ICA Commission on Map Projections

Symbols in Map Projections – A Proposal for Standardization

ICC2017

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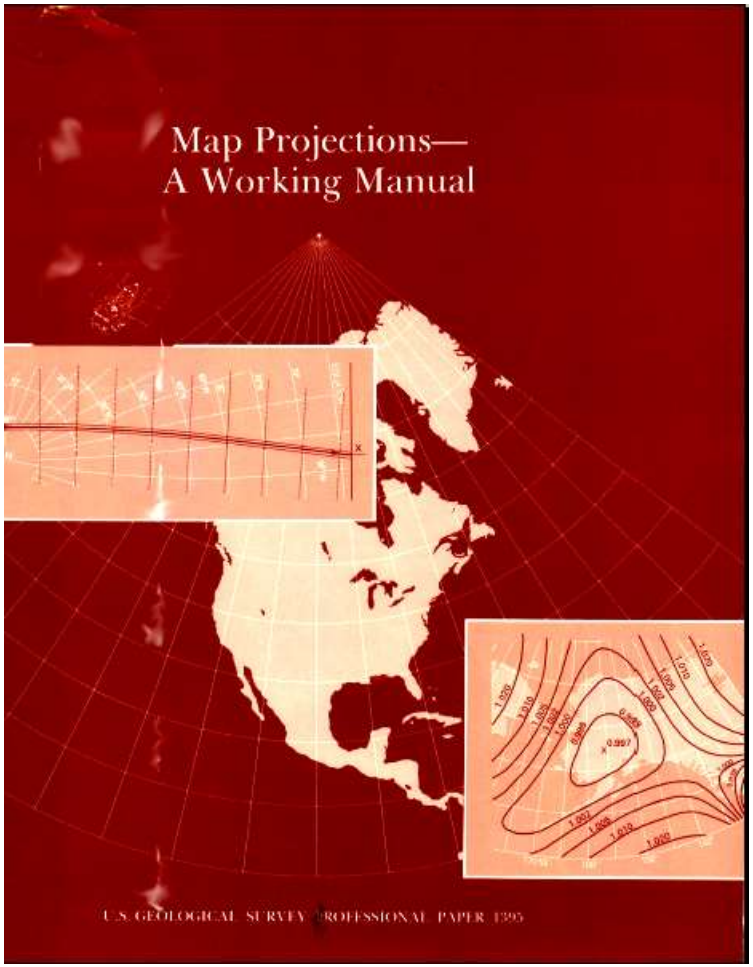

Map Projections—
A Working Manual

By JOHN P. SNYDER

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SYMBOLS

If a symbol is not listed here, it is used only briefly and identified near the formulas in which it is given.

Az = azimuth, as an angle measured clockwise from the north.
a = equatorial radius or semimajor axis of the ellipsoid of reference.
b = polar radius or semiminor axis of the ellipsoid of reference.
$= a(1 - f) = a(1 - e^2)^{1/2}$.
c = great circle distance, as an arc of a circle.
e = eccentricity of the ellipsoid.
$= (1 - b^2/a^2)^{1/2}$.
f = flattening of the ellipsoid.
h = relative scale factor along a meridian of longitude. (For general perspective projections, h is height above surface of ellipsoid.)

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α

azimuth, as angle measured clockwise from the north

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a

semimajor axis of the ellipsoid of reference

b

semiminor axis of the ellipsoid of reference

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e

first eccentricity of the ellipsoid = $\sqrt{1-\frac{b^2}{a^2}}$

e'

second eccentricity of the ellipsoid = $\sqrt{\frac{a^2}{b^2}-1}$

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f

flattening of the ellipsoid = $\frac{a-b}{a}$

f'

second flattening of the ellipsoid = $\frac{a-b}{b}$

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h

relative scale factor along a meridian of longitude.
For general perspective projections, *h* is height above surface of sphere/ellipsoid.

k

relative scale factor along a parallel of latitude

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n

cone constant on conic projections, or the ratio of the angle between meridians to the true angle,

or the third flattening of the ellipsoid = $\frac{a-b}{a+b}$

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R

radius of the sphere

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S

surface area

REMARK
Only I think if it is not better to use "A" for surface area instead of "S" because S is used very often for Scale

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x

rectangular coordinate: distance to the right of the vertical line (*y* axis) passing through the origin or center of a projection (if negative, it is distance to the left). In practice, a "false" *x* of "false easting" is frequently added to all values of *x* to eliminate negative numbers.
Note: Many texts use *x* and *y* axes interchanged, not rotated, from this convention.

y

rectangular coordinate: distance above the horizontal line (*x* axis) passing through the origin or center of a projection (if negative, it is distance below). In practice, a "false" *y* of "false northing" is frequently added to all values of *y* to eliminate negative numbers.

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z

zenithal distance from North Pole of latitude φ,
or $90° - \varphi$,
or colatitude

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ln

natural logarithm,
or logarithm to base e, where e ≈ 2.71828

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δ

angle measured counterclockwise from the central meridian, rotating about the center of the latitude circles on a normal aspect conic or azimuthal projection

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θ

angle of intersection between meridian and parallel in a plane of projection

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λ

longitude east of Greenwich (for longitude west of Greenwich, use a minus sign)

REMARK
And for the longitude and latitude related definition, maybe it would be better to separate out the sign convention. I think it would make the definitions clearer. For example, something like, “Longitude. Longitude values are positive east of Greenwich (or another prime meridian). For longitude west of Greenwich, apply a negative sign.”

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λ_0

longitude east of Greenwich of the central meridian of the map (for west longitude use a minus sign), or longitude chosen as a parameter to define the origin of rectangular coordinates for a projection

λ'

transformed longitude east of the new prime meridian, when graticule is rotated on the globe

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ρ

radius of latitude circle on normal aspect conic or azimuthal projection

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φ

north geodetic or geographic latitude (if latitude is south, apply a minus sign)

φ_0

middle latitude, or latitude chosen as a parameter to define the origin of rectangular coordinates for a projection

φ'

transformed latitude relative to the new poles and equator when the graticule is rotated on the globe

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φ_1, φ_2

standard parallels of latitude for projections with two standard paralells. These are true to scale and with zero angular distortion

φ_1 (without φ_2)

single standard parallel

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ω

maximum angular distortion at a given point on a projection

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$$M = \frac{a(1-e^2)}{\sqrt{(1-e^2 \sin^2 \varphi)^3}}$$

radius of curvature in the plane of the meridian (meridional radius of curvature)

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$$N = \frac{a}{\sqrt{1 - e^2 \sin^2 \varphi}}$$

radius of curvature of the ellipsoid in a plane perpendicular to the meridian and also perpendicular to a plane tangent to the surface (transverse radius of curvature)

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$$P = N \cos \varphi$$

radius of the parallel at given latitude

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χ

conformal latitude on a sphere which is truly conformal in accordance with the ellipsoid

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ψ

isometric latitude, which is directly proportional to the spacing of parallels of latitude from the Equator on the ellipsoidal Mercator projection

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β

authalic latitude on a sphere with the same surface area as the ellipsoid

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μ

rectifying latitude on a sphere, which has correct distances along the meridians as the ellipsoid

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R_q

radius of the sphere having the same surface area as the ellipsoid (authalic sphere)

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R_m

radius of the sphere with correct distances along the meridians as the ellipsoid (rectifying sphere)

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a, b, c

semi-axes of the tri-axial ellipsoid

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e

eccentricity of the meridional ellipse $e^2 = \frac{a^2 - c^2}{a^2}$

e'

second eccentricity of the meridional ellipse $e'^2 = \frac{b^2 - c^2}{b^2}$

e_1

eccentricity of the equatorial ellipse $e_1^2 = \frac{a^2 - b^2}{a^2}$

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s

particular scale factor in any direction at a given point on a projection

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p

area scale factor at a given point on a projection

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$$\Omega = \frac{\omega}{2}$$

maximum direction distortion at a given point on a projection

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a

semimajor axis of the Tissot's indicatrix

b

semiminor axis of the Tissot's indicatrix

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γ_a

direction of the maximum scale distortion (semimajor axis of the Tissot's indicatrix) counterclockwise from the positive axis on the map

γ_b

direction of the minimum scale distortion (semiminor axis of the Tissot's indicatrix) counterclockwise from the positive axis on the map

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- R: maybe it's interesting to make a distinction between the radius of the generating globe R (which is used in map projection formulas) and the radius of the Earth at full size: R_E
- Apart from the cone constant n it may be useful to also standardize the symbol used for the integration constant in map projection formulas for conical projections. Often a small c or large C is used.
- In many publications co-latitude is represented by δ instead of z
- In many publications the angle measured counterclockwise from the central meridian in an azimuthal projection is represented by θ instead of δ
- In many publications the radius of a latitude circle on an azimuthal or conical projections is represented by r instead of ρ.
- ρ is often used to indicate the radius of a parallel on the globe
- ω often refers to the maximum change of direction in a map projection, implying that the maximum angular distortion is 2ω

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Thank you very much for your cooperation and attention!

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