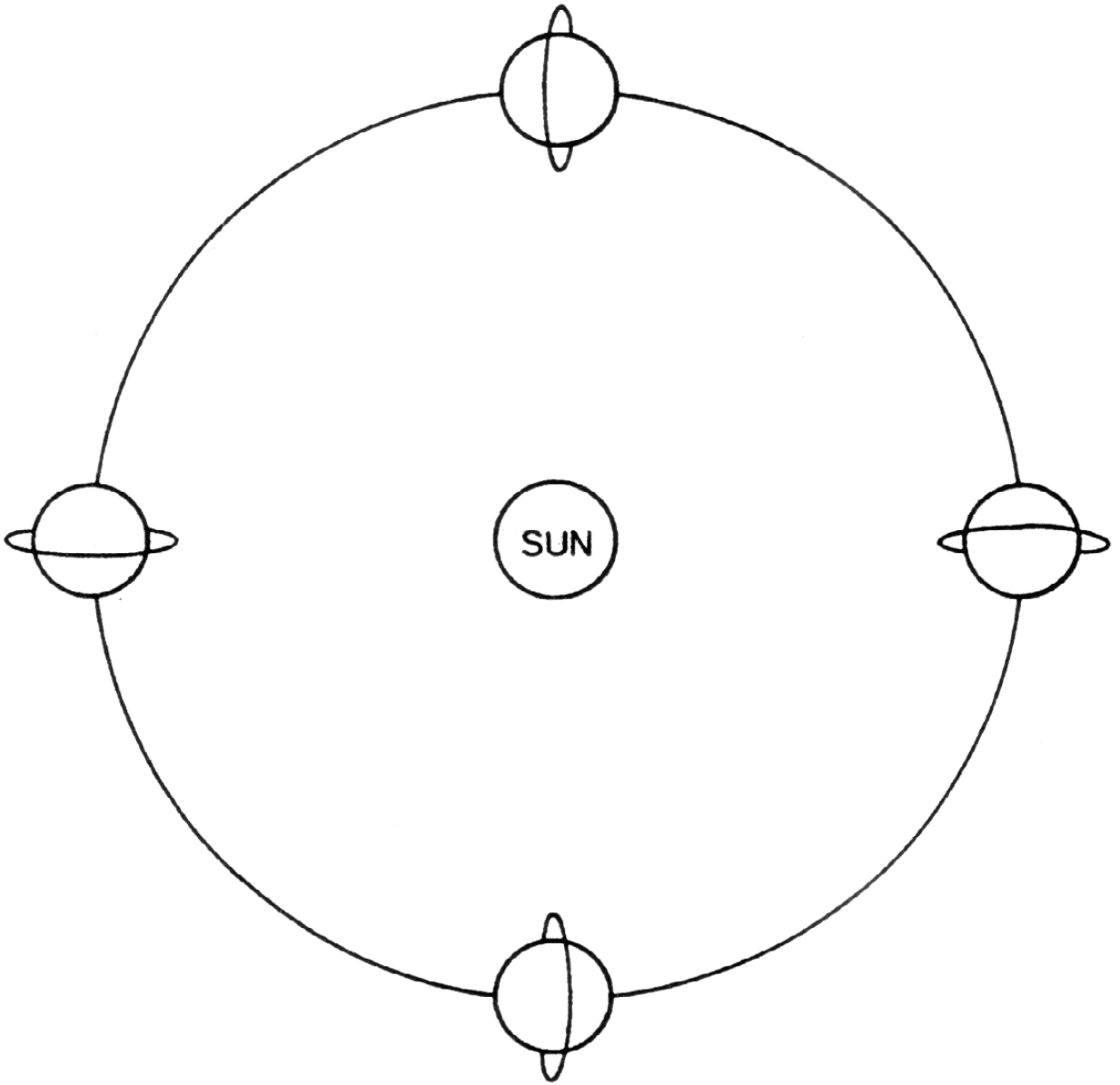
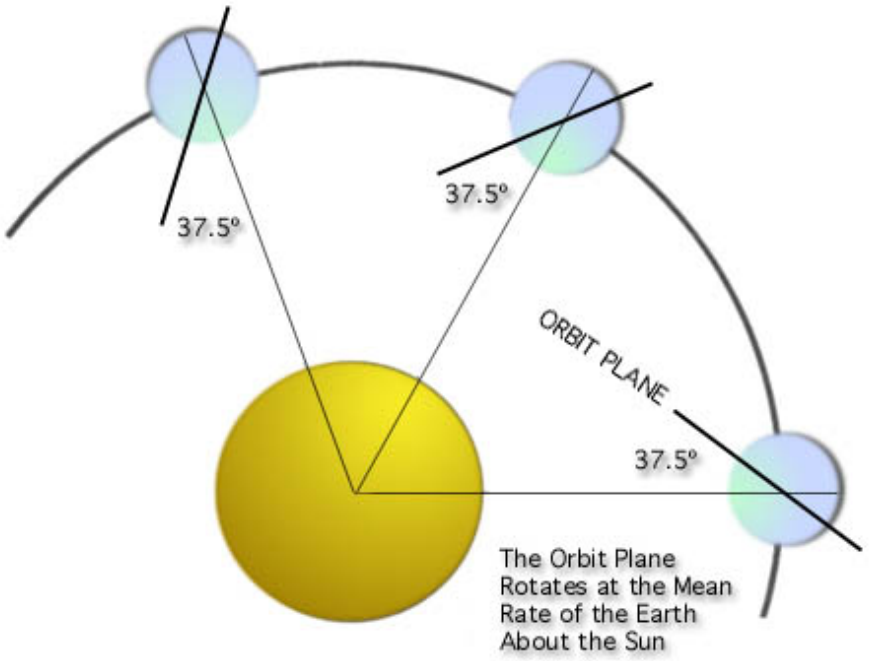
Satellite Image Analysis

(Illustrations)

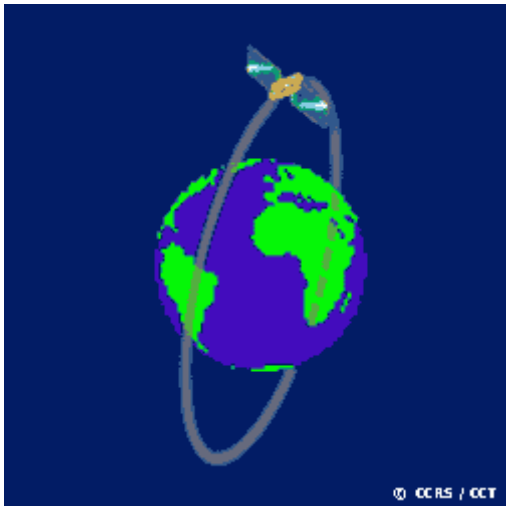
sun-synchronous orbit

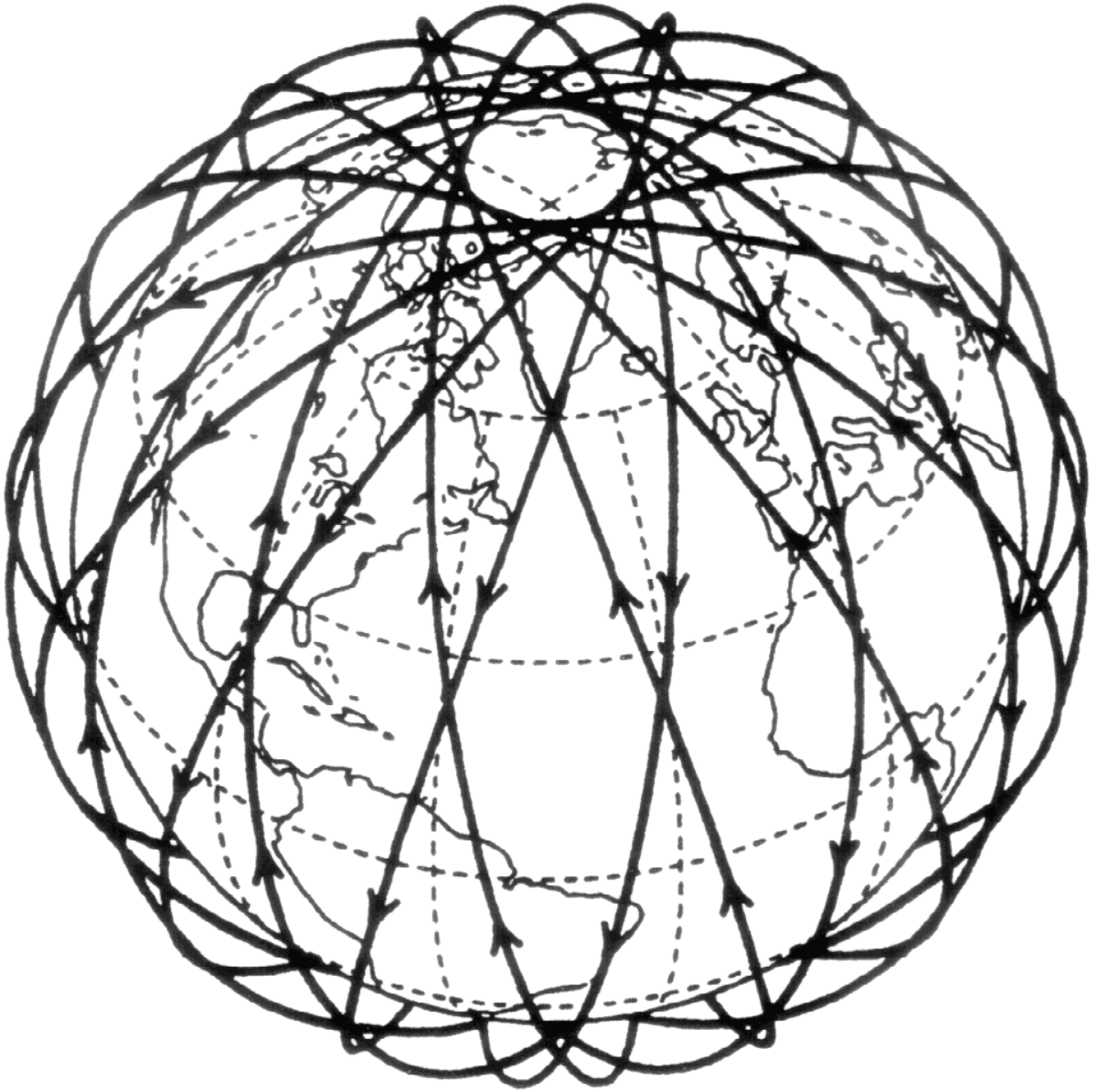


(from [1])


37.5°
37.5°
ORBIT PLANE
37.5°
The Orbit Plane
Rotates at the Mean
Rate of the Earth
About the Sun

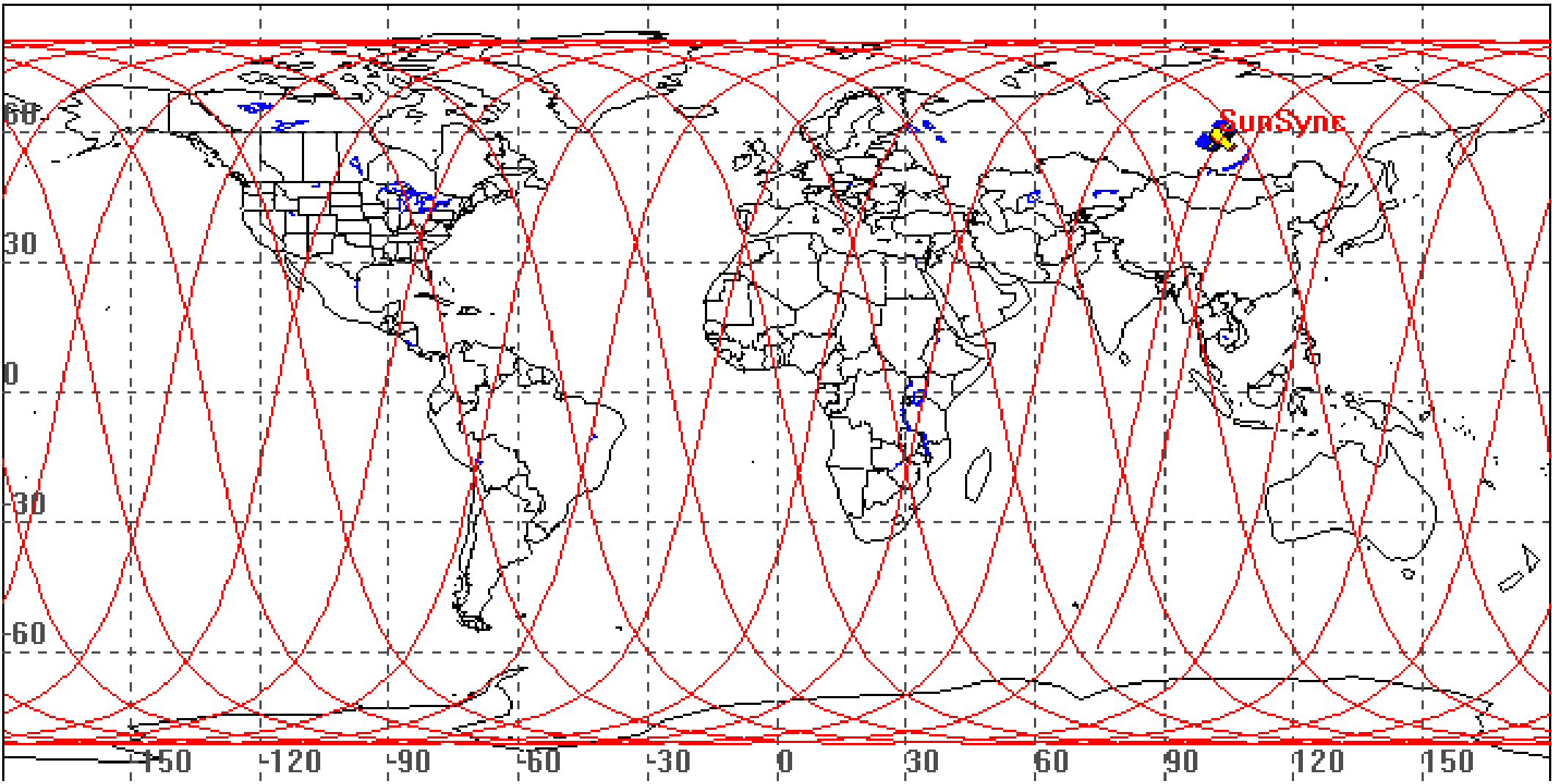
- height: 800 – 1200 km
- orbit time: ≈ 100 min
- inclination: 98°
- non-spherical shape of Earth
  → torque on satellite
  → precession once per year:
  → always same orientation relative to sun





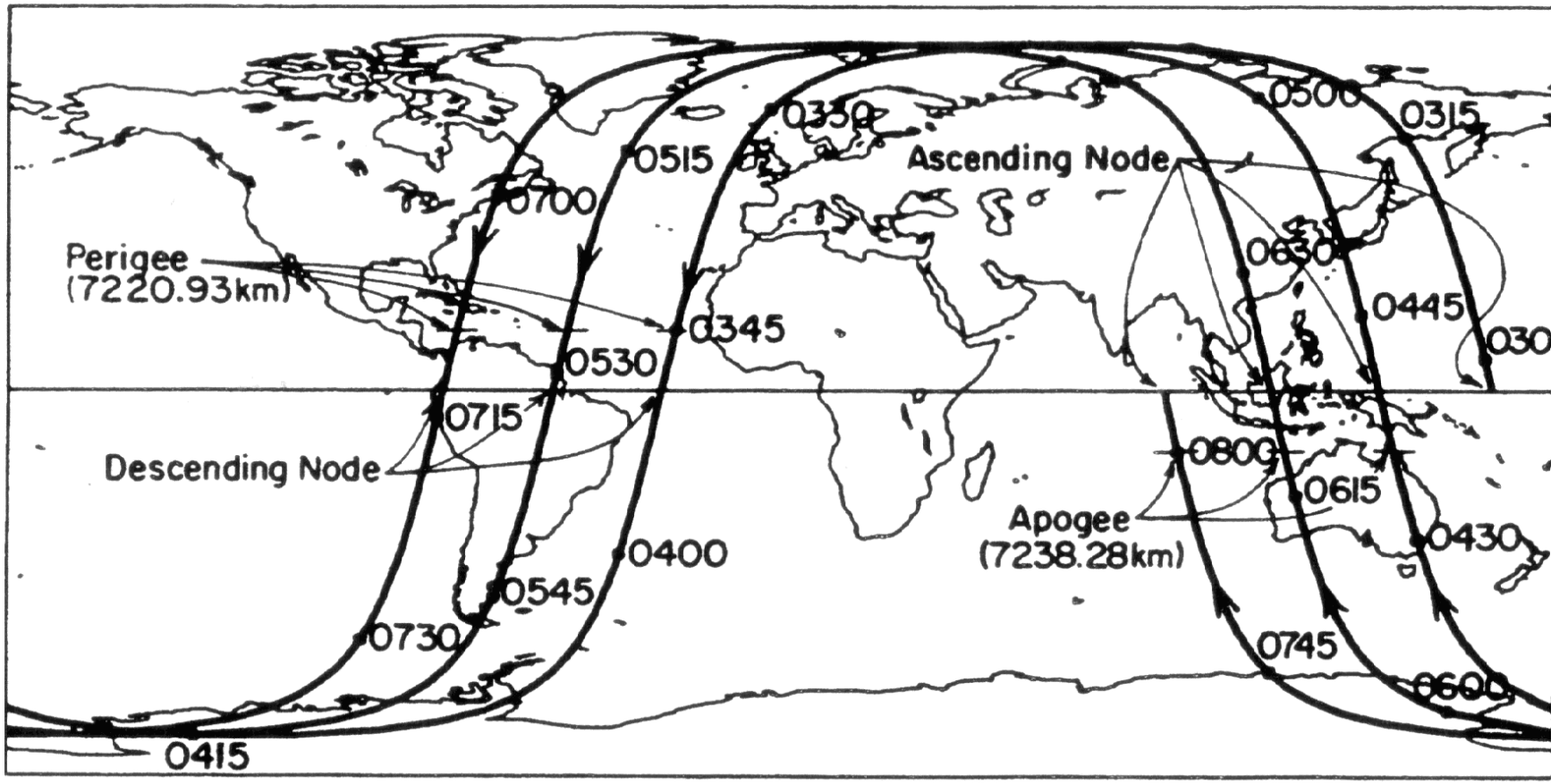
orbital path in near-polar orbit (1 day)

(from [1])



orbital path in near-polar orbit (1 day)

(from [1])



ground track, 3 orbits of sun-synchr. sat.

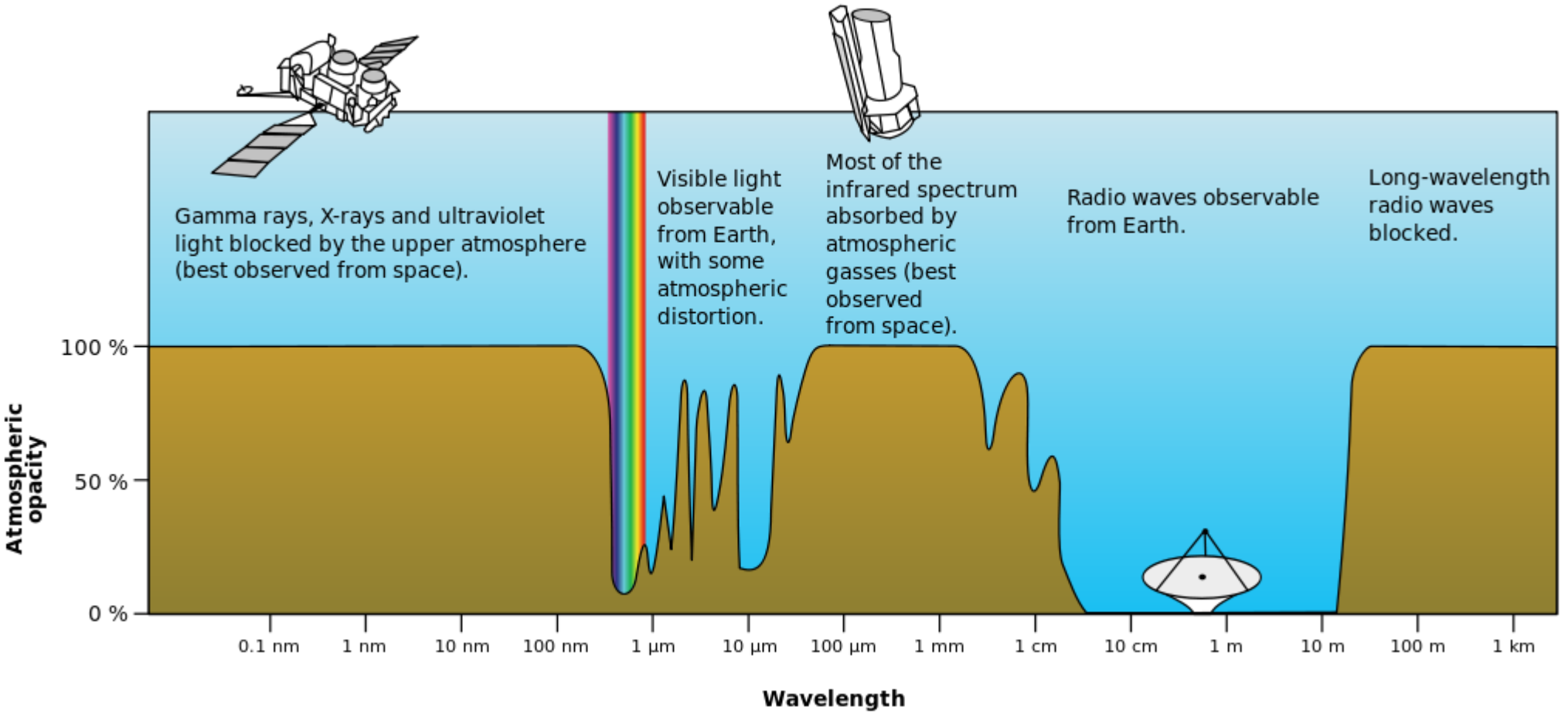
(from [1])

Geostationary Orbit

- one orbit per day

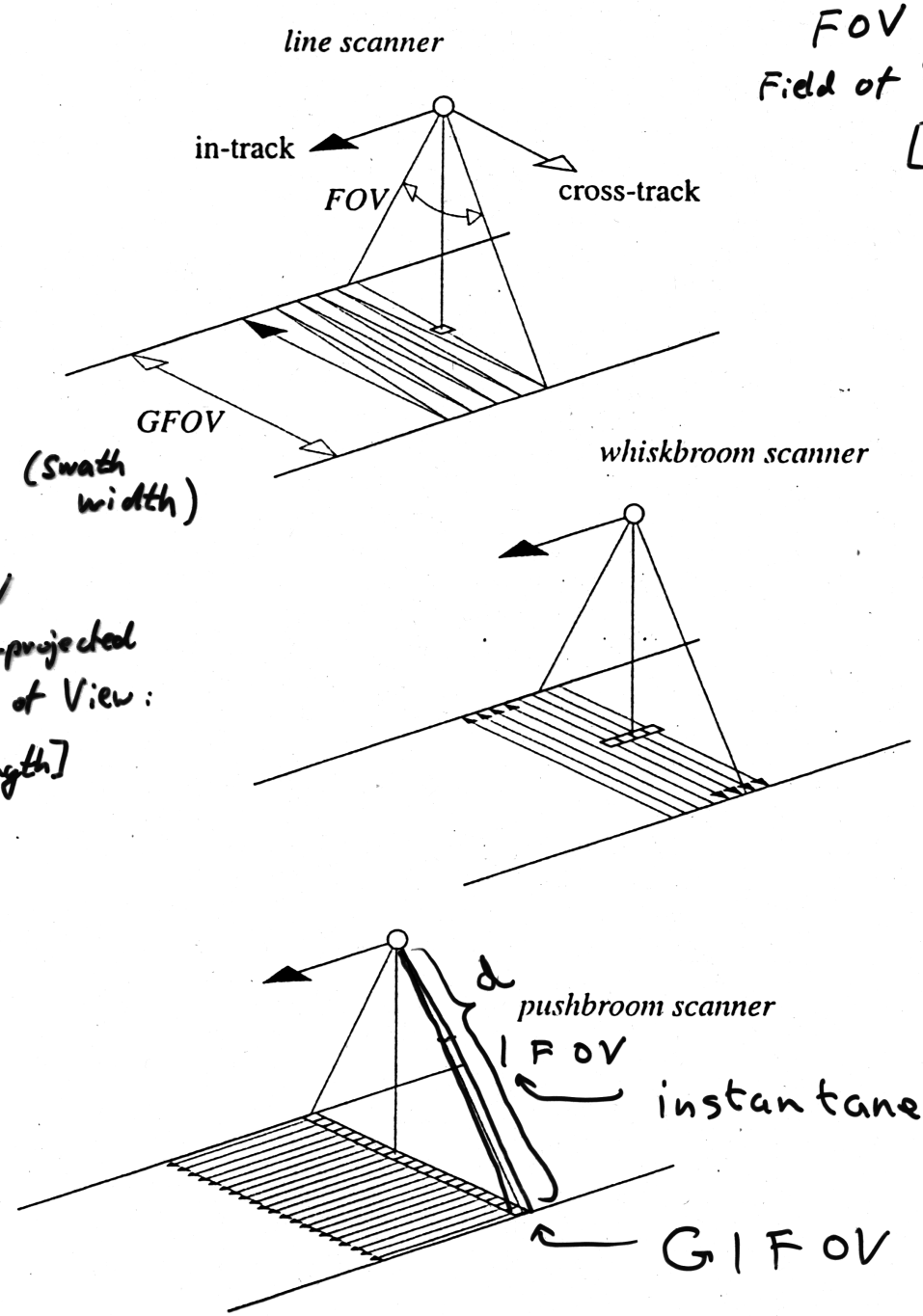
  → satellite “fixed” with respect to Earth surface

  → $h \approx 36\,000$ km (!)



[NASA/Wikipedia: http: // en. wikipedia. org/ wiki/ File: Atmospheric_ electromagnetic_ opacity. svg]

name	wavelength range	radiation source	surface property of interest
Visible	0.4-0.7 μm	solar	reflectance
Near Infrared (NIR)	0.7-1.1 μm	solar	reflectance
Short Wave Infrared (SWIR)	1.1-1.35 μm 1.4-1.8 μm 2-2.5 μm	solar	reflectance
Mid Infrared (MWIR)	3-4 μm 4.5-5 μm	solar,thermal solar,thermal	reflectance, temperature
Thermal Infrared (TIR)	8-9.5 μm 10-14 μm	thermal	temperature
microwave, radar	1 mm – 1 m	thermal (passive) artificial (active)	temperature (passive) roughness(active)

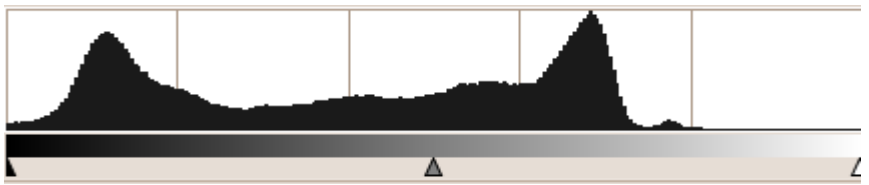


FOV
Field of View:
[angle]

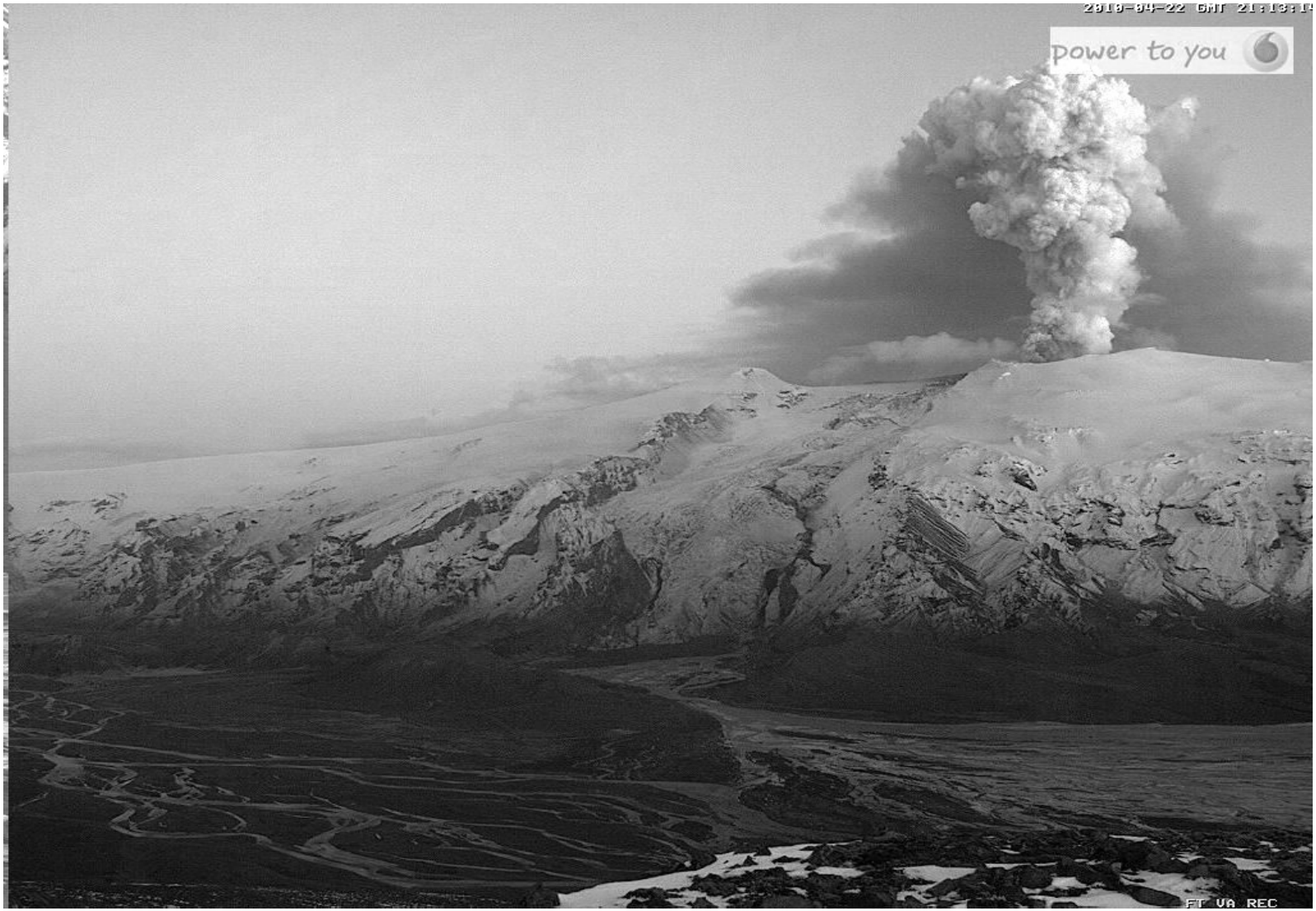
GFOV
Ground-projected
Field of View:
[length]

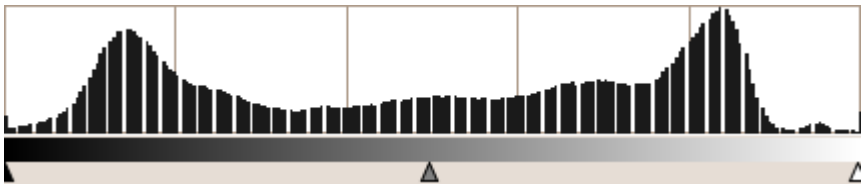
$d \cdot \tan(\text{IFOV}) = \text{GIFOV}$

(adapted from from [3])

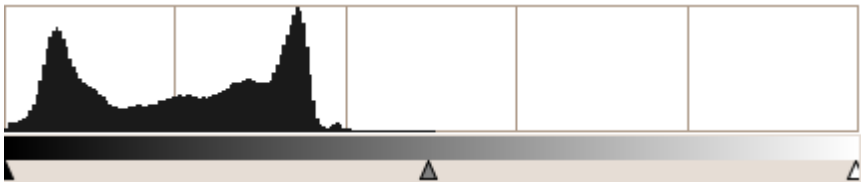


Original image of Eyafjall, Iceland, by webcam of an Icelandic telecommunication company

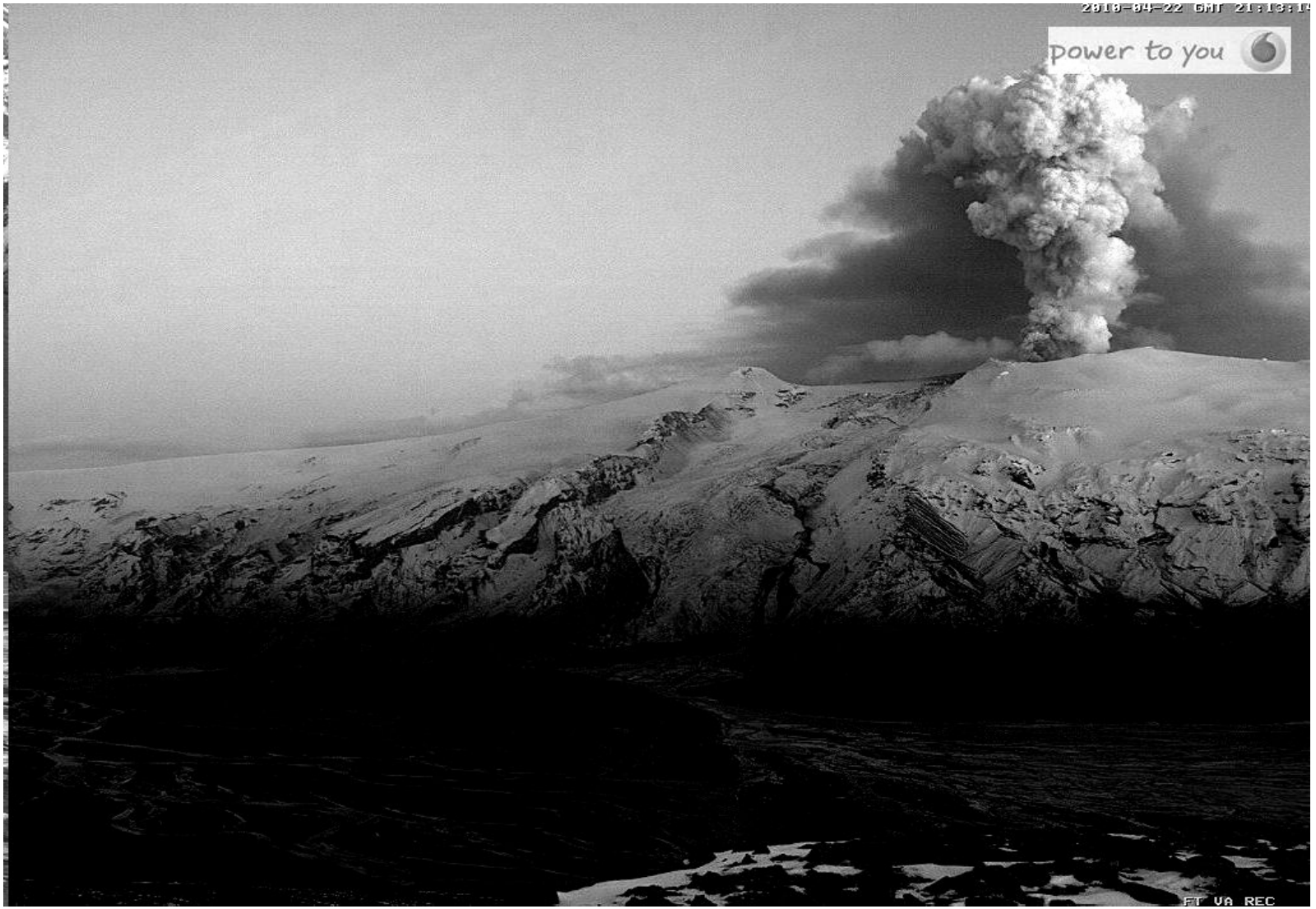




Linear contrast stretch applied

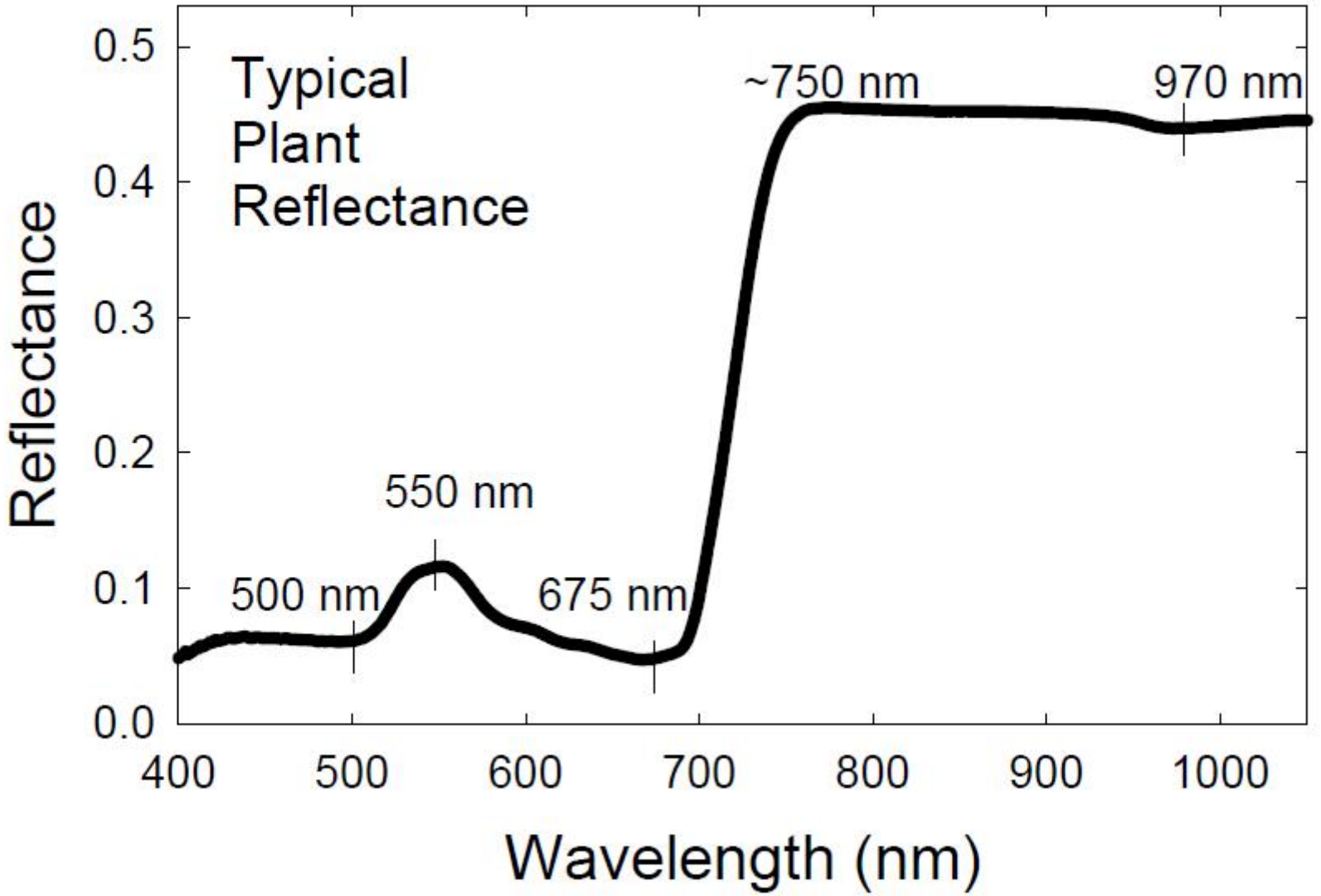


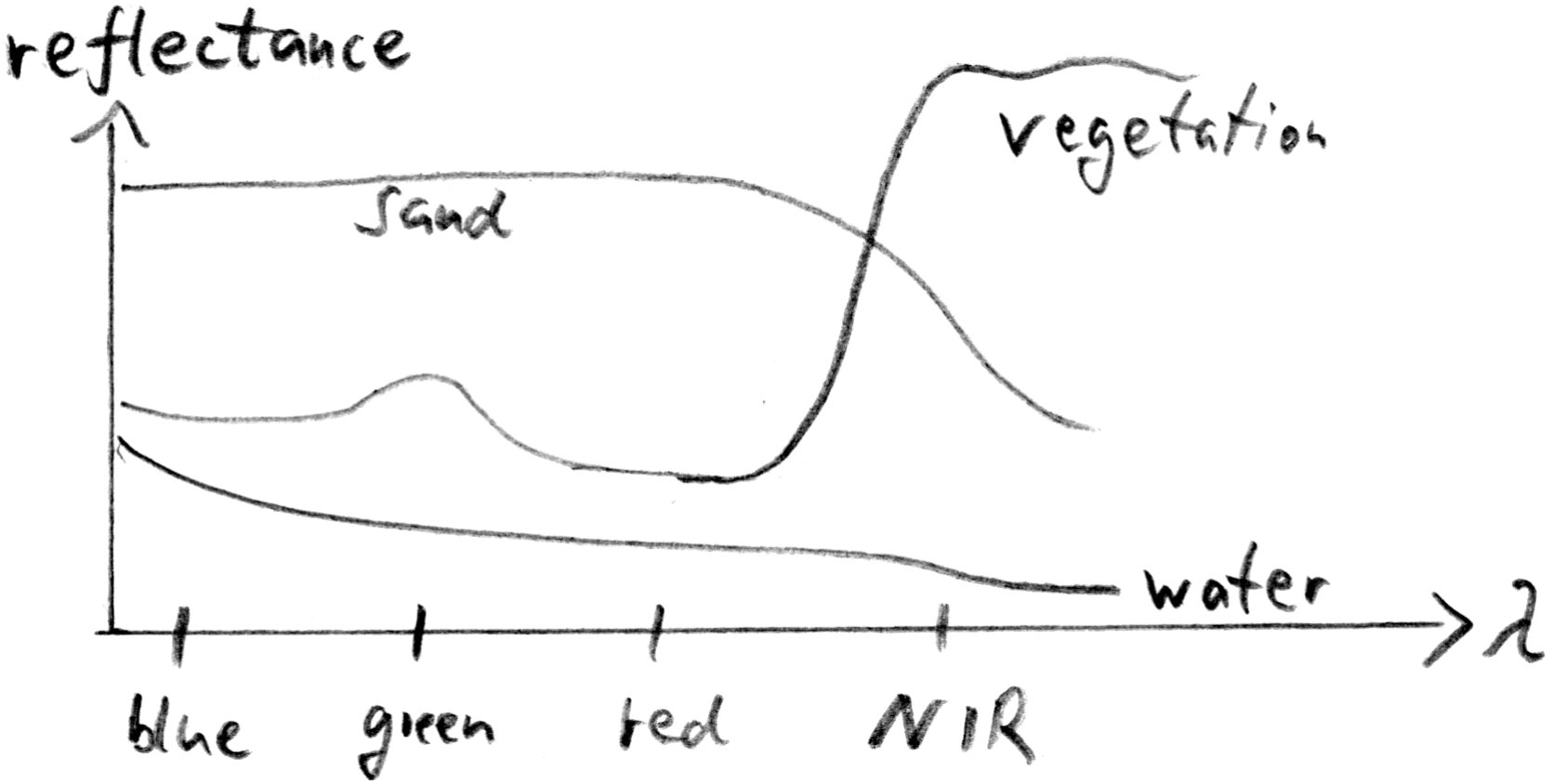
low contrast



setting lower threshold above the dark peak: all pixels darker than that are now black (value 0)

display colour	sensor spectral band		
	True Colour	Colour IR	False Colour
red (R)	red	NIR	any
green (G)	green	red	any
blue (B)	blue	green	any


Typical
Plant
Reflectance
~750 nm
970 nm
550 nm
500 nm
675 nm
Reflectance
0.0
0.1
0.2
0.3
0.4
0.5
400
500
600
700
800
900
1000
Wavelength (nm)


reflectance
vegetation
sand
water
λ
blue
green
red
NIR

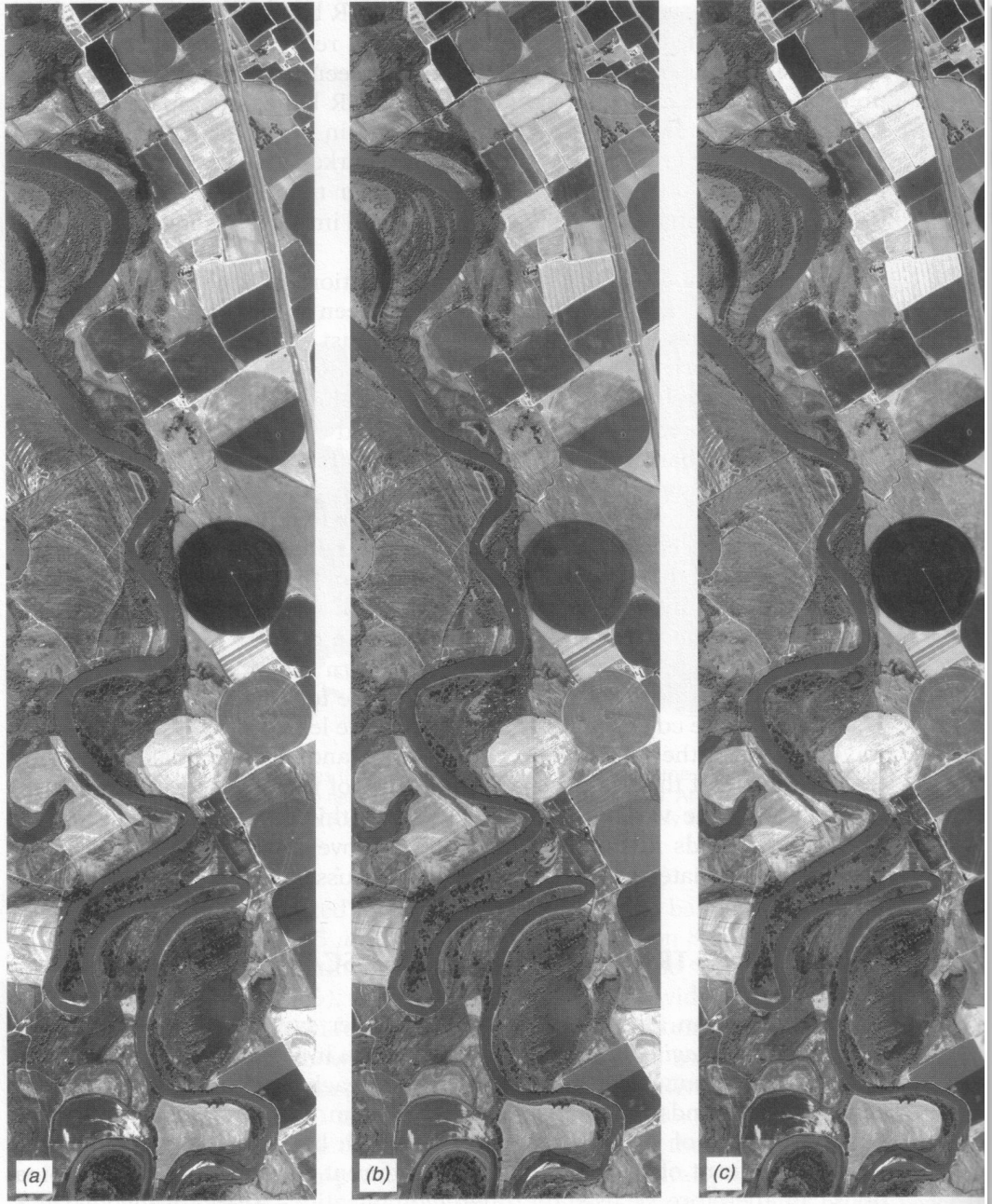


Figure 5.7 Six-band multispectral scanner data, Yakima River valley, Washington, mid-August 1997: (*a*) band 1, 0.
to 0.52 μm (blue); (*b*) band 2, 0.52 to 0.60 μm (green); (*c*) band 3, 0.63 to 0.69 μm (red); (*d*) band 4, 0.76 to 0.90 μ
(near IR); (*e*) band 5, 0.91 to 1.05 μm (near IR); (*f*) band 6, 8.0 to 12.5 μm (thermal IR). Scale 1:50,000. (Courtesy S
sys Technologies, Inc.)

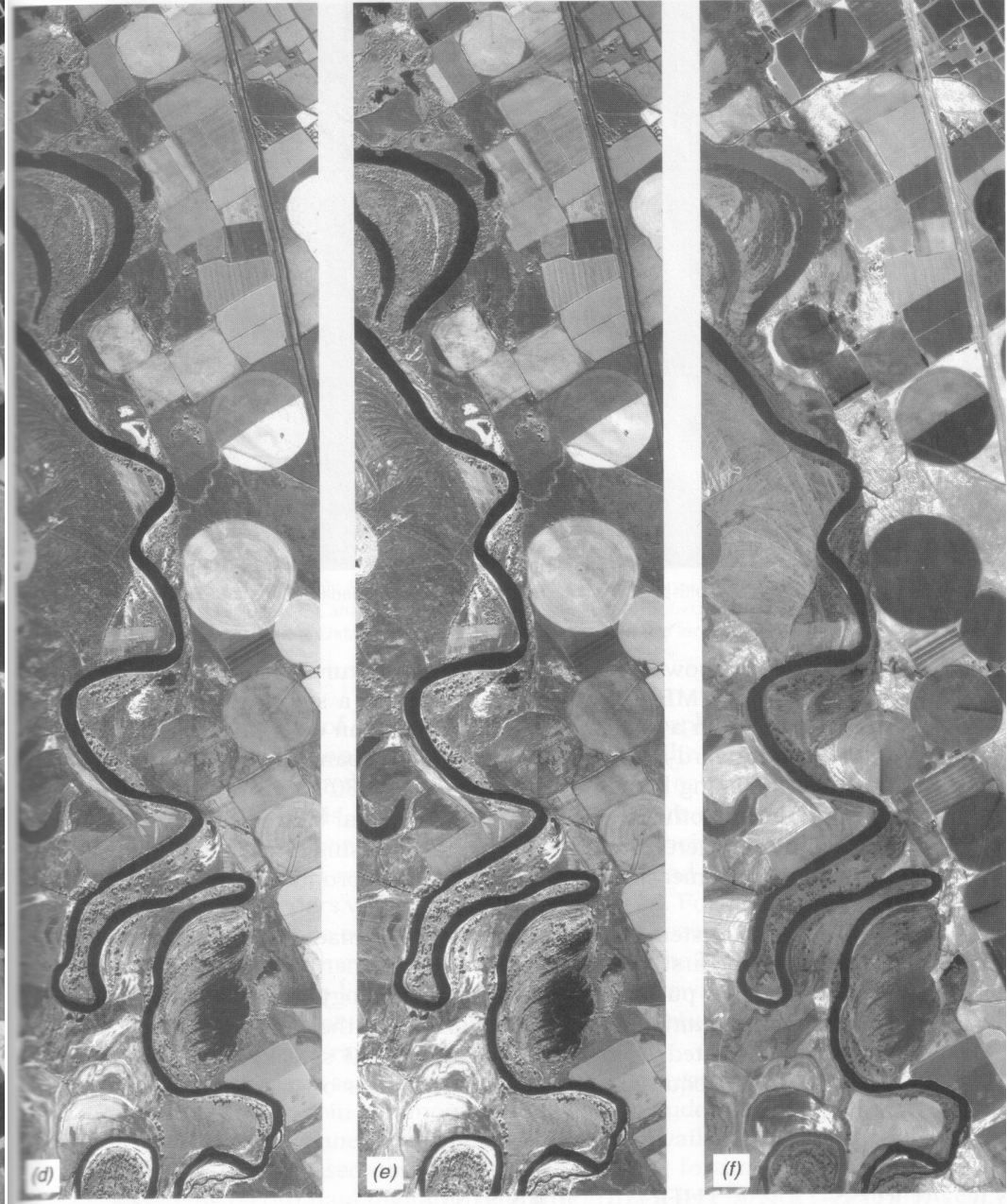


Figure 5.7 *(Continued)*

Blue **Green** **Red** **NIR1** **NIR2** **TIR**

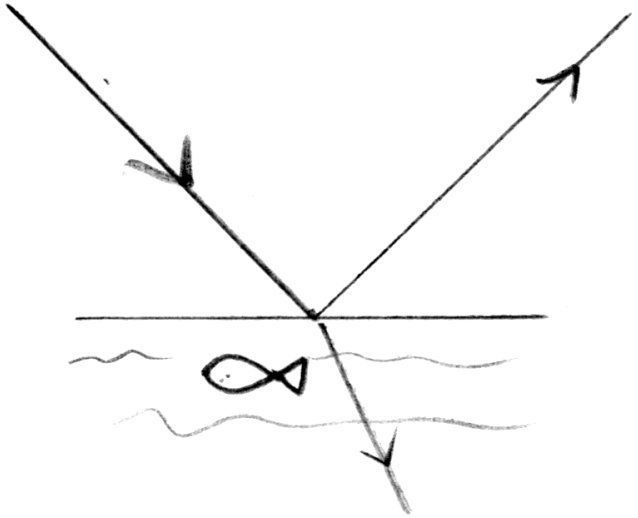
(adapted from [2])

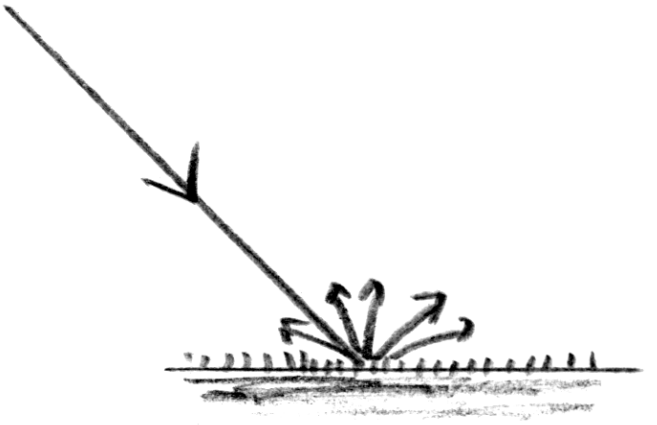
True Color

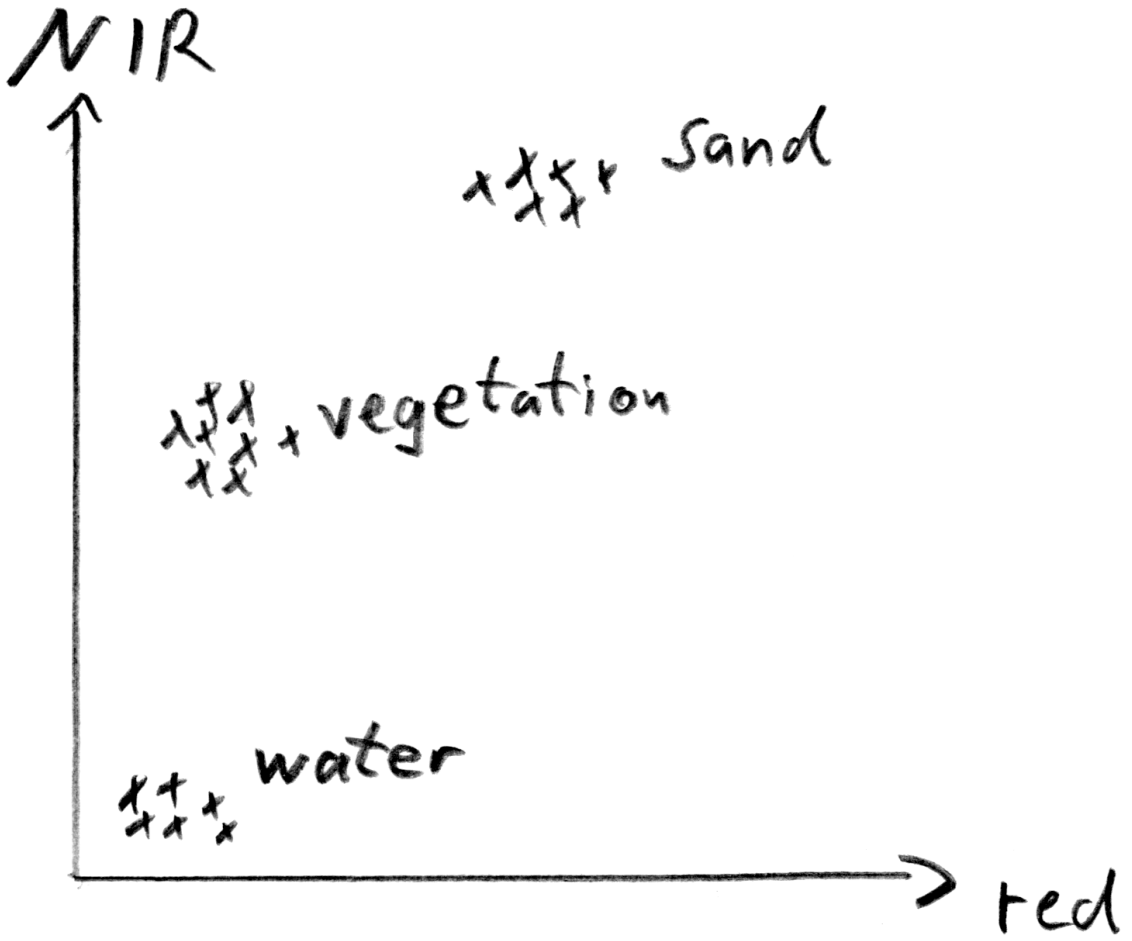
False Color
“Color IR”:
R=NIR
G=Red
B=Green

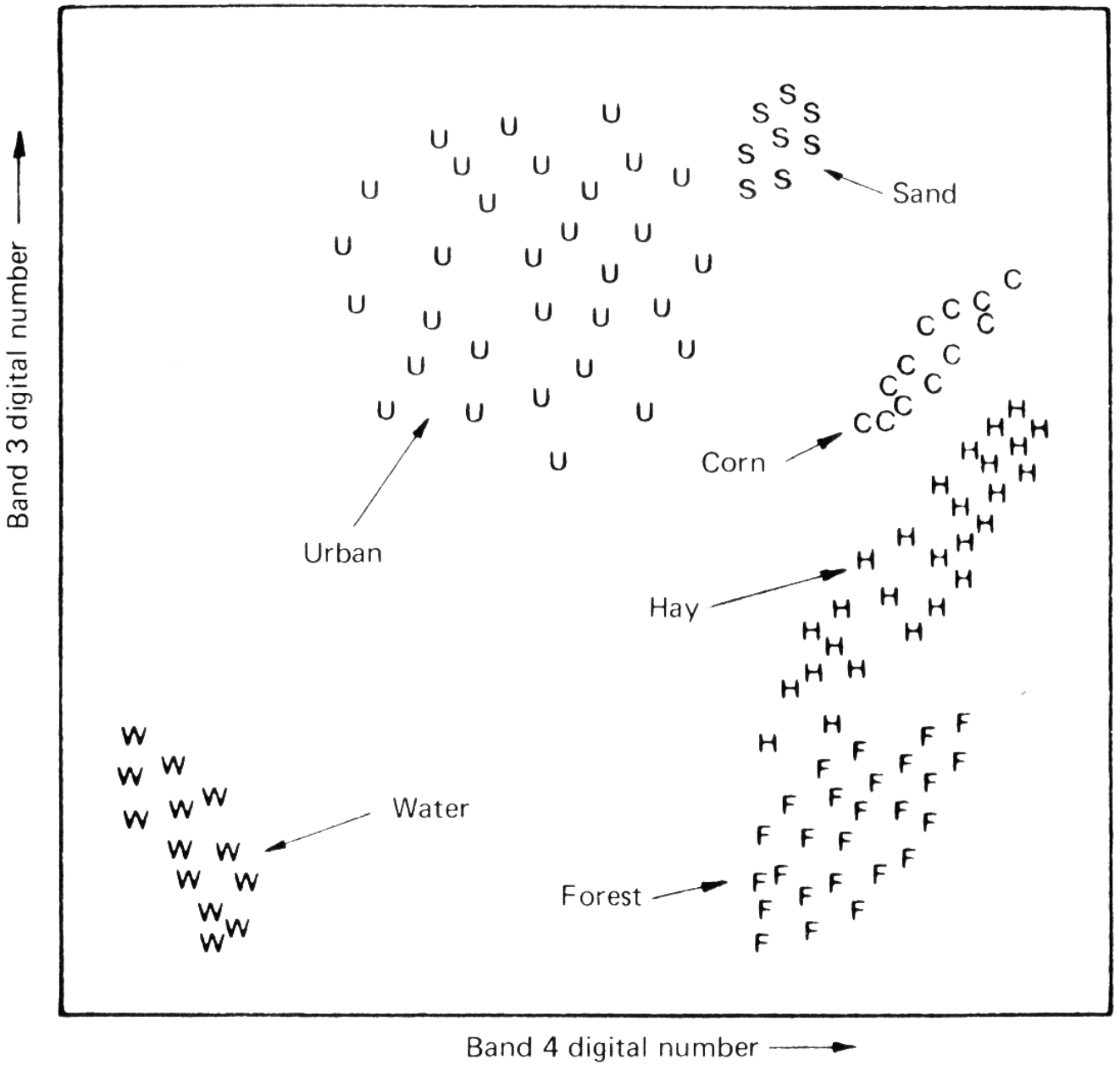
Plate 10 Multispectral scanner images, Yakima River valley, WA, mid-August: (*a*) normal color composite, bands 1, 2, and 3 (blue, green, and red) shown in Figure 5.7; (*b*) color IR composite, bands, 2, 3, and 5 (green, red, and near-IR) shown in Figure 5.7. Scale 1 : 34,000. (Courtesy Sensys Technologies, Inc.) (For major discussion, see Section 5.5.)

(from [2])

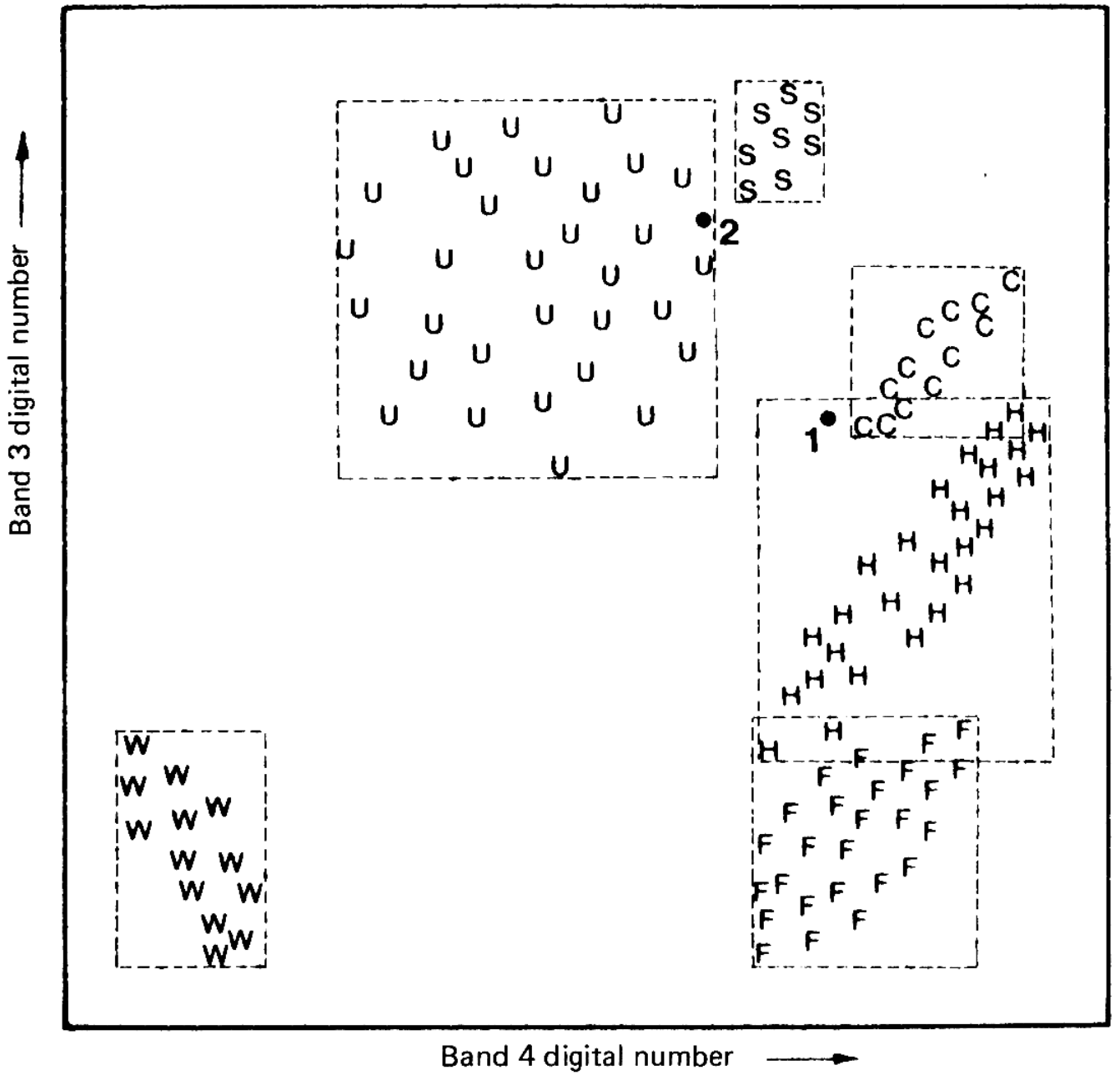





NIR
sand
vegetation
water
red


Band 3 digital number
Band 4 digital number
Sand
Corn
Urban
Hay
Water
Forest

(from [2])



(adapted from [2])

References

[1] S. Q. Kidder and T. H. VonderHaar. Satellite meteorology: an introduction. Academic Press, San Diego, Calif., 1995. ISBN 0-12-406430-2.
[2] T. Lillesand and R. Kiefer. Remote Sensing and Image Interpretation. Wiley, 2000.
[3] R. A. Schowengerdt. Remote Sensing, Models and Methods for Image Processing. Academic Press, 1997.