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Landsat Program

Training Center

Regional Centre for Mapping of Resources for Development (RCMRD)
Nairobi, Kenya

U.S. Geological Survey
Center for Earth Resources Observation and Science (EROS)
Sioux Falls, South Dakota, USA

Applications of Coarse to High Resolution Satellite Imagery for Land Productivity Assessment & Management

THE LANDSAT PROGRAM

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Bamako , Mali

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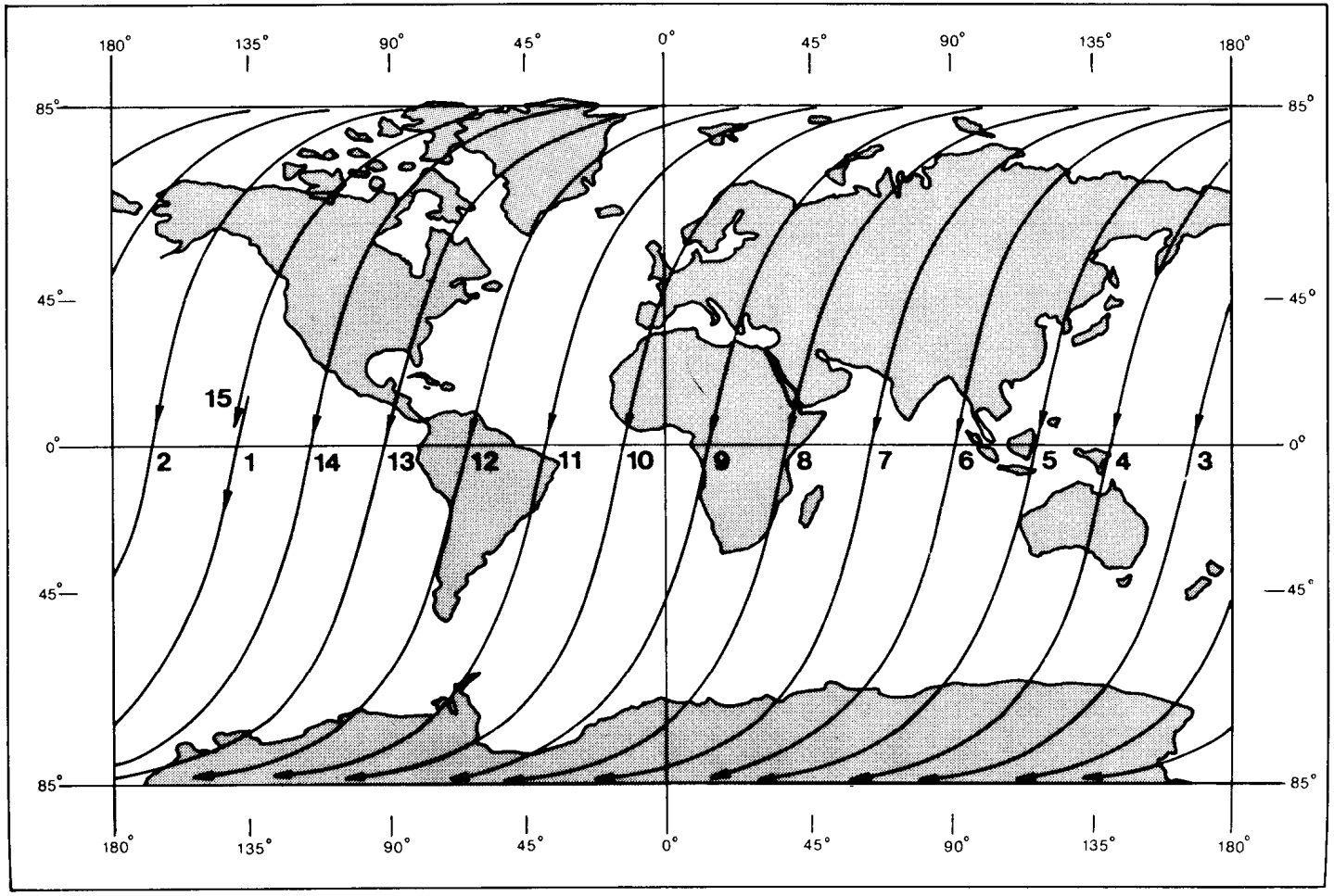
Background

- Started as Earth Resource Technology Satellite Program (ERTS) in early 1970's
- First satellite (ERTS-1) was launched in 1972
- Prior to the launch of ERTS-2, NASA changed the name of the program to Landsat

LANDSAT-1, 2, AND 3 ORBITAL CHARACTERISTICS

- Circular orbits at a nominal altitude of 900 km
- Cross the Equator at 9^{o} from normal
- Sun-synchronous (same local time)
- The satellite yields about 14 orbits per day
- Swath width is 185 km
- The satellite covers the Globe once every 18 days

LANDSAT-1,2, & 3 ORBIT PATTERN



Courtesy of NASA and US Geological Survey

LANDSAT-1, 2, AND 3 SENSORS

Return Beam Vidicon (RBV) System:

- 3-TV like cameras aimed to view the same ground area simultaneously (185X185 km)
- 80 m nominal ground resolution (30 m in Landsat-3)
- Spectral sensitivity: green, red, & near infrared
- No film. Images were exposed by a shutter device on a photosensitive surface which is later scanned by an internal electronic beam to produce a video signal

LANDSAT 4 AND 5 ORBITAL CHARACTERISTICS

- Circular orbits at a nominal altitude of 705 km
- Cross the Equator at 8.2^{o} from normal
- Sun-synchronous (9:45 AM local time)
- The satellite yields about 14.5 orbits per day
- The satellite image has a 185 km swath
- 16 days repeat cycle (Global coverage)

LANDSAT-4, AND 5 SENSORS

Multispectral Scanner (MSS) System:

- Same sensor, but bands named 1, 2, & 3

Thematic Mapper (TM)

- 30 m nominal ground resolution. Thermal is 120 m
- Seven spectral bands: blue, green, red, near infrared, mid infrared, thermal infrared, and mid infrared
- Improved geometry over the MSS sensor and better signal-to-noise ratio
- Uses 16 detectors for each of the non-thermal bands and 4 detectors for the thermal

LANDSAT-7
ORBITAL CHARACTERISTICS

- Circular orbits at a nominal altitude of 705 km
- Cross the Equator at 8.2^{o} from normal
- Sun-synchronous (10:00 - 10:15 AM local time)
- The satellite yields about 14 orbits per day
- The satellite image a 185 km swath
- 16 days repeat cycle (Global coverage)

LANDSAT-7 ETM+ SENSOR

- Spatial resolution
  - 15 meter panchromatic band (0.52 - 0.90 µm)
  - 30 meter multispectral bands (thermal is 60 meter)

- Spectral resolution
  - 7 spectral bands (µm)

Blue	Green	Red	Near Infrared	Mid Infrared	Thermal Infrared	Mid Infrared
0.45-0.515	0.525-0.605	0.63-0.69	0.75-0.90	1.55-1.75	10.40-12.5	2.09-2.35

- Radiometric resolution
  - 8 bits

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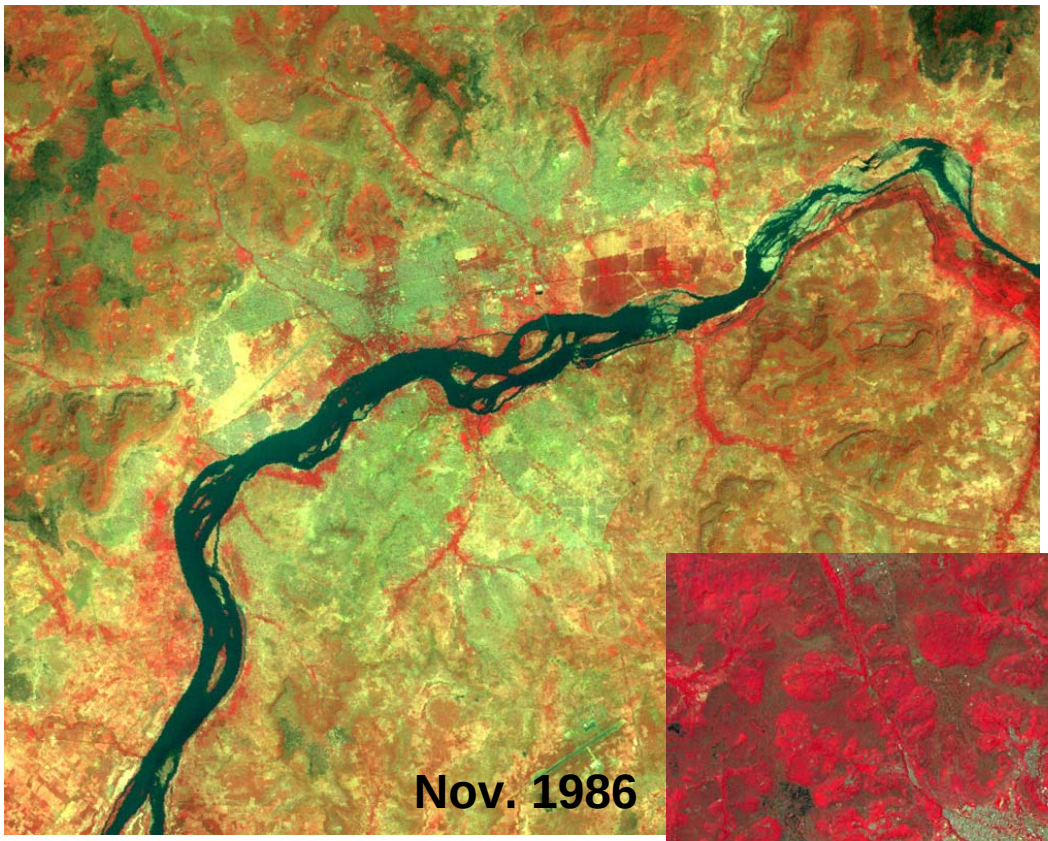
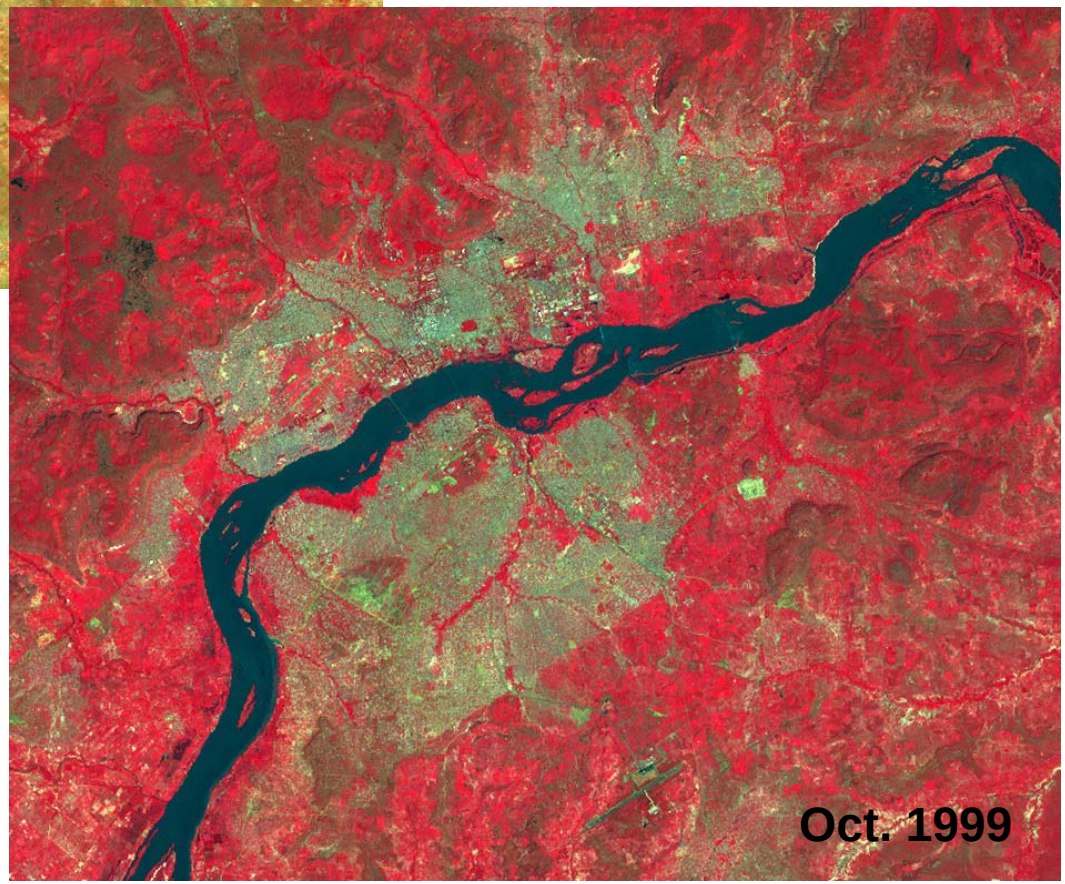
Landsat images of Bamako





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