Subject: Orthographic projection using parametrized ellipsoid
Posted by vince33600 on Fri, 06 May 2016 00:16:32 GMT

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Hi all,

Do you guys have any ideas how to produce maps using othographic projections in the case of oblate planets?

I would like to plot spacecraft data over pretty oblate ellipsoids such as Jupiter and Saturn. Orthographic projections only works with spheres and most of the other projections of the map function don't fit my purposes..

Do you guys have any ideas?

Thanks!
Vince

Subject: Re: Orthographic projection using parametrized ellipsoid
Posted by lecacheux.alain on Sun, 08 May 2016 11:47:39 GMT

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Le vendredi 6 mai 2016 02:16:34 UTC+2, vince...@gmail.com a écrit :
> Hi all,
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> Vince

Orthographic projection with oblate body is very unusual (even outside IDL...). I guess that is because the distortions due to parallel projection are larger than those due to neglecting Earth oblateness. Also because it is ambiguous: in usual orthographic projection, the projection plane (perpendicular to the line of sight) is naturally tangent to the sphere; in case of oblate body, what would be the projection plane (the one perpendicular to the line of sight at the sub observer point or the one tangent to the ellipsoid there, or another) ?
I suggest to handle your problem by simply using matrix calculus: 3D positions of any points can be referenced in both ECEF and ENU Cartesian frames (i.e. planetocentric equatorial with z-axis along the rotation axis, and topocentric horizontal with z-axis along local vertical: simply replace E for Earth, by J or S for your preferred planets). The correspondence between those frames can be

exactly expressed by a 4x4 matrix (translation + rotation) in homogeneous coordinates. If you want to do any projecting operation (for a 2D viewing of any 3D problem), you still can achieve it by using the corresponding 4x4 matrix transformation in homogeneous coordinates (this is the way in which IDL works in 3D graphics !) .

More generally, I think (I am astronomer, not geographer !) that most of the mapping libraries are somewhat obsolete. They were useful in the old time when the problem was to measure distances and orientations by using compass and ruler from a map drawn on a sheet of paper: conformal techniques were mandatory for getting a representative approximate result. Now, at the time of computers, the result can be obtained exactly. By the way, in your own GPS receiver, your raw position is first given in some ECEF coordinates ("easting" and "northing") in general not visible to you, then translated and displayed in sexagesimal longitude and latitude...

In any case, as a direct answer to your question, here is an useful paper:
 http://hydrometronics.com/downloads/Ellipsoidal%20Orthograph ic%20Projection.pdf

Cheers,

alx.