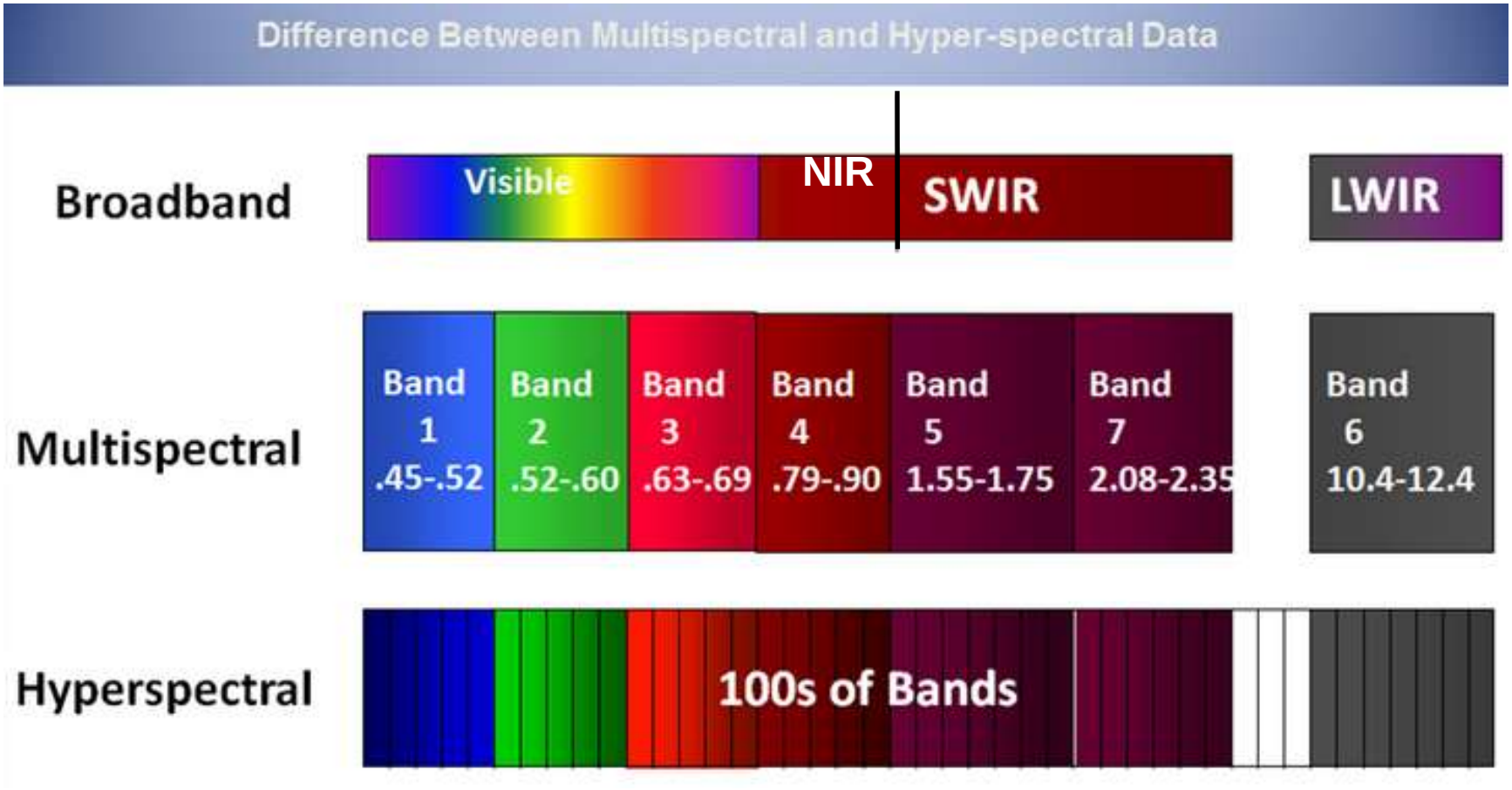
Hyperspectral remote sensing ('Image spectroscopy')

- **Multispectral** systems contain~4-15 bands, 70-400 nm wide
- **Superspectral:** 16-60 (e.g. MODIS)
- **Hyperspectral** : 100- 200+ bands 0.38 - 2.5μm, 5-10nm each
  Bands are contiguous and high spectral resolution

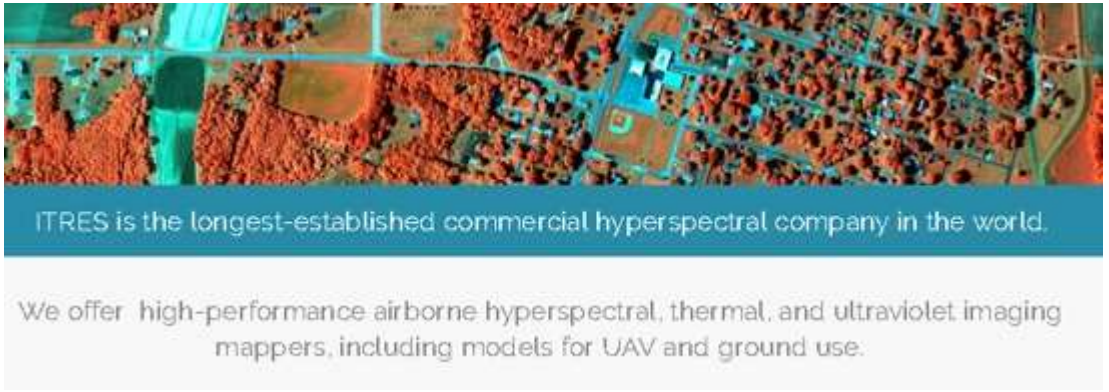


Some 'earlier' airborne hyperspectral systems

- Now available on drones (UAV)

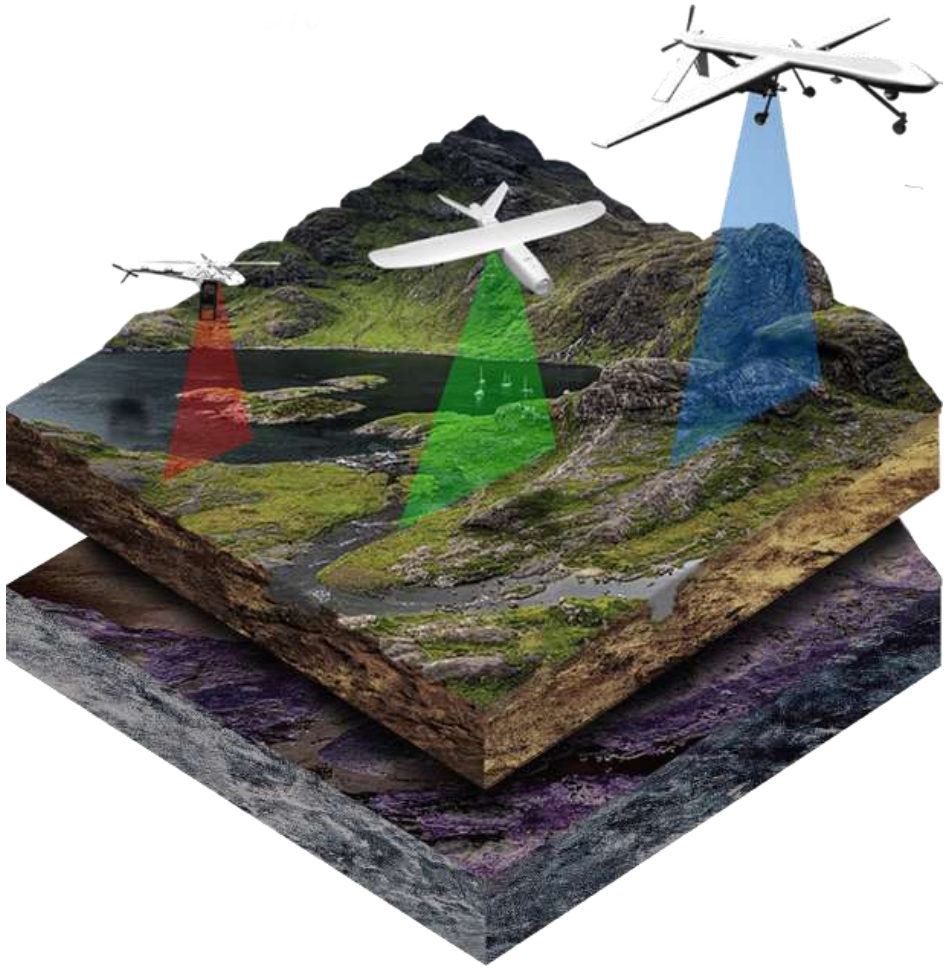
Sensor	Wavelength (nm)	Band width (nm)	# bands
AVIRIS	400-2500	10	224
TRWIS III	367-2328	6	335
HYDICE	400-2400	10	210
CASI (ITRES)	400- 900	1.8	288
OKSI AVS	400-1000	10	61
ESSI Probe-1	400-2450	15	128

https://www.itres.com
Calgary, AB



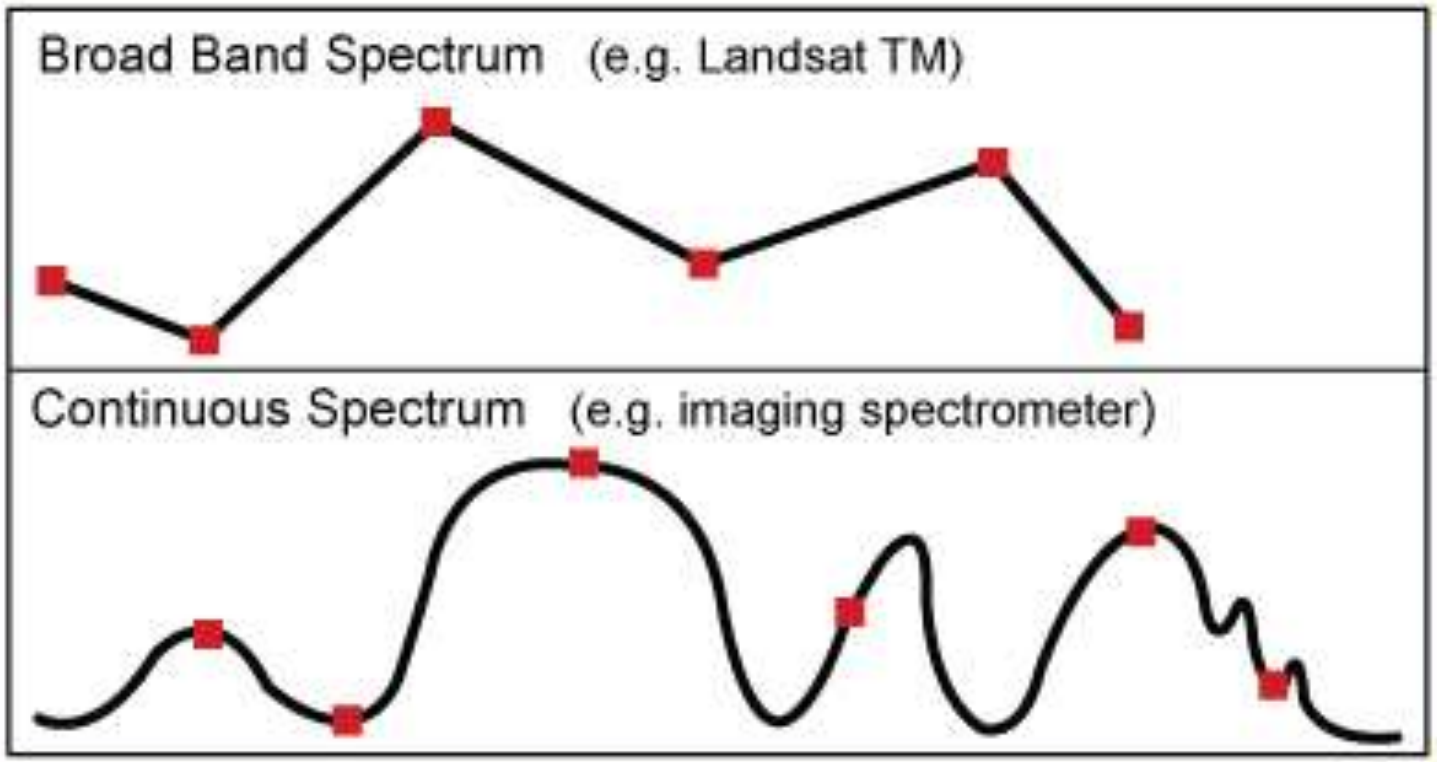
Founded 1979
First sensor 1989
SWIR/TIR 2001

Sample applications
- Coastal
- Forestry
- Agriculture
- Ozone



https://www.itres.com/gallery

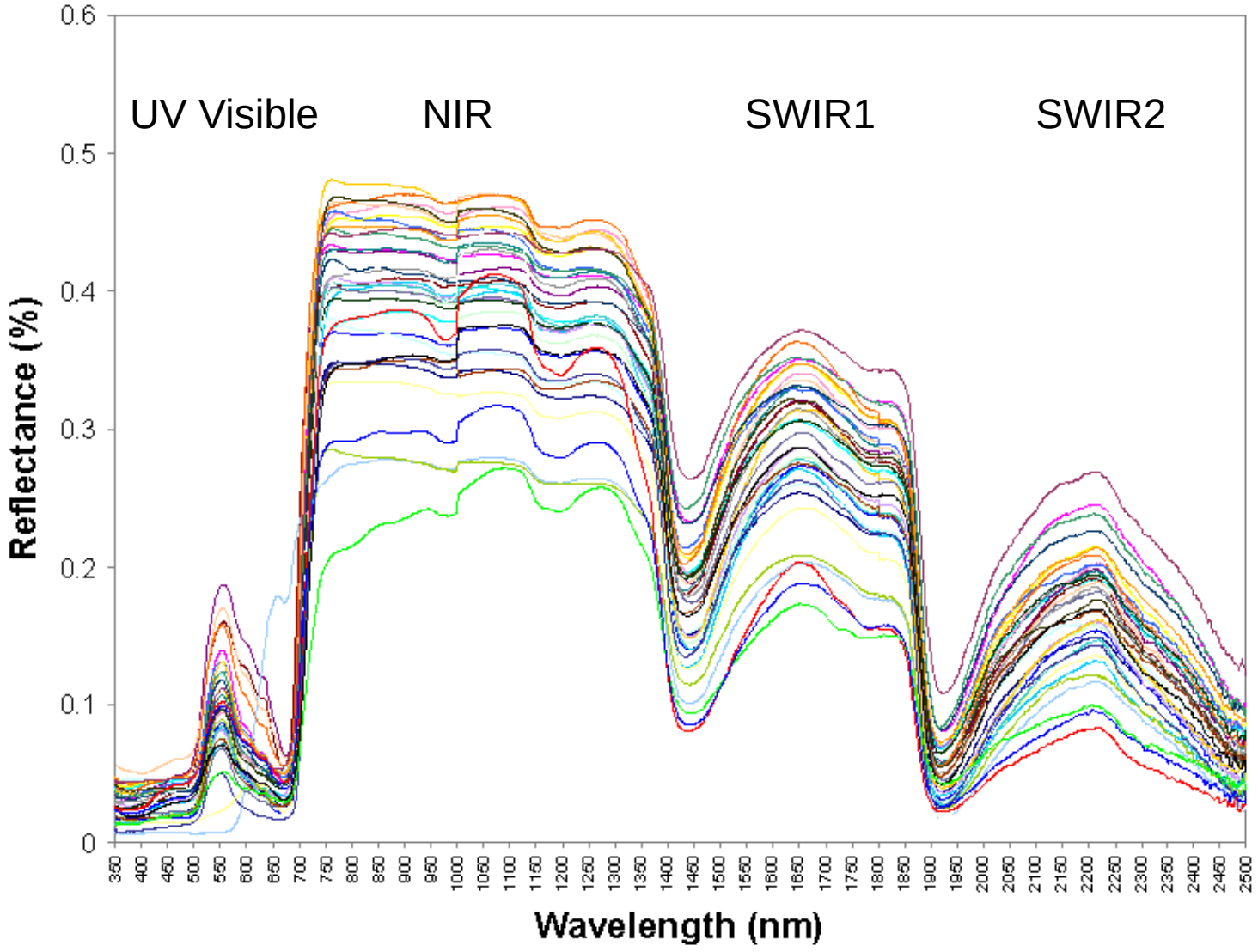
Spectral signatures: Landsat TM v hyperspectral



Above: Spectral comparison between hyperspectral and broad-band data.

LBL Overstory Vegetation Spectra

http://www.murraystate.edu



- White Oak
- Sycamore
- Shingle Oak
- Black Willow
- White Ash
- White Ash
- Pignut Hickory
- Black Cherry
- Blackjack Oak
- Boxelder
- Blackgum (green)
- Blackgum (medium)
- Blackgum (red)
- Mockernut Hickory
- Shumard Oak
- Black Locust
- Silver Maple
- Black Oak
- Hackberry
- Sweetgum
- Overcup Oak
- Pin Oak
- Red Mulberry
- Winged Elm
- Sugar Maple
- Sugar Maple
- Post Oak
- Red Maple
- Southern Red Oak
- Shagbark Hickory
- Willow Oak
- Silktree
- Loblolly Pine

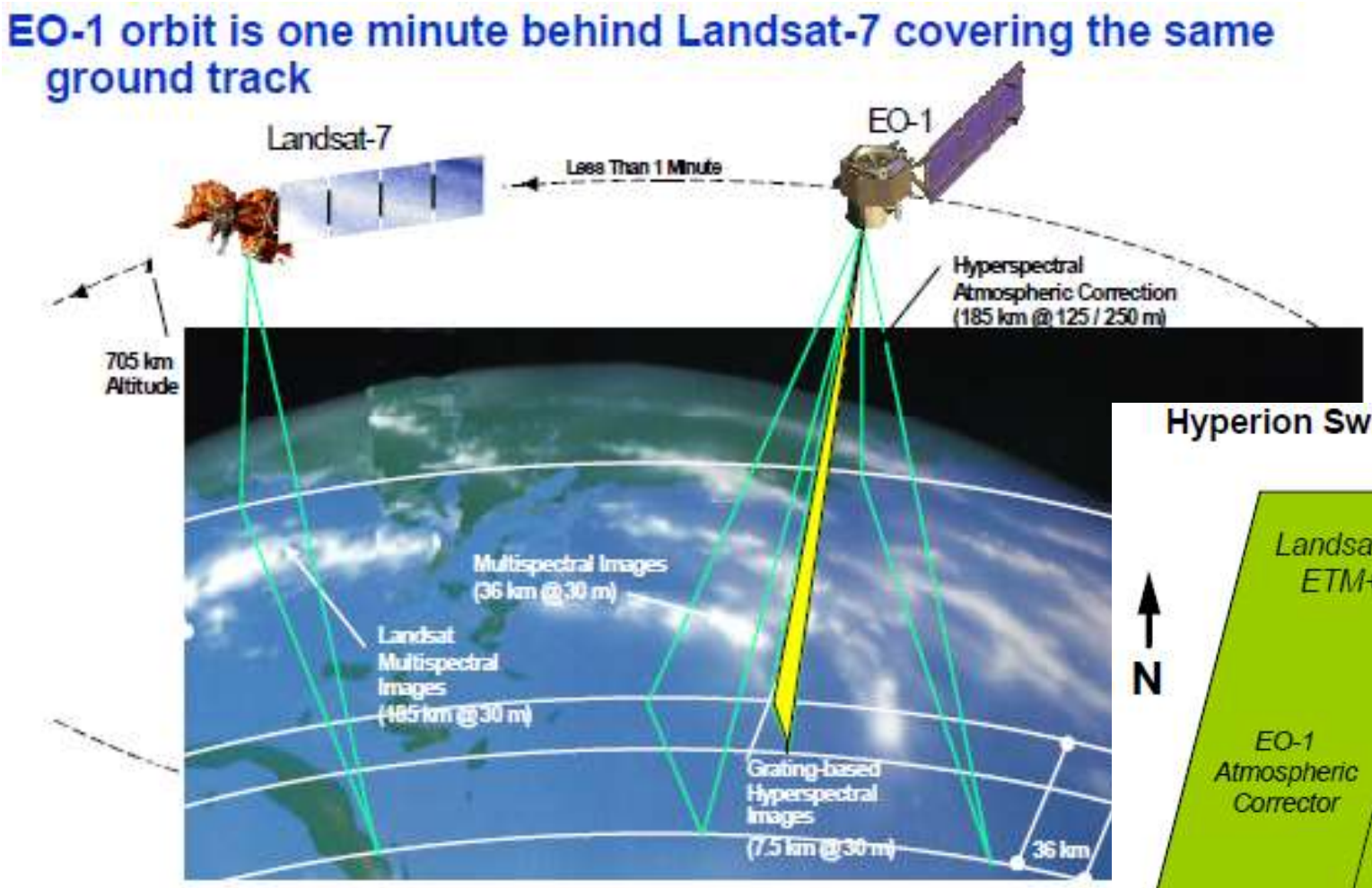
SOME APPLICATIONS:

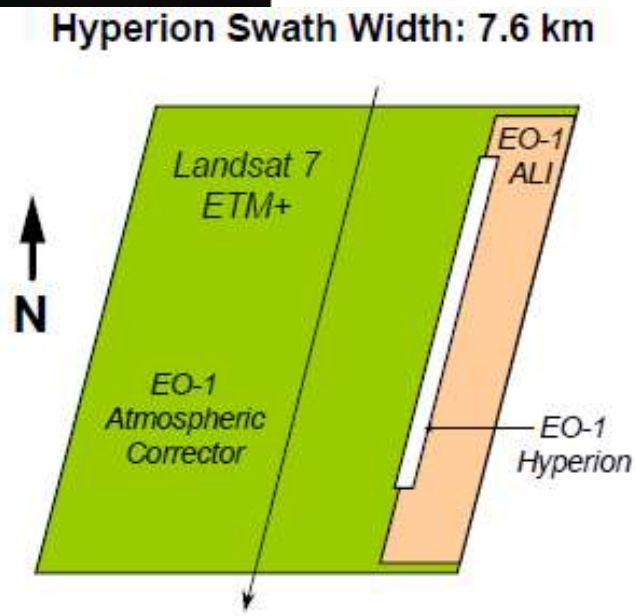
- wetland and coastal vegetation
- mineral composition and soils
- agricultural crops
- forest structure

http://www.itres.com/casi-1500/

Satellite borne hyperspectral systems

Hyperion: on Earth Observing 1 (EO-1), Dec 2000; 50km behind Landsat 7
Data available on EarthExplorer.usgs.cov (also ALI)





CHRIS

(Compact High Resolution Imaging Spectrometer)

on PROBA (2001)
(Project for On-Board Autonomy) – Belgian

CHRIS provides 200 narrow bands in the VNIR range (400 - 1050 nm) at 30 m. Each nominal image forms a square of 13 km x 13 km.

Launch:
http://www.esa.int/SPECIALS/Proba/index.html

Venice

The Niau atoll, in the central South Pacific Ocean, acquired on 6 October 2005 with the Compact High Resolution Imaging Spectrometer (CHRIS).

Initial lifetime of 2 years, it's now ESA's longest running EO mission

PROBA-2 2009 includes SWAP telescope to observe the Sun in the UV

SWAP = Sun Watcher using Active Pixel

PROBA-3 2024 Planned launch: Nov 29, Dec 4 ?

Coming ‘soon’ ……. ?

2025: Spaceborne Hyperspectral Applicative Land and Ocean Mission (SHALOM)

… is a joint mission by the Israeli Space Agency and the Italian Space Agency to develop two commercial hyperspectral satellites

Shalom is a Hebrew word meaning peace, harmony, and wholeness

Lab 10: GEOG357 Project planning outline 2024

submit by Nov 15 via Moodle for 5%

Lab 10 will outline how to download project image data: Landsat / Sentinel

Fill in your details between these headings as best you can

a. **Geographic area** e.g. locale / province / country / region ?

b. **Application** e.g. forestry, landcover, glaciers, urban

c. **Image requirements** e.g. expected year(s), change optional-not required

d. **Anticipated processing** e.g. classification, ratios, transforms, indices

e. **Expected outcomes** e.g. extracted features or classes, attribute values