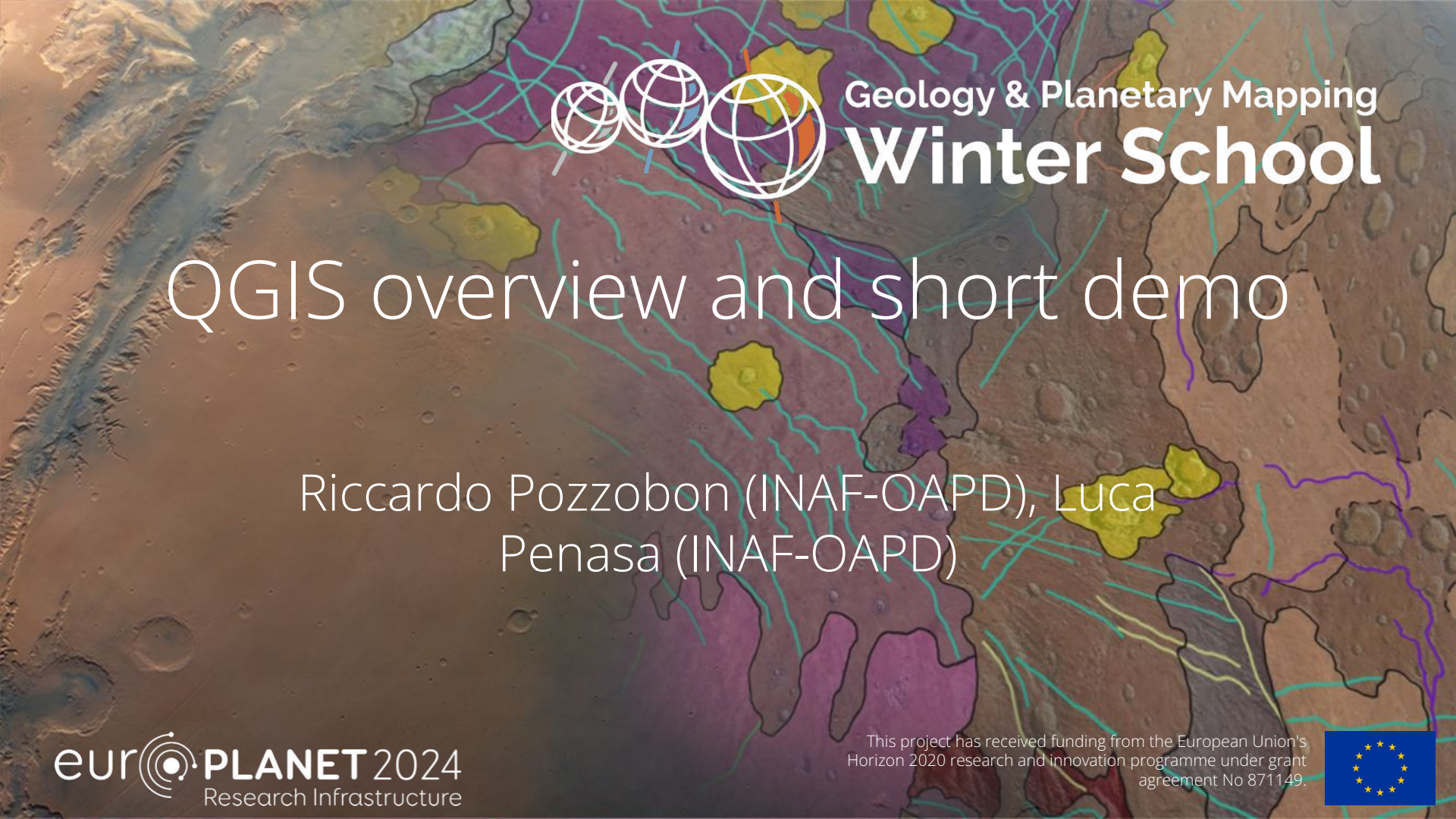

europlanet 2024
Research Infrastructure



Geology & Planetary Mapping
Winter School

QGIS overview and short demo

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EUROPLANET 2024 Research Infrastructure

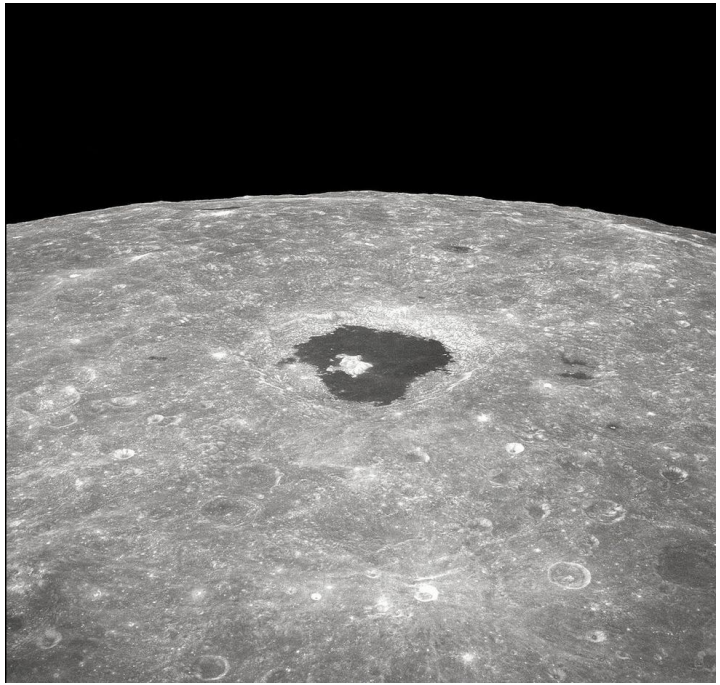
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871149.

Data for QGIS demo

The dataset:

Mappy + Trafficability

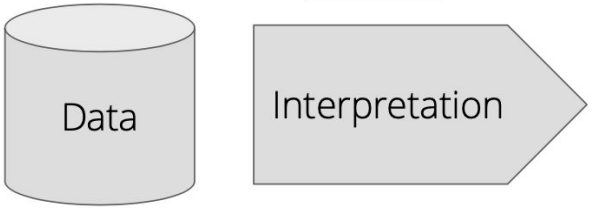
https://bit.ly/gmap_trafficability



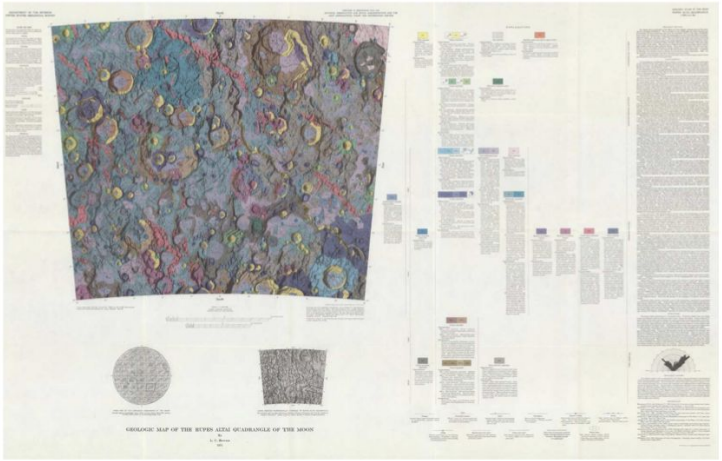
https://en.wikipedia.org/wiki/Tsiolkovskiy_(crater)

Traditional cartography

Planetary geologic maps in the paper domain



Authors

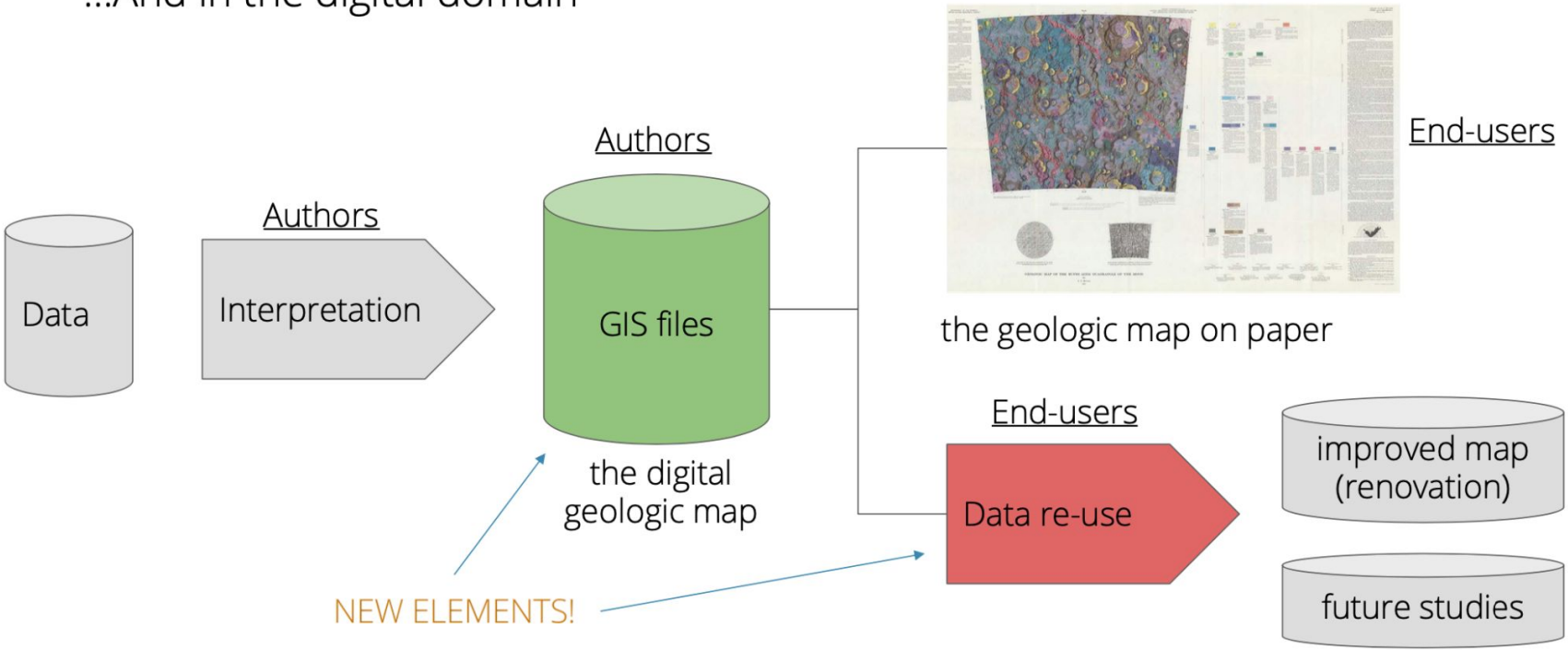


End-users

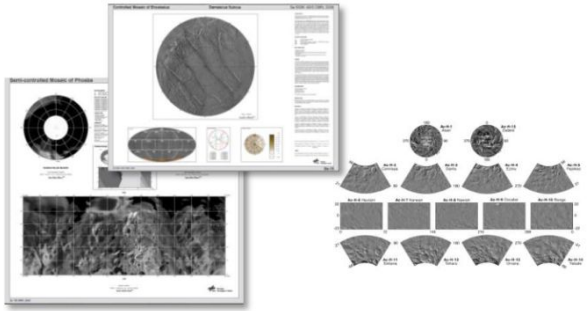
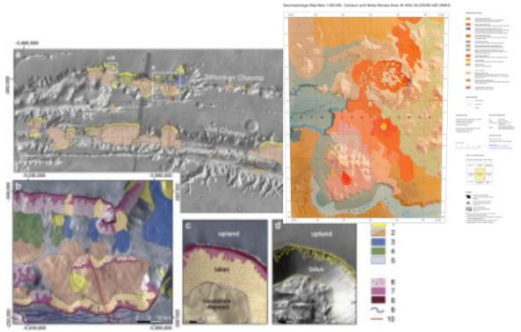
final product: the geologic map on paper

Digital cartography

...And in the digital domain

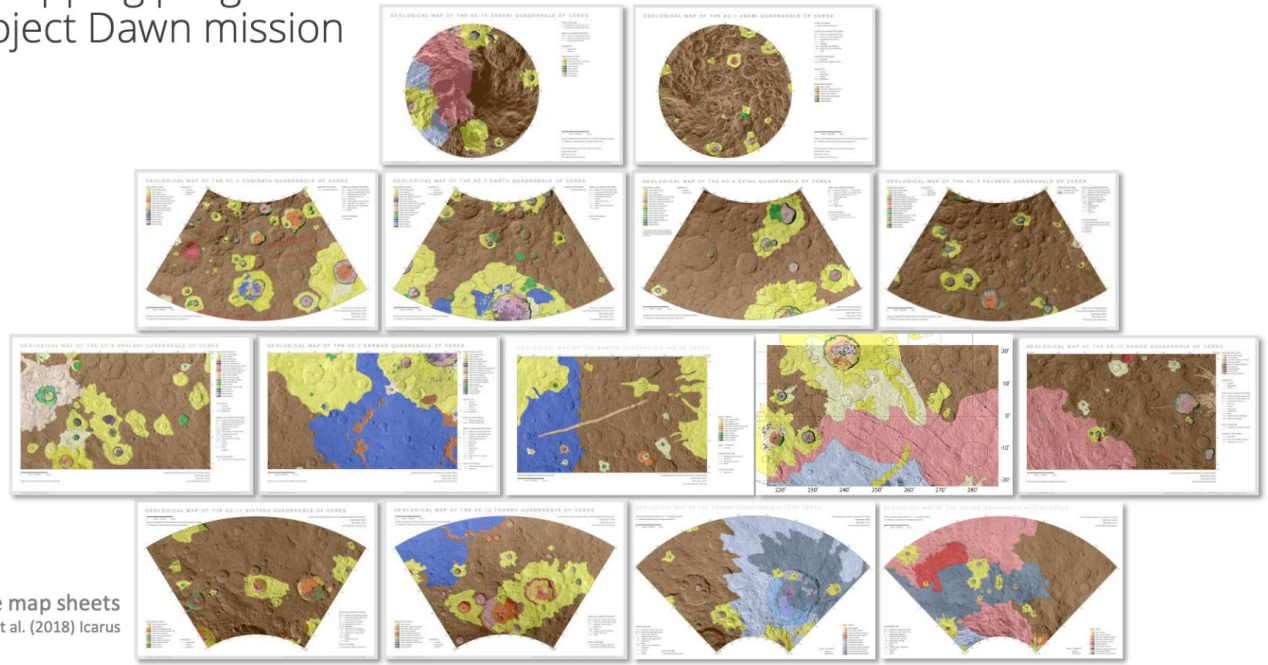


Mapping projects

Systematic Mapping Programs		Single map sheets
funded by NASA and coordinated by USGS Venus, Lunar, Mars Galilean Satellites	within different missions, e.g. Saturn satellites (Cassini data) Vesta and Ceres (Dawn data)	within scientific research questions/tasks local, regional, global maps
		

Systematic mapping

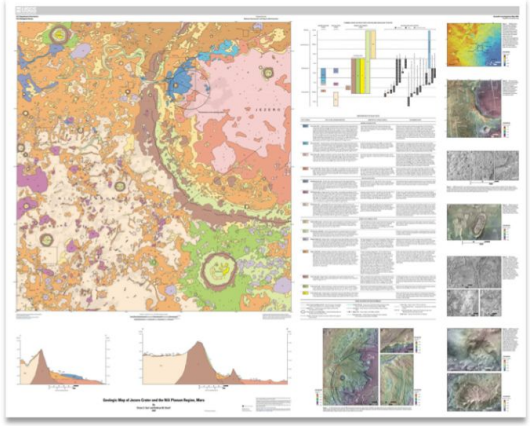
Systematic mapping programs mapping project Dawn mission (Ceres)



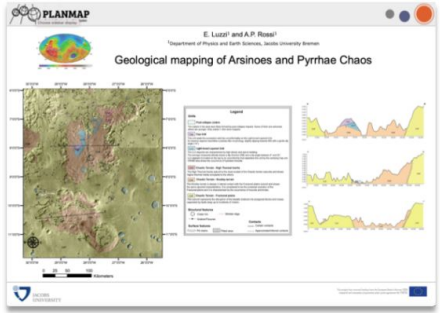
Unified map of 15 single map sheets

e.g. Williams, D. et al. (2018) Icarus

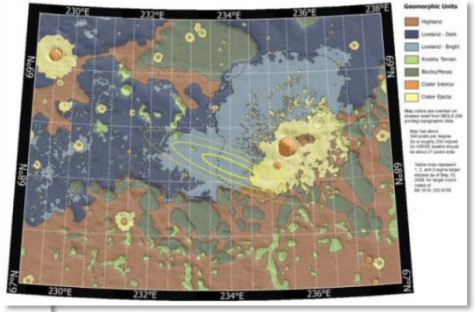
Single map sheets



Geologic map of Jezero Crater (Sun and Stack, 2020)



Morphostratigraphic map of Arsinoes Chaos (Luzzi et al., 2020)



Phoenix landing site map as of May 19 (2008)

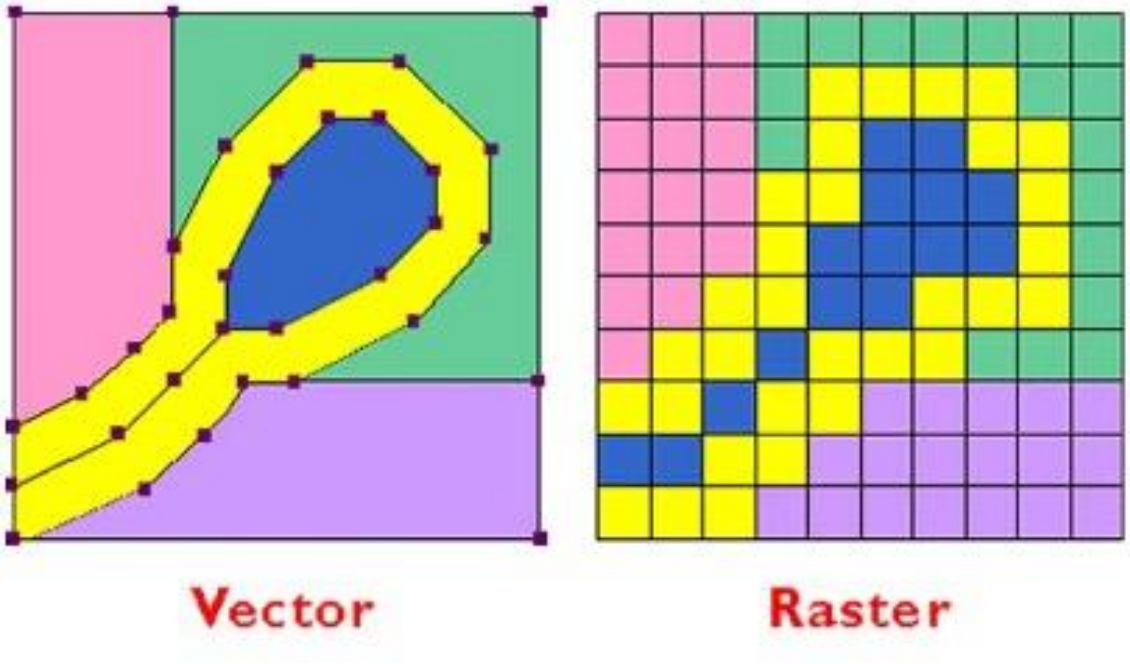
Geomorphologic Map of the Hale and Bond Crater Region, Mars (Albertz et al., 2008)

GIS: geographic information system

A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data. [1]

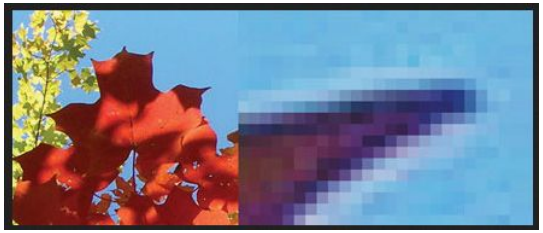
[1] https://researchguides.library.wisc.edu/GIS

Vector and Raster Data Models



Raster

Image



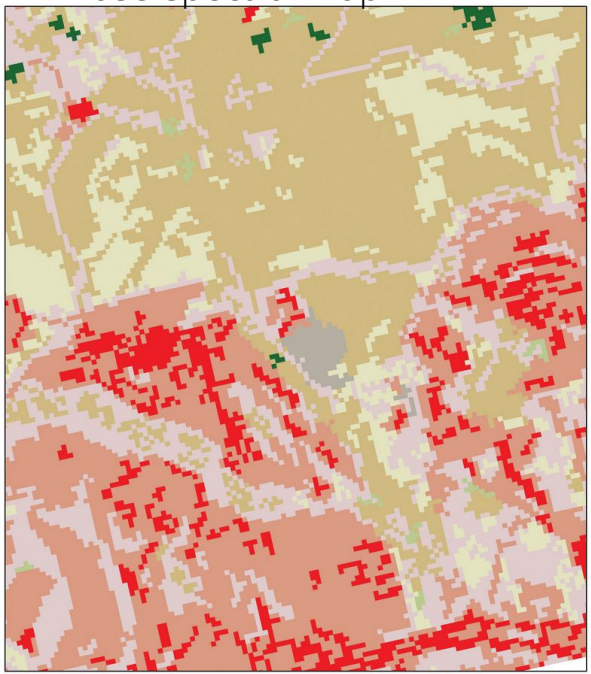
Raster: a matrix of pixels of a given size

Size n the ground is defined as raster resolution (e.g. meters/pixel)

Rasters can represent:

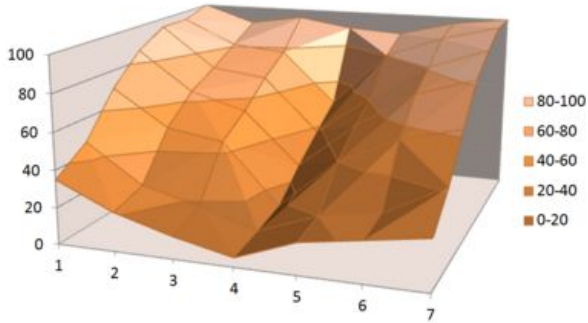
- Images
- Altimetry
- Classes
- Any other quantifiable property

Multispectral/classified
E.g. classes of land use/spectral map



Topography

100	90	95	90	88	96	100
95	81	78	49	80	92	100
95	72	68	38	61	81	92
86	64	55	26	52	72	82
70	50	45	12	40	55	63
47	26	18	8	20	25	42
35	21	12	5	17	22	27



https://serc.carleton.edu/download/images/36309/raster_dem.v3.pr

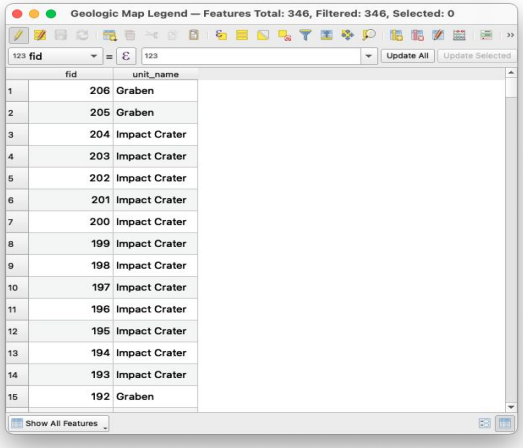
Images:
https://saylordotorg.github.io/text_essentials-of-geographic-information-systems

Vector

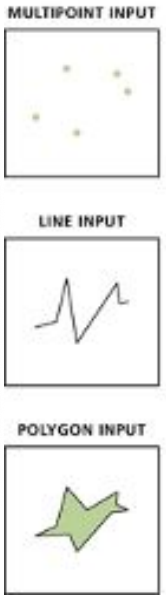
Vector spatial data:

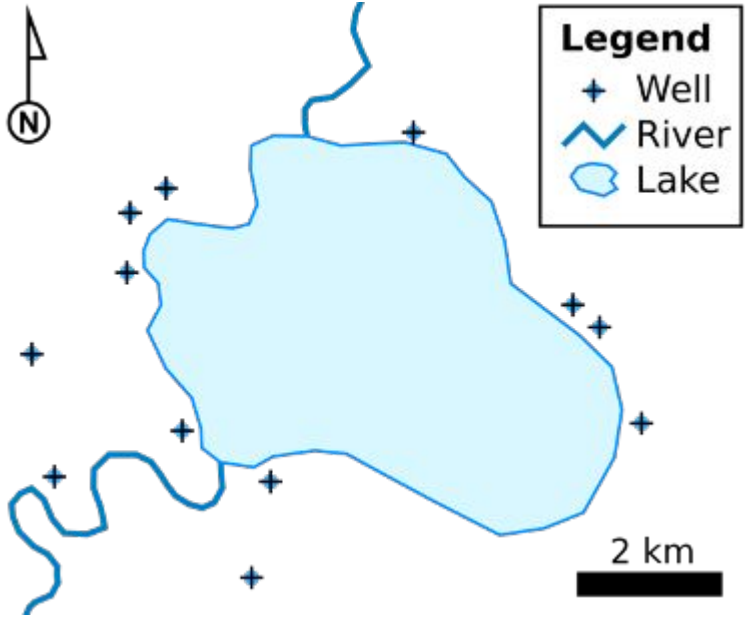
- Points
- Lines (polylines)
- Polygons (areas)

Additional information can be stored in their attribute table

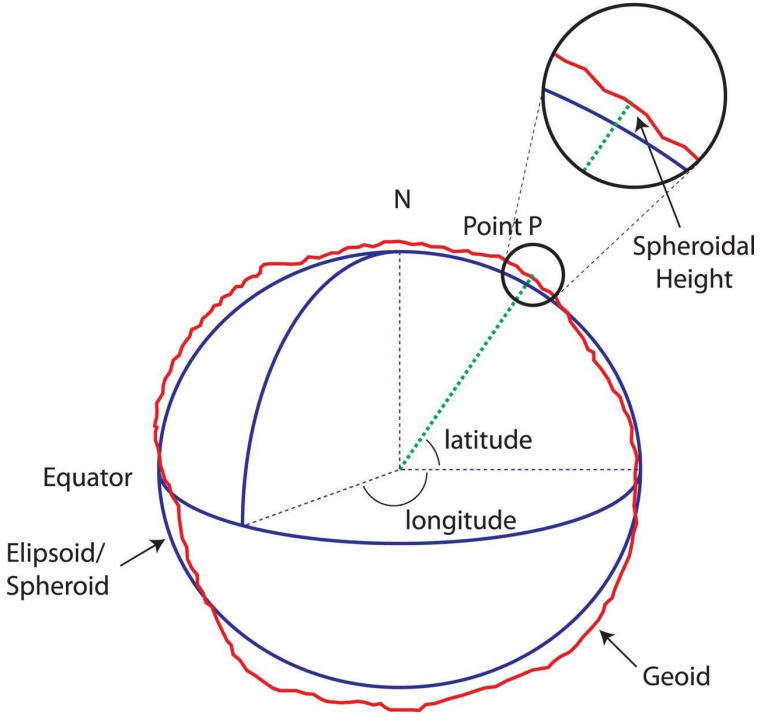


	fid	unit_name
1	206	Graben
2	205	Graben
3	204	Impact Crater
4	203	Impact Crater
5	202	Impact Crater
6	201	Impact Crater
7	200	Impact Crater
8	199	Impact Crater
9	198	Impact Crater
10	197	Impact Crater
11	196	Impact Crater
12	195	Impact Crater
13	194	Impact Crater
14	193	Impact Crater
15	192	Graben



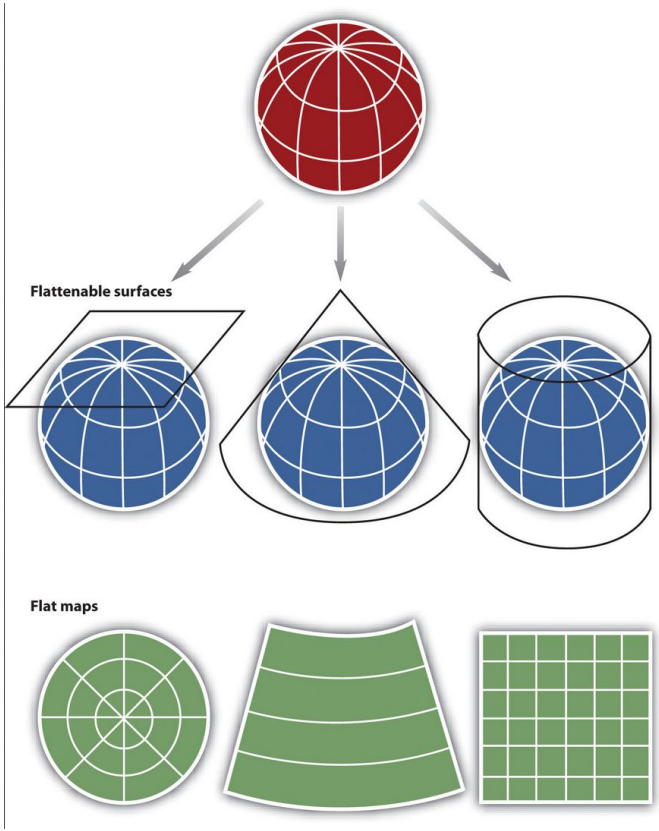


Ellipsoidal approximation



For cartographic purposes the shape of planetary bodies is approximated to a reference spheroid or ellipsoid, which approximates the real shape of the object, the geoid

Map projections



Mathematical formulas used to transform the spherical three-dimensional earth into two-dimensional planar surfaces.

Map projections introduce distortions in distance, direction, and area.

For this reason choosing the right map projection for your project is important

from: https://saylordotorg.github.io/text_essentials-of-geographic-information-systems

CRS - Coordinate Reference System

Defines:

- The ellipsoid used to approximate the body
- The projection used to transform the 3D coordinates of a point on the ellipsoid to its 2D map view.
- Additional parameters: unit of measure used, reference meridian, etc...

Examples of Proj4 definitions of CRSs for Mars

+proj=eqc +R=3396190 +units=m
[Equirectangular projection, spheroid with radius 3396190 m, unit meters]

+proj=longlat +a=3396190 +rf=169.894447223612
[latitude and longitude "pseudo" projection, ellipsoids with minor axis 3396190 m and reverse flattening (1/f) 169.895]

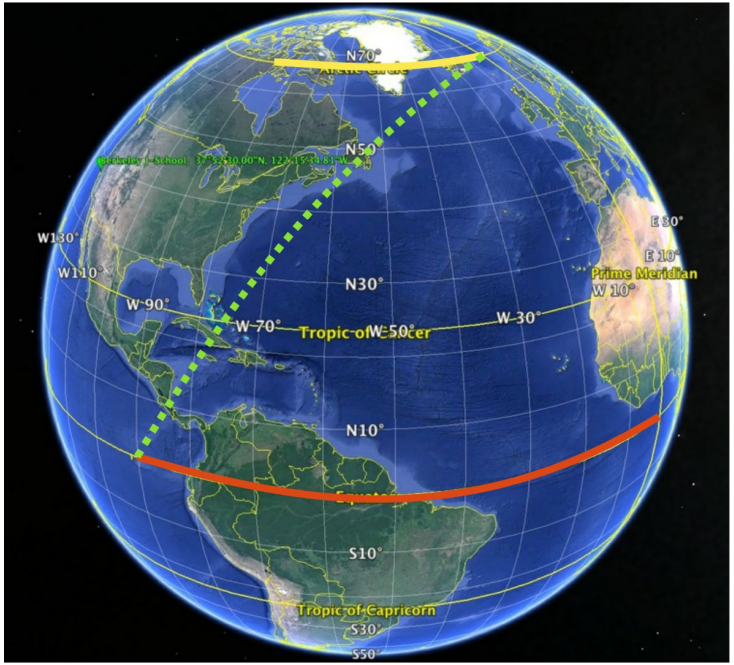
CRSs also have EPSG codes:
E.g. epsg:4326
Corresponds to WGS84 longlat (Earth):
+init=epsg:4326 +proj=longlat
+ellps=WGS84 +datum=WGS84

Find out more at https://proj.org/usage/projections.html

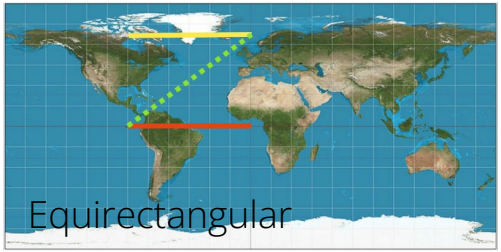
Measuring distances

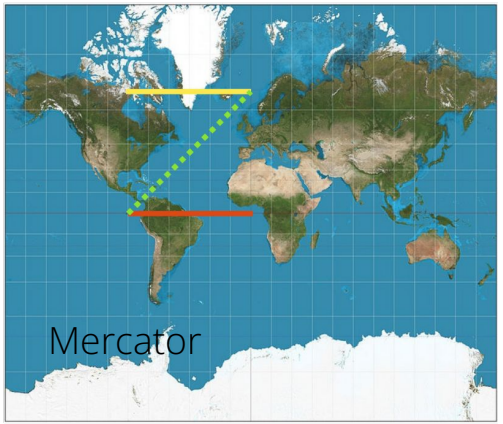
Ellipsoid-projected distances vs cartesian distances

On QGIS > 3.14 you might experience some issues on measuring projected distances on planetary CRS. Not a big problem for the school.



Credits: Google Earth, Wikimedia

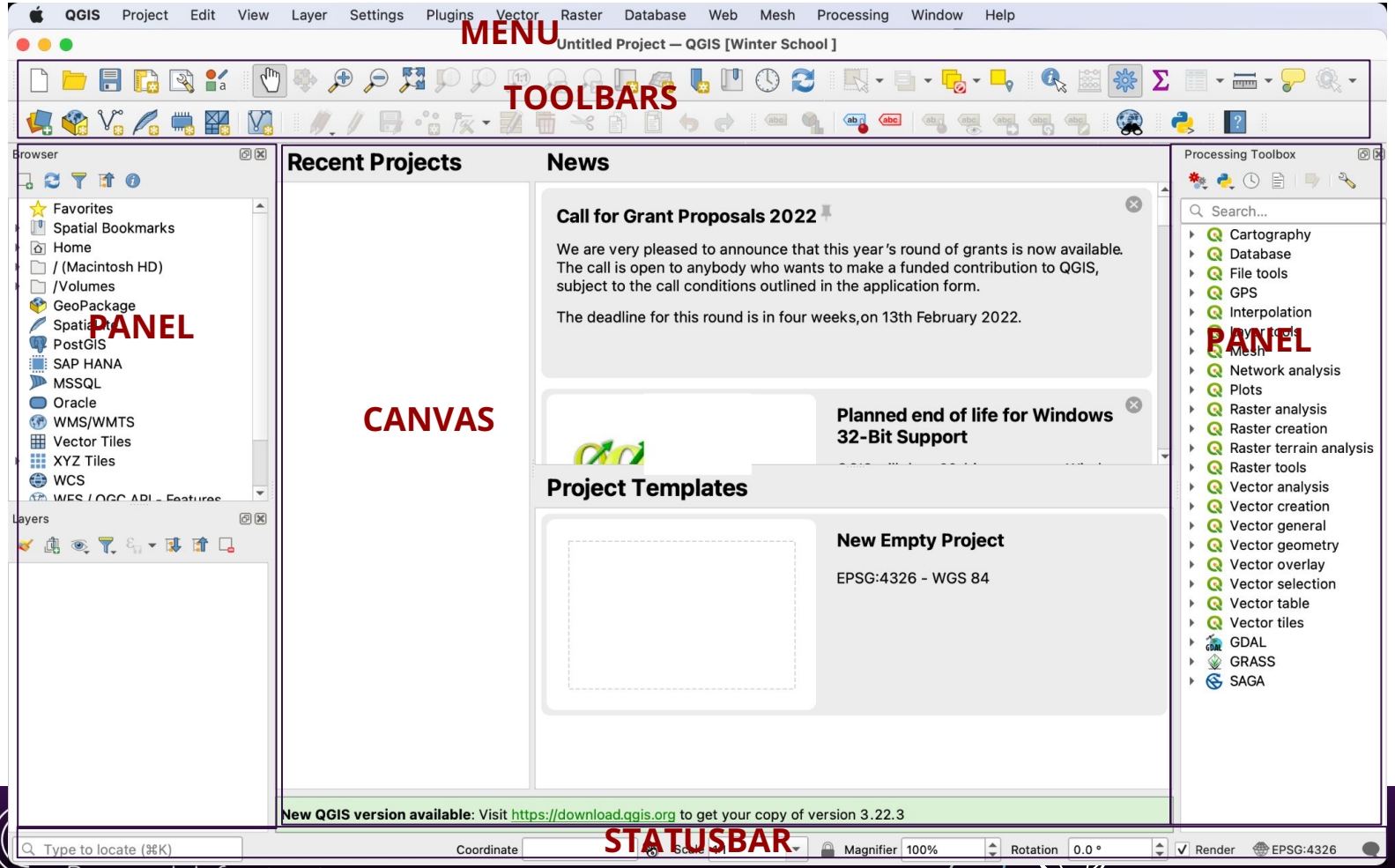




https://paldhous.github.io/ucb/2016/dataviz/week9.html

QGIS demo: outline

- **QGIS overview (Luca)**
  - The interface: quick overview: panels, toolbars (open advanced digitizing options), settings and menus
  - Quick look at the QGIS project, project folder, mouse interaction
- **Mapping project creation from scratch (Ric)**
  - Loading rasters: styling and properties of DTMs and imagery (styling transfer)
  - CRS: project and layer CRSs
  - Bookmarks and Decorations
  - Creating vector layers: types of vector data and fields, exemplary creation of points, lines and polygons.
  - First steps in geometry creation: Add Point/Line/Polygon Feature and populate fields.
  - Attribute table
  - Saving as project. Optional: see what happens on moving resources.
  - Measuring Distances, Identify Features tool, features selection
- **Map editing (Luca)**
  - Editing point layer: Node Moving (Vertex tool), selecting and deleting, the attribute table, saving layers
  - Editing line layer: Node Editing (Vertex tool), selecting and deleting a line and nodes, Split Features
  - Editing polygons
  - Advanced: using Snapping
  - Advanced: setting the forms for attribute inputs
  - Styling vectors using the fields
  - The processing toolbox, execution of algorithm: Add Geometry Attributes and view of the attribute table
  - Advanced: more on the attribute table: creating new columns, editing and selecting
- **Plugin manager (Ric)**
  - The interface, search bar, local installation from .zip, experimental
  - Mappy
  - qProf
  - qgis2threejs


QGIS Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Window Help
MENU
Untitled Project — QGIS [Winter School]
TOOLBARS
Browser
Favorites
Spatial Bookmarks
Home
/ (Macintosh HD)
/Volumes
GeoPackage
PostGIS
SAP HANA
MSSQL
Oracle
WMS/WMTS
Vector Tiles
XYZ Tiles
WCS
PANEL
Layers
Recent Projects
News
Call for Grant Proposals 2022
We are very pleased to announce that this year's round of grants is now available. The call is open to anybody who wants to make a funded contribution to QGIS, subject to the call conditions outlined in the application form.
The deadline for this round is in four weeks,on 13th February 2022.
Planned end of life for Windows 32-Bit Support
CANVAS
Project Templates
New Empty Project
EPSG:4326 - WGS 84
Processing Toolbox
Search...
Cartography
Database
File tools
GPS
Interpolation
Mesh
Network analysis
Plots
Raster analysis
Raster creation
Raster terrain analysis
Raster tools
Vector analysis
Vector creation
Vector general
Vector geometry
Vector overlay
Vector selection
Vector table
Vector tiles
GDAL
GRASS
SAGA
PANEL
New QGIS version available: Visit https://download.qgis.org to get your copy of version 3.22.3
Type to locate (⌘K)
Coordinate
Scale
Magnifier 100%
Rotation 0.0 °
Render
EPSG:4326
STATUSBAR

Useful links

- QGIS official documentation
  https://docs.qgis.org/3.22
- Mappy plugin
  https://github.com/europlanet-gmap/mappy/releases
- Books
  https://qgis.org/en/site/forusers/books/index.html