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Title of Investigation: 28990

Investigation of Environmental Change Pattern in JAPAN

Principal Investigator: Takakazu MARUYASU
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Noda City, Chiba ken, 278, JAPAN

October 29, 1976

Quarterly Progerss Report for period

July-Sept. 1976

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Title of Investigation : 28990

Investigation of Environmental Change Pattern in Japan

Principal Investigator : Takakazu Maruyasu

October 18, 1976

SUMMARY

SUBJECT: Investigation of Environmental Change Pattern in Japan

OBJECTIVES: The applications and feasibilities of space sensing of the environment and its change in Japan will be investigated with particular focus on the following subjects;

1. Establishment of ecological indicators of environmental disruption through observation of regional vegetation covers and growing conditions.
2. Application of space-acquired data for understanding environmental changes in the costal and offshore zone.

Summary of the results

The study is still going on and the results as intended at the beginning has not been obtained due to partly lack of data and partly due to delay of data. The results so far obtained are summarized below.

Land use

A detailed land use classification for a large urban area of Tokyo was made using MSS digital data. It was found that residental, commercial, industrial, wooded area and grass land can be successfully classified.

Based on the basic researches on land use and vegetation cover classification, an experiment of operational application of Landsat data in an environmental survey was made for a large area of Kanto and Central JAPAN area. In this experiment air-borne data of training area were also added. The result indicates that a regional planning map can be made very effectively. The systems for this operational application is also developed.

Coastal zone and offshore zone

A mesoscale vortex associated with Large Ocean Current Kuroshio which is a rare phenpmenon was firstly recognized visually through the analysis of MSS data. It was found this vortex affects enormously the effluent patterns of river. A majority of investigators agree that this is a mesoscale oceanographical vortex, however there are few investigators taking this vortex as an atmospheric phenomenon.

Based on the Watanabe's theory and technique the same author made every possible efforts to distinguish between oceanographical and atmospheric phenomena.

The areal influence and pattern of " Red Tide " popularly called due to its color in Ise Bay located in Central Japan is found.Through the analysis of four bands data of MSS it is found Band-4 can show partly red tide,however there remains a problem to distinguish it from other water pollution and smog.

An experiment was made to enhance and distinguish sea surface status through photographic processes.

Geophysics and related field

In an attempt to find the applicability of MSS data in the field of volcanology and geology, MSS data covering Active Volcano Sakurajima were analyzed. It was found that lava flowed out at the time of 3 major erruptions which took place in 1779, 1914 and 1946 can be clearly classified.

The observed values of MSS include the effects of atmospheric scattering and absorption. An attempt is made to numerically evaluate its effects through numerical integration of radiative transfer equation. It is found that the radiance due to atmospheric effect popularly called as path radiance for Bands 4,5,6 and 7 of MSS amounts as large as 47, 34, 24 and 20% of the measured value (total radiance) respectively.

Fig.1. Theme Extraction Imagery of Kanto Area

Blue : Forest
Yellow : Firm field
White : Bare soil
Red : Urban area, Polluted water

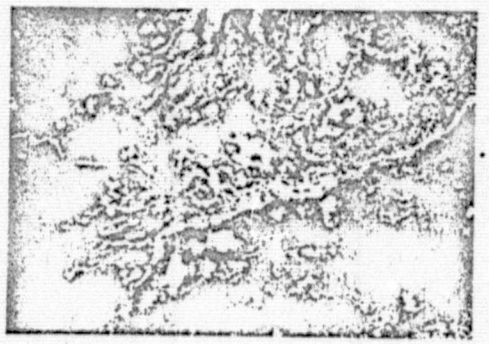


Fig.2. Color Composit Imagery of Westside Tokyo by LANDSAT-1 CCT, used for the determination of the classification and the training area.

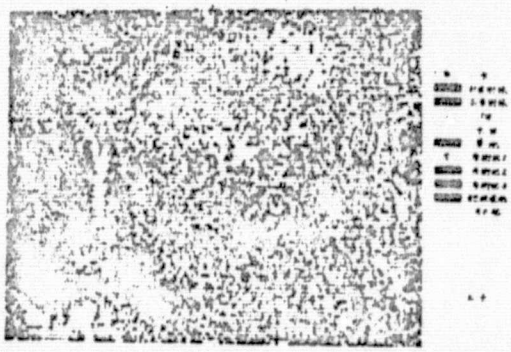


Fig.3. Digital Pattern Recognition Output of Fig.2 area.
Classification to 10 items.

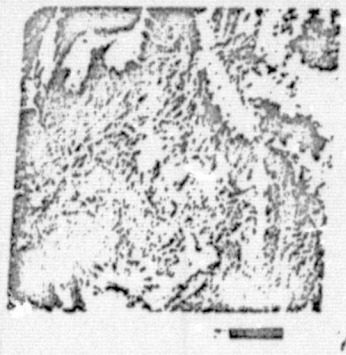


Fig.4. Color Composit Imagery of Middle Part of Japan, at the end of September the rice field harvested already.

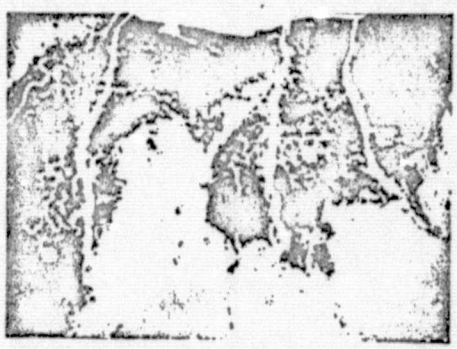


Fig.5. Land Use Map of Fig.4 area.
Green : Rice field
Yellow : Other crops
Black : Urban
Red : Under construction

Fig.6. Pattern Classification in Mountainous Forest.
Green : Ever green grass land
Brown : Artificial conifer
Yellow : Pine and other conifer

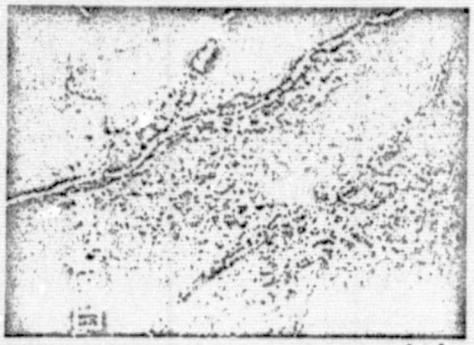


Fig.7. Land Use Pattern Recognition of North Suburb Tokyo.
Green : Forest
Yellow : Firm field
Red : Urban
Blue : Water

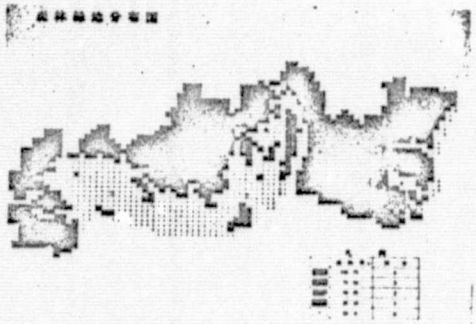


Fig.17. Forest Type Quadrate Map of North Kanto.
5 classes by the tree cover densities. (2x2 km unit)
Total area : 7,460 km^2.

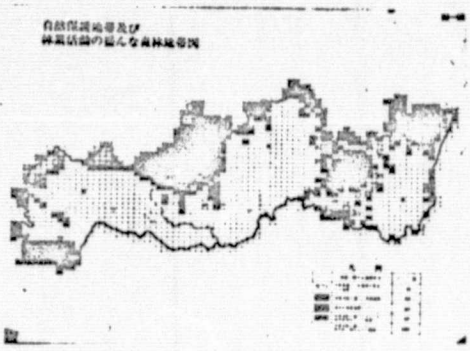


Fig.18. Timber Productivity Classification.
Produced by LANDSAT data and census data.

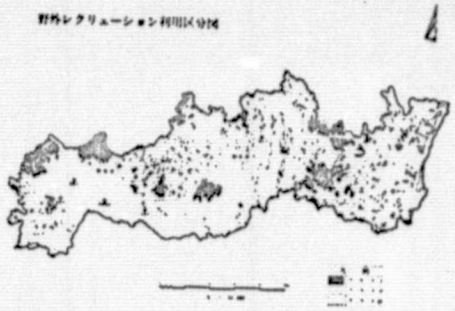


Fig.19. Recreation Area Zoning in 3 classes.
Calculated from the population data and green capacity of each quadrate unit, also relative distance.

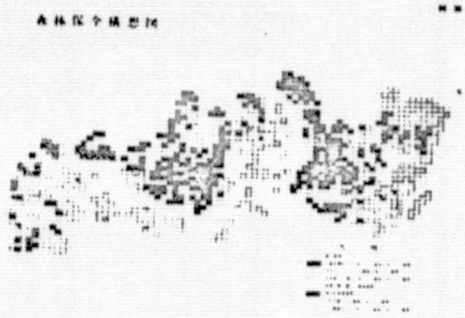


Fig.20. Forest Conservation Planning Map.
Each quadrate unit was evaluated by the potential power for watershade, erosion control, flood control and timber productivity.

Land Use around Central Tokyo

These 4 photos show the results of land use analysis of Central Tokyo by using the LANDSAT CCT on 14-DEC-72.

A

C

B

D

A: Central Tokyo

Red:Densely built up area
Pink:Residential area
Green:Park and woody field and forest
Light blue:Fresh water
Dark blue: Salty water
Black:Uncategorized area

B: Urban of Tokyo

Red:Built up area
Pink:Residential area

C: Urban of Tokyo

Green:Woody forest as imperial palace
Yellowish green:Grass field as golf links

D: Tokyo bay

Water area divided into sea area and fresh water

Table 1. Land use ratio in the Central Tokyo

NO. OF ORIGINAL VARIABLES = 4
REJECTION LEVEL = 3.00

GRP NO.	CATEGORY	NOB	PERCENT OF TOTAL	ACRES	SQ. KM.
0	UNCATEGORIZED	1570	8.25	1755.10	7.10
1	KOKYO GREEN	1366	7.17	1527.04	6.18
2	SHINBASHI	7799	40.96	8718.46	35.28
3	TODOROKI PINK	6636	34.85	7418.35	30.02
4	ARAKAWA LB	805	4.23	899.91	3.64
5	TOKYO BAY	864	4.54	965.86	3.91
TOTALS		19040	100.00	21284.73	86.14

Table 2. Training area selected for MCP analysis

18-MAR-76 18:15:21

DN	GN	COLOR	NOB	X1	Y1	X2	Y2	X3	Y3	X4	Y4	NAME
0	0	000										
1	1	050	95	1079	80	1094	81	1090	91	1081	90	KOKYO GREEN
2	1	050	9	1051	98	1062	100	1059	101	1055	103	JINGU GREEN
3	1	050	31	1009	105	1018	104	1018	114	1009	111	MEIJI JINGU G
4	2	500	18	1093	129	1103	129	1103	132	1093	132	SHINBASHI
5	2	500	120	1118	67	1131	67	1131	78	1118	78	NIHONBASHI
7	3	544	24	978	196	986	195	985	206	978	205	TODOROKI PINK
8	3	544	39	938	135	951	127	950	133	944	139	CHOOFU PINK
9	3	544	109	872	58	881	59	886	70	870	69	MITAKA PINK
10	4	007	21	1238	73	1242	73	1242	80	1237	80	ARAKAWA LB
11	4	007	159	1253	136	1265	139	1264	158	1257	158	YUMENOSHIMA L B
12	5	003	250	1240	198	1252	201	1251	220	1238	226	TOKYO BAY
13	5	003	333	1164	191	1192	195	1191	214	1167	202	TOKYO HARBOR D B
15	1	050	38	822	360	842	364	836	365	826	367	TAMAHILL-2
16	1	050	30	913	237	925	242	918	244	912	243	TAMA-HILL 3
20	1	050	35	824	361	832	359	835	365	825	366	YOKOHAMA GREEN

Table 3. Categorization table (showing the precision of analysis)

TNG SET	PERCENT CATEGORIZED AS GROUP 0	1	2	3	4	5
1	2.	93.	0.	5.	0.	0.
2	0.	100.	0.	0.	0.	0.
3	3.	97.	0.	0.	0.	0.
4	0.	0.	100.	0.	0.	0.
5	1.	0.	94.	3.	3.	0.
7	0.	0.	0.	100.	0.	0.
8	3.	3.	0.	95.	0.	0.
9	4.	4.	3.	90.	0	0.
10	0.	0.	0.	0.	100.	0.
11	2.	0.	2.	0.	96.	0.
12	2.	0.	0.	0.	0.	98.
13	3.	0.	0.	0.	0.	97.
15	3.	97.	0.	0.	0.	0.
16	0.	97.	0.	3.	0.	0.
20	3.	94.	0.	3.	0.	0.

Land Use

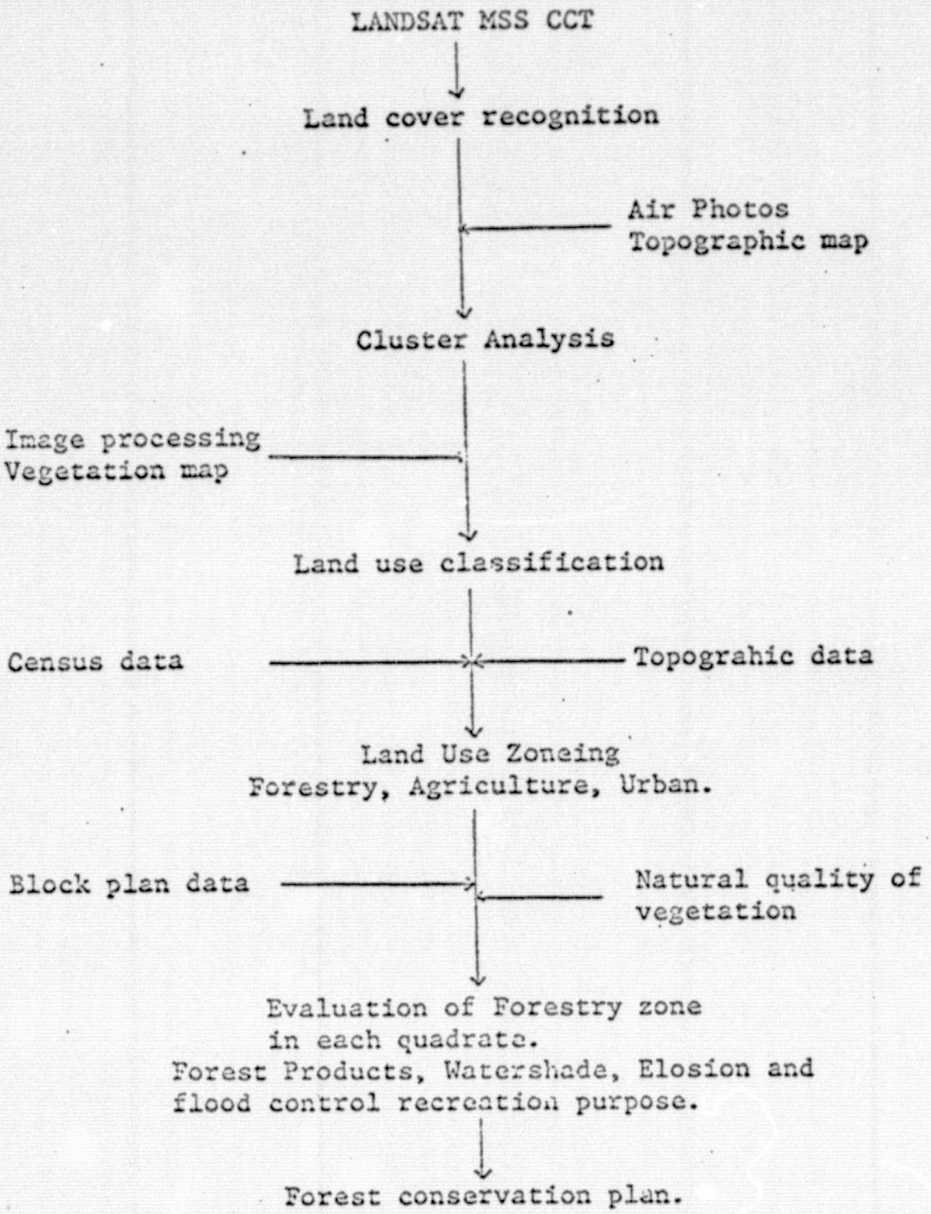


Table 1. LANDSAT data application diagram for Forest conservation plan.

A Vortex off Shionomisaki (1)

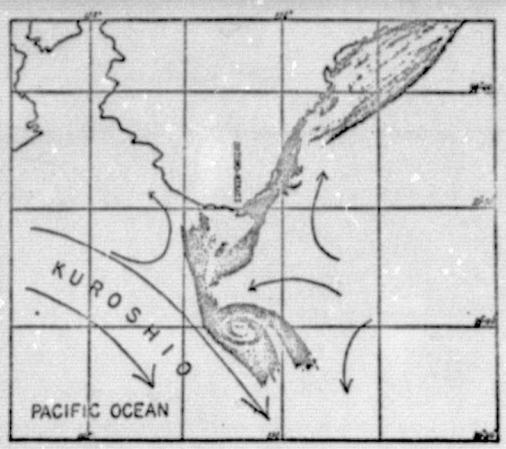


Fig.3

Photograph

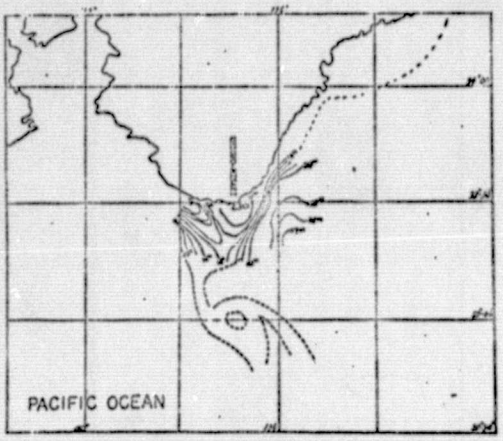


Fig.4

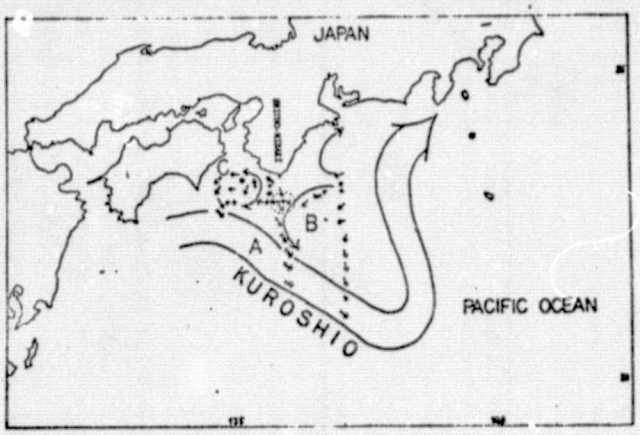


Fig.1

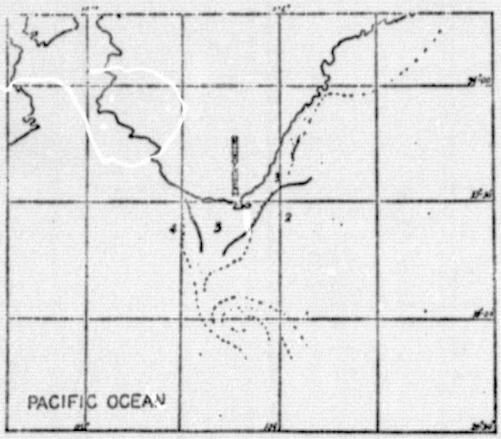


Fig.5

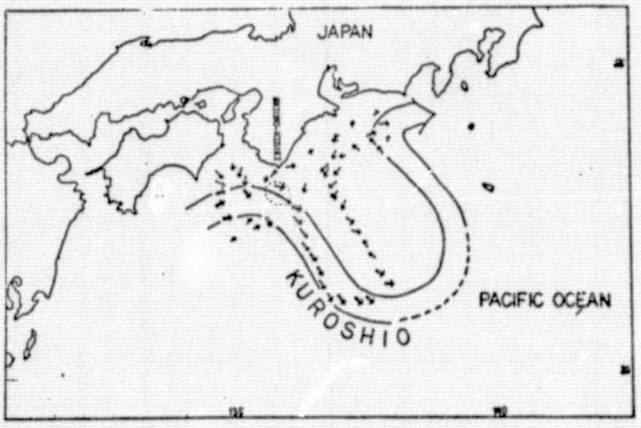


Fig.2

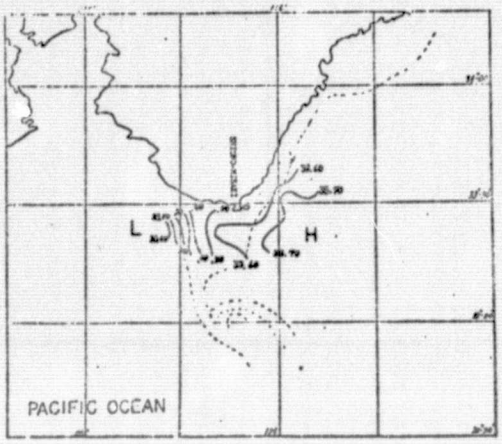


Fig.6

Figure's captions are found in page 10.

A Vortex off Shionomisaki (2)

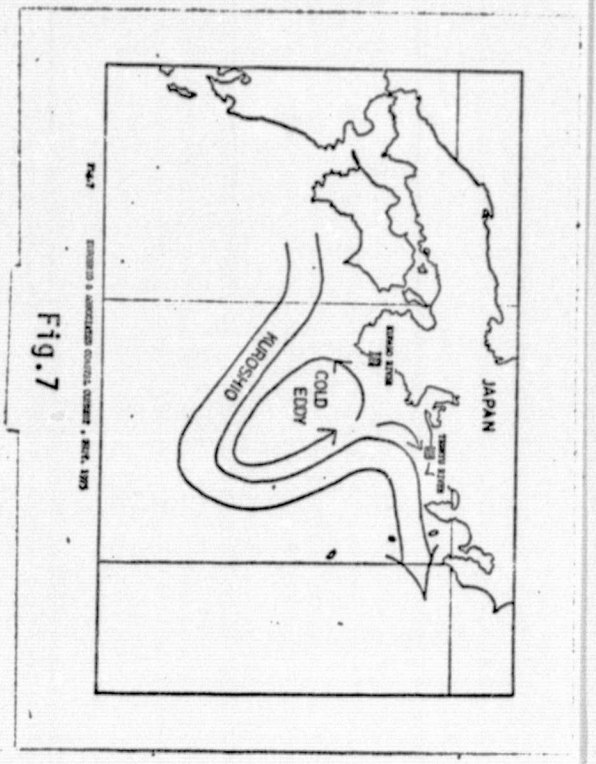


Fig.7

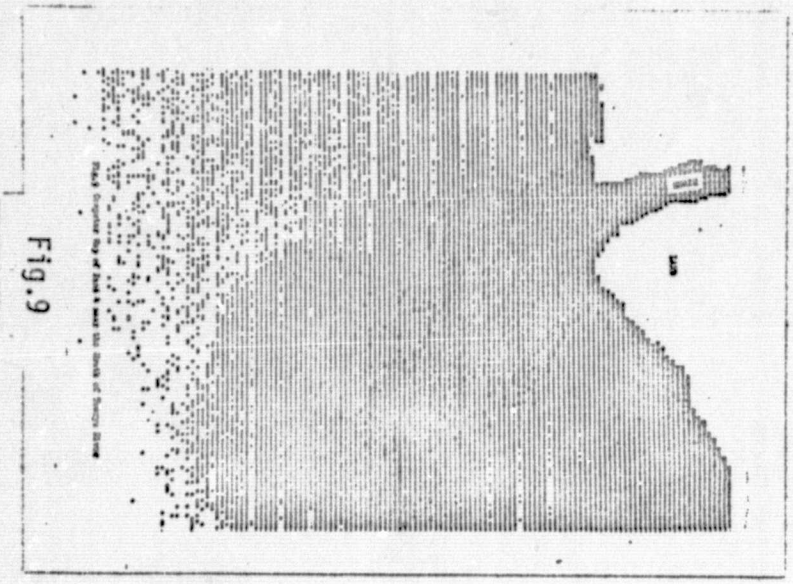


Fig.9

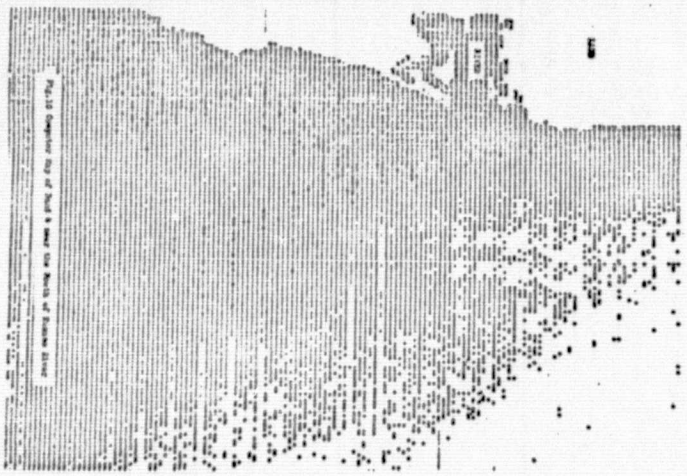


Fig.10

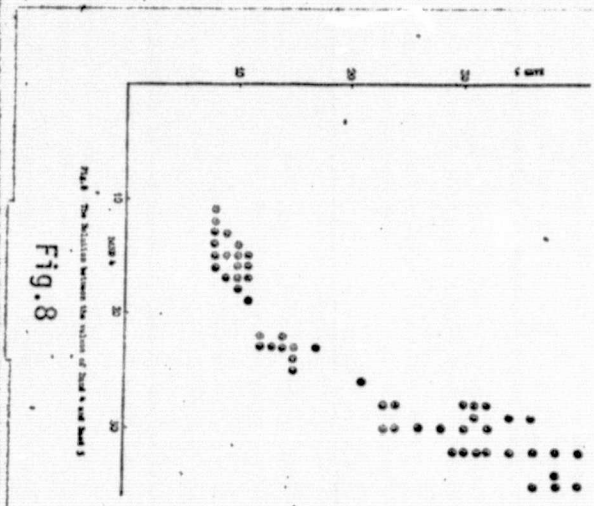


Fig.8

Figure's captions of "A vortex off Shionomisaki", coastal zone and offshore zone.

Photograph : Elliptical Vortex off Shiono Misaki, Sep. 11 1975

Fig.1 : Surface Current around the Place where vortex is found by GEK, Aug. 14 - Sep. 3, 1975

Fig.2 : Surface Current by GEK, Sep. 8 - 16, 1975.

Fig.3 : Hypothetical Stream Line of Kuroshio

Fig.4 : Transparency Distribution (m), Sep. 11 and 12, 1975

Fig.5 : Water Color Distribution, Sep. 11 and 12, 1975

Fig.6 : Surface Salinity (%), Sep. 11 and 12, 1975

Fig.7 : Kuroshio and Associated Coastal Current, Sep. 1975

Fig.8 : The Relation Ship between the values of Band 4 and that of 5

Fig.9 : Computer Output of Band 4 near mouth of Tenryu River

Fig.10 : Computer Output of Band 4 near mouth of Kumano River

Fig.1

Figure's captions are found in page 13.

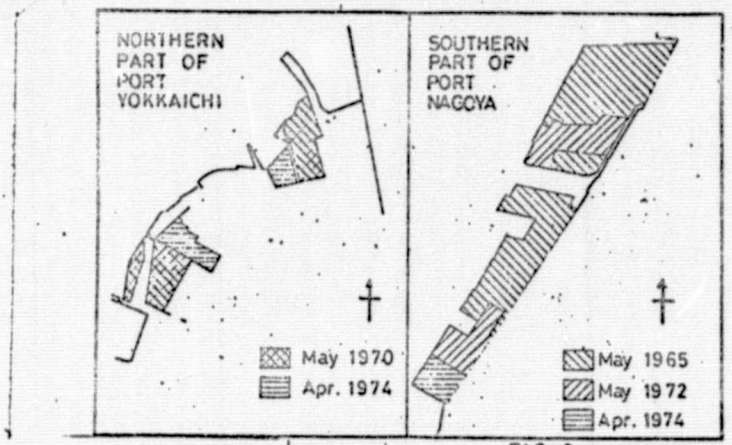


FIG. 2

Fig.2

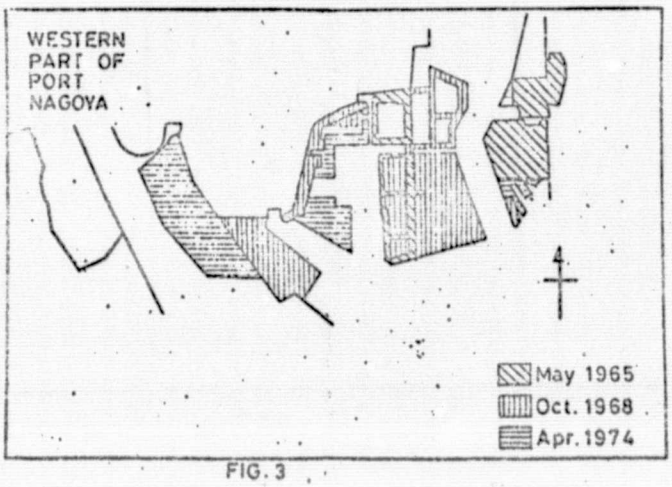


FIG. 3

Fig.3

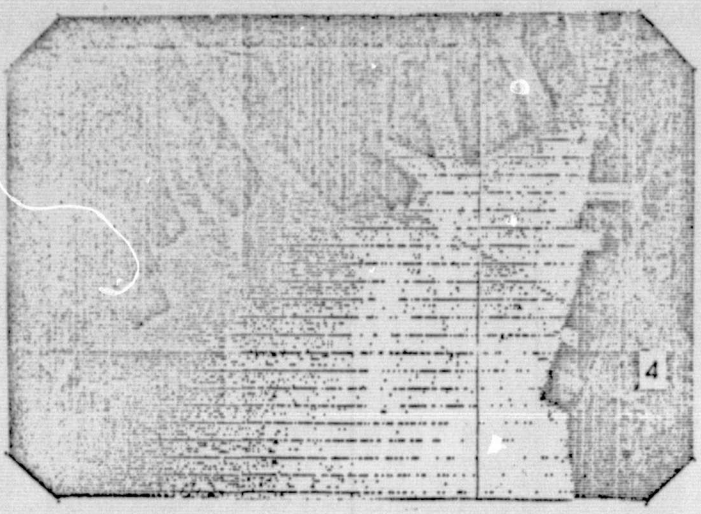


Fig.4

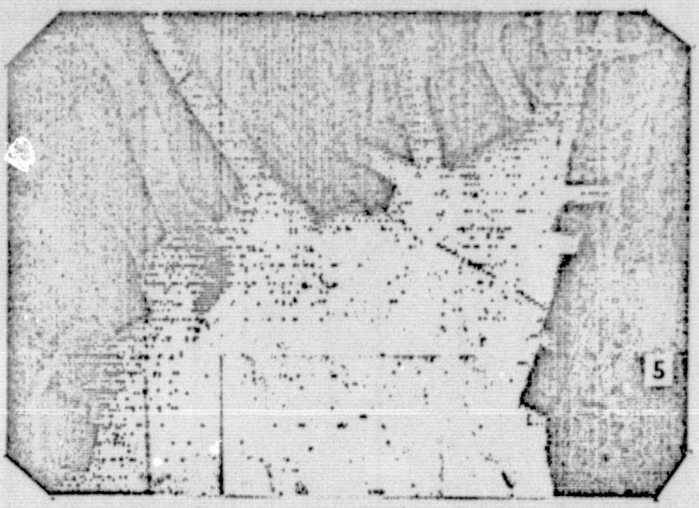


Fig.5

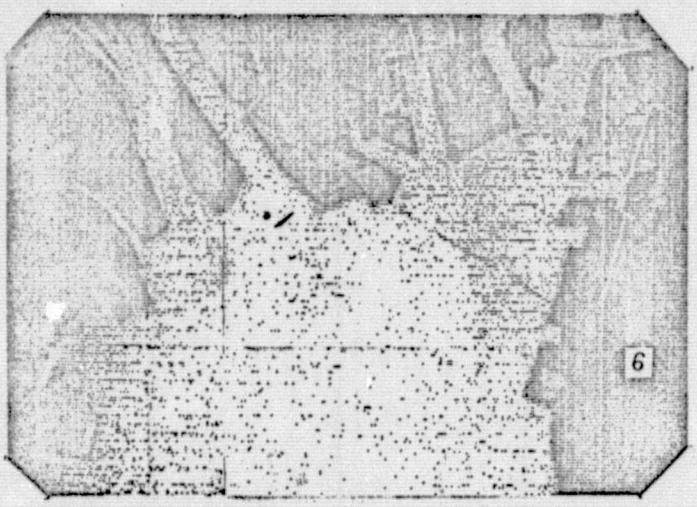


Fig.6

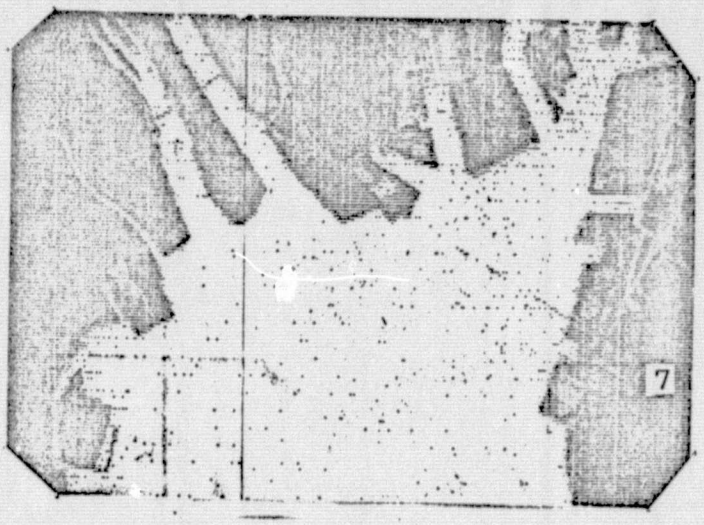


Fig.7

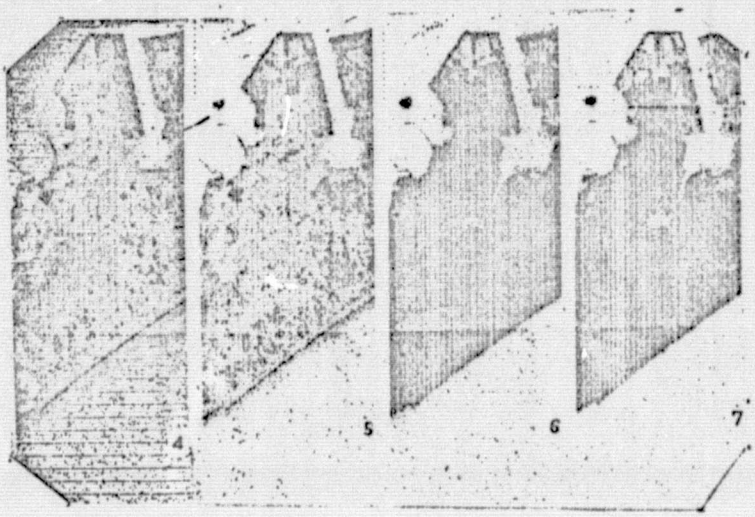


Fig.8

Figure's Captions

Fig.1 : Landsat-2 MSS Image Covering Ise Bay and Nagoya District.

Fig.2 : Reclaimed areas at Northern part of Yokkaich and Southern part of Nagoya ports which are located to the western part of Ise Bay.

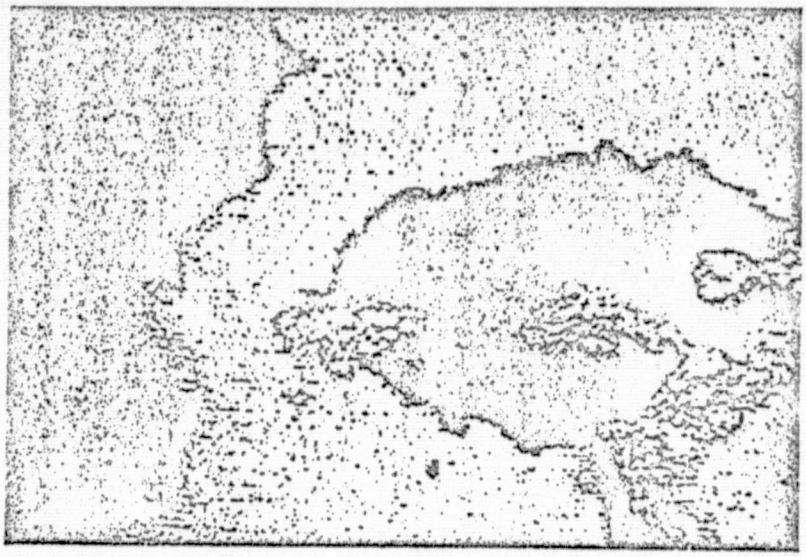
Fig.3 : Reclaimed area in the western part of Nagoya port

Fig.4-7: Computer output of MSS-4, 5, 6 and 7 showing the coastal areas of Ise Bay

Fig.8 : Computer output of MSS-4, 5, 6 and 7 showing Nagoya port

A

B



Sakurajima Island image is extracted from LANDSAT-1 CCT on 2-DEC-72. The area of the naked lava is divided from another area, where the vegetation has been grown up already. Furthermore two types of the lava are classified. One flowed out in 1914 and another by the big erruption in 1946. There are some area where the two classified are mixed.

A: Green; Vegetation grown up area
Brown; Naked lava

B: White; Showa lava (year 1946)
Light brown; Taisho lava (year 1914)

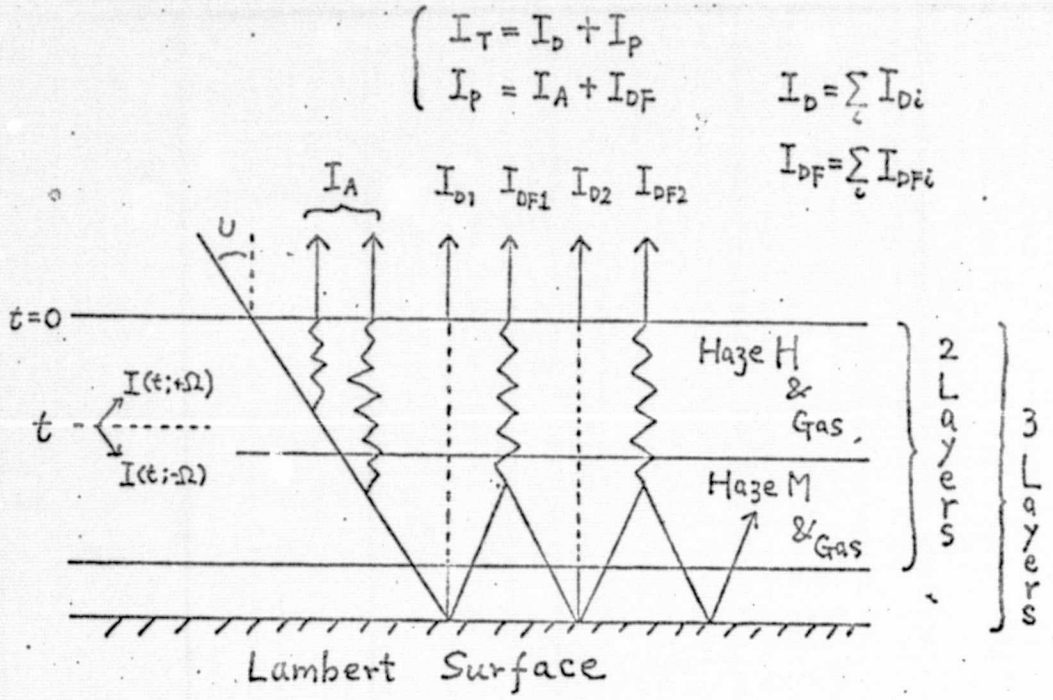


Fig. Geo-1 Schematic representation of the model. used for the computation.

	$\lambda = 0.55\mu$		$\lambda = 0.65\mu$	
3 Layers	I_D/I_T	I_P/I_T	I_D/I_T	I_P/I_T
	0.534	0.466	0.659	0.341
	$\lambda = 0.75\mu$		$\lambda = 0.95\mu$	
3 Layers	0.762	0.238	0.805	0.195

Table Geo-1 I_D: Intrinsic radiance of the surface

I_P: Path Radiance I_T: Total Radiance

Each value is obtained through numerical integration of Radiative Transfer Equation.