

Interdisciplinary Data Sharing

Climate science uses terrestrial data to build and drive models.

Weather stations, elevation, etc.

Terrestrial science and industrial applications use climate data.

Enviro. modeling, resource management, utilities system planning, etc.

We need a common language for spatial reference of our data.

A Motivating Example

- From OSGeo.org's PROJ.4 help archives:

"Hi, I'm working with meteorological model-data. The models usually use a spherical earth. Since the resolution of the models is now ~1km, I have to think more about converting those data for people using GIS systems."

- Should a conversion be done at all?
- What if this person doesn't have correct metadata?

What to do?

Use a standard for coordinate reference system identification.

- ISO 19111, 19115 define CRS metadata model
- NetCDF-CF allows parametric definition of datum parameters.
- EPSG registry includes a huge number of GIS CRSs
- OGC hosts a supplemental CRS registry
- For legacy data, make datum information to guide data users.

"But my data isn't very accurate. Specifying a datum would imply otherwise."-Anonymous

- Small systematic biases will result.
- Positional accuracy (or uncertainty) should be explicitly stated.
- Could do this by decreasing numerical precision.

If numerical precision is needed to preserve grid geometry, the true spatial accuracy of the grid should be defined in metadata. ie. The grid is not tied to the earth in a precise way.

The Moral of this Poster

- Latitude and longitude are not unique locations on the Earth's surface.
- We need a way to track datum information through climate models and subsequent analyses.

How will we achieve this?

Lost in Space: Understanding the consequences of unknown or incorrect datums in applications of climate and other geosciences analysis

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What is a datum?

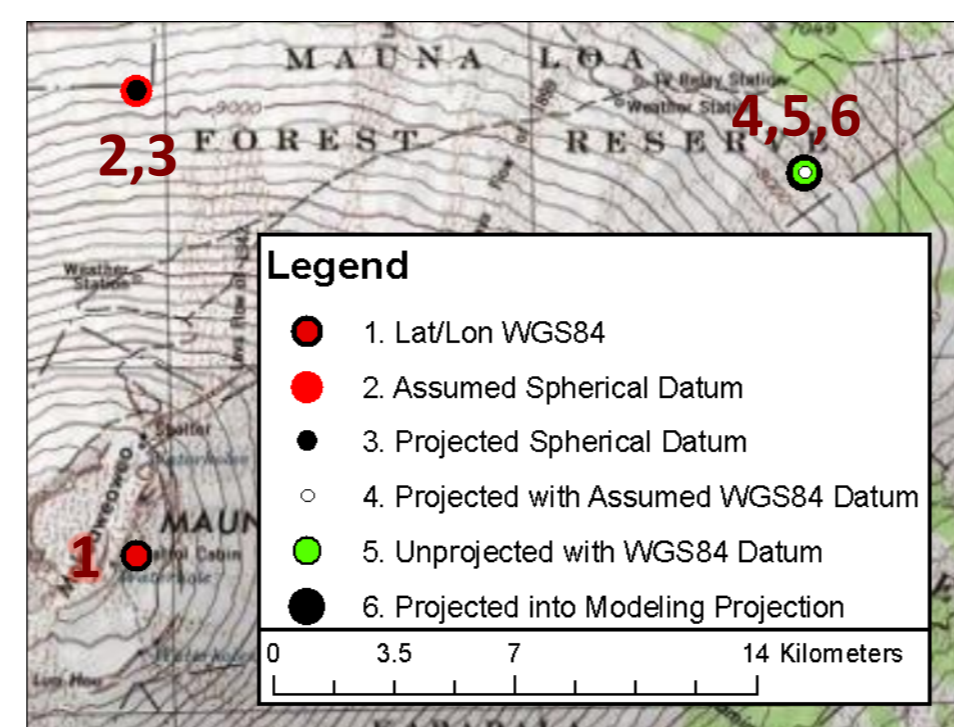


Ellipsoid: A geometric model of the earth's shape. Measurement System: Demarcations tied to the earth (Prime Meridian). Datum: Ellipsoid and Measurement System Combo.

- (Latitude, Longitude) coordinates are not unique to a spot on the Earth!
- Datums are integral to any latitude, longitude measurement.
- Thousands of datums have been defined; hundreds are in regular use.

Ex. Degrees Kelvin are different than degrees Celsius because they use a different datum!

How positional accuracy can be lost!

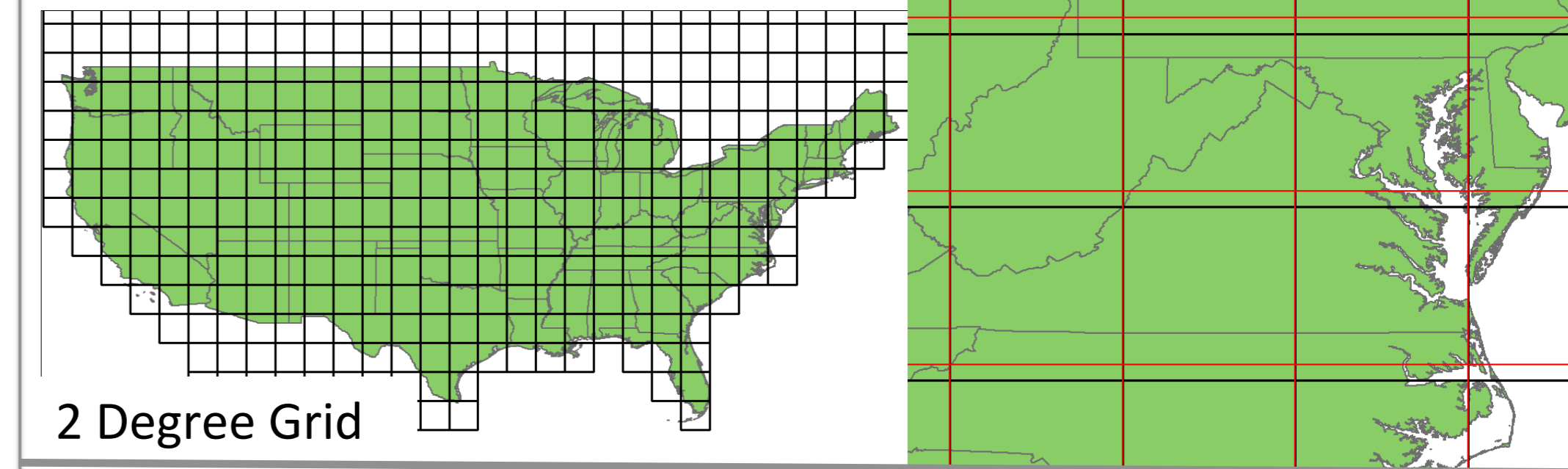


- Original coordinates from GPS uses WGS84 datum (volcano peak at ~13K ft elevation)
- Climate model assumes spherical datum.
- Climate model projects spherical coordinates. (~9K ft)
- GIS user assumes WGS84 datum.
- GIS user unprojects to WGS84 lat/lon.
- GIS user projects to their modeling projection. (~8k ft)

Assumption Points!

- Errors are introduced only when datum assumptions are made.
- Geographic transformations are precise given appropriate input parameters.
- Datum metadata are input parameters for datum transformations and geographic projection.

Latitude-Longitude at Global Climate Model Scale



With GCM's coarse resolution and high uncertainty, datums are generally ignored.

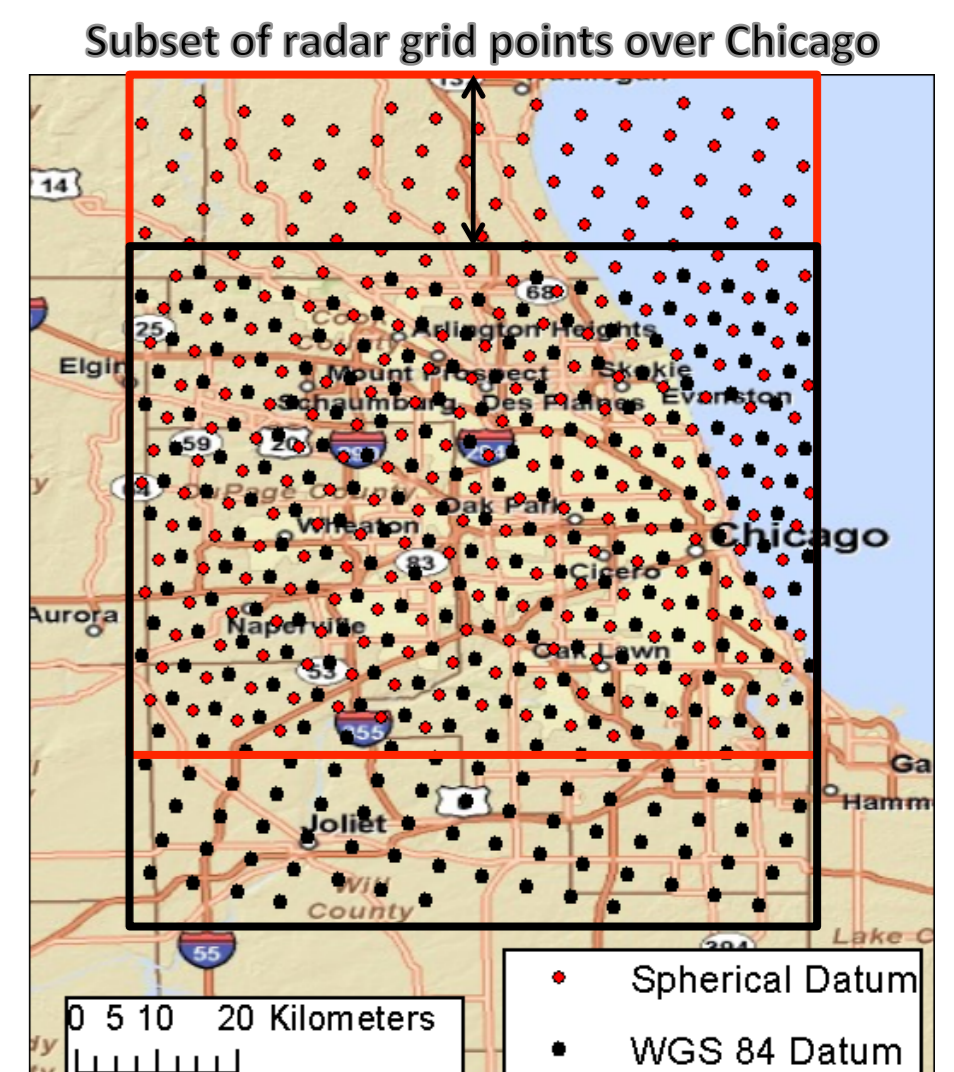
The earth is assumed to be a sphere.

Errors introduced by assuming datum are small compared to GCM resolution; however...

- All software that work with lat/lon data require or assume a datum.
- If no datum is provided, data consumers waste time trying to find the correct one.
- Low spatial accuracy should be indicated explicitly, not by exclusion of datum metadata.
- Neglect of datum metadata can foster a community-wide lack of appreciation for this critical piece of metadata.

When datum matters, an example.

- Radar station coordinates use a precise datum.
- Some radar observations are distributed on a grid projected using spherical math.
- Original coordinates were not transformed correctly.
- Original datum was lost.
- Subsequent analyses don't know what is correct.



Some NEXRAD products are distributed in grib format. The precise lat/lon of the radar station was used directly (without transformation) with a grid which claims (in its metadata) to use a spherical datum. This spherical metadata is an artifact of the grid's use with weather and climate modeling. A projection (from lat/lon to km north/km south) was applied to the lat/lon points of the radar station's observations. This projection used spherical datum parameters, not parameters associated with the true datum of the lat/lon coordinates. Correct handling of this data involves: (1) Unproject north/south (km) coordinates to lat/lon using spherical datum parameters. (2) Change datum metadata from spherical to an assumed ellipsoidal datum (like WGS84) (3) Apply desired projection. This workflow requires knowledge that is not readily available from metadata or documentation about the data resource.