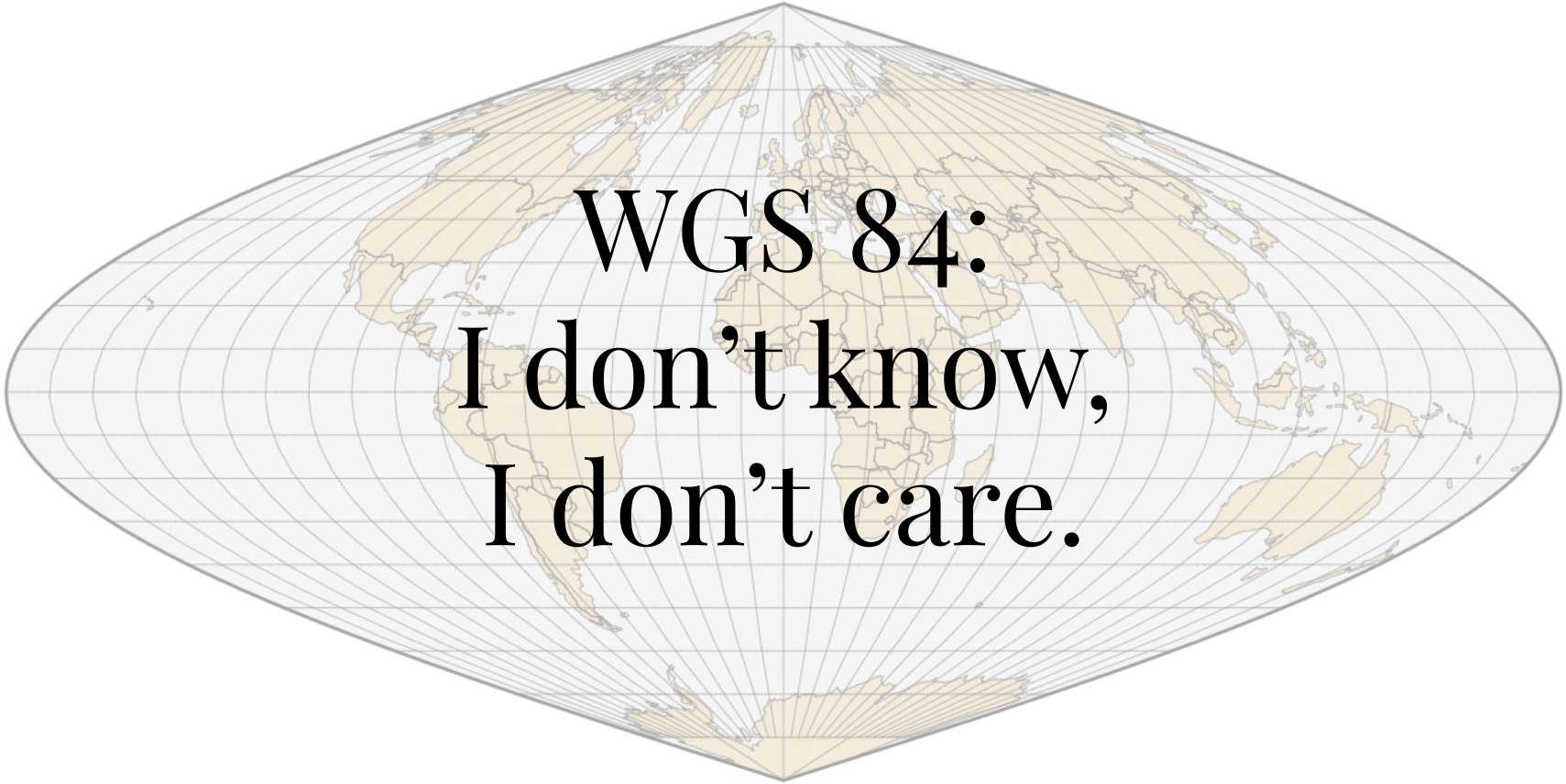


WGS 84:
I don’t know,
I don’t care.

Why this title?

me: The user should be able to select the CRS.

he: *No. Just use WGS 84.*

me: But that can be wrong.

he: *Just use WGS 84.*

me: That means the user **doesn't know or doesn't care**.

he: ***Exactly!***

me:   

WGS 84: I don’t know, I don’t care.

Javier Jimenez Shaw

[xaˈβjer xiˈmeneθ ʃɔː]

PROJ contributor.

Civil Engineer and Software Developer.

https://github.com/jjimenezshaw/


EVERY TIME YOU
MENTION WGS 84 IN VAIN
$DEITY KILLS A KITTEN
imgflip.com

Five stages of grief

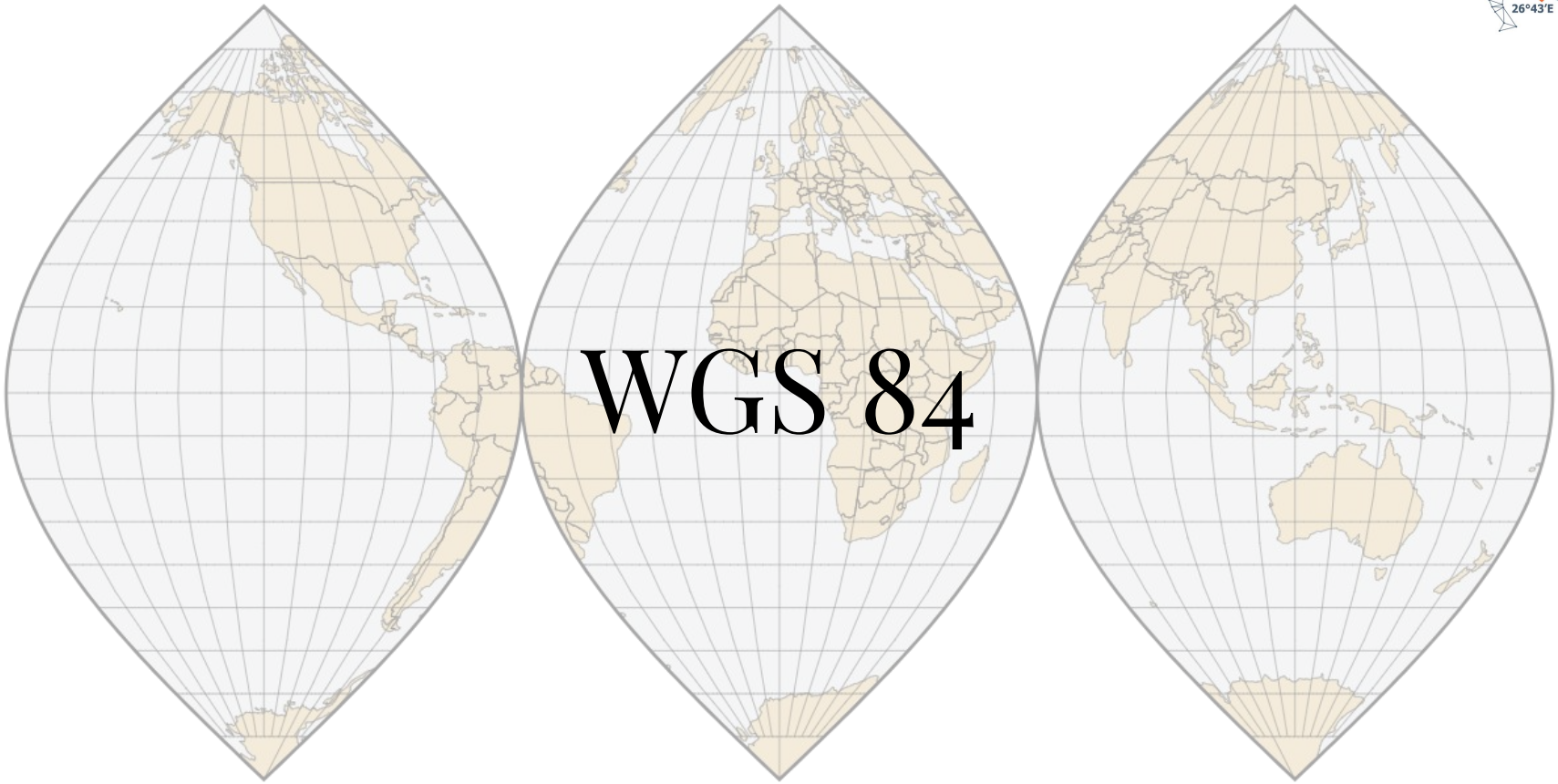
1. Denial 
2. Anger 
3. Bargaining 
4. Depression 
5. Acceptance 

Accurate measurements

GNSS (like GPS™) has an accuracy of about 1 m.

However, with some corrections (like RTK or PPK), measurements can go to **2 cm accuracy!**

Should we keep using EPSG:4326 with these (accurate) data?


WGS 84

What “is” WGS 84

- Geographic CRS (2D, 3D, geocentric)
- Datum *ensemble*
- Each datum in the ensemble
  - Used by GPS™ satellites.
  - Dynamic
- Ellipsoid

… and I am probably missing something

- Base for many projected CRSs

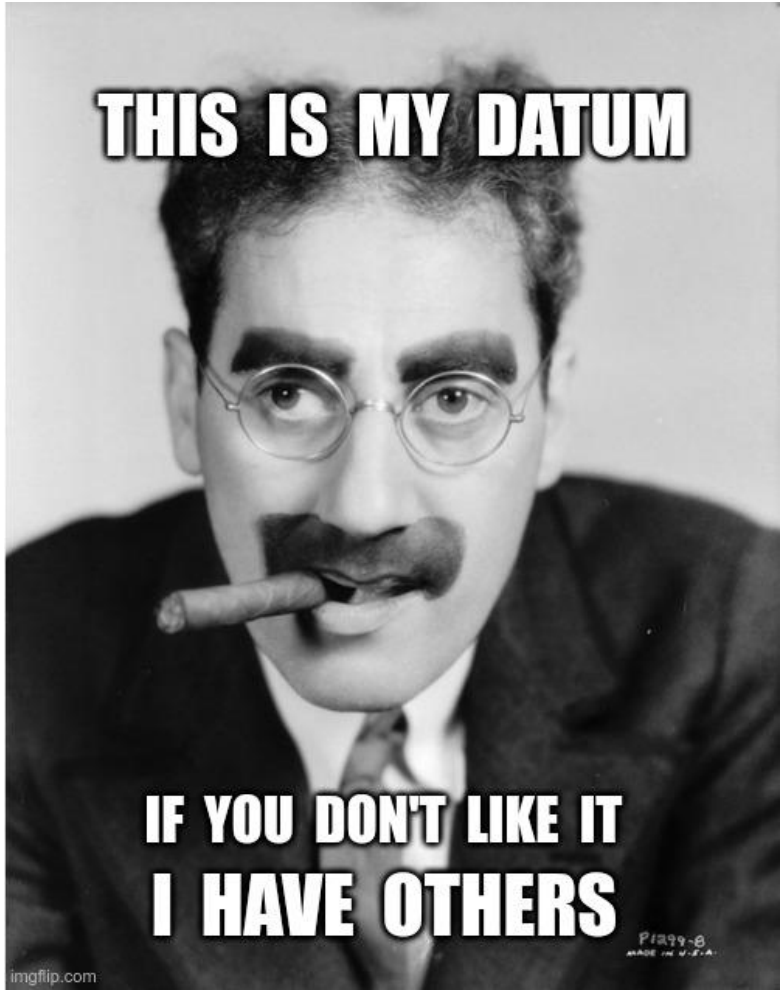
EPSG:4326

Geographic 2D coordinate reference systems in EPSG

EPSG:4326 WGS 84

EPSG:8888 WGS 84 (Transit)
EPSG:9053 WGS 84 (G730)
EPSG:9054 WGS 84 (G873)
EPSG:9055 WGS 84 (G1150)
EPSG:9056 WGS 84 (G1674)
EPSG:9057 WGS 84 (G1762)
EPSG:9755 WGS 84 (G2139)
EPSG:10606 WGS 84 (G2296)

Datum ensemble



Datum Details [VALID]

NAME:	World Geodetic System 1984 ensemble
CODE:	6326
TYPE:	ensemble
USAGE:	

Usage Details

SCOPE:	Satellite navigation.
EXTENT:	World

ACCURACY (M):	2.00
ELLIPSOID:	WGS 84
PRIME MERIDIAN:	Greenwich
DATUM MEMBERS	
MEMBER 1:	World Geodetic System 1984 (Transit)
MEMBER 2:	World Geodetic System 1984 (G730)
MEMBER 3:	World Geodetic System 1984 (G873)
MEMBER 4:	World Geodetic System 1984 (G1150)
MEMBER 5:	World Geodetic System 1984 (G1674)
MEMBER 6:	World Geodetic System 1984 (G1762)
MEMBER 7:	World Geodetic System 1984 (G2139)
MEMBER 8:	World Geodetic System 1984 (G2296)

Datum ≠ Ellipsoid

Datum and Ellipsoid are different things

- Ellipsoid is just the mathematical shape, defined by 2 numbers.
- Datum is the “reference”.

  A datum contains an ellipsoid definition.

  … and more things.

Different datums may use the same ellipsoid.

What “is **not**” WGS 84

- WGS 84 is not synonym of “lat-lon” (geographic CRS).
- The one and only (geographic) reference system.
  - WGS 84 is not “NAD83(2011)”, “ETRS89”, “GDA2020”, etc
- A wildcard.
- Answer to the Ultimate Question of Life, The Universe, and Everything.

Dynamic vs Static datums

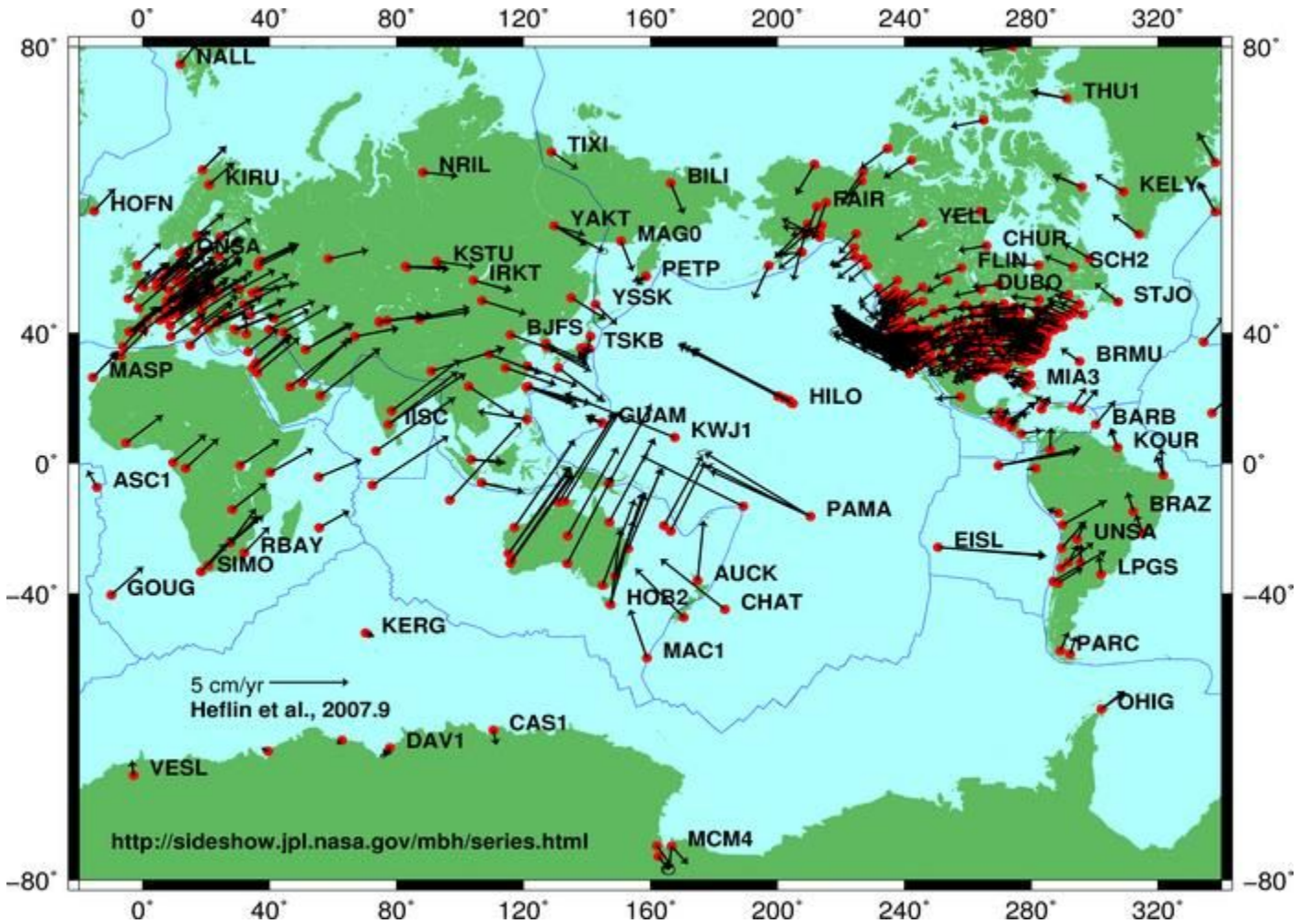
“Eppur si muove” (Galileo Galilei)

“To know *where* you are,

you must know *when* you are”

(Matthias Daues)

Some new CRS due to earthquakes

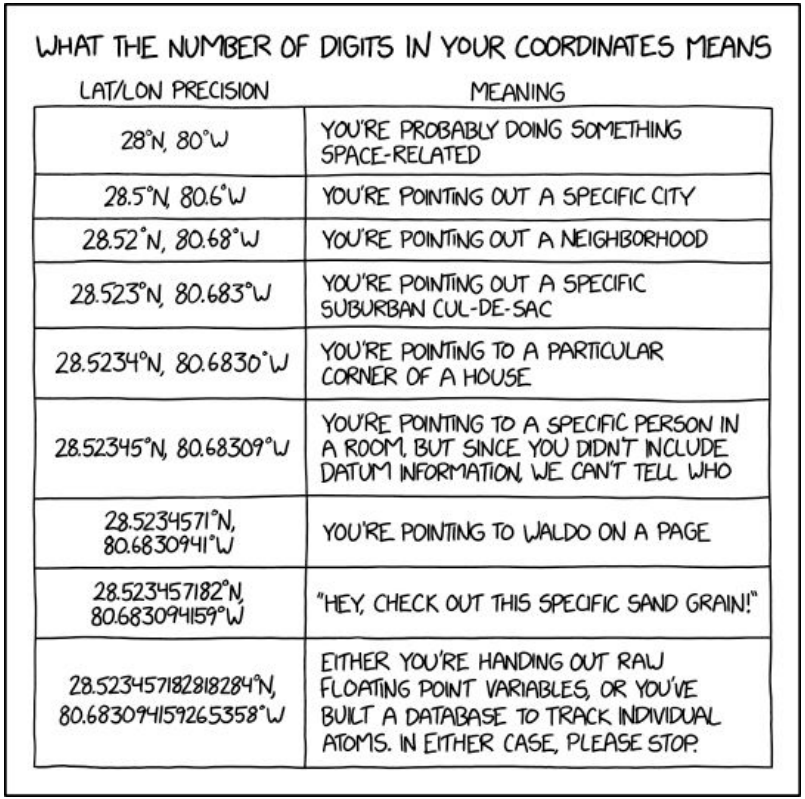

0° 40° 80° 120° 160° 200° 240° 280° 320°
80° 40° 0° −40° −80°
NALL
THU1
TIXI
NRIL
KIRU
BILI
HOFN
RAIR
KELY
YAKT
YELL
MAG0
CHUR
ONSA
KSTU
PETP
FLIN
SCH2
IRKT
DUBO
YSSK
STJO
BJFS
TSKB
BRMU
MASP
MIA3
HILO
IISC
GUAM
BARB
KWJ1
KOUR
ASC1
PAMA
BRAZ
RBAY
EISL
UNSA
SIMO
LPGS
AUCK
GOUG
HOB2
CHAT
KERG
PARC
MAC1
5 cm/yr
Heflin et al., 2007.9
OHIG
CAS1
DAV1
VESL
http://sideshow.jpl.nasa.gov/mbh/series.html
MCM4

We are at

(483399.7654842154,

6470323.1874351541)

ETRS89 / UTM 35N



WHAT THE NUMBER OF DIGITS IN YOUR COORDINATES MEANS

LAT/LON PRECISION	MEANING
28°N, 80°W	YOU'RE PROBABLY DOING SOMETHING SPACE-RELATED
28.5°N, 80.6°W	YOU'RE POINTING OUT A SPECIFIC CITY
28.52°N, 80.68°W	YOU'RE POINTING OUT A NEIGHBORHOOD
28.523°N, 80.683°W	YOU'RE POINTING OUT A SPECIFIC SUBURBAN CUL-DE-SAC
28.5234°N, 80.6830°W	YOU'RE POINTING TO A PARTICULAR CORNER OF A HOUSE
28.52345°N, 80.68309°W	YOU'RE POINTING TO A SPECIFIC PERSON IN A ROOM, BUT SINCE YOU DIDN'T INCLUDE DATUM INFORMATION, WE CAN'T TELL WHO
28.5234571°N, 80.6830941°W	YOU'RE POINTING TO WALDO ON A PAGE
28.52345718 2°N, 80.6830941 59°W	"HEY, CHECK OUT THIS SPECIFIC SAND GRAIN!"
28.523457182818284°N, 80.683094159265358°W	EITHER YOU'RE HANDING OUT RAW FLOATING POINT VARIABLES, OR YOU'VE BUILT A DATABASE TO TRACK INDIVIDUAL ATOMS. IN EITHER CASE, PLEASE STOP.

Credit: xkcd

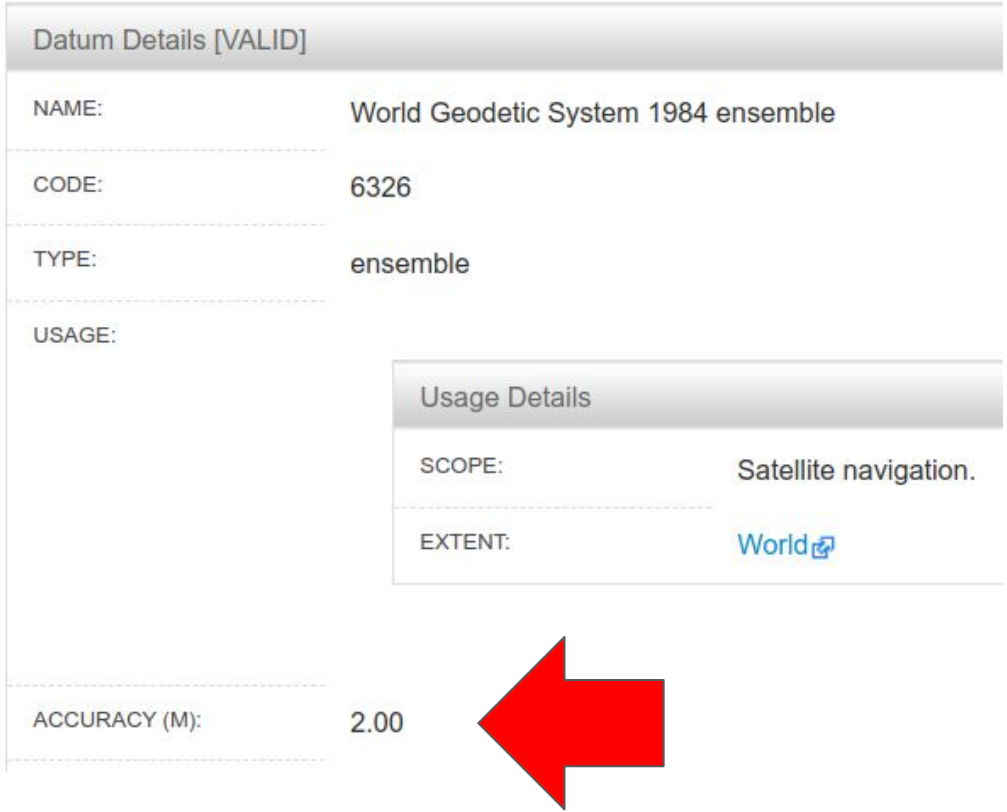
Datum Details [VALID]

NAME:	World Geodetic System 1984 ensemble
CODE:	6326
TYPE:	ensemble
USAGE:	

Usage Details

SCOPE:	Satellite navigation.
EXTENT:	World

ACCURACY (M):	2.00
ELLIPSOID:	WGS 84
PRIME MERIDIAN:	Greenwich
DATUM MEMBERS	
MEMBER 1:	World Geodetic System 1984 (Transit)
MEMBER 2:	World Geodetic System 1984 (G730)
MEMBER 3:	World Geodetic System 1984 (G873)
MEMBER 4:	World Geodetic System 1984 (G1150)
MEMBER 5:	World Geodetic System 1984 (G1674)
MEMBER 6:	World Geodetic System 1984 (G1762)
MEMBER 7:	World Geodetic System 1984 (G2139)
MEMBER 8:	World Geodetic System 1984 (G2296)


Datum Details [VALID]
NAME:
World Geodetic System 1984 ensemble
CODE:
6326
TYPE:
ensemble
USAGE:
Usage Details
SCOPE:
Satellite navigation.
EXTENT:
World
ACCURACY (M):
2.00

Geographic CRS

Clarification

We are not talking about projections, nor about the accuracy on the projection formulas, or the projection distortion.

The accuracy problem of a datum transformation is orders of magnitude bigger.

(Talk in FOSS4G 2023: Introduction to Coordinate Systems)

WGS 84 (G*) transformations

“Transforming between WGS84 Realizations”

Kevin M. Kelly and Michael L. Dennis, Ph.D., P.E., P.L.S., M.ASCE , 2022

https://doi.org/10.1061/(ASCE)SU.1943-5428.0000389

I don’t know,
I don’t care

I *don't know* that I don't know

Probably (but not only) because

- You are using WGS 84 as the one and only "lat-lon".
- Datum ensemble? What? Really that inaccurate?
- You thought that (datum) transformations were exact.
- Coordinates depend on time? Are you serious?

Welcome here!

Hopefully you learn something.

I *know* that I don’t know

- I really don’t know the datum (e.g. RTK is not telling me).
- I am consistent with all the data, coming from the same source.
- Data is provided in WGS84. I know it is inaccurate, but I cannot do anything.
- I am using a portable base station for RTK.
- I have to use a projected CRS, that is only on WGS84.

I don’t want to know

You know if you are here.

I don’t care

I **do not need** centimeter accuracy. Some meters is totally fine.

I don’t care

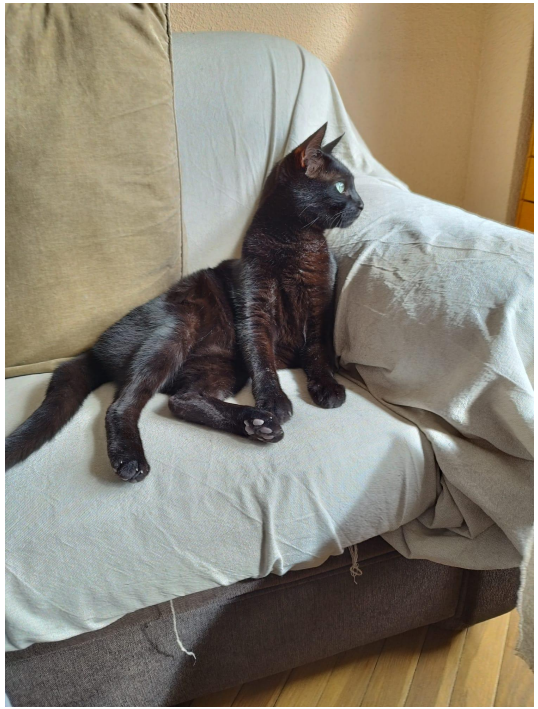
The small scale of my map doesn’t care

I don’t care

It is my data. It works for me.

I don’t care

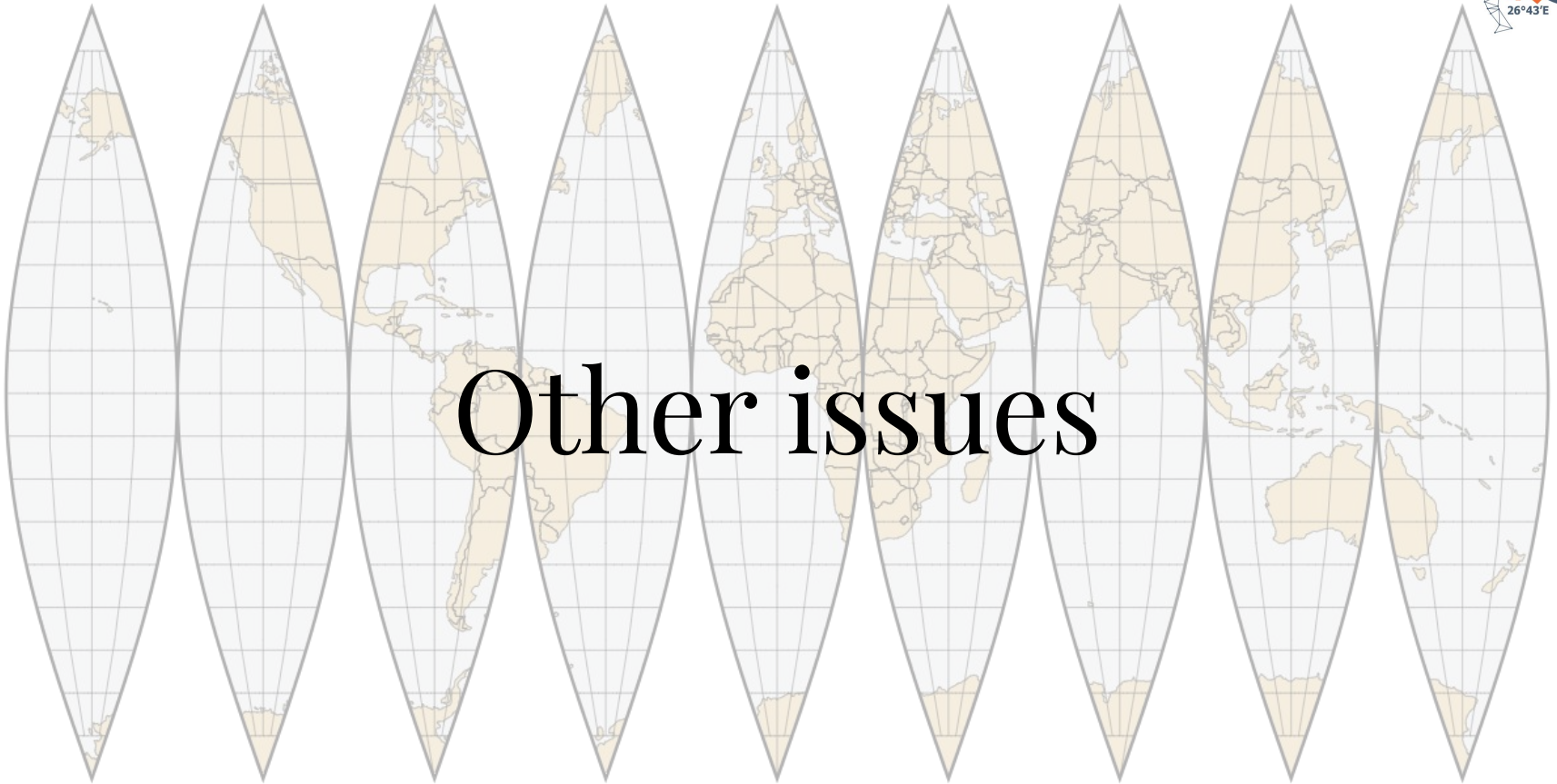
… it is not my problem.



I don’t care

all of the above,

including that I don’t know.

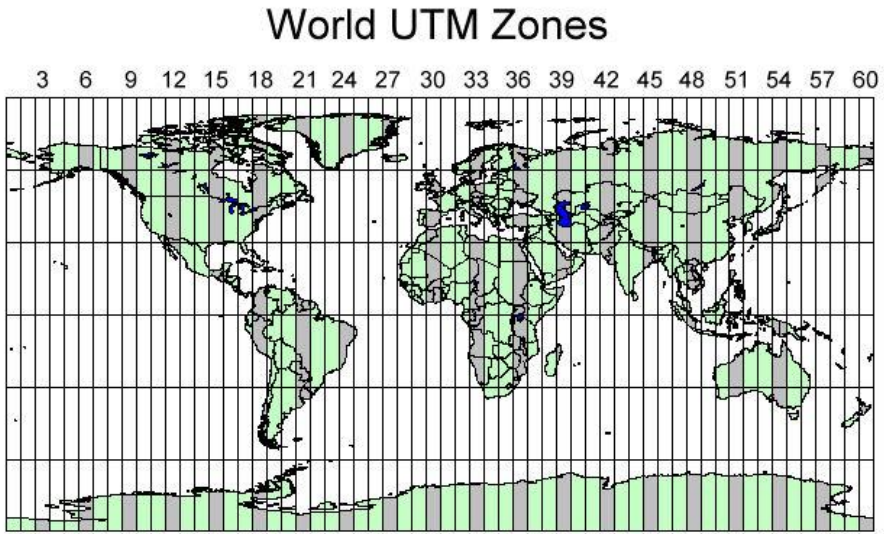


Other issues

Projected

What do I do with the projected systems that use WGS 84?

Like EPSG:32639 “**WGS 84** / UTM zone 39N”

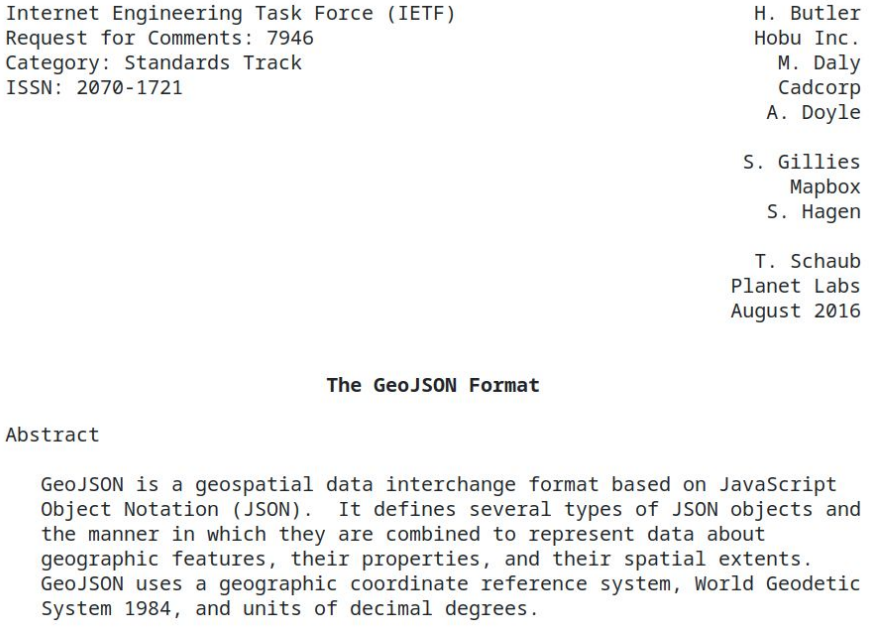


Credit

My format only supports WGS 84

Like GeoJSON.

There are reasons for that. But you should know the limitations of the format.



Internet Engineering Task Force (IETF)
Request for Comments: 7946
Category: Standards Track
ISSN: 2070-1721

H. Butler
Hobu Inc.
M. Daly
Cadcorp
A. Doyle

S. Gillies
Mapbox
S. Hagen

T. Schaub
Planet Labs
August 2016

The GeoJSON Format

Abstract

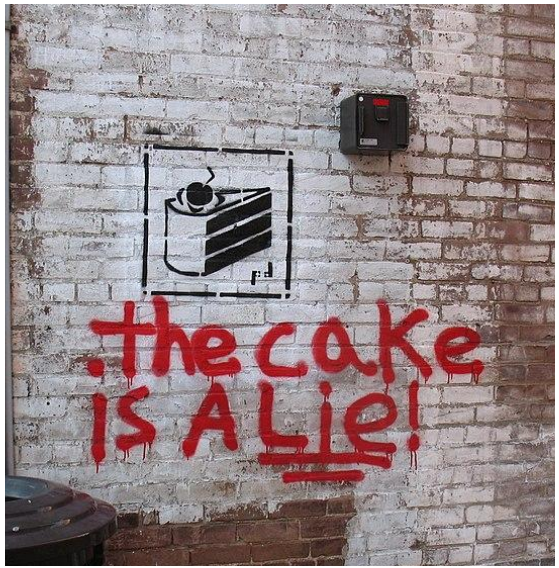
GeoJSON is a geospatial data interchange format based on JavaScript Object Notation (JSON). It defines several types of JSON objects and the manner in which they are combined to represent data about geographic features, their properties, and their spatial extents. GeoJSON uses a geographic coordinate reference system, World Geodetic System 1984, and units of decimal degrees.

RTK

It is **not** “WGS 84”, EPSG:4326

It is the reference system used in the base station.

A base station may broadcast in several systems.



© Marc-Antony Macon

The “correct” transformation

Different transformations for the same source-destination in EPSG

WGS 84 to GDA2020 (2), (3) and (4)

“(2) Remarks: Approximation at the 3m level assuming WGS 84 is equivalent to GDA2020. **Ignores the low accuracy** of the WGS 84 ensemble and the inconsistent application of **tectonic plate motion** to WGS 84 data.”

… I don’t know or I don’t care

OpenStreetMap

And what happens with OSM?

[You thought OpenStreetMap data uses the WGS84 datum? No it doesn't!]

… More precisely, the WGS84 Datum is not used everywhere.

- What should OSM do? Keep the dynamic WGS84 coordinates, or use some local datums as the surveyor’s world do?

Storing data

Do not use WGS84 as your “storage CRS”, to convert back to your “project CRS”. It can be problematic.

Store your original data! (properly identified)

… if you care about accuracy.

Solution (¿?)

`EPSG:IDNK` — “I do not know”

`EPSG:IDNK035` — “I do not know / UTM zone 35N”

…

Using ellipsoid GRS80 or WGS84, I don’t care.

— *This is a joke (more or less)* —

Solution (¿?)

`IDNK:11001` — “I do not know” (Geocentric)

`IDNK:11002` — “I do not know” (Geographic 2D)

`IDNK:10035` — “I do not know / UTM zone 35N”

…

Using ellipsoid GRS80 or WGS84, I don’t care.

— *This is also a joke* 🤔 —

The problem

Using the same term for different things produces misunderstandings.

Conclusions

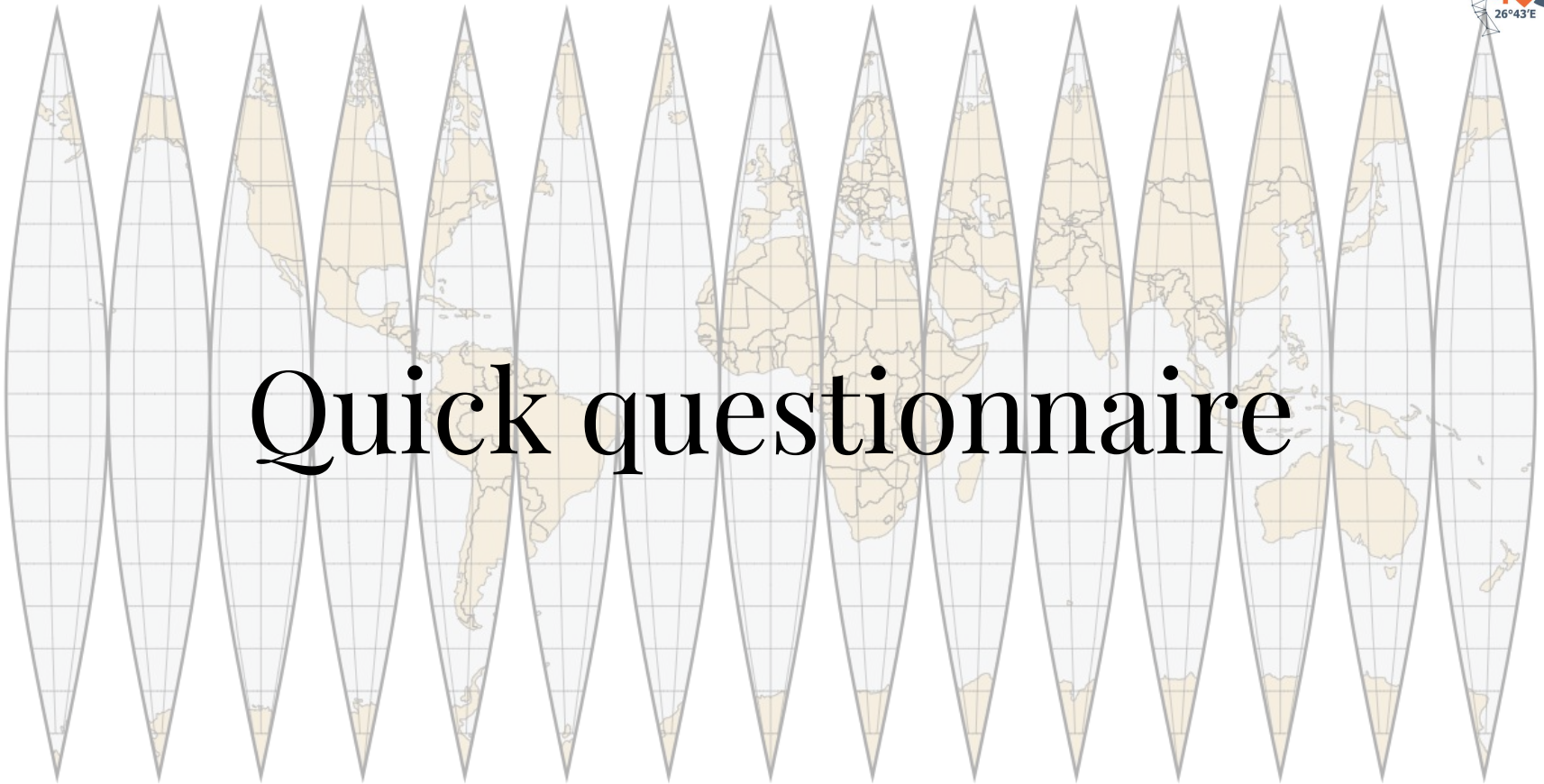
Is WGS 84 (EPSG:4326) always bad? No.

Can it be useful? Yes, of course.

However we should know its limitations and meaning.

Realize that you don’t know or you don’t care (or you don’t have a better option).

… and think that maybe other people do not realize that.



Quick questionnaire

Quick questionnaire

How did you use WGS 84?

- I don’t know that I don’t know.
- I know that I don’t know, but cannot avoid.
- I don’t care.
- I do not use it.
- None of the above.

Google Form. No auth needed.

Thanks for watching!

Javier Jimenez Shaw

https://github.com/jjimenezshaw/

jjimenezshaw mapstodon.space