √ | √ | Estuary ; Lake ; Meander; Alluvial Terrace ; Dune; Mudflat ; Conifer ;Deciduous ; Highway ; Railroad. |
| 1064 10190 6 | √ | √ | √ | Lake ; Tidal Flat ; Dune; Meander ; Island ; Estuary ; Alluvial Terrace; Conifer ;Corn ; Urban Area ; Highway ; Canal. |
| 1064 10190 7 | √ | √ | √ | Lake ; Tidal Flat ;Dune; Meander ; Island ; Esturary ; Alluvial Terrace ;Conifer ; Corn ; Irrigation ; Urban Area; Highway ; Canal. |

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| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Estuary | Coastal Marsh | Island | |
| 1066 10294 4 | √ | | √ | Bay Head Beach ; Coastal Current ; Coastal Dune ; Littoral Current ; Littoral Transport ; Inlet ; Shallow Water. |
| 1066 10294 5 | √ | EEO | √ | Fault (EEO) ; Bay Head Beach ; Coastal Current; Coastal Dune ; Inlet ; Littoral Transport ; Harbor ; Conifer ; Deciduous. |
| 1066 10294 6 | √ | √ | √ | Harbor ; Tidal Flat ; Lake ; Urban Area. |
| 1066 10294 7 | √ | √ | √ | Harbor ; Conifer ; Deciduous ; Lake ; Island ; Urban Area. |

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| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Sea | | | |
| 1067 10355 4 | √ | | | |
| 1067 10355 5 | √ | | | |
| 1067 10355 6 | √ | | | |
| 1067 10355 7 | √ | | | |

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (√) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

MAIL TO ERTS USER SERVICES
CODE 563
BLDG 23 ROOM E413
NASA GSFC
GREENBELT, MD. 20771
301-982-5406

GSFC 37-2 (7/72)

# ERTS IMAGE DESCRIPTOR FORM

(See Instructions on Back)

NDPF USE ONLY
D
N
ID

DATE February 26, 1973

PRINCIPAL INVESTIGATOR Dr Fernand VERGER

GSFC F-0429

ORGANIZATION Ecole Pratique des Hautes Etudes

| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Valley | Forest | Rivers | |
| 1101 10241 4 | V | V | V | Meanders ; Alluvial Plains ; Cropland ; Coast Line. |
| 1101 10241 5 | V | V | V | Meanders ; Alluvial Plains ; Cropland. |
| 1101 10241 6 | V | V | V | Meanders ; Tributaries; Alluvial Plain ; Lake; Plains ; Peneplain ; Fault ; Horst ; Syncline Cropland. |
| 1101 10241 7 | V | V | V | Meanders ; Tributaries; Alluvial Plain ; Lake; Alluvial Terraces ; Fault ; Horst ; Syncline ; Plain ; Peneplain ; Cropland ; Grassland. |

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

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# ERTS IMAGE DESCRIPTOR FORM

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| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Tributary | Cropland | Geology | |
| 1101 10244 4 | √ | √ | EEO | Meander ; Mature Stream; Alluvial Plains ; Outliers ; Cuestas ; Forest; Coast Line ; Shallow Water ; Coastal Marsh. |
| 1101 10244 5 | EEO | EEO | EEO | Mature Stream ; Meander; Conifers ; Deciduous ; Terrace ; Fault ; Coast Line ; Dunes ; Coastal Marsh ; Lake ; Forest. |
| 1101 10244 6 | √ | √ | √ | Dam ; Lake ; Urban Areas; Forest ; Highway. |
| 1101 10244 7 | √ | √ | √ | Meander ; Mature Stream; Dam ; Lake ; Urban Areas; Forest ; Highway ; Railroad. |

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C

# ERTS IMAGE DESCRIPTOR FORM

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DATE January 1973

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ORGANIZATION Ecole Pratique des Hautes Etudes

| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Coast | Coastal Marsh | Shallow Water | |
| 1102 10302 4 | ✓ | ✓ | ✓ | Tidal Flat ; Conifer ; Sediment. |
| 1102 10302 5 | ✓ | ✓ | ✓ | Tidal Flat ; Conifer ; Sediment ; Barrier Beach. |
| 1102 10302 6 | ✓ | | | |
| 1102 10302 7 | ✓ | ✓ | | |

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

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# ERTS IMAGE DESCRIPTOR FORM

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ORGANIZATION Ecole Pratique des Hautes Etudes

| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Snow | Meander | Rural Area | |
| 1118 10181 4 | √ | √ | | Alto Cumulus ; Anticline; Broken Clouds ; Cuesta ; Forest ; Parallel Drainage. |
| 1118 10181 5 | √ | √ | √ | Agriculture ; Anticline ; Broken Clouds ; City ; Cuesta ; Forest ; Highway ; Longshore Current; Littoral Transport ; Plateau ; Synclinal Valley. |
| 1118 10181 6 | √ | √ | √ | Agriculture ; City ;Coast; Coastal Dunes ; Cropland; Highway ; Industrial Area Plateau ; Rectangular Drainage ; Suburban Area. |
| 1118 10181 7 | √ | √ | √ | Agriculture ; Alto Cumulus ; Anticline ; Broken Clouds ;Coastal Dunes ; Croplands ; Cuesta ; Highway ; Industrial Area ; Marshes ; Plain ; Plateau ; Rectangular Drainage. |

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

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# ERTS IMAGE DESCRIPTOR FORM

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ID

DATE January 13, 1973

PRINCIPAL INVESTIGATOR Dr Fernand VERGER

GSFC F-0429

ORGANIZATION Ecole Pratique des Hautes Etudes

| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Meander | Rural Area | Agri-culture | |
| 1118 10184 4 | ✓ | | | Clouds ; Cuesta ; Dendritic Drainage ; Forest ; Geography ; Highway ;Hydrology ; Plateau. |
| 1118 10184 5 | ✓ | ✓ | ✓ | Alluvial Plain ; Cuesta ; Dendritic Drainage ; Forest ; Geography ; Highway ; Hydrology ; Plateau Valley. |
| 1118 10184 6 | ✓ | ✓ | ✓ | Conifer ; Clouds ; Cropland ; City ; Cuesta ; Deciduous ; Dendritic Drainage ; Forest ; Geography ; Highway ; Hydrology ; Industrial Area ; Meadowland ; Plateau ; Valley ; Vegetation. |
| 1118 10184 7 | ✓ | ✓ | ✓ | Conifer ; Corn ; Cropland ; City ; Cuesta ; Deciduous ; Forest ; Grassland ; Highway ; Hydrology ; Industrial Area ; Meadowland ; Plateau ; Valley ; Vegetation |

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

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GSFC 87-2 (7/72)

Significant Techniques.

Usage of the Imagery.

Images 1031 - 10355, 1031 - 10361, and 1067 - 10355, which are of totally oceanic areas have not made possible a study of the ocean floor, or of the sedimentary suspended matter, and therefore have only given rise to a brief study.

Images 1064 - 10175, 1101 - 10241, 1101 - 10244 and 1118 - 10184 present an interest which is not directly related to the Fralit program and will be the object of a more detailed study later.

Images 1031 - 10350, 1031 - 10352, 1064 - 10190, 1066 - 10294, 1102 - 10362, and 1118 - 10181 have been the subject of diverse investigations.

## COLOR PRINTING

The laboratory has attempted to produce experimental colored images from multispectral black and white originals. These efforts concern two or three bands which were produced in offset printing.

The images thus obtained make possible a synthetical study of the original images. Figures 8 and 9 represent certain of these prints.

Fig. 8 . Experimental printed image produced from multi-spectral black and white MSS 4, 5 and 6 images.

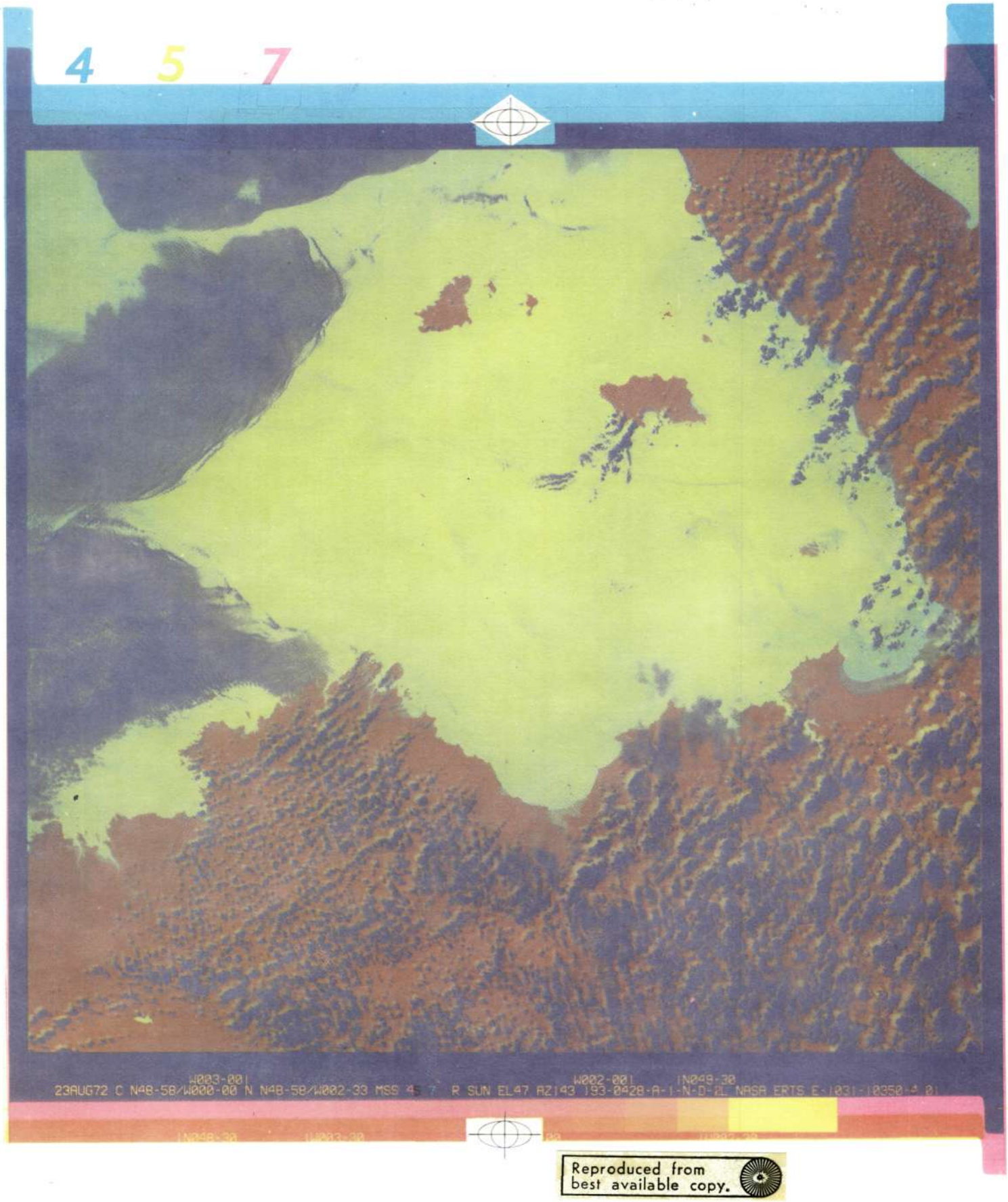




Fig.9 : Experimental printed image produced from multispectral black and white MSS 4,5,7.

Other prints are under preparation, but this process seems better adapted to global, but superficial studies, rather than to research in depth.

## STUDY OF MULTISPECTRAL SCANNER IMAGES BY ISODENSITOMETRIC AREAS :

Series of grey values were isolated in each image ( Fig. 10 ) the expanses of the images which correspond to a well defined combination of values in each of the four spectral bands can be determined. A superimposition of appropriate photographic masks and conter masks enable one to identity these expanses. This research is currently being undertaken parallel with a ground investigation to clarify certain spectral signatures which are insufficiently explained.

## STUDY OF MULTISPECTRAL SCANNER IMAGES BY MICRODENSITOMETRY :

In the regions which are of particular interest to the investigators, transects were chosen to be scanned by microdensitometer. These measurements were done in four squares in order to prepare for a systematic research of spectral signatures and, more particularly, in order to study the distribution of sedimentary matter suspended in water.

Equipment Used.

The Machine used is a Joyce Loebl Mark III CS Microdensitometer, whose operation is thus described by the constructing company :

The principle of operation is based on a true double-beam light system, in which two beams from a single light source are switched alternately to a single photomultiplier. If the two beams are of a different intensity, a signal is produced by the photomultiplier, which, after amplification, causes a servo motor to move an optical attenuation so as to reduce the intensity difference to zero. In this way a continuously null balancing system is obtained, in which the position of an optical attenuator is made to record the density at any particular part of a specimen.

The position of the optical wedge, to which a direct-writing pen is attached, is controlled as follows : -

The signal from the photomultiplier is fed to the amplifier, the outpout of which is applied to the servo motor. Servo stability and sensitivity control are achieved by applying a feedback signal, derived from the tacho generator coupled to the servo motor, to the amplifier.

The specimen and record tables are driven by another servo system at a speed proportional to the rate of change of density. When the rate of change is small, the speed is at its maximum, and vice versa.

Base Line. Position of the optical attenuator and, therefore, the pen, is controlled by a manually-operated wedge in light path.

Neutral Filters are provided to control intensity of the specimen

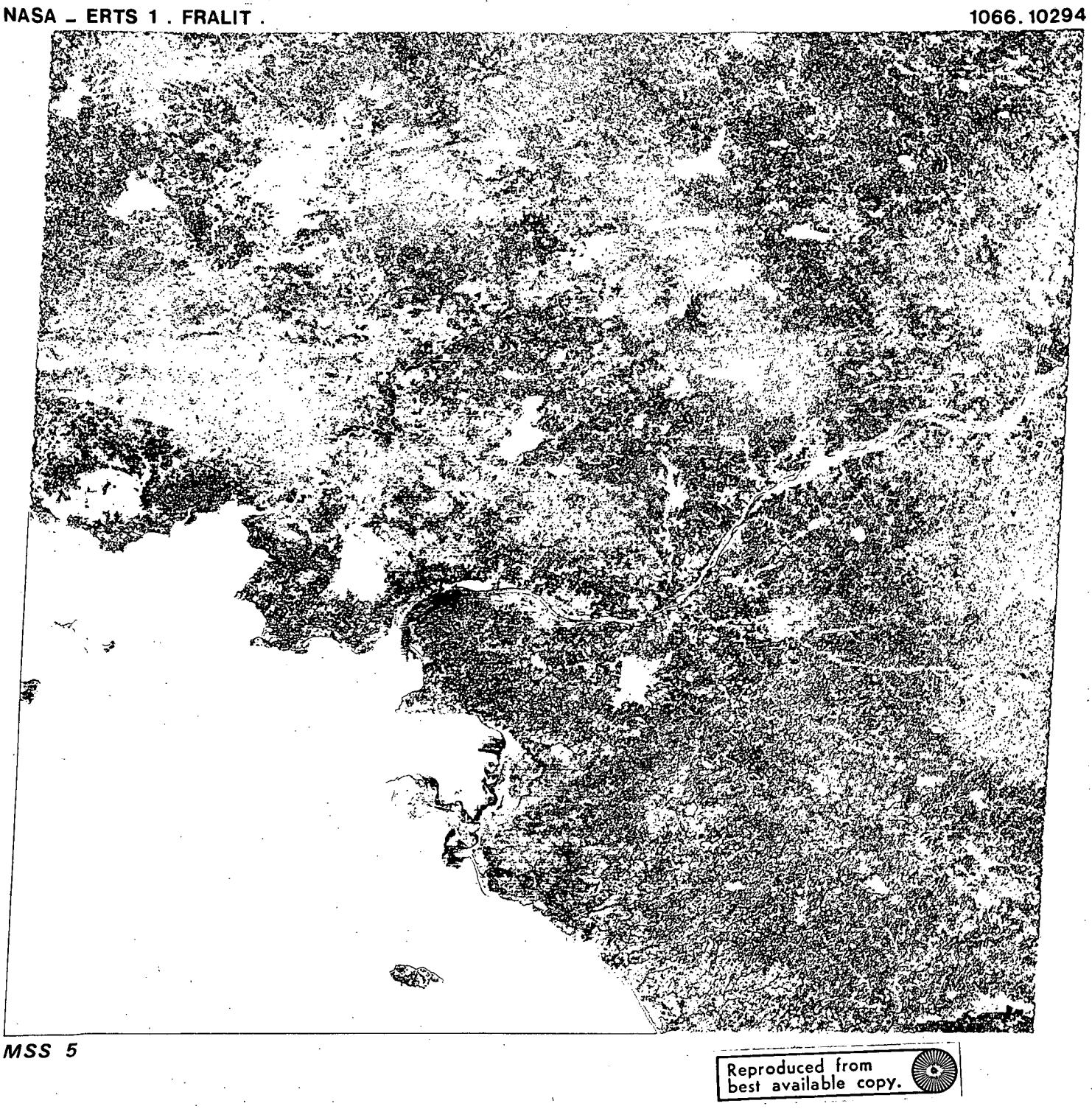




Fig.10 : Selection by isodensity of gray level of MSS 5 image.

light path to obtain balanced conditions with wide aperture openings as the reference light path intensity is set to work within photomultiplier range under all conditions. Filters ensure that the red light from the red glass jaws does not reach the photomultiplier.

In the following, some of the major design features of the instrument are described : ---

( A ) DOUBLE-BEAM SYSTEM OF OPERATION

The instrument incorporates a true double-beam system in which the two beams arise from a single light source and terminate in a single photo-electric receiver. This makes the instrument almost independent of its own parameters and complete reproducibility of record is possible, within the range of densities specified.

( B ) DIRECT RECORD/SPECIMEN TABLE LINKAGE

The mechanical direct linkage between the specimen and record tables ensures complete synchronisation, irrespective of the ratio by which the record is expanded with respect to the specimen. This enables the instrument to be used for accurate measurements of distances between specimen details. The direct linkage also facilitates identification of specimen details, provided a simple routine is followed.

( C ) DENSITY MEASUREMENT

The density range is approximately 5.6 D under optimum conditions The density limits which can be recorded linearly cannot, however, be stated generally, as they depend on a number of conditions, such as optical magnification, the aperture width and area, etc. In cases where the detail is either a very small size i.e. of the order of a few microns, or where the density is greater than 2.7 D approximately, some care is therefore required.

( D ) VISUAL LOCATION OF SPECIMEN DETAILS

The image presented to the aperture is the magnified image. This not only enables a high degree of resolution to be achieved, (the effective aperture being the actual aperture divided by the overall optical magnification), but also provides a simple means for locating fine detail on the viewing screen. The aperture is continuously variable in both width and height, up to maximum of 3 mm. and 25 mm. respectively.

MEASUREMENTS UNDERTAKEN

The transects were performed with an opening of 100 µm X 100 µm. This is a relatively large value, but it is our opinion that a smaller opening would give results having no real physical sense. The transects are 41 kilometers long, and have been represented by graphs showing , on the abscissa, horizontal distances of approximatally 1/ 200,000, and, showing, on the ordinate, the densities. In fact the grey value present on each image made it possible to graduate the ordinance values in radiance. These radiance values are only approximate and don't take in account the influence of neighboring areas ( chemical development, adjacency effects etc...).

The research described above has been the most fruitful. It has consisted in measuring densities on axes acrefully chosen for their pertinence to the investigators' objectives. This research has made it possible to undertake other tentative research on spectral signatures that is tosay, the identification of objects on the ground, according to the distribution of densities in different bands. However, using the method described above, it is not possible to push research very far in this direction, primarely because the photographic retranscription doesn't retain the entire range of energy levels recorded, and because the localzing of the same detail on four bands is imprecise. Only numerical treatment with a computer compatible tape would make it possible to obtain more general and precise results, this is why on February 1973, we ordered from Nasa the computer compatible tapes which correspond to an image of excellent quality, absent of clouds, for the the four bands of the Multispectral Scanner System. ( Sensor Band M , Product Type D, Product Format 9, Observation Identifier 1066 - 10294 ). The computer to be used is an IBM 365-25. In the preliminary phase of the operation, partial thematic maps will be produced by the computer's printing system. Afterwards a thematic cartography of the entire region concerned, that is tosay the "basse vallée de la Loire " can be elaborated using a tracing table. We have at our disposal two tracing tables, a Calcoup 718 and a Contravès.

## Significant Results

The comparative study of microdensitometric transects in four MSS bands for carefully delimited profiles on the ground, makes it possible to isolate and recognize various types of countryside .

I . Countryside of Coastal Plains :

I a : coastal plains uniformly, covered by permanent meadows ( MSS 6 and 7 )

I b : coastal plains formerly used for the production of salt, and which have retained water surfaces. (MSS 6 and 7 ).

I c : coastal plains consisting in well drained agricultural exploitation. (MSS 5, 6 and 7).

II . Countryside of coastal sand dunes and beaches.

II a : dunes used for gardening ( MSS 4, 5, and 6 ).

II b : dunes with sea-pine forests ( MSS 4, 5, 6, and 7 ).

II c : dunes with sand vegetation ( MSS 5, and 7 ).

II d : sand beaches ( MSS 4, 5 , and 6 ).

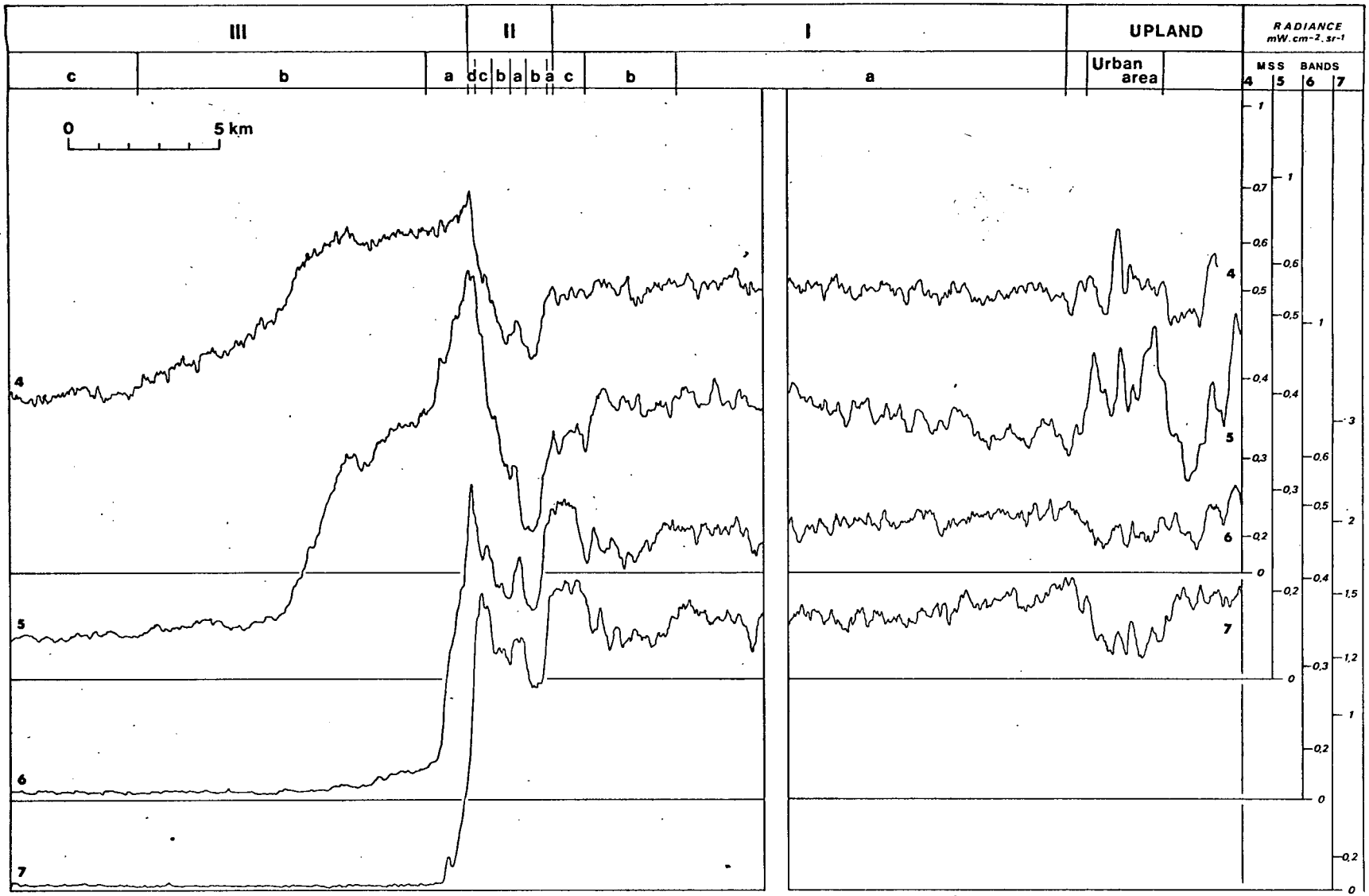


Fig. 11 : Microdensitometric transects in four spectral bands of the Marais de Monts, the coastal zone, and the plume of the inlet of Fromentine. The radiance values indicated on the ordinate, which are determined according to the gray scale, are only approximate values, and don't take in account the influence of neighboring areas (modulation transfer function effects, chemical development adjacency effects etc. ). Observation identifier : 1066.10294. MSS 4,5,6,7. Low gain .

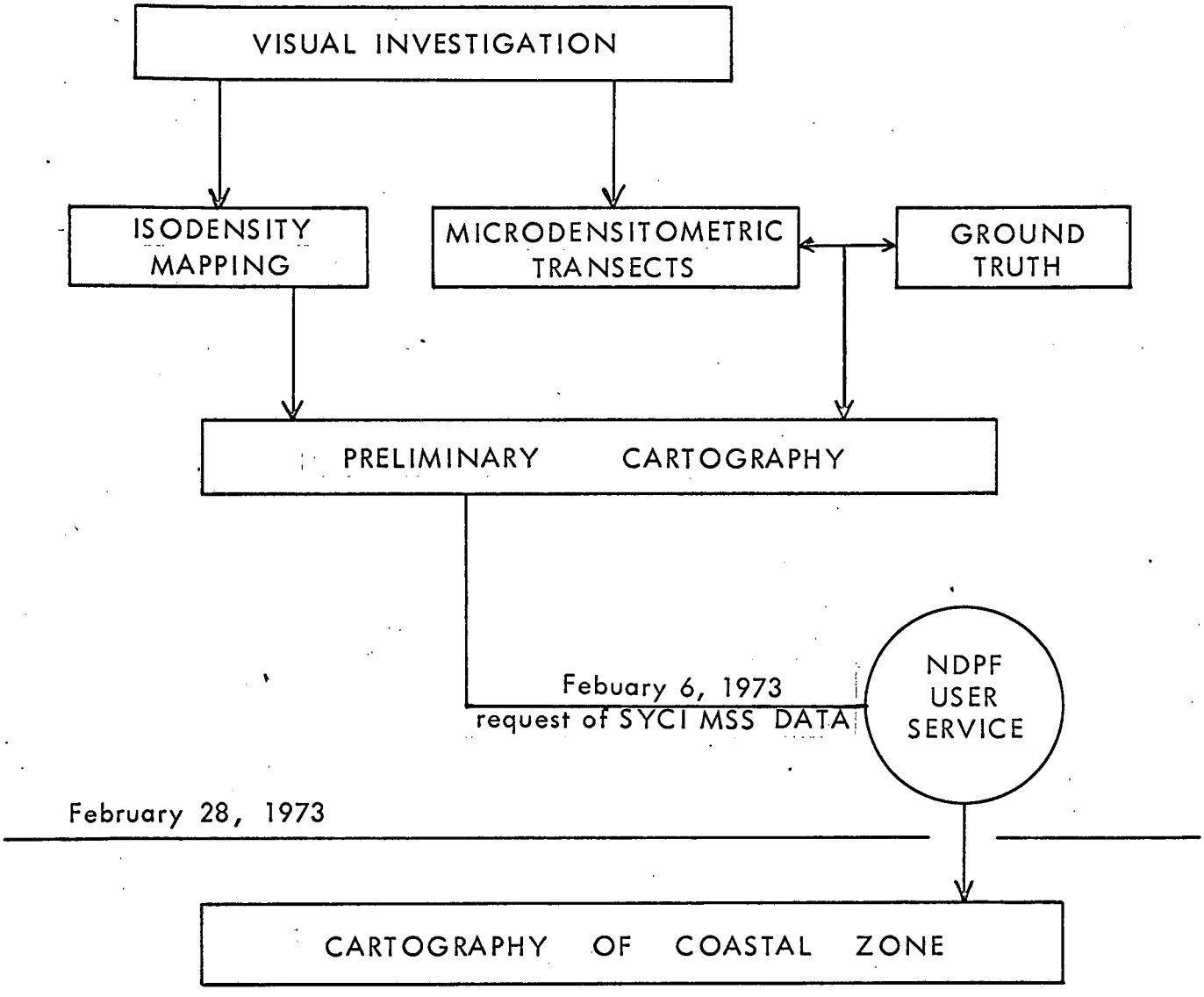


Fig. 12. Overall Lay-out of FRALIT-studies

III . Offshore Domain : Formsand Processes

III a : tidal delta ( MSS 4, 5 , and 6 )

III b : suspended matter : plume of inlet ( MSS 4, and 5 ).

III c : Sea

This investigation, by microdensitometric transects was extended to larger surfaces by combining images of density founded on several spectral bands. The cartography of the plume of the inlet of Fromentine was established in this manner.

This study shows the usefulness of the ERTS program in establishing a rapid cartography of the physiographic units of the coastal plains in the interest of a rational program of exploitation and development.

Countryside I : These regions present numerous problems ( Wildlife Conservation, Hunting, Agriculture, Water management, Flood control, Oyster-breeding, Conch-breeding, fish breeding ..... ).

Countryside II : Forest conservation, soil erosion, shoreside recreation, swimming, sunbathing .... ).

Countryside III : Shipping, boat sportfishing, beach erosion and maintenance.

## ( 4 ) - CONCLUSIONS.

The multispectral information provided by ERTS-1 is very rich for the coastal regions but the cloud cover, even when only partial, often cuts up the data, and lessens its practical value. The research by densitometric methods has thus far been the most fruitful. It consists in measuring densities along preferential axes. This method has enabled the investigators to perfetc a system of computer cartography for the best image. This is why on February 6 1973 , the investigators asked Nasa for the following bands : Sensor band M, Product type D, Product format 9.

## ( 5 ) - RECOMMENDATIONS.

Research is currently being pursued by photographic isodensities of microdensitometric transects in accordance with known ground truths. The great interest of this research shows that it would be very valuable to arrive at a computer cartography for the best imagery. The analyses already performed and those currently underway make it possible to define the principles of this computer cartography.

The Fralit Program researchers would greatly appreciate receiving SYCI MSS DATA for the best existing image. This data was requested from Nasa on February 6 , 1973 , Request Form 560 -213 (7/72).

Brief Summary of Report II

for the Geomorphic and Land Survey

Code 3. 1.

The MSS Imagery has enabled a better knowledge of the geomorphology of the tidal flats, beaches, salt marshes, marshlands and peat-bogs of the oceanic (Atlantic) coastal regions of France. Much of the data must be interpreted through the intermediary of the vegetation.

" French Atlantic littoral " ERTS-1 Project

SR N 031, Prof. F. Verger, P.I. ID F-0429

Type II Report February 1973

Brief Summary of Report II

for Estuary and Wetlands Survey

Code 4. C.

The multispectral data MSS 4, 5, 6, and 7 were used to gain knowledge of the French estuaries of the Loire, the Gironde and the wetlands. The densitometric transects, and colored isodensities were undertaken for the estuaries. They allow one to establish a cartography of the turbid waters zones in the estuary, and in the sedumentary plume which, in rising tide, prolongs the plume towards open sea. Unfortunately ERTS 1 has not yet provided imagery of the west part of the Gironde due to heavy cloud cover. For the Loire, it was only possible to undertake study of the ebb tide.

" French Atlantic littoral " ERTS-1 Project

SR N 031 ,Prof. F. Verger, P.I. ID F-0429

Type II Report February 1973



D

Brief Summary of Report II

for the coastal zone process

Code 5. H.

The MSS 7 data make possible a precise determination of the coast line as a function of the level of the tide, and the MSS 4 and 5 data permit a precise determination of sediment movement in coastal waters, especially in the plume of the Loire, and that of the inlet of Fromentine. MSS bands 5, 6, and 7 make possible knowledge of the evolution of the tidal flats of the "Bassin d'Arcachon".

"French Atlantic littoral" ERTS-1 Project

SR N 031, Prof. F. Verger, P.I. ID F-0429

Type II Report February 1973