Comments and Questions About Geospatial Data

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1. The Earth is three-dimensional, but humans walk erect on a flat Earth.
2. Elevation is third dimension and referenced to sea-level. Sea level is a dynamic reference surface.
3. What is the geoid? How is that better than sea-level as a reference surface?
4. What does it take to locate the geoid?
5. GPS (and other spatial data) are three-dimensional with an origin at Earth's center of mass.
6. Equations of solid geometry expressed in rectangular values are easier to understand than lat/lon.
7. What is the best way to represent a curved Earth on a flat map? Cartographers do it routinely.
8. That is, how can 3 dimensions be compressed into 2 dimensions?
9. Many "rules" for constructing maps – conformal, azimuthal, equal-distant, and others.
10. Intermediate projection surfaces provide mathematical basis for unique mapping relationships.
11. What are characteristics of a conformal map? Mercator got it figured out.
    a. Start at one port and sail a constant bearing to distant port without getting lost.
    b. Grid scale factor at a point is the same in all directions – essential for use by surveyors.
12. Why do surveyors need a conformal map?
    a. We don't need to sail on the ocean and sailors have better tools for navigating.
    b. Most surveyors would really like to avoid horizontal distance distortions.
13. What is the definition of "horizontal"? See http://www.globalcogo.com/HD-Options.pdf
    a. Right triangle component of a slope distance. (Is there some circular logic happening here?)
    b. A line having the same elevation at both ends – happens on the ocean surface.
    c. Can a horizontal distance be curved on a map projection? If so, what is inverse distance?
14. State plane coordinates were "invented" to facilitate "flat-Earth" procedures to use lat/lon.
15. Distortion of horizontal distance is the "price" to be paid for using a conformal map projection.
16. How much distortion is permitted until "a foot is not a foot"?
17. If the toleration for distortion is "small," then a given zone will cover only a small area.
18. The goal for surveyors is to avoid distortion (and the need for elevation and grid scale factors).
    (That means many "small" zones and many possibilities for confusion/inadvertent errors.)
19. The goal for GIS disciplines is on zone to cover area of interest (typically state by state).
20. The global spatial data model (GSDM) accommodates both surveyors and GIS persons.
21. GSDM: one set of solid geometry equations for the entire world. Less complicated than mapping.
22. Distances are computed at the elevation selected by the user using 3-D Pythagorean equation.
23. The 3-D azimuth is computed simply as atan (Δe/nΔ). Forward & back azimuths computed correctly.