II

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Investigation of Environmental Change Pattern in JAPAN

Principal Investigator: Takakazu MARUYASU
Science University of Tokyo
Noda City, Chiba ken, 278, JAPAN

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Name and Address of National Sponcering Agency

Science and Technology Agency
Kasumigaseki 2-2-1 Chiyodaku
Tokyo, 100, JAPAN

28990

Principal Investigator: Takakazu MARUYASU
Science University of Tokyo

Co-Investigator:

Hiroaki OCHIAI
Toba Merchant Marine College

Yasuhiro SUGIMORI
Chief of Disaster Analysis Laboratory,
National Research Center for Disaster Protection
Science and Technology Agency

Daitaro SHOJI
Chief ofHydrographer,Hydrographic Department
Marine Safety Agency

Kaname TAKEDA
Leader of Research Group,National Institute
of Resources.

Kiyoshi TSUCHIYA
National Space Development Agency of JAPAN

Iwao NAKAJIMA
Section Chief of Management Technology,Forest
Experiment Station,Forest Agency

Takamasa NAKANO
Faculty of Science,Tokyo Metropolitan University

Shigechika HAYASHI
Chief of Soil Improvement Laboratory,Hokkaido
National Agricultural Experiment Station
Upland Farming Division,Forest Agency

Seiji HORIKAWA
Faculty of Engineering,University of Tokyo

Shunji MURAI
Insitute of Industrial Science,University of
Tokyo

Kantaro WATANABE
Faculty of Marine Science and Technology,
Tokai University

Taisuke WATANABE
Chief of No 2 Resources Section,Tokai Region
Fisheries Research Laboratory,Fishery Agency

TITLE OF INVESTIGATION: 28990, INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN

PRINCIPAL INVESTIGATOR: DR. TAKAKAZU MARUYASU
SCIENCE UNIVERSITY OF TOKYO
NODA-CITY, CHIBA-KEN, 278, JAPAN

CO-INVESTIGATORS: KIYOSHI TSUCHIYA
NATIONAL SPACE DEVELOPMENT AGENCY OF JAPAN
2-4-1, HAMAMATSU-CHO, MINATO-KU, TOKYO, 105, JAPAN

KANAME TAKEDA
NATIONAL RESEARCH INSTITUTE, SCIENCE AND TECHNOLOGY AGENCY.
2-2-1, KASUMIGASEKI, CHIYODA-KU, TOKYO, 100 JAPAN

HIROAKI OCHIAI
TOBA MERCHANT MARINE COLLEGE
TOBA-CITY, MIE-KEN, JAPAN

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NAME AND ADDRESS OF NATIONAL SPONSORING AGENCY : SCIENCE AND TECHNOLOGY AGENCY
2-2-1, KASUMIGASEKI, CHIYODA-KU, TOKYO, 100, JAPAN

APPLICATION OF LANDSAT-2 DATA FOR UNDERSTANDING ENVIRONMENTAL CHANGE IN THE COASTAL AND OFFSHORE

KIYOSHI TSUCHIYA
National Space Dvelopment Agency of Japan. 2-4-1, Hamamatsu-cho, Minato-ku Tokyo, Japan

KANAME TAKEDA
National Research Institute, Science and Technology Agency.
2-2-1, Kasumigaseki, Chiyoda-ku, Tokyo, Japan

HIROAKI OCHIAI
Toba Merchant Marine College. Toba-city, Mie-ken, Japan

S U M M A R Y

During the period of October to Decempber 1976, digital analyses on radiance values of MSS CCT were made on the images of LANDSAT-2 covering a part of central Japan on September 11 1975 which are only available one for the area taken by LANDSAT-2 and comparison was made with the previous one taken by LANDSAT-1 on Oct. 5 1972.

It is found that there exists not a little difference in the values of radiance as is shown in Table 1 below for 4 selected sample areas.

Table 1 Comparison of digital values for selected areas.

		LANDSAT-1 5 OCT 72				LANDSAT-2 11 SEP 75			
		B4	B5	B6	B7	B4	B5	B6	B7
A	M	39.3	32.0	43.5	21.5	22.8	22.9	47.1	21.7
	S.D.	7.0	3.2	4.7	3.0	3.1	4.8	6.9	4.5
B	M	37.8	31.7	29.1	12.1	27.7	30.5	31.1	10.9
	S.D.	6.3	3.0	2.9	1.6	2.8	4.5	5.4	2.6
C	M	23.1	14.5	33.3	19.5	12.5	10.7	38.1	19.8
	S.D.	8.3	3.2	6.7	4.5	2.0	2.9	8.4	5.0
D	M	25.7	15.5	11.3	3.4	13.3	9.5	4.0	0.0
	S.D.	1.4	1.3	1.4	0.8	0.8	0.8	0.9	0.3

A: Farm Villeges, B: Large City, C: Thickly Wooded Mountain, D: Sea Surface
B4, B5, B6 and B7 are Band-4, Band-5, Band-6 and Band-7 respectively.
M; Mean Value, S.D.: Standard Deviation.

In the table the sizes of the sample areas of A, B, C and D are 8.4 x 10, 6.4 x 10, 9.2 x 10.7 and 12.1 x 11.4 km^2 respectively. Multiplication of 0.925 to the values of Septemer 11 1975 (Landsat-2) makes them to those under the same sun elevation angle of Landsat-1.

From the values in the talbe it is clear that the values of Oct 5 1972 (Landsat-1) are systematically larger than those of Sep 11 1975 (landsat-2) in spite of the fact that the elevation angle of the sun of the latter is higher than the former. Careful inspection, however, reveal that the difference between the two in Bands 6 and 7 (near infrared spectra) is much smaller than the others.

Two main factors contribute to the difference of the values of the two cases, i. e. the variation of the earth's surface and atmospheric condtions. The result of meteorological analysis indicates that weather station at Nagoya in the area B reported patched cirrus and a few stations around the other areas also observed cirrus which is hardly recognizable in the image films. Smog was also reported at Nagoya. It is clear that the effect of thin cirrus is much larger in shorter wave length spectra. This fact is sometimes important in the interpretation of MSS data.

An attempt is made to evaluate atmospheric effect numerically. As the first step the global albedo defined as the ratio of observed radiance to the incoming solar radiance outside the atmosphere is computed and shown in Table 2 below.

Tabe 2. The global albedo corresponding to the values of Table 1.

Unit: %

Area	LANDSAT-1 5 OCT '72				LANDSAT-2 11 SEP '75			
	B4	B5	B6	B7	B4	B5	B6	B7
A	45.4	36.0	49.0	49.1	24.3	23.9	49.0	45.5
B	43.6	35.8	32.9	27.6	29.5	31.6	32.2	22.9
C	26.8	16.4	37.5	44.5	13.4	11.1	39.5	41.6
D	12.0	17.5	12.6	7.7	14.2	9.8	4.1	0.0

In the computation, the radiance of the i-th band R_i is obtained from Eq. (1).

$$R_i = K_i \cdot C_i \qquad (1)$$

where K_i and C_i are conversion factor and digital values of the i-th band respectively and assumtions are made that the conversion factors of the four bands of MSS are 0.0195, 0.0157, 0.0138 and 0.0730 mW/ $cm^2 \cdot Sr$ respectively (Ref. 1 & 2). It seems the values thus obtained are a little larger than those obtained by previous investigator theoretically (Ref. 3). It is also found through the solution of radiative transfer equation that the path radiance reaches as large as 47, 34, 24 and 20 % of the radiance obtained at satellite level. Further studies are going on in this field.

REFERENCES

1.Rogers R. H., K. Peacock and N. J. Shah, 1973: A technique for correcting ERTS data for solar and atmospheric effect. IIIrd ERTS-I Symp. NASA, 1787 - 1804.

2. NASA, 1972: Data Users Handbook. Section G.

3. Tanaka, M, 1971: Radiative transfer in turbid atmosphere. - II. Augular distribution of intensity of the solar radiation diffusely reflected and transmitted by turbid atmospheres. J. Meteor. Soc. Japan, Vol. 49, 321 - 332.