Cartography

Doç. Dr. Erkan Yılmaz

CYLINDER PROJECTIONS

Geographic Projection

Equirectangular Projection

Center Cylinder Projection

Gall Projection

Lambert Cylinder Projection

Mercator Cylinder Projection

Mollweide Projection

Sinusoidal Projection

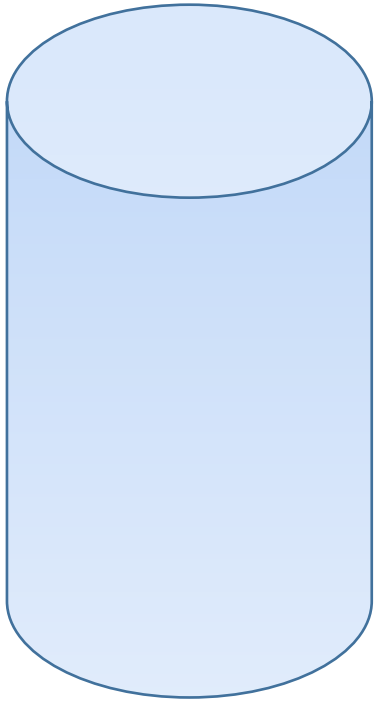
Eckert Projection

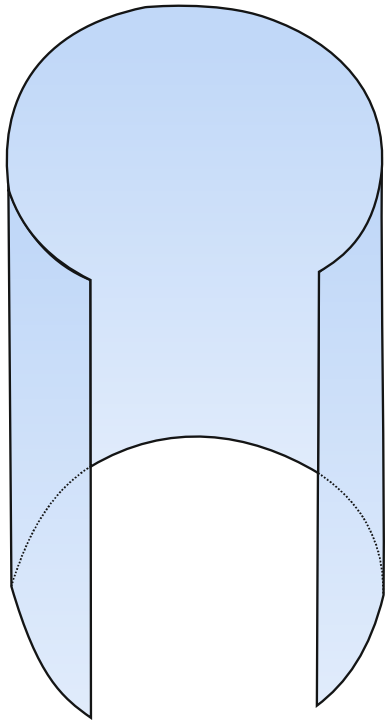
Robinson Projection

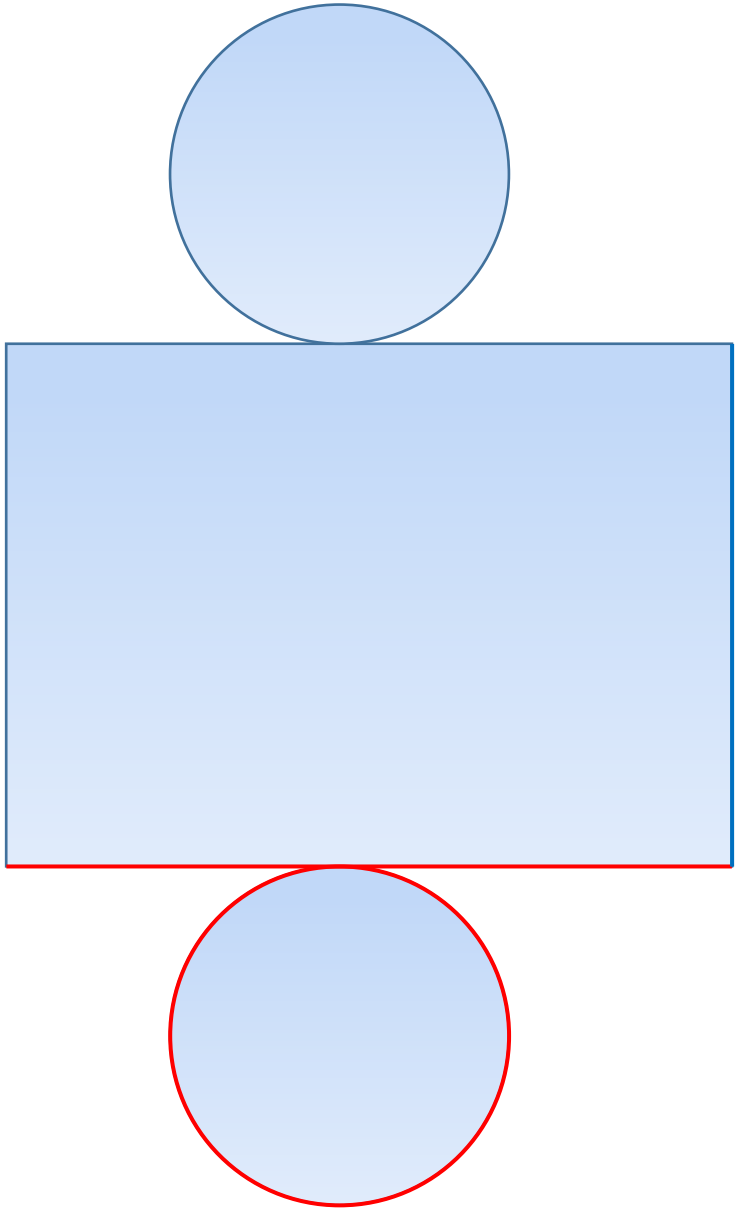
Winkel Tripel Projection

Segmented Projections

Central Meridian Change





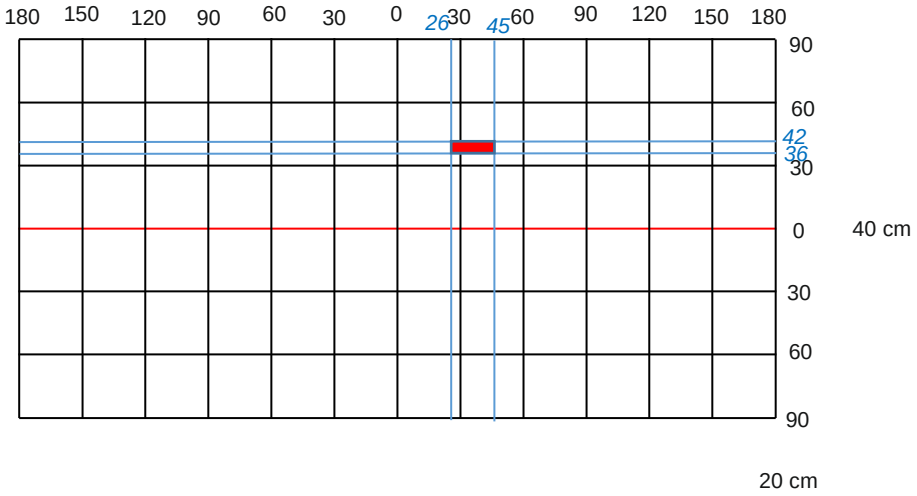


h

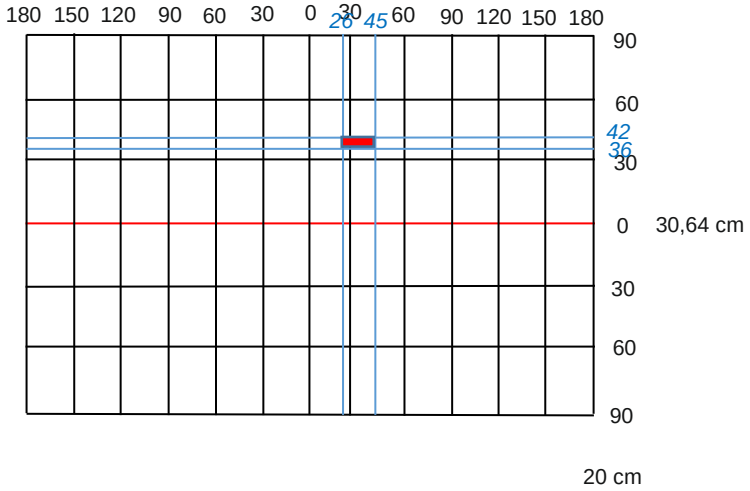
$2\pi R$

Geographic and Equirectangular Projections

Drawing of the graticule (grid network) of the Geographic projection at a scale of 1/100,000,000 (Interval: 30 degree) and showing the location of Turkey.



Drawing of the graticule (grid network) of the Equirectangular projection at a scale of 1/100,000,000 (Interval: 30 degree) and showing the location of Turkey.



0 2000 km

Logic

Maintaining length across the Equator.
Maintaining length along Meridians

$2\pi R = 2*3,14*6,37 = 40cm$

$\pi R = 3,14*6,37 = 20cm$

$\frac{20}{6} = 3,33cm$

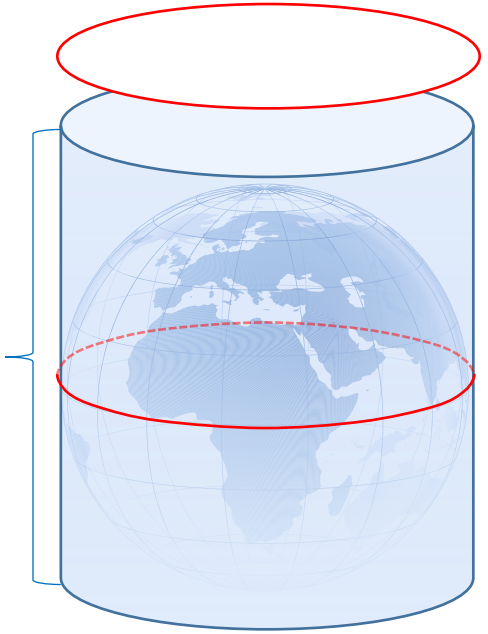
$\frac{40}{12} = 3,33cm$

h = Meridian Length

$\frac{2\pi R}{2} = \pi R$

$2\pi R$
$\pi = 3,14$
$R = 6,37cm$

h



Türkiye

$\varphi_{36} = \frac{\pi R}{180}*36 = \frac{20}{180}36 = 4,00$ $\gamma_{26} = \frac{2\pi R}{360}*26 = \frac{40}{360}26 = 2,89$

$\varphi_{42} = \frac{\pi R}{180}*42 = \frac{20}{180}42 = 4,67$ $\gamma_{45} = \frac{2\pi R}{360}*45 = \frac{40}{360}45 = 5,00$

Logic

Maintain length along standard parallel.
Maintaining length along Meridians.

$2\pi \cos_{40} R = 2*3,14*0,766*6,37 = 30,64cm$

$\pi R = 3,14*6,37 = 20cm$

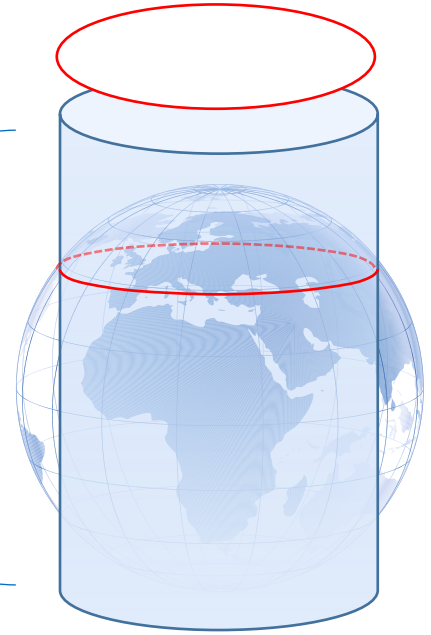
$\frac{20}{6} = 3,33cm$

$\frac{30,64}{12} = 2,55cm$

$2\pi \cos\varphi R$
$\pi = 3,14$
$R = 6,37cm$

$h = Md.Uz. = \pi R$

h



Türkiye

$\varphi_{36} = \frac{\pi R}{180}*36 = \frac{20}{180}36 = 4,00$ $\gamma_{26} = \frac{2\pi \cos_{40} R}{360}*26 = \frac{30,64}{360}26 = 2,21$

$\varphi_{42} = \frac{\pi R}{180}*42 = \frac{20}{180}42 = 4,67$ $\gamma_{45} = \frac{2\pi \cos_{40} R}{3600}*45 = \frac{30,64}{360}45 = 3,83$

Features of Projection

- Entire world.
- Maintains length along meridians.
- Parallels are straight lines parallel to the equator.
- The parallel spaces are equal.
- Meridians are lines perpendicular to the equator.
- Meridian spaces are equal.
- Distortion is low a the the equatorial region. As you move from the equator to the poles, the distortions increase.
- The distortions at the poles are infinite.

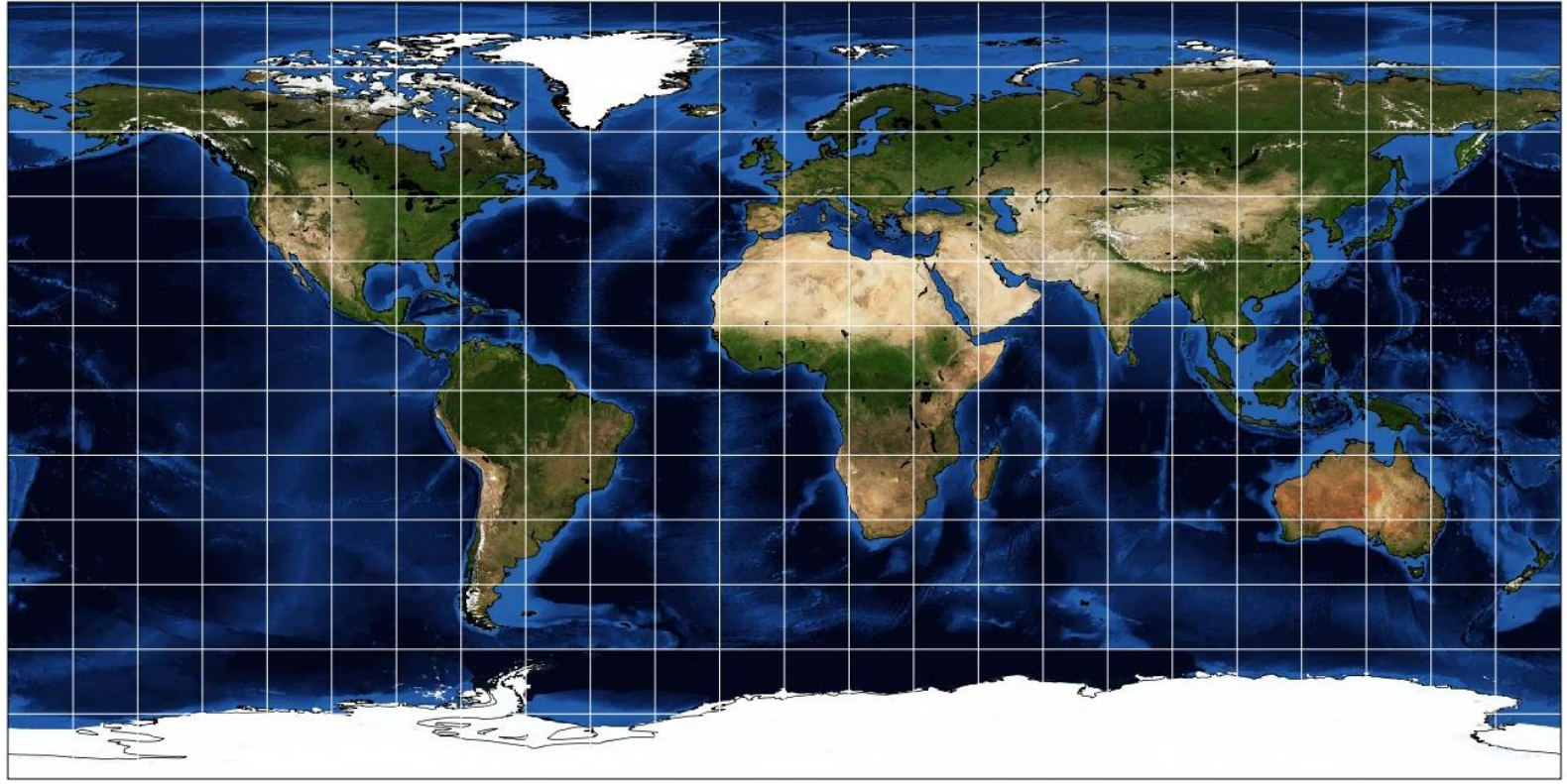
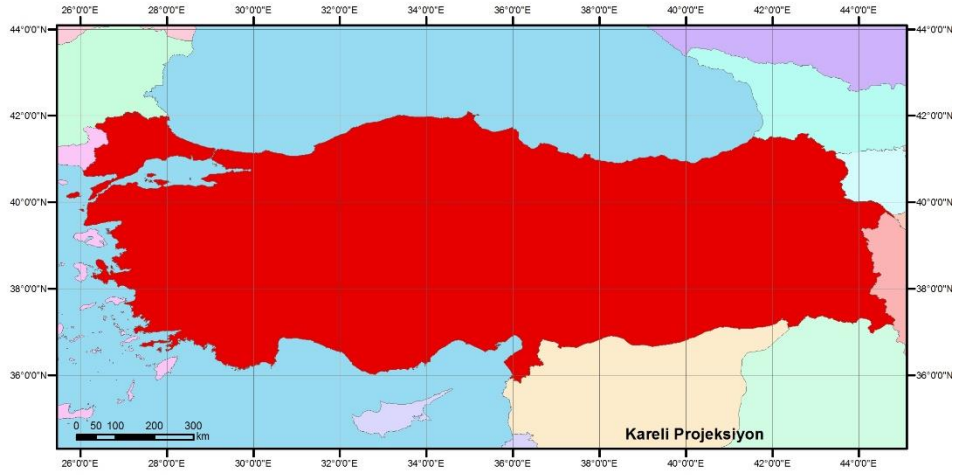
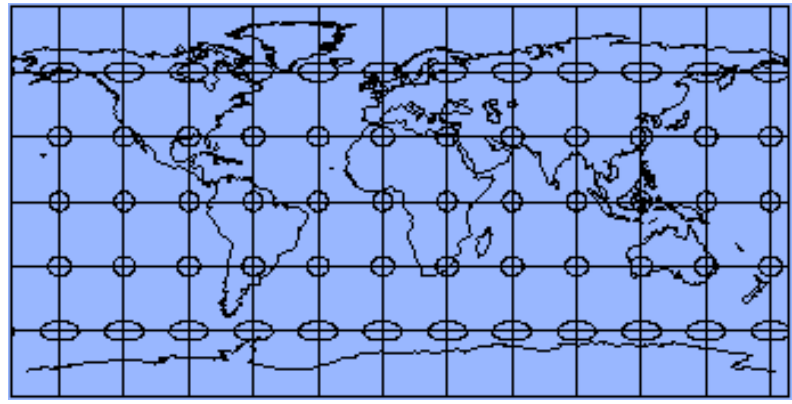


Plate Carrée
Plane Chart
Geographic Projection
Latitude Longnitude
WGS84



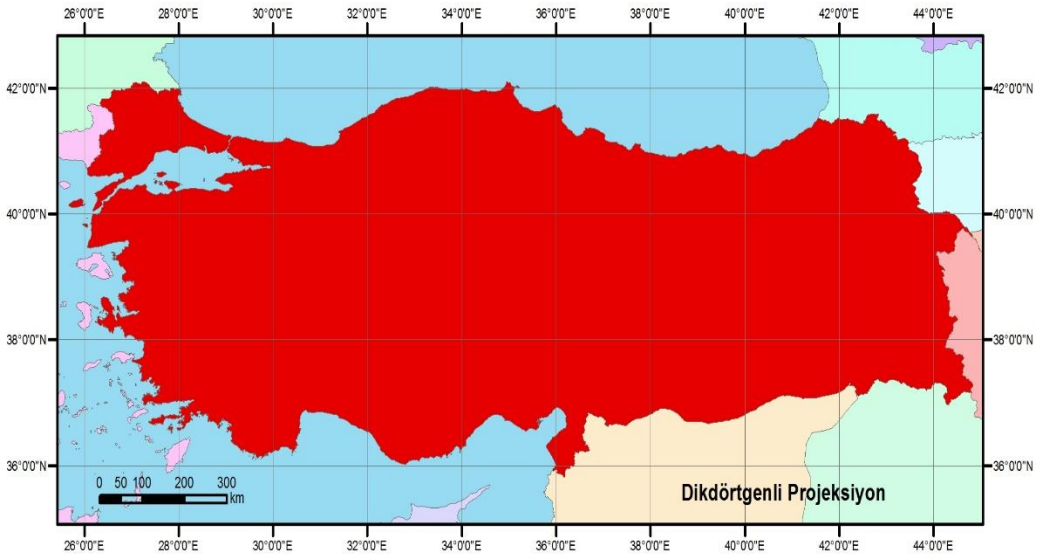


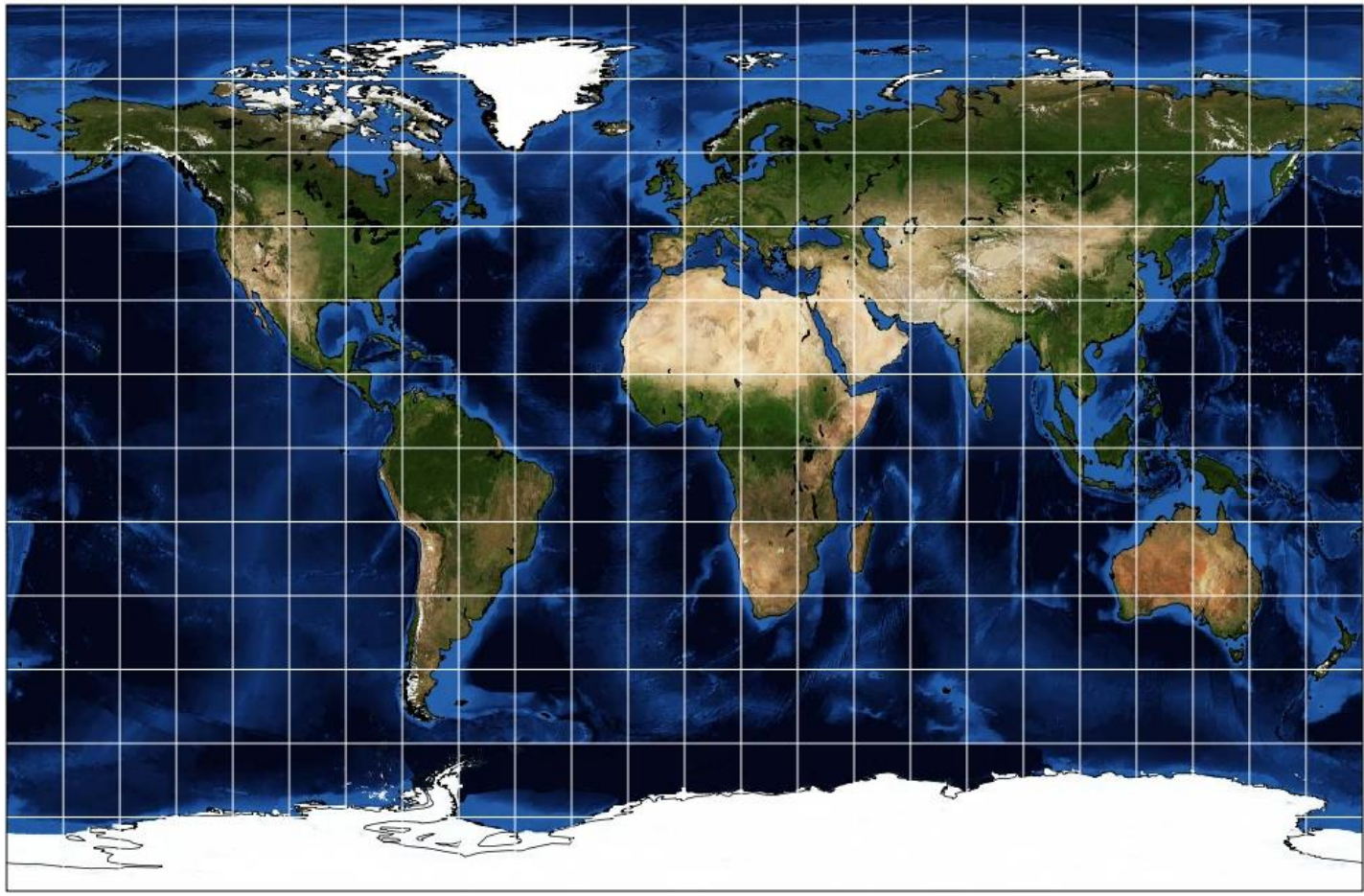
Usage

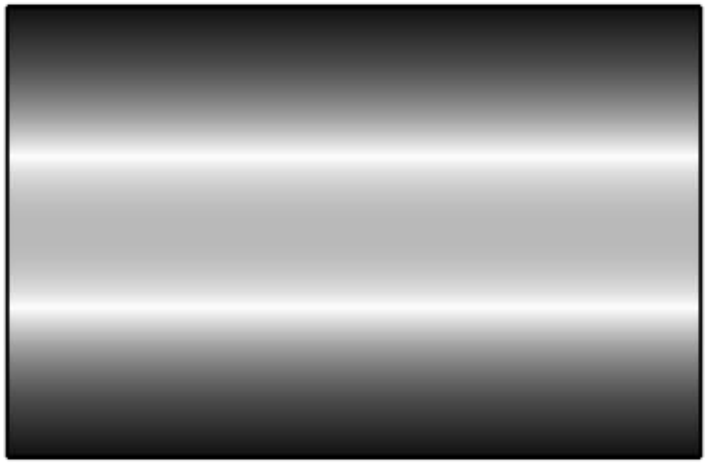
- It was used in maps made in the 15th and 16th centuries.
- It is used in the construction of maps that assume the world as a sphere.
- Index maps.

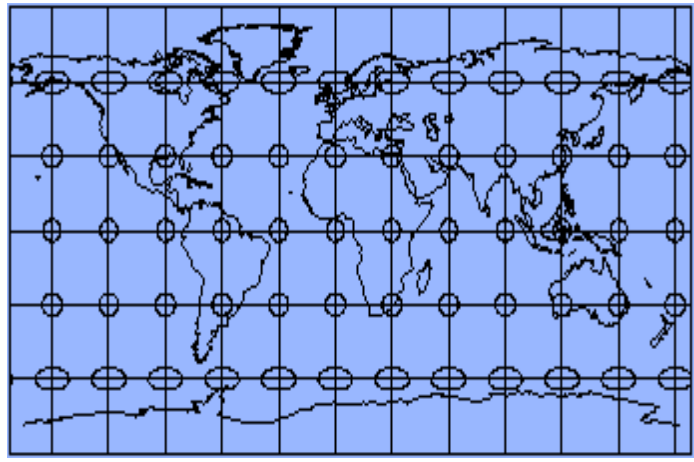
Features of Projection

- Entire world.
- Maintains length along meridians.
- Parallels are straight lines parallel to the equator.
- The parallel spaces are equal.
- Meridians are lines perpendicular to the equator.
- Meridians spaces are equal.
- Distortion is low at the standard parallel surrounds.
- Distortion increases as you go from standard parallel to equator and poles.
- The distortions are in form reduction towards the equator and enlargement towards the poles going away from the standard parallel.
- The distortions at the poles are infinite.



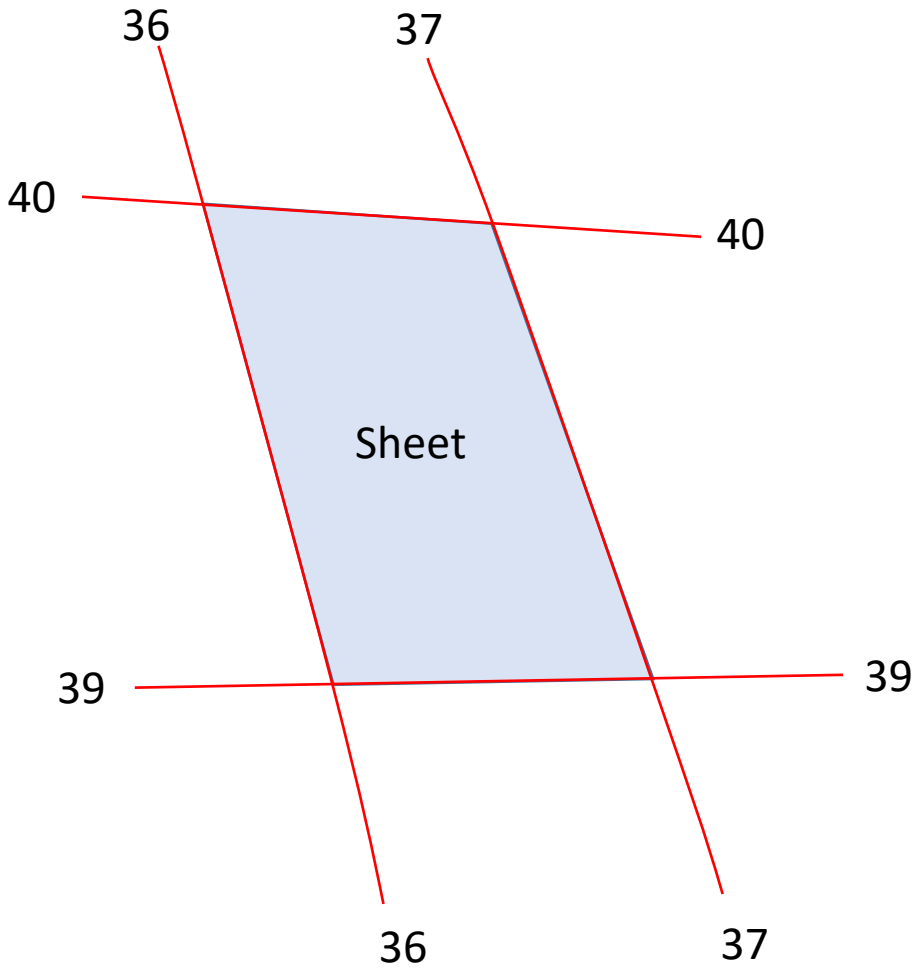


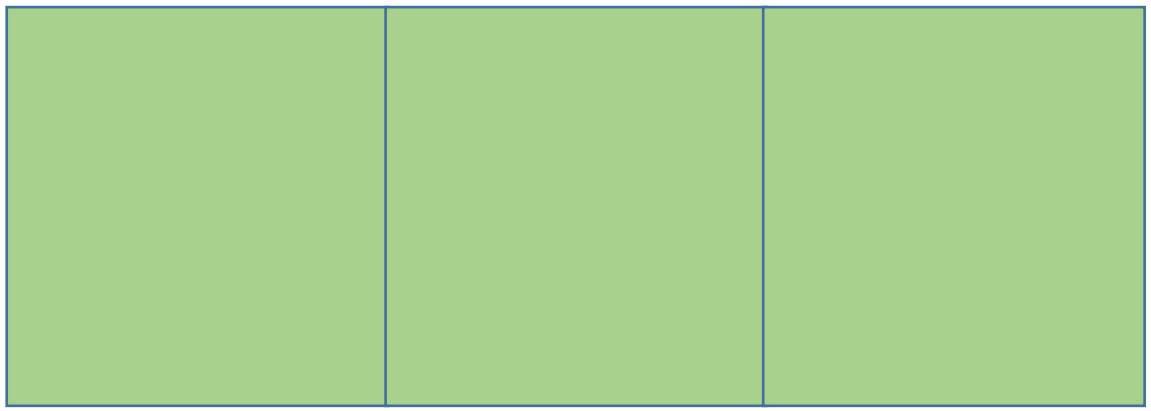




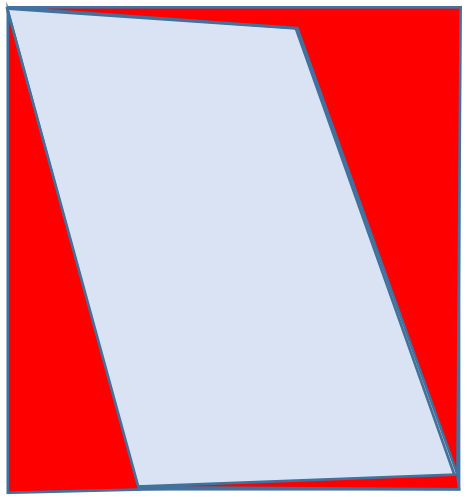
Usage

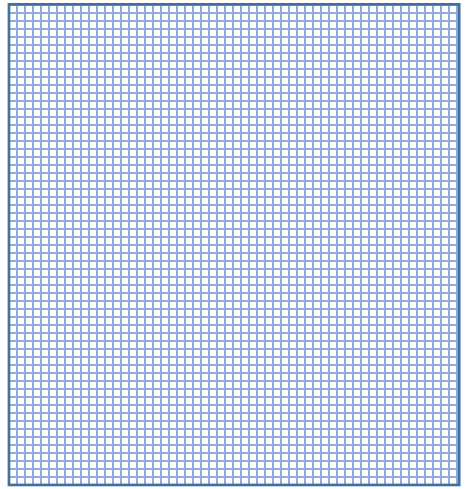
- The making of maps aimed at maintaining length along a parallel.



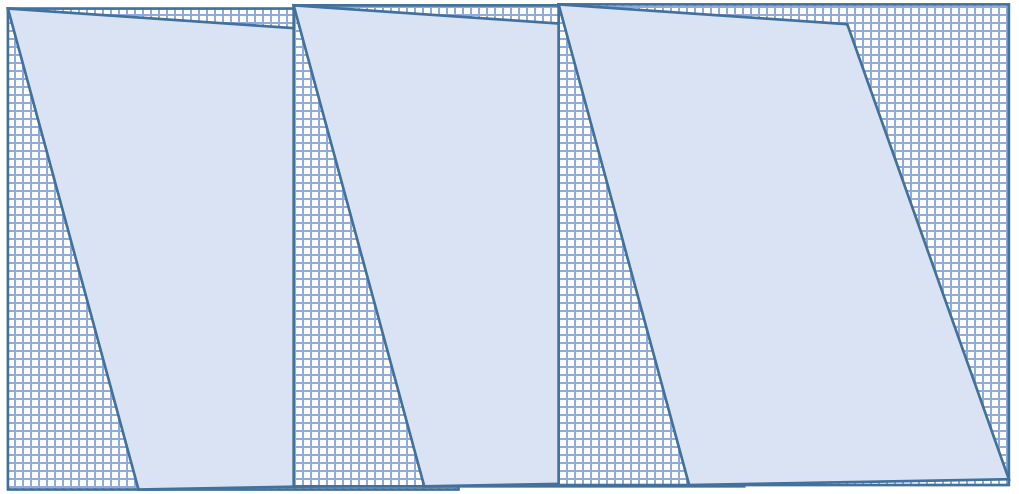


Getting Extra Digital Space





Merge Problem



$\frac{36+42}{2}$ 39 – This is the best standard parallel for Turkiye.

5 N
15 S

Brazil

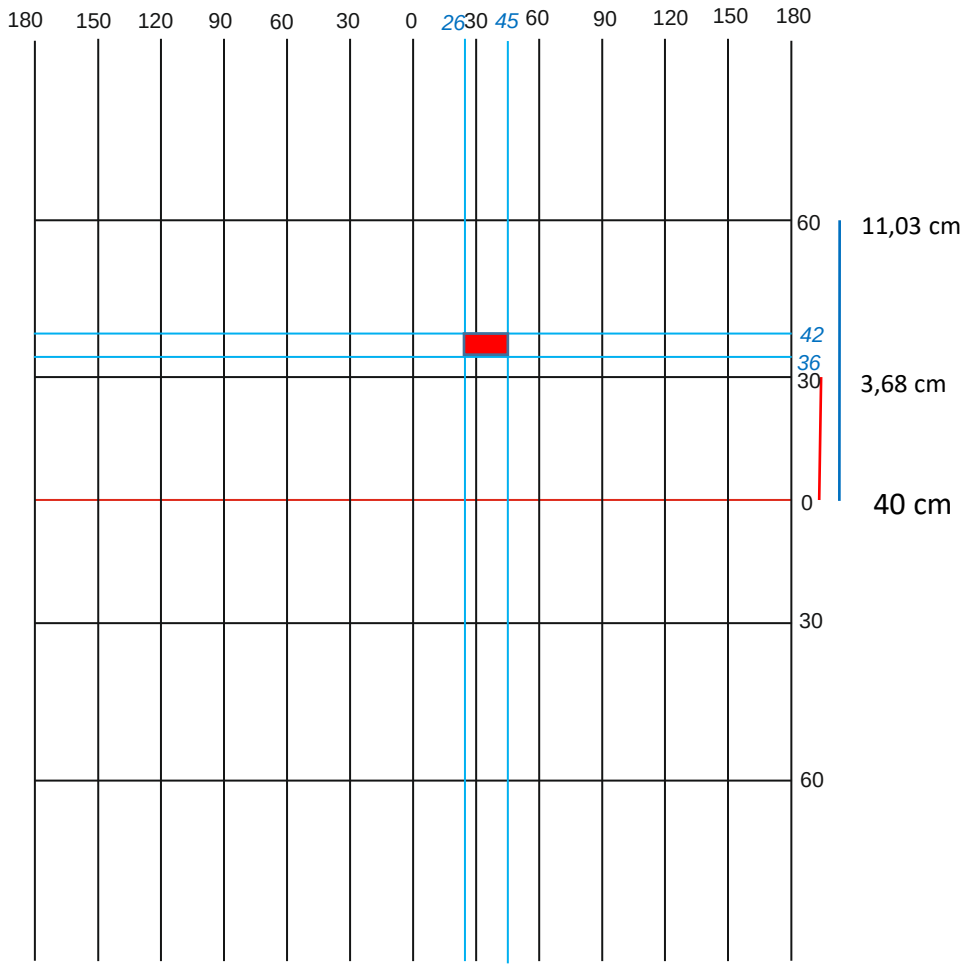
$\frac{5+(-15)}{2}$ $\frac{-10}{2}$ -5

-15

5 South

Central Projection

Drawing of the graticule (grid network) of the Central projection at a scale of 1/100,000,000 (Interval: 30 degree) and showing the location of Turkey.



Türkiye

$h_{\varphi 30} = tg36 * 6,37 = 0,7265 * 6,37 = 4,63$

$h_{\varphi 42} = tg42 * 6,37 = 0,9004 * 6,37 = 5,74$

$\frac{40}{360} * 26 = 2,89cm$

$\frac{40}{360} * 45 = 5cm$

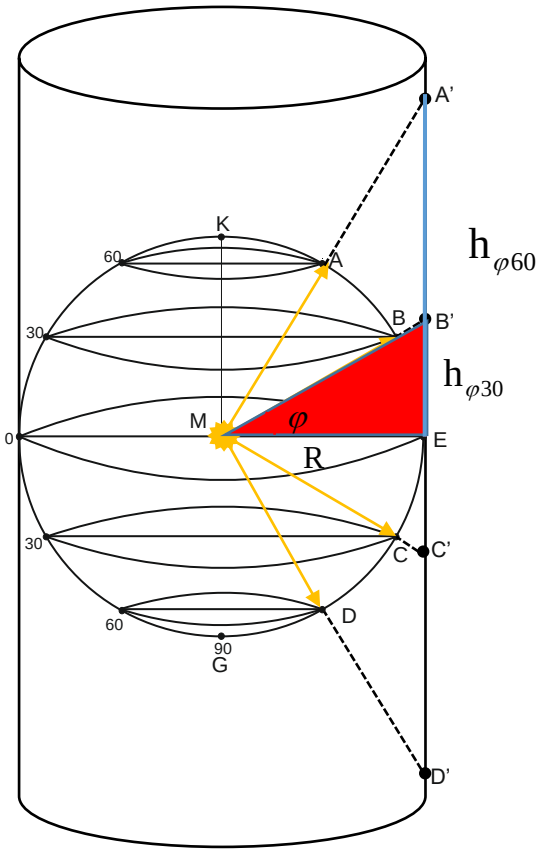
0 2000 km

$2\pi R = 2 * 3,14 * 6,37 = 40cm$

$h_{\varphi 30} = tg30 * 6,37 = 0,5773 * 6,37 = 3,68$

$h_{\varphi 60} = tg60 * 6,37 = 1,732 * 6,37 = 11,03$

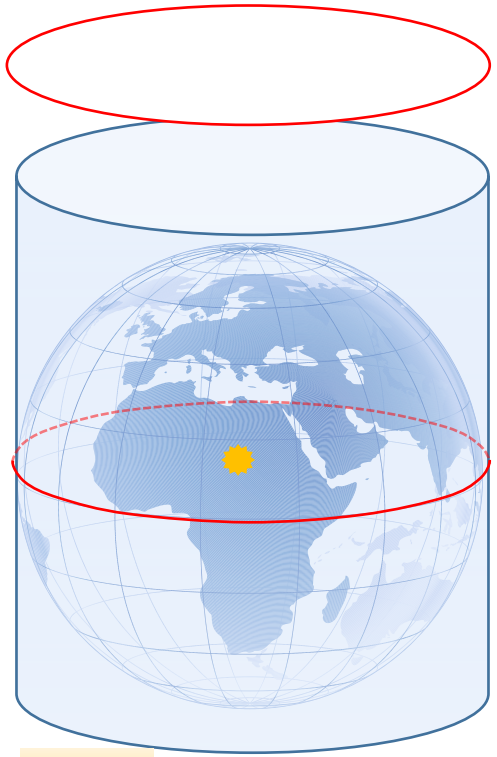
$\frac{40}{12} = 3,33cm$



$2\pi R$

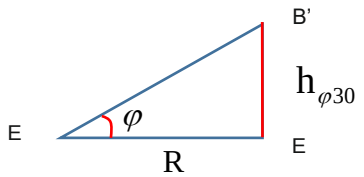
$\pi = 3,14$

$R = 6,37cm$



Mantık

Tangent from the equator.
There is a light source at the center



$tg\varphi = \frac{hyp}{adj}$

$tg\varphi = \frac{h_{\varphi 30}}{R}$

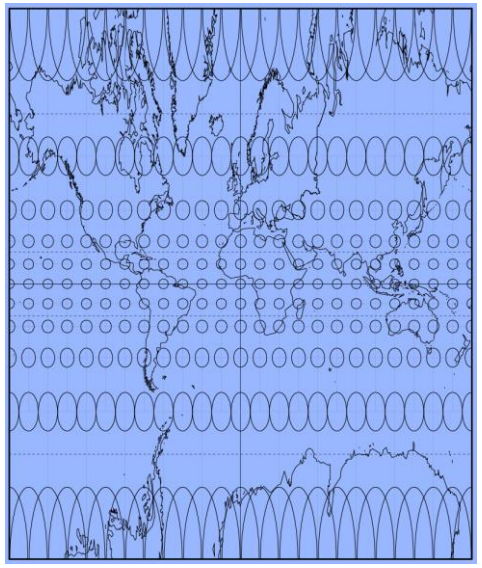
$h_{\varphi 30} = tg\varphi * R$

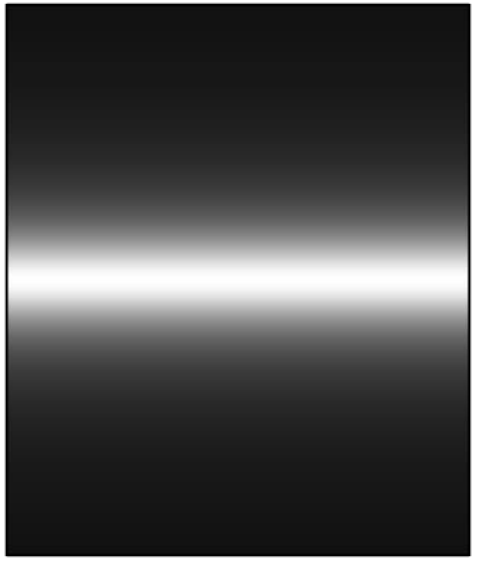
Features of Projection

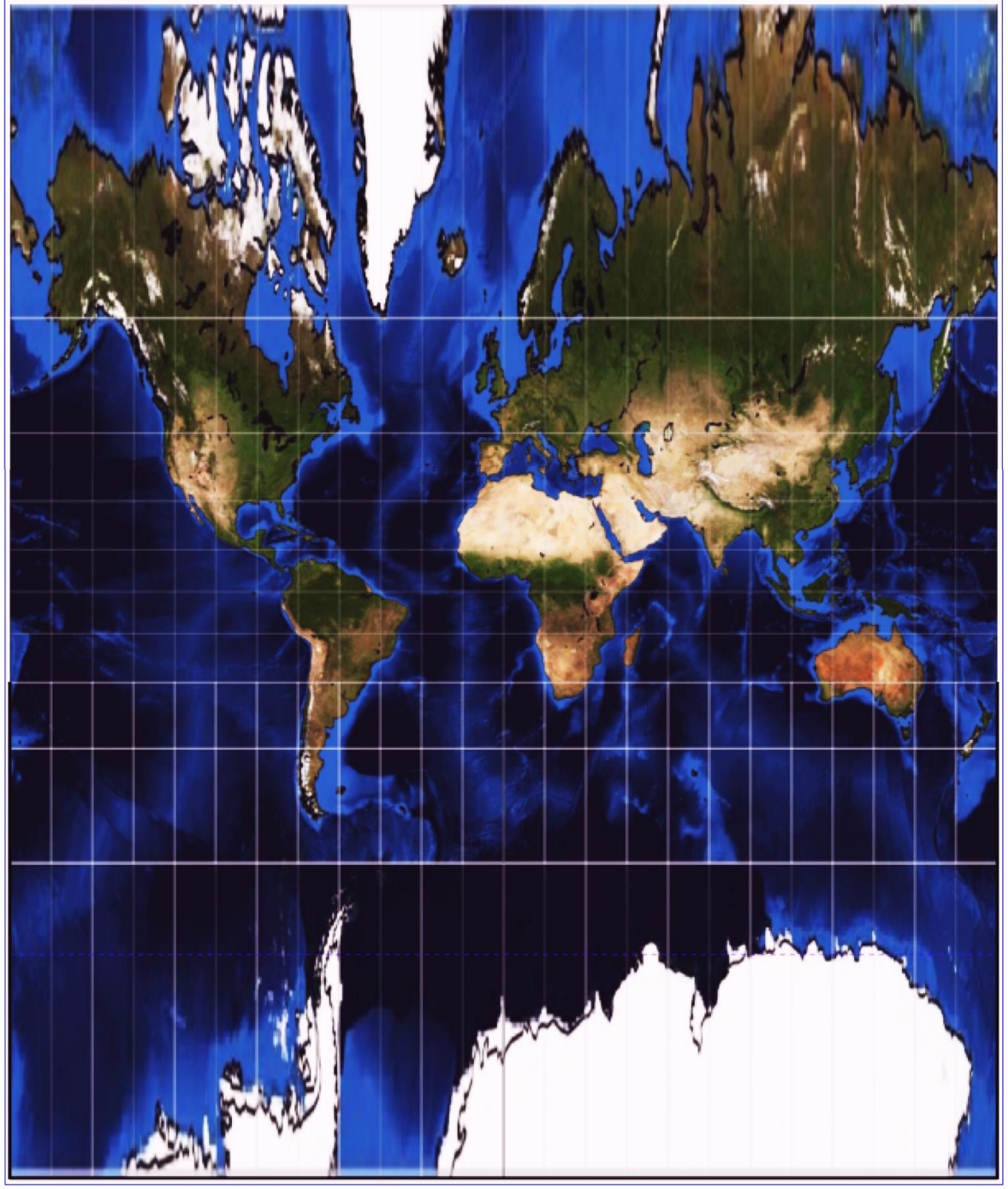
- Entire world.
- Parallels are straight lines parallel to the equator.
- The space between the parallels widen as you move from the equator to the poles.
- After 50 degrees, this space becomes visible.
- Meridians are straight lines perpendicular to the equator.
- Meridian spaces are equal.
- The poles are at the eternity.
- Distortions are low a the he equatorial region. Distortion rates increase with distance from the equator.
- The distortion rates at the poles are infinite.

Usage

Panoramic photo.

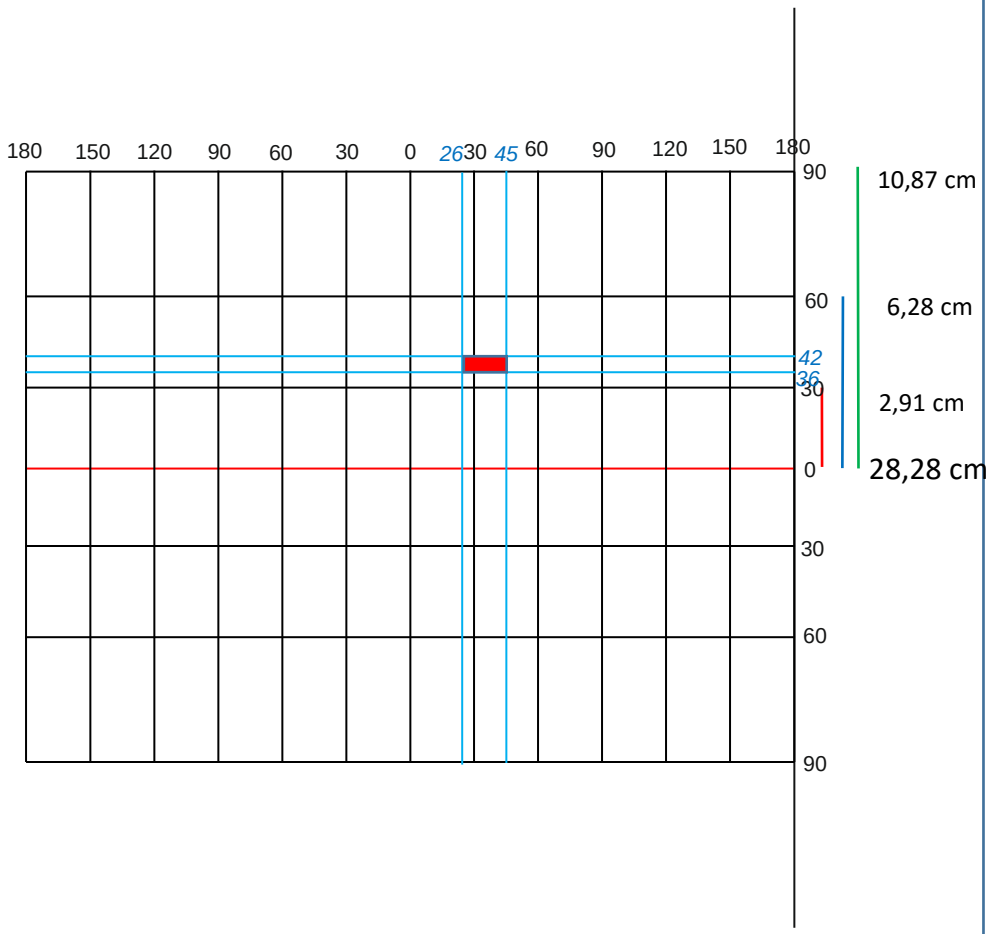






GALL PROJEKSİYON

Drawing of the graticule (grid network) of the Gall projection at a scale of 1/100,000,000 (Interval: 30 degree) and showing the location of Turkey.



Türkiye

$$h_{\varphi 36} = tg\frac{36}{2} * 10,87 = 0,3249 * 10,87 = 3,53$$

$$h_{\varphi 42} = tg\frac{42}{2} * 10,87 = 0,4143 * 10,87 = 4,17$$

$$\frac{28,28}{360} * 26 = 2,04cm$$

$$\frac{28,28}{360} * 45 = 3,54cm$$

0 2000 km

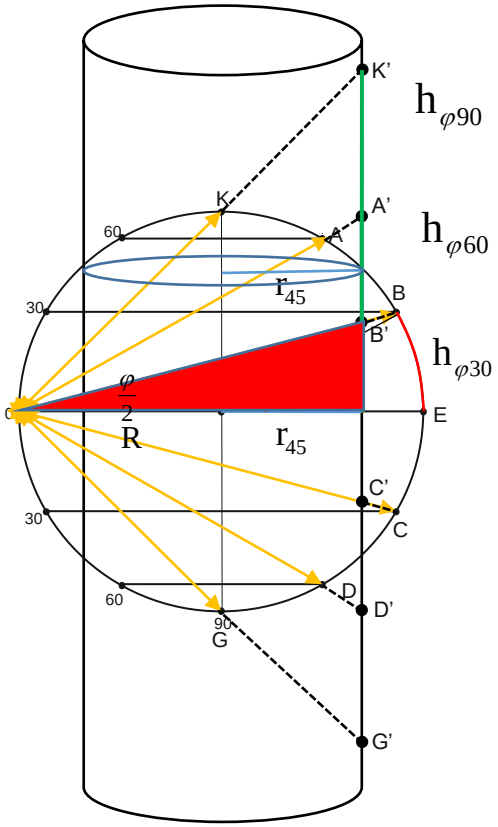
$$2\pi \cos 45 * R = 2 * 3,14 * 0,7071 * 6,37 = 28,28$$

$$R + \cos 45 * R = 6,37 + (0,7071 * 6,37 = 6,37 + 4,5 = 10,87$$

$$h_{\varphi 30} = tg\frac{30}{2} * 10,87 = 0,2679 * 10,87 = 2,91$$

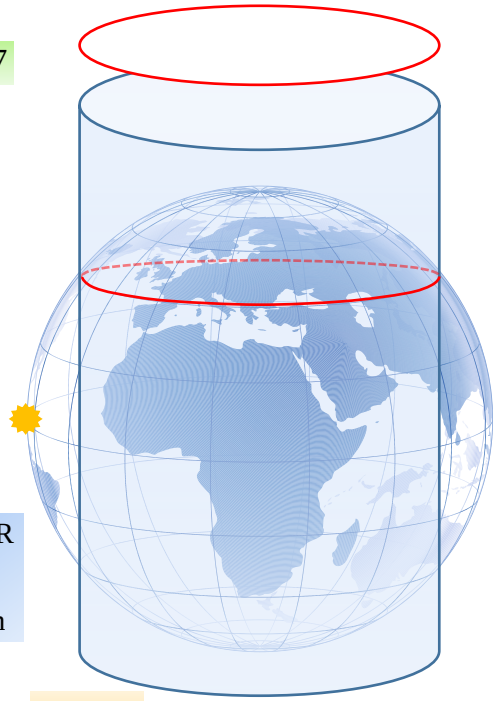
$$h_{\varphi 60} = tg\frac{60}{2} * 10,87 = 0,5773 * 10,87 = 6,28$$

$$h_{\varphi 90} = tg\frac{90}{2} * 10,87 = 1 * 10,87 = 10,87$$



$$\frac{28,28}{12} = 2,36cm$$

$2\pi \cos 45 * R$
$\pi = 3,14$
$R = 6,37cm$



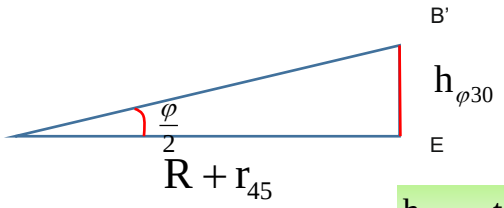
Logic

Intersect at 45 degrees
Light source at the equator

$$r_{45} = \cos 45 * R$$

$$tg\varphi = \frac{opp}{adj}$$

$$tg\varphi = \frac{h_{\varphi 30}}{R + r_{45}}$$



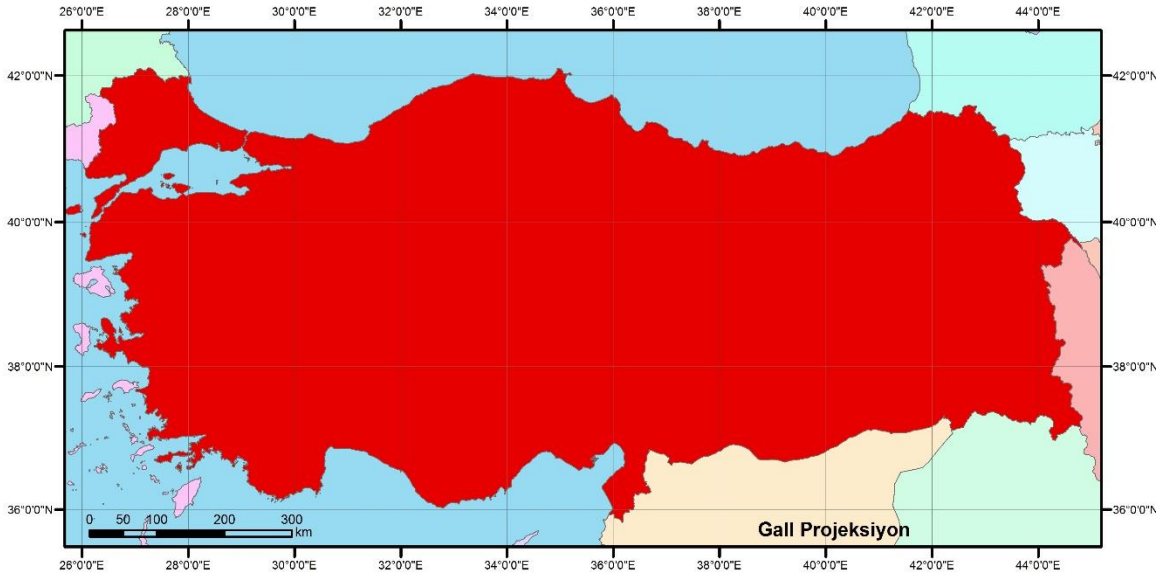
$$h_{\varphi 30} = tg\varphi * (R + \cos 45 * R)$$

Features of Projection

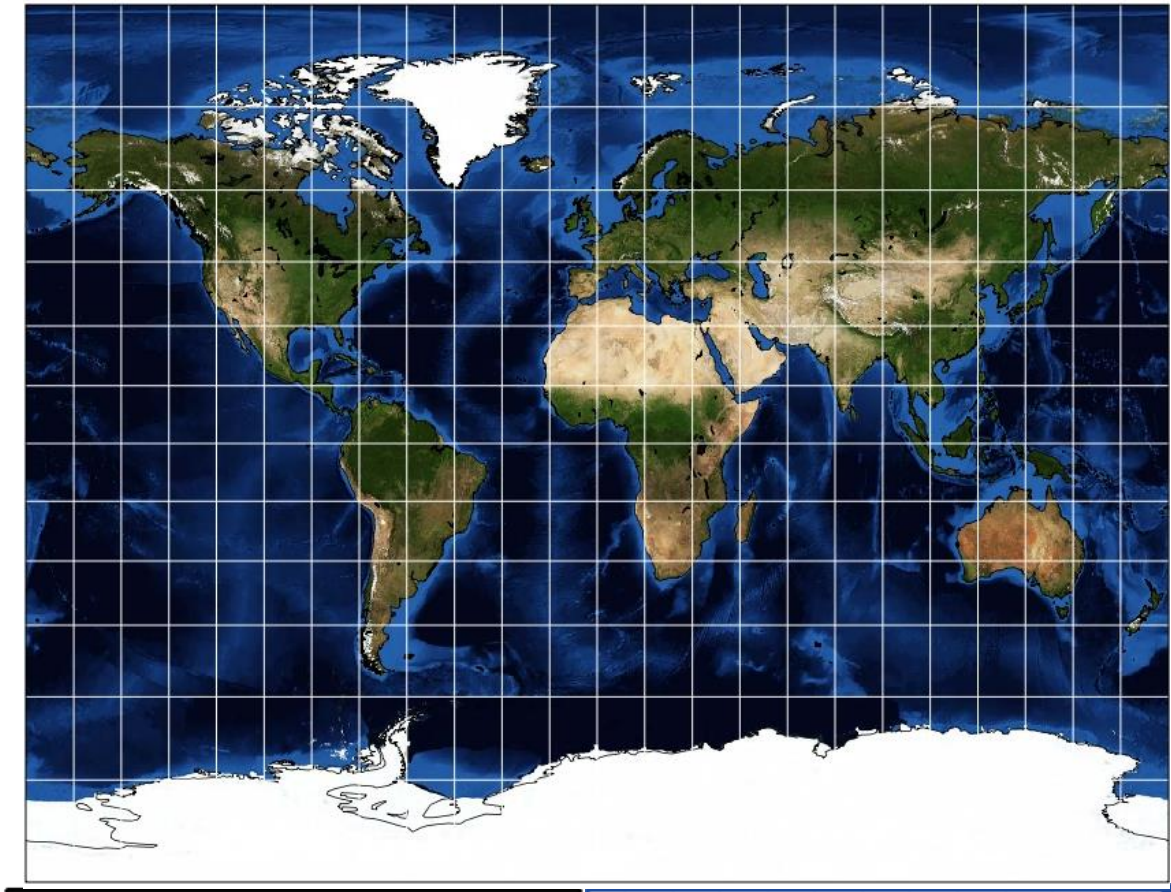
- Entire world.
- Parallels are straight lines parallel to the equator.
- Parallel spaces open as you go from the equator to the poles.
- Meridians are straight lines perpendicular to the equator.
- Meridian spaces are equal.
- The poles are at the eternity.
- Distortion rates are low at the 45 degrees parallels surrounds.
- The distortion at the poles is infinite.
- Distortion increases as you go from 45-degree parallel to equator and poles.
- The distortions are in form reduction towards the equator and enlargement towards the poles going away from the 45-degree latitude.

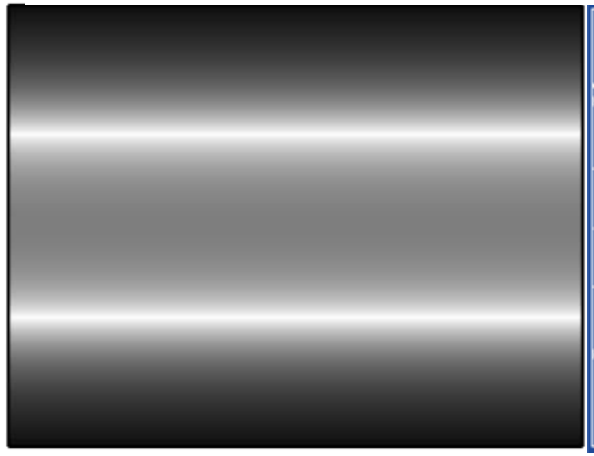
Usage

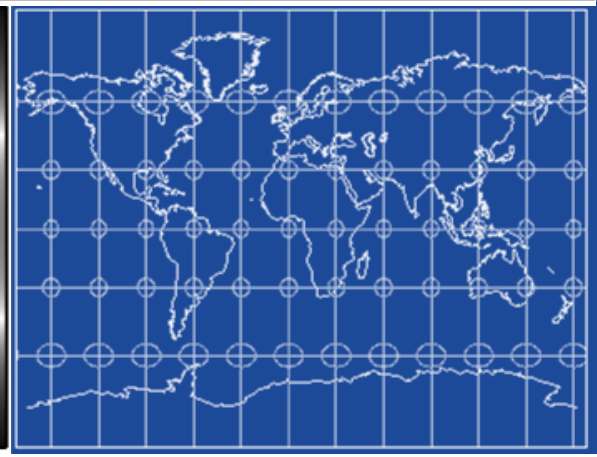
- Atlas.



Gall orthographic
Gall-Peters
Peters

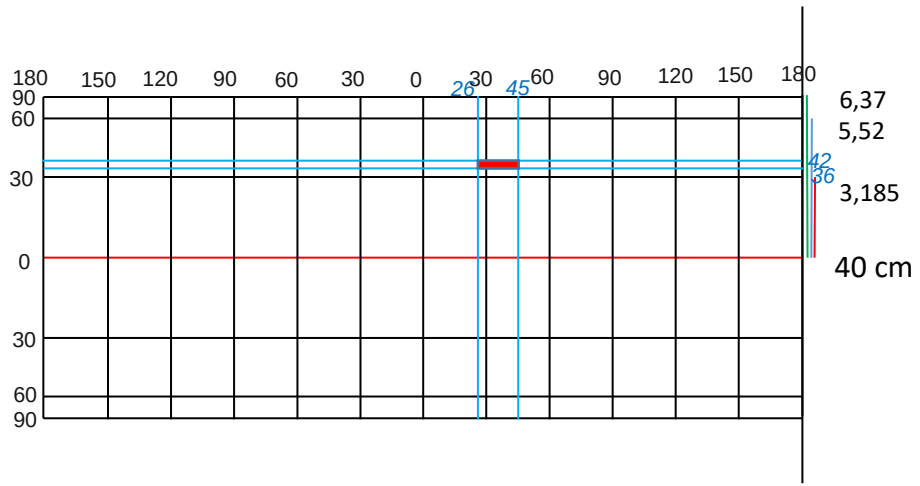






Lambert Cylinder Projection

Drawing of the graticule (grid network) of the Lambert Cylinder projection at a scale of 1/100,000,000 (Interval: 30 degree) and showing the location of Turkey.



Türkiye

$h_{\varphi 36} = \sin 36 * R = 0,5878 * 6,37 = 3,74$

$h_{\varphi 42} = \sin 42 * R = 0,6691 * 6,37 = 4,26$

$\frac{40}{360} * 26 = 2,89cm$

$\frac{40}{360} * 45 = 5cm$

0 2000 km

$2\pi R = 2 * 3,14 * 6,37 = 40cm$

$h_{\varphi 30} = \sin 30 * R = 0,5 * 6,37 = 3,185$

$h_{\varphi 60} = \sin 60 * R = 0,8660 * 6,37 = 5,52$

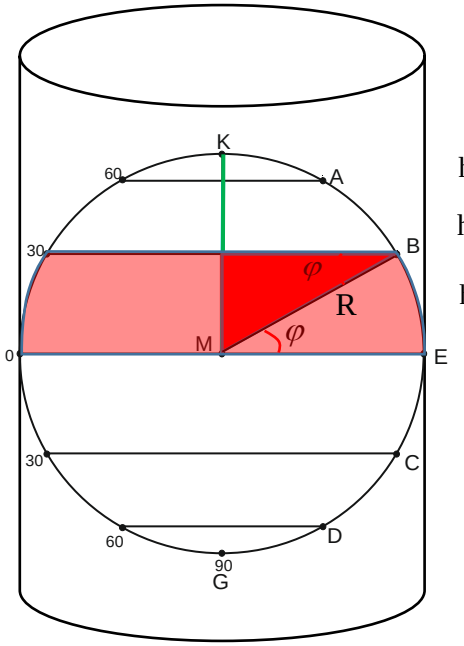
$h_{\varphi 90} = \sin 90 * R = 1 * 6,37 = 6,37$

$\frac{40}{12} = 3,33cm$

$2\pi R$

$\pi = 3,14$

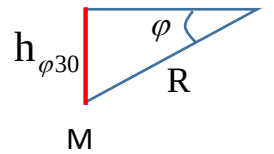
$R = 6,37cm$



$h_{\varphi 90}$

$h_{\varphi 60}$

$h_{\varphi 30}$



$\sin \varphi = \frac{opp}{hyp}$

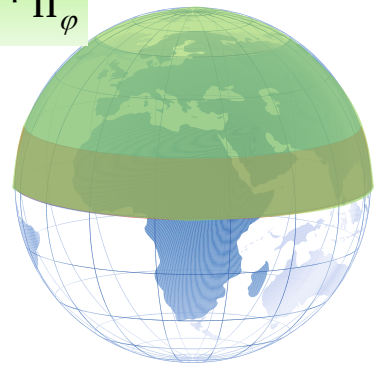
$\sin \varphi = \frac{h_\varphi}{R}$

$h_\varphi = \sin \varphi * R$

Logic

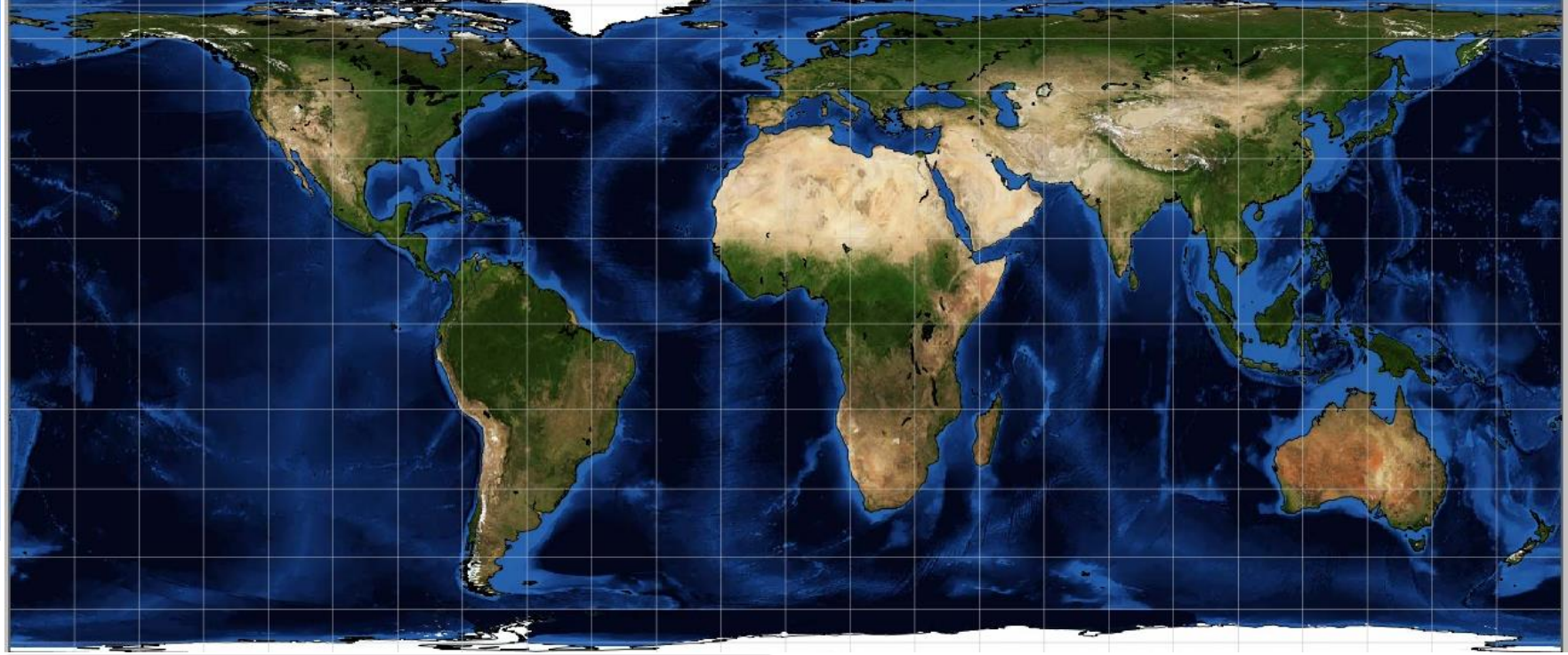
Tangent at the equator protect the area.

$2\pi R * h_\varphi$

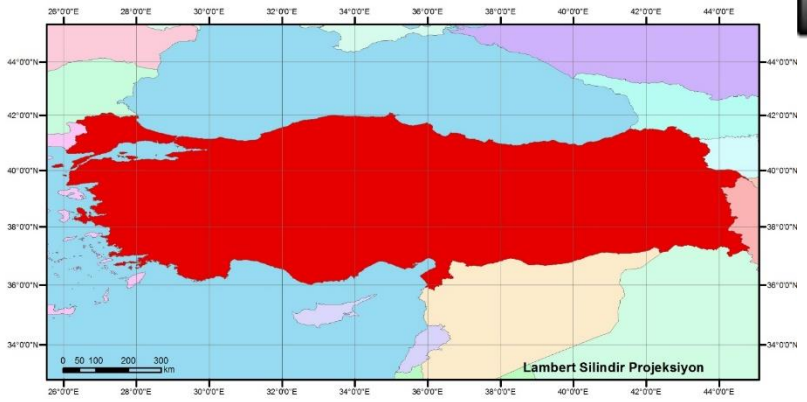


Features of Projection

- Entire world.
- Equal area
- Parallels are straight lines parallel to the equator.
- Parallel spaces open as you go from the equator to the poles.
- Meridians are straight lines perpendicular to the equator.
- Meridian spaces are equal.
- The equator and its immediate surroundings have low error.
- Distortion rates increase going away from the equator.



Lambert Equal-Area Cylindric
Cylindric Equal-Area

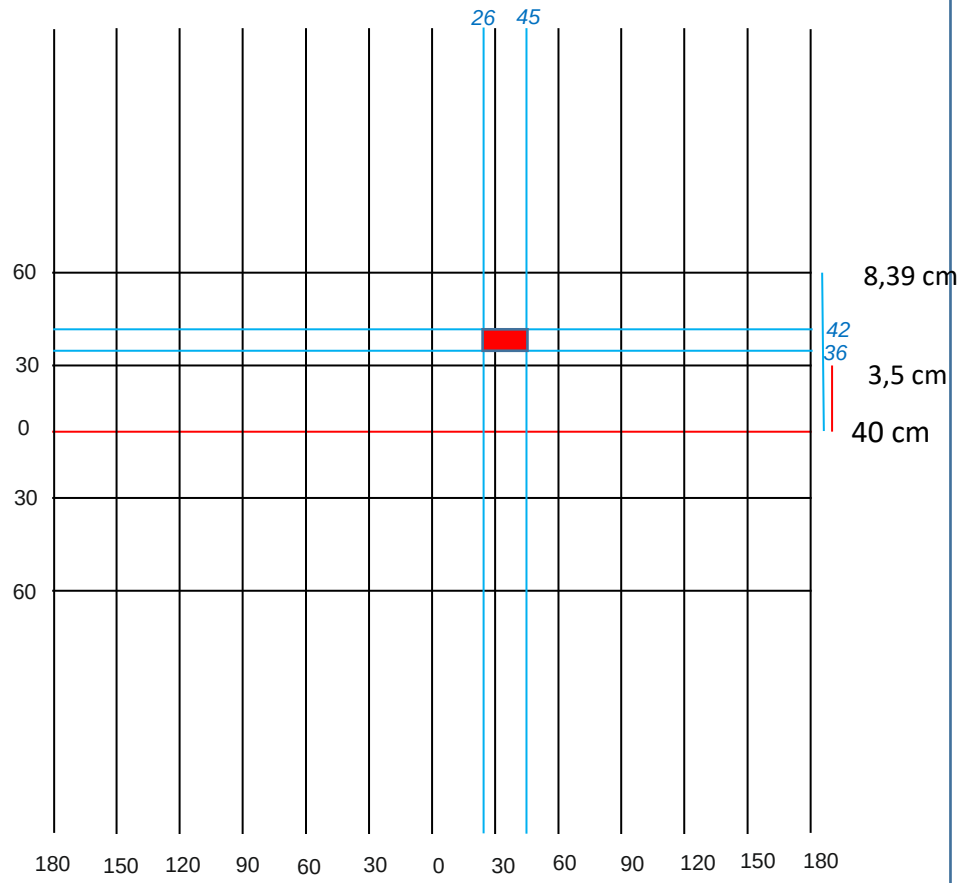


Usage

- It is used for making of maps that equal area.

MERKATOR PROJEKSİYON

Drawing of the graticule (grid network) of the Mercator projection at a scale of 1/100,000,000 (Interval: 30 degree) and showing the location of Turkey.



Türkiye

$h_{36} = 4,3$

$h_{42} = 5,15$

$\frac{40}{360} * 26 = 2,89cm$

$\frac{40}{360} * 45 = 5cm$

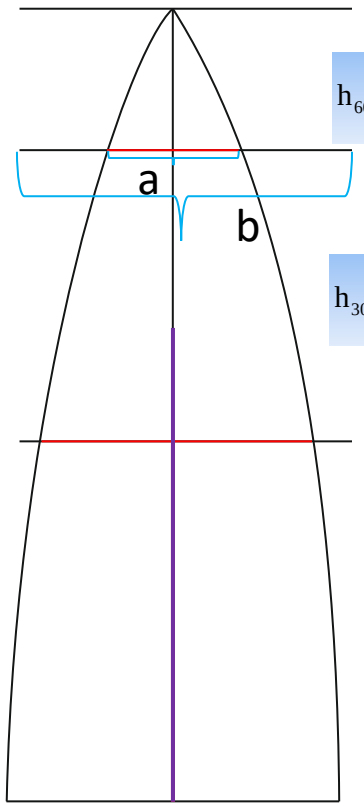
0 2000 km

$2\pi R = 2 * 3,14 * 6,37 = 40cm$

$h_{30} = 3,5$

$h_{60} = 8,39$

$\frac{40}{12} = 3,33cm$



$h_{60} = R \ln\left[tg\left(45 + \frac{60}{2}\right)\right]$

$h_{30} = R \ln\left[tg\left(45 + \frac{30}{2}\right)\right]$

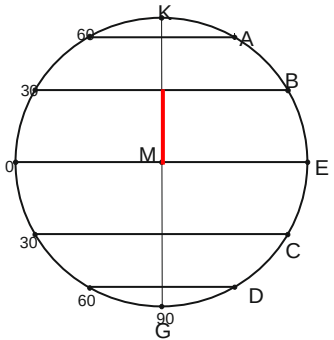
Logic

Tangent at the equator, conform.

$2\pi R$

$\pi = 3,14$

$R = 6,37cm$

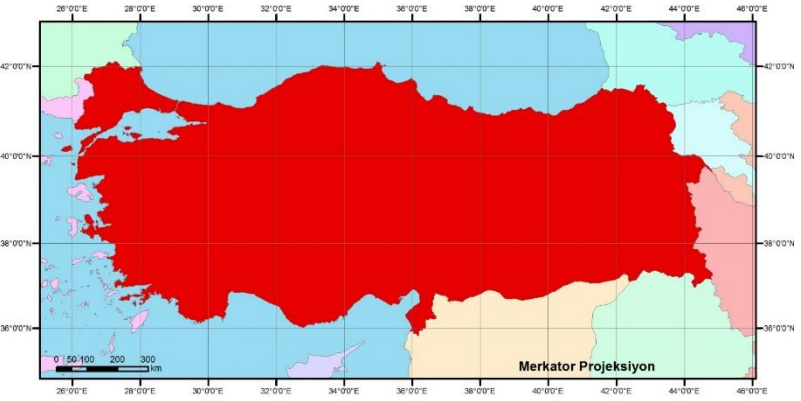


Features of Projection

- Entire world.
- Conform
- Parallels are lines parallel to the equator.
- The spaces between the parallels widen as you move from the equator to the poles.
- After 75 degrees, this spaces becomes visible.
- Meridians are straight lines perpendicular to the equator.
- Meridian spaces are equal.
- The poles are thrown to the eternity.
- The best near the equator is shown. Distortion rates increase with distance from the equator.
- The distortion at the poles is infinite.

Usage

- Nautical and flight charts.
- Loxodrome.
- Drawing of maps aimed at maintaining angles.



Loxodrome

A path, also known as a rhumb line, which cuts a meridian on a given surface at any constant angle but a right angle. If the surface is a sphere, the loxodrome is a spherical spiral.