

# Digital Earth

## GEOG-104

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8/22/2017

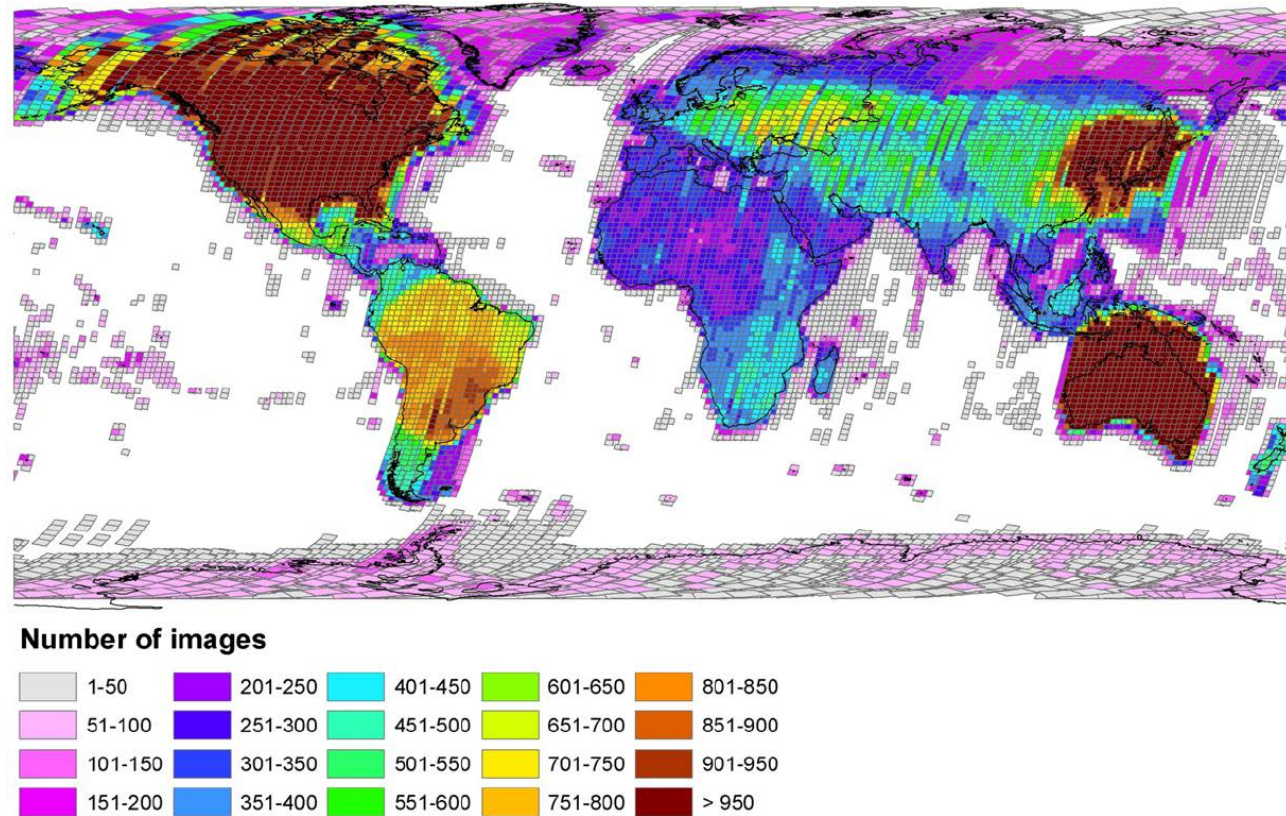
# Digital Earth

- What is Digital Earth?
- Why we need Digital Earth?



# The information explosion (the Big Data Era)

- As of January 1, 2015, the Landsat satellites have archived 5.5 million images (~4134TB).



USGS Landsat archive holdings as of January 1, 2015



# The information explosion (Big Data Era)

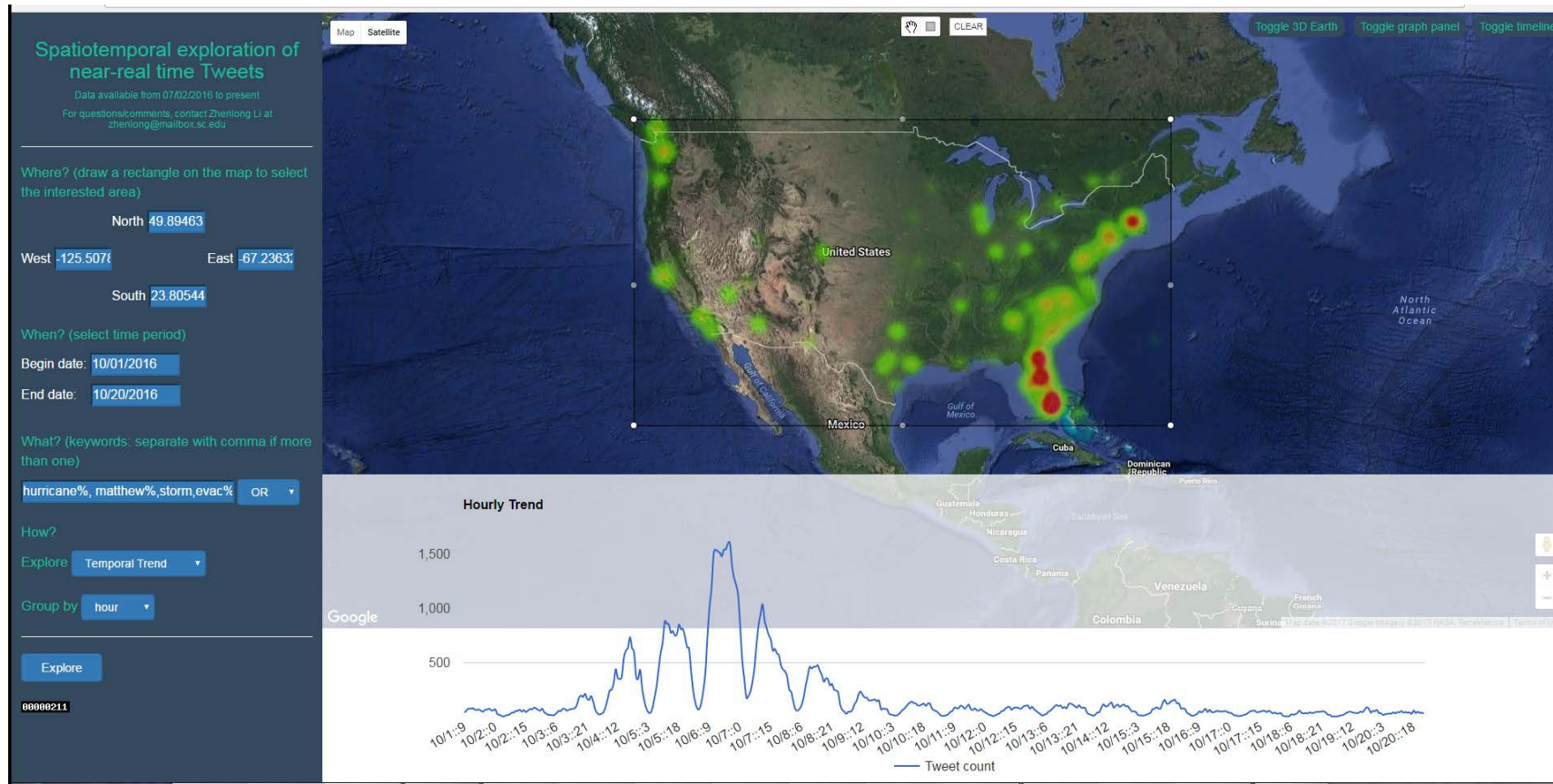
- DigitalGlobe has archived 100-**petabyte** high-resolution satellite imagery since 2017.



Worldview images acquired by DigitalGlobe

# The information explosion (Big Data Era)

- In Twitter, people post 500 million tweets per day and around 5% can be directly geocoded.



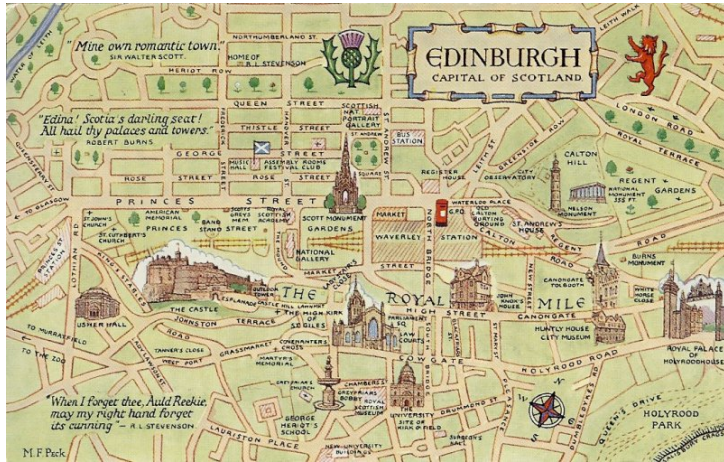
Spatial and temporal distribution of Hurricane Matthew related tweets

# The capacity of our brain

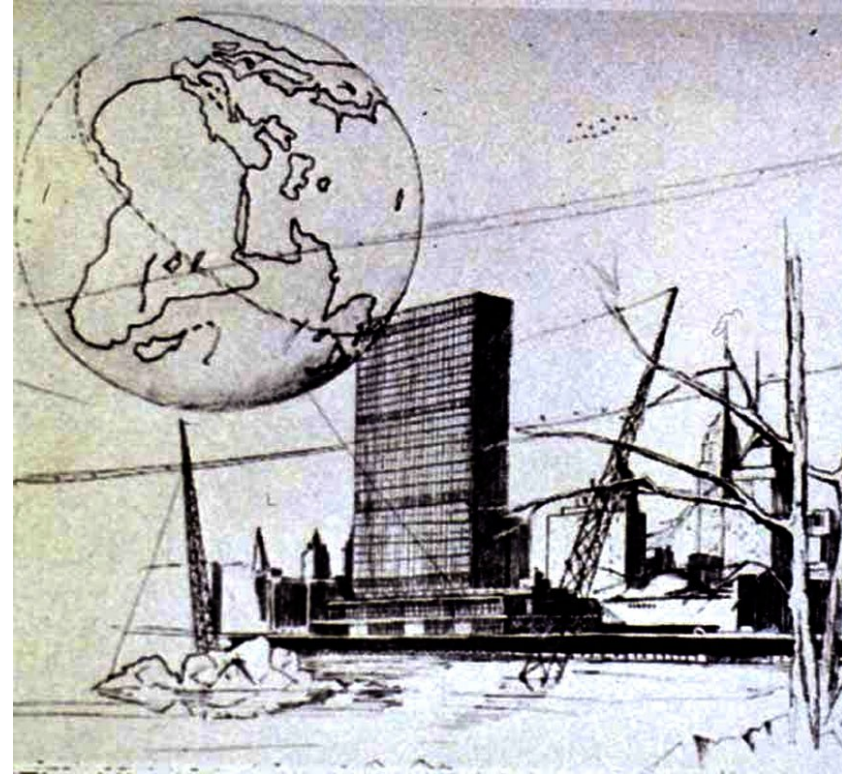




# Traditional models of the Earth



# Buckminster's Geoscope



"... a large two-hundred-foot diameter (or more) lightweight geodesic sphere hung hoveringly at one hundred feet above mid-campus by approximately invisible cables from three remote masts. This giant sphere is a miniature earth. Its entire exterior and interior surfaces will be covered with closely-packed electric bulbs, each with variable intensity controls. The lighting of the bulbs is scanningly controlled through an electric computer." — R. Buckminster Fuller, 1962

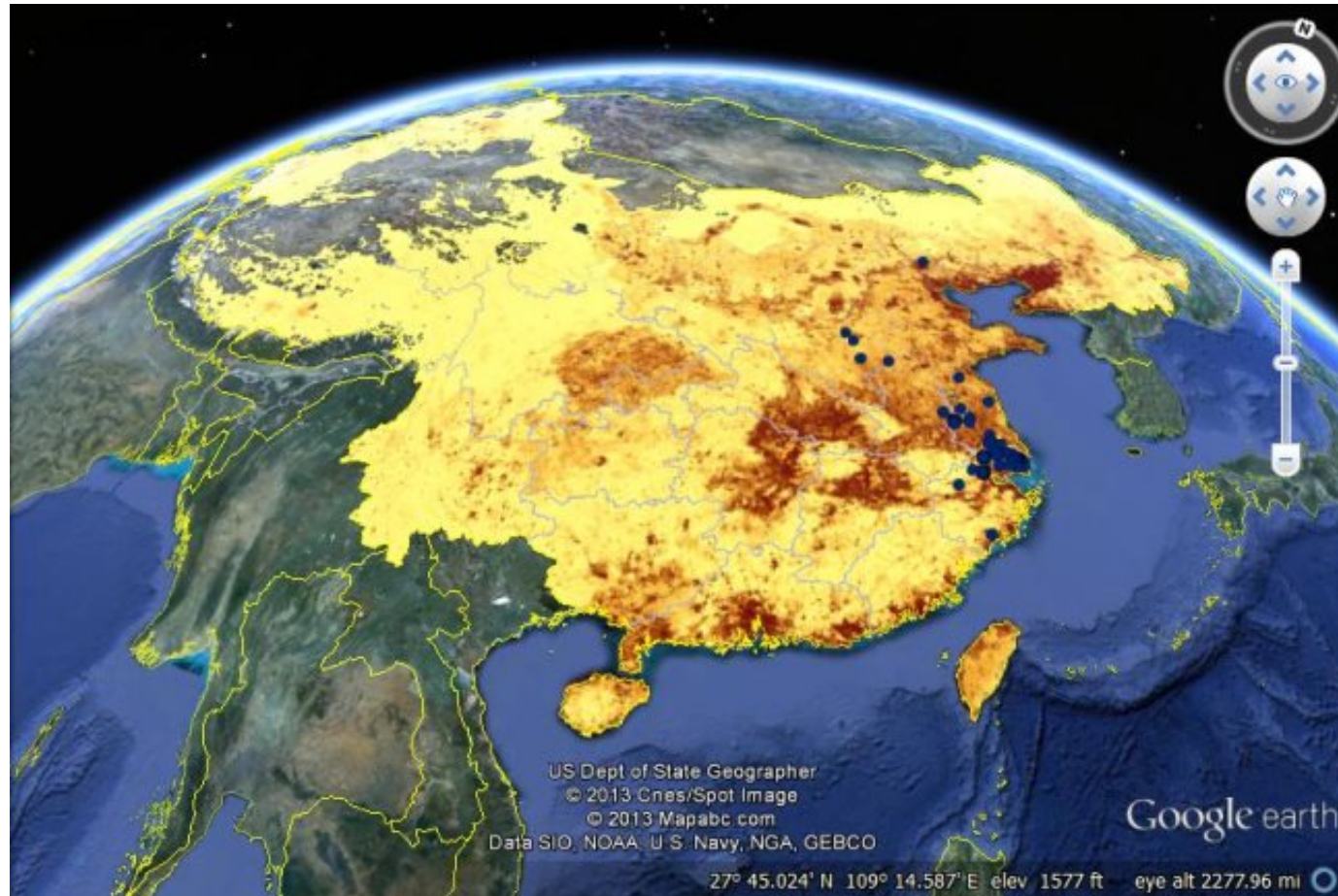


# Mapparium: a inside view of the world



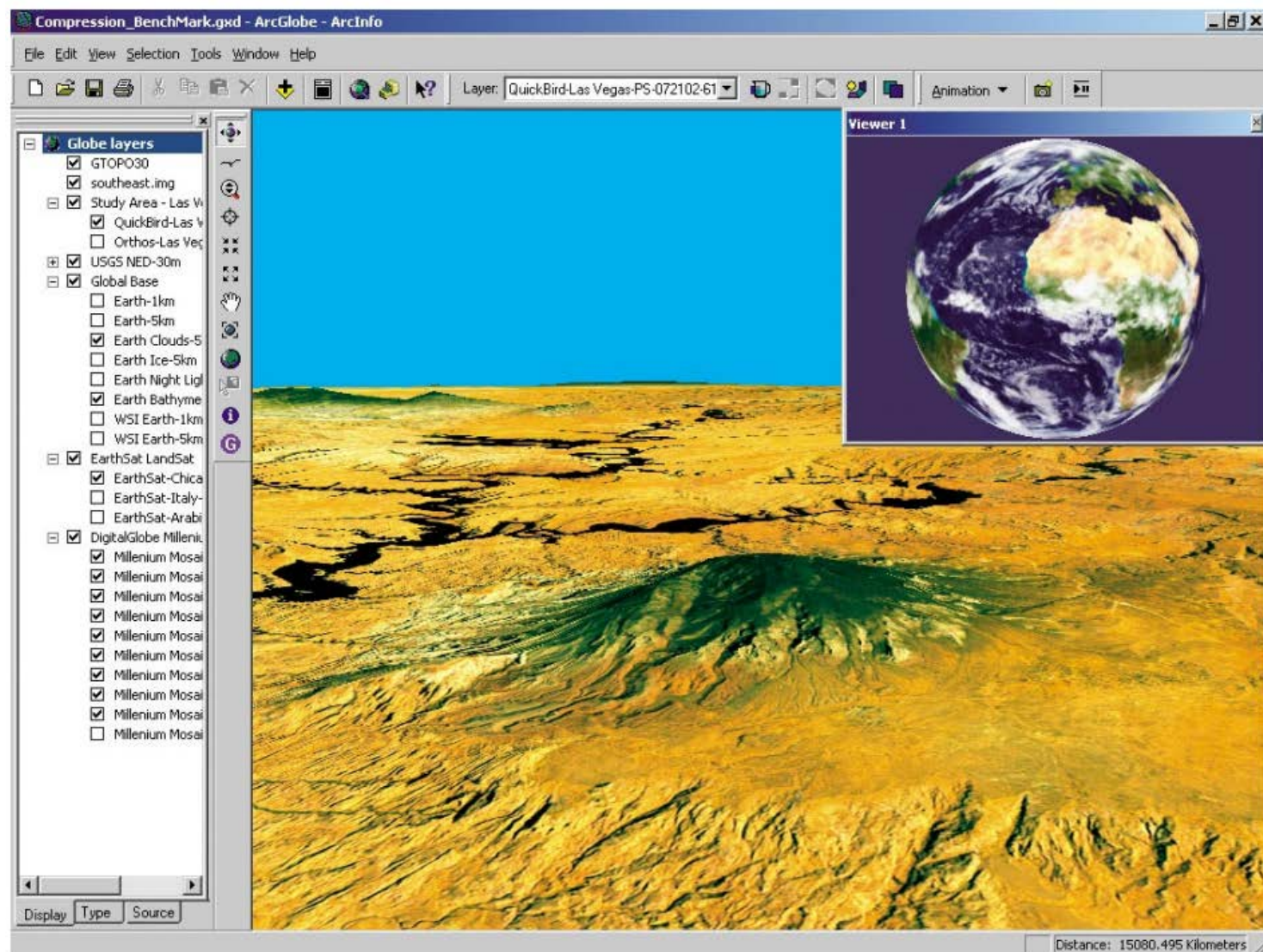
- A three-story-tall globe made of stained glass that is viewed from a 30-foot-long (9.1 m) bridge through its interior.
- Shows the political world in 1935 with orchestration of words, music, and LED lights

# Google Earth



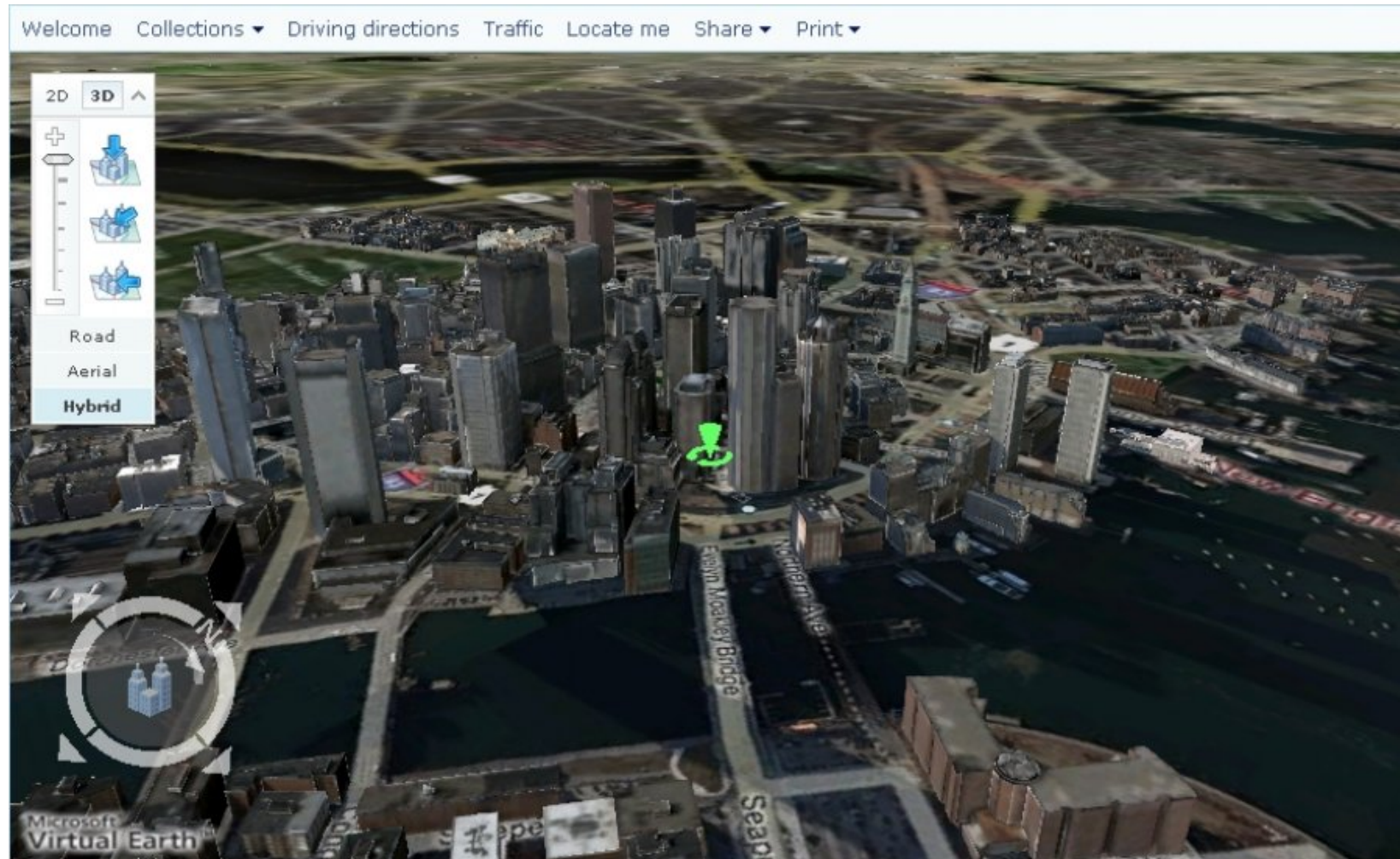


# ArcGlobe (ESRI)

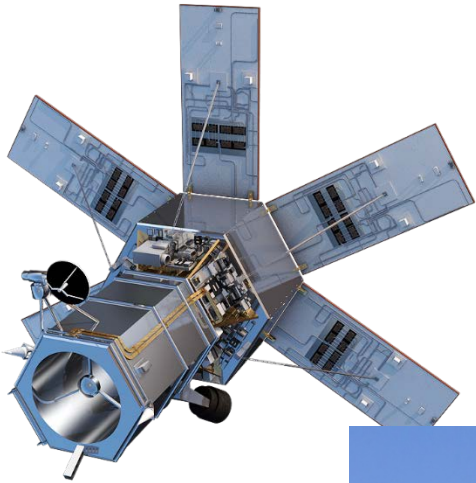




# Virtual Earth (Microsoft)



# Earth Observation Techniques



# Storage of the Big Data





# Cyberinfrastructure (distributed computing)



# What is Digital Earth

Originated from a speech by Al Gore at Los Angeles on January 31, 1998.

- New technologies allow us to capture, store, process and display an unprecedented amount of information about our planet.
- Much of this information is "georeferenced" - that is, it will refer to some specific place on the Earth's surface.
- Processing such vast amount of information is beyond the capacity of human brains and other media – it has to be done by computers.

# What can the Digital Earth do?

- 3-D representation of the planet, into which we can embed vast quantities of geo-referenced data
- Higher and higher levels of resolution to see continents, then regions, countries, cities, and finally individual houses, trees
- Moves backward in time to learn about history, perusing digitized maps overlaid on the surface of the Digital Earth, newsreel footage, oral history, newspapers and other sources.
- It is a "collaboratory"-- a laboratory without walls — for research scientists to share, integrate and interoperate their data and models.
- Based on the advancement of computer science, earth observation, global positioning system, the internet, and cyberinfrastructure.

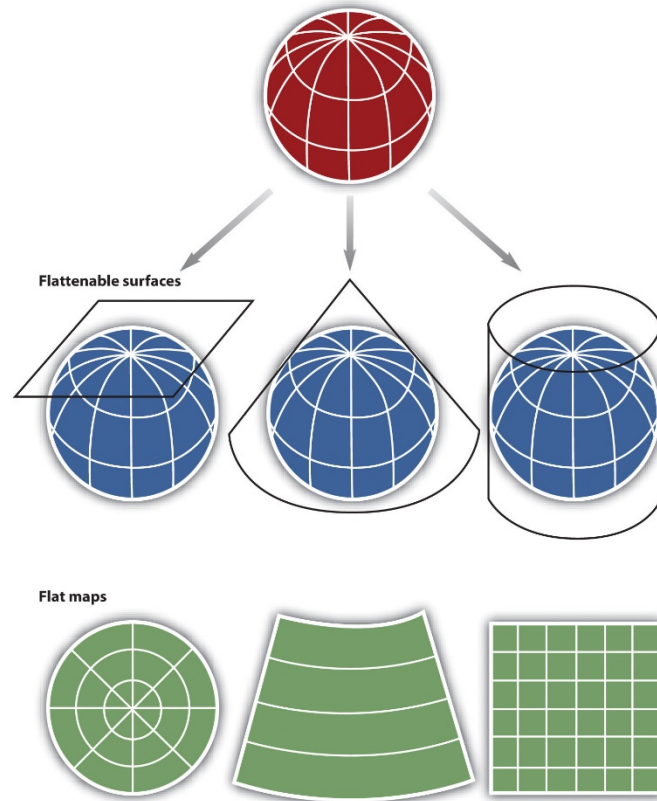


# This course will include

- Common methods to digitalize the Earth – how we code the Earth as mathematical and computer models.
- Digital mapping techniques to represent human and environmental interactions on the Earth.
- Basic skills of using geographical information systems (GIS) to analyze geospatial data.
- Emerging technologies to collect, process, manage and analyze the vast amount of information about the Earth.

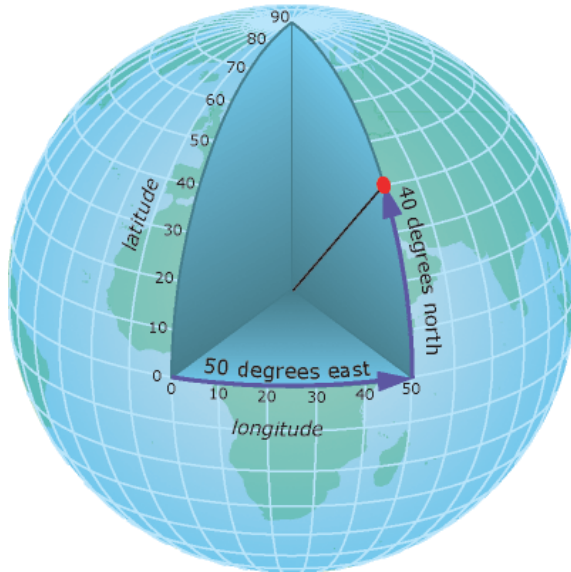
# This course will include

- Map projections

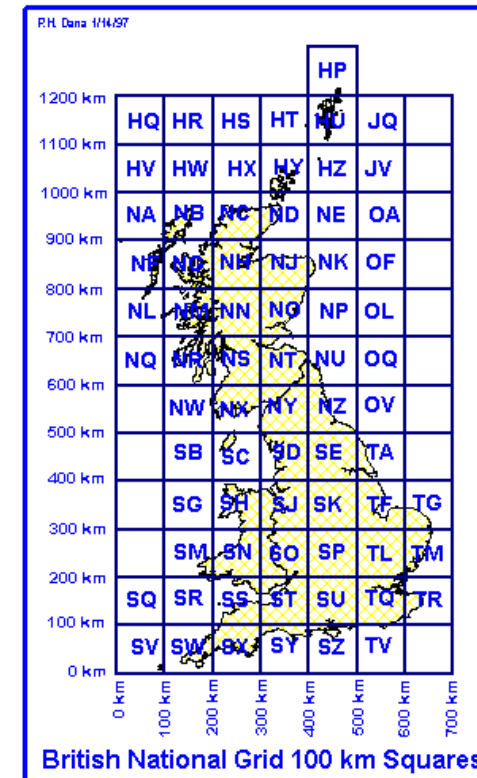


# This course will include

- Georeferencing and coordinate systems



Geographic coordinate system

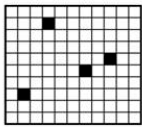

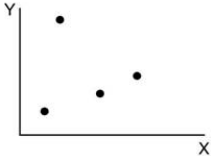
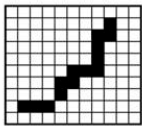


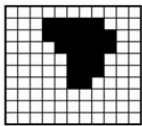
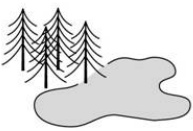
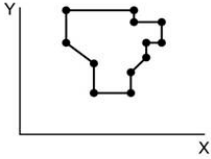
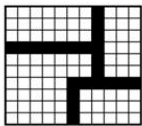
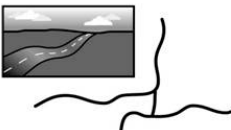
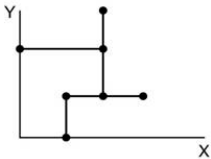
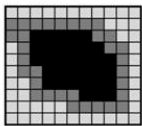

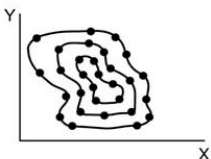


National Grid of UK



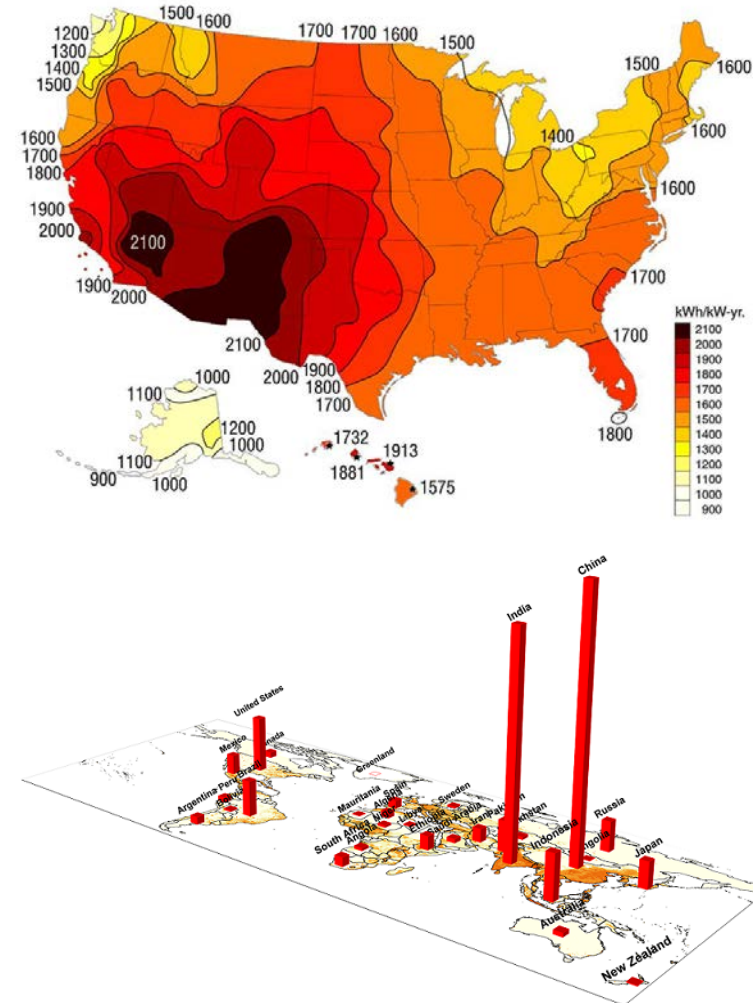
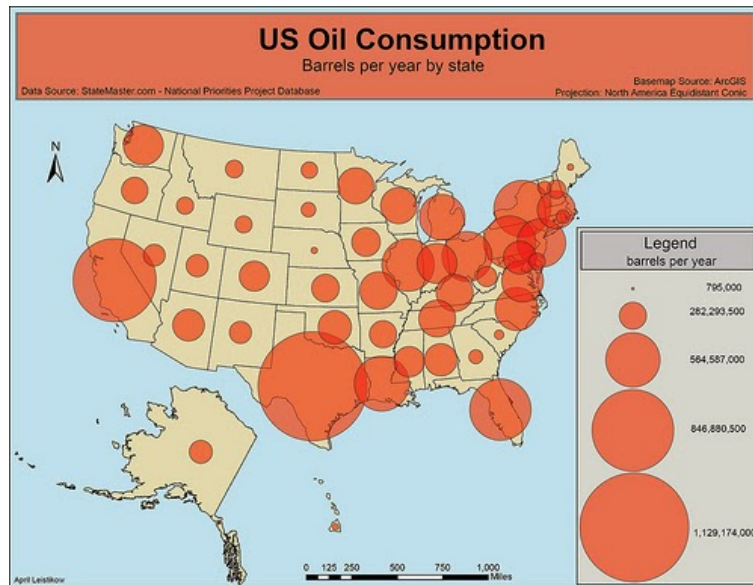
# This course will include

- The representations of space

The raster view of the world	Happy Valley spatial entities	The vector view of the world
	 x x Points: hotels	
	 Lines: ski lifts	
	 Areas: forest	
	 Network: roads	
	 Surface: elevation	

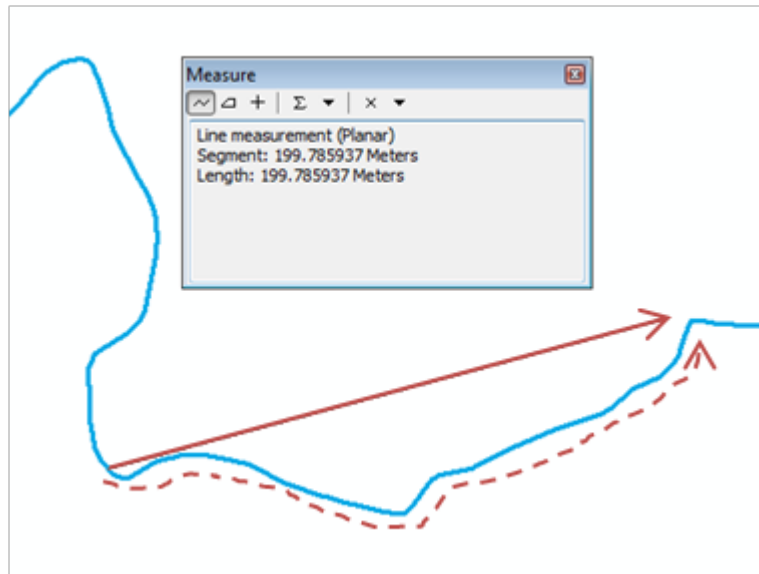
# This course will include

- Reading and creating mapping



# This course will include

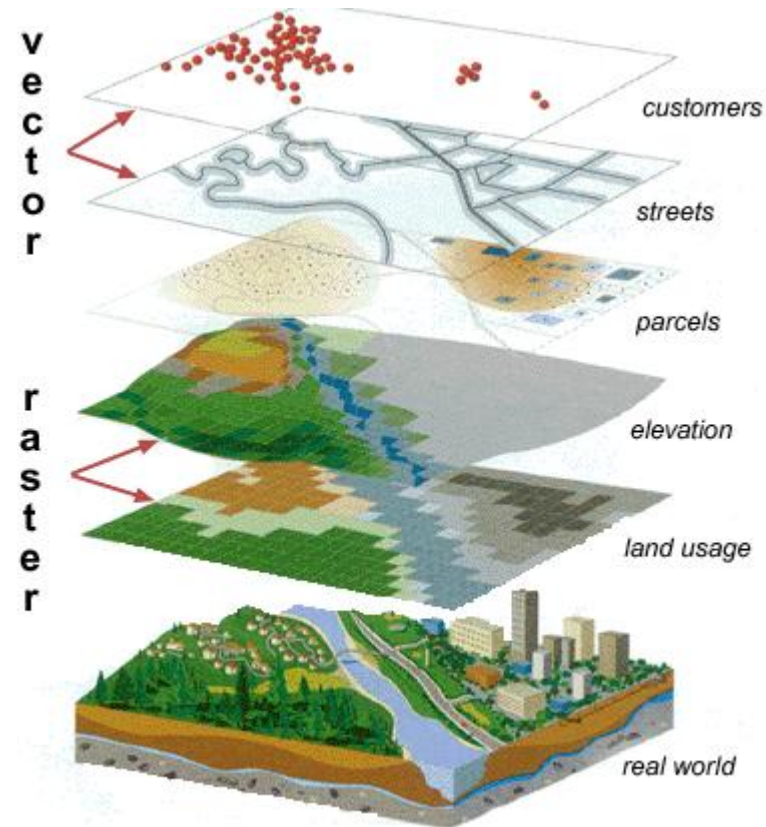
- Measurement and analysis in map





# This course will include

- Geographic information systems



# This course will include

- Mobile maps and location-based service



# This course will include

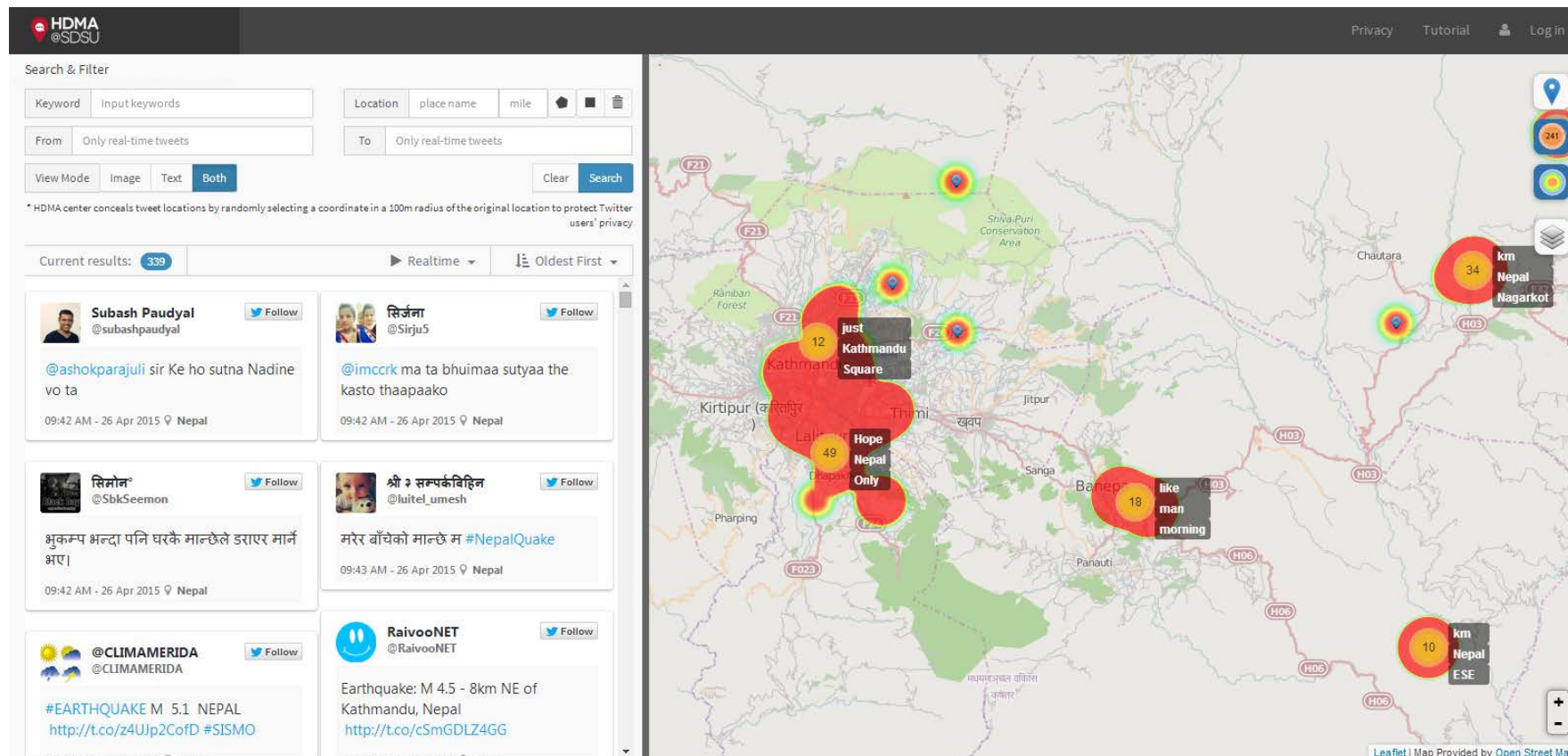
- Volunteer-GIS or public-participating GIS





# This course will include

- Crowdsourced data (e.g. social media data)



# Approaches to Lectures & Labs

- An overview of geospatial technologies and trending development
- Combination of theories, applications and case studies
- Including both lectures and lab exercises
- Home assignments will be given weekly
- After-class readings will be recommended
- Evaluation will be based on home assignments, mid-term and final exams.

# Course rules

## **Do**

- Ask anytime when you have questions (raise your hands)
- Comments and open discussion is encouraged (raise your hands)
- Ask me questions after class (email or office hour)
- Submit your home assignments on time

## **Do not**

- Be late (>15min late deemed as absence)
- Talking out of the topic
- Use cell phone in class (mute your phone)
- Other disruptive behavior



# Evaluation

- 12 lab exercises/home assignments (60%)
- Mid-term (10%)
- Final (20%)
- Participation (10%)

# Social sensing in Twitter

Using Twitter to Track Eclipse Visitors to the Midlands