



LANDSAT – 40th Anniversary – the first steps

Landsat - 40th Anniversary

The Early Days of Landsat Operations in the 1970ties

Lothar Beckel
European Academy of Sciences and Arts

Dr. William Nordberg - The Father of Landsat



William Nordberg



Dr. William Nordberg - An Austrian Pioneer – his Way to Space 1930 - 1976

1970 Invited by the US-Ning to work as physicist at Research Center East, Massachusetts, New Jersey, only later to USA. After his flight from the cabinet, the "Secret Service Department", a leave in physics to study the Upper Manhattan, the book for all space flights.

W59 Wilkshire is moved to Goddard Space Flight Center of NASA.

1954. W. N. Harding became Director of NASA Space Applications Department. In his outstanding work he received from NASA the "Exceptional Scientific Achievement Award" (1962), from NASA - the "National Scientific and Technological Administration" the "William F. Brock Award" (1972). NASA awarded W. N. Harding with its highest decoration the "Exceptional Service Medal" (1972).

Highest International Honor Medal was awarded at the time the "William N. Harding Memorial Award for Scientific Services" (1984) and the "William N. Harding Medal of COSPAR" (1984). W. N. Harding died in Cleveland, Michigan.

Dr. William Nordberg - Director of Applications National Aeronautics and Space Administration,
Goddard Space Flight Center, Greenbelt, Maryland

Autograph of William Nordbergs Visions on the Benefits of earth Observation from Space In „Österreich im Satellitenbild“ - 1975

[illegible]

Dr. William Nordberg



Oberrflächen betrachtet, erscheint es paradox, daß Satelliten, die fast 1000 km hoch um die Erde kreisen, dazu verwendet werden, um unsere unmittelbare Umgebung auf der Erdoberfläche zu erforschen. Jedoch der Druck, der durch die lawinenartige wachsende Bevölkerung auf die Rohstoffe und allgemeine Umwelt unseres Planeten ausgeübt wird, macht es notwendig, Mittel zu finden, mit denen man untertunlich und zielgerecht jene Faktoren überblicken kann, die zur Entwicklung neuer Rohstoffquellen, zur besseren und ökologisch erträglichen Landnutzung und zur allgemeinen Erhaltung der lebensfördernden Umwelt führen. Abgesehen von technischen Schwierigkeiten wäre es rein wirtschaftlich undenkbar, alle diese Faktoren weltweit und kontinuierlich ohne Hilfe von Satelliten zu erfassen. Die thematischen Kartierungen, die seit über drei Jahren aus polychromatischen Bildern mit den LANDSAT-Satelliten auf der ganzen Welt gemacht werden, haben einen Weg gezeigt, der zu einem äußerst wirtschaftlichen und praktischen, globalen Umweltüberwachungssystem führen könnte.

EARTH RESOURCES PROGRAM

SYNOPSIS OF ACTIVITY

MARCH 1970



NASA DEVELOPMENT OF REMOTE SENSORS

ELEMENTS OF PROJECTS



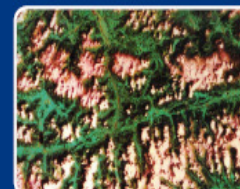
EARTHNET

The ESA data distribution organisation
Access to first Data Catalogue



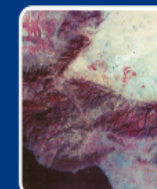
ÖSTERREICH | AUSTRIA

The first satellite image atlas of Austria
Foreword by William Nordberg (1975) see above



MISSION TO EARTH

The first NASA Satellite Image Atlas of Earth, Landsat Views the World® - 1976





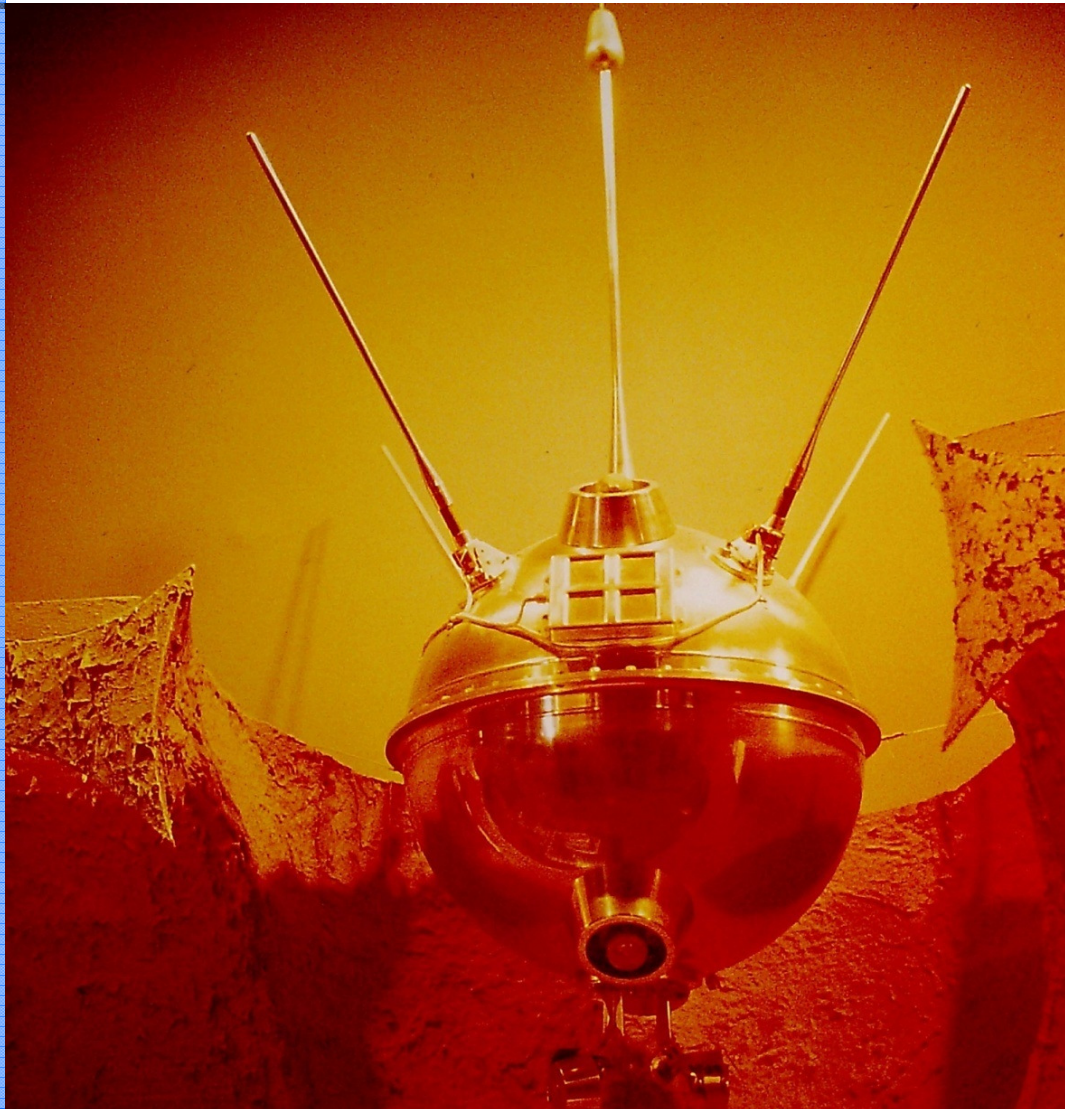
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Bill NORDBERG (right) in his homeland Styria, on top of his favorite mountain „Dachstein“ (3004 m), August 1976, with his friend Bill CAMPBELL, NASA/USGS.



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How did it start?

Sputnik 1

The first man
Made Satellite –
launched by the Soviet
On October 4th, 1957

© Foto: L. Beckel



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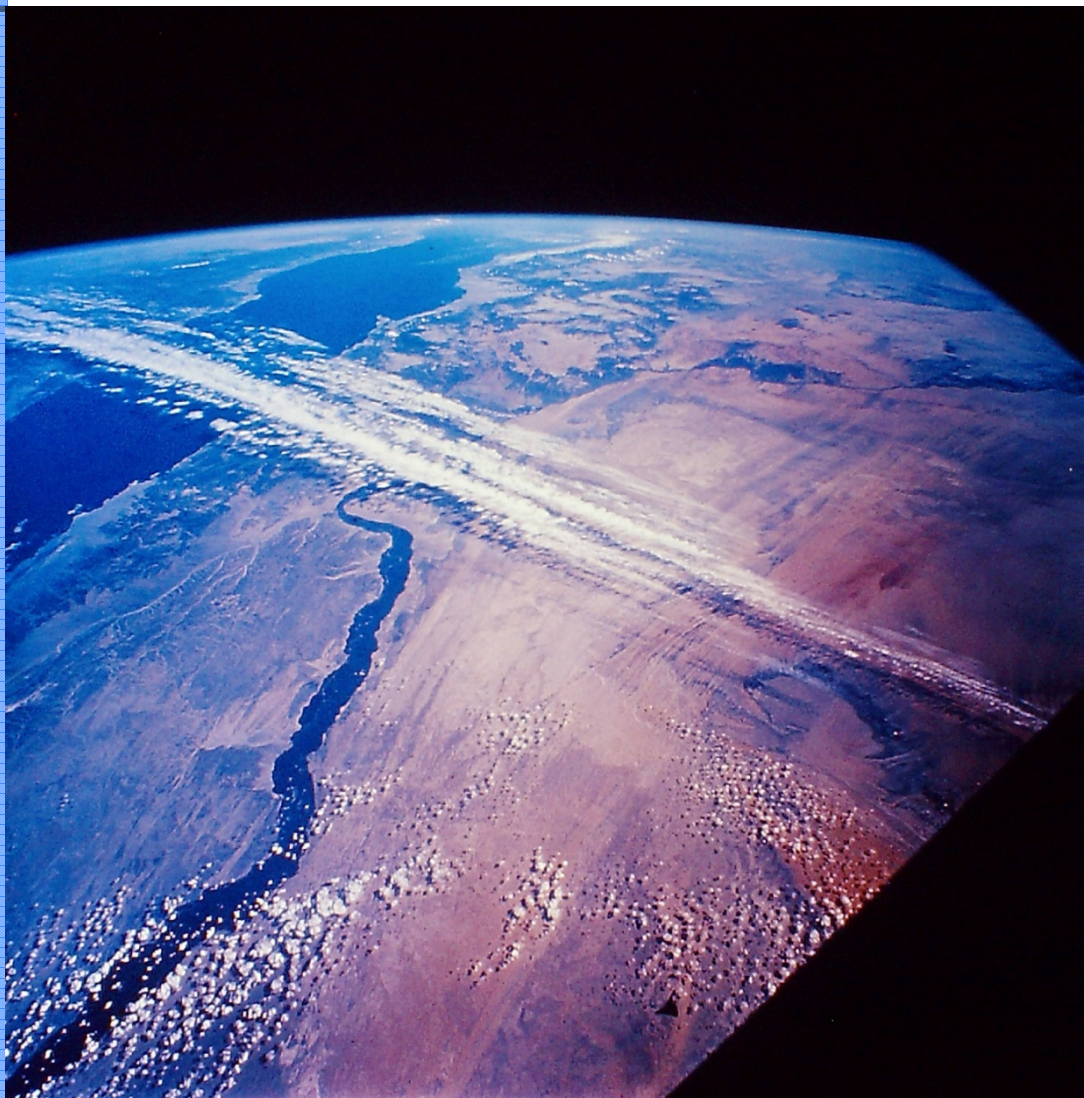


First US manned
Spaceflights.

The Gemini Programm
1961 – 1966
brought exciting
space photographs
back to earth.



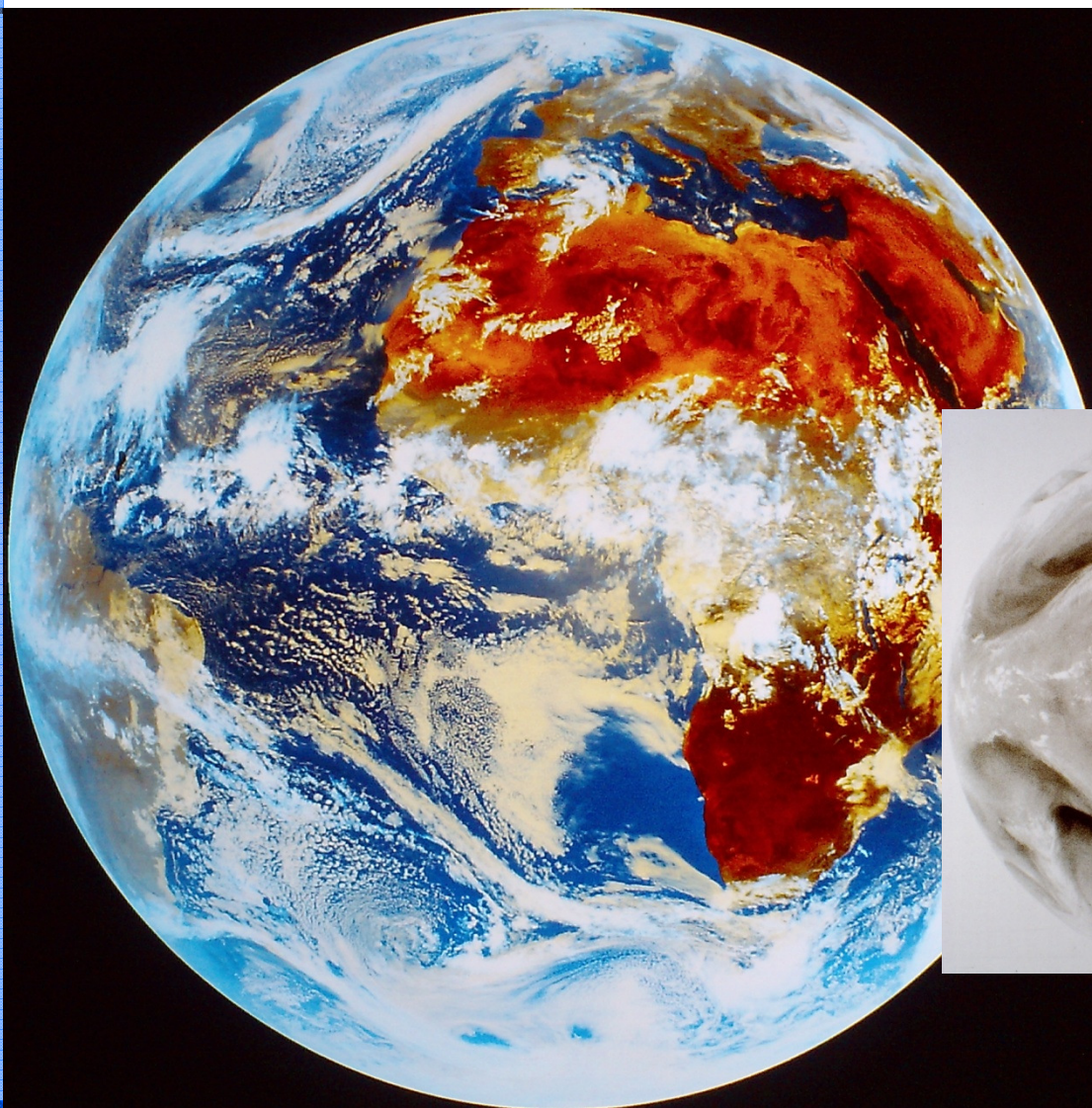
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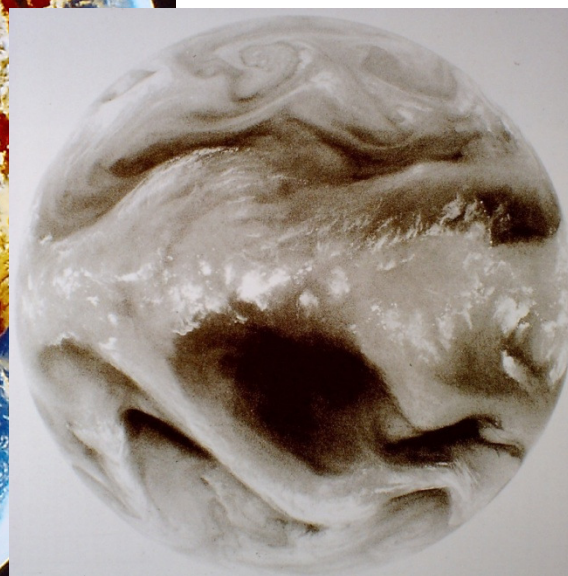
View from Gemini
Space Craft to Egypt
with River Nile
and via Red Sea
to Saudi Arabia
The vision of Earth
Observation from
space was born.



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The Globe as seen from
Meteosat Weather
Satellite – with its
impressive atmosphere
and its water vapour in
summer time.





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An Artists view on the
early Earth Observation
Research System,
Source: Telespacio, Italy



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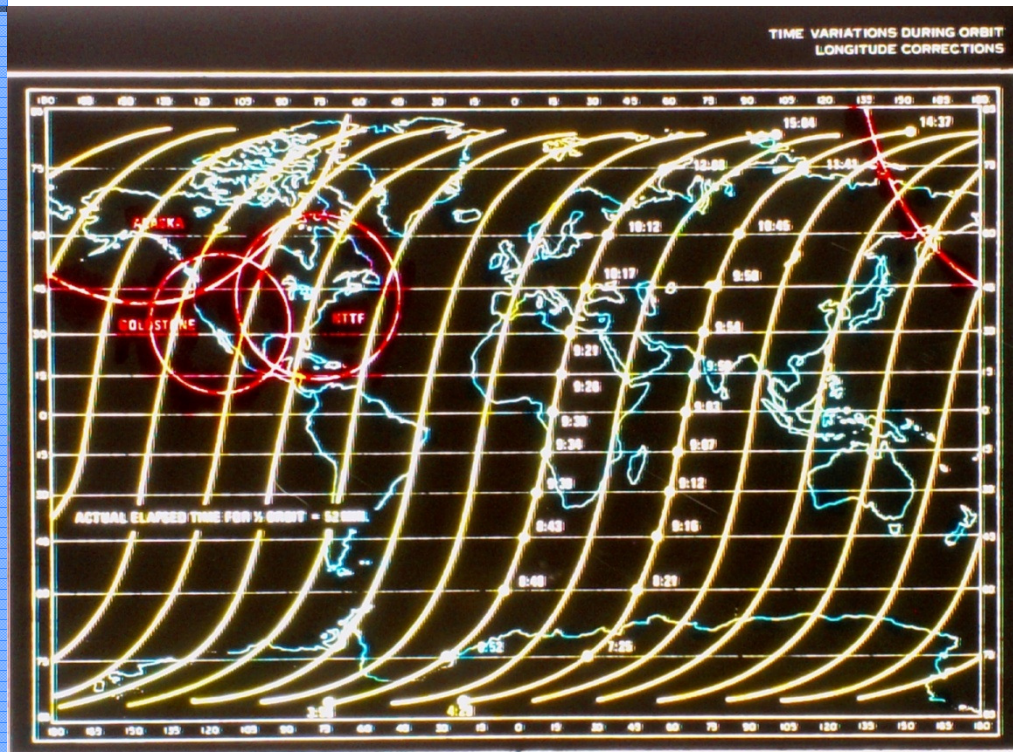


Figure I-9. Local Time – Variations Within an Orbit

The local time that the satellite crosses over a given point at latitudes other than at the equator will also vary due to (1) the time the

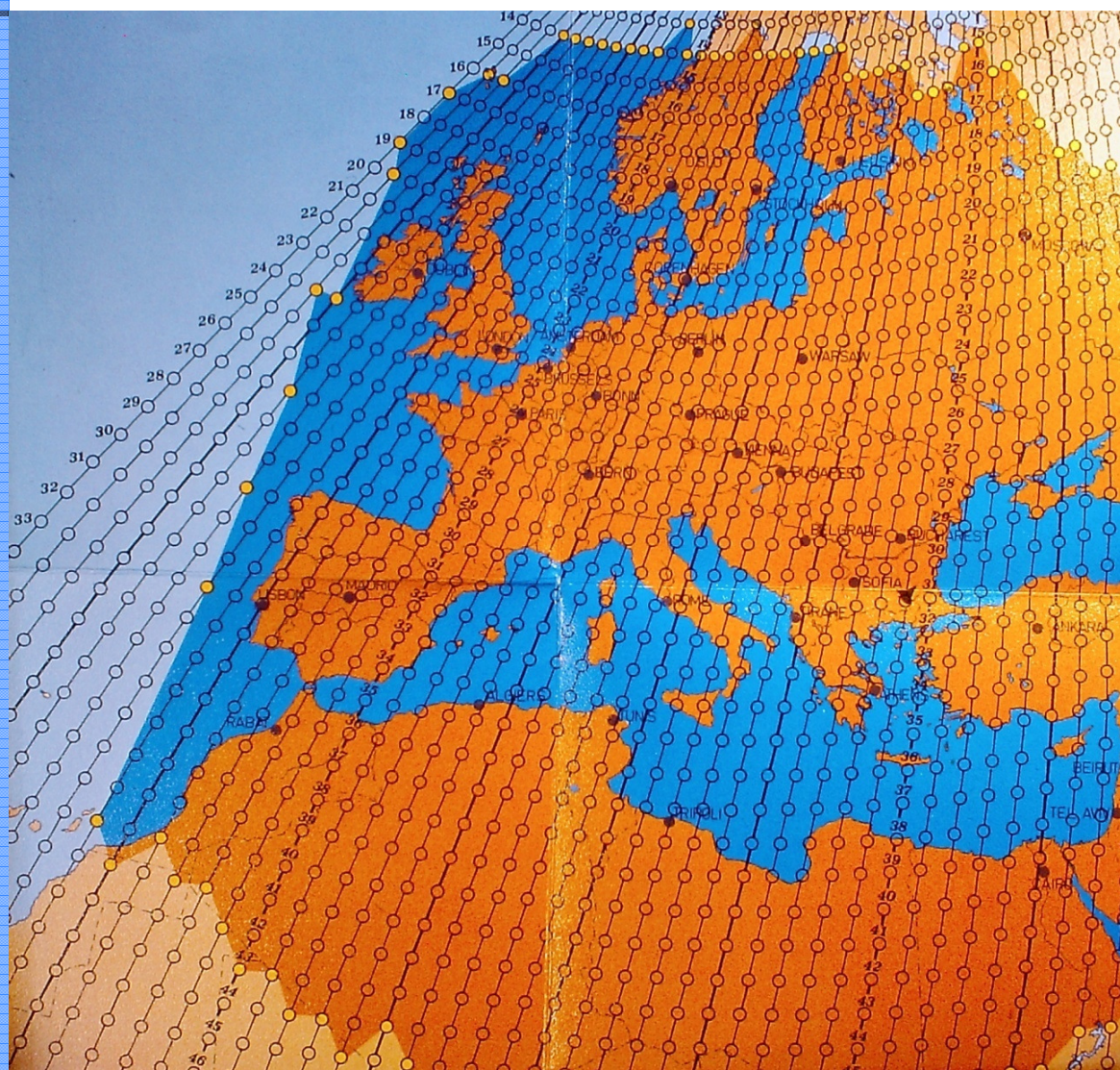
a. Locate the latitude of the point of interest on the ordinate of Figure I-10.

Landsat Orbital Tracks,
The „sun-synchronous“
flight pattern of
Landsat 1,
one day coverage

© NASA Landsat Data Users Handbook,
PAO Number E 6391- 35
© James V. Tarant, USGS, NASA Open-
File Report 78-187, Sioux Falls, 1978
Report 78-187, Sioux Falls, 1978



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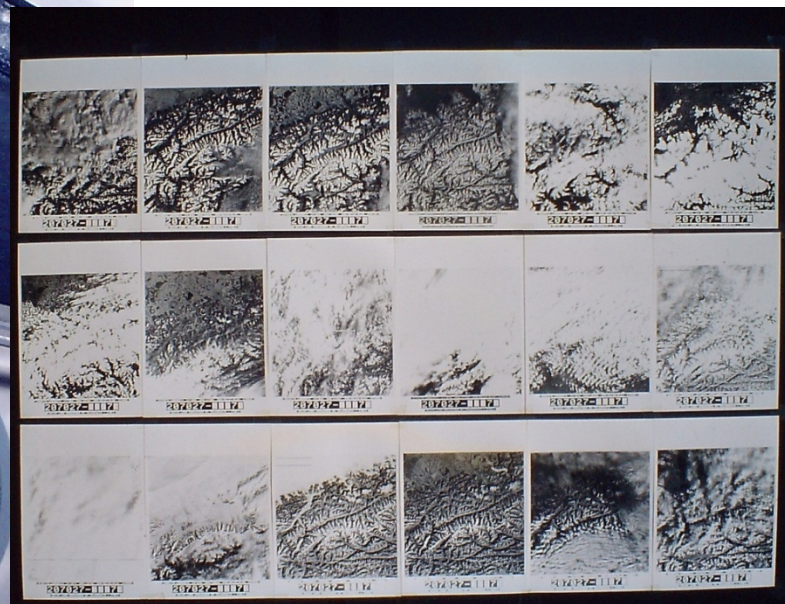
Landsat 3 and 4:
Flight path and
image raw numbers
for data order.



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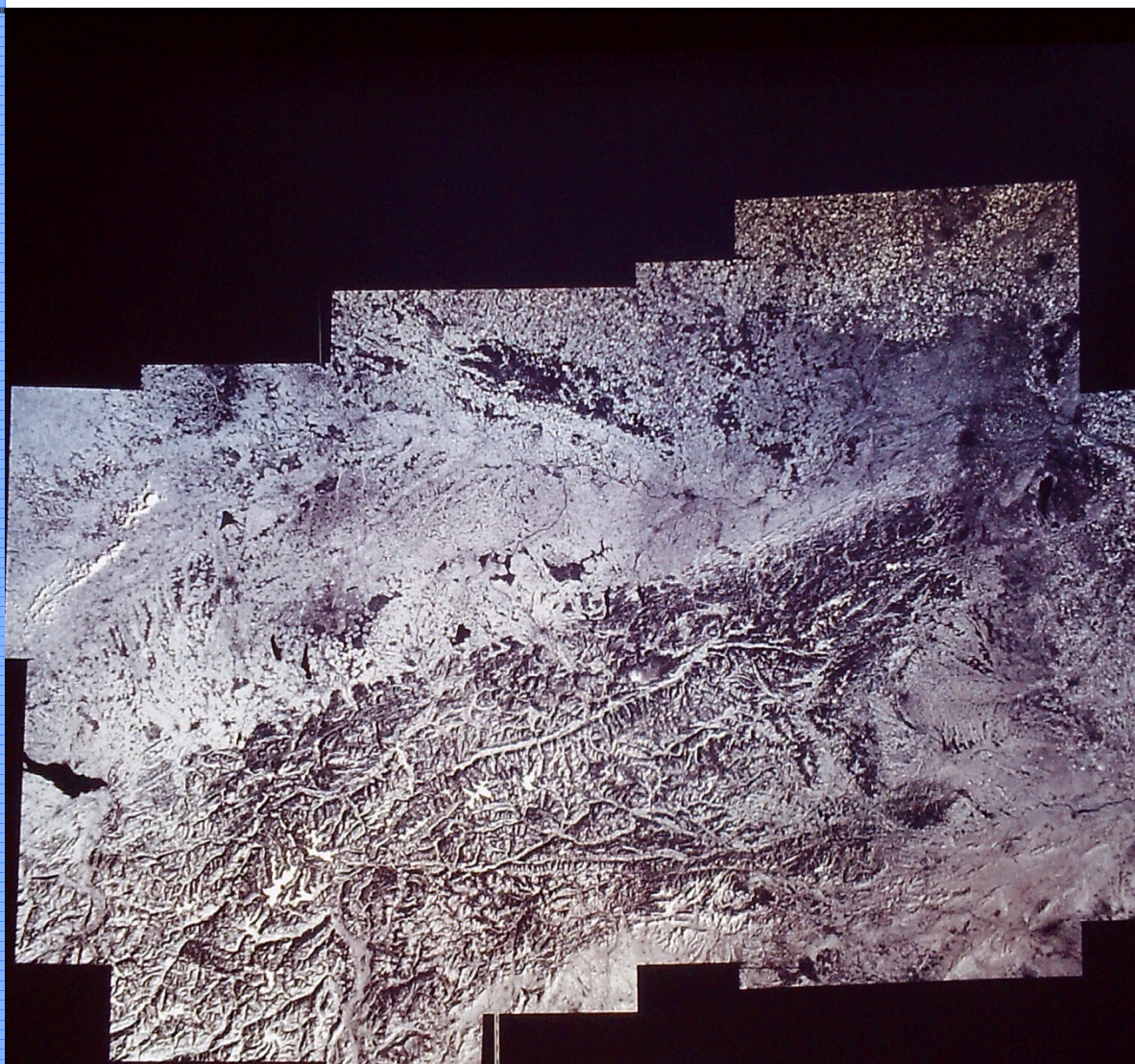
Landsat 1 – ESA Data collection and archive system: Microfiche with acquisition dates, Microfilm with images, Postcard-quicklooks of images, collection of 1-year data acquisitions over path 207, raw 27, 1972. CCT for delivery to customer.



© Foto: L. Beckel



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Austria –

1st Landsat-
Mosaic

1972 – 1973

A combination
of 17 Landsat
images.



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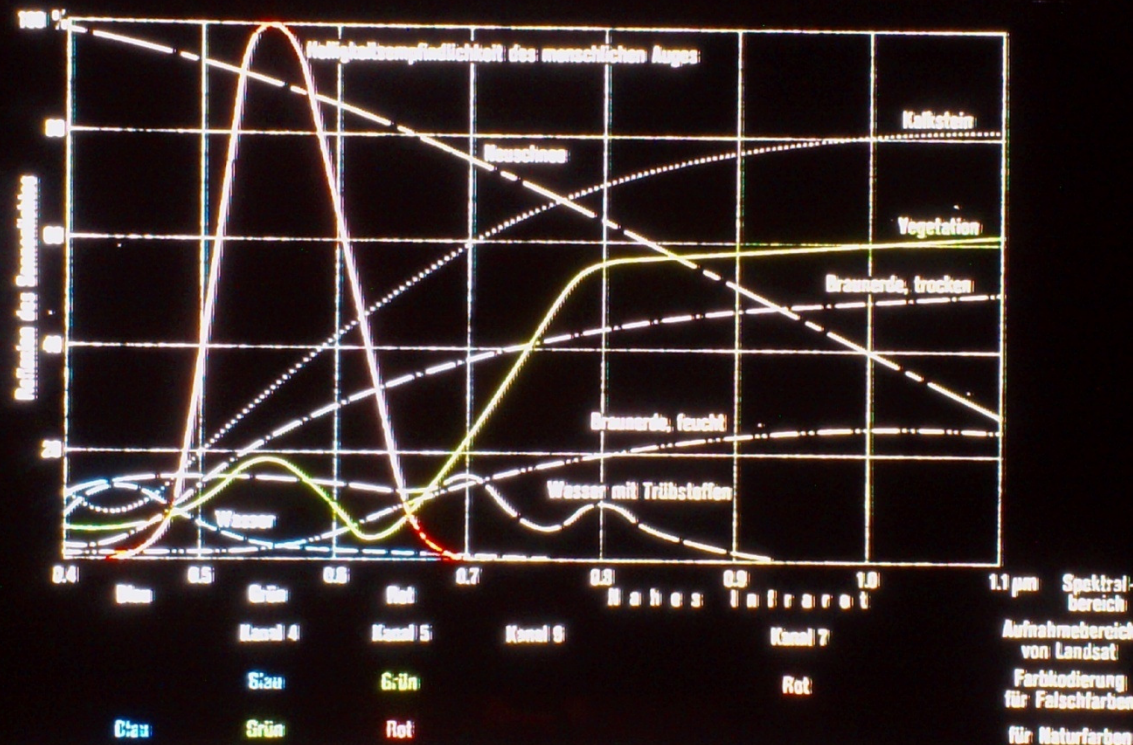


Abbildung 6: Reflexionscharakteristika verschiedener Oberflächen (etwas verändert nach U.S. Geological Survey, Open-File Report 78—187)

Spectral response of different surface areas, modified, source: USGS Open-File Report 78-187 by James V. Tarantik, Sioux Falls 1978.



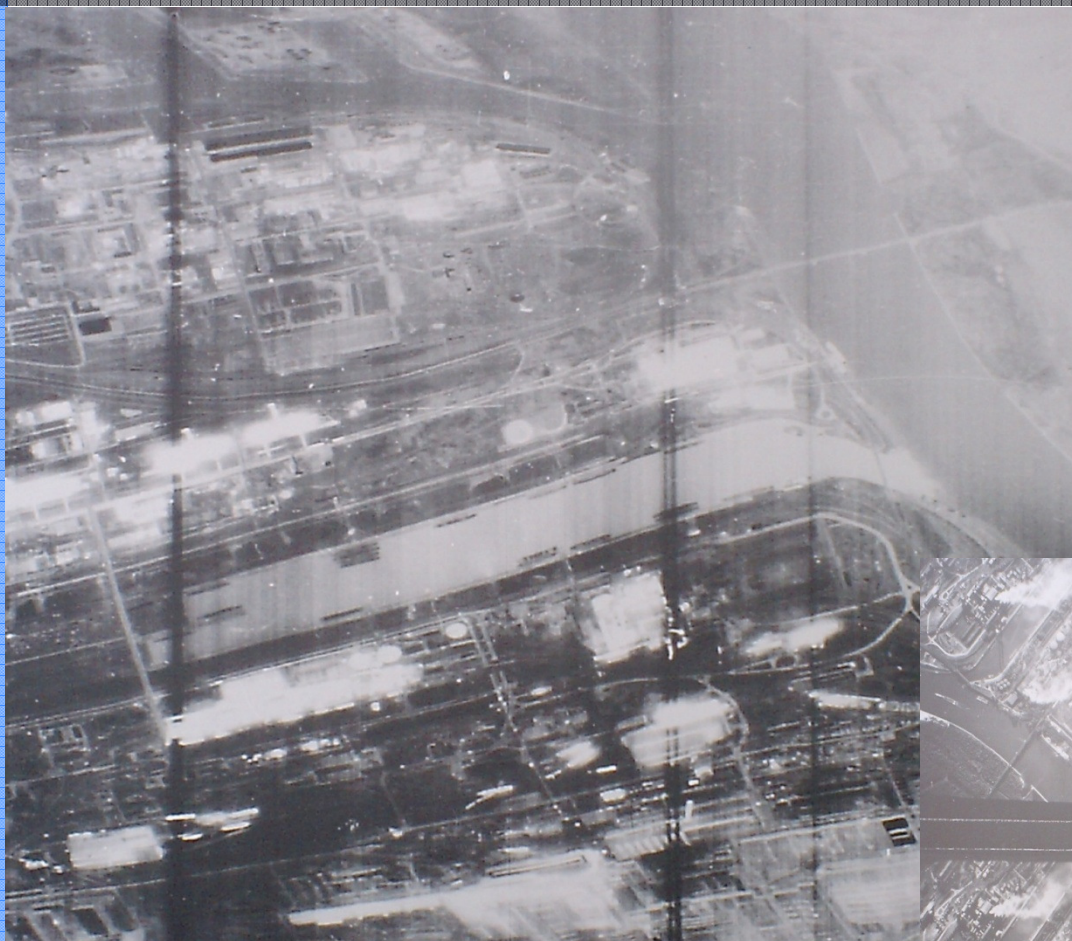
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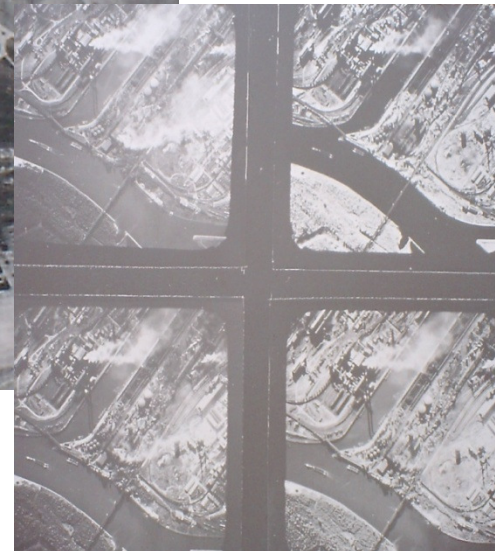
Field work in the Alps – collection of surface reflectance for Landsat spectral bands interpretation. 1973.



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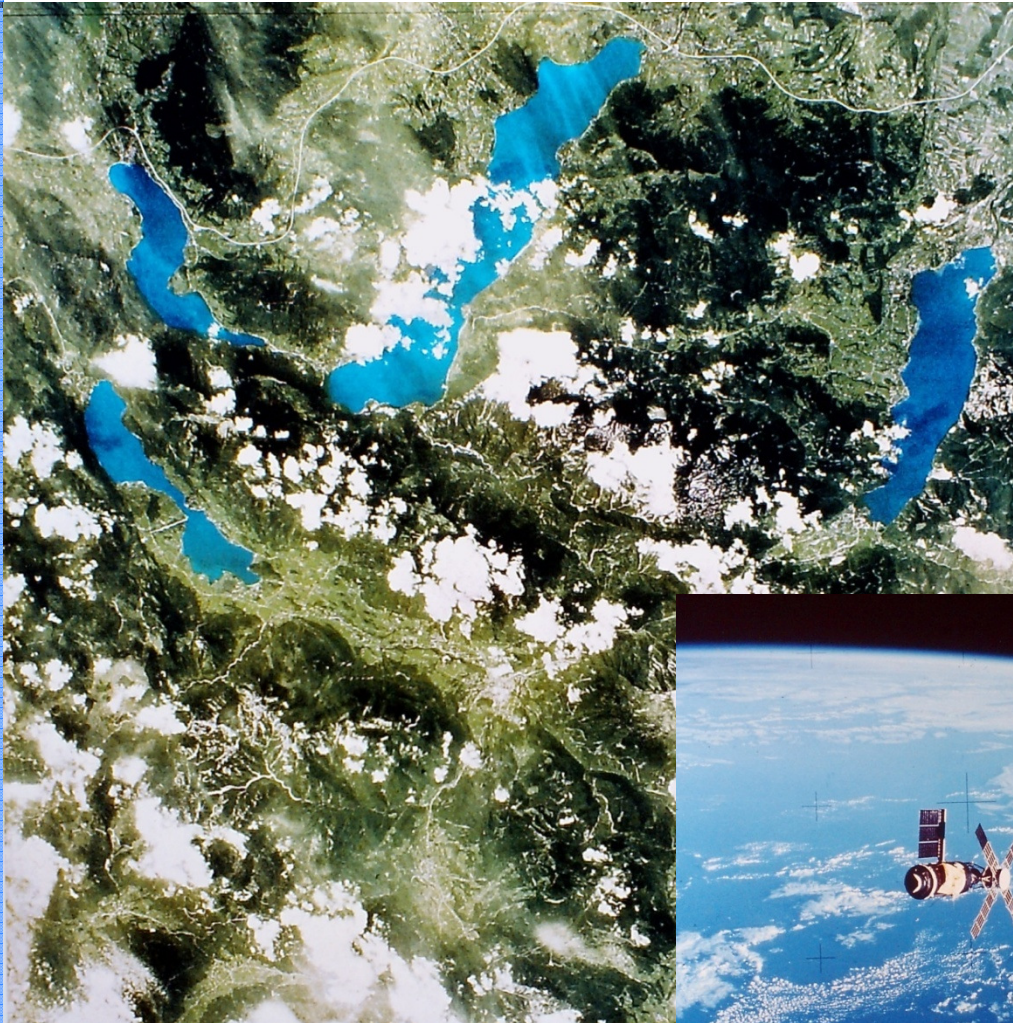
Night Thermal (DLR
Thermal Scanner)
and day time
multispectral airborne
photograph of industrial
site in Austria, for
Landsat data
interpretation 1973.



© Foto: L. Beckel



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© Foto: NASA

Skylab, launched 1973, on its circular orbit in 435 km altitude. Three manned missions with a duration of 28, 59 and 84 days brought a great amount of metric camera photographs. Skylab photograph of Salzammergut Lake district in Austria, September 1973.





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NASA Research Aircraft
CV 990 during the
Marginal Ice Zone
Experiments 84 (MISEX),
over Greenland Sea.
Bill Campbell
USGS/NASA Scientist on
the right. Tromsø,
Norway, July 1994



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Fully microwave
remote sensing
equipped NASA
research aircraft
CV 990, in flight
Over Greenland Sea
between Greenland
and Svalbard,
July 1984



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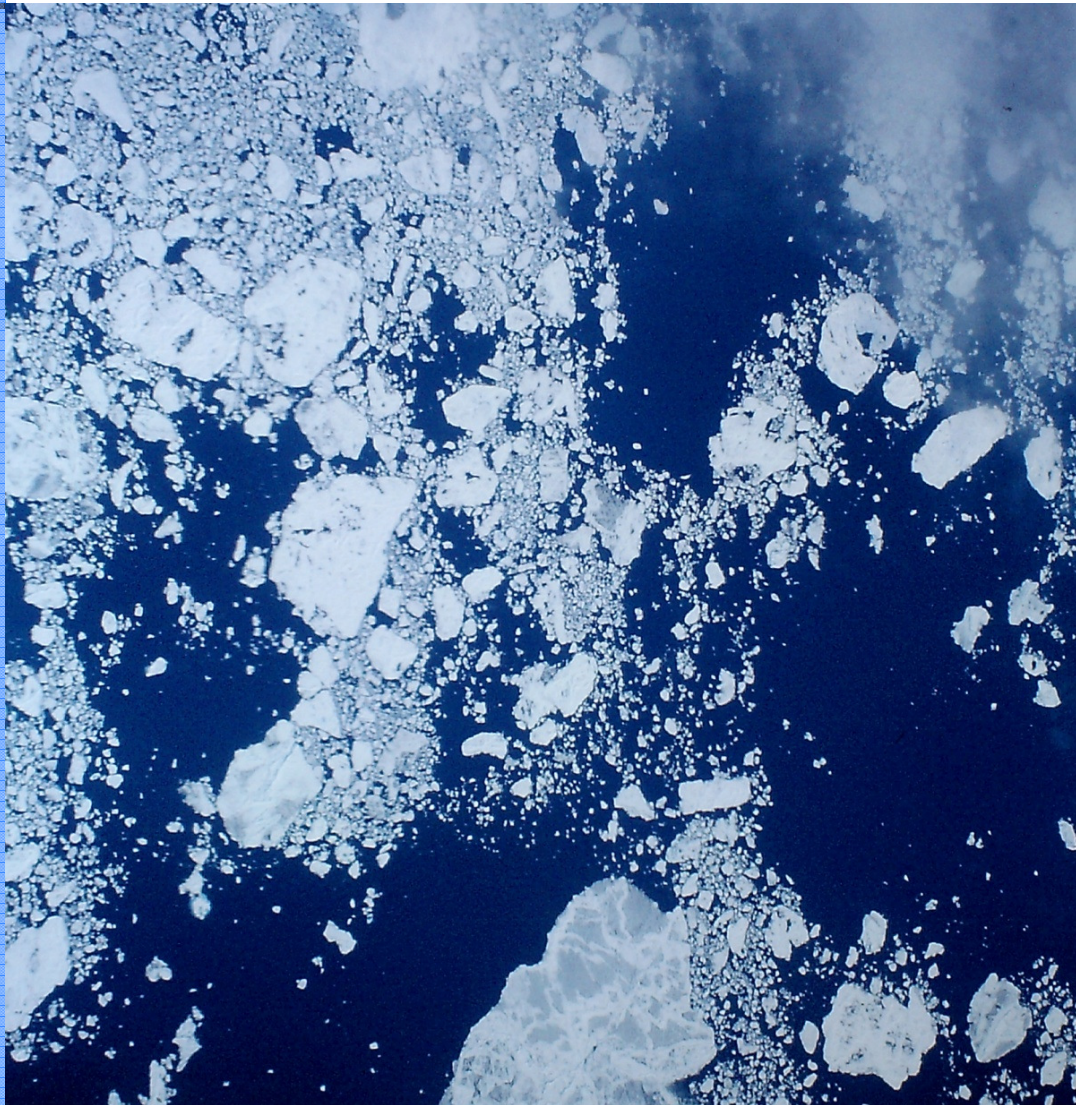


Hectic activities on board
of NASA CV 990

© Foto: L. Beckel



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North Polar Sea Ice
Edge, as seen from
NASA CV 990,
July 1984.

© Foto: L. Beckel



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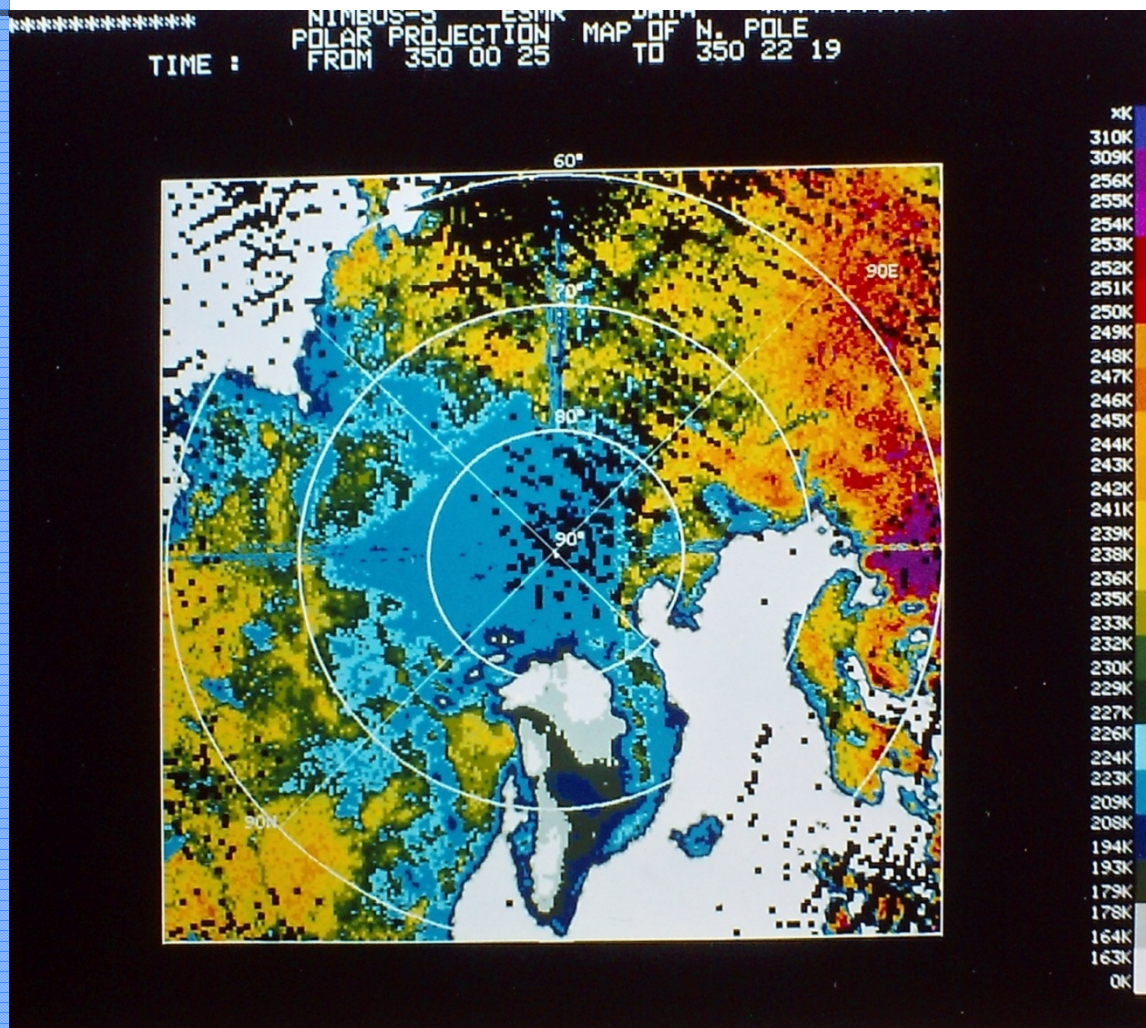


The French CNES / IGN joined with its research aircraft, a modified Boeing B-17 Flying Fortress, the MIZEX 84 Program. Equipped with a digital X-band side-looking radar (SLAR).

© Foto: L. Beckel



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North Pole Sea Ice Concentration, several year average June-July, 1973-1976, calculated from sea ice brightness temperature, acquired by Nimbus 5 - ESMR microwave sensors.



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Early satellite image processing system, 1973, at Institute for General and Applied Geology, University München, Germany.



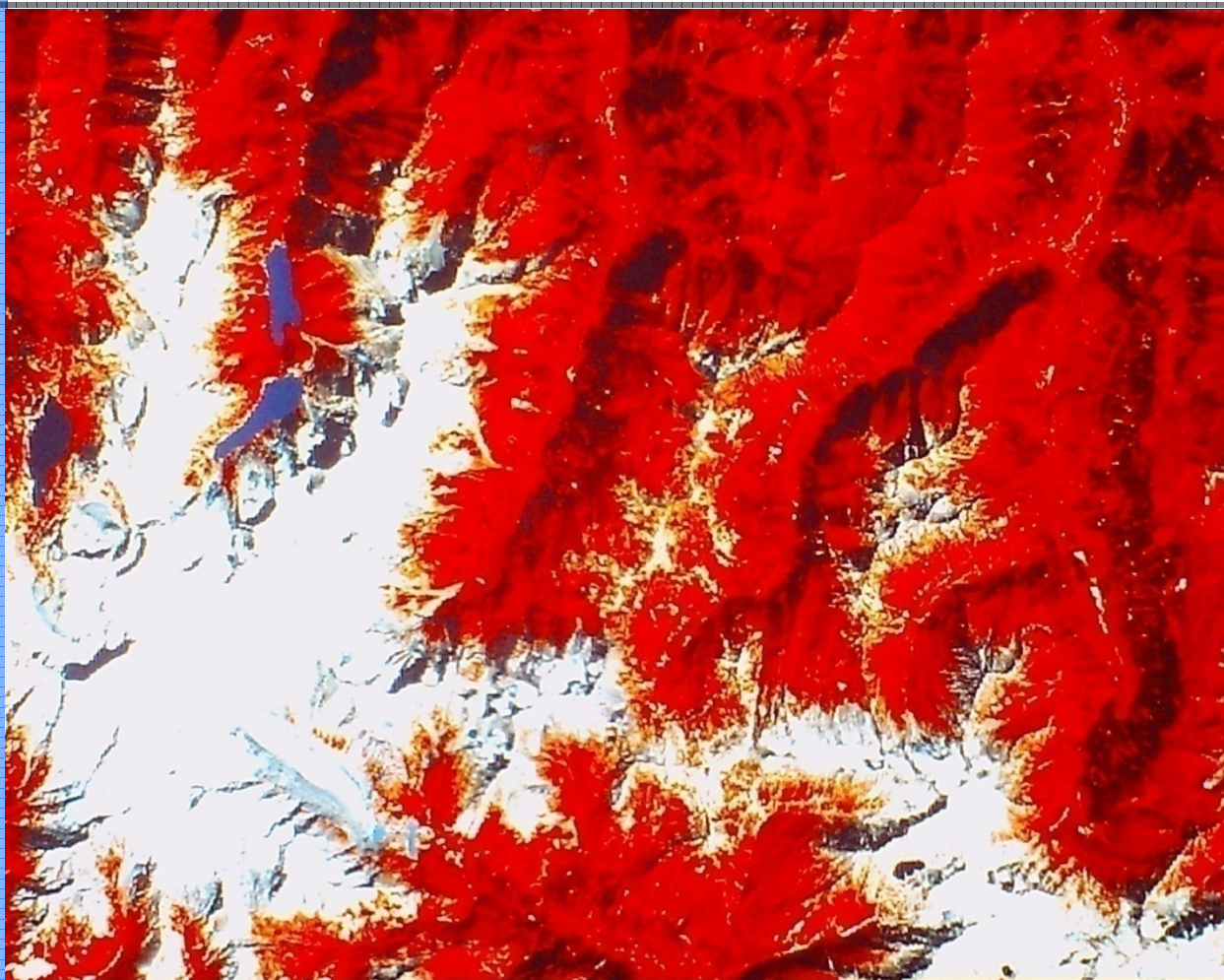
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Landsat 5,
near true color
image of the
Central Alps,
Austria, with
Grossglockner -
Austrians
highest
mountain
(3798 m).
(band
combination:
1, 2, 3), 1984.



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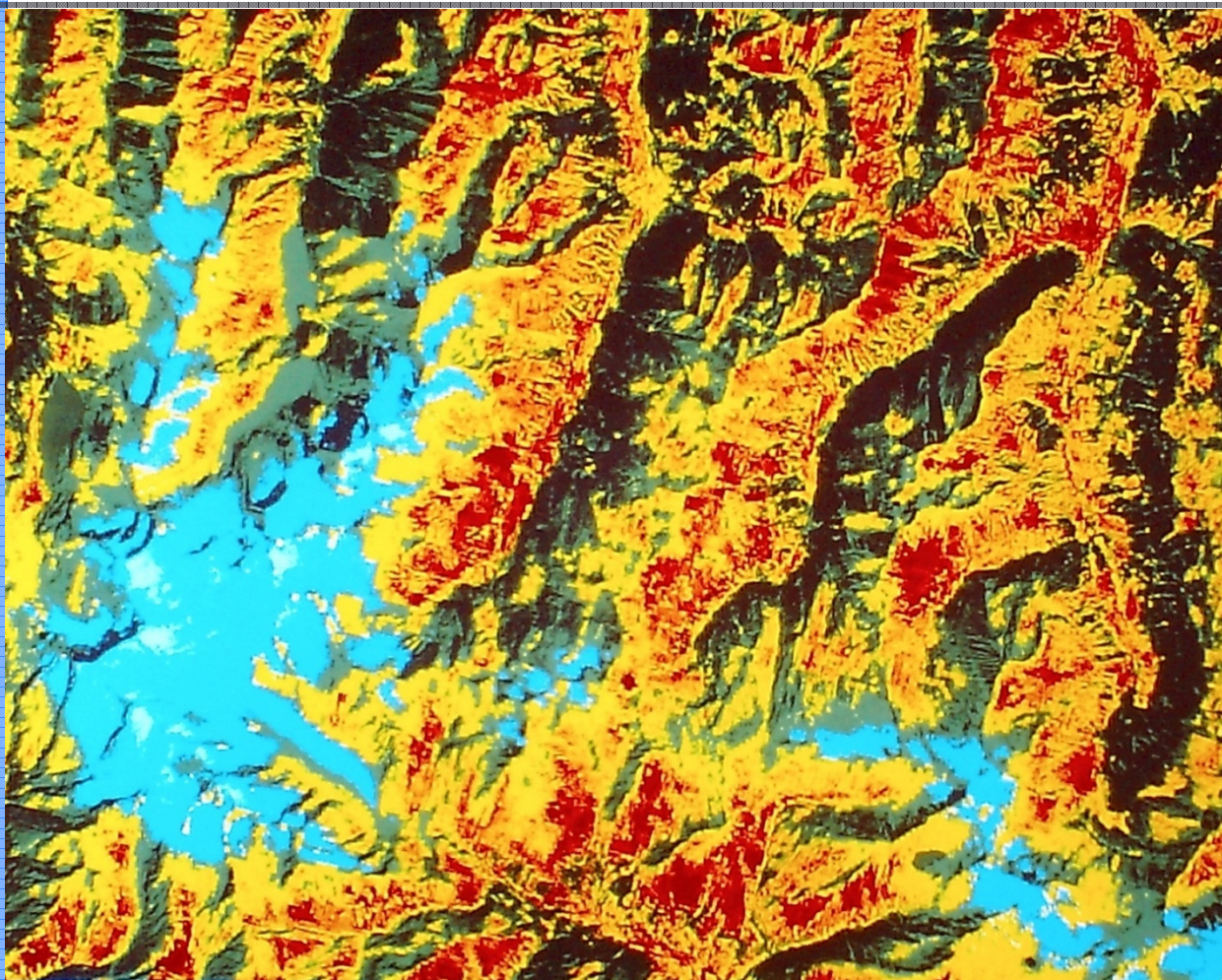


Landsat 5 -
infrared false
color image of
the Central
Alps, Austria,
band
combination:
4, 3, 2.

© Foto: L. Beckel Geospace/original data
ESA Earthnet. 1984.



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Landsat 5 -
color coded
thermal image
of the Central
Alps,
superimposed
to band 4
for terrain
visualisation,
1984.

© Foto: L. Beckel Geospace/original data
ESA Earthnet. 1984.



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Shaded digital terrain model of the Central Alps, Grossglockner area. Processed from DTM data, provided by the Austrian Federal Mapping Institute, to be used for the calculation of 3-D oblique views.

© L.Beckel Geospace/DTM Data:
Bundesamt für Eich- und
Vermessungswesen, Wien.



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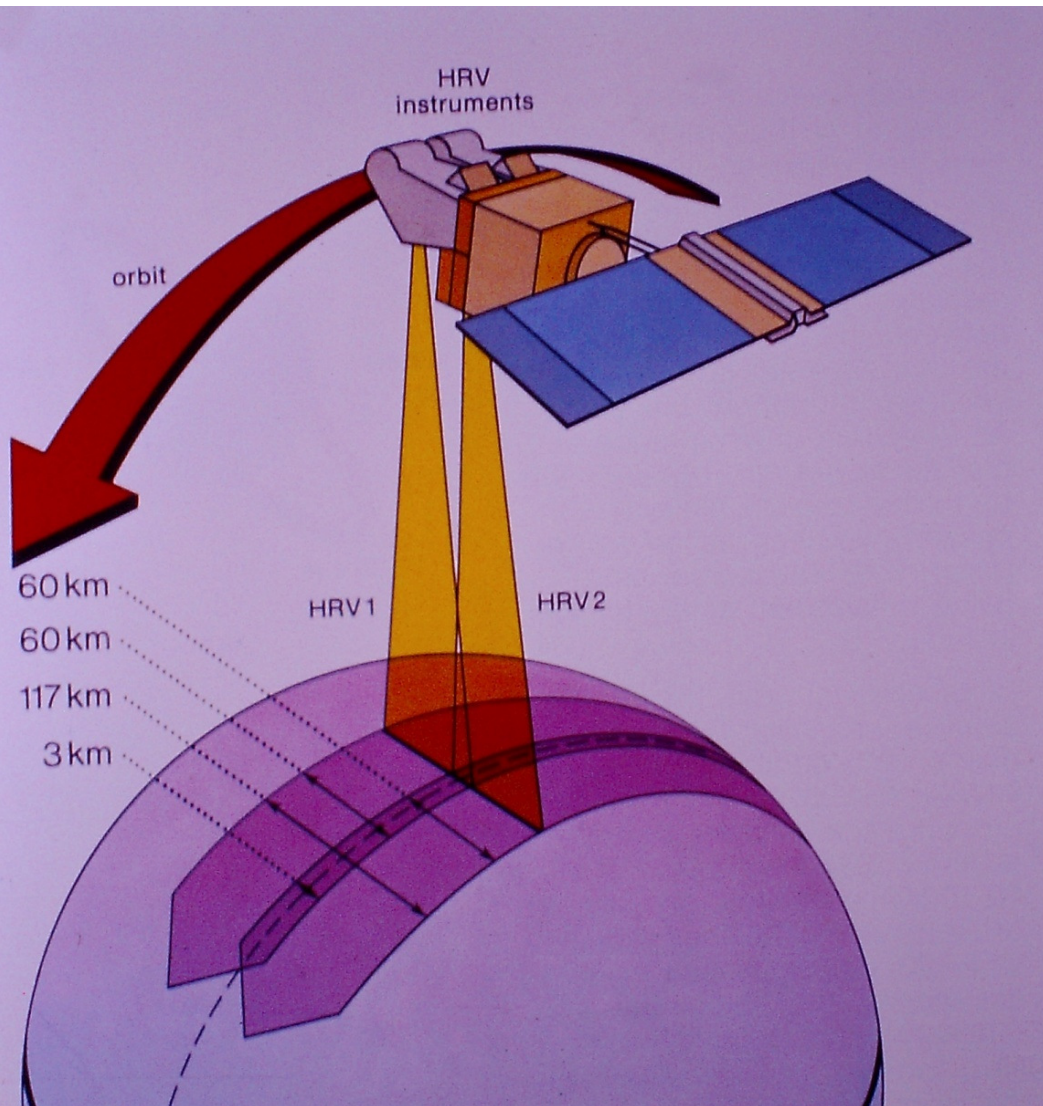


Oblique view to the Central Alps of Austria with its highest mountain, the Grossglockner (3798 m). Calculated from Landsat 5 data, 1985, combined with digital terrain data from Austrian Federal Mapping Service.

© L.Beckel Geospace/DTM Data:
Bundesamt für Eich- und
Vermessungswesen, Wien.



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SPOT IMAGE, France, launched 1986 the first French earth observation satellite SPOT 1. Two swiveable sensors permitted the acquisition of stereo pairs for 3-D views.



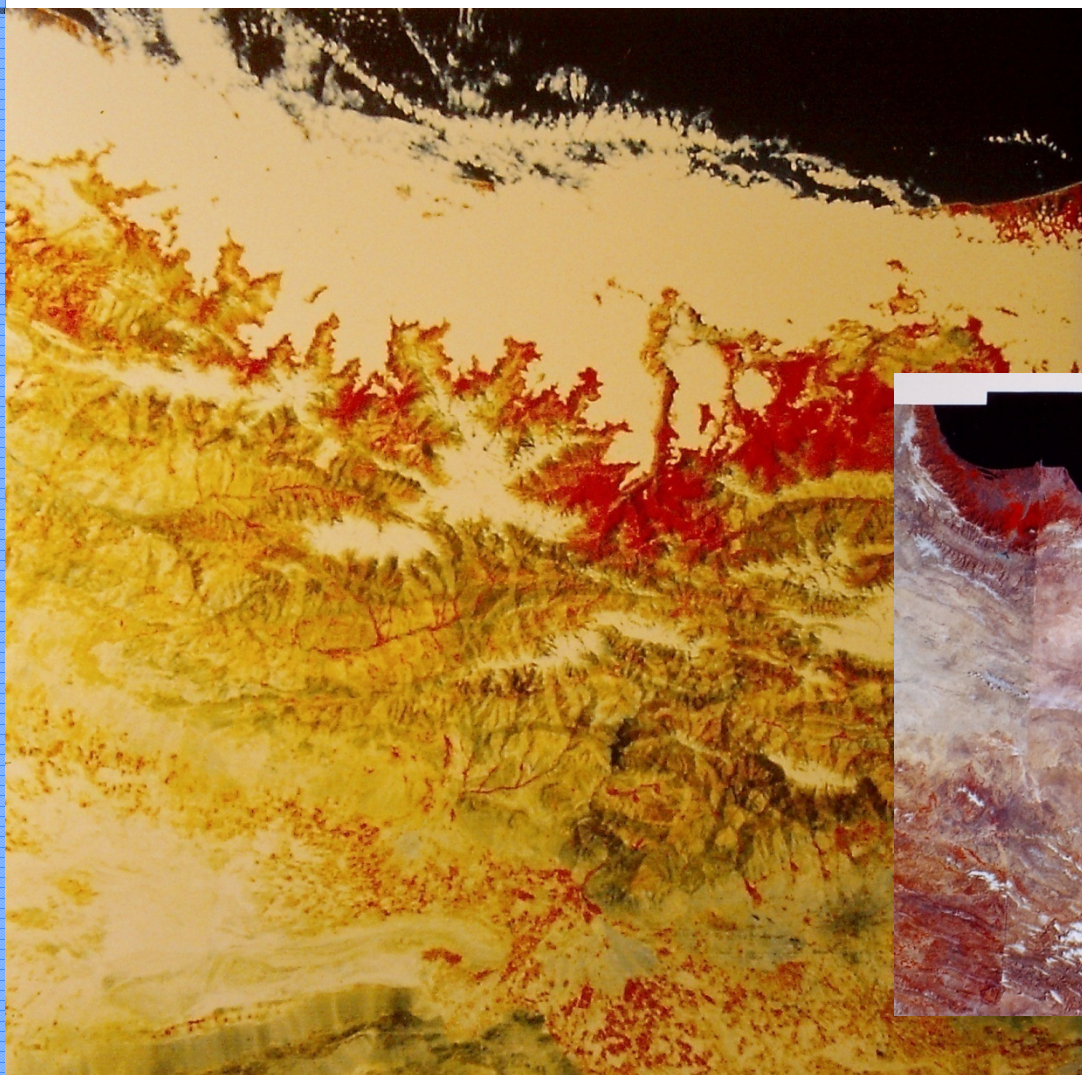
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Vienna seen from
Landsat 1, 1973.
Photographic color
image produced
from three 60 mm
black- and white
film negatives.

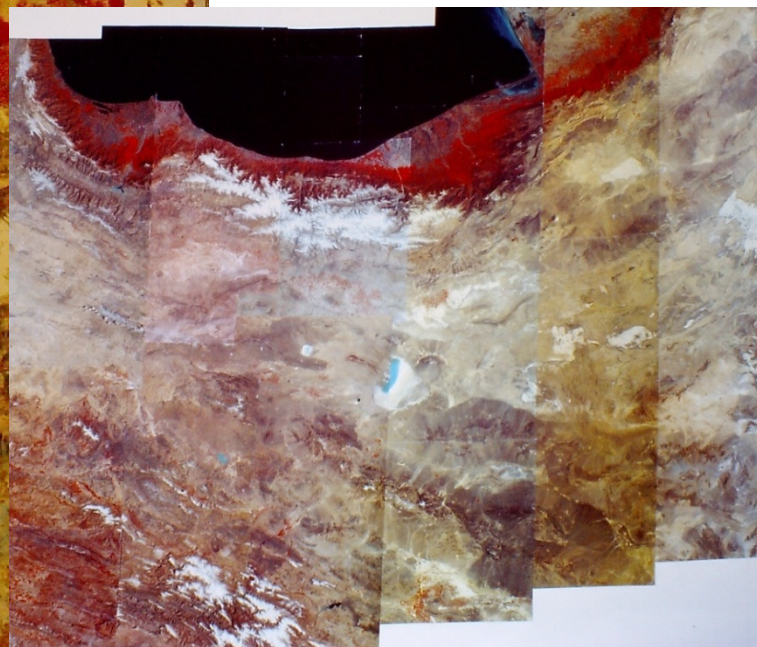


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Interrelations of nature and culture become obvious.

Landsat image and mosaic of the Elburz Mountains, Iran. (1973)





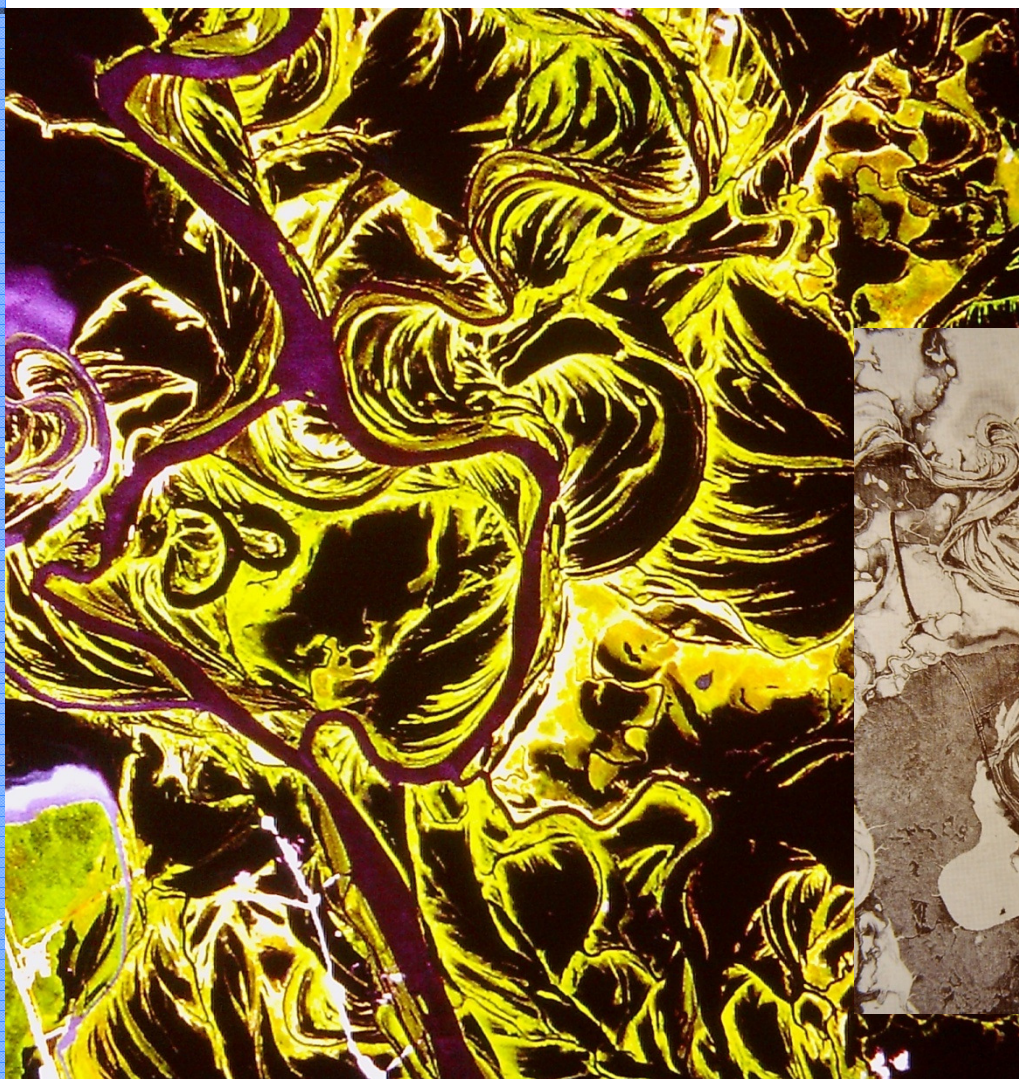
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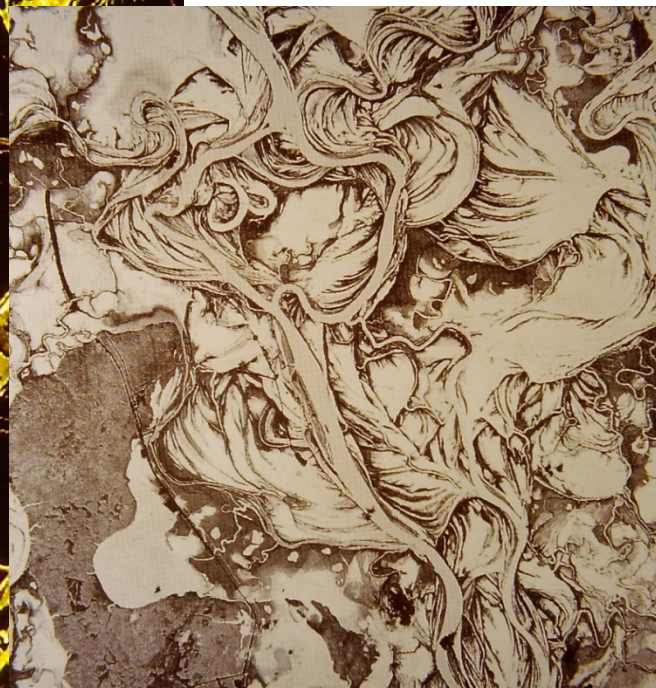
The Globe – a piece
of art:
Kilimandscharo,
Jan. 1974.



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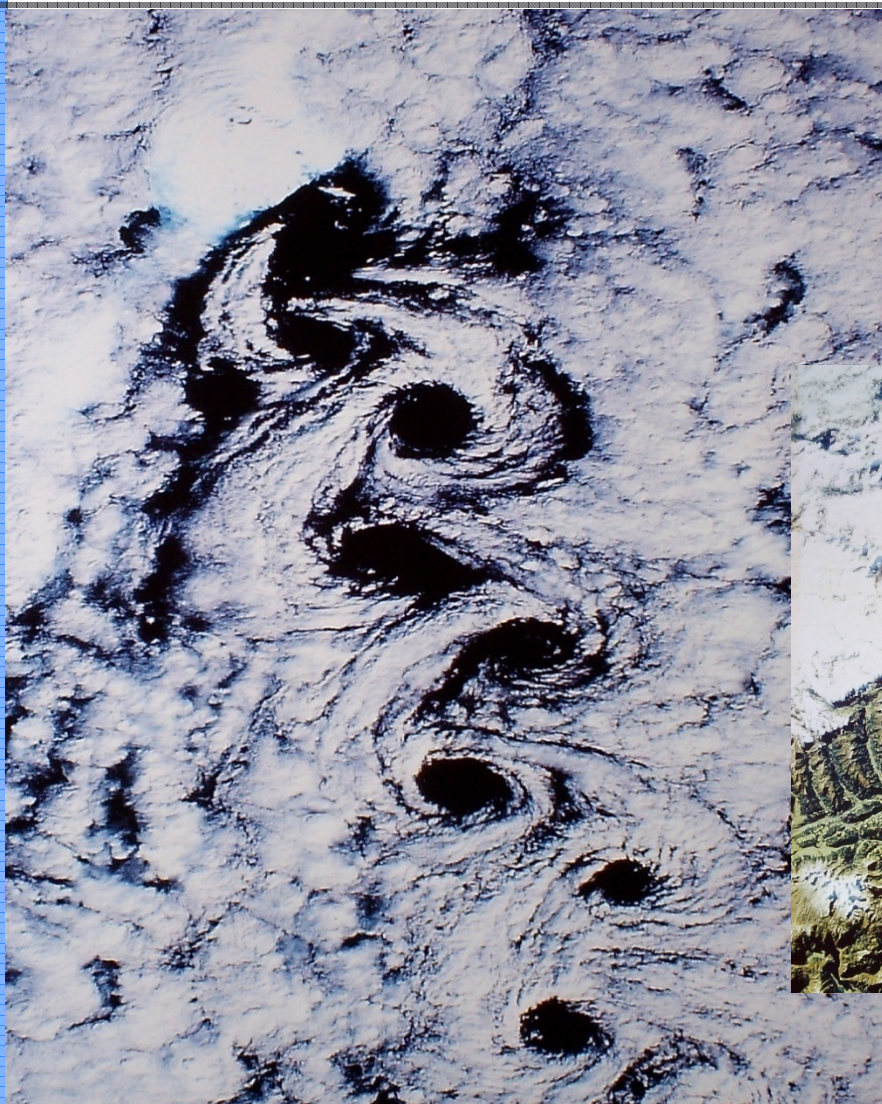
The Globe – a piece of art: Ob River in the lowlands of West Siberia, 1985, in 2 versions.



© Geospace/ESA-Earthnet 1985

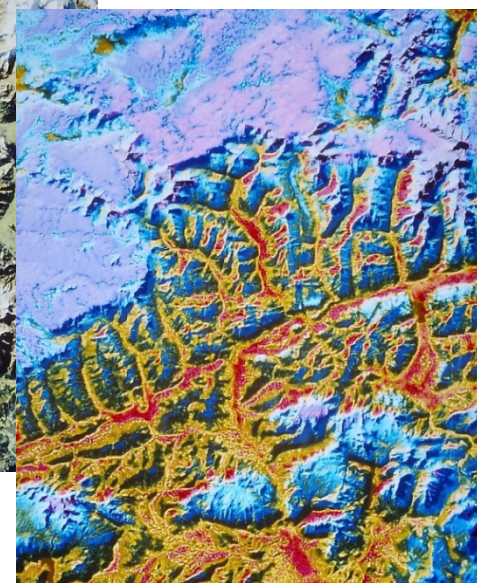


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Atmospheric turbulences on the lee side of Jan Mayen Island (2341 m), North Atlantic; 1985.

Foehn-Wall at the Central Ridge of the Alps, visible and thermal infrared image.





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© Foto: L. Beckel

NPOC Austria – Landsat Exhibition at Unispace II, 1982



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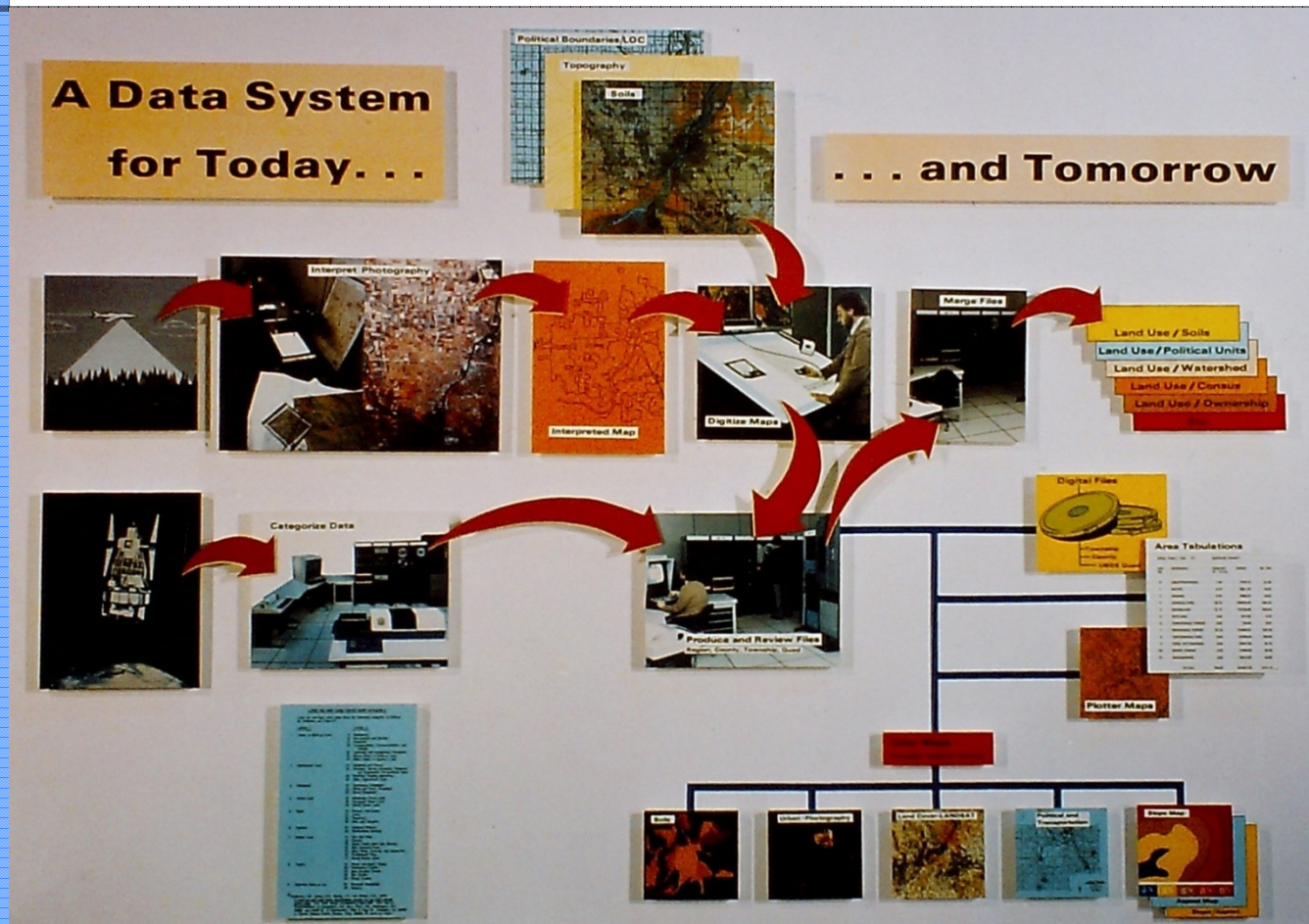


Visitors at
UNISPACE II
admire Landsat
images and
space art.

© Foto: L. Beckel



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Looking into the future: Satellite data acquisition, data processing, data distribution and GIS applications. 1970-ties.

© Foto of EOSAT-exhibition plate,
L. Beckel.



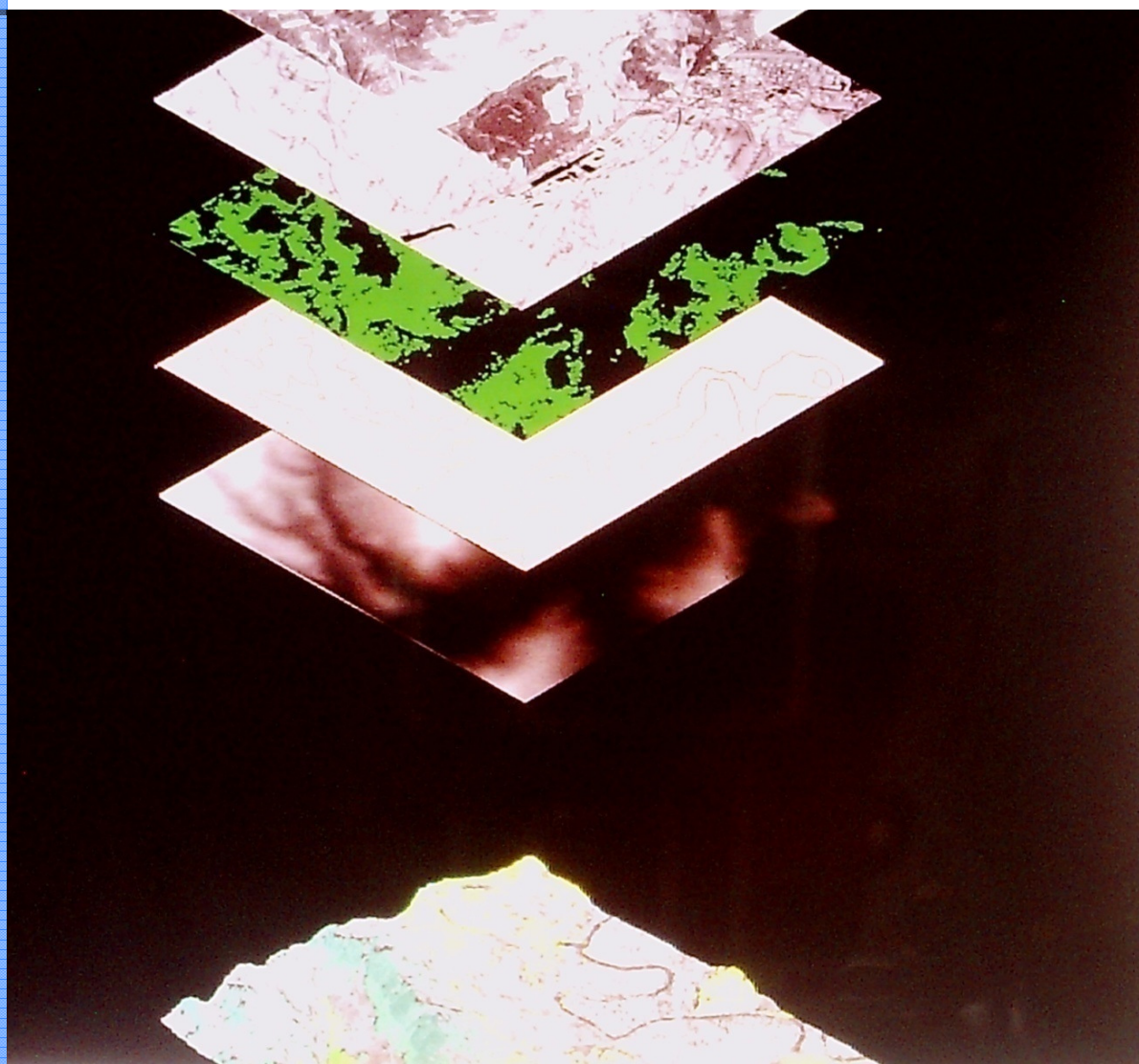
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What is a Geographic Information System?
A Collection of maps, research results, information, measurements, ground truth data, photographs, etc., geocoded and digitally stored in separate layers in a data bank, to be merged with each other to understand interrelations of themes. (1972).



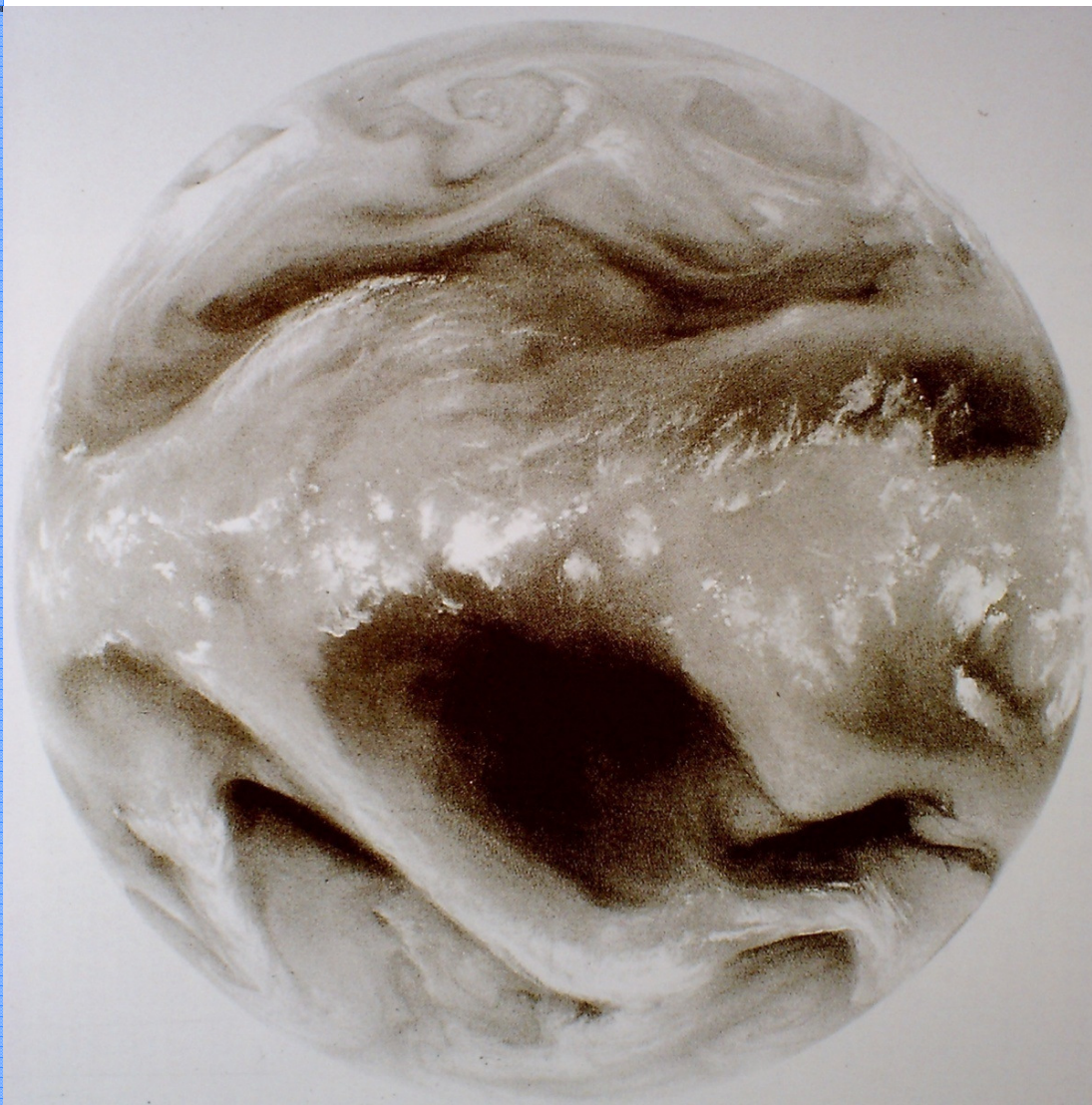
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Structure of a digital interactive GIS – Geocoded correlated elements can be merged and interpreted.



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Our Globe – a World
of Turbulences.
Thanks to Landsat
and all pioneers of
successive Earth
Observation Systems
we understand our
world better.



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The father of Landsat:
Bill NORDBERG –
born in Austria 1930 ,
died in Greenbelt,
Md. 1976

Thank you Bill
for LANDSAT