GEOG 205: update / labs

- Syllabus, labs, lectures are posted on www.gis.unbc.ca
- Labs, quizzes and exams submitted on Moodle
- First week of labs – Tuesday, Wednesday, Friday

- If you miss your lab or don't get all done, drop in on another lab section

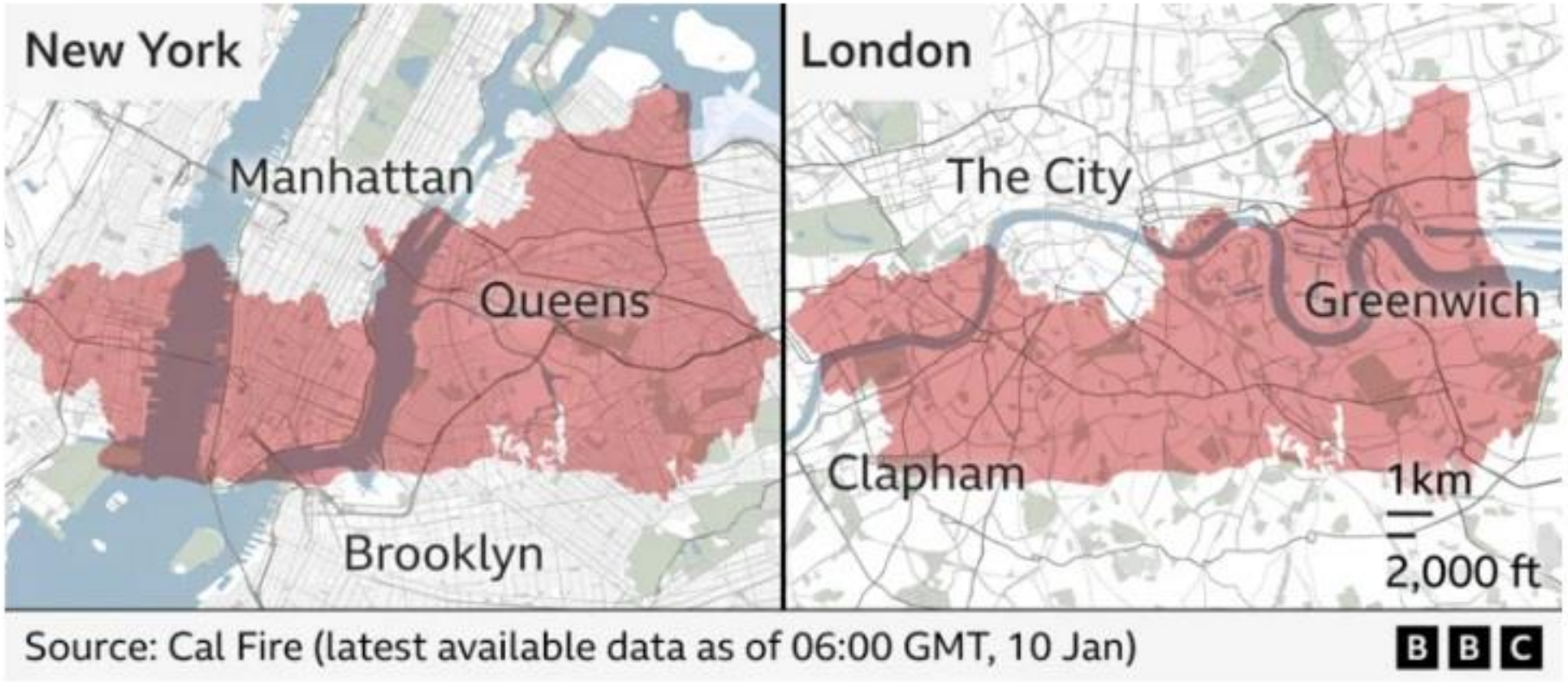
- Labs are due before the next week's lab
- This week: Submit map / question as per directions – just checking, no grades
- Quiz #1: will be posted on Moodle after Thursday lecture
- Please see request on Moodle for note takers

Where are the Los Angeles fires burning?

Source: Cal Fire (latest available data as of 06:30 GMT, 11 Jan)

BBC

See satellite image and fires on Google Maps

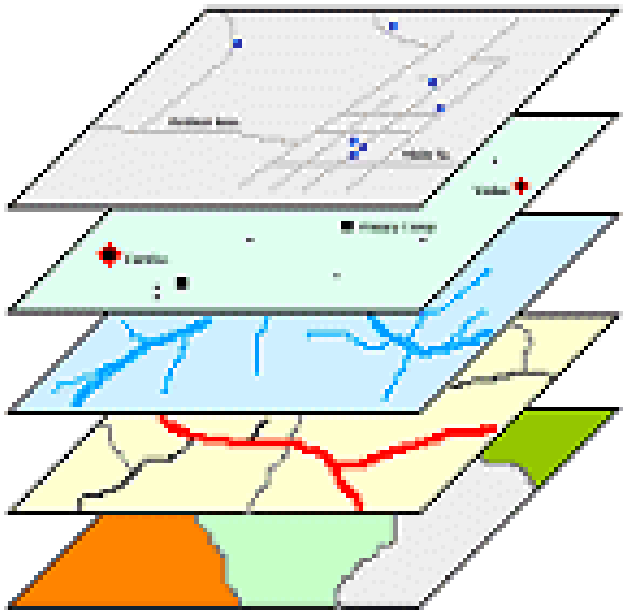


‘Bigger than Manhattan’

‘Would cover 2000 football fields’

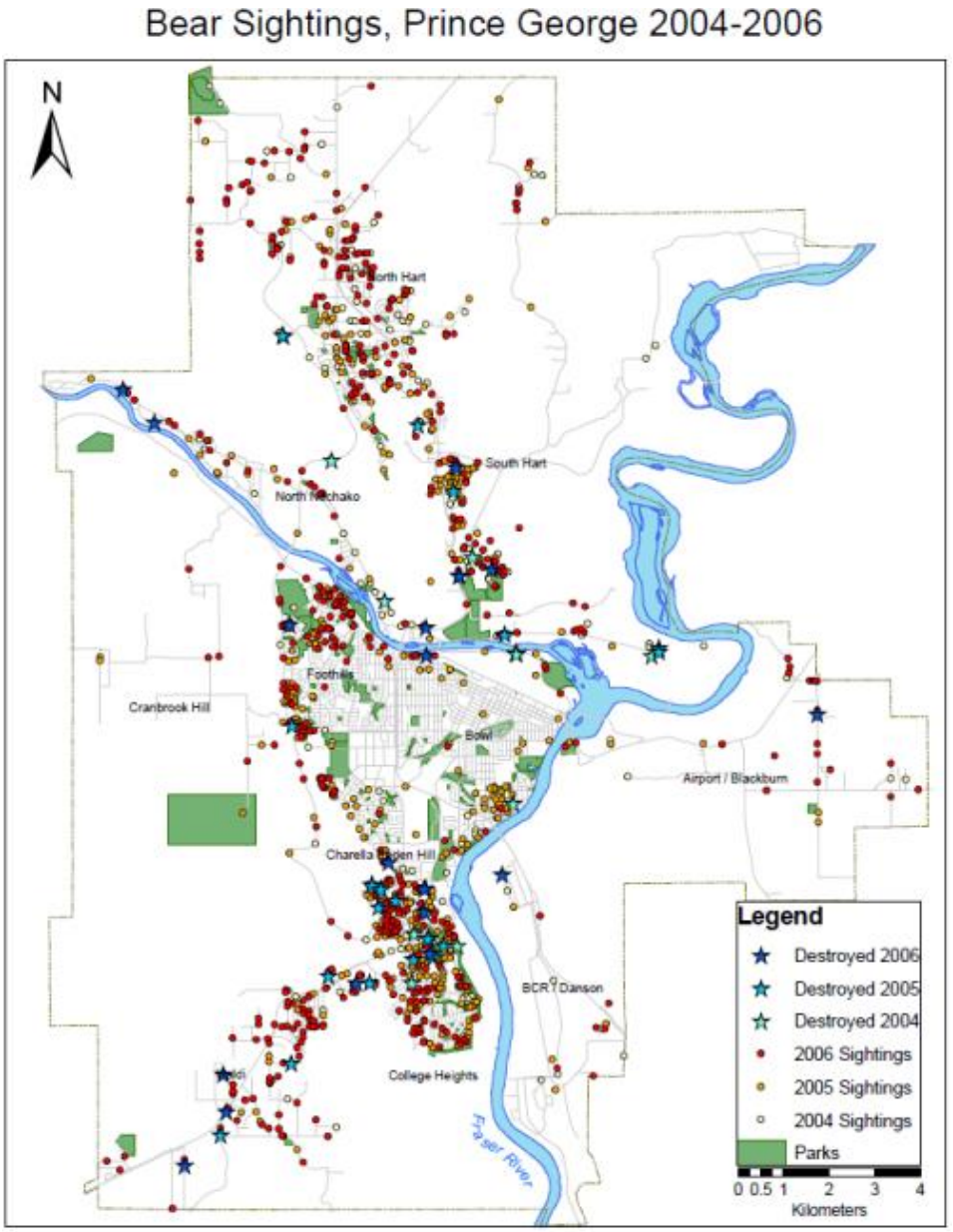
1/3 of Saskatoon ?

Coordinate map systems and Georeferencing



Registered map layers

digital mapping needs coordinates
- local for local mapping
- global for global datasets



Registration vs Referencing

Registration:
-lining up the layers together

Georeferencing:
Linking layers to map coordinates

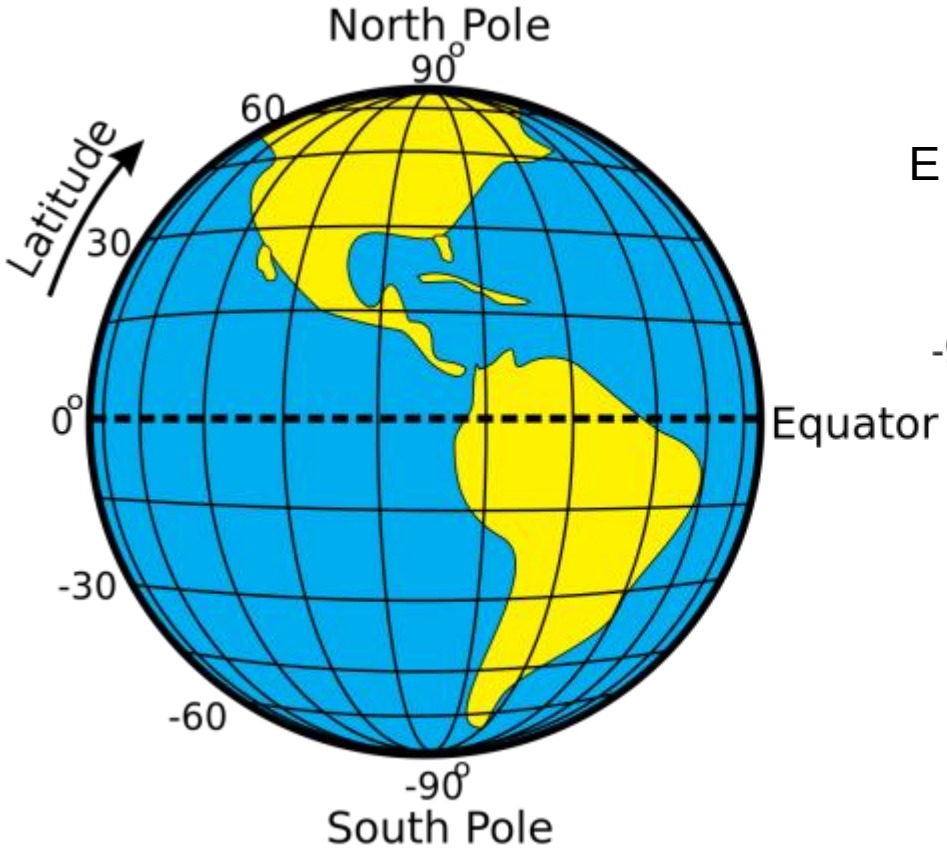
The FLAT EARTH SOCIETY

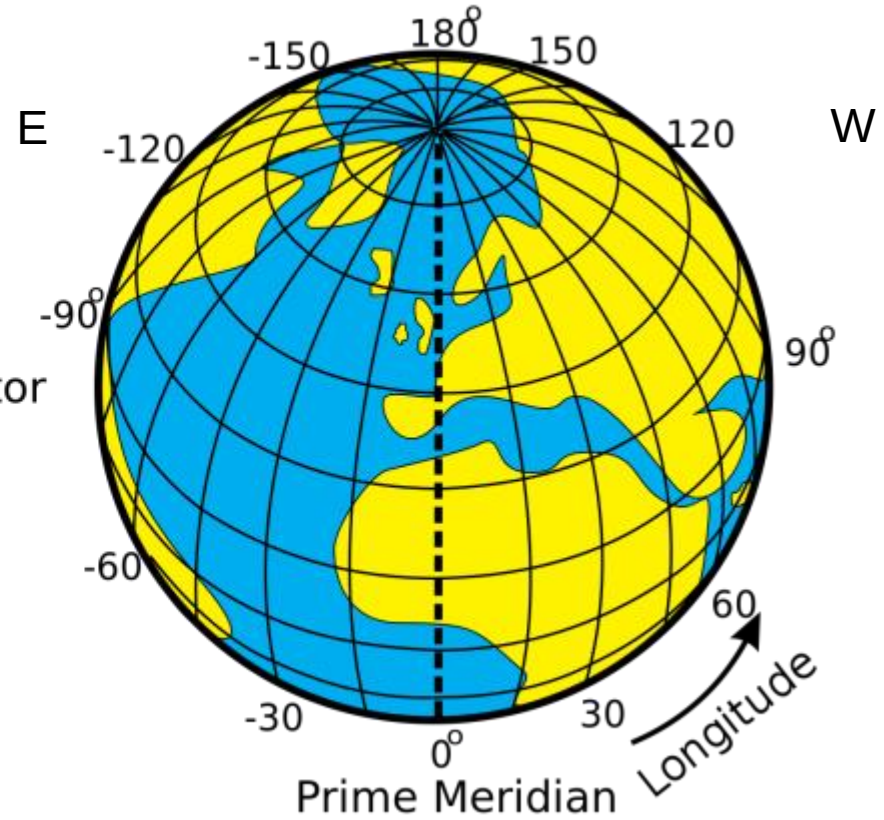
Flat Earth options:– if only it was flat, this would be a very short lecture

Coordinate map systems

1.The Earth's Graticule: Latitude - Longitude

- The graticule is the imaginary grid of lines running east-west lines of latitude (parallels) and north-south lines of longitude (meridians)
- The system was first devised by Hipparchus (190-120 BC)





1a. 'Geographic Referencing'

We can identify locations by latitude, longitude

I degree latitude = ~ 111km

1 degree = 60′ (minutes) 1′=~ 2km (111km /60)

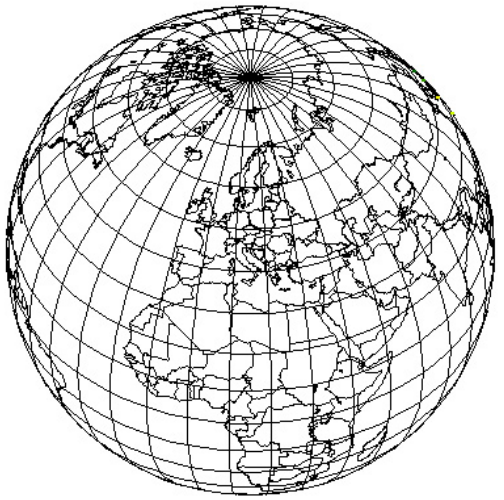
1′ = 60″ (seconds) 1″=~30m (2km / 60)

e.g. UNBC campus agora

In degrees, minutes, seconds: (DMS) 53° **53' 33" N 122° 48' 50" W**
In degrees and decimal minutes (DDM) **53° 53.54' N 122° 48.82' W** (GPS)

In decimal degrees: 53.892381, -122.813699 (N, W)
See: http://maps.google.ca (right-click)

Latitude

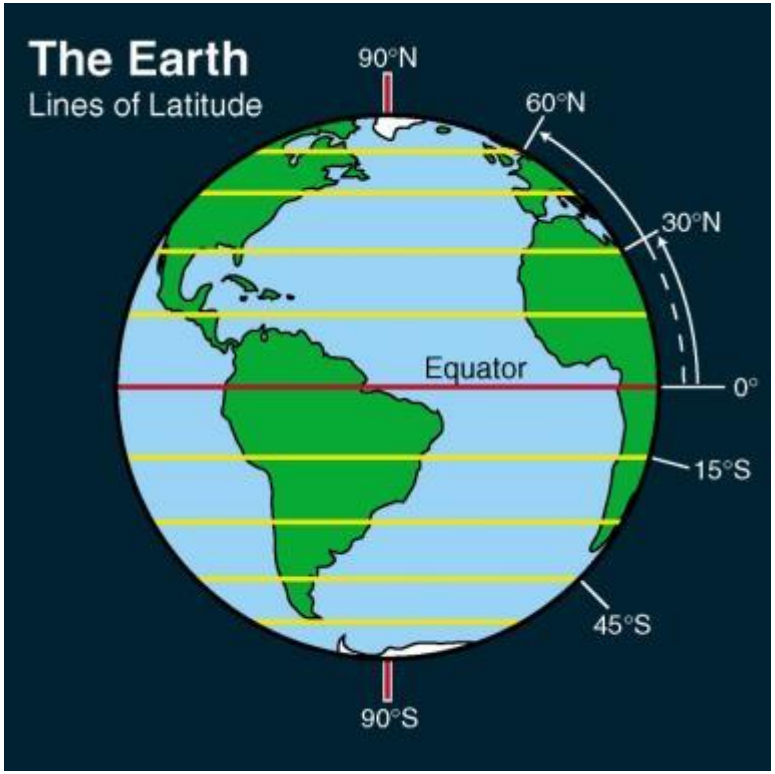


- **Latitude** = the vertical angle from the centre of earth to the location

- e.g. Prince George is at 54°N
- Quesnel is at 53°N

- [1° = ~ 111km]

- Latitude is 0 on the equator

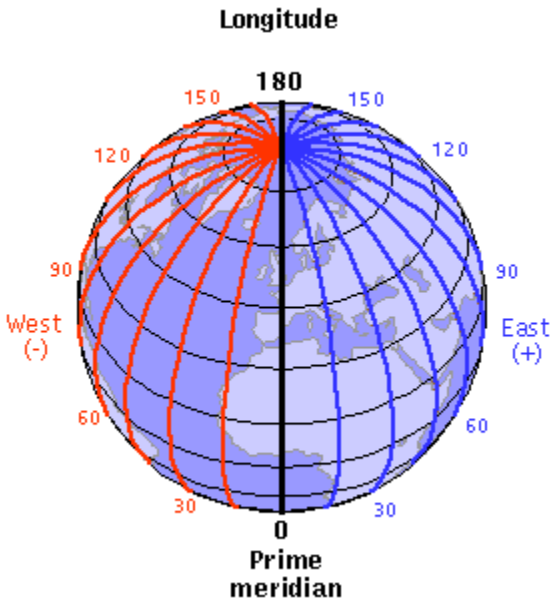


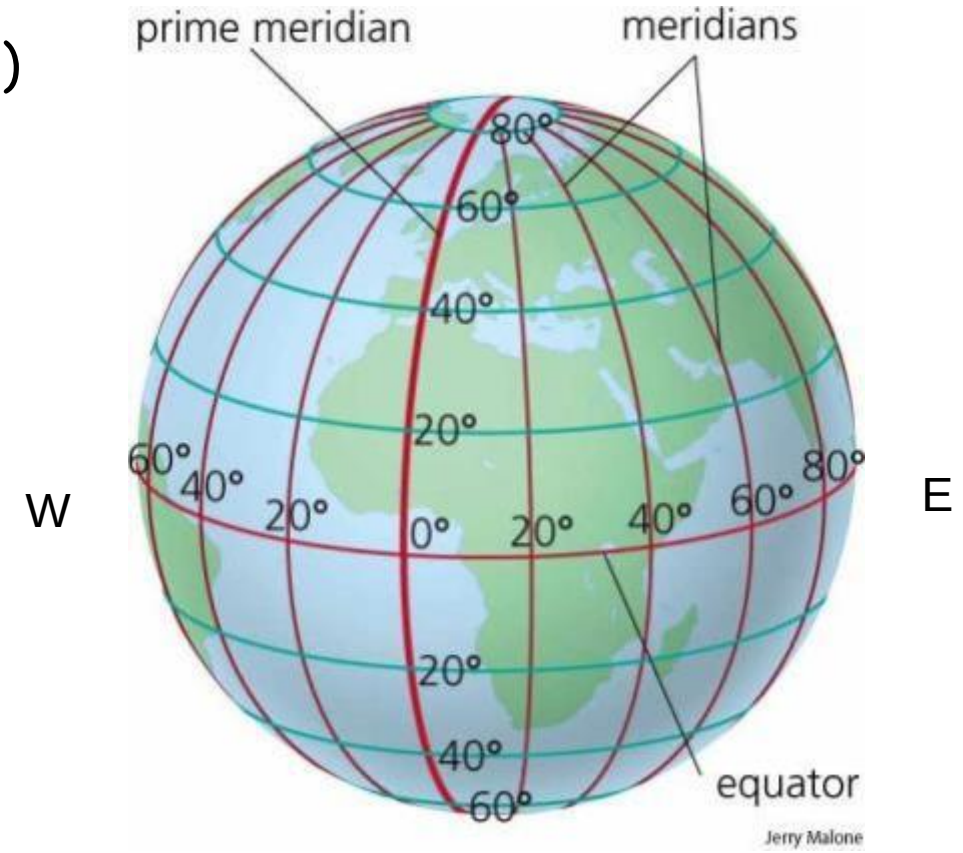
Longitude

Longitude = the angle formed between line from centre of earth to the (arbitrary) 'prime meridian' running through Greenwich, England and the local meridian. The 0 location is arbitrary (established 1884)

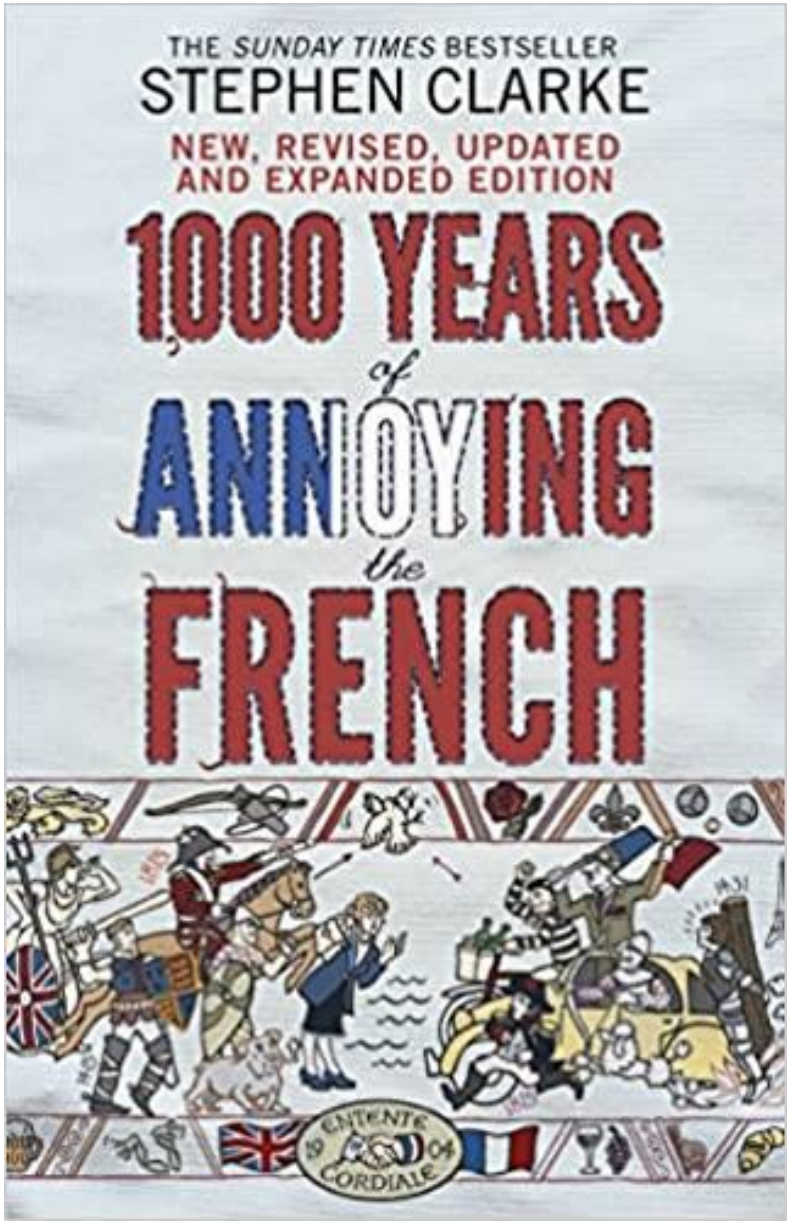
Longitude ranges from
0 to 180 W / 180 E (the same line)

Prince George = 123°W





Meridian Room (or Cassini Room) at the Paris Observatory, The Paris meridian is traced on the floor. Established 1634.



'Geographic' (latitude/longitude) referencing issues

a. Geographic is <u>not decimal</u>, it is '<u>sexagesimal</u>' (= base 60)
Before computers we used Degrees, Minutes, Seconds (DMS)

b. It is suitable for storing global datasets, but … with <u>negative values</u> south and west of 0, 0; e.g. in a digital system, PG = 54, -123

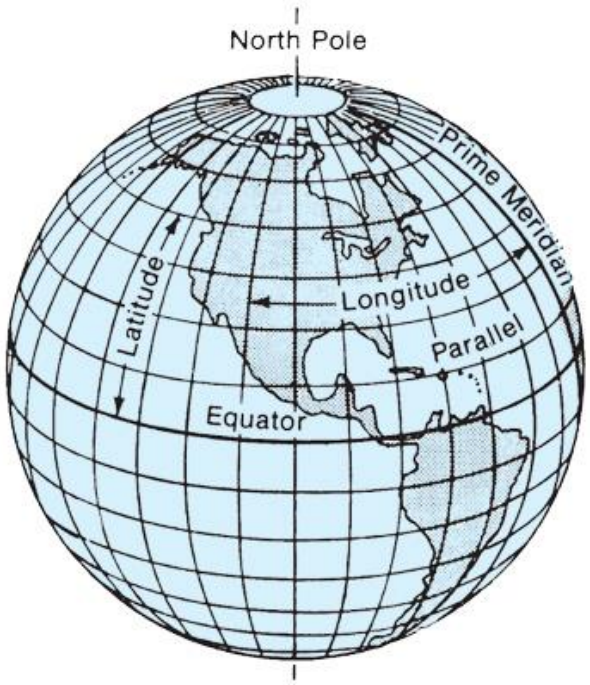
c. The main issue mapping with Longitude: it's not rectangular …

1 degree longitude varies widely from
~111 km at the equator to 0 km at poles

half the distance at 60 ° N/S →

Equator →

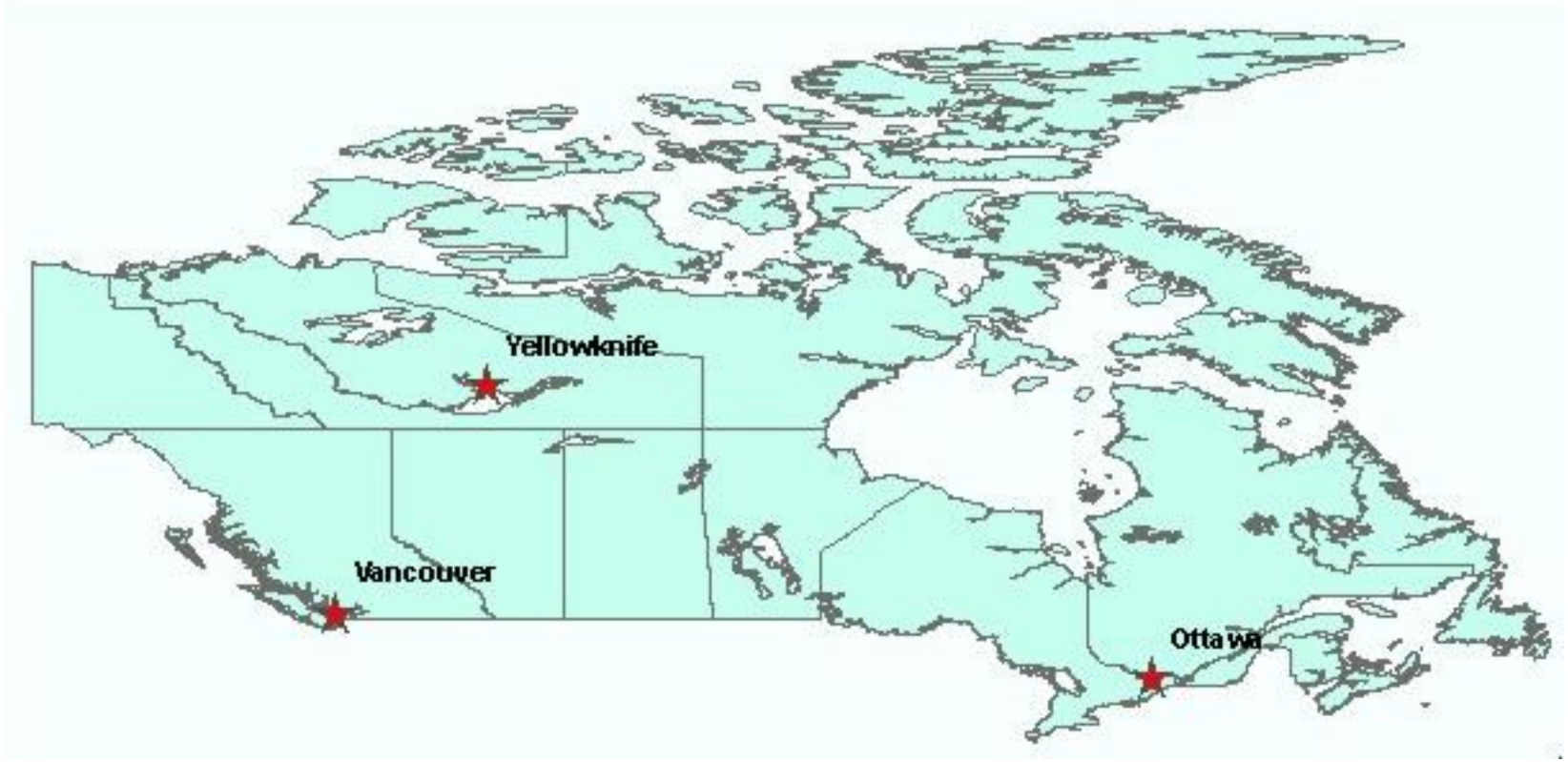
i.e. 1 degree has no fixed length



-1 degree longitude varies from 0 -> 111 km

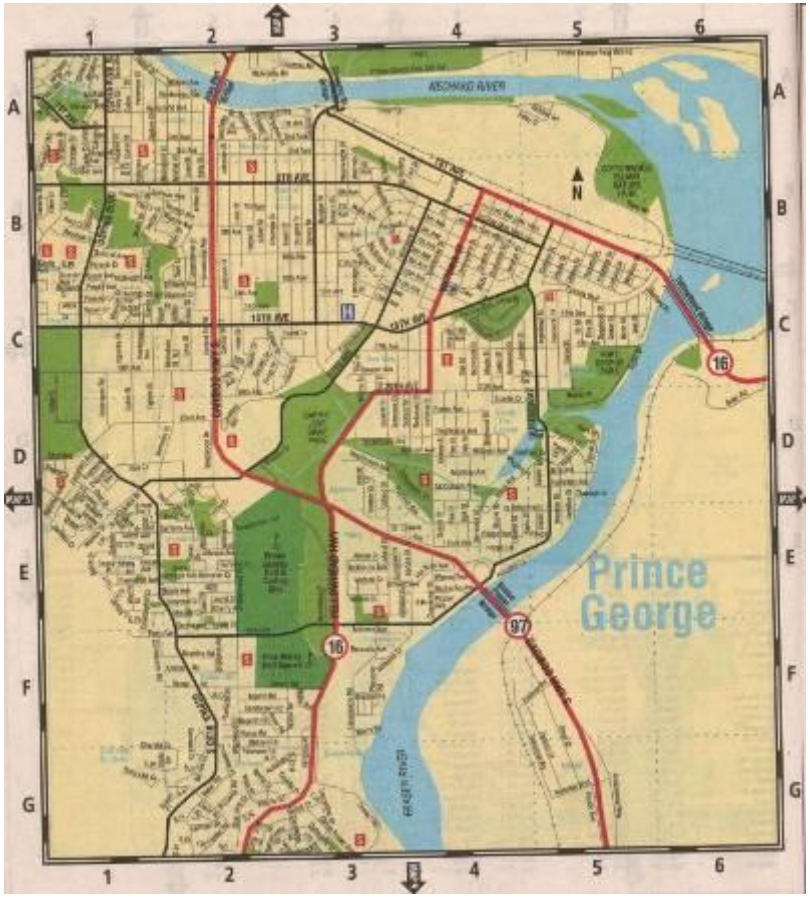
->East-west stretching away from equator
(as a degree is treated uniformly)

<u>OK for data storage, not for display</u>

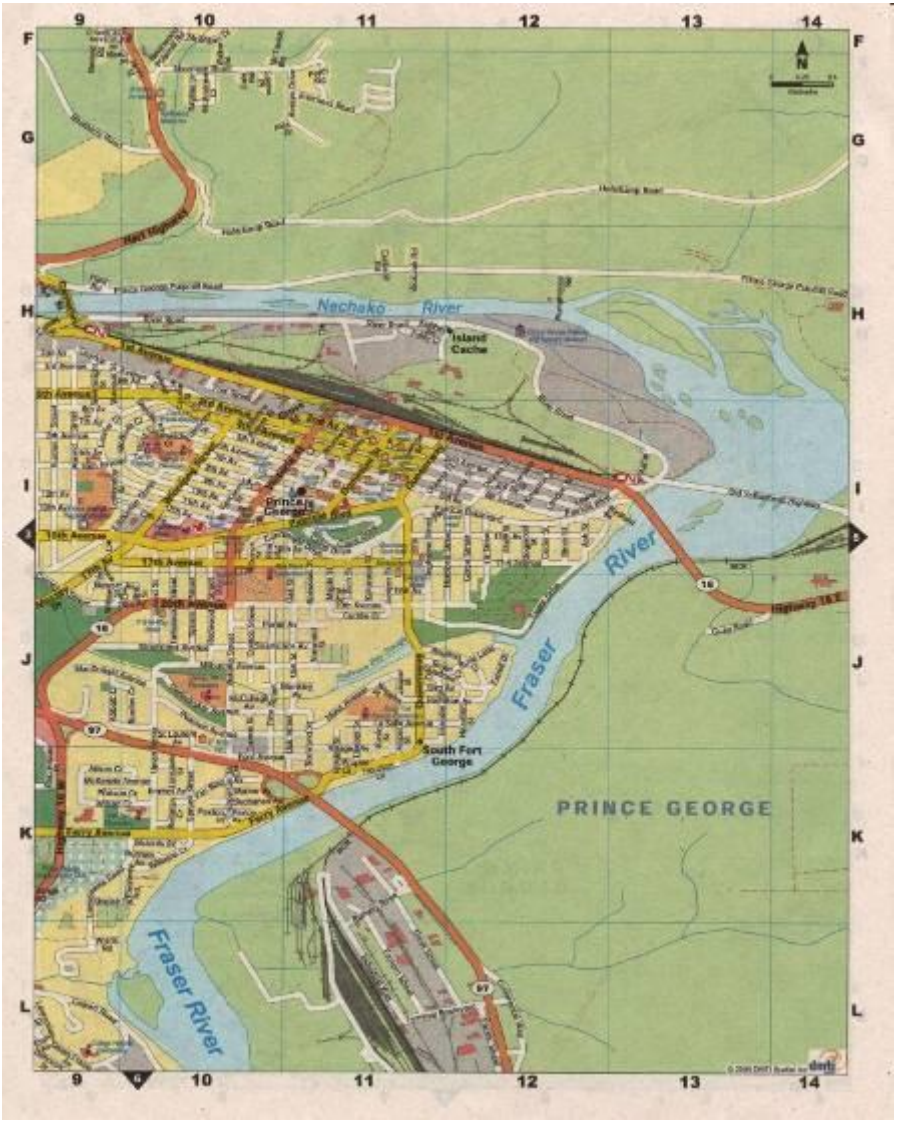


Local example from the phone book

2007–scale is consistent

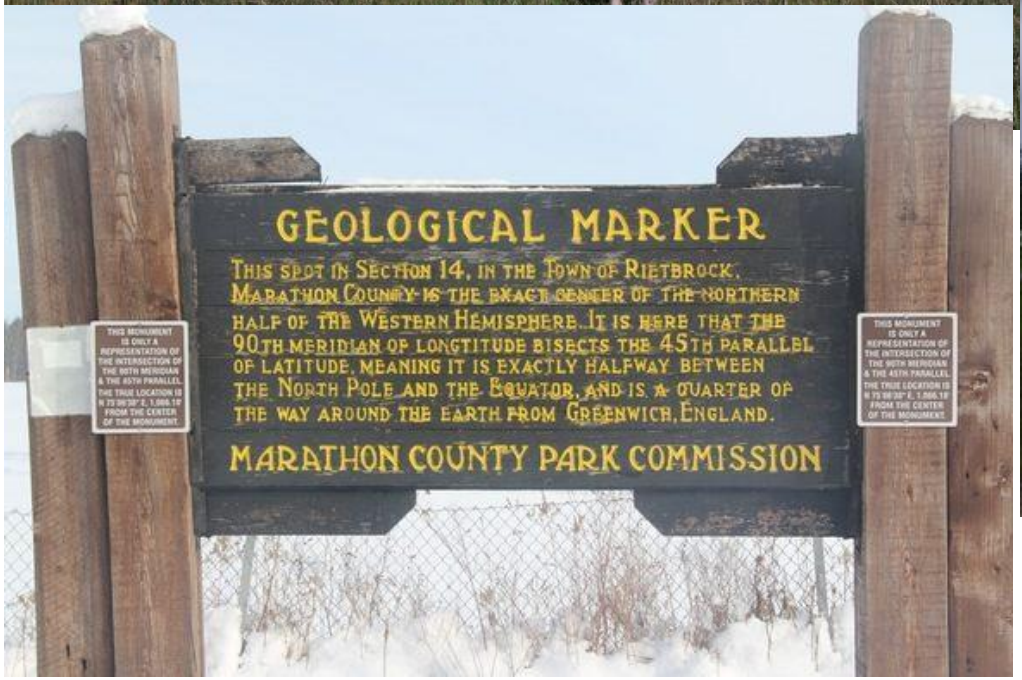


2008: horizontal scale is almost double



Latitude and Longitude

Length of One Degree of Longitude			Length of a Degree of Latitude		
Latitude	Kilometres	Miles	Latitude	Kilometres	Miles
0º	111.32	69.17	0º	110.57	68.71
10º	109.64	68.13	10º	110.61	68.73
20º	104.65	65.03	20º	110.70	68.79
30º	96.49	59.95	30º	110.85	68.88
40º	85.39	53.06	40º	111.04	68.99
50º	71.70	44.55	50º	111.23	69.12
60º	55.80	34.67	60º	111.41	69.23
70º	38.19	23.73	70º	111.56	69.32
80º	19.39	12.05	80º	111.66	69.38
90º	0.00	0.00	90º	111.69	69.40

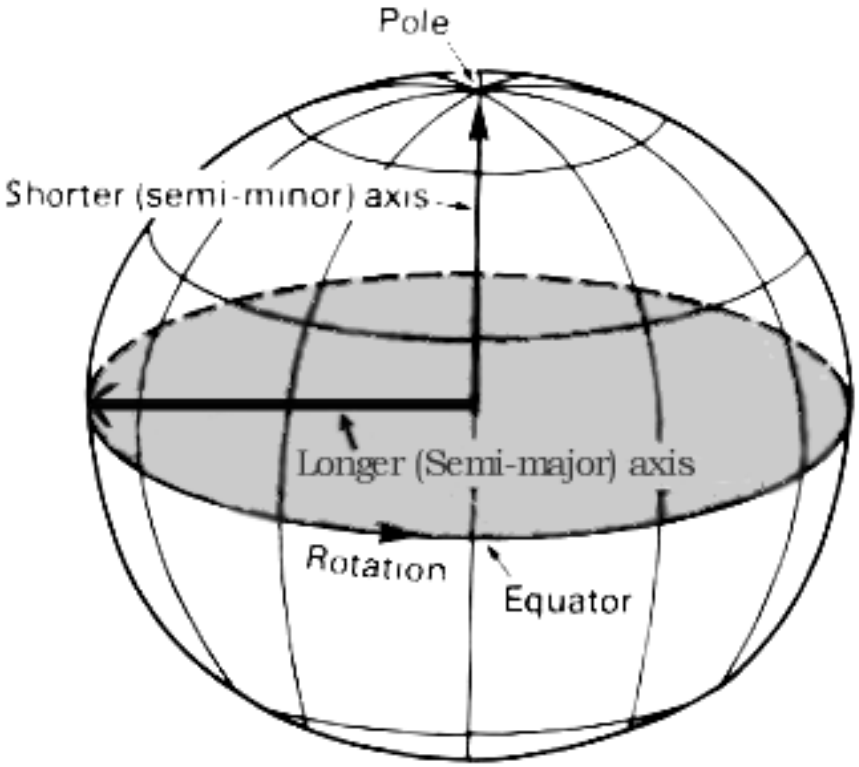


But is 45° North halfway ?

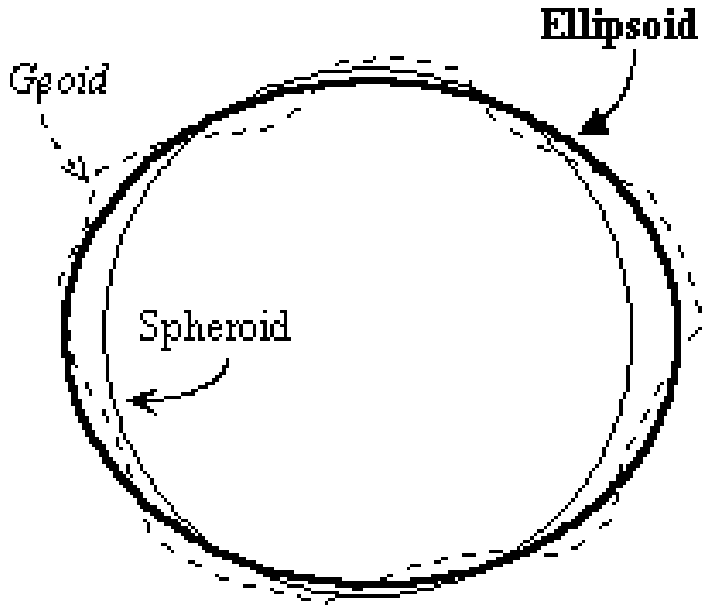
1b. The Geoid

Earth is not a perfect sphere, it is ellipsoidal ..

The difference between the length of the two axes = the amount of 'polar flattening' is about 1/300 (0.3%)



An ellipsoid is formed by rotating an ellipse on its shorter axis

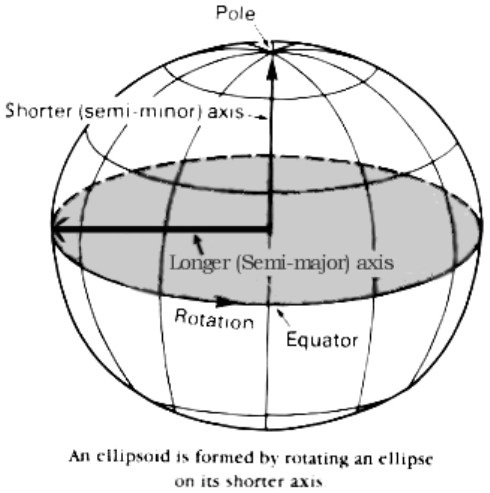


99.7% soccer ball
0.3% 'football'

Official Ellipsoids

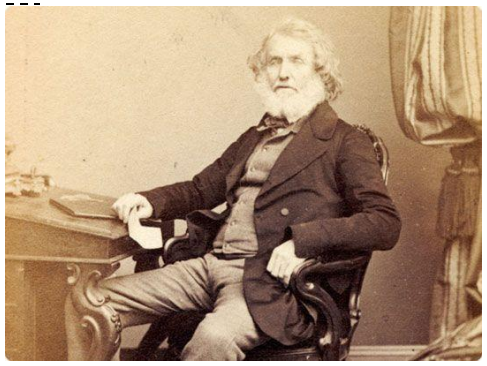
(part of the study of Geodesy)

(from J. Snyder, Map Projections--A Working Manual)



An ellipsoid is formed by rotating an ellipse on its shorter axis

Name	Date	Equatorial Radius *a* (metres)	Polar Radius *b* (metres)	Polar Flattening
WGS 84	***1984***	***6,378,137***	***6,356,752***	***1/298***
GRS 80	1980	6,378,137	6,356,752	1/298
WGS 72	1972	6,378,135	6,356,750	1/298
International	1924	6,378,388	6,356,912	1/297
Clarke	***1866***	***6,378,206***	***6,356,584***	***1/295***
Everest	1830	6,377,276	6,356,075	1/301



Datums (do we need to know this?)

'Datum' = "a set of values that serve as a base for mapping"

a. North American Datum, NAD27 *(1927) based on Clarke 1866*

b. North American Datum, NAD83 *based on GRS80/WGS 1984*

-> NAD27 was the datum for mapping in most of the 20th century

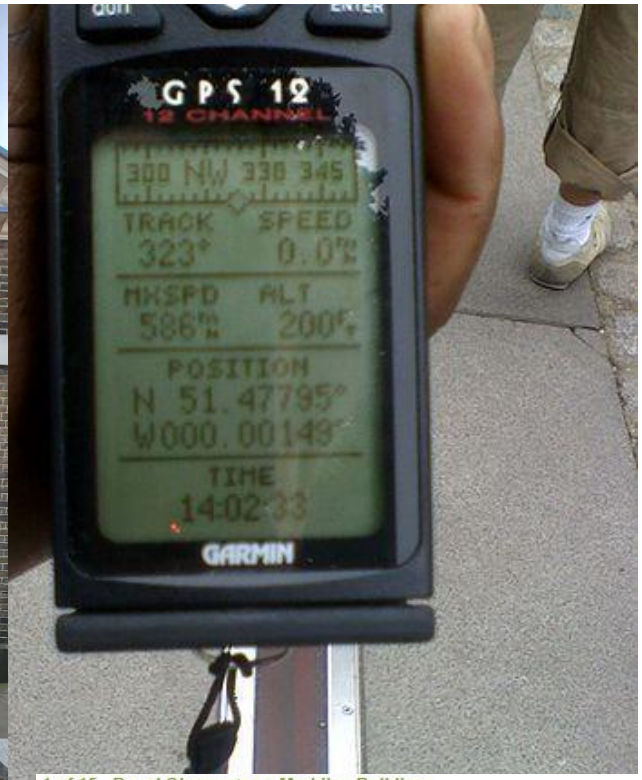
-> NAD83 is the current datum for digital mapping / GIS data

-> The two can differ by ~ **70 metres** (x) and **170 metres** (y)

New millennium: you can 'almost' forget about NAD27 ….
but when UNBC opened in 1994, we still had a lot of NAD27 mapping

The datum shift: e.g. Greenwich prime meridian 1884 - 1984

W000.00149°

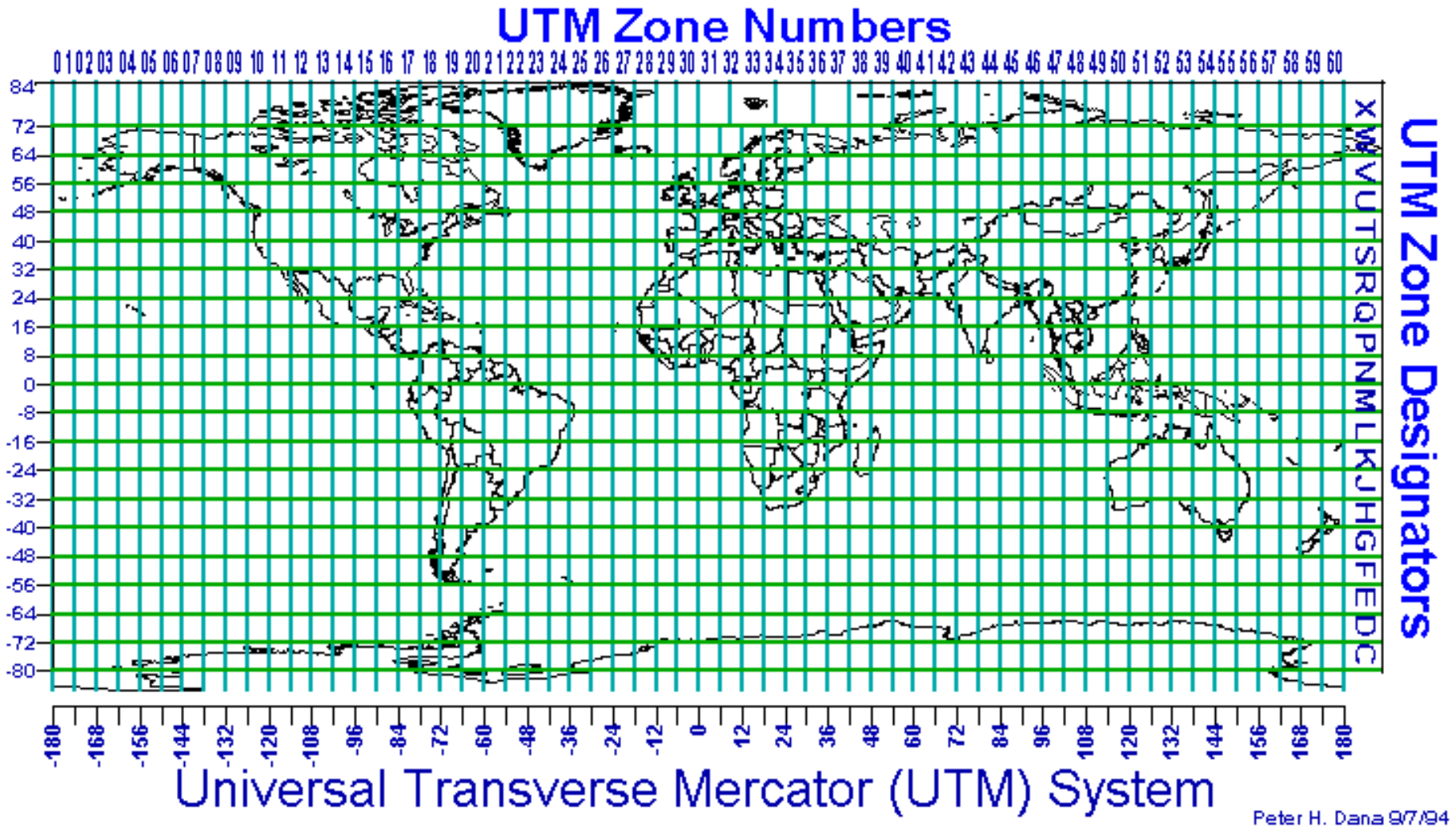


The Meridian switch is a minor conversion

2. Universal Transverse Mercator (UTM) System Coordinates

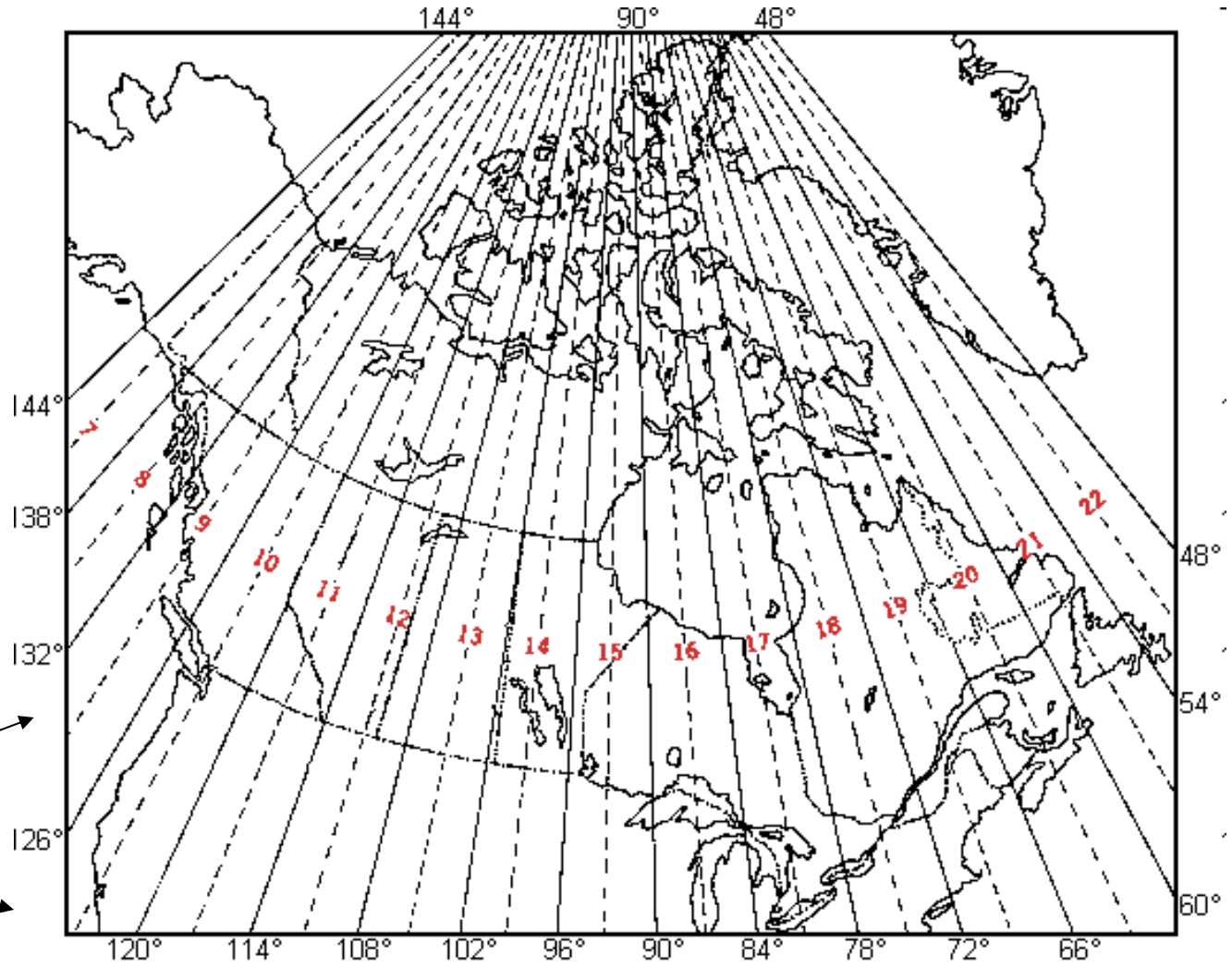
this bit is harder so pay attention …

The world is divided into 60 x 6 ° longitude (vertical) strips numbered 1 - 60 from 180 degrees West to 180 degrees East



Canada: UTM zones – adopted in 1947 for mapping

the system was either developed by the United States Army Corps of Engineers or the German Wehrmacht



Zone Central Meridians

Figure 2 - Zones UTM

– the width of each zone varies from 666 km (6 x 111km) at the equator
…to ~338 km (6 x 55.8 km) at 60 ° N/S, with a 'central meridian' in the middle

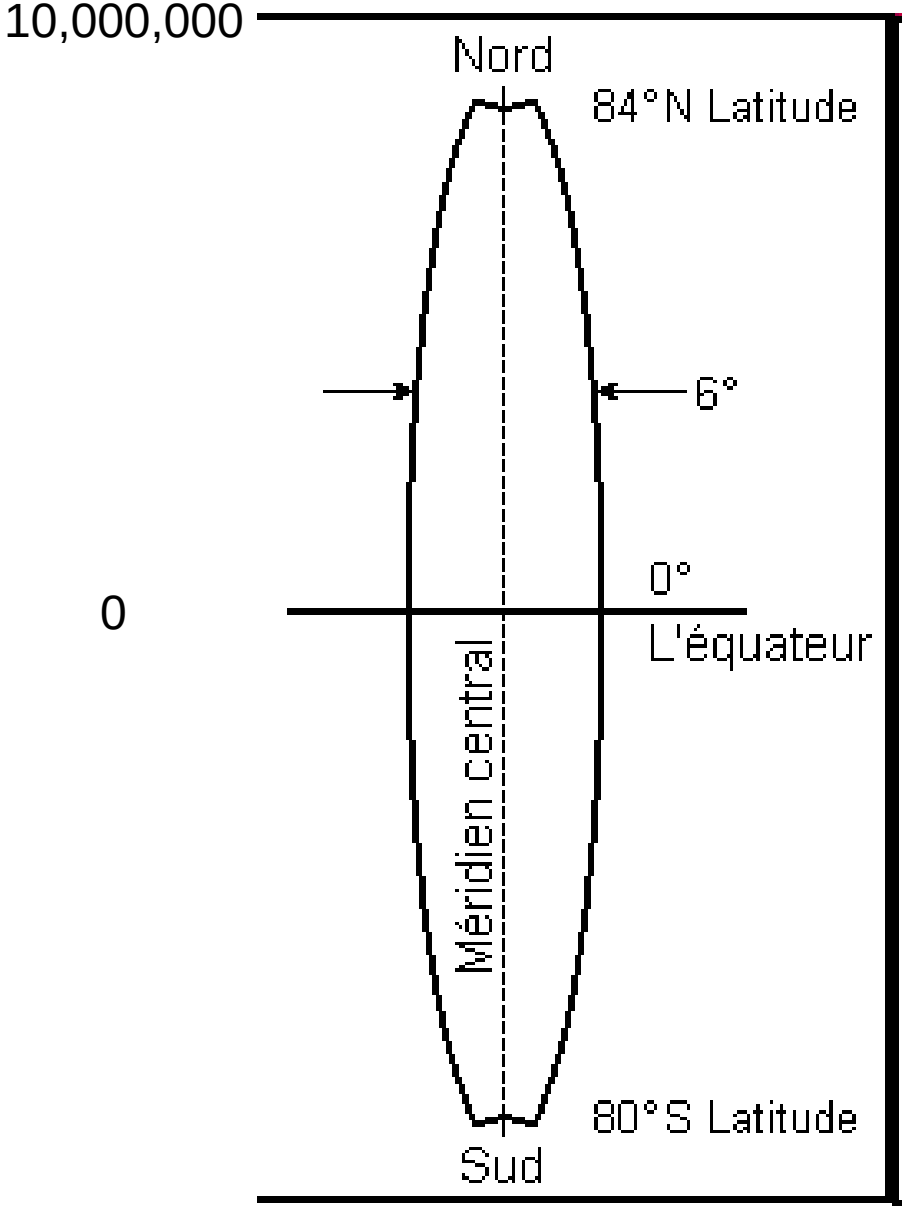


Figure 1 - Zone UTM

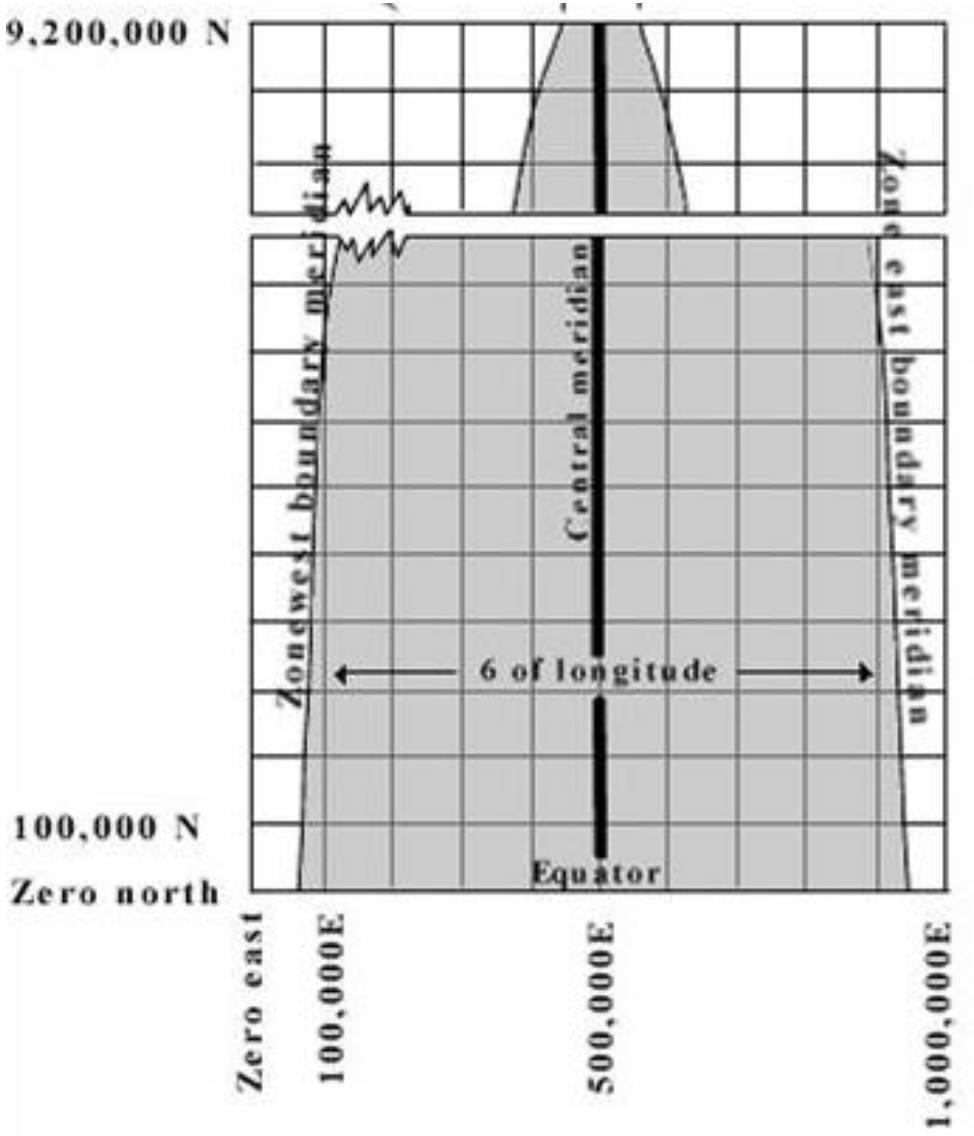
UTM coordinates

within each zone …

The ‘Y’ coordinate Northings (N):

is measured from the Equator (0) – to the north pole (10,000,000) … in metres
[this is the metric system]

e.g. UNBC ~ 5,972,000



UTM coordinates

The 'x' coordinate

- this is the hardest part …

Eastings (E) for each zone

- based on the zone
Central Meridian at 500,000

the easting value increases to the east, but not > 1,000,000

the easting value decreases to the west but not below zero

e.g. UNBC ~ 512,000

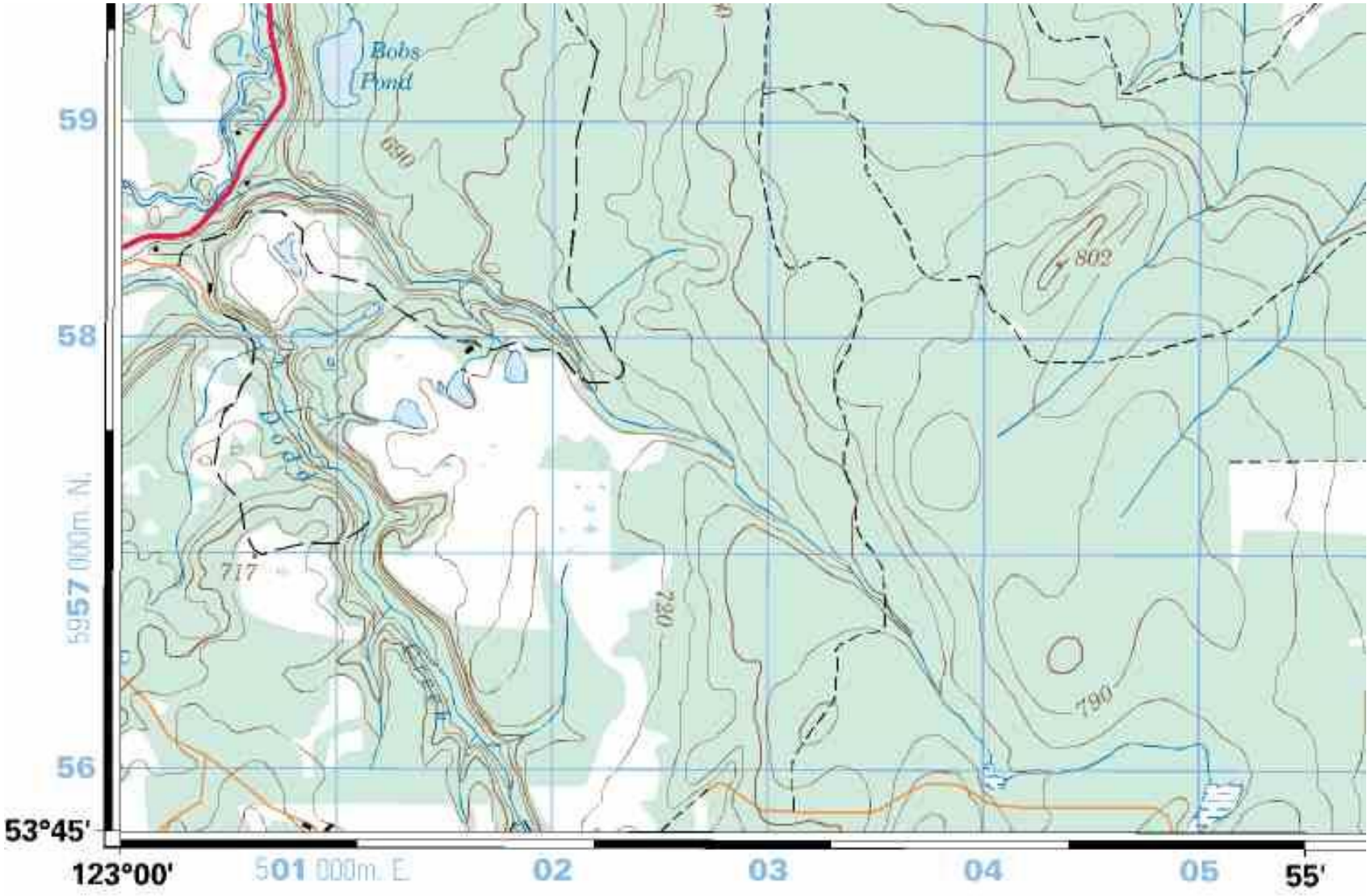
BC range= ~300,000-700,000

Zone must also be given as Coordinates repeat for each zone- 10 for PG

Grrrr … who came up with this crazy scheme !?

UTM map coordinates - a rectangular system

UTM : Eastings are 6-digit, Northings are 7-digit (in Canada)



Blue grid squares in this map are 1000m = 1km

It may make more sense here : - view these also in the lab

PGMAP: https://pgmap.princegeorge.ca/Html5Viewer/index.html?viewer=PGMap

UTM coordinates – or lat/long (geographic)
.. the same in ArcGIS in Lab 1, and Google Earth

Natural Resources Canada and BC Forestry– UTM grid
https://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9779

Coordinates quiz on Moodle end of week, based on this lecture

The last 3 words on coordinates
https://what3words.com

What3words: The app that can save your life:

Canada
https://what3words.com/news/emergency/three-words-to-tell-canadian-emergency-services-exactly-where-you-are

Lonely Planet
https://venturebeat.com/mobile/lonely-planet-adopts-what3words-geocoded-navigation-system-to-find-places-using-just-3-words/