

PROCEEDINGS
of the
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ON
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OF
ENVIRONMENT

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**PROCEEDINGS of the NINTH INTERNATIONAL SYMPOSIUM
ON
REMOTE SENSING OF ENVIRONMENT**

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Environmental Research Institute of Michigan

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**ENVIRONMENTAL
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Ann Arbor, Michigan

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G. J. Zissis, Environmental Research Institute of Michigan

PROGRAM

MONDAY

APRIL 15

Registration, Rackham Lobby

Welcome and Introduction

M. R. HOLTER, Executive Vice President,
Environmental Research Institute of Michigan,
Ann Arbor, Michigan

SESSION 1
(Rackham Lecture Hall)

Chairman: HANS DOLEZALEK, Office of Naval
Research, Arlington, Virginia

*Some Features of the Urban Environment of Tokyo
by Remote Sensing*

IWAO TSUCHIYA, Meteorological Research
Institute, Tokyo, Japan

*Estimation of Population Density in Tokyo Dis-
tricts from ERTS-1 Data*

SHUNJI MURAI, Institute of Industrial Science,
University of Tokyo, Tokyo, Japan

*An Examination of the Extent of Fire in the Grass-
land and Savanna of Africa Along the Southern
Side of the Sahara*

WALTER DESHLER, University of Maryland,
College Park, Maryland

*Environmental Studies of Iceland with ERTS-1
Imagery*

RICHARD S. WILLIAMS, JR., U. S. Geological
Survey, EROS Program, Reston, Virginia;
ÁGÚST BÖÖVARSSON, Icelandic Surveying Depart-
ment; STURLA FRIÖRIKSSON, Agricultural Re-
search Institute; GUOMUNDUR PÁLMASSON, National
Energy Authority; SIGURJÓN RIST, National
Energy Authority; HLYNUR SIGTRYGGSSON,
Icelandic Meteorological Service; KRISTJÁN
SAEMUNDSSON, National Energy Authority;
SIGURÓUR THORARINSSON, University of Iceland;
INGVI THORSTEINSSON, Agricultural Research
Institute; Reykjavík, Iceland

*A Method of Specifying Remotely Sensed Units for
Soil Sample Points*

G. A. MAY, G. W. PETERSEN, F. Y. BORDEN and
D. N. APLEGATE, The Pennsylvania State
University, University Park, Pennsylvania

*Computer Recognition of Aerial Multispectral
Photography Using Optical Density of Object*
YOSHIZUMI YASUDA and YASUFUMI EMORI, Institute
of Color Technology, Chiba University, Japan

*Geologic Interpretation of ERTS-1 Satellite
Images for Aswan Area, Egypt*

E. M. EL SHAZLY and M. A. ABDEL-HADY,
Academy of Scientific Research and Technology;
M. A. EL GHAWABY and I. A. EL KASSAS, Atomic
Energy Establishment, Cairo, Egypt

*Classification and Mapping of Coal Refuse, Vege-
tation Cover Types, and Forest Types by Digital
Processing ERTS-1 Data*

F. Y. BORDEN, B. F. MEREMBECK, D. N. THOMPSON,
B. J. TURNER and D. L. WILLIAMS, The
Pennsylvania State University, University
Park, Pennsylvania

*Transference of ERTS-1 Spectral Signatures in
Time and Space*

B. F. MEREMBECK, F. Y. BORDEN and D. N.
APLEGATE, The Pennsylvania State University,
University Park, Pennsylvania

*A Remote Sensing Study of Pacific Hurricane Ava
D. ROSS, National Oceanic and Atmospheric
Administration, Miami, Florida; B. AU, Naval
Research Laboratory, Washington, D. C.; W.
BROWN, Jet Propulsion Laboratory, Pasadena,
California; and J. MCFADDEN, National Oceanic
and Atmospheric Administration, Miami, Florida*

*A Clustering Algorithm for Unsupervised Crop
Classification*

L. BORRIELLO, CSATA, Bari, Italy and
F. CAPOZZA, TELESPIAZIO, Rome, Italy

BREAK

SESSION 2
(Rackham Lecture Hall)

Chairman: HAROLD RIB, Federal Highway
Administration, Washington, D. C.

*Simultaneous Active and Passive Microwave
Response of the Earth - The Skylab Radscat
Experiment*

R. K. MOORE, J. P. CLAASSEN, A. C. COOK, D.
L. FAYMAN, J. C. HOLTZMAN, A. SOBTI, W. E.
SPENCER, F. T. ULABY and J. D. YOUNG, The
University of Kansas Remote Sensing Labora-
tory, Lawrence, Kansas and W. J. PIERSON, V. J.
CARDONE, J. HAYES and W. SPRING, City University
of New York Institute of Oceanography, Bronx,
New York and R. J. KERN, General Electric
Valley Forge Space Center, Philadelphia,
Pennsylvania and N. M. HATCHER, NASA Johnson
Space Center, Houston, Texas

Feasibility of Using Multiplex Slar Imagery for Water Resource Management and Mapping Vegetation Communities

ROBERT A. SHUCHMAN and BEN DRAKE,
Environmental Research Institute of Michigan,
Ann Arbor, Michigan

Extraction of Urban Land Cover Data from Multiplexed Synthetic Aperture Radar Imagery

M. LEONARD BRYAN, Environmental Research
Institute of Michigan, Ann Arbor, Michigan

Land-Use Planning Aided by Computer Cellular Modelling/Mapping System to Combine Remote Sensing, Natural Resources, Social, Economic, and Cadastral Data

HARRY W. SMEDES, U. S. Geological Survey,
GEORGE NEZ and LARRY SALMEN, Federation of
Rocky Mountain States, Denver, Colorado;
KEITH TURNER, Colorado School of Mines,
Golden, Colorado; and EDWIN LUTZEN, Missouri
Geological Survey, Rolla, Missouri

SESSION 3

(Rackham Amphitheater)

Chairman: JOHN E. SATER, Arctic Institute of
North America, Washington, D. C.

Signatures of Various Earth Surfaces Measured by the Nimbus-5 Microwave Spectrometer

K. F. KUNZI, R. L. PETTYJOHN and D. H.
STAEELIN, Massachusetts Institute of Tech-
nology, Cambridge, Massachusetts; and J. W.
WATERS, Jet Propulsion Laboratory, Pasadena,
California

A Study of Microwave Emission Properties of Sea Ice - AIdjex 1972

D. C. MEEKS, Aerojet ElectroSystems Company,
Azusa, California; R. O. RAMSELER, Department
of the Environment, Ottawa, Ontario, Canada;
and W. J. CAMPBELL, U. S. Geological Survey,
Tacoma, Washington

Investigation of Radar Discrimination of Sea Ice

S. K. PARASHAR, A. W. BIGGS, A. K. FUNG and
R. K. MOORE, University of Kansas Center for
Research, Lawrence, Kansas

Areal Extent of Snow in Forested Regions:

A Practical Estimation Technique Using ERTS-1 Data

WILLIAM C. DRAEGER and DONALD T. LAUER,
School of Forestry and Conservation,
University of California, Berkeley, California

ERTS Applications in Thailand, A Progress Report

PRAYONG ANGSAWATANA, Department of Mineral
Resources; CHUMNI BOONYOBHAS, BOONCHANA
KLANKAMSORN, Royal Forestry Department;
JOSEPH MORGAN, U. S. Geological Survey;
MANU OMAKUPT and STAFF, Land Development
Department; PONGPIT PIYAPONGSE, Department of
Agriculture; and KHID SUVARNASUDDHI, SUVIT
VIBULSRESTH, Applied Scientific Research
Corporation, Thailand

Passive Microwave Sensing of Moist Soils

A. E. BASHARINOV, L. F. BORODIN, A. M.
SHUTKO, Academy of Sciences of the USSR,
Moscow, USSR

Interpretation of the Deep Structure of Epiplatform Mountain Country on Space Photographs

V. I. MAKAROV, Geological Institute of the
USSR Academy of Sciences, Moscow, USSR

The Deep Structure of the Tajic Depression on Space Images of Different Scale

S. F. SKOBELEV, Geological Institute of the
USSR Academy of Sciences and YU. K. SHCHUKIN,
VNIIGeophysica, Moscow, USSR

The Progress of Investigations in the USSR on the Use of Radar Imagery for Geological Purposes

V. B. KOMAROV, V. A. STAROSTIN and B. P.
NYAVRO, Ministry of Geology of the USSR,
Leningrad, USSR

TUESDAY

APRIL 16

SESSION 4

(Rackham Amphitheater)

Chairman: BERNARD ZAVOS, National Oceanic and
Atmospheric Administration, Rockville, MD

Remote Measurement of Atmospheric Temperatures by Raman Lidar

THOM A. CONEY and JACK A. SALZMAN, NASA,
Lewis Research Center, Cleveland, Ohio

Optical Crosswind Measurement Techniques

ERICK T. YOUNG and THOMAS H. PRIES,
Atmospheric Sciences Laboratory, U. S. Army
Electronics Command, White Sands Missile
Range, New Mexico

On the Detectability of Atmospheric Carbon Monoxide by Microwave Remote Sensing

J. FULDE and E. SCHANDA, Institute of Applied
Physics, University of Berne, Berne, Switzer-
land

Determination of the Aerosol Content in the Atmosphere from ERTS-1 Data

M. GRIGGS, Science Applications, Inc.,
LaJolla, California

The Effect of Atmospheric Water Vapor on Automatic Classification of ERTS Data

DAVID E. PITTS, WILLIAM E. McALLUM, NASA
Johnson Space Center and ALYCE E. DILLINGER,
Lockheed Electronics Company, Houston, Texas

On the Natural Limitations of Target Differentiation by Means of Spectral Discrimination Techniques

M. J. DUGGIN, CSIRO Minerals Research Labora-
tories, North Ryde, New South Wales, Australia

BREAK

SESSION 5
(Rackham Lecture Hall)

Chairman: ROBERT H. ALEXANDER, U. S. Geological Survey, Washington, D. C.

Design Concepts for Land Use and Natural Resource Inventories and Information Systems

RONALD L. SHELTON, Department of Resource Development, Michigan State University, East Lansing, Michigan and ERNEST E. HARDY, Department of Natural Resources, Cornell University, Ithaca, New York

Interactive Computer Processing for Land Use Planning

E. EARLE NELSON, Earth Information Services, McDonnell Douglas Corporation, Huntington Beach, California

Use of ERTS-1 Imagery for Land Evaluation in Pennington County, South Dakota

C. J. FRAZEE, P. H. RAHN, F. C. WESTIN and V. I. MYERS, South Dakota State University, Brookings, South Dakota and ERNEST E. HARDY, School of Mines and Technology, Rapid City, South Dakota

Some Findings on the Applications of ERTS and Skylab Imagery for Metropolitan Land Use Analysis

VALERIE A. MILAZZO, Geographic Applications Program, U. S. Geological Survey, Reston, Virginia

The Role of ERTS-1 Processed Data for Transportation Planning in Michigan

RICHARD E. ESCH, Michigan Department of State Highways and Transportation, East Lansing, Michigan and BUZZ SELLMAN, Environmental Research Institute of Michigan, Ann Arbor, Michigan

Land Type Analysis for Regional Land Use Planning From Photomorphologic Mapping: An Example for Boulder County, Colorado

JANET E. NICHOL, University of Aston, Birmingham, England

Sahelian Arid Zone Rehabilitation and Development Programming Using ERTS and Skylab Imagery as a Data Base

N. H. MACLEOD, J. S. SCHUBERT and R. FANALE, The American University, Washington, D. C. and Goddard Space Flight Center, Greenbelt, Maryland

BREAK

Keynote Address: Importance of Remote Sensing Technology to the International Community and in Particular to the Third World

Dr. GARNET A. BROWN, Ministry of Mining and Natural Resources, Kingston, Jamaica

SESSION 6
(Rackham Amphitheater)

Chairman: ROBERT F. HOLMES, Environmental Protection Agency, Warrenton, Virginia

Flood Inundation in the Southeastern United States from Aircraft and Satellite Imagery

GERALD K. MOORE and GARY W. NORTH, U. S. Geological Survey, Bay St. Louis, Mississippi

Mapping of the 1973 Mississippi River Floods by the NOAA-2 Satellite

D. R. WIESNET, D. F. MCGINNIS and J. A. PRITCHARD, U. S. Department of Commerce, NOAA, National Environmental Satellite Service, Hillcrest Heights, Maryland

A Hydrogeomorphic Approach to Evaluating Flood Potential in Central Texas from Orbital and Suborbital Remote Sensing Imagery

VICTOR R. BAKER, Department of Geological Sciences; ROBERT K. HOLZ, Department of Geography; STEVEN D. HULKE, Department of Geological Sciences, The University of Texas at Austin, Austin, Texas

Investigation of the Effects of Construction and Stage Filling of Reservoirs on the Environment and Ecology

R. E. RIGGINS, H. E. BALBACH and R. K. JAIN, U. S. Army Corps of Engineers, Construction Engineering Research Laboratory, Champaign, Illinois

Application of Remote Sensing to the Location of Hydrologically Active (Source) Areas

ACHI M. ISHAQ and DALE D. HUFF, Department of Civil and Environmental Engineering, The University of Wisconsin, Madison, Wisconsin

The Use of Remote Sensing and Natural Indicators to Delineate Floodplains - Preliminary Findings

S. C. SCOLLERS, Office, Chief of Engineers, Washington, D. C., and G. W. PETERSEN, D. L. HENNINGER and F. Y. BORDEN, The Pennsylvania State University, University Park, Pennsylvania

BREAK

Evaluation of ERTS-1 and Aircraft Data for Assessing Internal Drainage in Irrigated Agriculture

DENNIS W. RYLAND, FRED A. SCHMER and DONALD G. MOORE, Remote Sensing Institute, South Dakota State University, Brookings, South Dakota; and WILLIAM A. LIDSTER, United States Bureau of Reclamation, Denver, Colorado

Use of Visible, Near-Infrared, and Thermal Infrared Remote Sensing to Study Soil Moisture

M. B. BLANCHARD, Ames Research Center, NASA, Moffett Field, California, RONALD GREELEY, University of Santa Clara, California; and ROBERT GOETTELMAN, LFE Corporation, Richmond, California

Moisture Detection from Skylab
JOE R. EAGLEMAN, University of Kansas,
Lawrence, Kansas

Remote Detection of Soil Surface Moisture
E. H. STOCKHOFF and R. T. FROST, General
Electric Space Sciences Laboratory,
Philadelphia, Pennsylvania

*On the Feasibility of Remote Monitoring of
Soil Moisture with Microwave Sensors*
R. W. NEWTON, S. L. LEE and J. W. ROUSE, JR.,
Remote Sensing Center, Texas A&M University,
College Station, Texas; and J. F. PARIS,
Lockheed Electronics Company, Houston, Texas

*Operational Use of Satellite and High Altitude
Remote Sensing for the Generation of Input Data
for Water Demand Models*
LARRY R. TINNEY, JOHN E. ESTES, KONAI H.
THAMAN and RANDOLPH R. THAMAN, Geography
Remote Sensing Unit, University of California,
Santa Barbara, California

SESSION 7
(Rackham Lecture Hall)

Chairman: GEORGE J. ZISSIS, Environmental Re-
search Institute of Michigan,
Ann Arbor, Michigan

*Interactive Machine Assessment of Critical
Land Resources Using ERTS-1 Data*
WILLIAM W. KUHLOW and LAWRENCE T. FISHER,
The University of Wisconsin, Madison,
Wisconsin

*An Automated and Repeatable Data Analysis Pro-
cedure for Remote Sensing Applications*
B. J. DAVIS and P. H. SWAIN, IARS, Purdue
University, West Lafayette, Indiana

*New Application of Remotely Sensed Data Pro-
cessing Technique*
T. SAKATA and H. SHIMODA, Department of
Electro-Photo-Optics, Tokai University,
Hiratsuka Kanagawa, Japan

*Adaptive Processing of Multispectral Scanner
Data Using a Decision-Directed Kalman Filter*
ROBERT B. CRANE, Environmental Research
Institute of Michigan, Ann Arbor, Michigan

*An Improved Version of the Table Look-Up
Algorithm for Pattern Recognition*
W. G. EPPLER, Lockheed Electronics Company,
Houston, Texas

*Implementation of an Advanced Table Look-up
Classifier for Large Area Land-Use Classifica-
tion*
CLAY JONES, JSC, Earth Resources Laboratory,
NASA, Bay St. Louis, Mississippi

*Modifications in a Computer-Implemented Method
for the Detection and Extraction of Objects in
Aerial Photographs*
S. KLAUSNER and D. KARMEI, Technion, Israel
Institute of Technology, Haifa, Israel

Automatic Data Processing for Non-Mathematicians
G. PRESTON, Remote Sensing Unit, University
of Aston, Birmingham, England

BREAK

*Digital Image Correction and Information Ex-
traction*
RALPH BERNSTEIN, IBM Corporation, Gaithersburg,
Maryland

*SICLOPS: A System of Computer Programs for
Rectified Mapping of Airborne Scanner Imagery*
M. M. SPENCER, J. M. WOLF and M. A. SCHALL,
Environmental Research Institute of Michigan,
Ann Arbor, Michigan

*Effect of Atmospheric Haze and Sun Angle on
Automatic Classification of ERTS-1 Data*
J. POTTER, R. HILL and M. SHELTON, Lockheed
Electronics Company, Houston, Texas

*Skylab S-192 Ratio Codes of Soil, Mineral, and
Rock Spectra for Ratio Image Selection and
Interpretation*
R. K. VINCENT and W. W. PILLARS, Environmental
Research Institute of Michigan, Ann Arbor,
Michigan

*STANSORT: Stanford Remote Sensing Laboratory
Pattern Recognition and Classification System*
F. R. HONEY, A. PRELAT and R. J. P. LYON,
School of Earth Sciences, Stanford University,
Stanford, California

WEDNESDAY

APRIL 17

SESSION 8
(Rackham Lecture Hall)

Chairman: VINCENT E. NOBLE, U. S. Naval
Research Laboratory, Washington, D.C.

*Extensive Summer Upwelling on Lake Michigan
During 1973 Observed by NOAA-2 and ERTS-1
Satellites*
ALAN E. STRONG, HARRY G. STUMPF, JULIA L.
HART and JOHN A. FRITCHARD, U. S. Department
of Commerce, NOAA, National Environmental
Satellite Service, Hillcrest Heights, Maryland

Remote Sensing of Western Lake Superior
KIRBY STORTZ and MICHAEL SYDOR, Lake Superior
Basin Studies Center, University of Minnesota,
Duluth, Minnesota

Scanning Thermal Plumes
F. L. SCARFACE, R. P. MADDING and T. GREEN III,
The University of Wisconsin, Madison, Wisconsin

The Use of Remote Sensing in Limnological Studies
C. T. WEZERNAK, Environmental Research
Institute of Michigan, Ann Arbor, Michigan

Automatic Classification of Eutrophication of Inland Lakes from Spacecraft Data

ROBERT H. ROGERS, LARRY E. REED and NAVIN J. SHAH, Bendix Aerospace Systems Division, Ann Arbor, Michigan; and V. ELLIOT SMITH, Cranbrook Institute of Science, Bloomfield Hills, Michigan

BREAK

Correlation of Multispectral Imagery with Water Analysis - The Ross Barnett Reservoir Remote Sensing Project

D. L. WERTZ, W. T. MEALOR, M. L. STEELE and J. W. PINSON, University of Southern Mississippi, Hattiesburg, Mississippi

The Economic Impact of Remote Sensing Data as the Source of Nonpoint Pollution Monitoring and Control

W. L. MILLER, Purdue University, West Lafayette, Indiana

Preliminary Results of Fisheries Investigation Associated with Skylab-3

K. SAVASTANO, E. PASTULA, R., and G. WOODS, National Marine Fisheries Service; and K. FALLER, Earth Resources Laboratory, NASA, Bay St. Louis, Mississippi

Rapid Stook Assessment of Pilchard Populations by Aircraft-Borne Remote Sensors

D. L. CRAM, Sea Fisheries Branch, Cape Town, South Africa

SESSION 9
(Rackham Amphitheater)

Chairman: ROBERT H. MILLER, U. S. Department of Agriculture, Washington, D. C.

Determining Range Conditions and Forage Production Potential in California from ERTS-1 Imagery

DAVID M. CARNEGIE and STEPHEN D. DEGLORIA, Remote Sensing Research Program, University of California, Berkeley, California

Grass Canopy Bidirectional Spectral Reflectance

JOHN E. COLWELL, Environmental Research Institute of Michigan, Ann Arbor, Michigan

Remote Sensing Applications: Forest Tree Disease Detection and Vegetation Classification Within the Sub-Boreal Forest Region

ROBERT W. DOUGLASS, MERLE P. MEYER and DONALD W. FRENCH, The Pennsylvania State University, Mont Alto, Pennsylvania

Forest Defoliation Assessment with Satellite Imagery

WAYNE G. ROHDE, Earth Satellite Corporation, Washington, D. C. and HARRY J. MOORE, Plant Protection and Quarantine Animal and Plant Health Inspection Service, Hyattsville, Maryland

Spectral Reflectance Studies on Mineral Deficiency in Corn Plants

H. A. YOUNES, Agricultural and Biological Research Division, National Research Center; R. M. ABDEL-AAL, Soils and Water Research Institute, Ministry of Agriculture; M. M. KHODAIR, National Institute of Standards; and A. G. ABDEL-SAMIE, Agricultural and Biological Research Division, National Research Center, Dokki, Giza, Egypt

BREAK

Agricultural Resources Investigations in Southern France and Northern Italy

Authors of the European Communities, of the French Institutes C.E.A.R.N., C.E.S.R., I.N.R.A., S.C.V., and of the Italian Institutes C.A.T.A., E.N.R., I.S.C., I.S.P., I.N.P.L. and L.G.L.

Thermal Behaviour of Some Rice Fields Affected by a Yellowing-Type Disease

C. DeCAROLIS and G. BALDI, Rice Research Center, Mortara; S. GALLI, Joint Research Center, Ispra; and G. M. LECHI, GEOLAB, National Italian Research Council, Milano, Italy

First Results From the Crop Identification Technology Assessment for Remote Sensing (CITARS)

F. G. HALL, NASA, JSC, Houston, Texas; M. E. BAUER, LARS, Purdue University, West Lafayette, Indiana; W. A. MALILA, Environmental Research Institute of Michigan, Ann Arbor, Michigan

Vegetation Analysis with ERTS Digital Data: A New Approach

J. S. SCHUBERT, Goddard Space Flight Center, Greenbelt, Maryland and N. H. MACLEOD, The American University, Washington, D. C.

ERTS-1 Data for Classifying Native Plant Communities--Central Colorado

RICHARD S. DRISCOLL and RICHARD E. FRANCIS, U.S.D.A., Forest Service; JAMES A. SMITH and ROY A. MEAD, Colorado State University, Fort Collins, Colorado

SESSION 10
(Rackham Lecture Hall)

Chairman: JOHN C. WILKERSON, U. S. Naval Oceanographic Office, Washington, D.C.

Computer Derived Coastal Water Classifications Via Spectral Signatures

D. K. CLARK, J. B. ZAITZEFF, L. V. STREES and W. S. GLIDDEN, NOAA, National Environmental Satellite Service, Washington, D.C.

Coastal Wetlands Analysis From ERTS MSS Digital Data and Field Spectral Measurements

VIRGINIA CARTER, U. S. Geological Survey, Reston, Virginia; JANE SCHUBERT, Goddard Space Flight Center, Greenbelt, Maryland

California Nearshore Processes, ERTS-1

DAVID D. STELLER, Geoscience Division, Geo-source International, Seal Beach, California; and DOUGLAS M. PIRIE, U. S. Army Corps of Engineers, San Francisco, California

Surface Currents Along the California Coast Observed on ERTS Imagery

PAUL R. CARLSON, U. S. Geological Survey, Menlo Park, California

Correlation of Coastal Water Turbidity and Current Circulation with ERTS-1 and Skylab Imagery

V. KLEMAS, M. OTLEY, W. PHILPOT and C. WEITHE, College of Marine Studies, University of Delaware, Newark, Delaware; and R. ROGERS and N. SHAH, Bendix Aerospace Division, Ann Arbor, Michigan

BREAK

Boundaries of ERTS and Aircraft Data Within Which Useful Water Quality Information can be Obtained

W. G. EGAN, Grumman Aerospace Corporation, Bethpage, New York

Ocean Internal Waves off the North American and African Coasts from ERTS-1

JOHN R. APEL and ROBERT L. CHARNELL, Atlantic Oceanographic and Meteorological Laboratories, NOAA, Miami, Florida; RICHARD J. BLACKWELL, Jet Propulsion Laboratory, Pasadena, California

Detection of Several Sea States Around Japan from Multispectral Scanner Imageries by ERTS-1

KANTARO WATANABE, Tokai University, Shizuoka-ken, Japan

Activities of the Laboratoire de Meteorologie Dynamique (CNRS) Concerning Remote Sensing Techniques and Their Applications to Earth Resources and Environment

F. BECKER and F. SIROU, Centre National de la Recherche Scientifique, Bellevue-Meudon, France

Lake Ontario Water Mass Delineation from ERTS-1

JOHN C. MUNDAY, JR., Department of Geography, University of Toronto, Erindale College, Clarkson, Ontario, Canada

SESSION 11
(Rackham Amphitheater)

Chairman: ROBERT H. MILLER, U. S. Department of Agriculture, Washington, D.C.

Color Terrain Map of Yellowstone National Park, Computer-Derived from ERTS-MSS Data

RALPH R. ROOT, National Park Service, Denver, Colorado; HARRY W. SMEDES, U.S.G.S., Denver, Colorado; NORMAN ROLLER, Environmental Research Institute of Michigan, Ann Arbor, Michigan; DON DESPAIN, National Park Service, Yellowstone Park, Wyoming

Inventories of Delaware's Coastal Vegetation and Land-Use Utilizing Digital Processing of ERTS-1 Imagery

V. KLEMAS and D. BARTLETT, College of Marine Studies, University of Delaware, Newark, Delaware; R. ROGERS and L. REED, Bendix Aerospace Systems Division, Ann Arbor, Michigan

Texture Analysis with Fourier Series

H. MAURER, Department of Geography, University of Zurich, Zurich, Switzerland

On the Survey of Sea Water Pollution of the Seto Inland Sea by ERTS Pictures

JOJI IISAKA, Scientific Center, IBM Japan

Land Use Classification Accuracies and Ground Truth Correlations from Simultaneously Acquired Aircraft and ERTS-1 MSS Data

A. J. RICHARDSON, M. R. GAUTREAU, R. J. TORLINE and C. L. WIEGAND, U. S. Department of Agriculture, Weslaco, Texas

BREAK

Investigation into the Spectral Signature of Agricultural Crops During Their State of Growth

TH. A. de BOER, Institute for Biological and Chemical Research on Field Crops and Herbage, Wageningen; N.J.J. BUNNIK, H.W.J. van KASTEREN, D. UENK, W. VERHOEF, NIWARS, Delft; G.P. de LOOR, Fysisch Laboratorium TNO, The Hague, The Netherlands

Radar Cross Sections of Vegetation Canopies Determined by Monostatic and Bistatic Scatterometry

E.P.W. ATTEMA, L.G. den HOLLANDER, Delft University of Technology, Delft; TH. A. de BOER, D. UENK, Institute for Biological and Chemical Research on Field Crops and Herbage, Wageningen; W.J. ERADUS, G.P. de LOOR, Physics Laboratory TNO, The Hague; H. van KASTEREN, J. van KUILENBURG, NIWARS, Delft, The Netherlands

Photographs from Balloons: Their Use in Agronomy and Management of Environment

C.M. GIRARD-GANNEAU and M.C. GIRARD, Institut National Agronomique, Paris, France

The Interpretation and Use of False-Colour Infra-Red and True Colour Photography of Part of Argentina Obtained by Skylark Earth Resources Rockets

D.S.H. DRENNAN and C.J. BRAY, University of Reading; I.R. GALLOWAY, University of London; J.R. HARDY and C.O. JUSTICE, University of Reading; E.S. OWEN-JONES, University of London; R.A.G. SAVIGEAR and J.R.G. TOWNSHEND, University of Reading, Reading and London, England

Infrared Aerial Photography and Ground Tests of Thermal Structure of Dry Steppe Landscape
B. V. VINOGRADOV, A. A. GRIGORYEV, and
V. B. LIPATOV, Institute of Geography of
Academy of Science, Moscow, USSR

Some Results of Photography of Agricultural Lands and Crop Fields of Sal Steppe Test Site from Spacecraft Soyuz-9

B. V. VINOGRADOV, V. I. SEVASTYANOV, and
E. V. SERDYUKOVA, Institute of Geography
of Academy of Science, Moscow, USSR

Methods of Filtering Photoimages and Their Applications to Geological Problems

V. B. KOMAROV and YU. V. UGLEV, Ministry of
Geology of the USSR, Leningrad, USSR

SESSION 12
(Rackham Lecture Hall)

Chairman: EDWARD M. RISLEY, U. S. Geological
Survey, EROS Program, Reston,
Virginia

Review and Appraisal: Cost-Benefit Analyses of Earth Resources Survey Satellite Systems
EVELYN S. PUTNAM and ROMAN KRZYCZKOWSKI,
INTERPLAN Corporation, Santa Barbara,
California

Use of Results from ERTS-1 Experiments to Evaluate Benefits From Operational Earth Resources Survey Systems

H. THEODORE HEINTZ, JR. and PAUL M. MAUGHAN,
Earth Satellite Corporation, Washington, D.C.

Evaluation of ERTS Data Utilization in Developing Countries

E. J. GREENBLAT, ECON, Princeton, New Jersey;
D. S. LOWE, Environmental Research Institute
of Michigan, Ann Arbor, Michigan; R. A. SUMMERS,
System Planning Corporation, Arlington, Virginia

Panel Discussion of Cost-Benefit Evaluation of Satellite Earth Resources Survey Systems

THURSDAY

APRIL 18

SESSION 13
(Rackham Lecture Hall)

Chairman: MARVIN R. HOLTER, Environmental Research Institute of Michigan,
Ann Arbor, Michigan

A Feasibility Study on a Synthetic Aperture Radar Satellite (SARSAT) for Earth Resources Surveys

C. SKENDEROFF, Thomson-CSF, Velizy Villacoublay, France and J. R. COLDRIK, British Aircraft Corporation, Bristol, England

Investigation of Microwave Hologram Techniques for Application to Earth Resources

R. W. LARSON, R. W. BAYMA, Environmental Research Institute of Michigan; J. E. FERRIS, Radiation Laboratory, The University of Michigan; M. B. EVANS, J. S. ZELENKA and H. W. DOSS, Environmental Research Institute of Michigan, Ann Arbor, Michigan

Range Focused Doppler Spectra (RFD): A Transformation of SAR Signal Film for Radar Scattering Analysis

PHILIP L. JACKSON, Environmental Research Institute of Michigan, Ann Arbor, Michigan

Emissivities and Forward Scattering of Natural and Man-Made Material at Three Millimeter Wavelength

E. SCHANDA and R. HOFER, Institute of Applied Physics, University of Berne, Berne, Switzerland

Deteriorating Effects on 3 MM Wave Passive Imagery

G. SCHAEFER and E. SCHANDA, Institute of Applied Physics, University of Berne, Berne, Switzerland

The Usefulness of Imaging Passive Microwave for Rural and Urban Terrain Analysis

D. N. BRUNELLE, J. E. ESTES, M. R. MEL, R. R. THAMAN, F. E. EVANISKO, University of California, Santa Barbara, California; and R. P. MOORE, C. A. HAWTHORNE, J. O. HOOPER, Naval Weapons Center, China Lake, California

BREAK

Microwave Radiometric Characteristics of Snow Covered Terrain

ROBERT P. MOORE and JOHN O. HOOPER, Naval Weapons Center, China Lake, California

Single Flight Stereo Radar Capabilities

GORDON E. CARLSON and GEORGE L. BAIR, University of Missouri, Rolla, Missouri

Electrically Scanning Microwave Radiometers

RAYMOND F. MIX, Aerojet ElectroSystems Company, Azusa, California

Measurement of Sea Surface Currents Using Airborne Doppler Radar and Inertial Navigation Systems

J.F.R. GOWER, Marine Sciences Directorate Environment Canada, Victoria, British Columbia, Canada

Thermal and Multispectral Scanning Within a Broad, Model-Type Interdisciplinary Program on Climate, Land Use and Environmental Protection by the Regional Planning Authority Frankfurt (RPU)

KLAUS VOLGER, Institut für Angewandte Geowissenschaften; ALEXANDER VON HESLER, Regional Planning Authority; HELLA BARTELS, German Federal Weather Service, Frankfurt, Germany

SESSION 14
(Rackham Amphitheater)

Chairman: LLOYD R. BRESLAU, U. S. Coast Guard Research and Development Center, Groton, Connecticut

A Practical Oil Sensor

GUY S. RAMBIE, JR., RAMCO, Irving, Texas

Remote Measurements of Water Pollution with a Lidar Polarimeter

T. C. SHEIVES, J. W. ROUSE, JR., and W. T. MAYO, JR., Remote Sensing Center, Texas A&M University, College Station, Texas

Multi-Spectral Remote Fluorimeter for Detection of Oil Films

H. G. ELDERING and W. A. WEBB, Baird-Atomic, Inc., Bedford, Massachusetts

Development of an Experimental Airborne Laser Remote Sensing System for the Detection and Classification of Oil Spills

J. F. FANTASIA and H. C. INGRAO, DOT/Transportation Systems Center, Cambridge, Massachusetts

Crude and Refined Petroleum Oil Structured Luminescence Signatures Induced by UV Laser or Lamp and Their Remote Sensing Applications

H. GERALD GROSS and MICHIO MURAMOTO, McDonnell Douglas Astronautics Company, Huntington Beach, California

BREAK

Passive Microwave Sensing of Oil Slicks

JAMES P. HOLLINGER, E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, D.C.

Multi-Frequency Radiometric Measurements of Foam and a Mono-Molecular Slick

B. AU, J. KENNEY, L. U. MARTIN, Naval Research Laboratory, Washington, D.C. and D. ROSS, NOAA, Miami, Florida

Oil Slick Detection by X-Band Synthetic Aperture Radar

J. R. KOTLARSKI and H. R. ANDERSON, Hughes Aircraft Company, Culver City, California

Airborne Oil Pollution Surveillance System

A. T. EDGERTON, Aerojet ElectroSystems Company, Azusa, California and G. WOOLEVER, U. S. Coast Guard, Washington, D.C.

SESSION 15
(Rackham Amphitheater)

Chairman: ANTHONY J. CALIO, National Aeronautics and Space Administration, Houston, Texas

Summary of Flight Performance of the Skylab Earth Resources Experiment Package (EREP)

A. E. POTTER, C. K. WILLIAMS, A. L. GRANDFIELD, K. J. DEMEL, M. C. TRICHEL, T. L. BARNETT, R. D. JUDAY, W. E. HENSLEY, N. M. HATCHER and W. E. McALLUM, NASA, JSC, Houston, Texas; J. T. McGOOGAN, NASA Wallops Station, Wallops Island, Virginia; J. C. JONES, Martin Marietta Corp., Denver, Colorado; O. N. BRANDT, Lockheed Electronics Co., Houston, Texas; J. G. BRAITHWAITE and R. H. McLAUGHLIN, Environmental Research Institute of Michigan, Ann Arbor, Michigan; R. COLLINS, Itek Corp., Lexington, Massachusetts; W. H. PEAKE, Ohio State University, Columbus, Ohio; and R. K. MOORE, University of Kansas, Lawrence, Kansas

An Orbiting Visible/Infrared Spectrometer for Terrestrial, Atmospheric and Oceanographic Applications

G. R. PRUITT, Block Engineering, Inc., Cambridge, Massachusetts

A Motion-Compensated Spatial Scanner

K. S. GORDON and J. R. MILLER, Centre for Research in Experimental Space Science, York University, Toronto, Canada

BREAK

The Remote Raman Spectrometer is a Viable Instrument for Remote Sensing of the Environment

STANLEY M. KLAINER, WILLIAM ARDEN and TOMAS HIRSCHFELD, Block Engineering, Inc., Cambridge, Massachusetts

Geologic Interpretation of Infrared Thermal Images in East Qatrani Area, Western Desert, Egypt

E. M. EL-SHAZLY, Academy of Scientific Research and Technology; M. A. ABDEL-HADY, Oklahoma State University and Academy of Scientific Research and Technology; and M. A. MORSY, Atomic Energy Establishment, Cairo, Egypt

Statistical Separability of Agricultural Cover Types in Subsets of One to Twelve Spectral Channels

R. KUMAR and L. SILVA, IARS, Purdue University, West Lafayette, Indiana

Multi-Aspect Techniques in Remote Sensing

WILLIAM A. MALILA, Environmental Research Institute of Michigan, Ann Arbor, Michigan

SESSION 16
(Rackham Lecture Hall)

Chairman: RICHARD S. WILLIAMS, JR., U. S.
Geological Survey, EROS Program,
Reston, Virginia

*Geothermal Reconnaissance From Quantitative
Thermal Infrared Images*

KENNETH WATSON, U. S. Geological Survey,
Denver, Colorado

*Optical Data Processing Analysis of Stream
Patterns Exhibited on ERTS-1 Imagery*

DWIGHT EGBERT, JAMES MCCAULEY, FAWWAZ ULABY,
JAMES McNAUGHTON, University of Kansas
Center for Research, Inc., Lawrence, Kansas

*Remote Sensing of Rock Type in the Visible and
Near-Infrared*

JOHN W. SALLISBURY and GRAHAM R. HUNT, Air
Force Cambridge Research Laboratories,
L. C. Hanscom Field, Bedford, Massachusetts

*Prediction of the Fraunhofer Line Detectivity
of Luminescent Materials*

R. D. WATSON, U.S.G.S., Denver, Colorado;
W. R. HEMPHILL, U.S.G.S., Reston, Virginia;
T. D. HESSIN and R. C. BIGELOW, U.S.G.S.,
Denver, Colorado

*Application of Radar Imagery to Environmental
Geologic Mapping of Texas*

P. JAN CANNON, Bureau of Economic Geology,
The University of Texas, Austin, Texas

BREAK

*Remote Sensing Techniques Applied to the Study
of Italian Volcanic Areas: The Results of the
Repetition of the Airborne I. R. Survey Compared
to the Previous Data*

R. CASSINIS, C. M. MARINO and A. M. TONELLI,
University of Milan and C. N. R., Milan, Italy

*Surface Compositional Mapping in the Wind River
Range and Basin, Wyoming by Multispectral
Techniques Applied to ERTS-1 Data*

BETIE SALMON and ROBERT VINCENT, Environmental
Research Institute of Michigan, Ann Arbor,
Michigan

*Unsupervised Mapping of Geologic Features and
Soils in California*

ROBERT DILLMAN and ROBERT VINCENT, Environ-
mental Research Institute of Michigan,
Ann Arbor, Michigan

*Remote Sensing to Detect the Toxic Effects of
Metals on Vegetation for Mineral Exploration*

N. P. PRESS, Nigel Press Associates, London,
England

*Science Considerations for an Orbital Radar
Mapping Mission to Venus*

DANIEL C. WYCHGRAM, Planetary Geology Lab.,
Martin Marietta Aerospace, Denver, Colorado

*Elements of the Deep Structure of the Earth's
Crust on the Space Images of the East Caucasus*

V. G. TRIFONOV, Geological Institute of the
Academy of Sciences of the USSR, Moscow,
USSR

*The Use of Space Photos for Search of Oil and
Gas Fields*

P. V. FLORENSKIY, Geological Institute of
the Academy of Sciences of the USSR, I.M.
Gubkin's Institute of Oilchemical and Gas
Industry, Moscow, USSR

FRIDAY

APRIL 19

SESSION 17
(Rackham Lecture Hall)

Chairman: A. B. PARK, Earth Satellite Corp.,
Washington, D.C.

*The Remote Sensing Program of the Geological
Survey of Alabama*

JAMES A. DRAHOVZAL, JACQUES L. G. EMPLAINCOURT,
and CHARLES C. WIELCHOWSKY, Geological Survey
of Alabama, University, Alabama

*Application of ERTS Imagery to Indiana Coal
Mining Problems*

CHARLES E. WIER and HAROLD C. HUTCHISON,
Indiana Geological Survey, Bloomington,
Indiana; FRANK J. WOBBER, ORVILLE R. RUSSELL,
ROGER V. AMATO and THOMAS V. LESHENDOK,
Earth Satellite Corporation, Washington, D.C.

Resource Analysis Applications in Michigan

STEPHEN W. SCHAR and WILLIAM R. ENSLIN,
Michigan State University, East Lansing;
IRVIN J. SATTINGER, Environmental Research
Institute of Michigan, Ann Arbor; JOHN G.
ROBINSON, Bureau of Water Management,
Michigan Department of Natural Resources
Lansing; ROBERT S. FELLOWS, Soil Conserva-
tion Service, Lansing; KARL R. HOSFORD,
Office of Land Use, Department of Natural
Resources, Lansing; and JAN H. RAAD, Bureau
of Transportation Planning, Department of
State Highways and Transportation, Lansing,
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*Applications of Remote Sensing by the State of
Nebraska*

MARVIN CARLSON, REX PETERSON, RICHARD HOFFMAN,
JAMES DREW, DONALD EDWARDS, GARY HERGENRADER,
NORMAN ROSENBERG and LESLIE SHEFFIELD, The
University of Nebraska; MARION BALL, Nebraska
State Department of Water Resources; JAMES
BARR, Nebraska State Office of Planning and
Programming; GERALD CHAFFIN, Nebraska Game
and Parks Commission; GERALD GRAUER, Nebraska
State Department of Roads; RAYMOND HARTUNG,
Nebraska State Department of Environmental
Control; GERALD WALLIN, Nebraska Resources
Commission, Lincoln, Nebraska

*Application of ERTS-1 Data to the Protection
and Management of New Jersey's Coastal Environ-
ment*

ROBERT L. MAIRS, ROBERT T. MACOMBER, DENNIS
T. STANCZUK, FRANK J. WOBBER and LAWRENCE
R. Pettinger, Earth Satellite Corporation,
Washington, D.C., and ROLAND S. YUNGHANS,
EDWARD B. FEINBERG and JOANN STITT, New Jersey
Department of Environmental Protection,
Trenton, New Jersey

BREAK

*Multidisciplinary Applications of ERTS and
Skylab Data in Ohio*

D. C. SWEET and P. G. PINCURA, Department of
Economic and Community Development; C. J.
MEIER, Department of Natural Resources;
G. B. GARRETT, Ohio Environmental Protection
Agency; L. O. HERD, Department of Trans-
portation; J. M. DOWDY, The Ohio State
University; D. M. ANDERSON, Ohio Biological
Survey; G. E. WUKELIC, J. G. STEPHAN, H. E.
SMALL and T. F. EBBERT, Battelle, Columbus
Laboratories, Columbus, Ohio

An Overview of Texas Activities in Remote Sensing

ROGER N. NEECE, General Land Office; MICHAEL
ELLIS, Texas Water Development Board and
JOHN WELLS, Office of Information Services,
Remote Sensing Task Force, Interagency
Council on Natural Resources and the Environ-
ment, Austin, Texas

A Summary of ERTS Data Applications in Alaska

JOHN M. MILLER and ALBERT E. BELON,
Geophysical Institute, University of Alaska,
Fairbanks, Alaska

Closing Remarks

G. J. ZISSIS, Environmental Research Institute
of Michigan, Ann Arbor, Michigan

ABSTRACT

These Proceedings contain papers presented at the Ninth International Symposium on Remote Sensing of Environment, held April 15th through 19th, 1974, on the campus of The University of Michigan. The symposium was conducted by the Center for Remote Sensing Information and Analysis of the Environmental Research Institute of Michigan (formerly The University of Michigan's Willow Run Laboratories) as a part of a continuing program investigating current activities in the field of remote sensing.

Presentations include those on the utilization of this technology by regional governmental units and by federal governmental agencies, as well as various applications in monitoring and managing the earth's resources and man's global environment. Ground-based, airborne, and spaceborne sensor systems and manual and machine-assisted data analysis and interpretation are included.

EDITORIAL NOTE

The papers contained herein are in the order of presentation. Those manuscripts not received in time to meet publication deadlines have been represented by comprehensive summaries wherever possible. An author index and the revised program are included as a supplement to the table of contents.

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