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OF QUEENSLAND
AUSTRALIA

CREATE CHANGE



Queensland Alliance for
One Health Sciences



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AUSTRALIA

Spatial Epidemiology Course: Introduction and basic concepts

Professor Cassiano Victória

UQ Visiting Professor

Professor of Preventive Veterinary Medicine and One Health

School of Veterinary Medicine and Animal Science

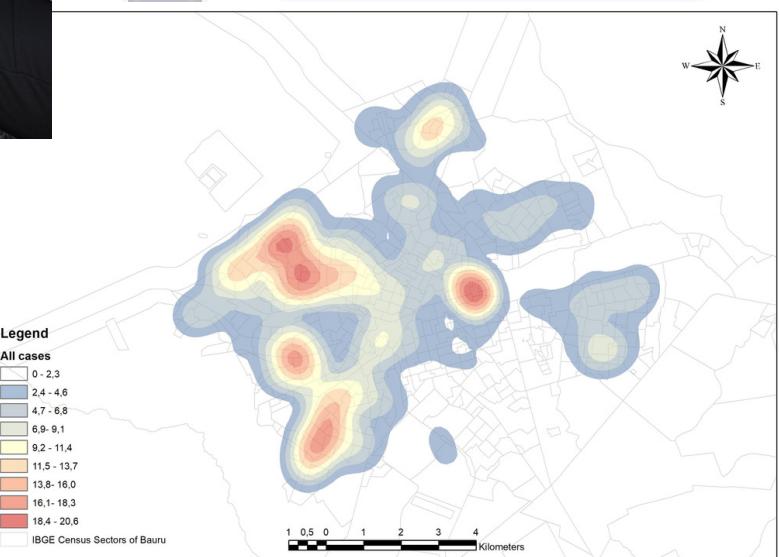
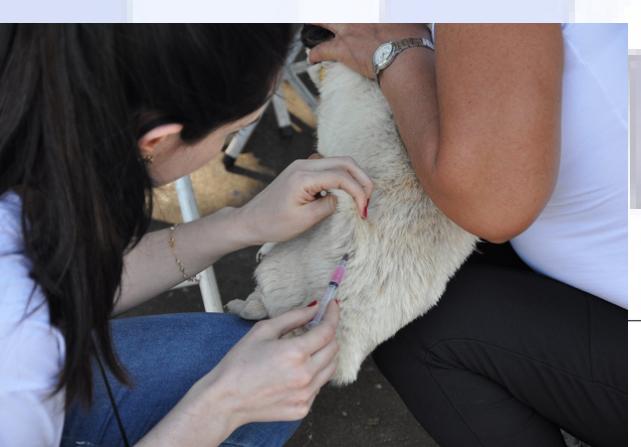
São Paulo State University - UNESP

Brazil



A little bit 'bout me...

- Graduated in Veterinary Medicine at the University of Marilia (1998)
 - Master Degree in Veterinary Medicine at the Sao Paulo State University - UNESP Botucatu (2003)
 - Doctor Degree in Preventive Veterinary Medicine (2007)
 - Veterinary Doctor Coordinator of the Environmental Health Surveillance Team VAS of Botucatu - SP (2005 - 2009)
 - Experience in Preventive Veterinary Medicine and Public Health, with emphasis in monitoring in health, specially Public health, Zoonosis, Epidemiologic Survey, Geoprocessing and Geoestatistics, OneHealth and rabies control.
 - Currently Professor Doctor of the Department of Animal Production and Preventive Veterinary Medicine of the FMVZ - Botucatu SP and visitor professor at The University of Queensland (UQ) - Austrália.

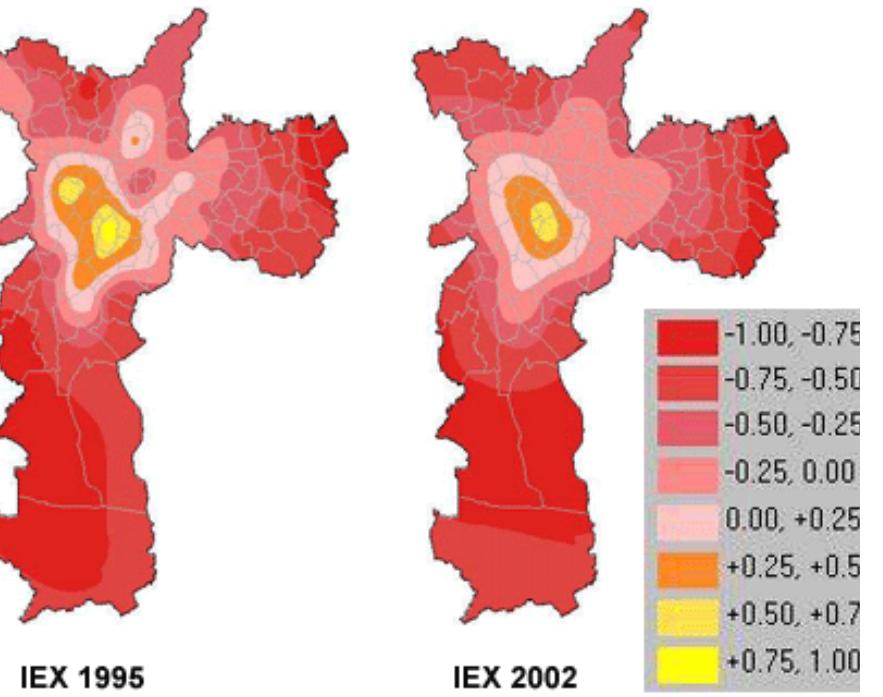
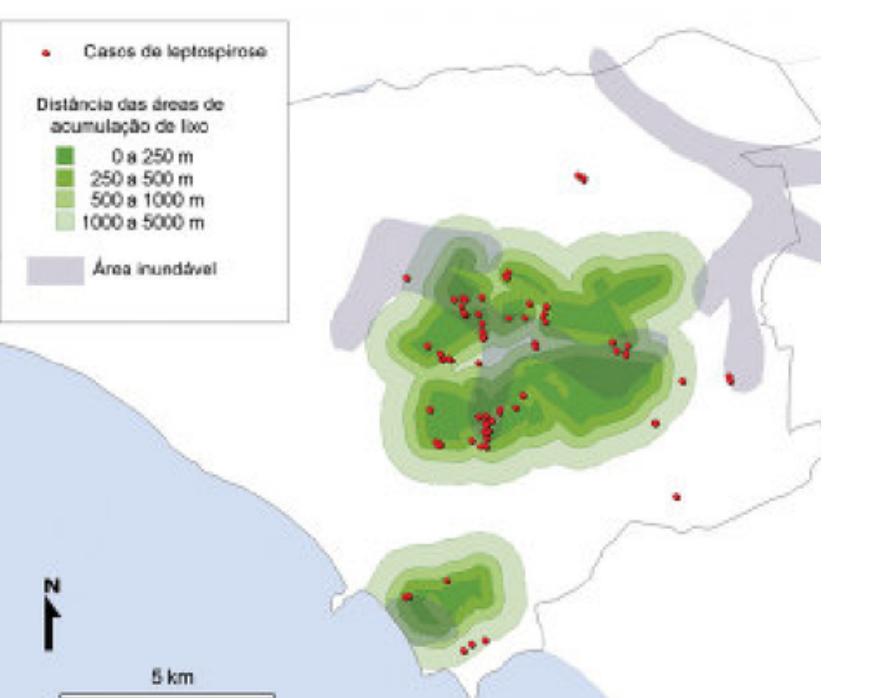
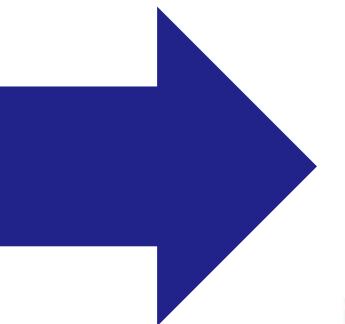


Learning goals

- Remember the basics concepts
- Geoprocessing and GIS
- Datum and Coordinates systems
- Databases
- Best practices

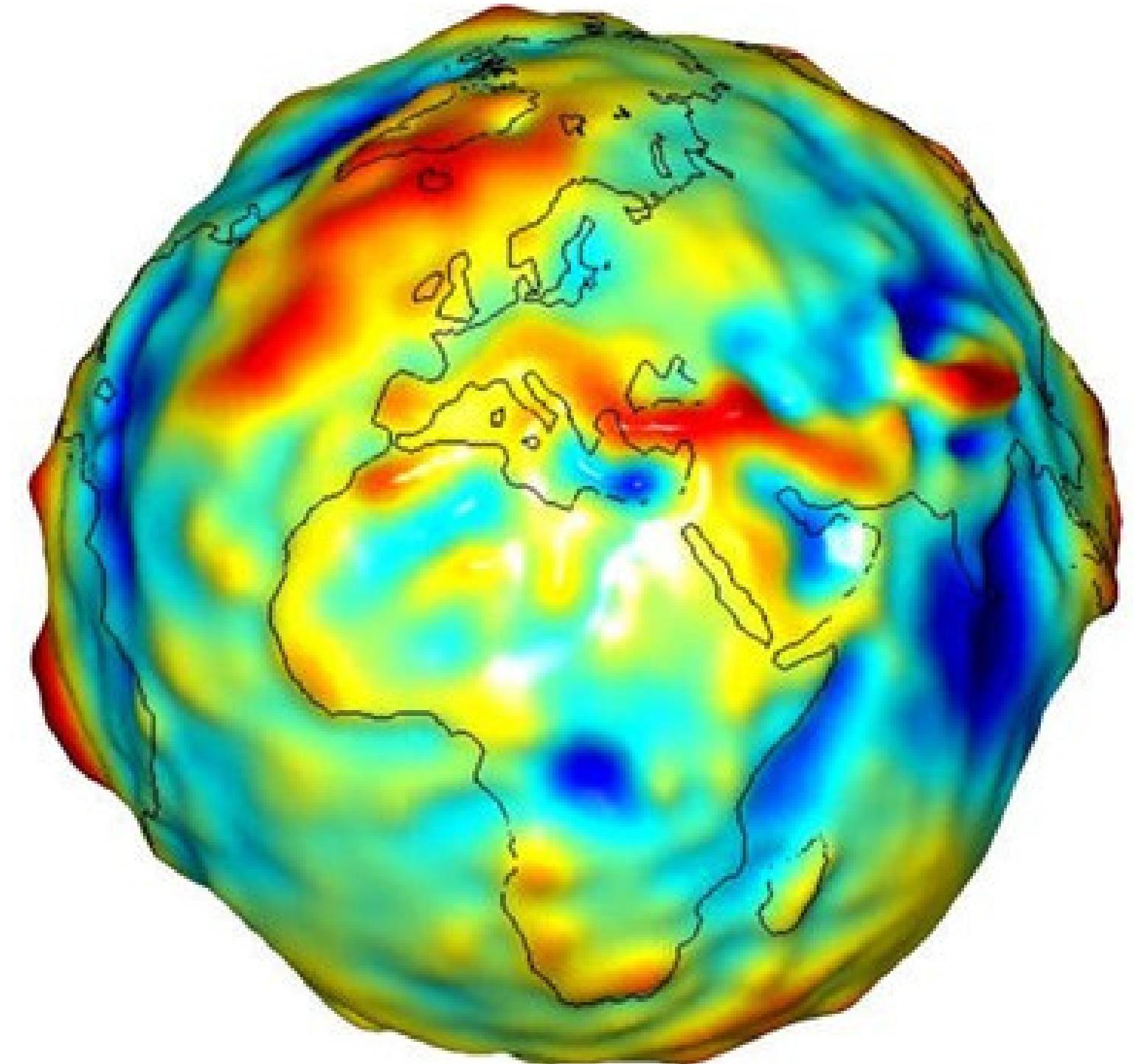
Basic concepts

A	B	C	D	E	F	G	H	I	J	K	L	M	N	CPF:
1		Funcionário:												
2														
3	Data	Tipo	Jornada	Jornada	Jornada	Em	Total	Sem	Total	Espera				CPF:
4			Inicio	Fim	Normal	Diária	Parado	Direção	Refeição	Diurna	Noturna	Total	Dia	
5	16/08/22 ter	Trabalho	03:56	13:32	08:00	08:10	05:36	02:56	02:34	01:13	00:22		00:22	
6	17/08/22 qua	Trabalho	08:07	17:01	08:00	09:53	04:41	05:12	05:12	01:01			01:01	
7	18/08/22 qui	Folga												
8	19/08/22 sex	Folga												
9	20/08/22 sáb	Trabalho	04:04	17:44	04:00	12:30	09:51	02:57	02:39	01:00	00:18		00:18	
10	21/08/22 dom	Trabalho	05:13	15:59	08:00	09:22	06:59	02:39	02:23	01:08	00:16		00:16	
11	TT HS Semana					39:55	27:07	13:44	12:48	04:22	00:56		00:56	11
12	22/08/22 seg	Trabalho	03:52	15:58	08:00	10:59	08:42	02:36	02:16	00:57	00:20		00:20	02
13	23/08/22 ter	Trabalho	04:15	16:03	08:00	10:31	07:33	03:22	02:58	00:59	00:24		00:24	03
14	24/08/22 qua	Trabalho	04:08	15:52	08:00	10:42	03:57	06:52	06:44	01:04	00:08		00:08	02
15	25/08/22 qui	Folga												
16	26/08/22 sex	Trabalho	04:11	15:55	08:00	10:39	08:10	02:43	02:29	00:58	00:14		00:14	02
17	27/08/22 sáb	Trabalho	04:08	15:55	04:00	10:48	08:13	02:41	02:35	01:00	00:06		00:06	01
18	TT HS Semana					53:35	36:35	16:14	17:02	04:58	01:12		01:12	11
19	TT HS Período					53:34	63:42	31:58	29:50	09:20	02:06		02:06	20
20														
21		Funcionário:												CPF:
22														
23	Data	Tipo	Jornada	Jornada	Jornada	Em	Total	Sem	Total	Espera				CPF:
24			Inicio	Fim	Normal	Diária	Parado	Direção	Refeição	Diurna	Noturna	Total	Dia	
25	16/08/22 ter	Trabalho	03:56	13:32	08:00	08:10	05:36	02:56	02:34	01:13	00:22		00:22	
26	17/08/22 qua	Trabalho	08:07	17:01	08:00	09:53	04:41	05:12	05:12	01:01			01:01	
27	18/08/22 qui	Folga												
28	19/08/22 sex	Folga												
29	20/08/22 sáb	Trabalho	04:04	17:44	04:00	12:30	09:51	02:57	02:39	01:00	00:18		00:18	
30	21/08/22 dom	Trabalho	05:13	15:59	08:00	09:22	06:59	02:39	02:23	01:08	00:16		00:16	01
31	TT HS Semana					39:55	27:07	13:44	12:48	04:22	00:56		00:56	11
32	22/08/22 seg	Trabalho	03:52	15:58	08:00	10:59	08:42	02:36	02:16	00:57	00:20		00:20	02
33	23/08/22 ter	Trabalho	04:15	16:03	08:00	10:31	07:33	03:22	02:58	00:59	00:24		00:24	03



Basic concepts: geoid

Geoid



Basic concepts: ellipsoid

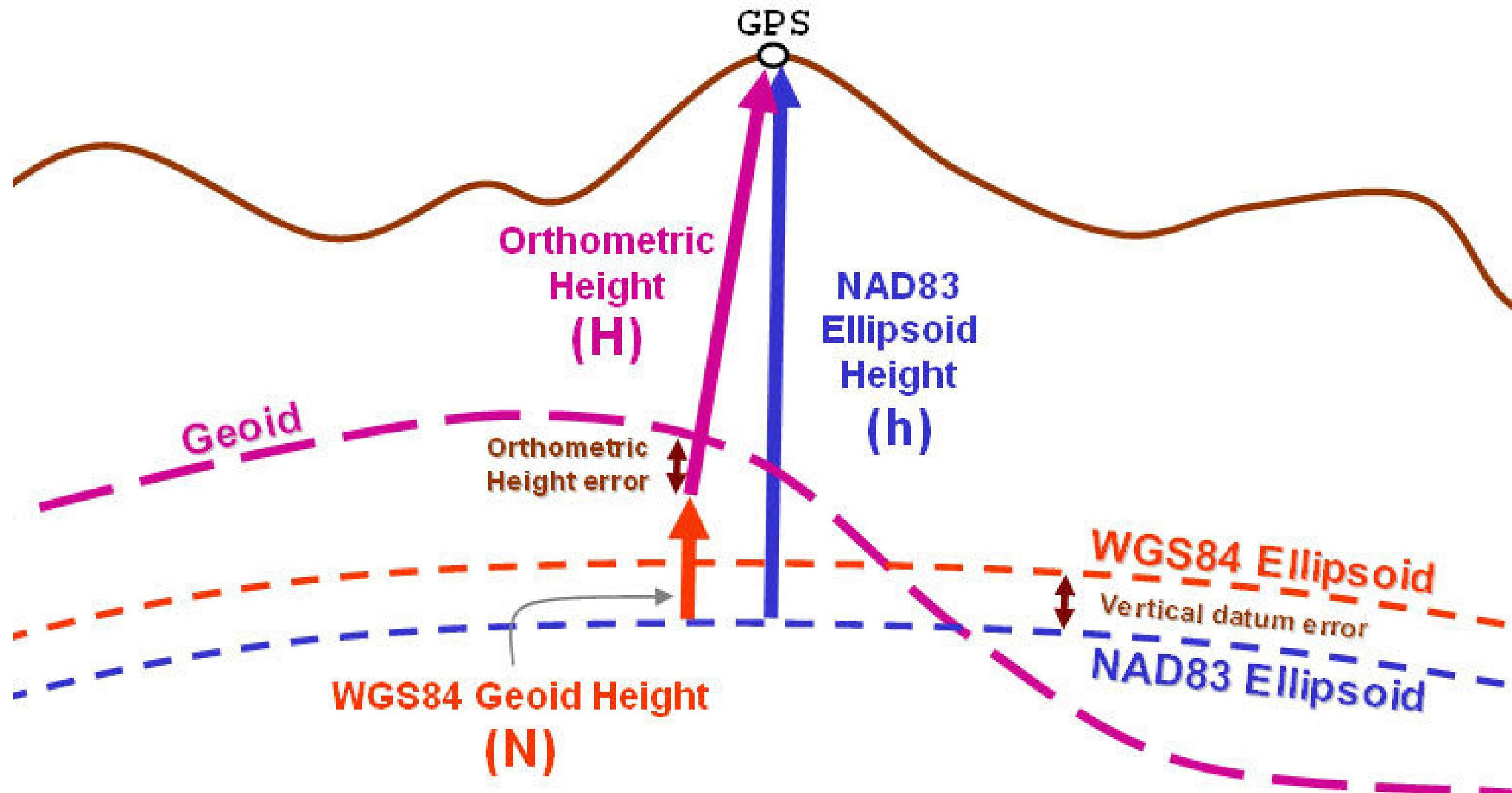
Topographic surface

Ellipsoid

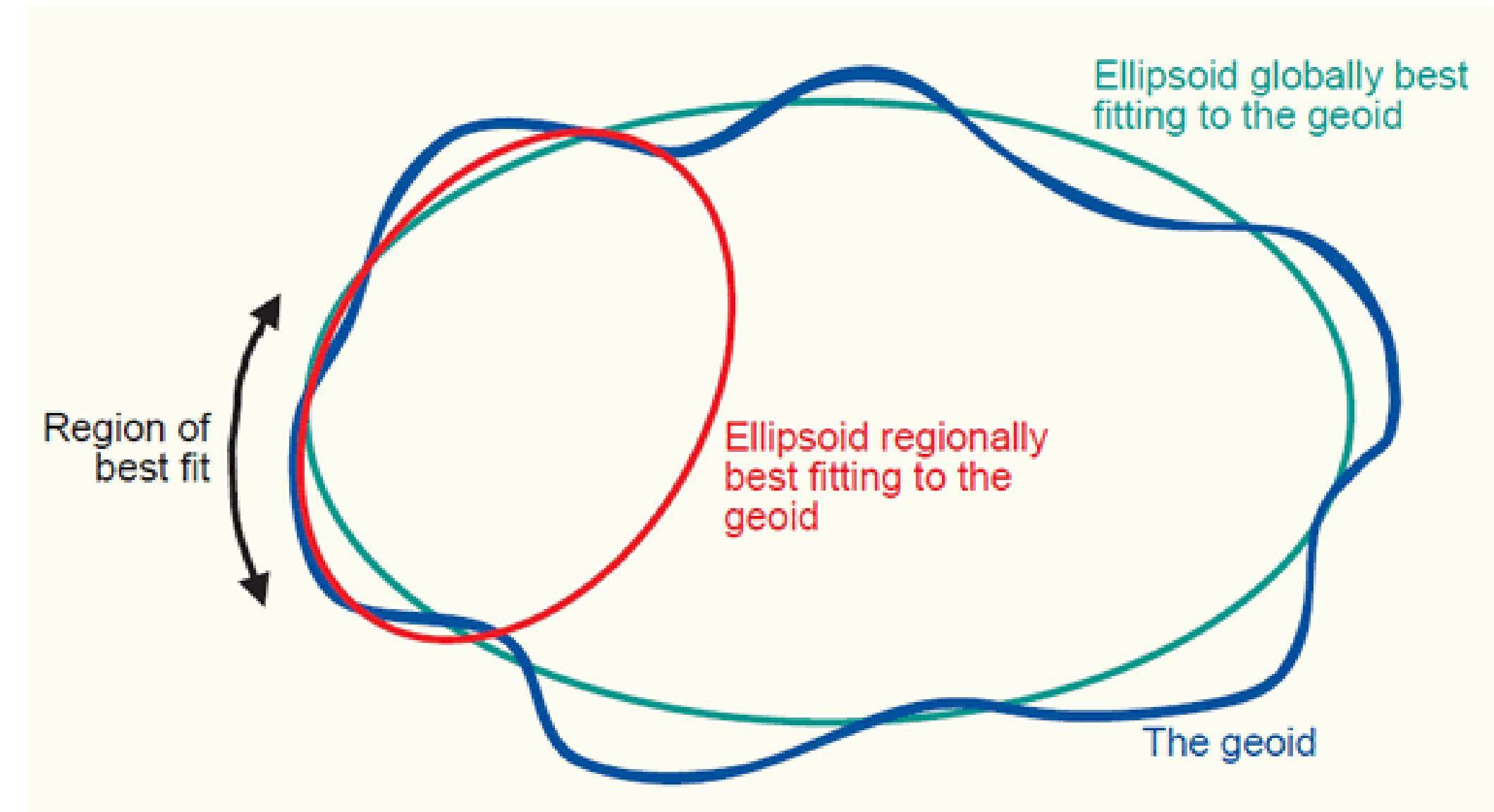
Geoid

Peter H. Dana 9/1/94

Planimetric Datum → reference ellipsoid



Basic concepts: ellipsoid



Brazil

Until 1978 - Córrego-alegre

1979 - SAD-69

WGS-84 - satélites GPS

Em 2015 – dia 25 de fevereiro

SIRGAS 2000

Major axis ->6.378.**388** m

Major axis ->6.378.**160** m

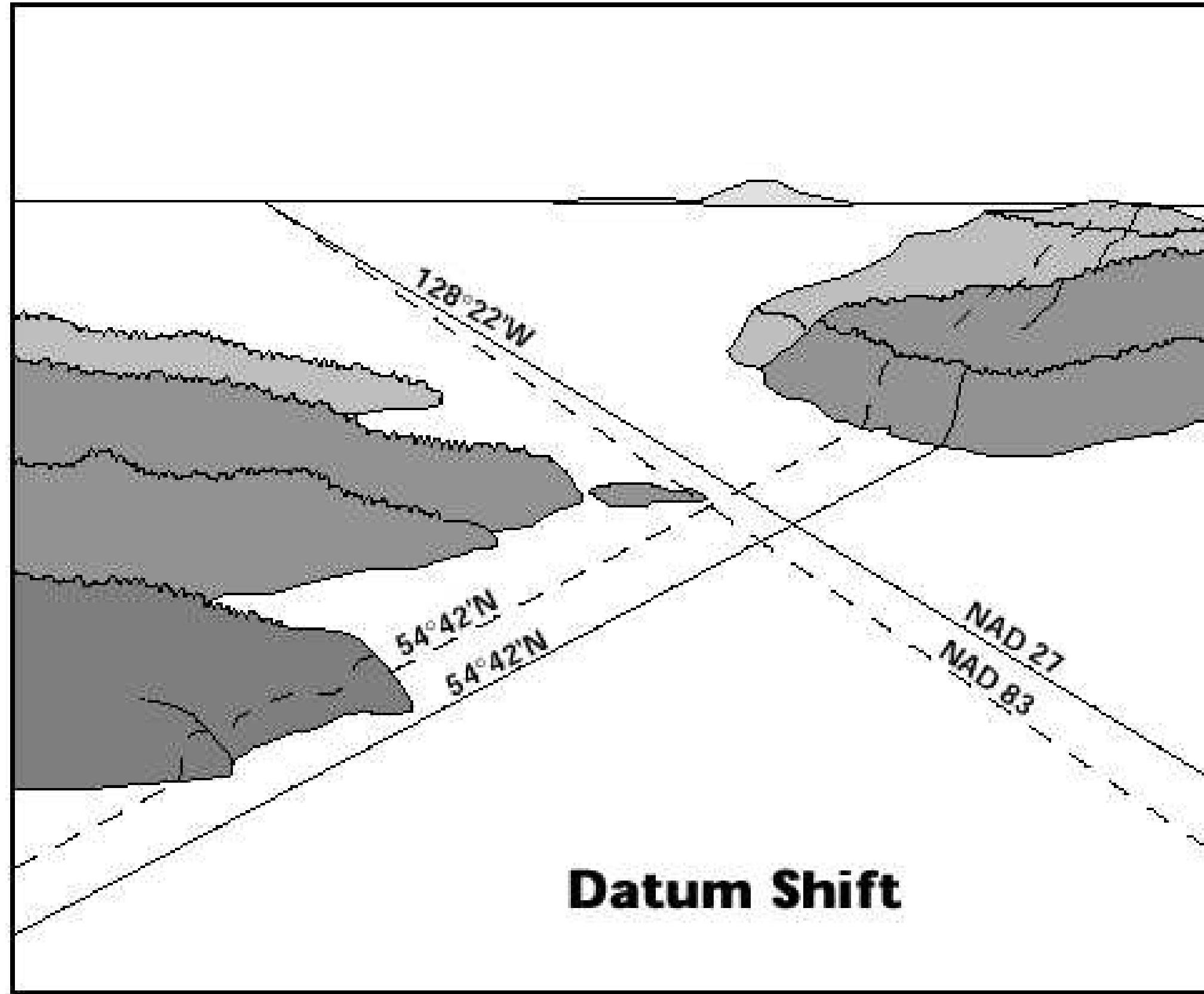
Major axis ->6.378.**137** m

} 228 m

} 23 m

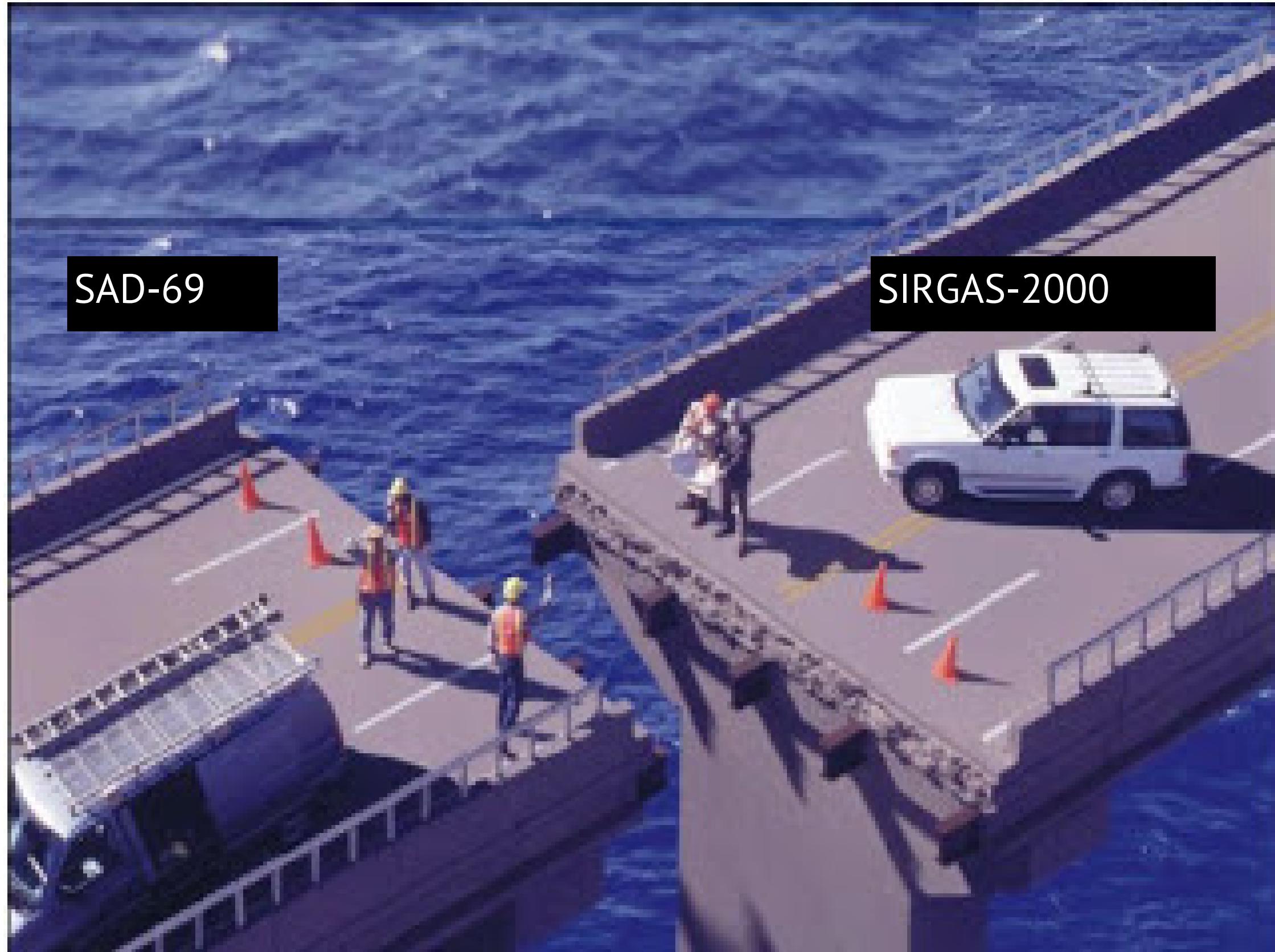
Major axis ->6.378.**137** m

Basic concepts: ellipsoid



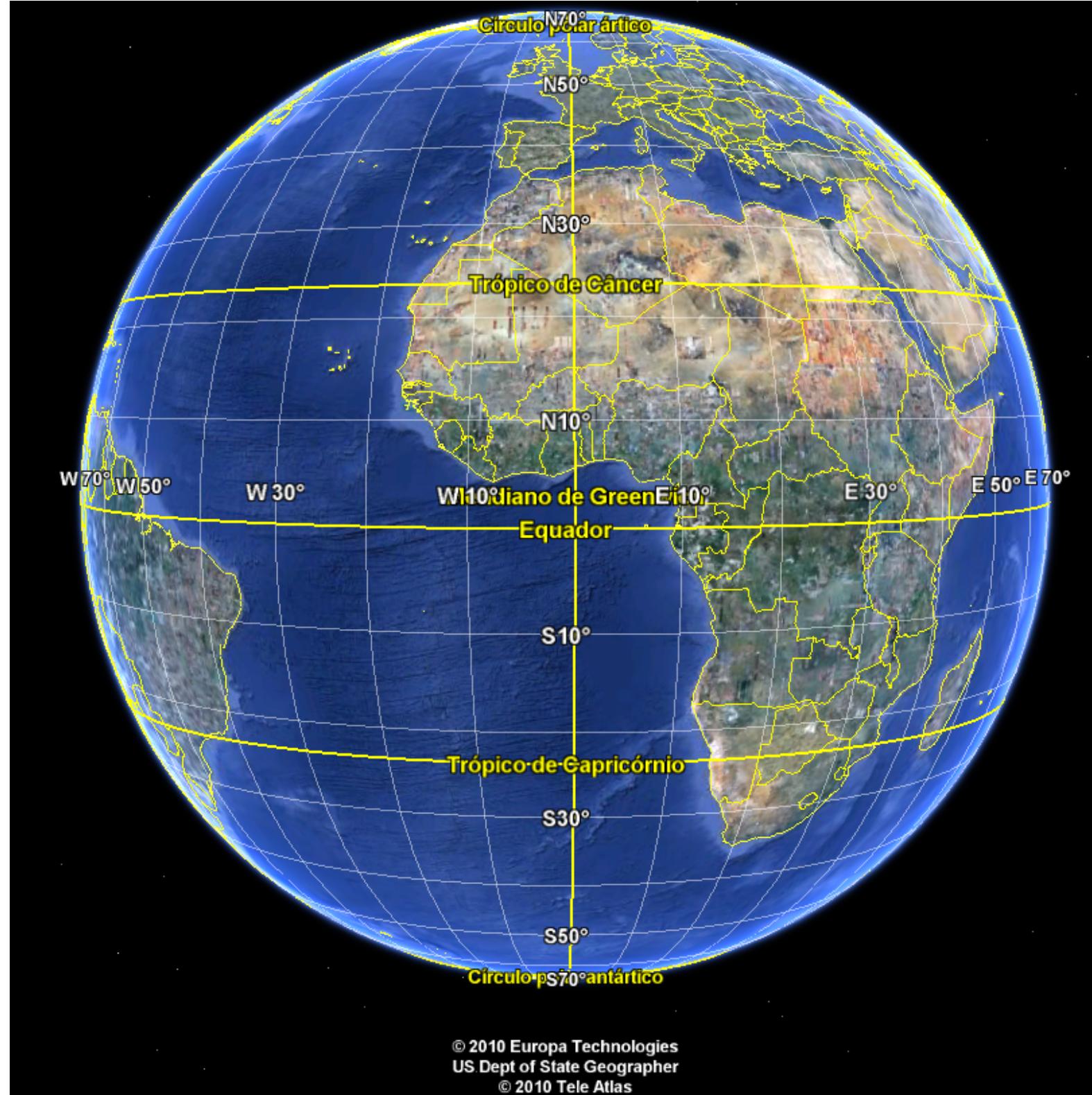
Fonte: <http://www.shipwrite.bc.ca/aboutgps.htm>

Basic concepts: ellipsoid

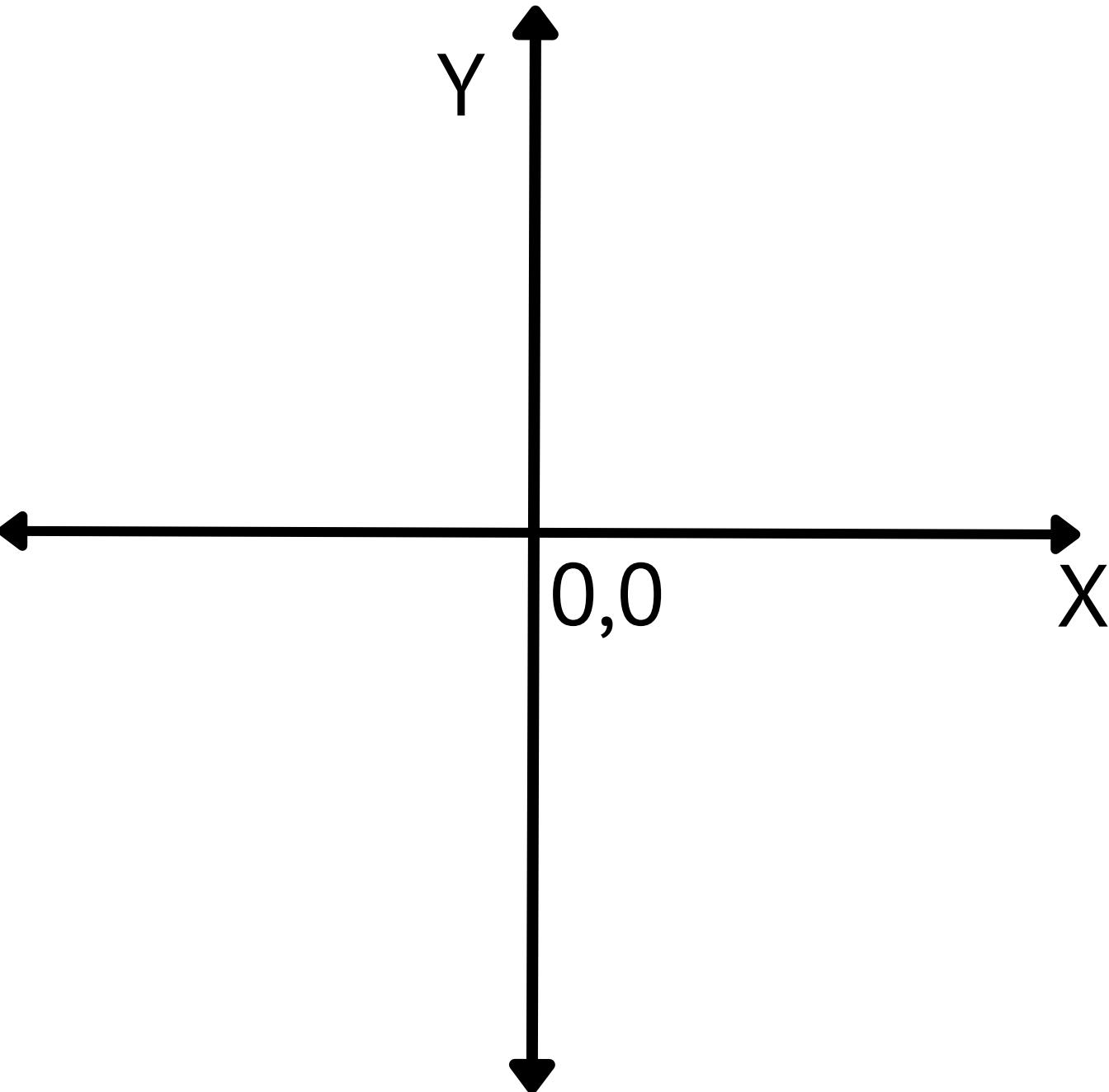


Fonte:<http://geoxy.blogspot.com.br/2009/01/projeto-datum-e-sig-mas-que-diabos.html>

Basic concepts: Coordinates Sistems

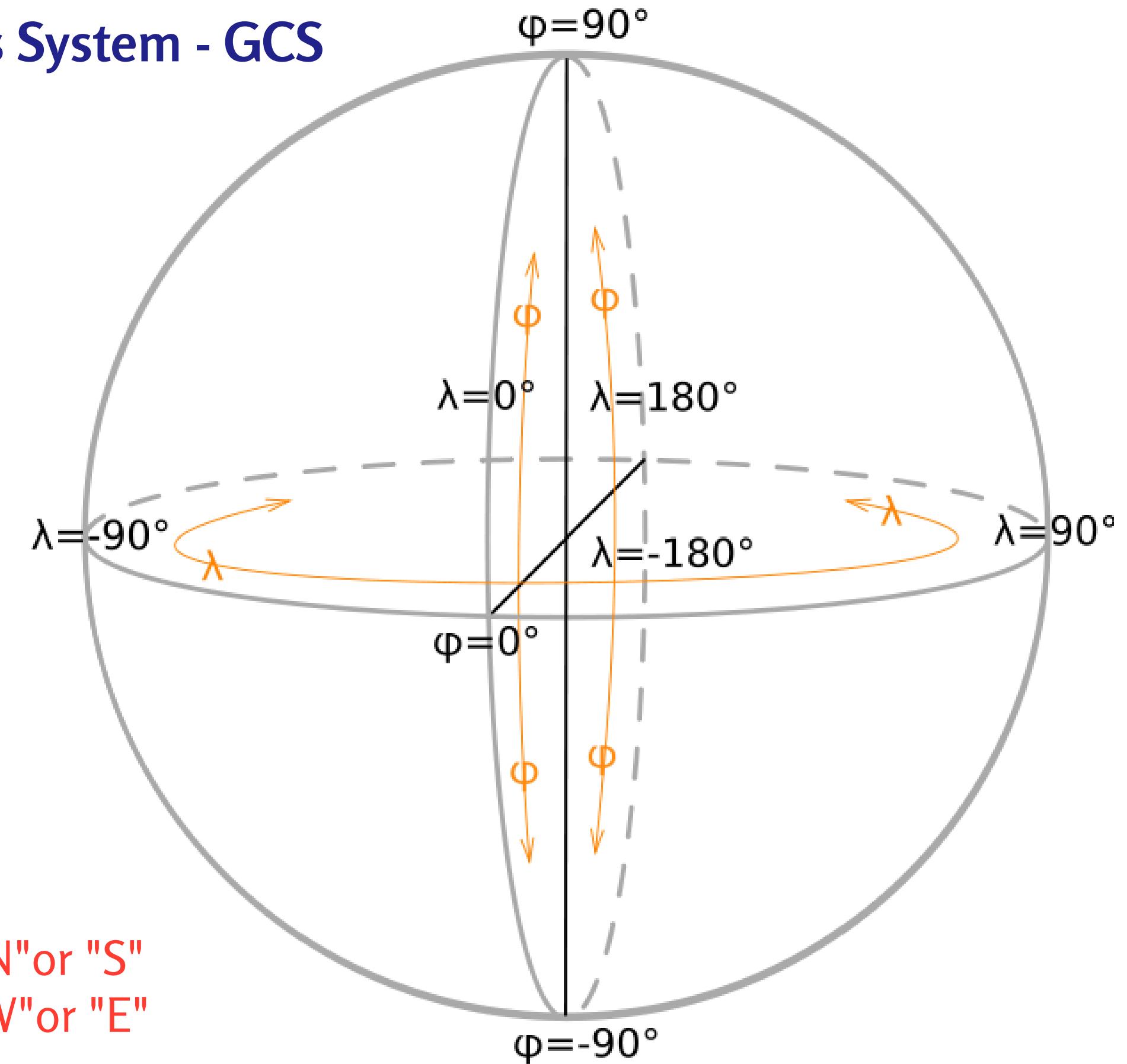


Fonte: Google Earth



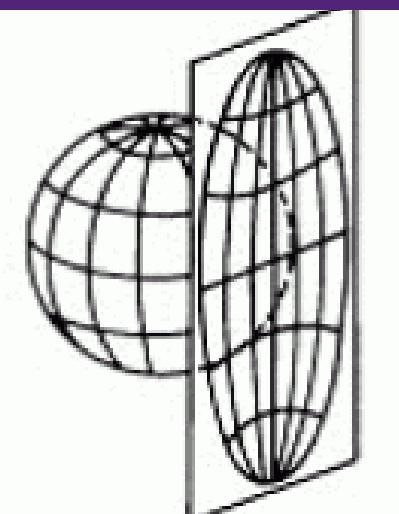
Basic concepts: Coordinates Sistems

Geographic Coordinates System - GCS

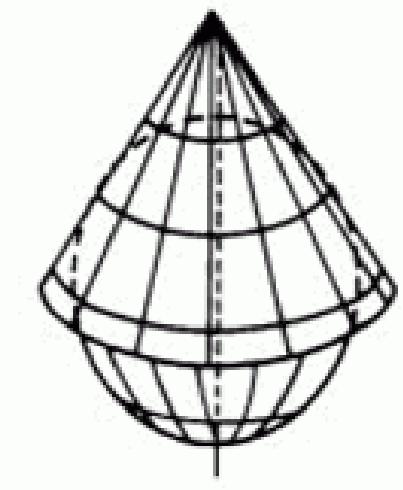


Basic concepts: Coordinates Systems

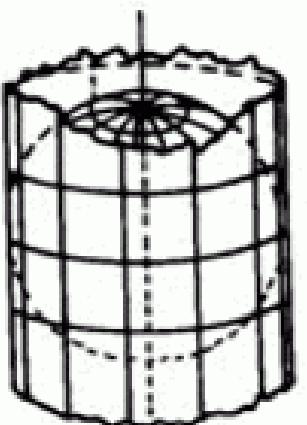
Projected Coordinates System



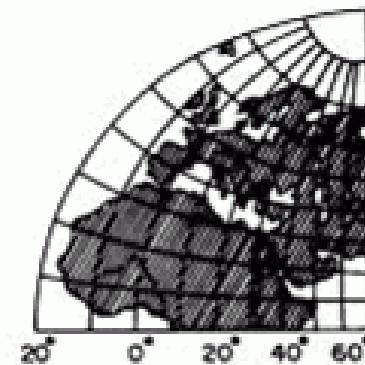
Projeção
estereográfica polar



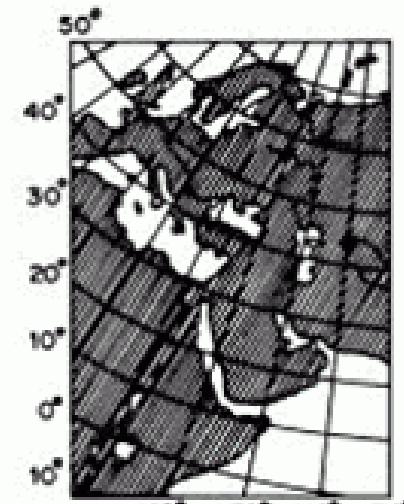
Projeção
cônica de
Lambert



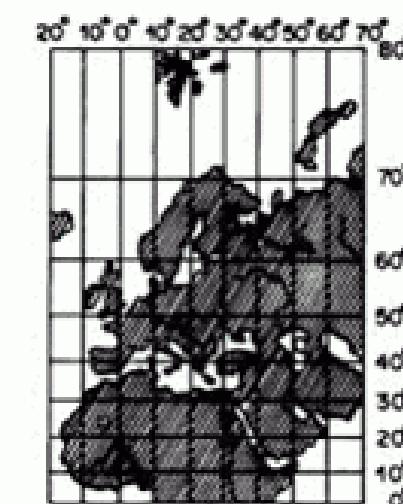
Projeção de Mercator



Projeção Plana



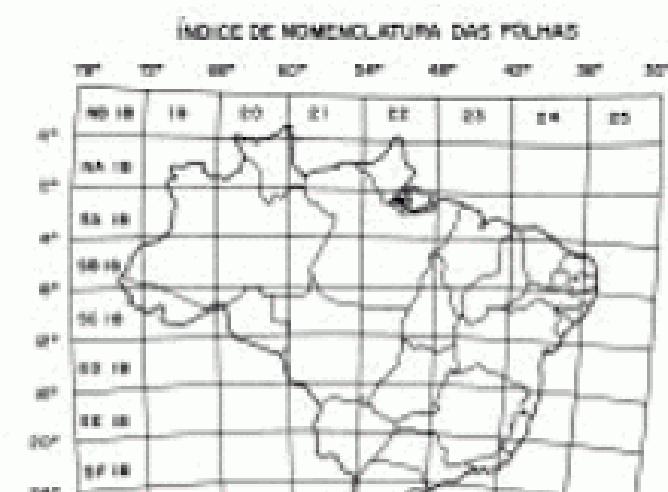
Projeção Cônica



Projeção Cilíndrica

Botucatu
Lat: 23°10'64.00m
Long: 46°46'377.00m

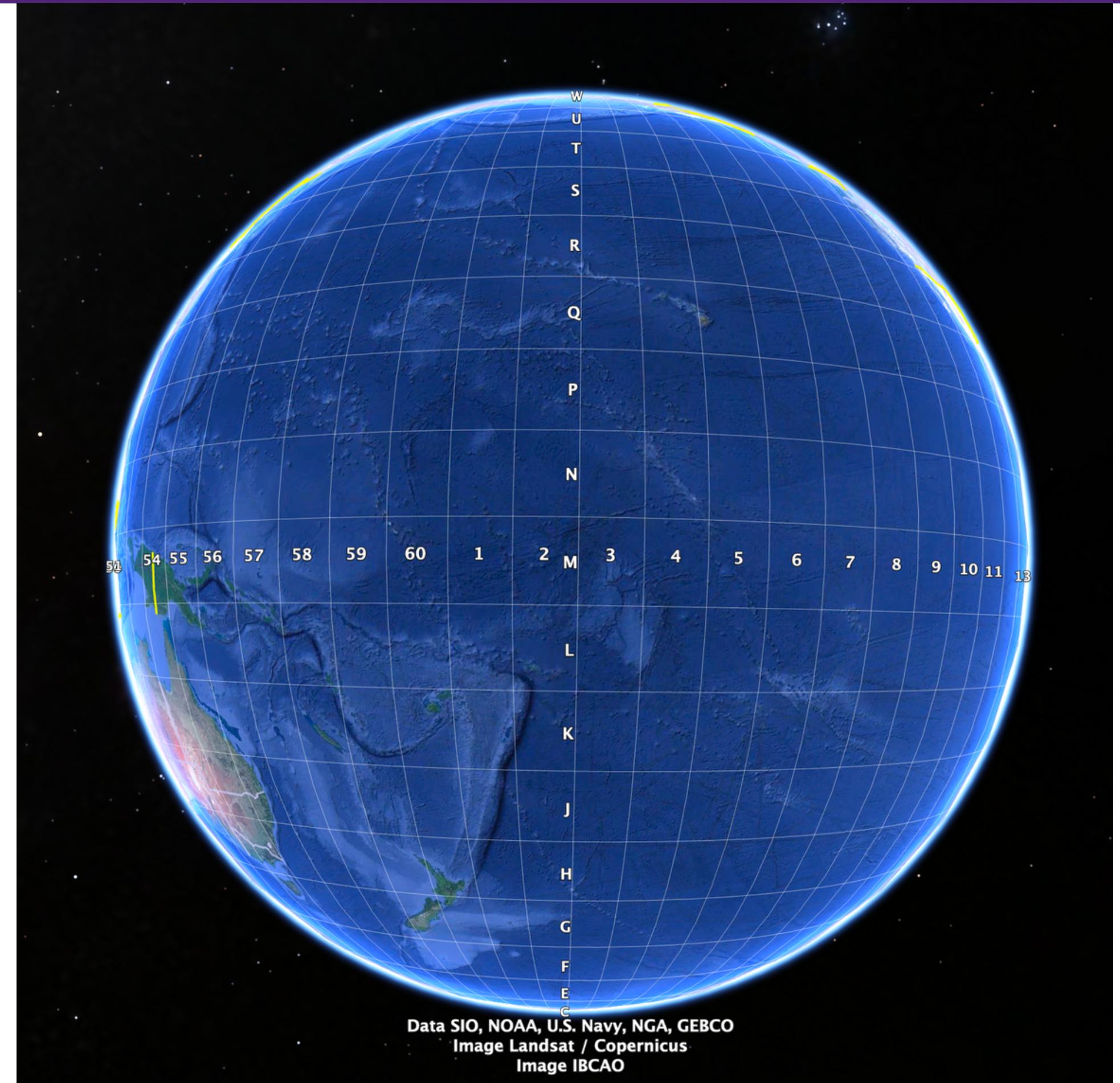
"Sectors"
22 k



Basic concepts: Coordinates Systems

Long -> 1 - 60

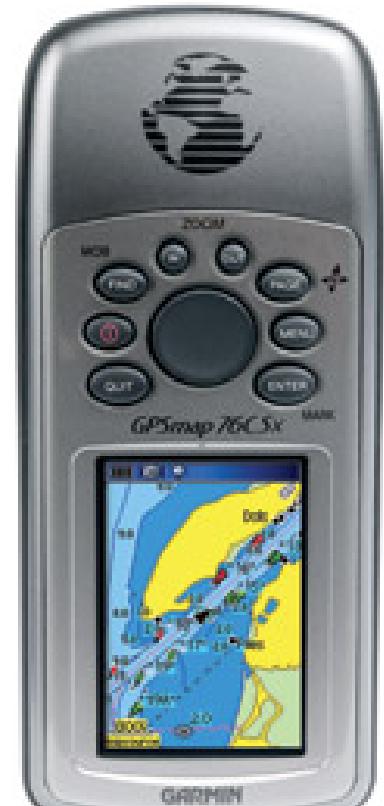
Lat -> C - X



Basic concepts: acquiring coordinates



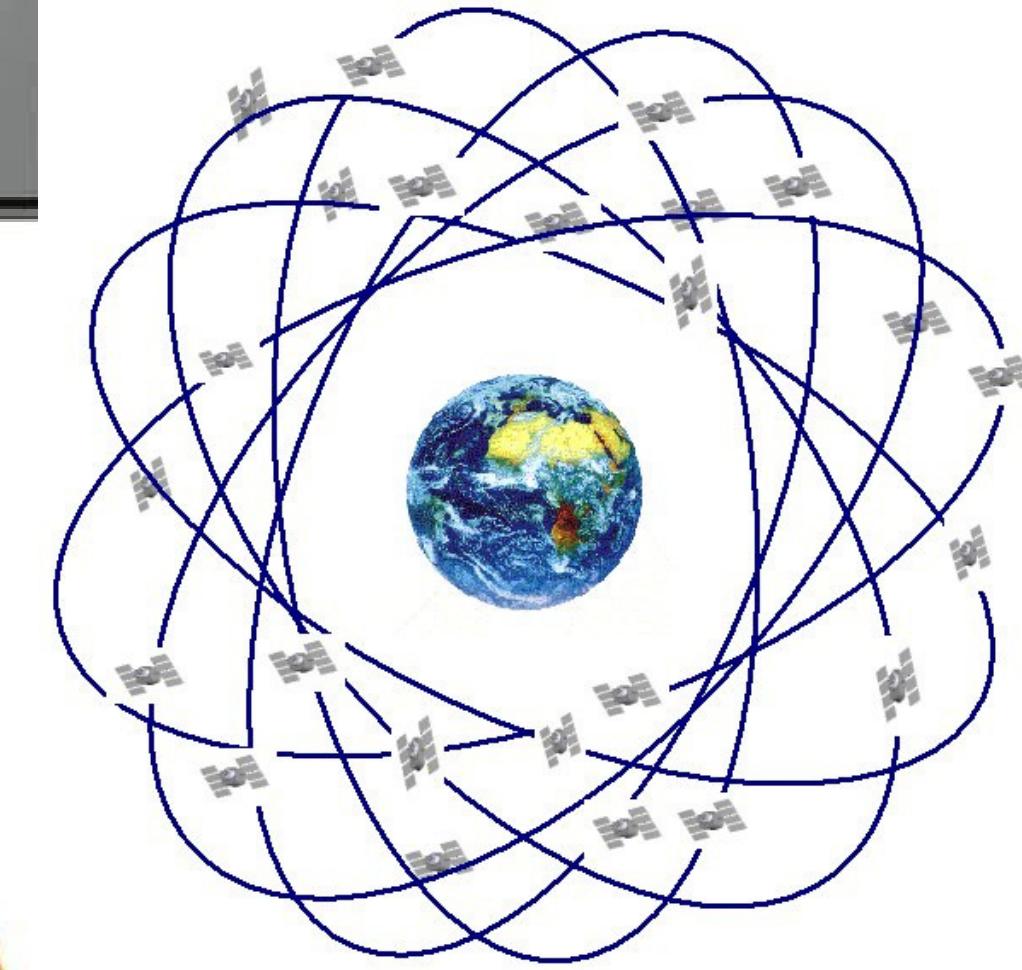
Fonte: shoppingparaguai.info



Fonte: www.lojautil.com.br



Fonte: www.bonnegocio.com

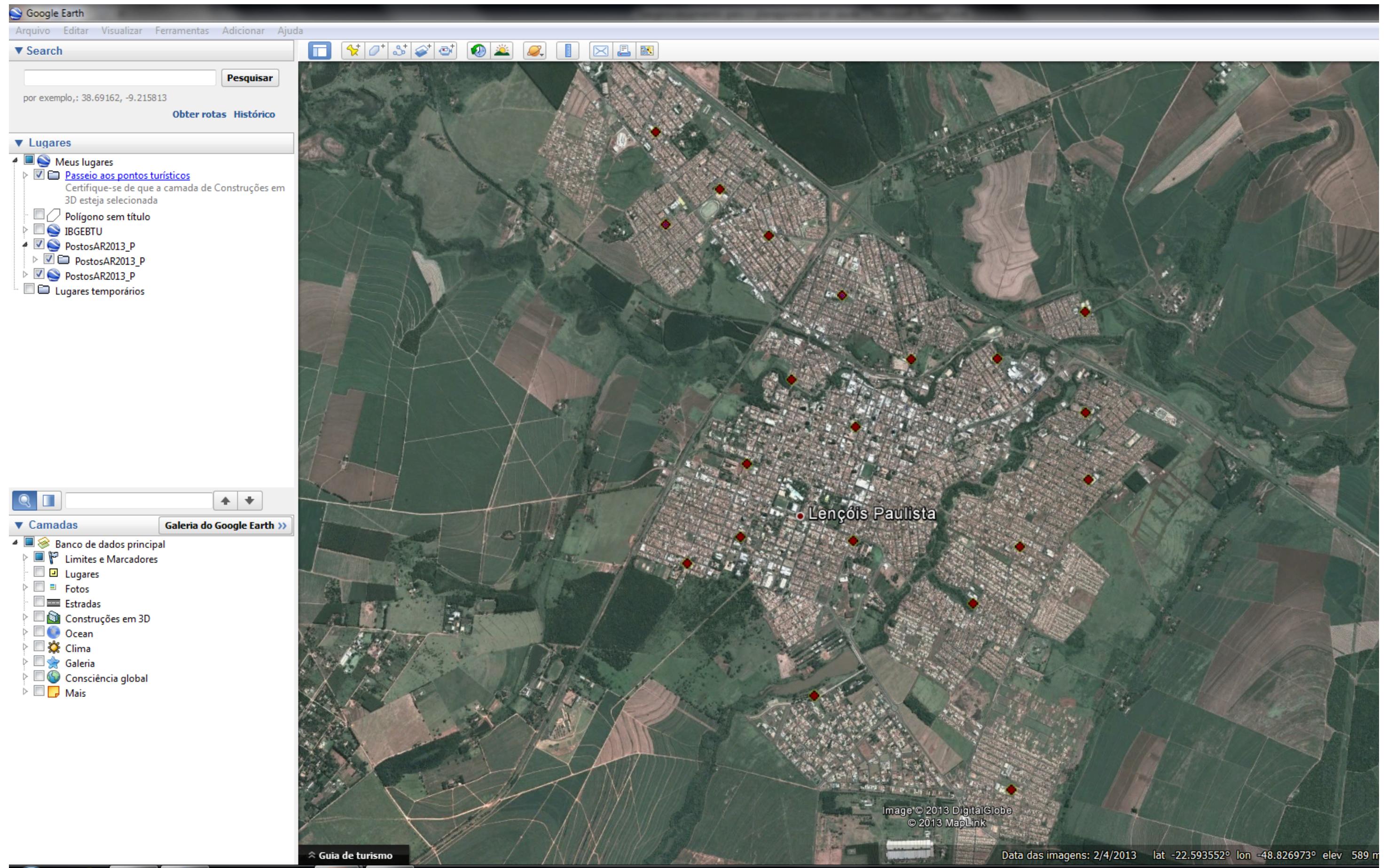


Fonte: blogdaagriculturadeprecisao.blogspot.com



Fonte: www.guiadecelular.com.br

Basic concepts: acquiring coordinates



Basic concepts: acquiring coordinates

S G GPS Visualizer's Easy Batch ...

Meus Favoritos

www.gpsvisualizer.com/geocoder/

GPS garmin 76c

GPSVisualizer

Home · Geocode an address · Calculators · Partner sites:
DRAW A MAP · Look up elevations · GPSBabel · GlobalMotion.com
DRAW A PROFILE · Google Earth overlays · Help/FAQ · EveryTrail.com
CONVERT A FILE · Split a Forerunner file · Examples

AdChoices ► Garmin GPS Maps ► City Map ► Google Map ► Address GeoCoder

GPS Visualizer's Address Locator

Convert multiple addresses to GPS coordinates

Input:

```
AVENIDA RUBENS RUBIO DA ROSA, 127, Botucatu SP
RUA ANTONIO SERAFIM, 133, Botucatu SP
RUA CARMINIO THADEI, 480, Botucatu SP
RUA BENJAMIN FIGUEIREDO, 170, Botucatu SP
RUA JOSE PEDRETTI TILIO, 304, Botucatu SP
RUA JOAO BATISTA VAZ, 45, Botucatu SP
RUA MARECHAL DEODORO, 48, Botucatu SP
RUA EUGENIO LOURENCON, 521, Botucatu SP
RUA ANTONIO ROSSETO, 211, Botucatu SP
```

Type of data: raw list, 1 address per line Source: Yahoo! **Start geocoding**

Add a color: Field separator in output: comma (.)

To use this free utility, simply enter addresses in the box to the left, one per line, and click "Start geocoding" to find their latitude and longitude. If your data is in a tabular format with a descriptive header at the top of each column, choose "tabular" for type of data (and make sure the headers make sense!). If you have a raw jumble of address data, that's okay too; choose "raw list mode," but be aware that everything should at least *look* like an address, and any non-address data such as names, descriptions, or other fields might confuse things.

You can choose from two sources of coordinates: **Yahoo!** or **Google**. Neither service is guaranteed to be 100% correct -- use them at your own risk!

(To see detailed information, including precision data, for a single address, try the **Quick Geocoder**. For general info, see the [Free Geocoding Utilities page](#).)

Results as text: (9 of 9 lines processed)

```
latitude,longitude,name,desc,color
-22.888555,-48.447155,"AVENIDA RUBENS RUBIO DA ROSA, 127, Botucatu SP",-
,-22.893335,-48.501204,"RUA ANTONIO SERAFIM, 133, Botucatu SP",-
,-22.87471,-48.428877,"RUA CARMINIO THADEI, 480, Botucatu SP",-
,-22.855783,-48.460931,"RUA BENJAMIN FIGUEIREDO, 170, Botucatu SP",-
,-22.876764,-48.422954,"RUA JOSE PEDRETTI TILIO, 304, Botucatu SP",-
,-22.888555,-48.447155,"RUA JOAO BATISTA VAZ, 45, Botucatu SP",-
,-22.887247,-48.443327,"RUA MARECHAL DEODORO, 48, Botucatu SP",-
,-22.873373,-48.429885,"RUA EUGENIO LOURENCON, 521, Botucatu SP",-
,-22.868229,-48.452739,"RUA ANTONIO ROSSETO, 211, Botucatu SP",-
```

Draw a map
format: Google Maps Labels on map [more map options]

Create a GPX file

clear results box and map

How this page works

Google and Yahoo each provide a geocoding "API" -- a way for other programs to quickly and easily access their services. But they only allow a certain number of queries per day, based on your IP address. This form uses JavaScript-On-Demand (JSON) code that causes your Web browser to make many small requests to the servers, which means your queries don't count against my server's limit. (And thanks are due to the developers of the batch geocoder at [BatchGeocode.com](#) for the Yahoo JSON info.)

Verifying strange results

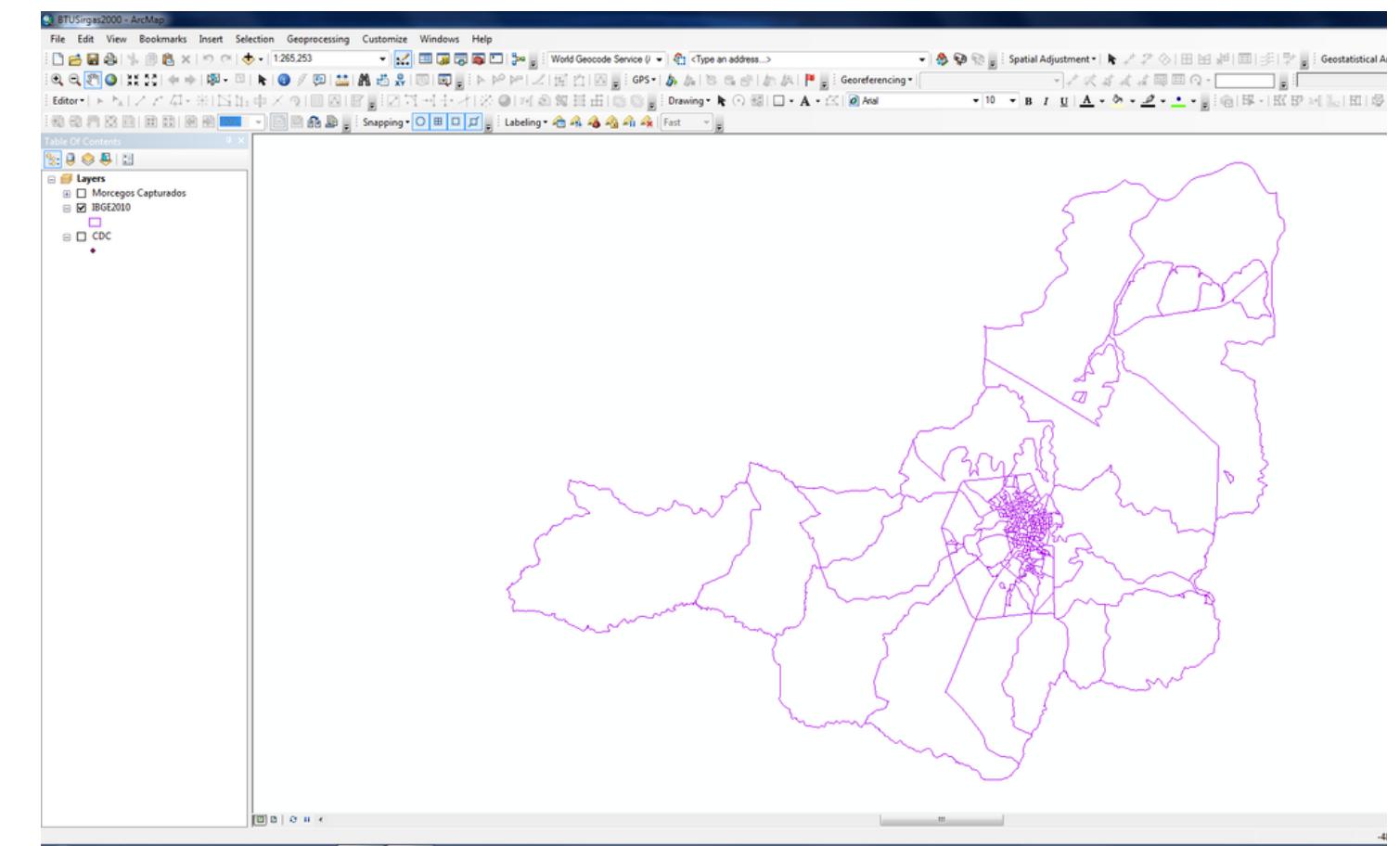
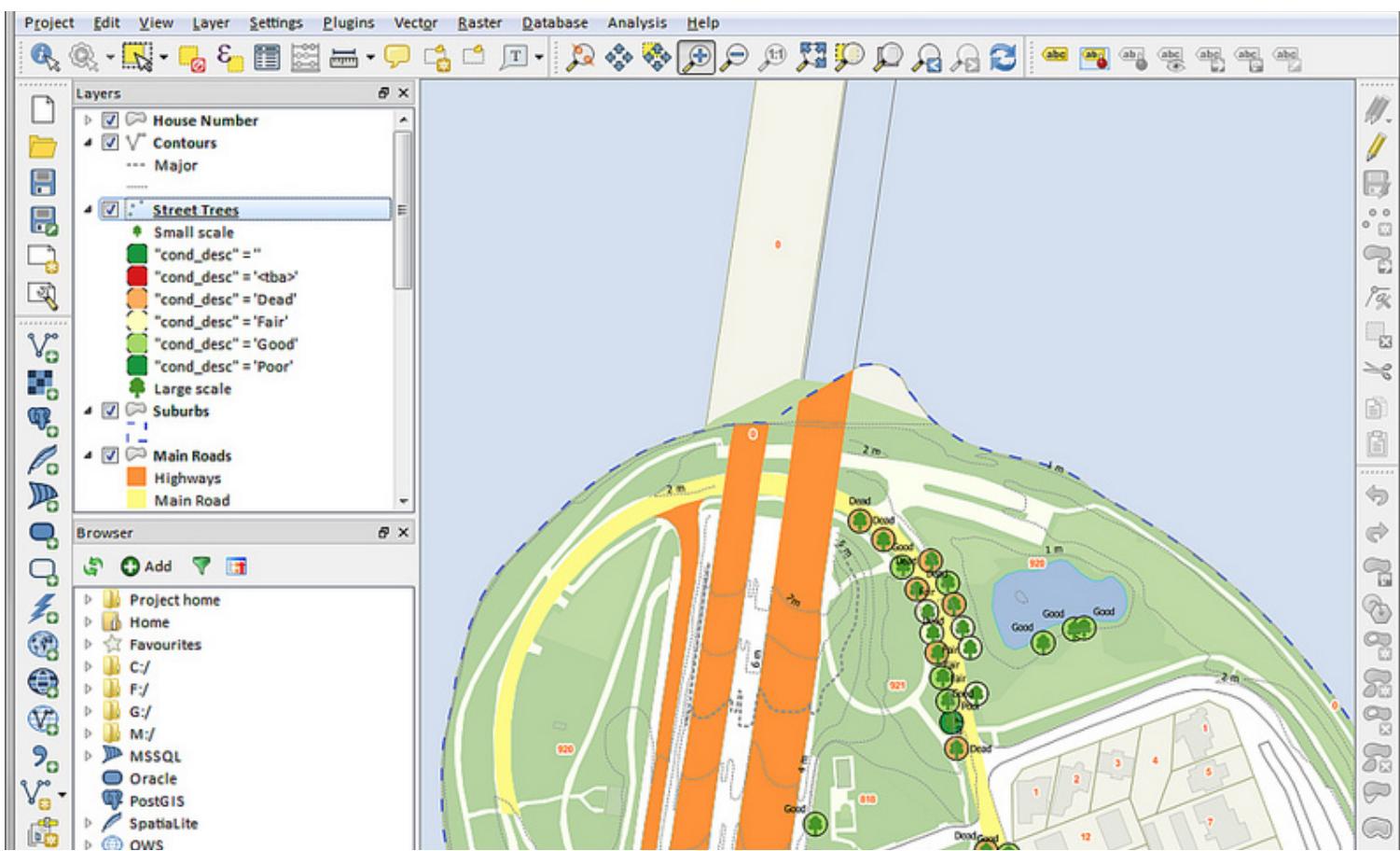
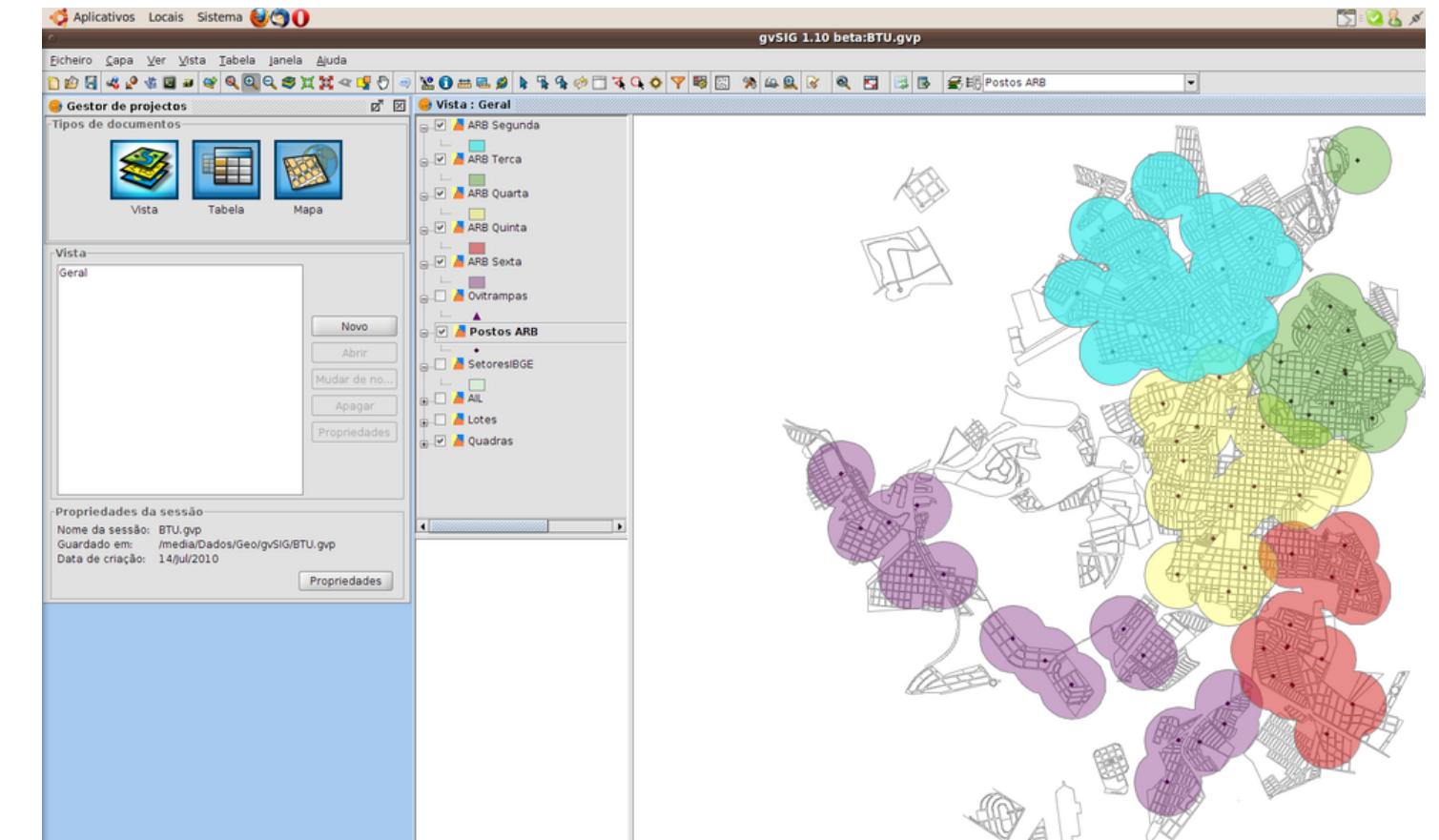
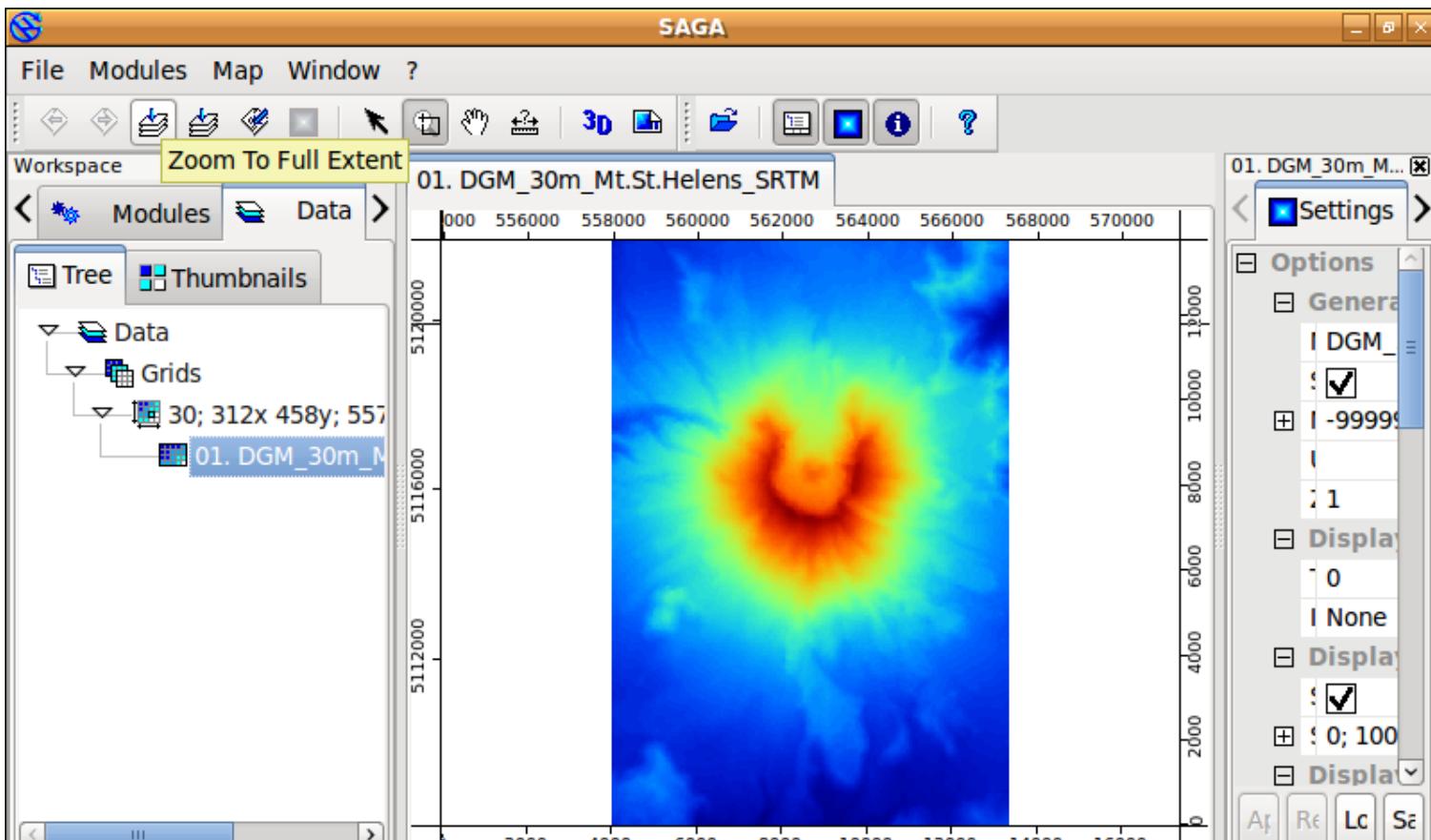
Sometimes the geocoder returns coordinates that don't seem right. Unfortunately, there's no way to get Yahoo's precision information using this form -- but you can see Yahoo's precision estimate for individual addresses if you run them through the [Quick Geocoder](#).

One common source of errors (aside from missing, misspelled, or poorly-aligned header rows) is non-street addresses that *look* like addresses, like P.O. Boxes or named buildings. For example, "200 Jackson Building, 333 2nd Street" might be interpreted as "200 Jackson Street" by the geocoder, other than ensuring that your "address" column contains actual street addresses.

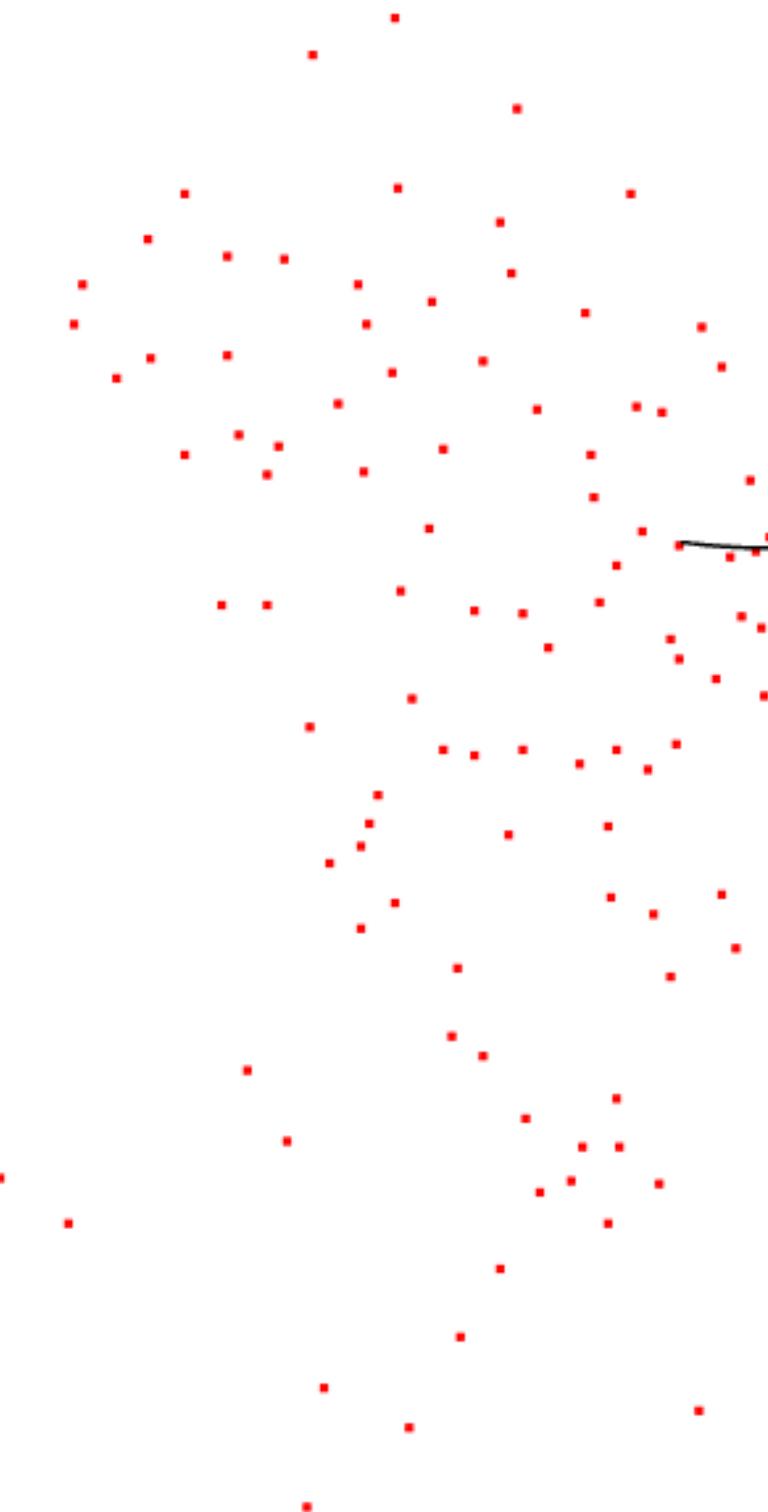
©2003-2012 Adam Schneider, adam@gpsvisualizer.com.

Estados Unidos da América 66.197.167

Basic concepts: GIS

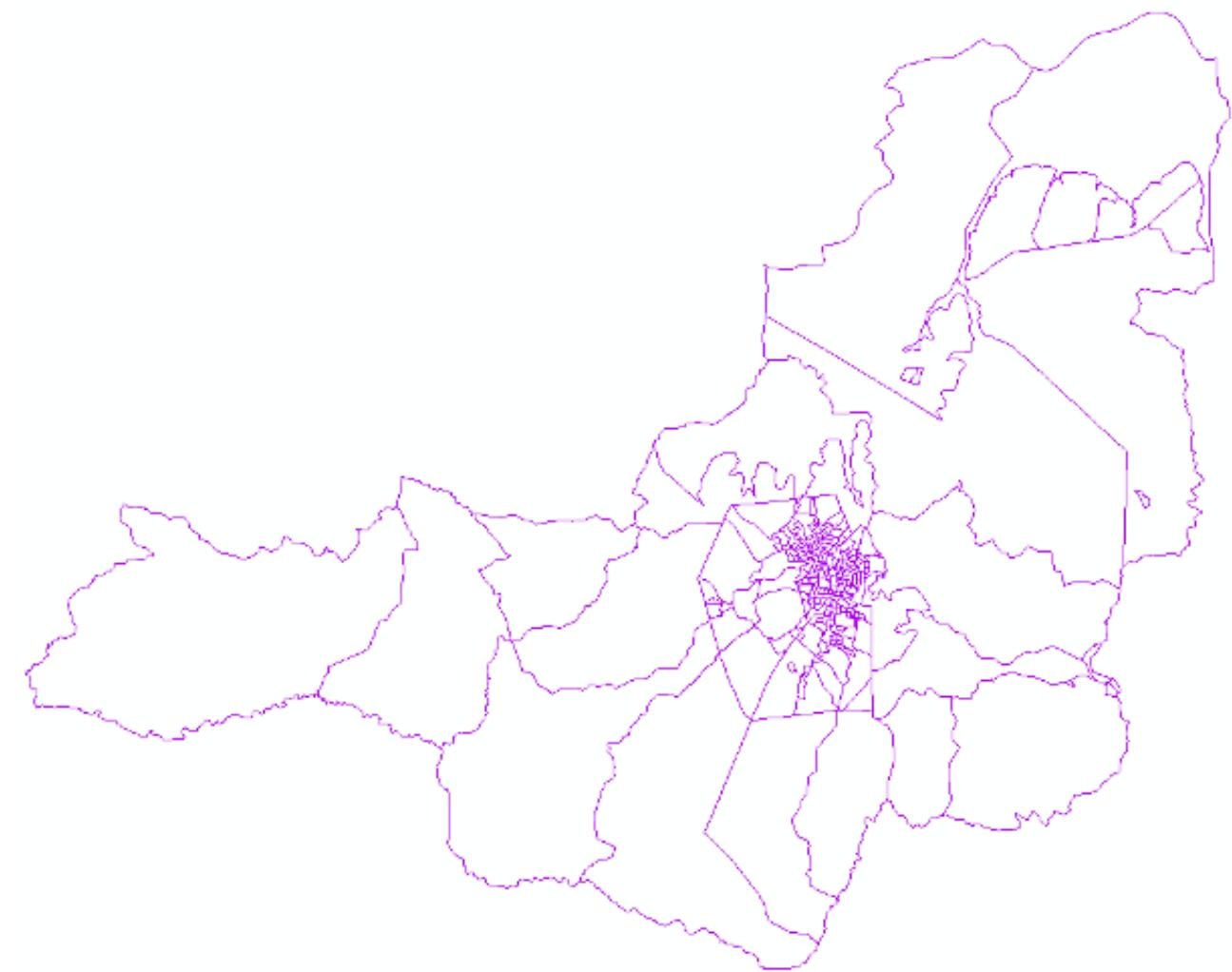


Point data



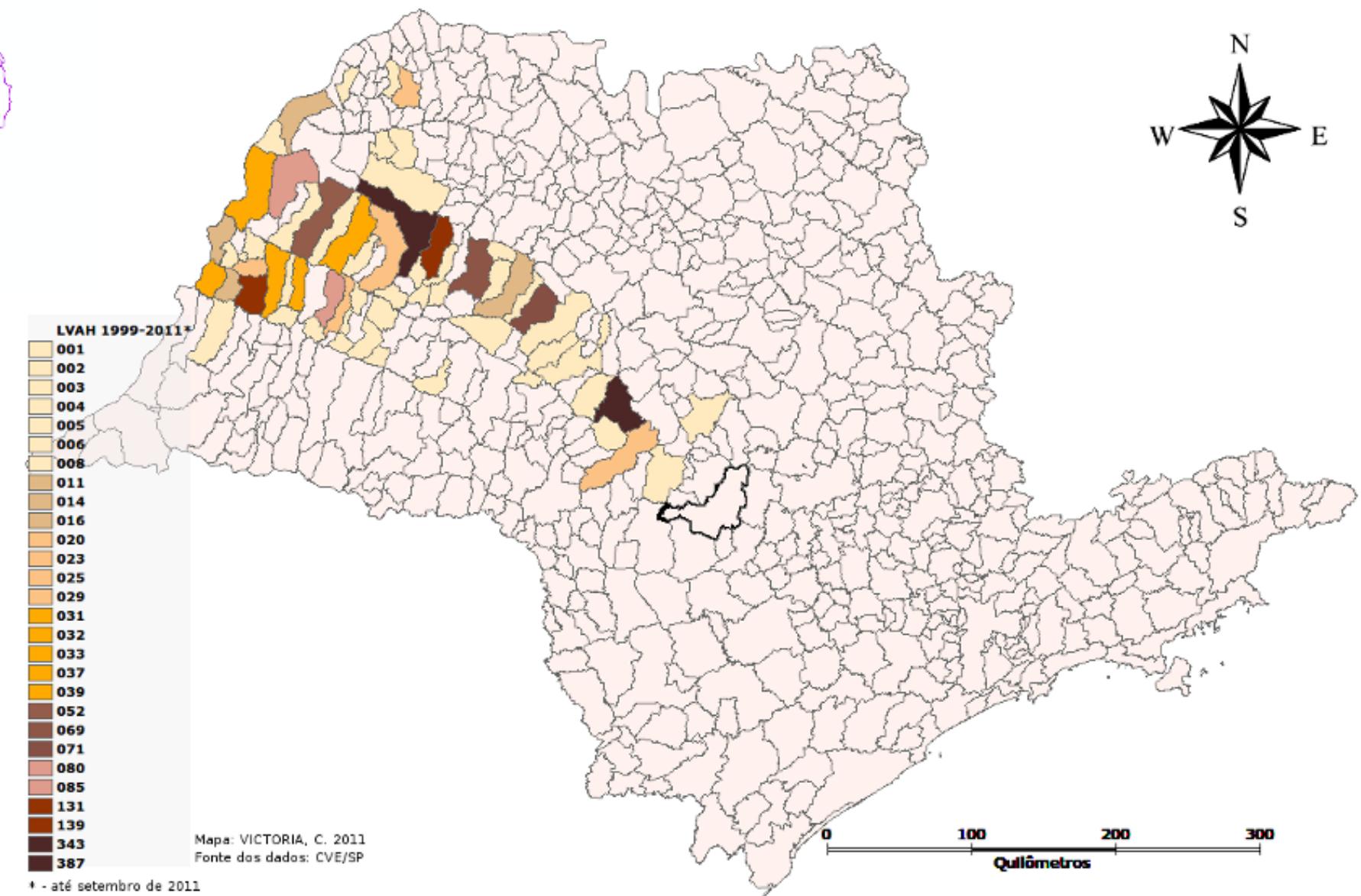
A	B	C	D	E	F
ID	ID_ARM	COORDX	COORDY	N_OVOS	...
1	OVI_1	781788	7487654	15	...
2	OVI_2	781846	7487801	29	...
3	OVI_3	782082	7487876	18	...
4	OVI_4	782126	7487182	10	...
5	OVI_5	783094	7486822	12	...
6	OVI_6	783498	7486975	18	...
7	OVI_7	783102	7487491	22	...
...

Basic concepts: vector data

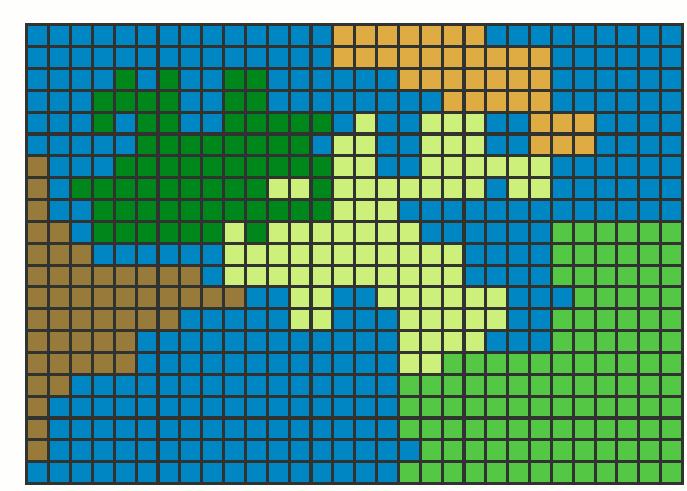
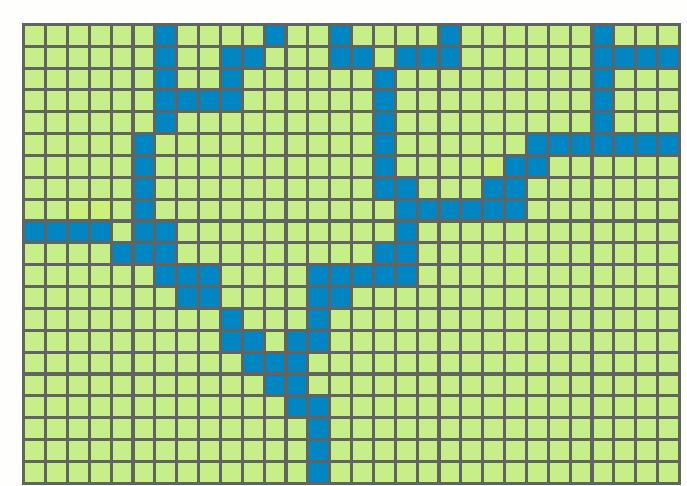
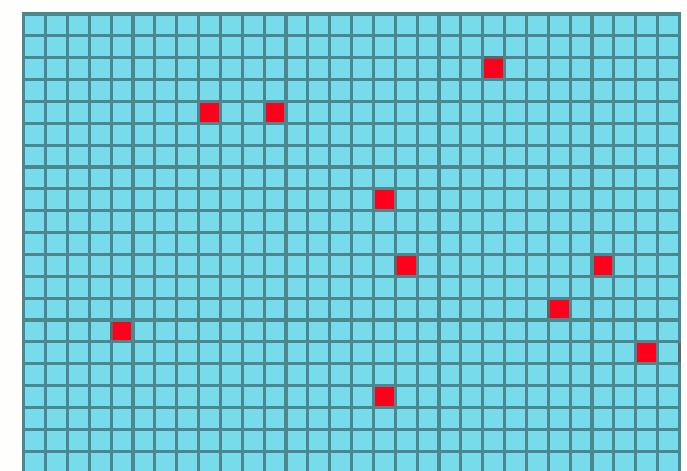
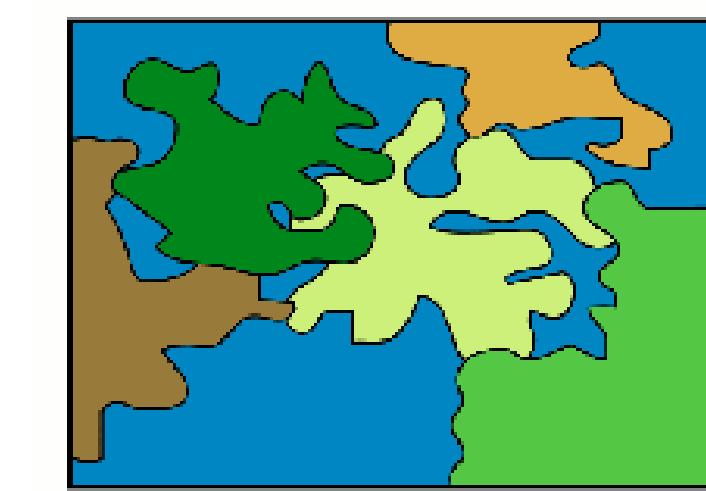
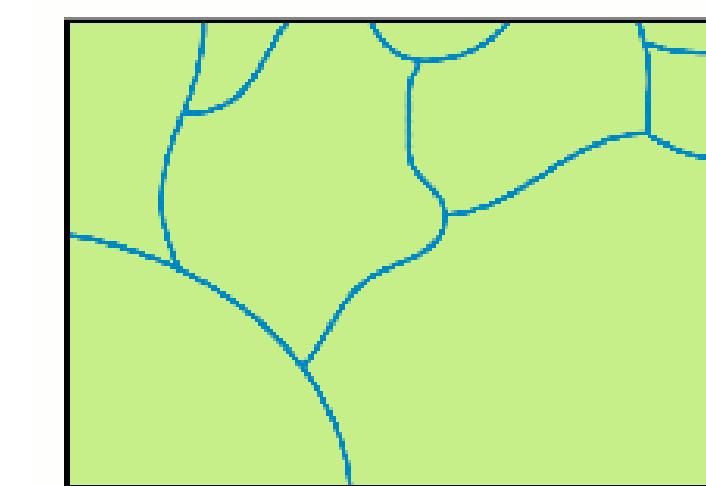
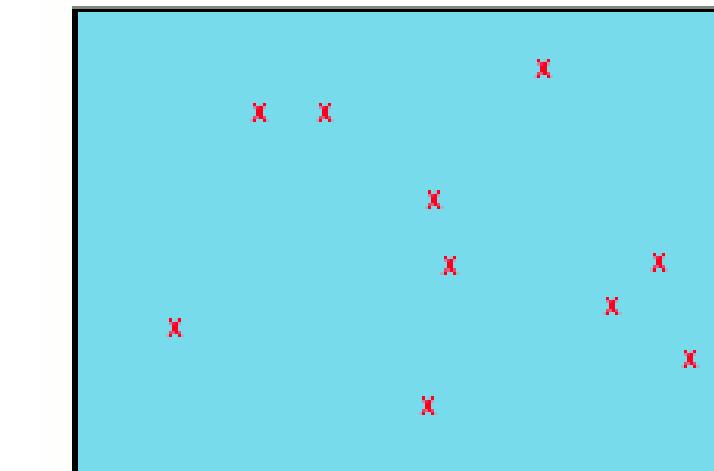
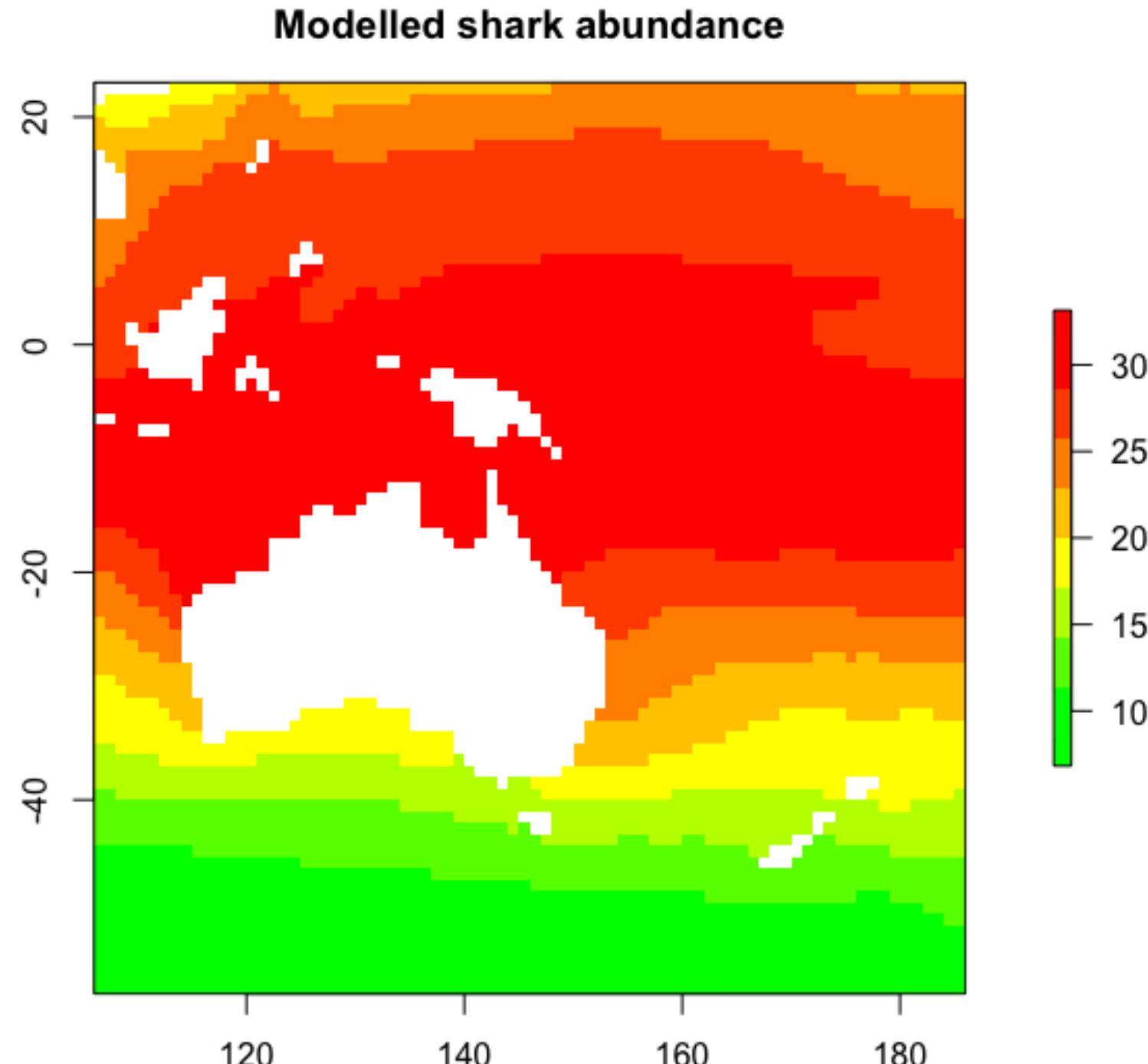


"centroids"

Area - "Polygon"



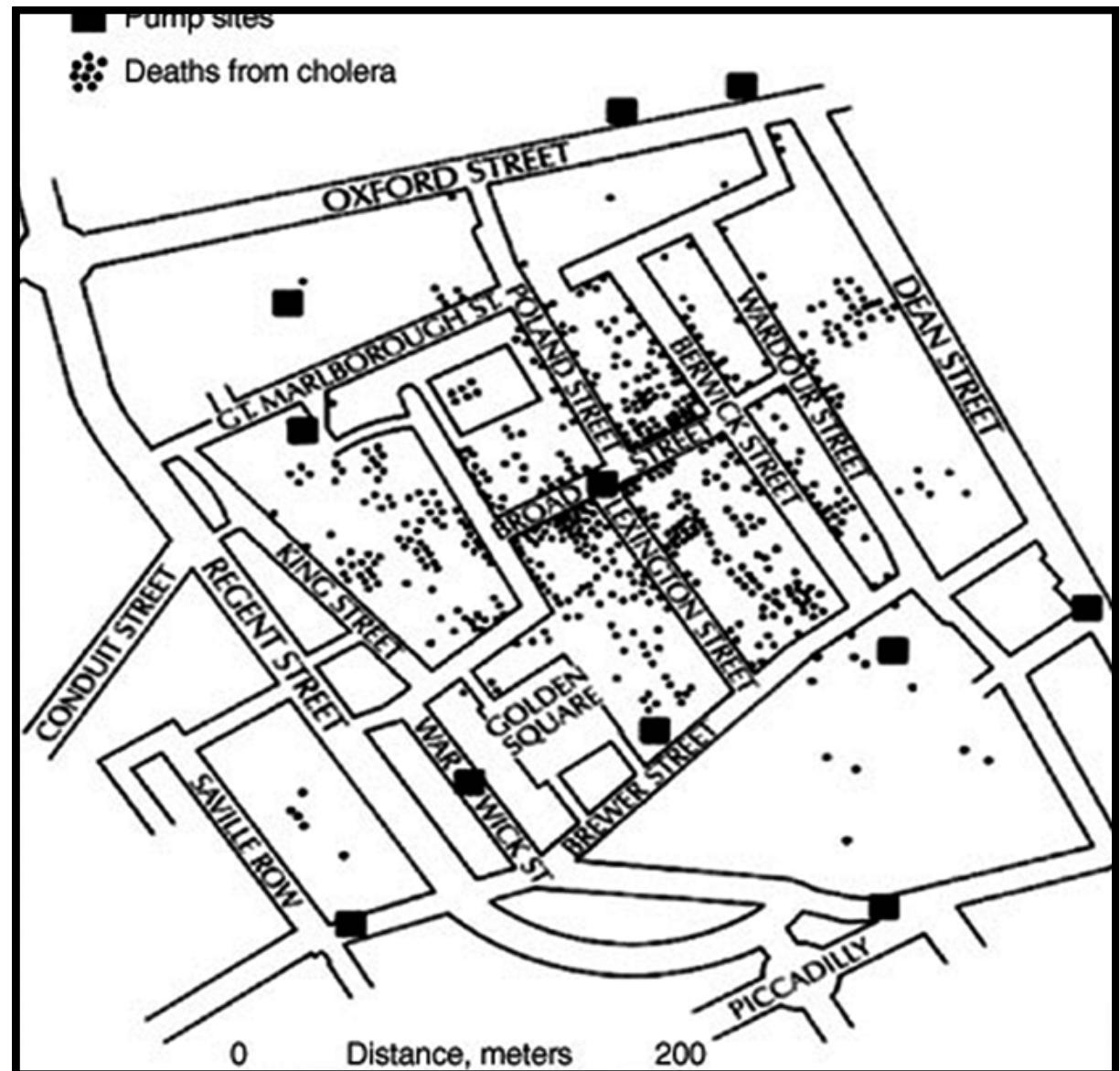
Basic concepts: raster data



Computer Representations of Geographic Features

Basic concepts

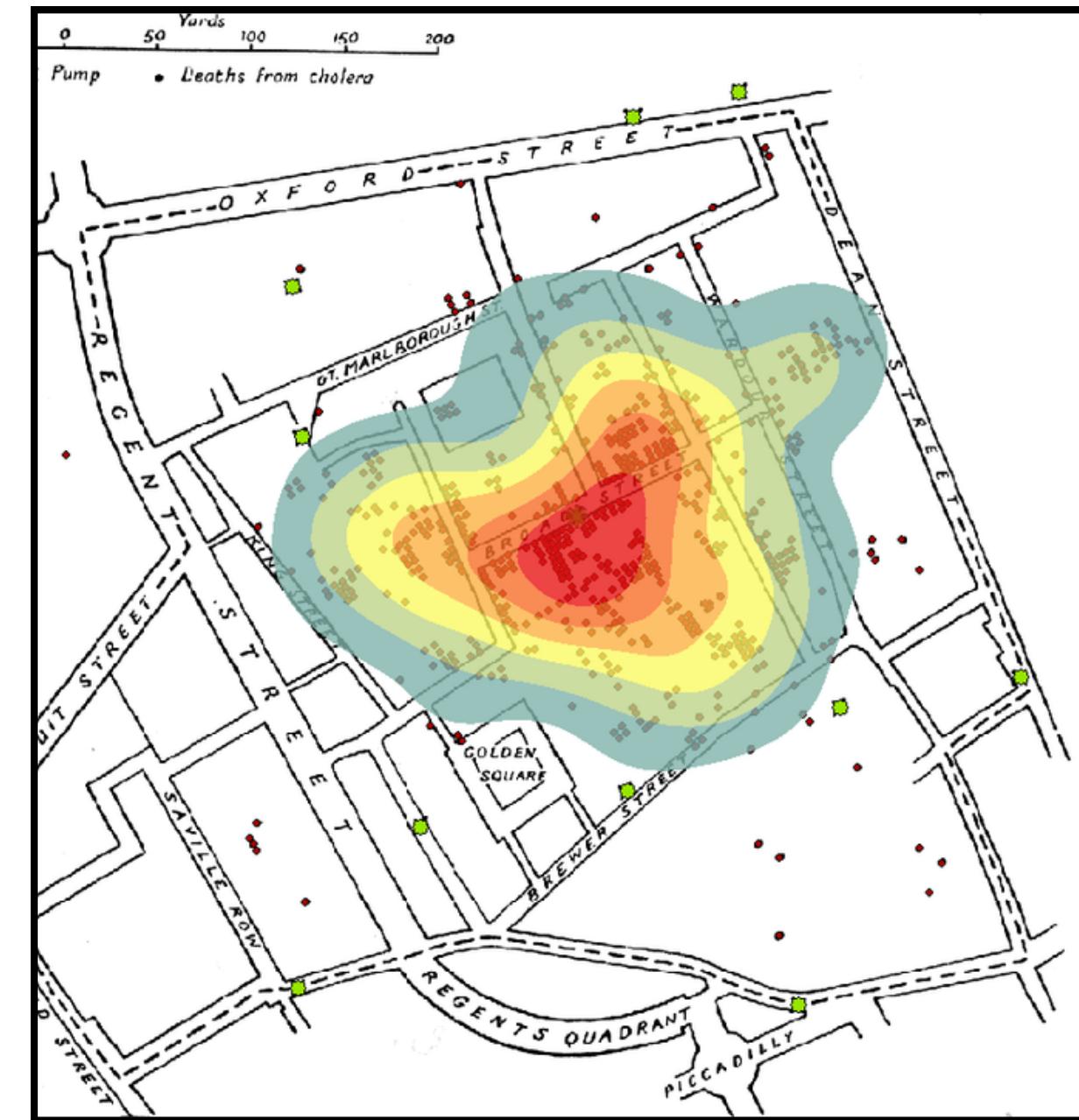
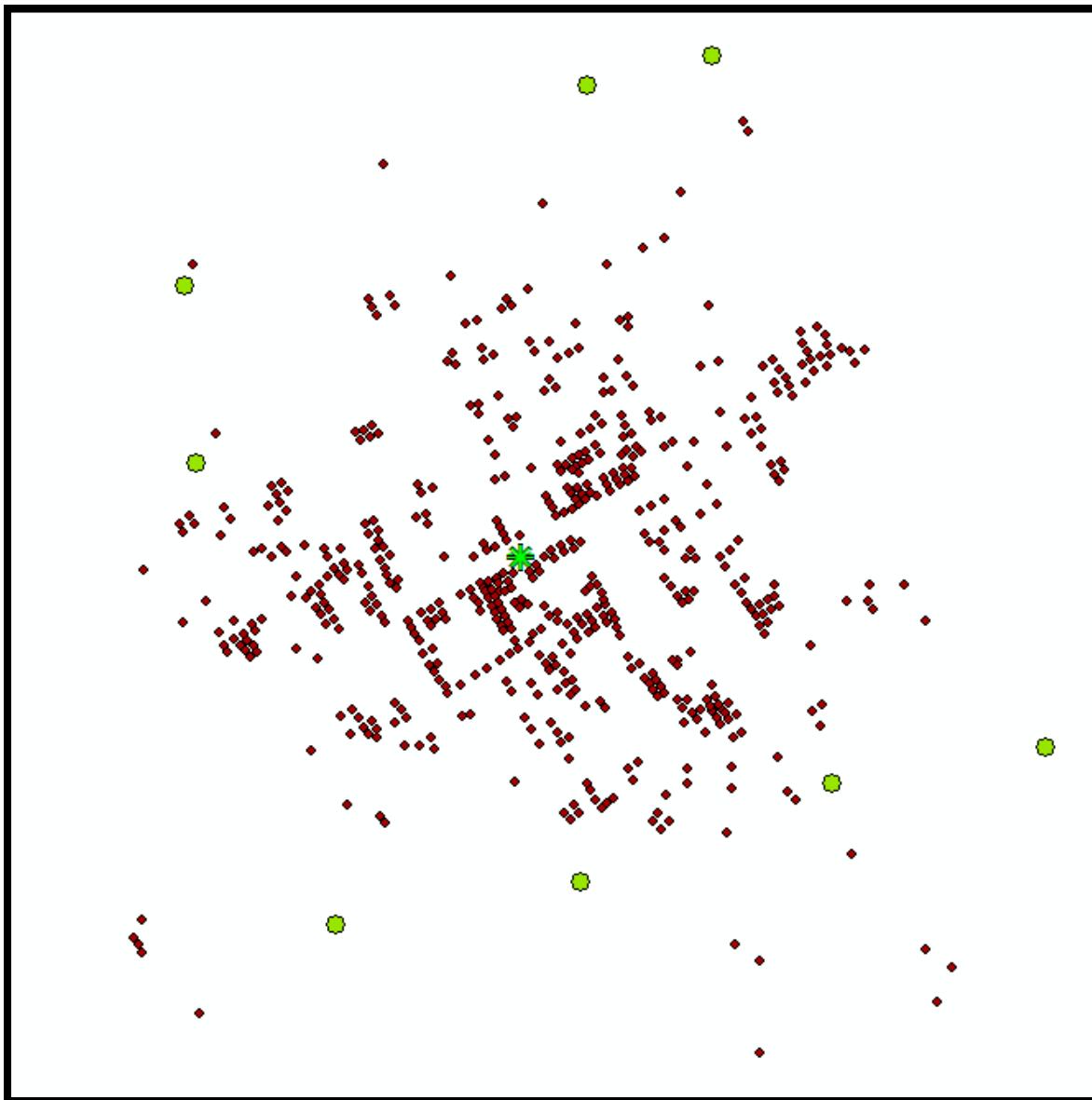
John Snow - 1854



Fonte: www.emeraldinsight.com



Fonte: www.londontown.com



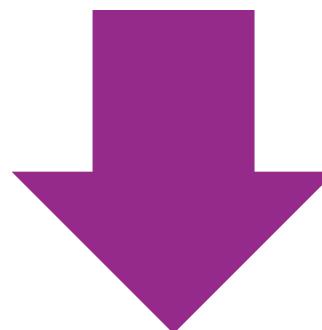
Kernel interpolator

Basic concepts: spatial databases

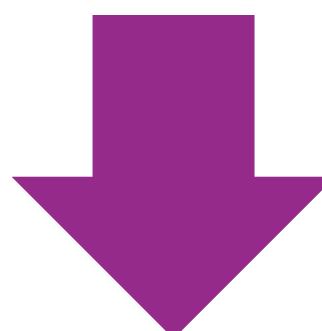


Basic concepts: spatial databases levels

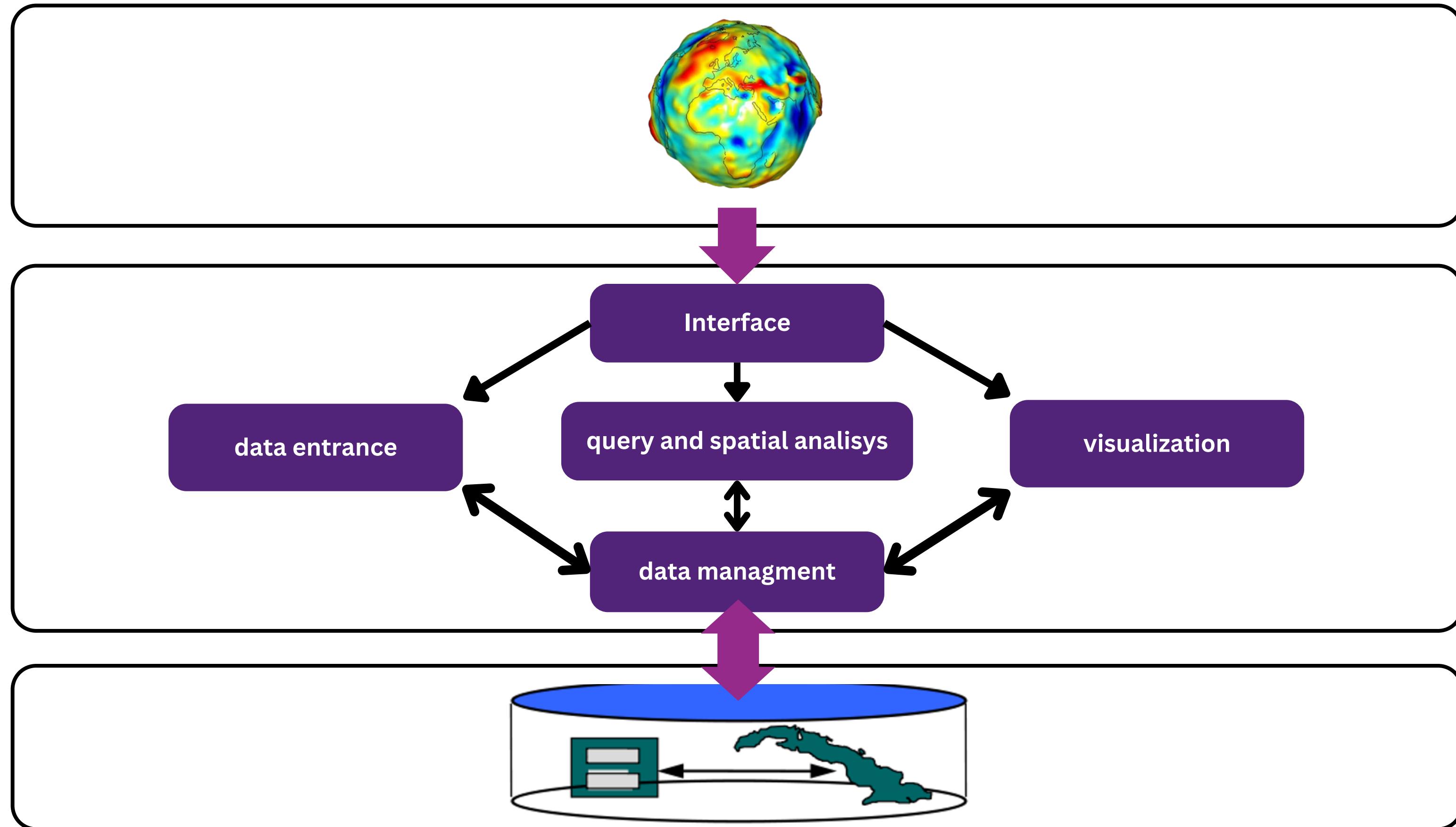
"Real World"



GIS

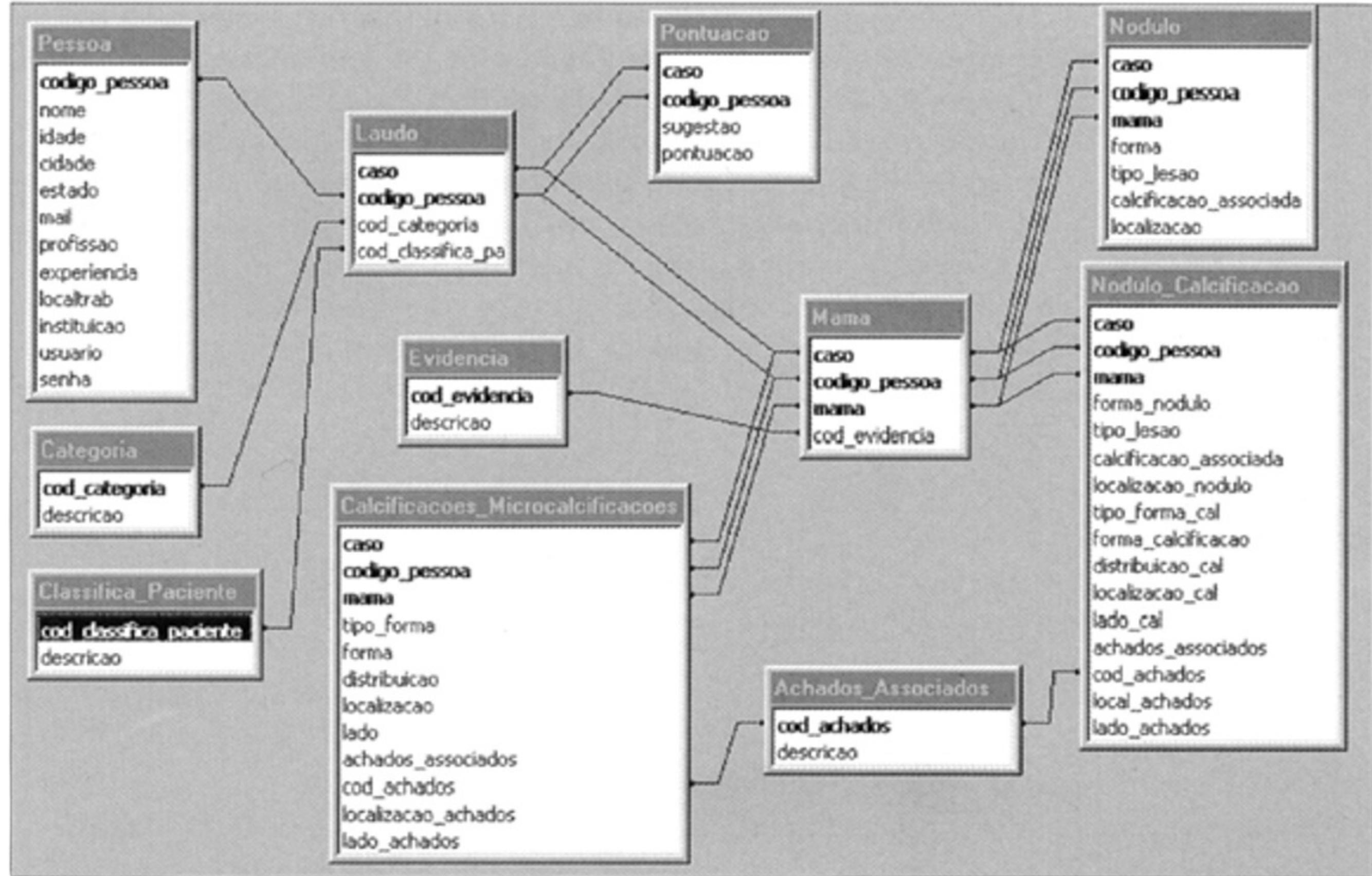


Databases



Relational databases

"ID"



Basic concepts: "best practices tips"

Before starting !!!

Transform your data → **Datum and Coordinate systems**

Split your tables → **Base and data tables**

Number ID's → **Use numbers instead letters**

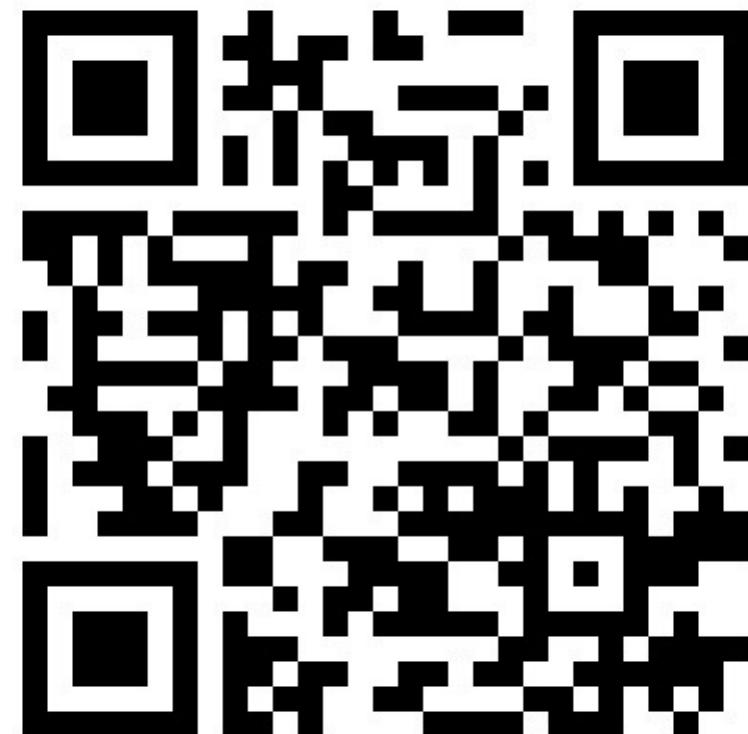
Scale → **Set scales**

Maps → **Define map output size beforehand.**
→ **Define map output extension beforehand.**

Questions & Comments

Cassiano Victoria

Professor Doctor



*Spatial Epidemiology
Geoprocessing and Geostatistics
Veterinary Public Health*

**UNIVERSIDADE ESTADUAL PAULISTA
“JÚLIO DE MESQUITA FILHO”**

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email: cassiano.victoria@unesp.br

