

Planar projections

The term planar projection has recently been used for certain projections. For example, in the book *Thematic Cartography and Geovisualization* (Slocum et al. 2001), map projections are classified into cylindrical, conic and planar. A footnote on page 137 states that some texts refer to planar projections as azimuthal and it is explained that those authors chose the term planar projections because it makes them easier to associate with the concept of developable surface because the plane is one of developable surfaces. According to this, we can conclude that Slocum et al. emphasize developable surfaces in the map projection theory, even though they also wrote (page 132): "The reference globe and developable surfaces are conceptual aids that help illustrate the projection process, but they are not used to create projections today." This means they emphasize something which is not used anymore! In addition, if map projections are used to represent a curved surface (e.g. Earth's sphere or ellipsoid) in a plane, then all projections are planar. Naming azimuthal projections planar would mean that no other projection is planar?!

The book by Slocum et al. (2001) is not the only one to feature the term planar projection instead of azimuthal projections. For example, the following text can be found on a web-page (Geokov 2017): "In planar (also known as azimuthal or zenithal) projections, the reference spherical

surface is projected onto a plane." Authors of those web-pages admit those projections are also known as azimuthal or zenithal, but they define them as those in which a spherical surface is mapped onto a plane. What makes those projections different than all other projections?

The National Atlas of the United States has not been accessible since 2014, but it can be found using Wayback Machine (2014). The Atlas defines a planar projection in the following way: "A planar projection projects information to a plane. The plane may be either tangent or secant." Of course, this contradicts the definition of a map projection: "A map projection is a way to represent the curved surface of the Earth on the flat surface of a map." because according to that no other projection is planar (?!). Maybe the authors of the National Atlas know mathematics well, so they distinguish between a plane and a flat surface. Namely, according to Wolfram MathWorld (2017), a flat surface is: "A regular surface and special class of minimal surface for which the Gaussian curvature vanishes everywhere. A tangent developable, generalized cone, and generalized cylinder are all flat surfaces". This would mean that an azimuthal projection maps not only onto a plane, but also onto a lateral surface of cylinder or cone (?!). In addition, the small dictionary (Commonly Used Map Projections Terms) does not contain the term planar projection, but there is a

reference to azimuthal projections: Azimuthal – A map projection in which the direction from a given central point to any other point is shown correctly. Also called a zenithal projection.)"

Furthermore, let us also mention course materials available on the Internet by full professor of computer and theoretical geography at Hunter College, City University of New York, Prof. Dr. Jochen Albrecht (Albrecht 2017). He defined planar projections as: "Planar projections, also called azimuthal projections, project map data onto a flat surface." One could find additional similar definitions, but we think these are more than enough.

There is another issue associated with planar projections, one concerning an unnecessary adjective to be used for transverse Mercator projection. Namely, on August 4, 2004, based on article 9, paragraph 2 of the Law on State Survey and Real Estate Cadastre, the Government of the Republic of Croatia passed the Decision on Determination of Official Geodetic Datums and Planar Map Projections of the Republic of Croatia (Government of the Republic of Croatia, 2004). Since the projection in question is transverse Mercator, which maps the Earth's ellipsoid into a plane, the adjective *planar* in the mentioned decision is completely unnecessary.

In conclusion, it is not advisable to use the term *planar projection*.

Miljenko Lapaine, Nedjeljko Frančula ■

It is unadvisable to use the term *planar projection*.

Upotreba naziva *ravninske projekcije* nije preporučljiva.

Ravninske projekcije

U novije doba pojavljuje se za neke projekcije naziv ravninske projekcije (*planar projections*). Tako se npr. u knjizi *Thematic Cartography and Geovisualization* (Slocum i dr. 2001) kartografske projekcije dijele na cilindrične, konusne i ravninske. U fusnoti na str. 137 piše da se u nekim tekstovima ravninske projekcije nazivaju azimutnima i objašnjava da se su autori odlučili za naziv ravninske jer ih je na taj način lakše staviti u odnos s konceptom razvojnih ploha jer da je ravnina jedna od razvojnih ploha. Iz navedenoga možemo zaključiti da Slocum i dr. daju veliki značaj primjeni razvojnih ploha u teoriji kartografskih projekcija premda su na str. 132 napisali: "The reference globe and developable surfaces are conceptual aids that help illustrate the projection process, but they are not used to create projections today." Znači da se daje važnost nečemu što se u današnje doba više ne upotrebljava! Osim toga, ako kartografske projekcije služe prikazivanju zakrivljene plohe (npr. Zemljine sfere ili elipsoida) u ravnini, onda su sve projekcije ravninske. Imenovanje azimutnih projekcija ravninskima značilo bi da sve druge nisu ravninske?!

Knjiga Slocuma i dr. (2001) nije jedina u kojoj se pojavljuje termin ravninske projekcije umjesto azimutnih projekcija. Tako se npr. na web-stranicama (Geokov 2017) može pročitati "In planar (also known as azimuthal or zenithal) projections, the reference spherical surface is projected onto a plane." Autori tih web-stranica priznaju da su te projekcije poznate i kao azimutne ili zenitne, ali ih definiraju kao one na koje se sferna ploha preslika u ravninu. Po čemu se onda te projekcije razlikuju od svih ostalih?

U National Atlas of the United States, koji od 2014. više nije izravno dostupan na internetu, ali ga je moguće naći na drugoj adresi (Wayback Machine 2014) definiraju se ravninske

projekcije na ovaj način: "A planar projection projects information to a plane. The plane may be either tangent or secant." To je naravno u sukobu s definicijom kartografske projekcije: "A map projection is a way to represent the curved surface of the Earth on the flat surface of a map." jer po tome sve ostale projekcije ne bi bile ravninske (!). Ili su možda autori National Atlasa dobri matematičari koji razlikuju ravninu (plane) od ravne plohe (flat surface). Naime, definicija ravne plohe prema Wolfram MathWorld (2017) je: "A regular surface and special class of minimal surface for which the Gaussian curvature vanishes everywhere. A tangent developable, generalized cone, and generalized cylinder are all flat surfaces". To bi onda značilo da je azimutna projekcija projekcija ne samo u ravninu, nego i na plašt valjka ili stošca (!). Dodajmo još k tome da u malom rječniku (*Commonly Used Map Projections Terms*) nema ravninskih projekcija, ali postoje azimutne: Azimuthal – A map projection in which the direction from a given central point to any other point is shown correctly. Also called a zenithal projection.)"

Spomenimo na tu temu još i nastavne materijale dostupne na internetu koje je postavio redoviti profesor računalne i teorijske geografije na Hunter College, City University of New York, Prof. Dr. Jochen Albrecht (Albrecht 2017). Njegova definicija ravninskih projekcija glasi: "Planar projections, also called azimuthal projections, project map data onto a flat surface." Sličnih definicija moglo bi se još naći, no mislimo da je i ovo dovoljno.

Imamo još jedan primjer ravninskih projekcija, ali ovaj put ne kao novo ime za azimutne projekcije nego kao nepotreban pridjev uz poprečnu Mercatorovu projekciju. Naime, na temelju članka 9. stavka 2. Zakona o državnoj izmjeri i katastru nekretnina

Vlada Republike Hrvatske je na sjednici održanoj 4. kolovoza 2004. godine, donijela Odluku o utvrđivanju službenih geodetskih datuma i ravninskih kartografskih projekcija Republike Hrvatske (Vlada RH 2004). Budući da je riječ o poprečnoj Mercatorovoj projekciji koja, kao što znamo, preslikava Zemljin elipsoid u ravninu, pridjev *ravninskih* u navedenoj odluci je sasvim nepotreban.

Zaključimo, upotreba naziva *ravninske projekcije* nije preporučljiva.

Literatura / References:

- Albrecht, J. (2017): Planar projections. <http://www.geography.hunter.cuny.edu/~jochen/GTECH361/lectures/lecture04/concepts/Map%20coordinate%20systems/Planar%20projections.htm> (3. 11. 2017.)
- Geokov (2017): Map Projections – types and distortions patterns. <http://geokov.com/education/map-projection.aspx> (3. 11. 2017.)
- Slocum T. A., McMaster R. B., Kessler F. C., Howard H. H. (2001): *Thematic Cartography and Geovisualization*, Third Edition, Pearson / Prentice Hall, Upper Saddle River
- Vlada RH (Government of the Republic of Croatia) (2004): Odluka o utvrđivanju službenih geodetskih datuma i ravninskih kartografskih projekcija Republike Hrvatske (Decision on Determination of Official Geodetic Datums and Planar Map Projections of the Republic of Croatia), Narodne novine (Official Gazette of the Republic of Croatia) broj 110 od 11. 8. 2004. (issue No. 110 of 11. 8. 2004.)
- Wayback Machine (2014): Map Projections: From Spherical Earth to Flat Map. https://web.archive.org/web/20140826044613/http://nationalatlas.gov/articles/mapping/a_projections.html (3. 11. 2017.)
- Wolfram MathWorld (2017): Flat Surface. <http://mathworld.wolfram.com/FlatSurface.html> (3. 11. 2017.)

Miljenko Lapaine, Nedjeljko Frančula ■