PETERS PROJECTION

The use of the Peters projection in our contribution "Do Marine Scientists have a Scientific View of the Earth," in *Oceanography* Vol. 8, No. 1, created considerable interest and correspondence. Several colleagues wanted to know how the Peters projection can be incorporated into computer graphics routines. The projection is now available for the GMT plotting package (contact Mark J. Stevens of the Climate Research Program at Texas A&M University, stevens@diffuse.tamu.edu) and for the NCAR.Graphics routines (contact Dan Kelley at Dalhousie University, da.kelley@dal.ca).

Some colleagues drew our attention to the debate about the Peters projection among cartographers and questioned its value. The arguments, raised since its presentation in 1972, concern mainly three points, the "unnatural look" of the projection, its suitability for general use, and priority of thought.

The correspondence prompted us to study the history of the Peters projection in more detail. We think that what we learned is of sufficient interest to readers of *Oceanography* to justify an addendum to our original article in the form of this letter.

The Peters projection belongs to a family of maps known as cylindrical equal-area projections. All have fidelity of area and a rectangular latitude/longitude grid. They differ in the width/height ratio of the total map surface, depending on the choice of the reference latitude where north-south and east-west distances are equal. The Lambert projection of 1772, which we showed as Fig. 8 of our paper, is based on the equator as reference latitude. In 1855 Gall published a map with 45° as reference latitude. A map with 30° as reference latitude was published by Behrmann in 1910.

The historian Arno Peters derived his projection empirically by dividing the equator and the meridians into 100 equal increments and determining the width/height ratio of a basic map rectangle next to the equator by the desired shape of the map. After some experimentation with the final shape, which Peters wanted to be close to the so-called "golden section," he arrived at a width/height ratio next to the equator of 1/2. Moving away from the equator, the width of the rectangles is maintained while their height is decreased in proportion to the convergence of the meridians. The result is a finite difference approximation of Gall's cylindrical equal-area map of 1855. The same result is achieved by scaling all latitudes, given a longitude scaling factor of 1.0, by the latitude scaling factor 2.0 × cos (latitude). This is, in fact, the easiest and most accurate way of producing a Peters map.

The fact that Gall's and Peters' maps are identical does not detract from their value. When Gall presented his cylindrical equal-area map as one of several possible projections, he saw it as an exercise in cartography without immediate application. The time for a cylindrical equal-area projection based on 45° as reference latitude came with the introduction of today's standard paper sizes and of computer and television screens (the so-called golden section). Peters introduced the idea of a finite difference approximation and constructed his map empirically, independently from Gall's earlier efforts, and propagated its use. It is therefore, in our view, justifiable to call it the Peters projection. Gall's contribution to cartography could be honored by referring to it as the Gall/Peters projection.

The question of the "unnatural look" could be raised with any projection, since no projection can depict the continents and oceans in their true shape (i.e., as they appear when looking vertically down from space). It is true that a width/height ratio of 1/2 near the equator results in a vertical stretching of Africa and South America and that other projections come much closer to matching their true shape on the globe. In particular equal-area projections with curved coordinates manage to keep departures from true shape within tolerable limits. Such projections might be preferable for physical and political geography. Our conclusion that "the Peters projection will often be the best choice" refers to oceanographic applications, where a rectangular coordinate grid, the possibility of matching maps of individual oceans at meridians without redrawing, and equal area representation of all ocean basins are more important than the shape of continents.

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