19 Further Information

19.1 Introduction

In this chapter we will give further information and further references to books and other material. The chapter is intended to be updated more often than other chapters of the book.

19.2 Complements to the Chapters

Chapter 9 Map Projections and Reference Systems

The chapter on projections and reference systems is more detailed than the other chapters. That is necessary because so many details had to be provided. The coordinates of geographic data can be stated in different reference systems in different databases. When data are merged, it is important to consider whether a transformation of the coordinates is necessary. If you are insure, ask a person with geodetic knowledge.

Questions and Answers

Questions

1. What is a map projection?
2. Is it possible to project/transform a spherical or ellipsoidal surface into a plane without distortions?
3. What is geodesy about?
4. What is a satellite navigation system?
5. Which are the only global operational GNSSs?
6. What is the Earth's ellipsoid?
7. What describes a geodetic datum?
8. Which are geodetic coordinates?
9. Which are geographic coordinates?
10. Describe the Universal Transverse Mercator (UTM) system.
11. Explain geometric classification of map projections.
12. What is the main characteristic of conformal projections?
13. What is preserved on equal-area or equivalent projections?
14. Why is the Mercator projection not recommended for world maps?
15. Describe the main characteristic of the Stereographic projection.
16. Explain the connection between the logo of the International Cartographic Association (ICA) and the map projections.
17. Which map projection is used to represent the Earth on the UN's flag?
18. What is Web Mercator?
19. Which are the two most commonly used projections for large-scale maps?
20. Which kind of map projections are recommended for general-purpose world maps?

Answers

1. The transformation from the curved surface into a plane is known as map projection.
2. It is not possible to project/transform a spherical or ellipsoidal surface into a plane without distortions.
3. Geodesy is a technology and science dealing with the survey and representation of the Earth's surface, the determination of the Earth's shape and dimensions and its gravity field.
4. A satellite navigation system is a system of satellites that provide autonomous geospatial positioning with global coverage.
5. As of April 2013, only the United States NAVSTAR Global Positioning System (GPS) and the Russian GLONASS are global operational GNSSs.
6. The Earth's ellipsoid is any ellipsoid approximating Earth.
7. Geodetic datum describes the relation of origin and orientation of axes on a coordinate system in relation to Earth.
8. Geodetic coordinates are geodetic latitude and geodetic longitude, with or without height.
9. Geographic coordinates are geographic latitude and geographic longitude, with or without height.
10. The Universal Transverse Mercator (UTM) system is based on projections of six-degree zones of longitude, 80° S to 84° N latitude, and the scale factor 0.9996 is specified for the central meridian for each UTM zone yielding a maximum error of 1 part in 2,500. In the northern hemisphere, the x coordinate of the central meridian is offset to have a value of 500,000 meters instead of 0, normally termed as "False Easting." The y coordinate had 0 set at the Equator. In the southern hemisphere, the False Easting is also 500,000 meters with a y offset of the Equator or False Northing equal to 10,000,000 meters.
11. According to the geometric classification, map projections are usually referred to as cylindrical, conical, and azimuthal, but there are also pseudocylindrical, pseudoconic, polyconic and many others.
12. Maps with angles preserved are called conformal projections.
13. Maps with areas preserved are referred to as equal-area or equivalent projections.
14. Significant size distortion occurs in the higher latitudes and that is why the Mercator projection is not recommended for world maps.
15. The Stereographic projection, developed by the 2nd century BC, is a perspective azimuthal projection that preserves angles (*i.e.*, is conformal). This projection is the only projection in which all circles from the globe are represented as circles in the plane of projection.
16. Logo of the International Cartographic Association (ICA) represents Earth in Mollweide projection.

17. The Earth is represented on the UN's flag in azimuthal equidistant projection.
18. Web Mercator is the mapping of WGS84 datum (*i.e.*, ellipsoidal) latitude/longitude into Easting/Northing using spherical Mercator equations (where R = a).
19. The two most commonly used projections for large scale maps are the Lambert Conformal Conic and the Transverse Mercator, which are the basis of the UTM and most of the USA State Plane coordinate systems.
20. For general-purpose world maps, our recommendation is not using any cylindrical map projection, but some of pseudocylindrical (*e.g.*, Robinson, or compromise like the Winkel Tripel)

Further References

Some literature references were provided already at the end of the chapters. Here comes some more:

Anderson, P. B. and W. R. Tobler (s. d.). Blended map projections are splendid projections, http://www.geog.ucsb.edu/~tobler/publications/pdf_docs/inprog/BlendProj.pdf (accessed 3 August 2011).

Boggs, S. (1929). A new equal-area projection for world maps, *Geographical Journal*, 73-3, 241–245.

Bugayevskiy, L. M. and J. P. Snyder (1995). *Map Projections: A Reference Manual*, Taylor and Francis, London, 248 p.

Canters, F. (2002). *Small-Scale Map Projection Design*, Taylor and Francis, London, 336 p.

Eckert, M. (1906). Neue Entwürfe für Weltkarten. Petermanns Mitteilungen, 52-5, 97–109.

Érdi-Krausz, G. (1968). Combined equal-area projections for world maps, Hungarian Cartographical Studies, 44–49.

Fenna, D. (2007). Cartographic science: a compendium of map projections, with derivations. CRC Press.

Finn, M. P., E. L. Usery, S. T. Posch, and J. C. Seong (2004). "A Decision Support System for Map Projections of Small Scale Data," U. S. Geological Survey Scientific Investigation Report 2004-5297.

Foucaut, H. C. de Prépetit (1862). Notice sur la construction de nouvelles mappemondes et de nouveaux atlas de géographie, Arras, France.

Gede, M. (2011) Optimising the distortions of sinusoidal-elliptical composite projections. A. Ruas (ed.), *Advances in Cartography and GIScience*. Volume 2: Selection from ICC 2011, Paris, Lecture Notes in Geoinformation and Cartography 6, DOI 10.1007/978-3-642-19214-2_14, Springer-Verlag Berlin Heidelberg, 209–225.

Goode, J. P. (1925). "The Homolosine Projection: A New Device for Portraying the Earth's Entire Surface," *Annals of the Association of American Geographers*, 15:119-125.

Goussinsly, B. (1951). "On the Classification of Map Projections," *Empire Survey Review*, 11:75-79.

Hammer, E. (1900). Unechtcylindrische and unechtkonische flächentreue Abbildungen, Petermanns Geographische Mitteilungen, 46, 42–46.

Iliffe, J. C. (2000). *Datums and Map Projections*, Whittles Publishing, Caithness, Scotland, 150 p.

Jenny, B. (2012). Adaptive composite map projections. IEEE Transactions on Visualization and Computer Graphics (Proceedings Scientific Visualization/Information Visualization 2012) 18(12): 2575–2582.

Jenny, B. and T. Patterson (2007). Flex Projector, http://www.flexprojector.com (accessed 3 August 2011).

Jenny, B. and T. Patterson (2013). Blending world map projections. Cartography and Geographic Information Science, (in print).

Jenny, B., T. Patterson, and L. Hurni (2008). Flex Projector—interactive software for designing world map projections, *Cartographic Perspectives*, 59, 12–27.

Jenny, B., T. Patterson, and L. Hurni (2010). Graphical design of world map projections. *International Journal of Geographic Information Science*, 24-11, 1687–1702.

Maling, D. H. (1968). "The Terminology of Map Projections," *International Yearbook of Cartography*, 8:11–65.

Maling, D. H. (1992). *Coordinate Systems and Map Projections, 2nd Edition*, Pergamon Press, Oxford.

Maurer, H. (1935). *Ebene Kugelbilder, Ein Linnésches System der Kartenentwürfe,* Petermanns Mitteilungen, Erg@nzungsheft no. 221.

McBryde, F. W. (1978). A new series of composite equal-area world maps projections, International Cartographic Association, 9th International Conference on Cartography, College Park, Maryland, Abstracts, 76–77.

Pearson II, F. (1990). *Map Projections: Theory and Applications*, CRC Press, Boca Raton, FL, 384 p.

Putniņš, R. V. (1934). Jaunas projekci jas pasaules kartēm, Geografiski Raksti, Folia Geographica 3 and 4, p. 180–209. [Latvian with extensive French résumé].

Snyder, J. P. (1977). A comparison of pseudocylindrical map projections, *The American Cartographer*, 4-1, 59–81.

Snyder, J. P. (1987). *Map Projection: A Working Manual*, US Geological Survey Professional Paper 1395, US Government Printing Office, Washington, DC, 383 p.

Snyder, J. P. (1993). *Flattening the Earth: Two Thousand Years of Map Projections*, University of Chicago Press, Chicago, 365 p.

Snyder, J. P. and P. M. Voxland (1989). *An Album of Map Projections,* US Geological Survey Professional Paper 1453, US Government Printing Office, Washington, DC, 249 p.

Starostin, F. A., L. A. Vakhrameyeva, and L. M. Bugayevskiy (1981). Obobshchennaya klassifikatsiya kartograficheskikh proyektsiy po vidu izobrazheniya meridianov i paralleley, Izvestiya Vysshikh Uchebnykh Zavedeniy, *Geodeziya i Aerofotos'emka,* 6:111-116.

Steinwand, D. R., M. P. Finn, J. R. Trent, E. L. Usery, and R. A. Buehler (2005). "Re-projecting Raster Data of Global Extent," *Proceedings, Auto-Carto 2005: A Research Symposium,* Las Vegas, NV. Cartography and Geographic Information Society, Gaithersburg, MD.

Strebe, D. (2010). Mapthematics Geocart 3 User's Manual. Online: http://www.mapthematics.com/Downloads/Geocart_Manual.pdf

Takos, I. K. (1978). "The Azimuthal Equidistant Projection of Hatt," (in Greek), Hellenic Military Geographical Service, Greece, 21-52.

Tissot, N. A. (1881). *Mémoire sur la Représentation des Surfaces et les Projections des Cartes Géographiques*, Gauthier Villars, Paris.

Tobler, W. R. (1962). "A Classification of Map Projections," *Annals of the Association of American Geographers*, 52:167–175.

Tobler, W. R. (1973). The hyperelliptical and other new pseudo cylindrical equal area map projections. *Journal of Geophysical Research*, 78-11, 1753–1759.

Tobler, W. R. (1986). Polycylindric map projections, *The American Cartographer*, 13-2, 117–120.

USGS (2006). "Cartographic Research," http://carto-research.er.usgs.gov/, US Geological Survey, Rolla, Missouri (data last accessed, August 2006).

Wagner, K. (1949). Kartographische Netzentwürfe, Leipzig: Bibliographisches Institut.

Welch, R. and A. Homsey (1997). "Datum Shifts for UTM Coordinates," *Photogrammetric Engineering & Remote Sensing*, 63(4):371–375.

Welch, R. and E. L. Usery (1984). "Cartographic Accuracy of Landsat-4 MSS and TM Image Data," *IEEE Transactions on Geoscience and Remote Sensing*, GE-22(3):281–288.

Winkel, O. (1921). Neue Gradnetzkombinationen, Petermanns Mitteilungen, 67, 248–252.

Yang, Y., J. P. Snyder, and W. R. Tobler (2000). *Map Projection Transformation Principles and Applications*, Taylor and Francis, London, 367 p.

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Chapter 15 Geographic Information, Access and Availability

Members of the Joint Board of Geospatial Information Societies (JBGIS)

The **Joint Board of Geospatial Information Societies** (JBGIS) is a coalition of recognised international geospatial organisations involved in the coordination, development, management, standardisation or regulation of geospatial information and related matters, represented by the Presidents, Secretary-Generals or equivalent office bearers or their nominees that lead those organisations.

The JB GIS is a co-operation network and there are no obligations to the membership neither does the JB GIS collect any membership fees. The JBGIS was set up in 1999 since there was a need of cooperation between the different organisations that deal with geospatial information and that the organisations needed a common voice for instance in the communications with UN. The current members of the JB GIS are:

Global Spatial Data Infrastructure (GSDI) Association
IEEE Geoscience and Remote Sensing Society (IEEE-GRSS)
International Association of Geodesy (IAG)
International Cartographic Association (ICA)
International Federation of Surveyors (FIG)
International Geographic Union (IGU)
International Hydrographic Organization (IHO)
International Map Industry Association (IMIA)
International Society of Photogrammetry and Remote Sensing (ISPRS)
International Steering Committee for Global Mapping (ISCGM)

To get more information on the societies just click the link above.

The JB GIS meets normally once a year, in normal case, linked to one of the conferences or other meetings of one or two of the member associations.

Chapter 17 Education

Masters in Cartography

http://learn.org/articles/Cartography_Masters_Degree_Program_FAQs.html

Internet based education