



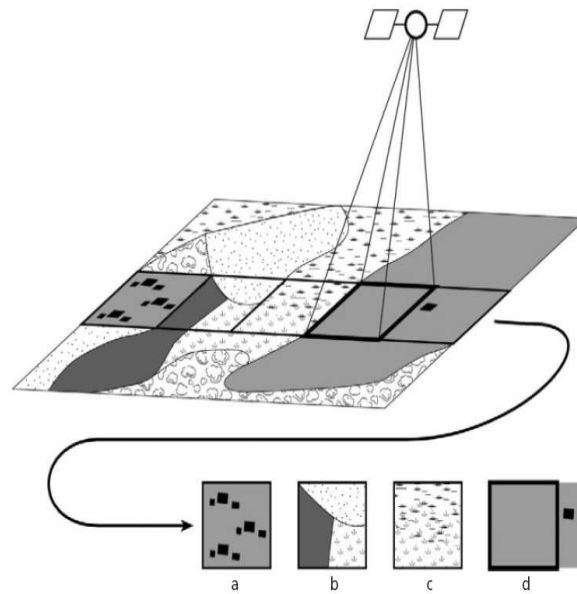
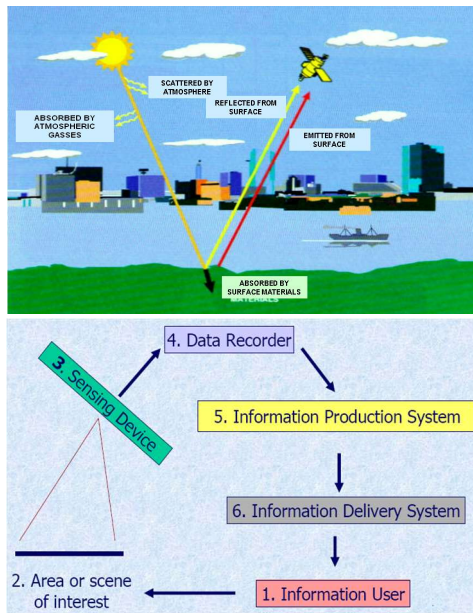
Χαρακτηριστικά δορυφορικών καταγραφών, τυπικές εφαρμογές και μελλοντικές τάσεις



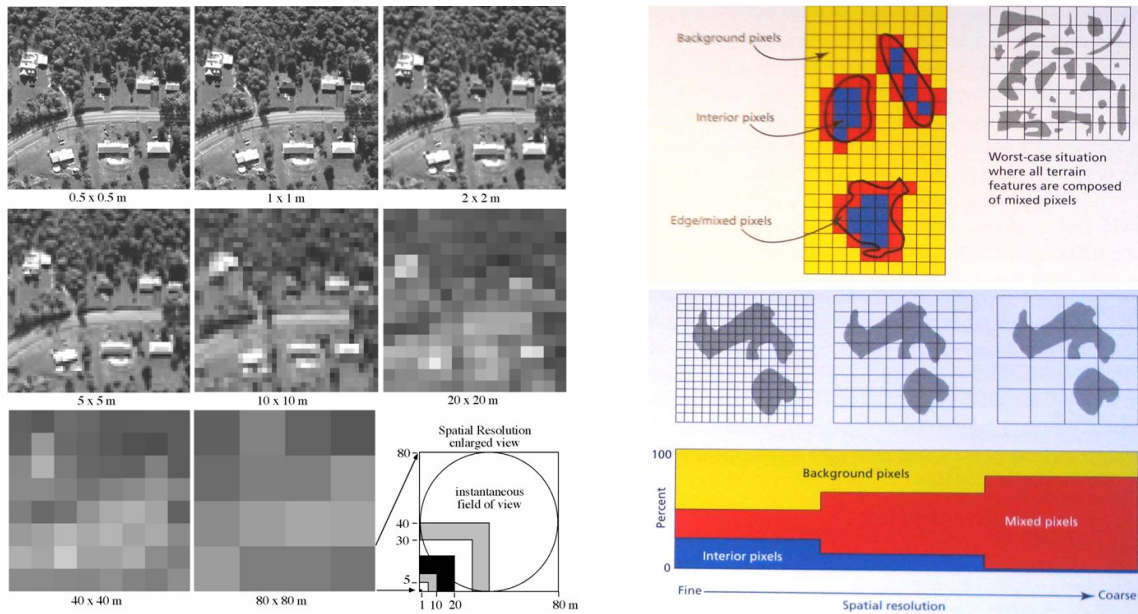
Νεκτάριος Χρυσουλάκης

Εργαστήριο Τηλεπισκόπησης | IYM | <http://rslab.gr>

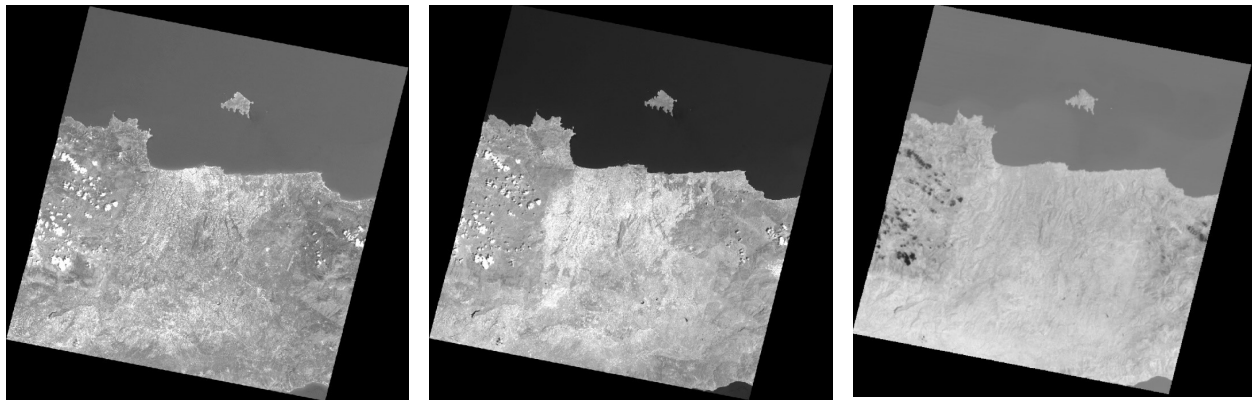
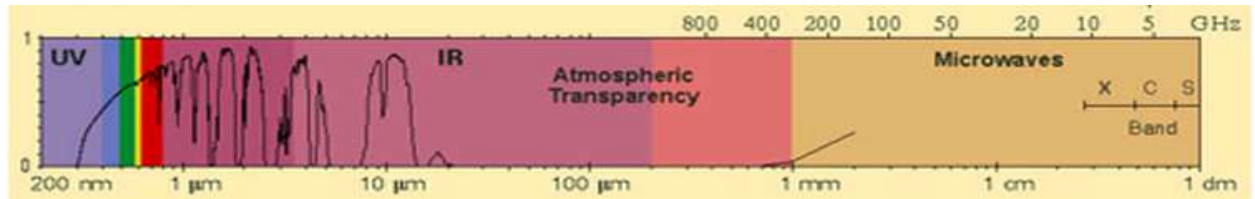
Χαρακτηριστικά των δορυφορικών καταγραφών



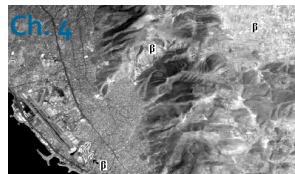
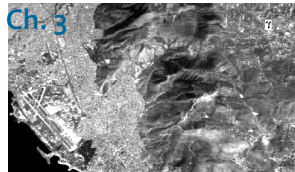
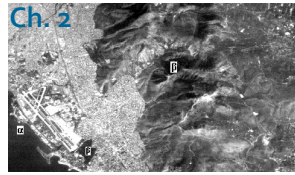
Χαρακτηριστικά των δορυφορικών καταγραφών



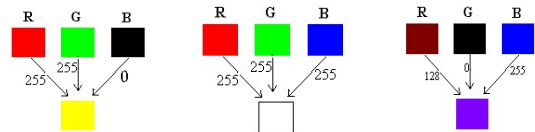
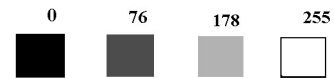
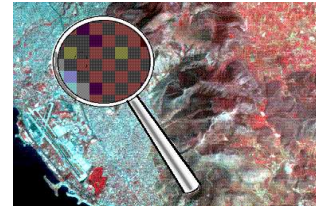
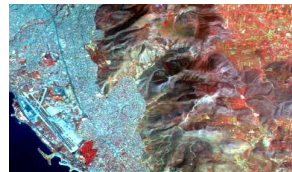
Χαρακτηριστικά των δορυφορικών καταγραφών



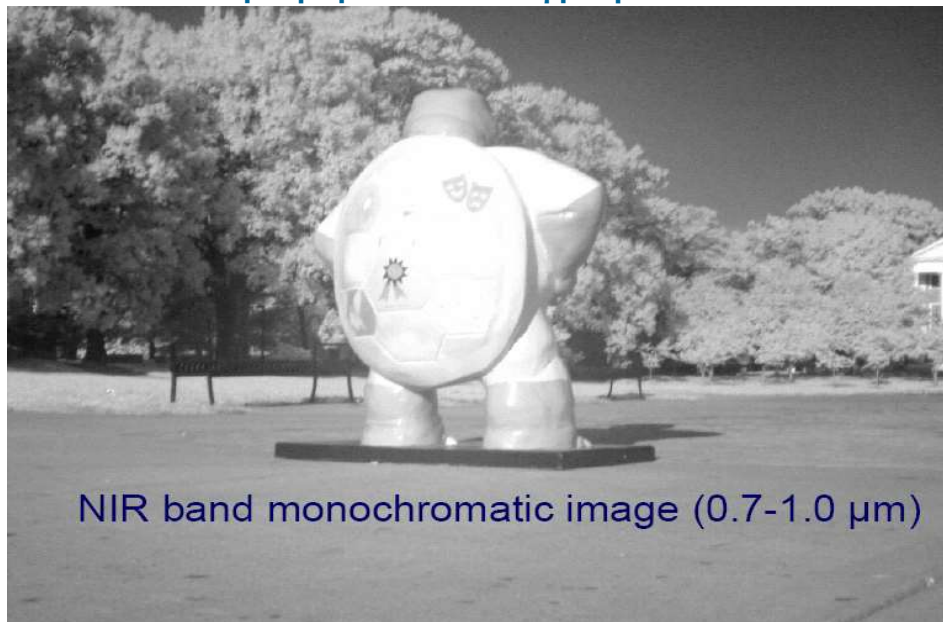
Χαρακτηριστικά των δορυφορικών καταγραφών



Ψευδόχρωμη σύνθεση
R-G-B: 4-3-2

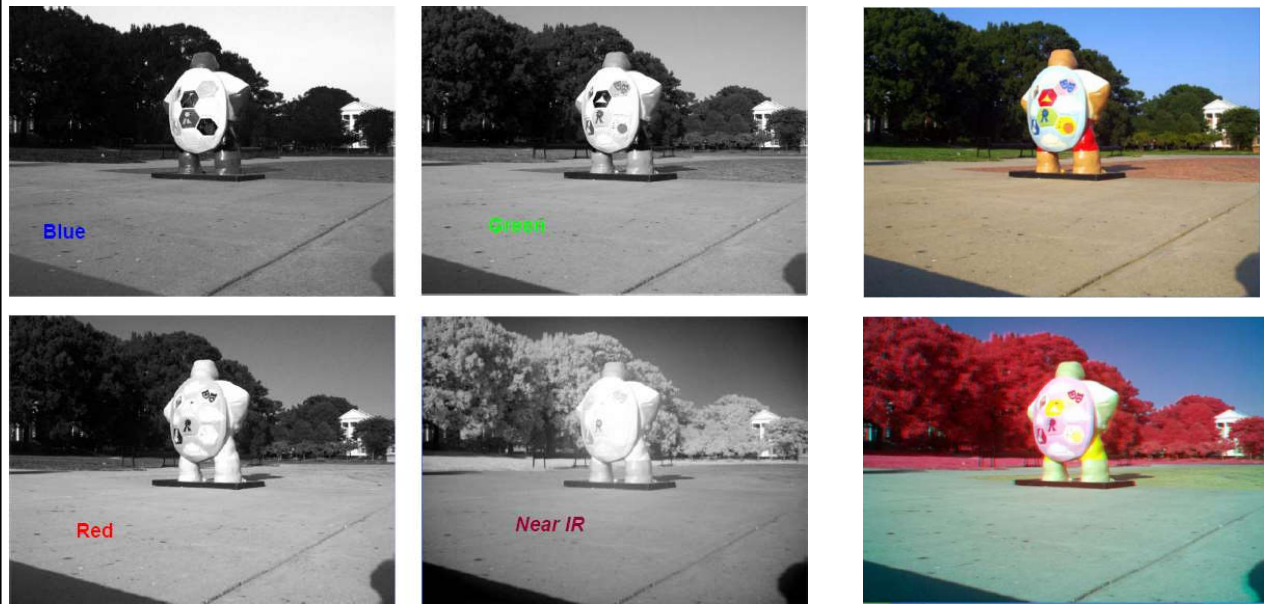


Χαρακτηριστικά των δορυφορικών καταγραφών

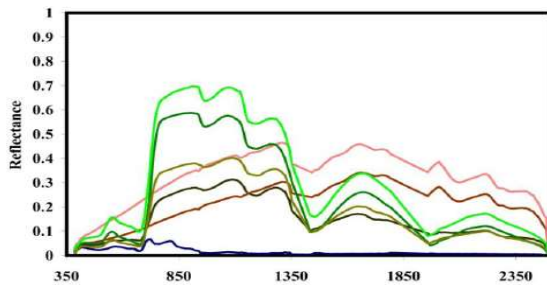


NIR band monochromatic image (0.7-1.0 μm)

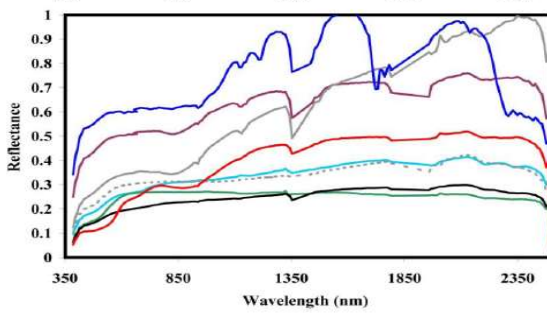
Χαρακτηριστικά των δορυφορικών καταγραφών



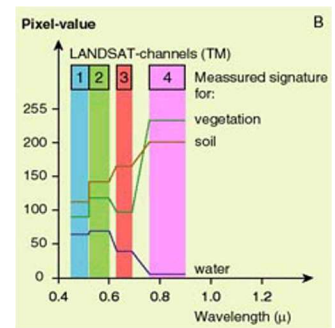
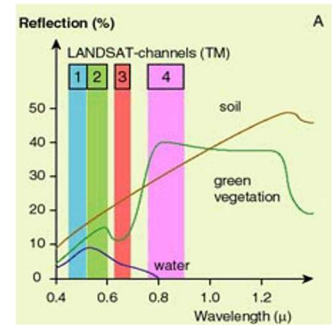
Χαρακτηριστικά των δορυφορικών καταγραφών



- Devereux_slough
- Eucalyptus
- tall_npv
- short_npv
- sports_field
- live_oak
- golf_course



- beach
- Albertsons_roof
- Rosses_roof
- asphalt_tarmack
- parking_lot
- grey_tile_roof
- Costco
- red_tile



Χαρακτηριστικά των δορυφορικών καταγραφών

CH 1
BLUE



CH 2
GREEN



CH 3
RED



CH 4
NIR



RGB: 4-3-2

Χαρακτηριστικά των δορυφορικών καταγραφών

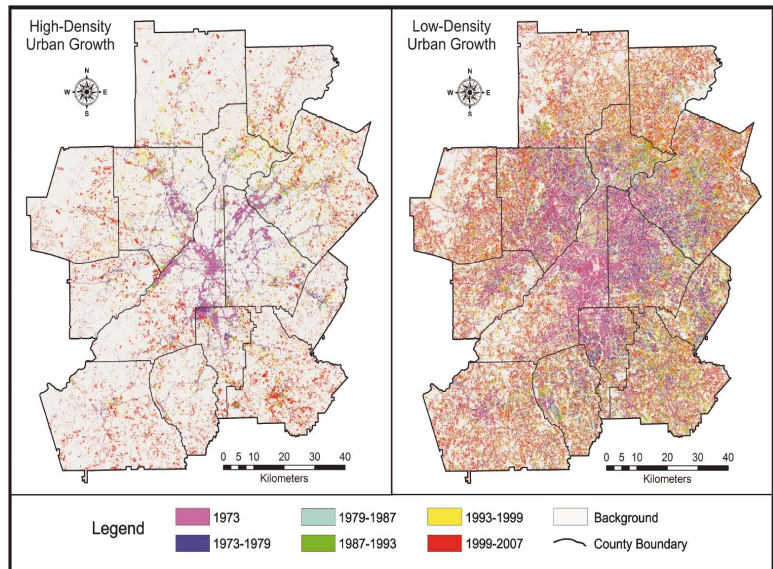
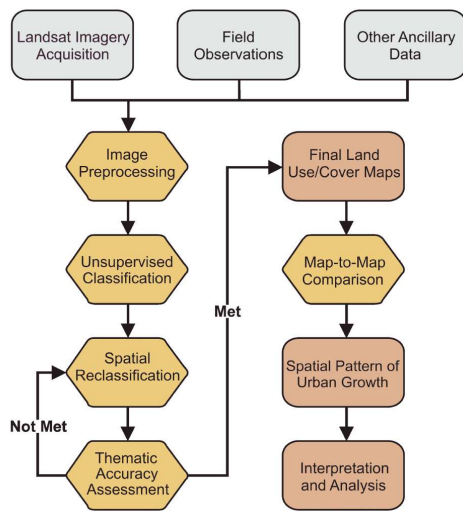


Landsat

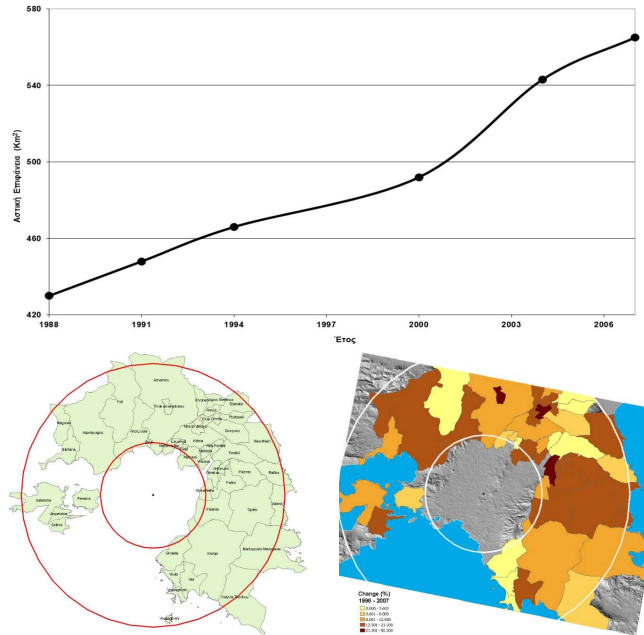
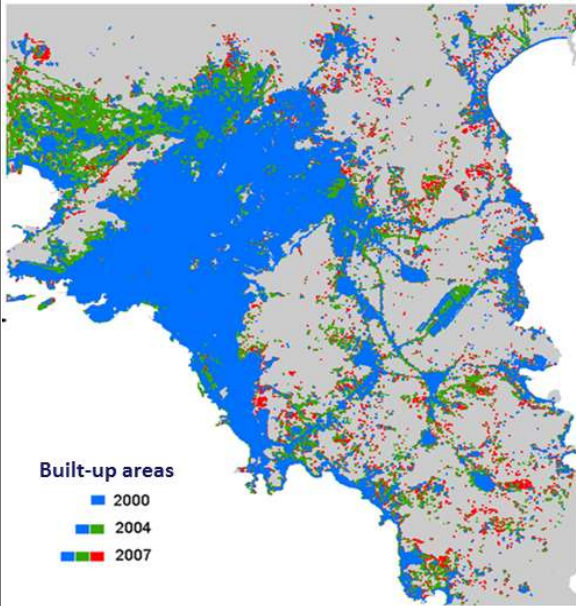
Landsat Missions: Imaging the Earth Since 1972

The screenshot displays the USGS EarthExplorer website. At the top, five circular images represent different Landsat missions: Landsat 1 (1973 - Peru Avalanche), Landsat 2 (1980 - Mt. St. Helens), Landsat 5 (2005 - Hurricane Katrina), Landsat 7 (2011 - Los Conchas Fire), and Landsat 8 (2015 - Dubai). Below these is a search interface with fields for 'Address/Place', 'Coordinates', and 'Date Range'. A 'Search Criteria Summary' map shows a satellite view of a coastal region with various urban and natural features labeled.

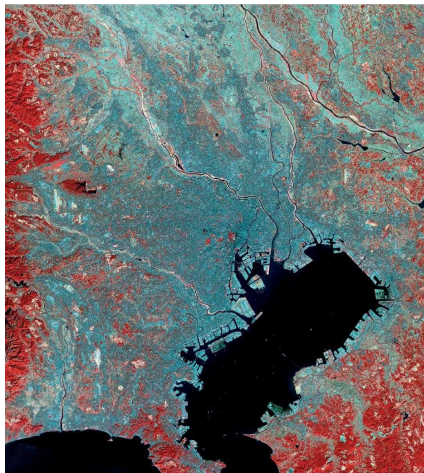
Landsat



Landsat



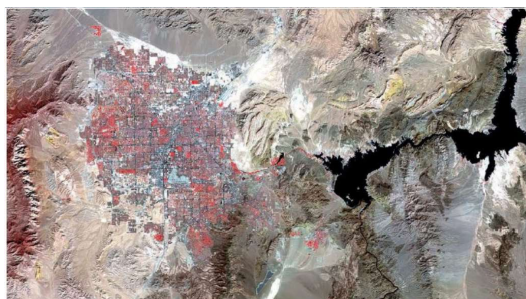
Landsat



Tokyo:
 - 1979: 28.169.000
 - 2017: 38.241.000

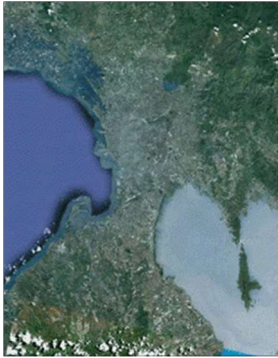


Lagos:
 - 1984: 3.291.000
 - 2015: 13.123.000

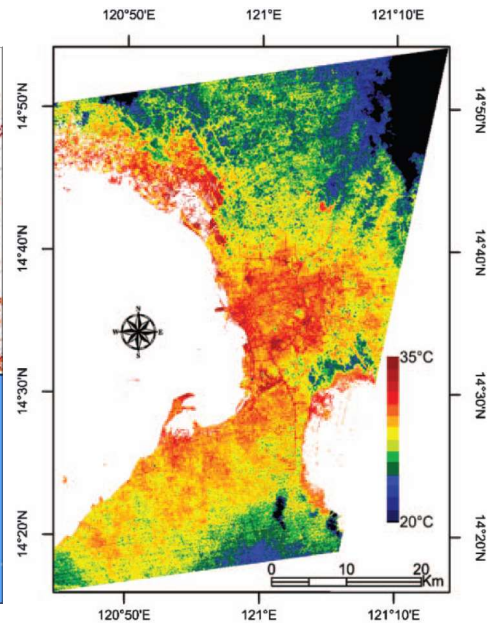
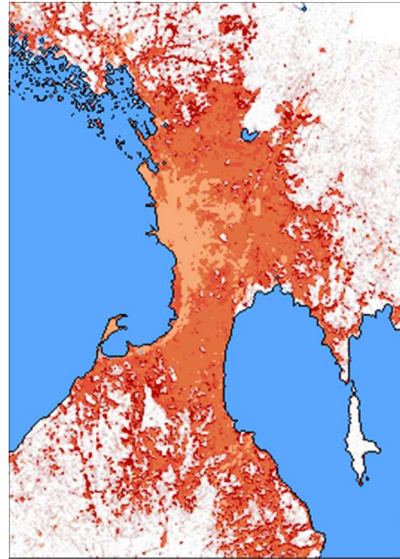


Las Vegas:
 - 1976: 345.000
 - 2015: 2.270.000

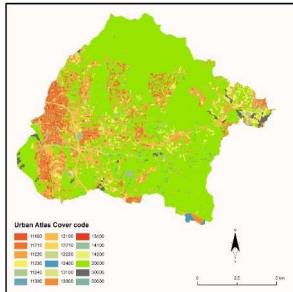
Landsat



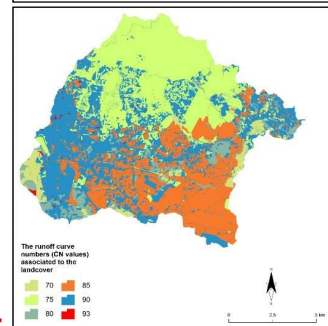
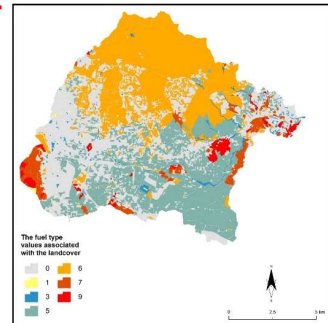
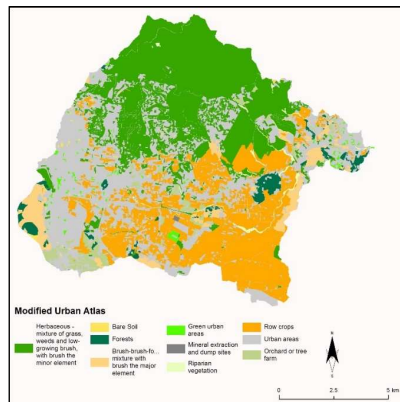
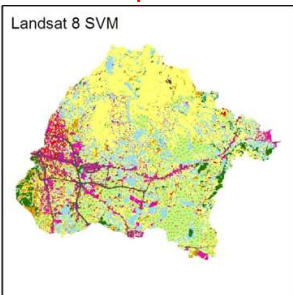
2010
2000
1990
1975



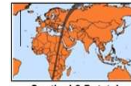
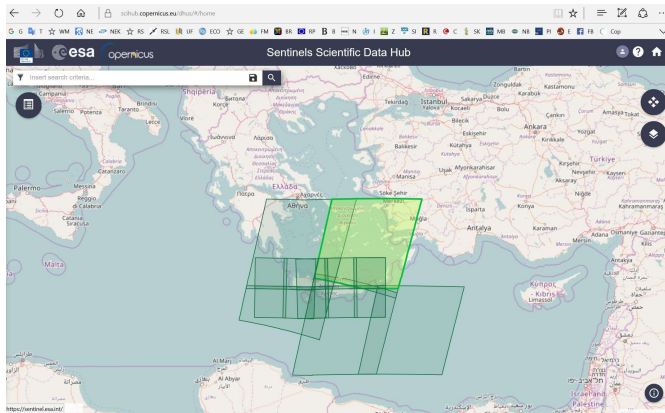
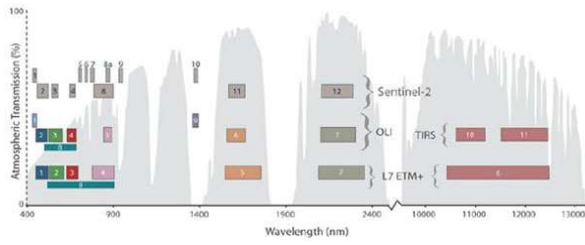
Landsat



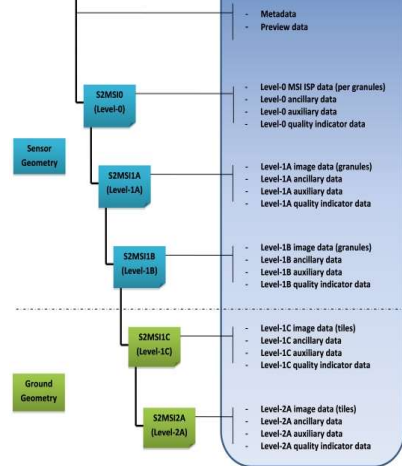
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Sentinel 2



Sentinel-2 Datatake

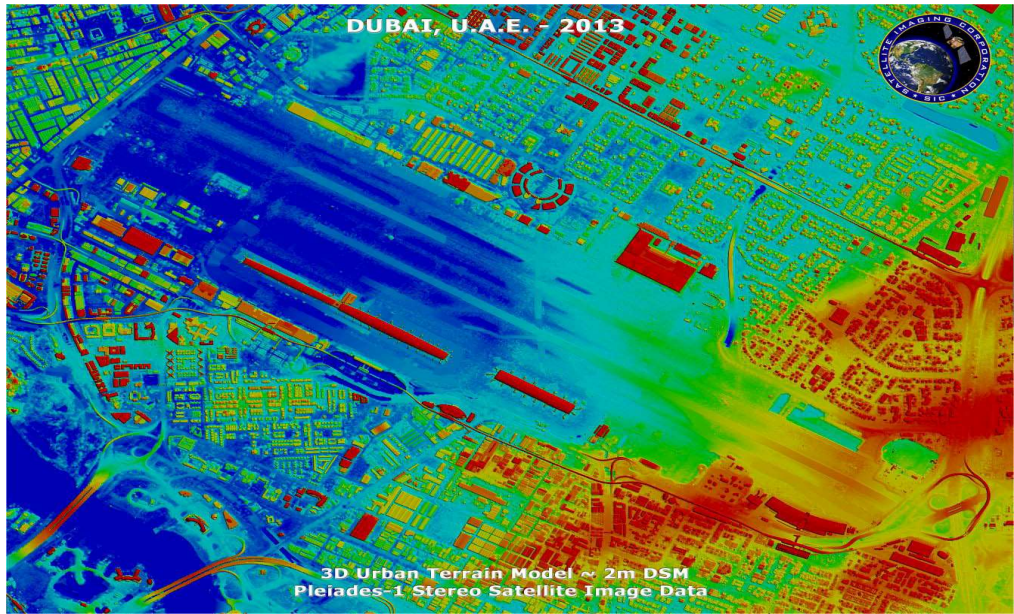


Sentinel 2



VHR Optical Sensors

WorldView-4 (0.31m)
WorldView-3 (0.31m)
WorldView-2 (0.46m)
WorldView-1 (0.46m)
GeoEye-1 (0.46m)
Pleiades-1A (0.5m)
Pleiades-1B (0.5m)
SuperView-1 (0.5m)
KOMPSAT-3A (0.55m)
KOMPSAT-3 (0.7m)
QuickBird (0.65m)
Gaofen-2 (0.8m)
TripleSat (0.8m)
IKONOS (0.82m)
SkySat-1 (0.8m)
SkySat-2 (0.8m)



VHR Optical Sensors

Commercial

Industrial

Transportation



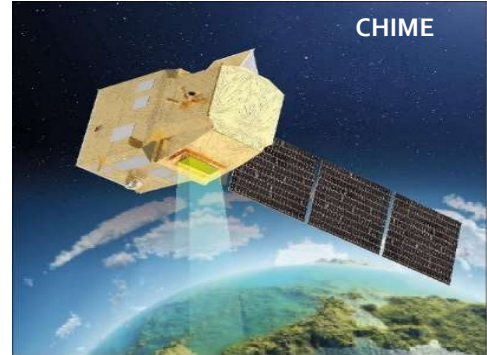
High-density residential

Med-density residential

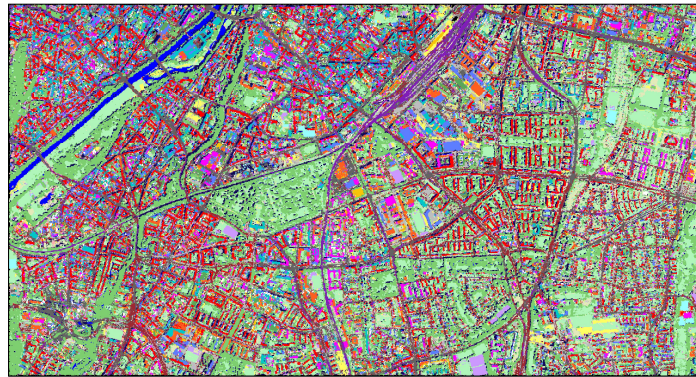
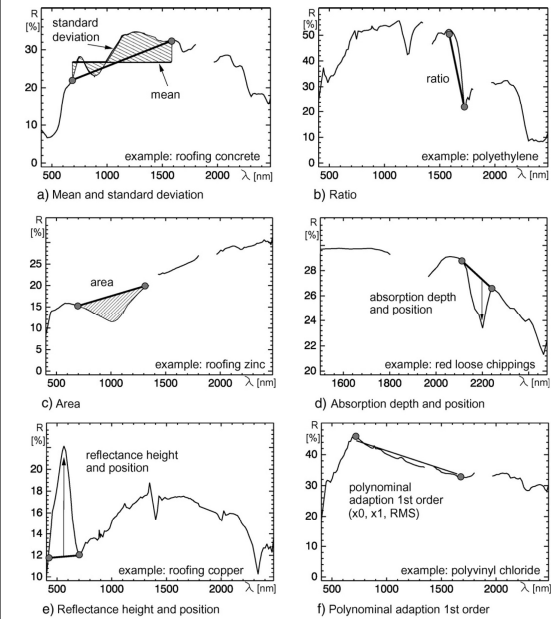
Low-density residential

Hyperspectral Sensors

Level 1	Level 2: Land cover types	Level 3: Material types	Level 4: Surface materials
Man-made/artificial surfaces	Buildings/roofs	Mineral materials	Asbestos Blumen roof sheeting Clay tiles Concrete slabs Concrete tiles Fiber cement Glass Gravel Slate
		Metallic materials	Aluminum Copper Zinc Steel with protective coating Coated metal sheet Lead Gold leaf Tin
		Hydrocarbon materials	Coated corrugated metal sheet (PVC, Polyethylene, coating coat) Polystyrolide (PS) Polyethylene (PE) Polyisobutylene (PIB) Pentglas Tar Paper
	Biomass materials	Green roof Thatched roof Wood shingles	
Artificial open spaces	Partially impervious surfaces	Gravel Clay-baked paving stones Cobblestone pavement Concrete paving stones Gravel Grass pavers Loose chippings Railway tracks	
	Fully impervious surfaces	Asphalt Concrete Flagstone (Granite) Synthetic turf Tartan	
	Water bodies with artificial bottom	Pool Garden pond	

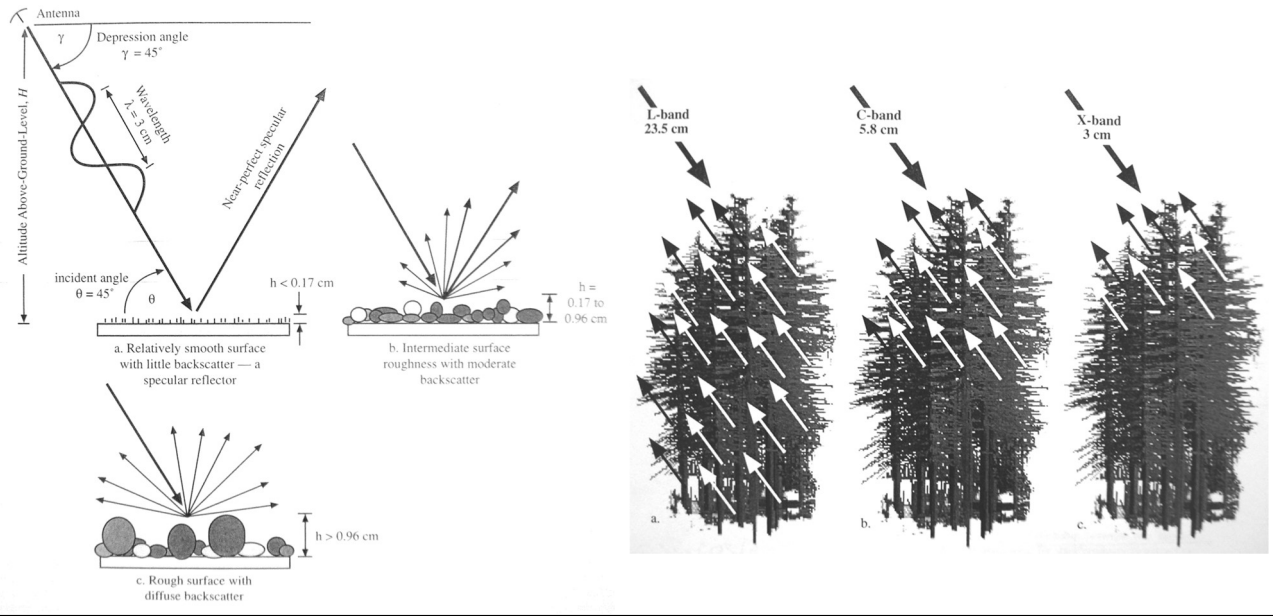


Hyperspectral Sensors

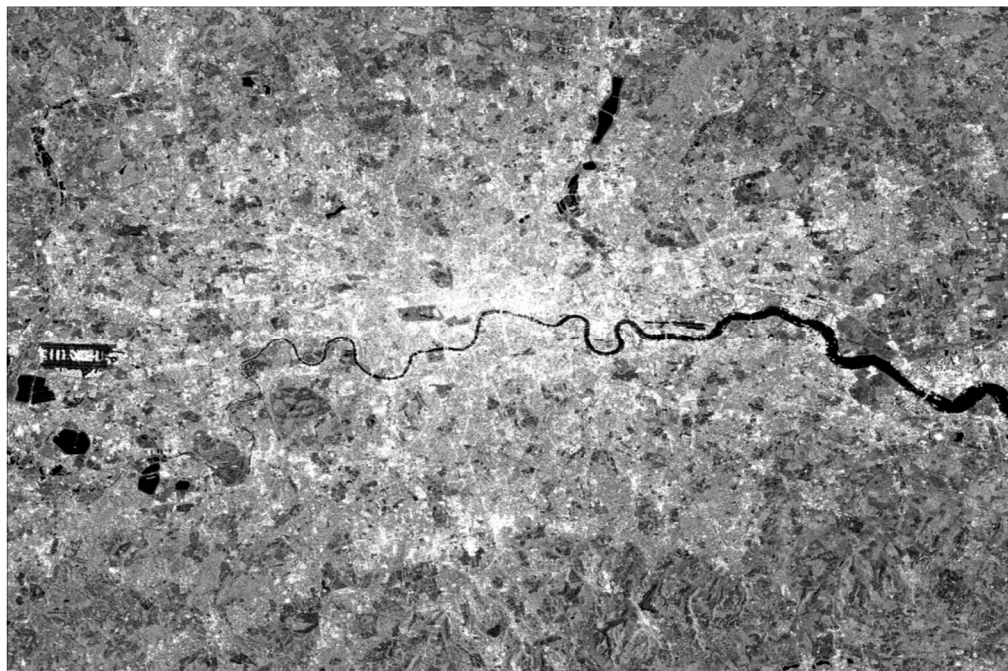


- Roofing tiles
- Tartan/ synthetic turf/polyethylene surfaces
- Roofing concrete
- Loose chippings
- Roofing metal
- Railway tracks
- Roofing bitumen / tar
- Sand/soil
- Roofing synthetic / glass
- Vegetated roof
- Trees
- Roofing gravel
- Lawn
- Unknown
- Water
- Concrete
- Shadow
- Asphalt

SAR



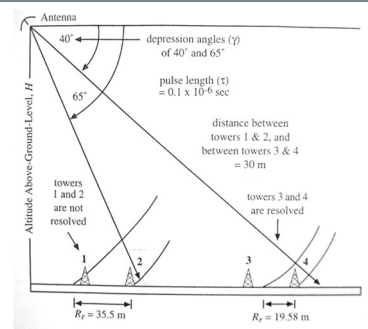
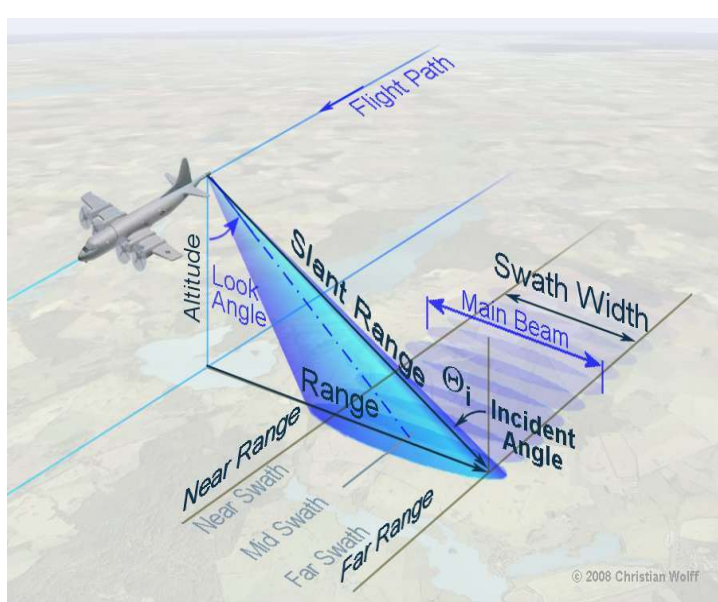
SAR



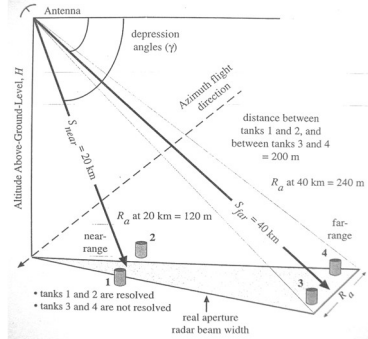
SAR



SAR

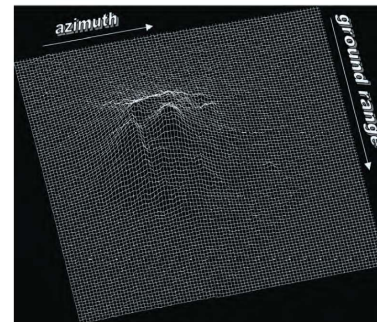
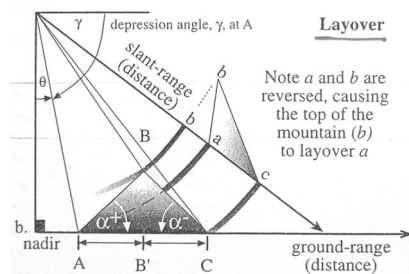
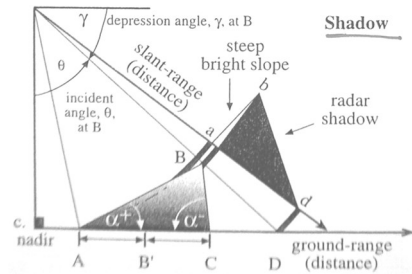
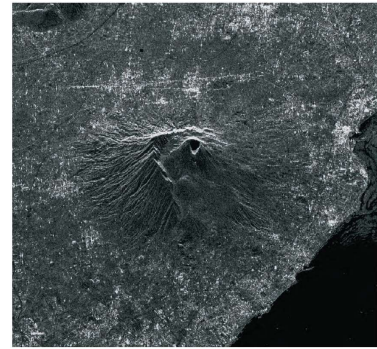
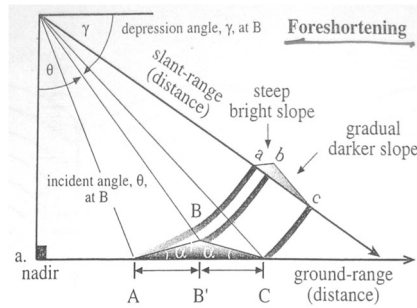


$$R_r = \frac{\tau c}{2 \cos \gamma}$$



$$R_a = \frac{H \lambda}{\sin \gamma L}$$

SAR



$a^- > \gamma$

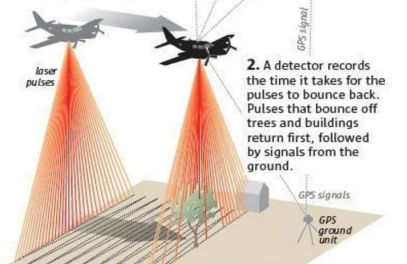
$\theta < \alpha^+$

LiDAR

How lidar works

Lidar (light detection and ranging) uses an aircraft equipped with a scanning laser rangefinder to "peer" through forests and construct a topographic map accurate to within a few inches.

1. The laser fires up to 150,000 harmless, invisible pulses per second at the ground while the aircraft flies a precise grid guided by GPS and an inertial navigation system.



COST: \$500-\$1,000 per square mile.

Sources: USGS, Snohomish County Information Services, lidar.ok.com, NASA's Goddard Space Flight Center, pu.getsoundlidar.ess.washington.edu/About_LIDAR.htm

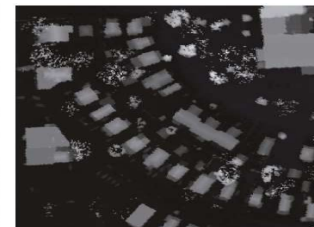
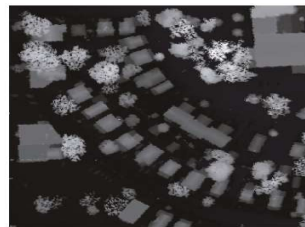
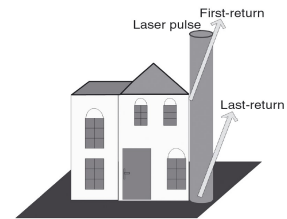
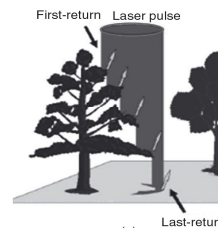
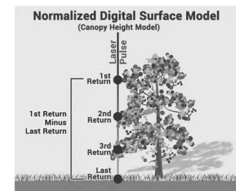
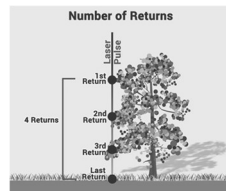
A sharper view
 These three images of the Oso slide area (taken before Saturday's slide) illustrate lidar's superiority over aerial photos or contour maps.

AERIAL/SATELLITE IMAGE
 2013 USDA Ortho Imagery

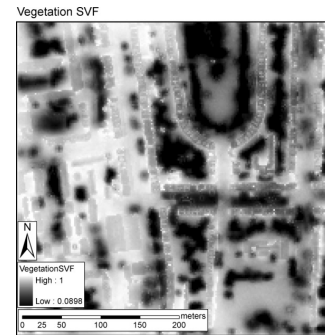
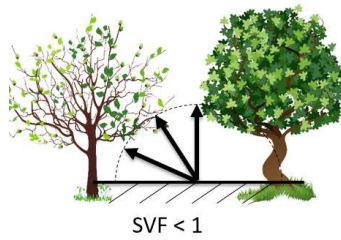
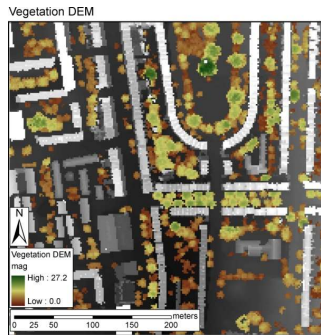
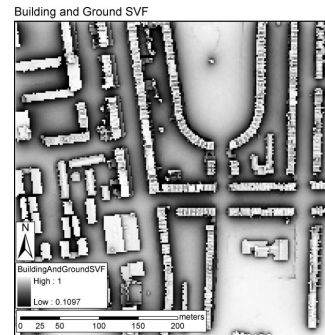
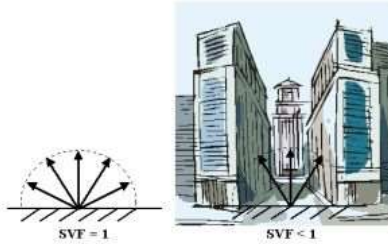
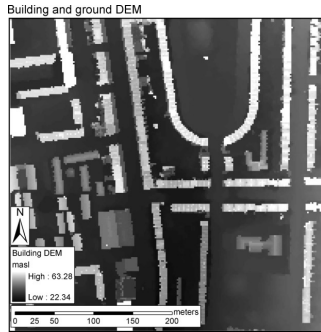
STANDARD CONTOUR TOPOGRAPHY IMAGE
 Elevation model derived from 1:24,000-scale USGS topographic map contours

LIDAR IMAGE
 Calculated from the 2013 lidar survey

MARK NOWLIN / THE SEATTLE TIMES

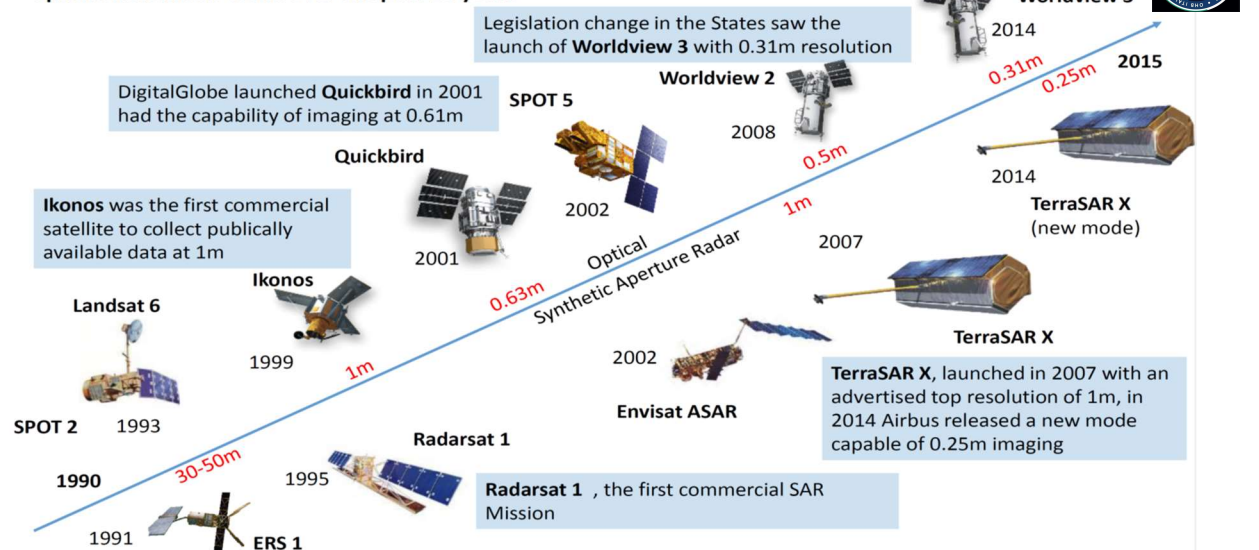


LiDAR

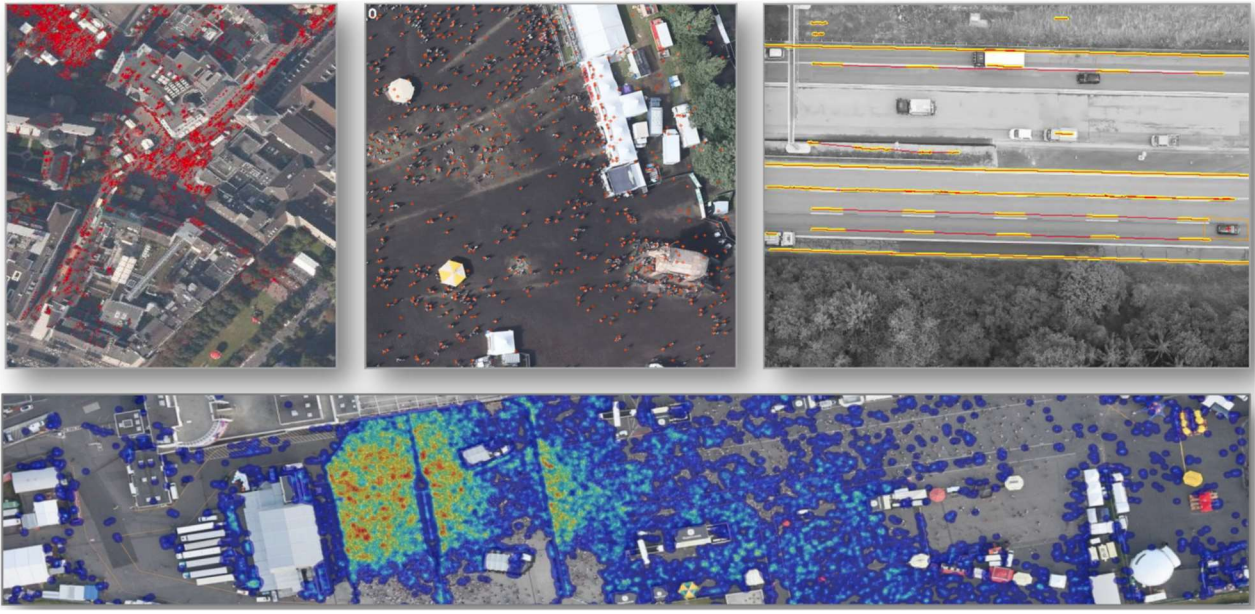


Future trends

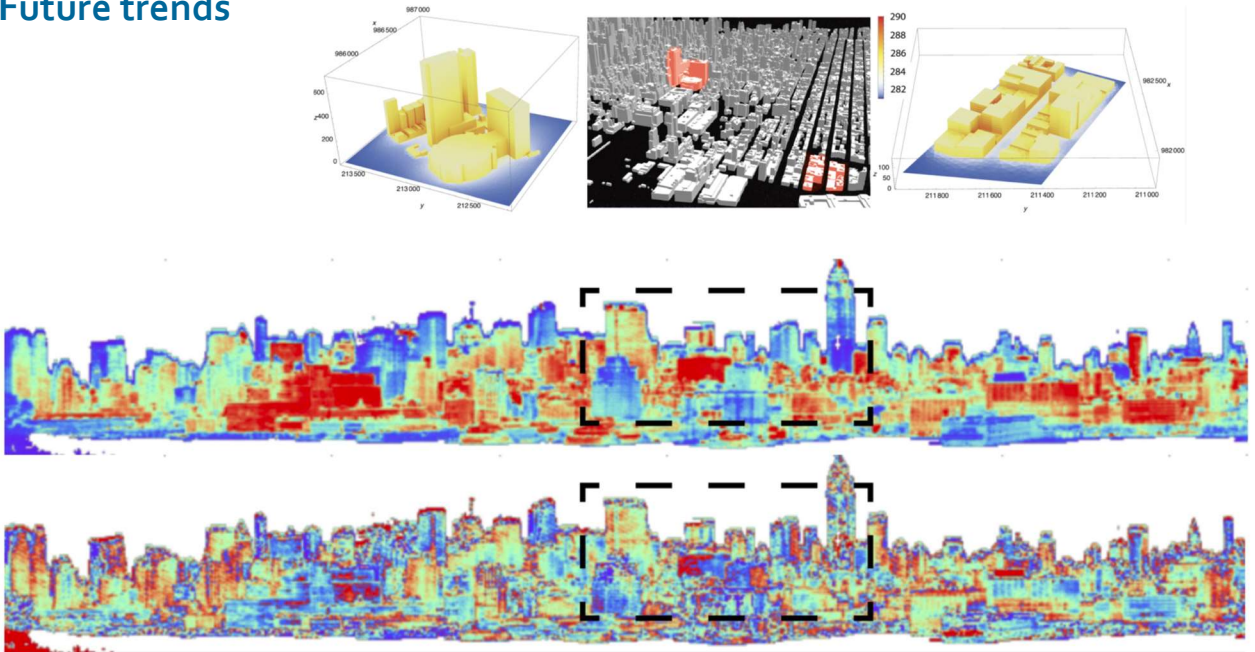
Spatial Resolution Trend over the past 15 years



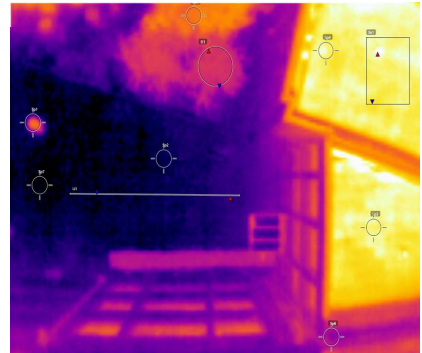
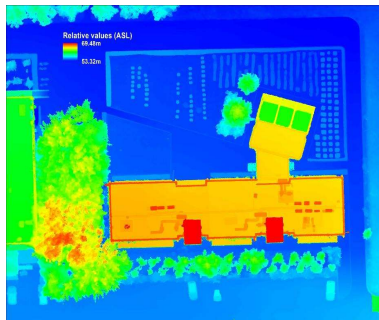
Future trends



Future trends



Future trends



Future trends



EO Expert

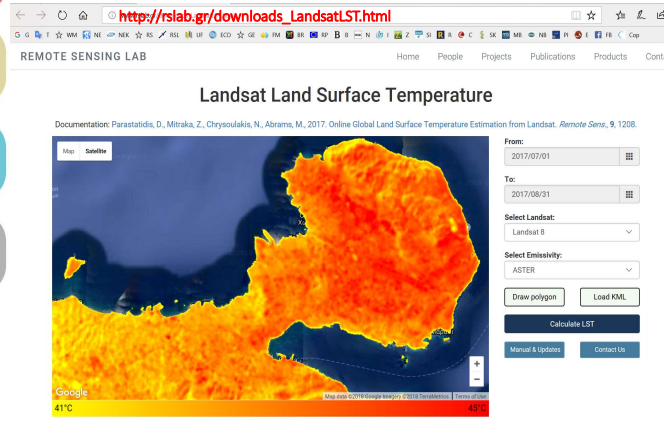
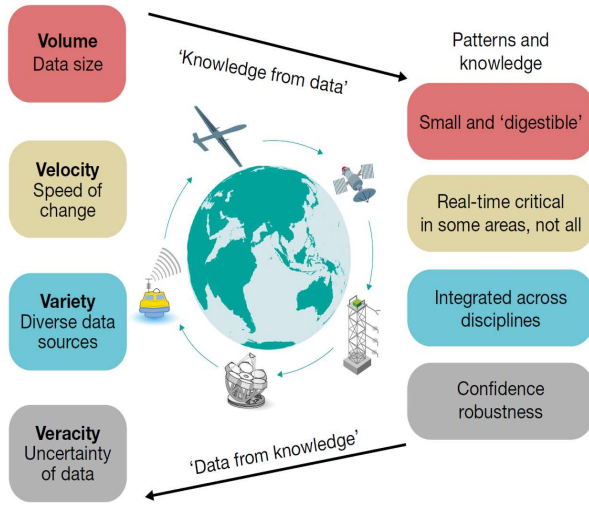


Training data

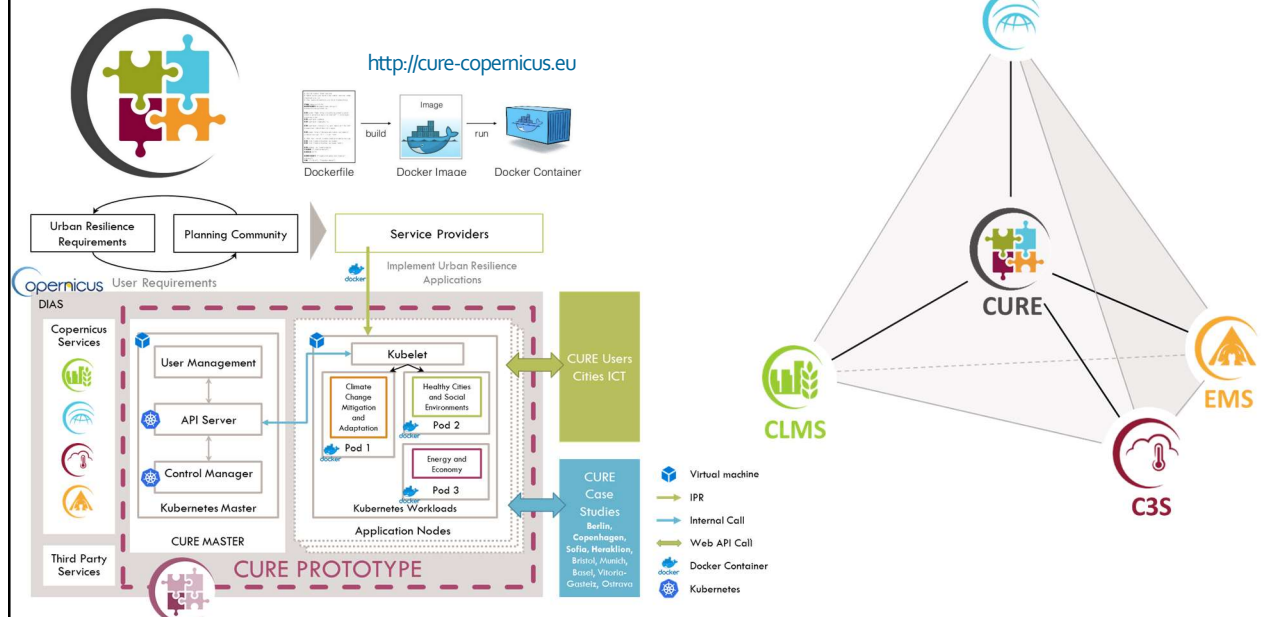


AI expert

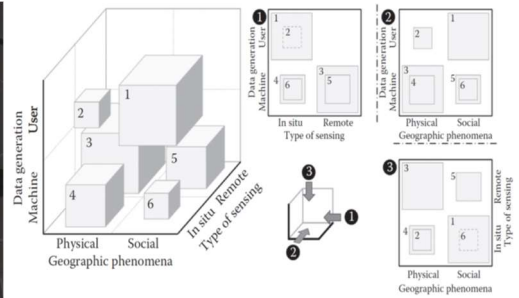
Future trends



Future trends



Future trends



1. VGI and mobile network traffic
2. VGI in the context of environmental status updates
3. Satellite imagery
4. Measurements from sensors and sensor networks
5. Human settlements extracted from satellite imagery
6. Counter data at entrances and exits of shopping malls, public transport.

Future trends



Global Research and Action Agenda on Cities and Climate Change Science

Crosscutting Urban Action Integrate Communicate

Cities and Climate Change

Full Version

GHG Monitoring from Space

Joint report by the Group on Earth Observations (GEO), Climate TRACE and the World Geospatial Industry Council (WGIC)

A mapping of capabilities across public, private, and hybrid satellite missions

Future trends



A screenshot of the Planet website. The Planet logo is in the top left. Navigation links include "PRODUCTS", "SOLUTIONS", "PARTNERS", "INVESTORS", and "COMPANY". A "Real-Time Satellite Monitoring with Planet" section is featured, with a sub-headline: "With 180+ Dove satellites in orbit, PlanetScope Monitoring provides a high-resolution, continuous, and complete view of the world from above, every day." To the right of the text is a satellite imagery interface showing a map of a coastal region and a data panel.

Albedo wins license to sell 10-centimeter imagery

by Debra Welmer — December 14, 2021



A screenshot of the SATellite VU website. The background is a high-resolution thermal satellite image of a city. The SATellite VU logo is in the top left. "PRESS SERVICES" is in the top right. The main headline reads: "An Earth Observation Company Bringing the Highest Resolution Thermal Imagery and Insights".