E77-10082
CR-149565

N77-17535
Unclas
G3/43 00382
CSCI 08C
(E77-10082) WATER ENVIRONMENT EVALUATION FOR INLAND SEA BY PRINCIPAL COMPONENT ANALYSIS Quarterly Report (Tokyo Univ.) 2 p HC A02/MF A01

# Water Environment Evaluation for Inland Sea by Principal Component Analysis

Quarterly Report for LANDSAT-2 Project

Dr. Shunji MURAI
Associate Professor
Institute of Indsutrial Science
University of Tokyo
Tokyo, Japan

Dec. 20, 1976

## ABSTRACT

Water environment evaluation has been done for the inland sea in Japan, by using the principal component analysis. LANDSAT MSS digital data for tow different dates, Nov. 12, 1972 and Dec. 30, 1975, were utilized for the comparative study.

The results shows that the comprehensive evaluation for the water environment could be made by combining the first principal component with the second principal component.

The computer generated dot map includes the distribution of the polluted water or turbid water in the inland sea.

## INTRODUCTION

The inland sea in Japan, has been popular with the national park and the fishery since the ancient. However the reclamation for the industry and industrial land use has increased rapidly to pollute the water environment of the inland sea since ten or fefteen years ago.

The comprehensive evaluation for the water environment for the whole area of the inland sea should be appreciated to be monitored for the water pollution. The objective of the study is to provide the environmental manager of the environmental protection agency with the comprehensive water environmental evalution map for the inland sea, from the LANDSAT MSS digital data processing.

## PRINCIPAL COMPONENT ANALYSIS

The principal component analysis were tested for the LANDSAT MSS data of two different dates nov. 12, 1972 and Dec. 30, 1975.

The result of the principal component analysis shows that the first principal component corresponds to the total radiance of four bands, which enhances the turbid water, whereas the second principal component corresponds to the difference between the visible radiance and the infrared radiance which enhances the organic matter on the water surface.

## COMPREHENSIVE ENVALUATION FOR WATER ENVIRONMNET

The comprehensive evaluation for the water environment were made by the criteria which was established by combining the first principal component with the second principal component as shown in the Figure 1.

The computer generated dot map were made which shows the water environment for the inland sea including the distribution of the polluted water.

| Rank | Range | First Principal Component (Turbid Water) | Second Principal Component (Organic Matter) |
|---|---|---|---|
| 1 | $Z \leq -1.5$ | very low | very high |
| 2 | $-1.5 < Z \leq -0.5$ | low | high |
| 3 | $-0.5 < Z \leq 0.5$ | normal | normal |
| 4 | $0.5 < Z \leq 1.5$ | high | low |
| 5 | $1.5 < Z$ | very high | very low |

*Z: Score of Principal Component

Fig. 1 (a) Rank of the Principal Component

| Rank of $Z_1$ / Rank of $Z_2$ | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | | | B | A | A |
| 2 | | D | C | B | A |
| 3 | D | C | C | C | C |
| 4 | E | D | C | D | |
| 5 | E | E | C | | |

A: very clear
B: clear
C: little polluted
D: polluted
E: highly polluted

Fig. 1 (b) Criteria for Water Environment