Map Projection Aspects

Miljenko Lapaine, Nedjeljko Frančula

* University of Zagreb, Faculty of Geodesy, Kačićeva 26, 10000 Zagreb

Extended Abstract

A projection can have various aspects. What do projections in different aspects have in common? The answer is a mapping principle depicted by, for example, the representation of main and collateral circles and distortion distribution. How do aspects of the same projection differ? They differ according to the representation of contents, for example graticule form and position or orientation of represented elements (land, borders, etc.).

In this paper, we define projection aspects without referring to auxiliary surfaces and their axes. In fact, it is well known that mapping to auxiliary surfaces (cylinder or cone) which are to be developed onto a plane is only the case with a small group of map projections, e.g. perspective projections. All other projections map directly to the projection plane. Therefore, using terms which only refer to some cases in general definitions should be avoided.

Thus, the issue of map projection aspects is not only a linguistic issue, but relates primarily to the definition of the term. How can a map projection aspect be defined unambiguously? Is it even possible?

If we want to understand the concept of aspects in map projection theory, we first have to define the standard geographic coordinate system using geographic parameterization of a sphere. Analogously, we have to define the generalized or pseudogeographic coordinate system using pseudogeographic parameterization of a sphere. Then, we can establish the relation between the two spherical coordinate systems. It is possible to obtain each one from the other by rotating around the centre of a sphere, and each rotation in space is defined by three parameters.

Subsequently, the basic equations of map projection or an equivalent representation of map projection must be defined and that is a matter of convention. The map projection aspect can now be defined as the position of the

ICA European Symposium on CARTOGRAPHY
VIENNA, 10–12 NOVEMBER 2015

Published in "Proceedings of the 1st ICA European Symposium on Cartography", edited by Georg Gartner and Haosheng Huang, EuroCarto 2015, 10-12 November 2015, Vienna, Austria

projection axis in relation to the axis of geographic sphere parameterization.

At first, this may seem to provide a solution to the aspect problem, but this is not the case. The equations of a certain projection in a pseudogeographic system must still be formulated.

If we want to refer to the aspect of any other map projection, we must provide a definition in a pseudogeographic system in a similar way. In fact, projection categorization according to the shape of the normal cartographic network (cylindrical, conic, azimuthal, pseudocylindrical, etc.) is not unique, because, for example, an orthographic projection is both azimuthal and pseudocylindrical. Therefore, additional sorting criteria are required. We suggest the following additional criteria:

- author's definition of basic equations of map projection or an equivalent representation of map projection
- compatibility of the graticule's appearance with projection distortion distribution
- simpler appearance of the graticule
- simpler mathematical expressions

We propose the following definitions.

Basic equations of map projection are map projection equations which define a map projection in a pseudogeographic system.

The *projection axis* is the axis of pseudogeographic parameterization of a sphere, based on which the basic equations of map projection are defined.

The *projection aspect* is the position of the projection axis in relation to the geographic sphere parameterization axis. The aspect can be normal, transverse or oblique.

The *normal aspect* is the aspect in which the projection axis coincides with the geographic parameterization sphere's axis.

The *transverse aspect* is the aspect in which the projection axis is perpendicular to the geographic parameterization sphere' axis.

The *oblique aspect* is neither normal nor transverse.

Finally, we show that the definitions of the polar and equatorial aspects are imprecise and ambiguous, and should be avoided.