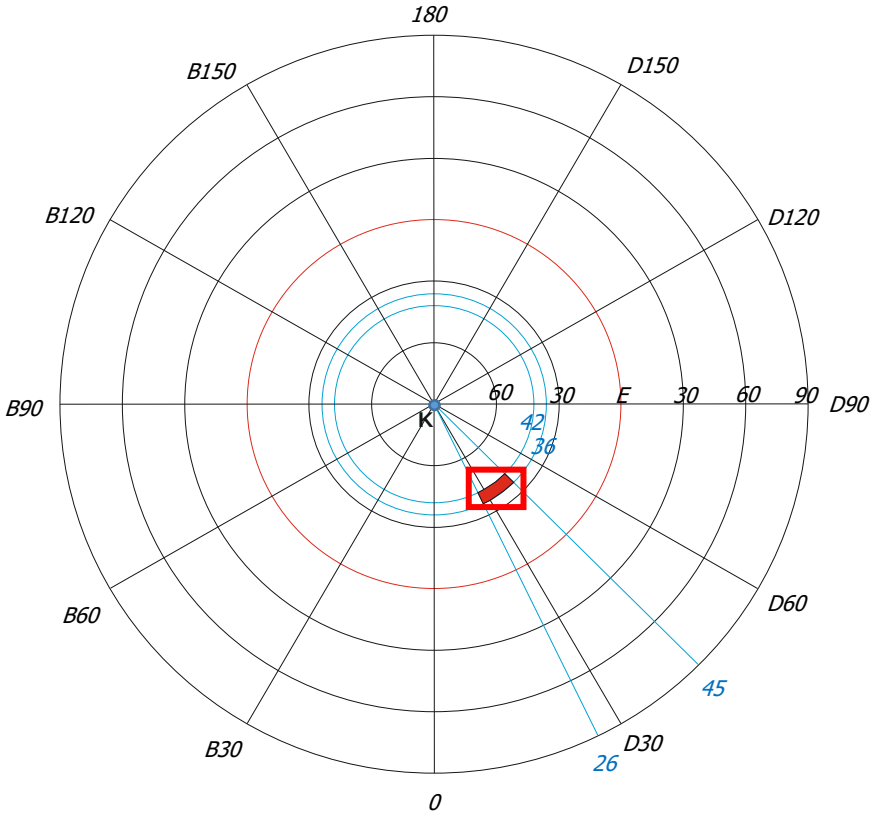
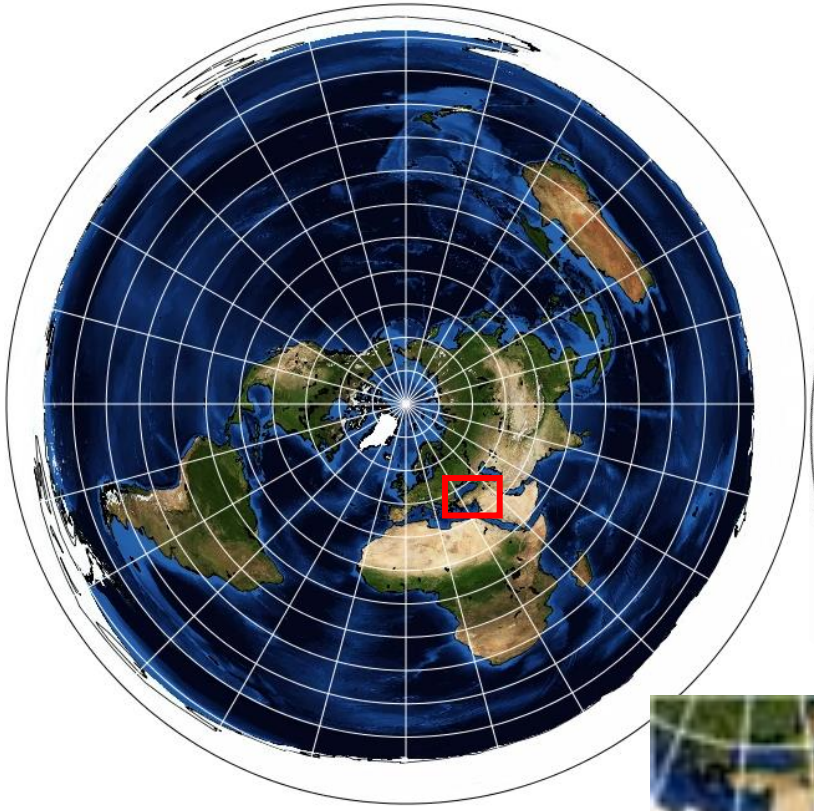
Cartography

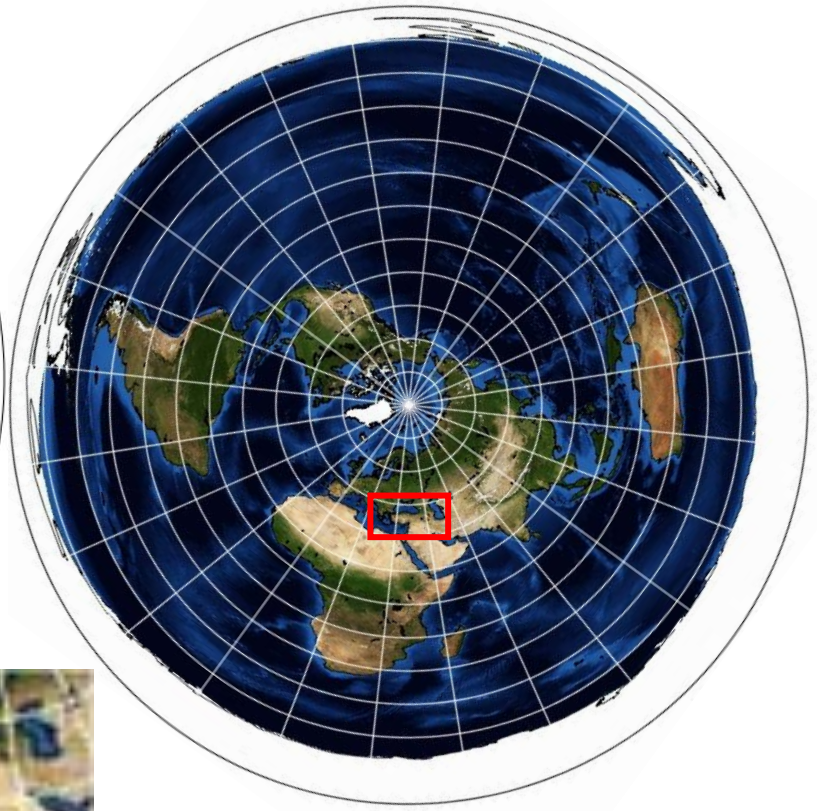
Doç. Dr. Erkan Yılmaz

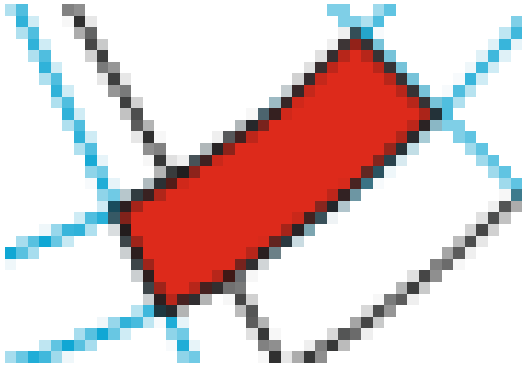
- **Planar Projections**
    1. **Equidistant Projection**
    2. **Gnomonic Projection**
    3. **Orthographic Projection**
    4. **Stereographic Projection**
    5. **Lambert Azimuthal Projection**
    6. **Stab-Werner Projection**
    7. **Globular Projection**

Central Meridian Change

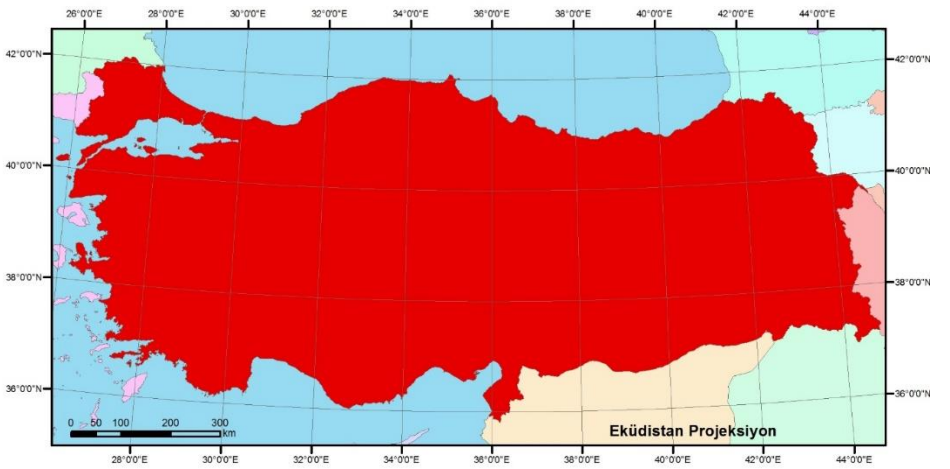






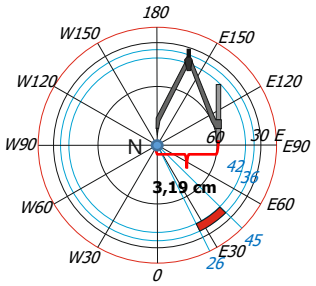


Central Meridian 36 E



Orthographic Projection

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



Türkiye

$\overline{NA'}_{N36} = R*\sin(90-36) = 6,37*0,8090 = 5,15$

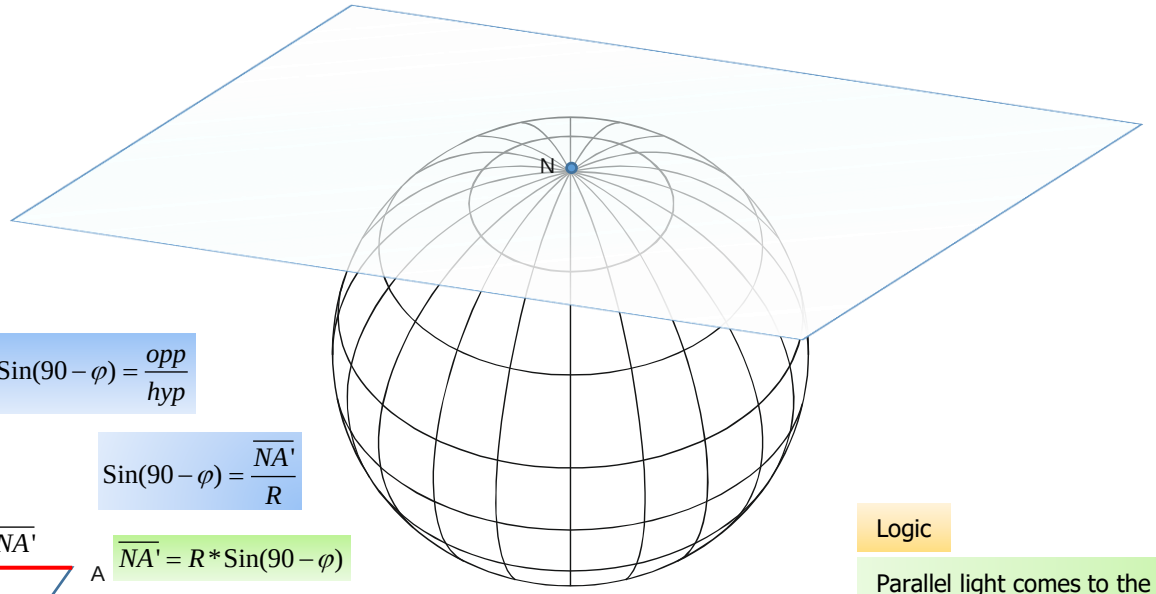
$\overline{NA'}_{N60} = R*\sin(90-60) = 6,37*0,5 = 3,185$

$\overline{NA'}_{N42} = R*\sin(90-42) = 6,37*0,7431 = 4,73$

$\overline{NA'}_{N30} = R*\sin(90-30) = 6,37*0,8660 = 5,52$

$\overline{NA'}_{E} = R*\sin(90-0) = 6,37*1 = 6,37$

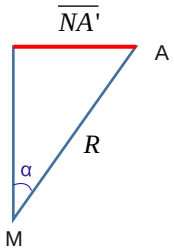
0 2000 km



$\text{Sin}(90-\varphi) = \frac{opp}{hyp}$

$\text{Sin}(90-\varphi) = \frac{\overline{NA'}}{R}$

$\overline{NA'} = R*\text{Sin}(90-\varphi)$



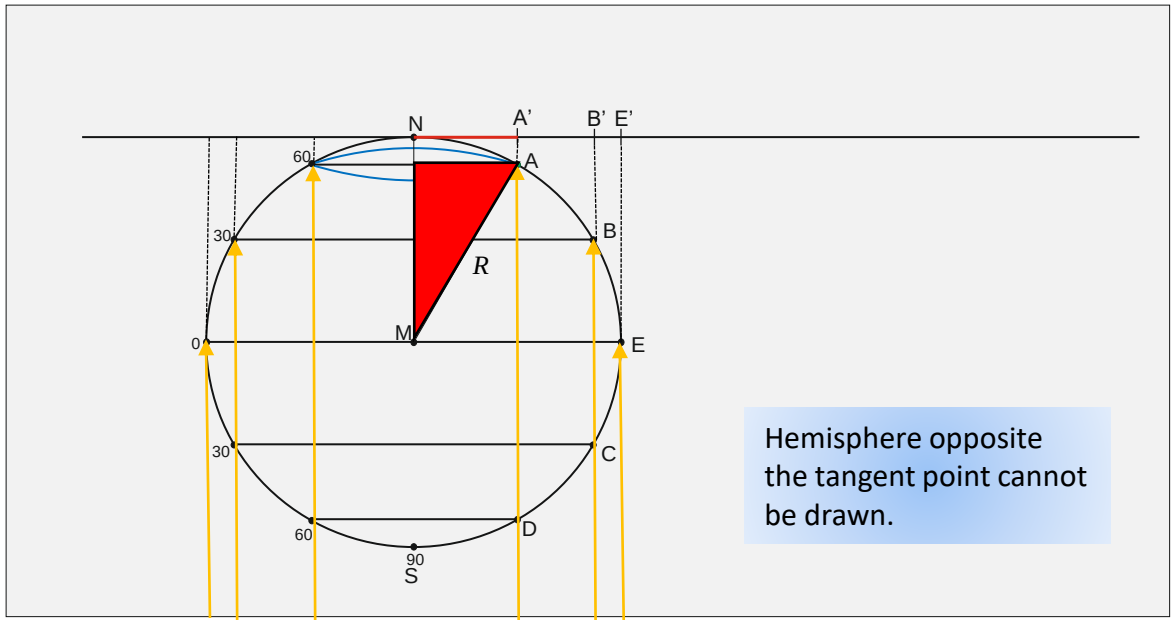
$\alpha = 90-\varphi_A$

$\alpha = 90-\varphi$

$R = 6,37cm$

Logic

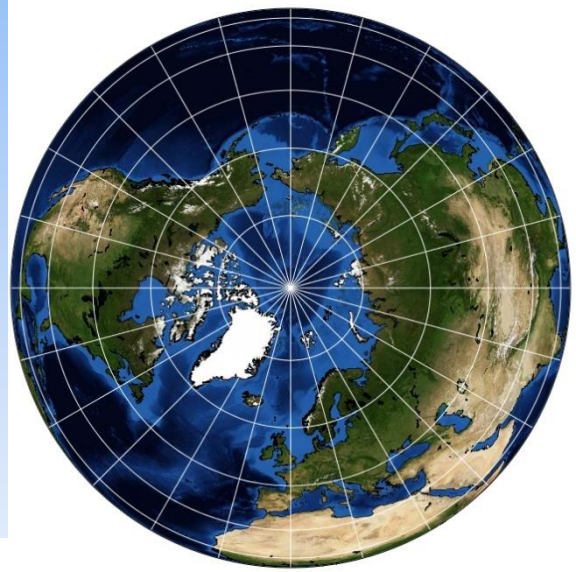
Parallel light comes to the tangent point and the trace of each parallel falls on the plane.

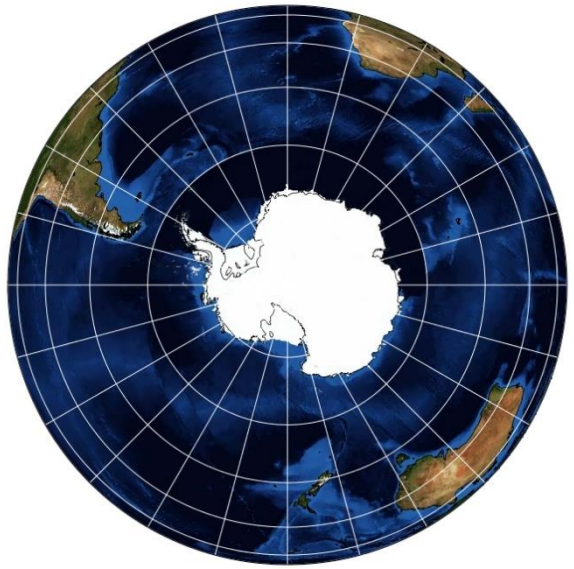


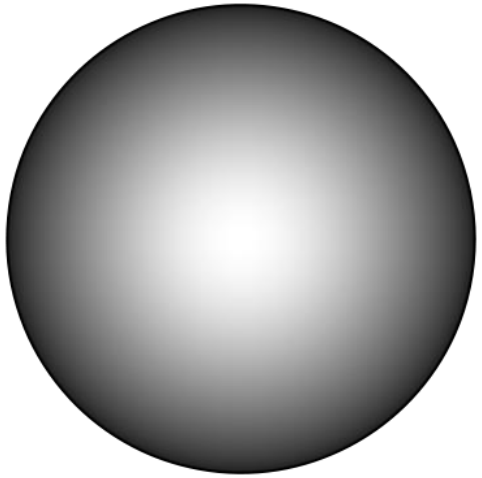
Hemisphere opposite the tangent point cannot be drawn.

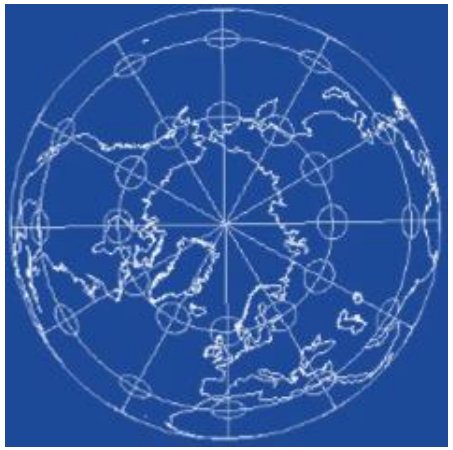
Orthographic Projection (Polar Type)

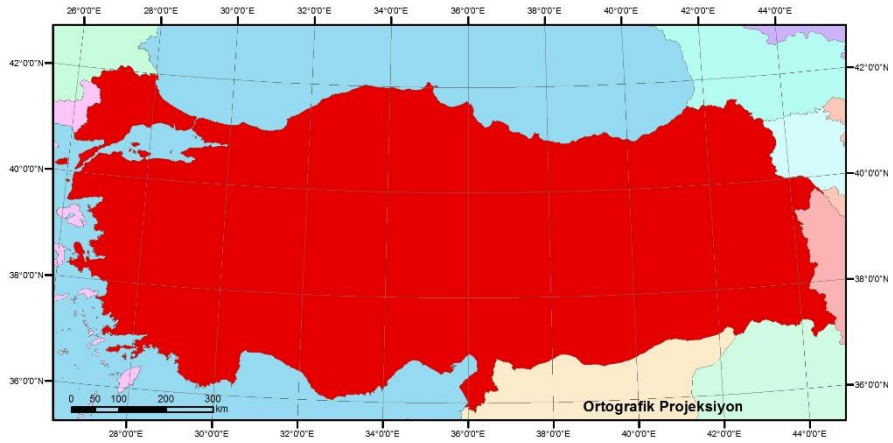
- No more than one hemisphere at a time
- **Maintains length along parallels.**
- Its parallels are circle.
- Parallel spaces decrease away from the pole.
- Meridians are radial.
- The angle between the meridians is equal to their value on earth.
- The least error is around the tangent point.
- Distortion rates increase as you move away from the tangent point. All three types of projection are used.









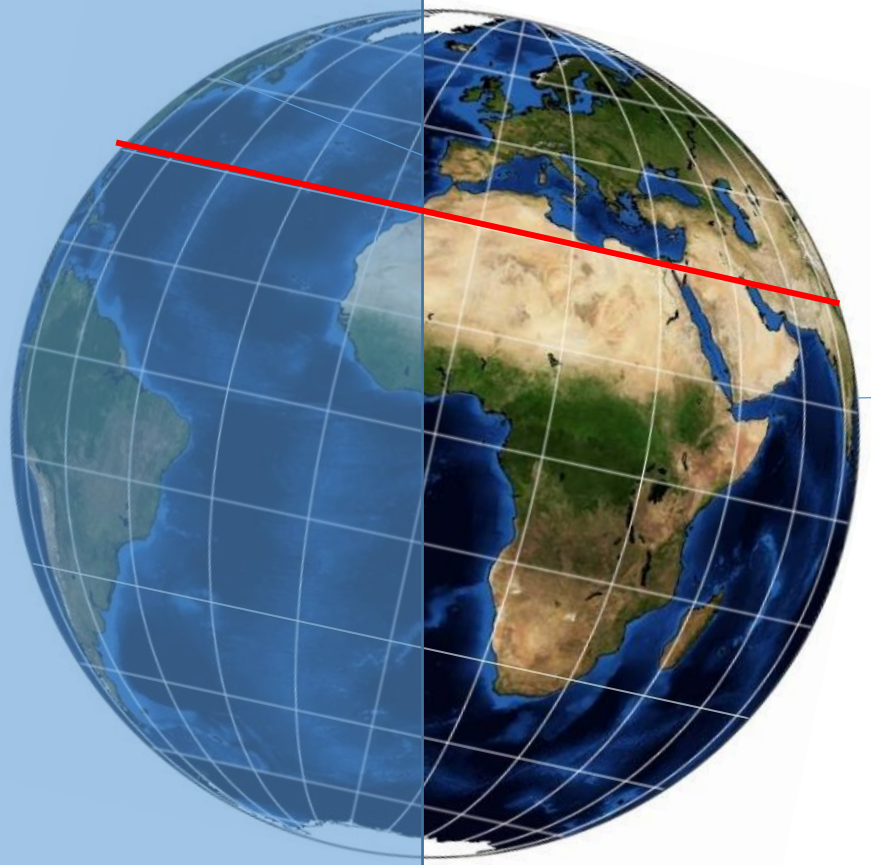


Tangent Point
45 Degrees N.
Central Meridian
36 Degrees E.

Usage

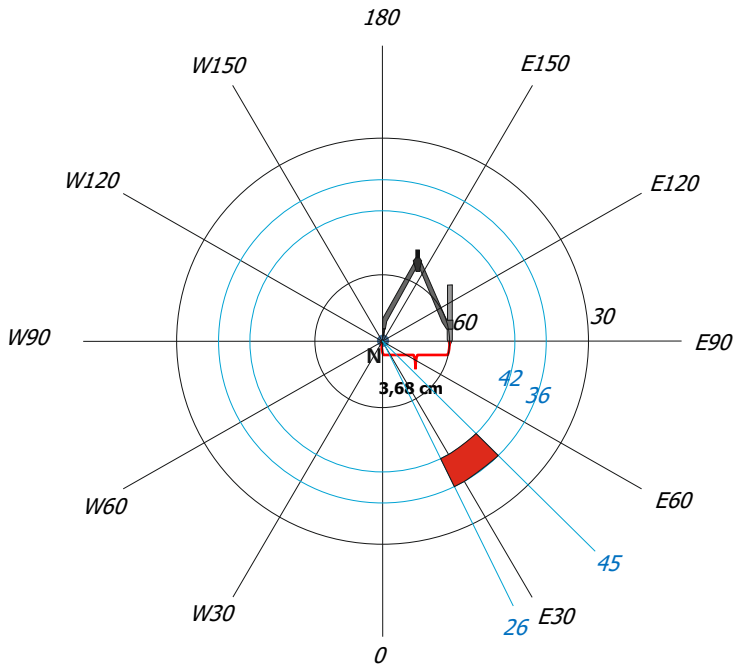
- Used in drawing hemisphere maps.
- Used to calculate the duration of daytime and nighttime (Equatorial type).
- Used for displaying the Earth from space

June, 21st Position



Gnomonic Projection

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



Türkiye

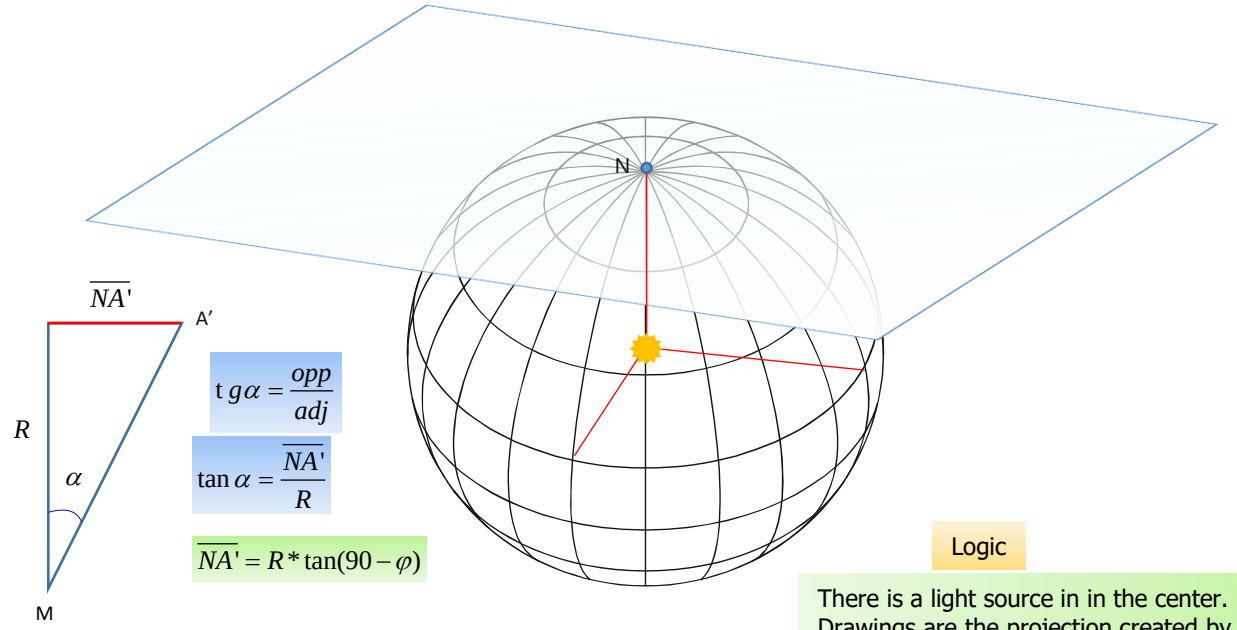
$\overline{NA'}_{N60} = R * \tan(90-60) = 6,37 * 0,5773 = 3,68$

$\overline{NB'}_{N30} = R * \tan(90-30) = 6,37 * 1,732 = 11,03$

$\overline{NA'}_{N36} = R * \tan(90-36) = 6,37 * 1,376 = 8,77$

$\overline{NA'}_{N42} = R * \tan(90-42) = 6,37 * 1,111 = 7,08$

0 2000 km



$$\text{t}\,g\alpha = \frac{opp}{adj}$$

$$\tan\alpha = \frac{\overline{NA'}}{R}$$

$$\overline{NA'} = R * \tan(90-\varphi)$$

Logic

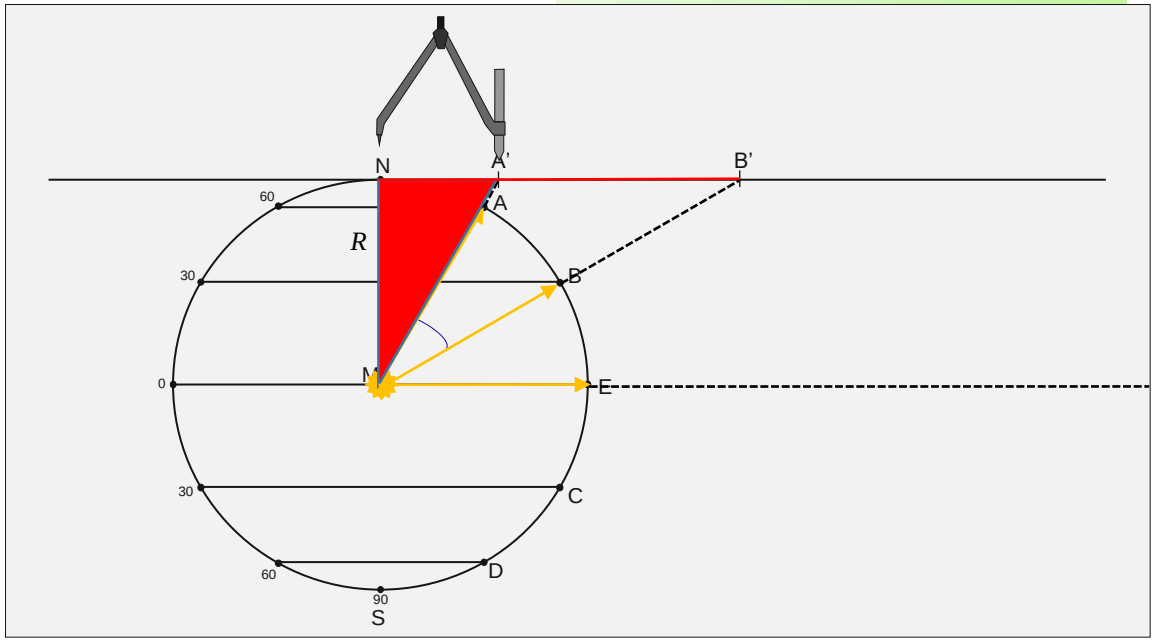
There is a light source in in the center.
Drawings are the projection created by this light..

$\alpha = 90 - \varphi$

$R = 6,37$

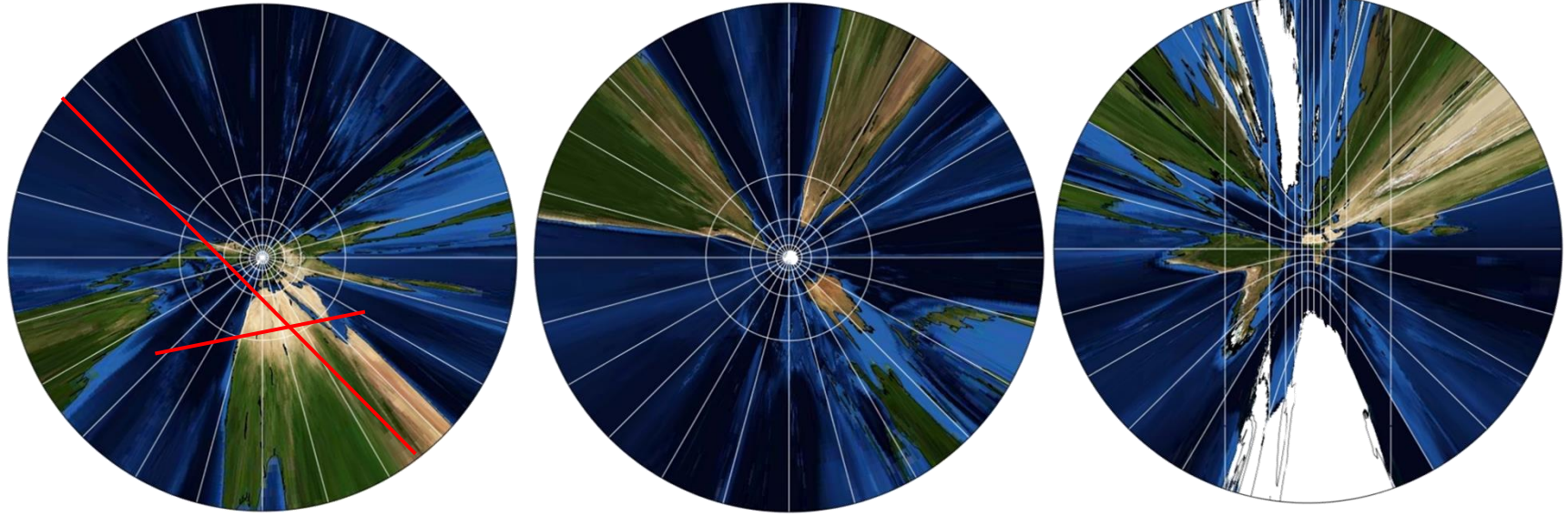
$\tan_{30} = 0,5773$

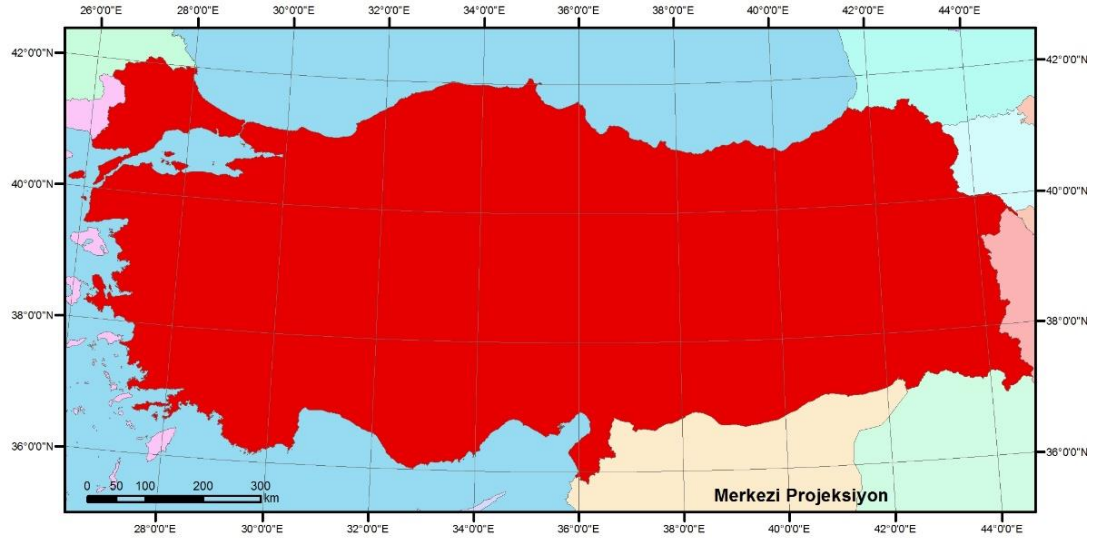
$\tan_{60} = 1,732$

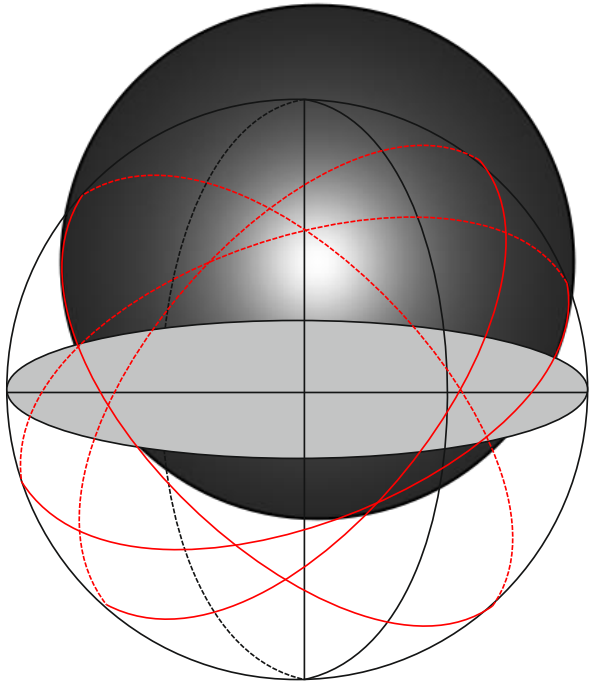


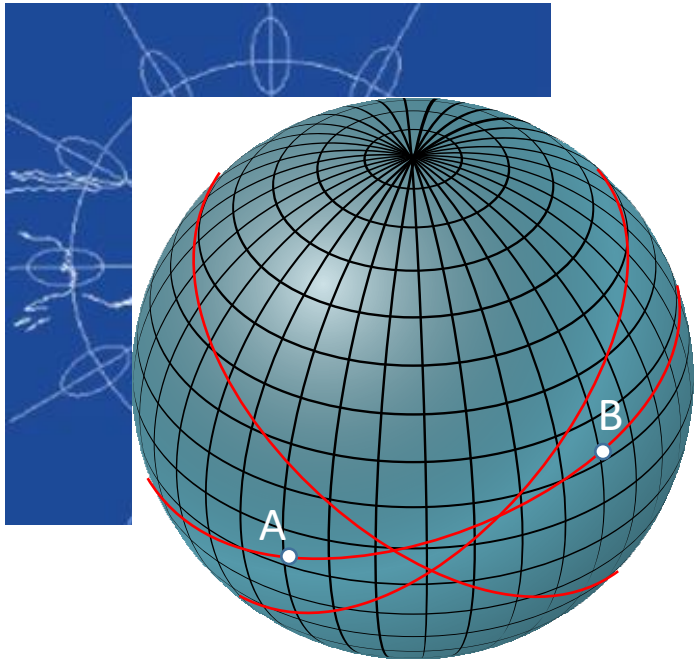
Gnomonic Projection (Polar)

- Less than one hemisphere centered on a given pole of projection or map origin
- The Equator and the opposite hemisphere cannot be shown origin
- Parallels are circle
- Spacing increases rapidly away from the pole.
- The spaces is visible after 50 degrees parallel.
- Its meridians are radial.
- The angle between the meridians is equal to the angle values on the sphere.
- The least error is around the tangent point.
- Distortion rates increase as you move away from the tangent point.
- Meridian extensions have been cast to infinity.



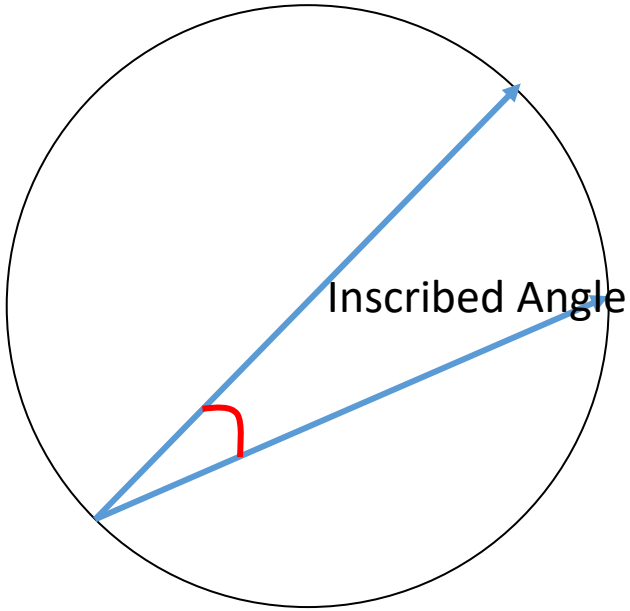


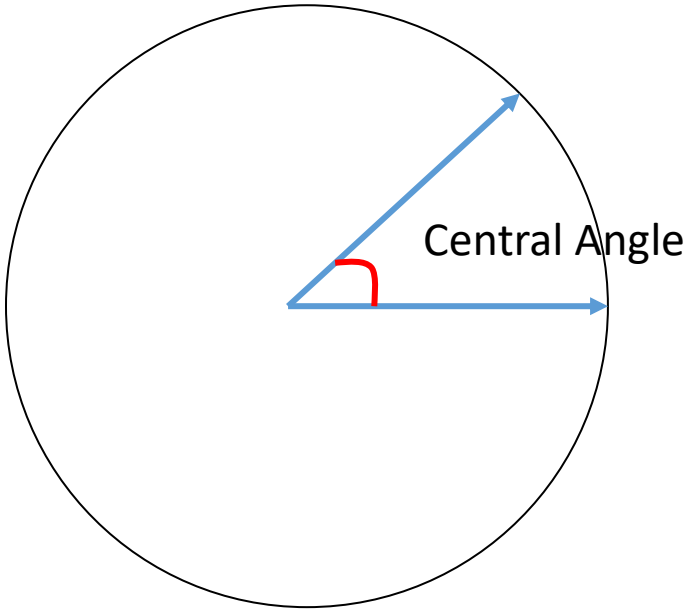


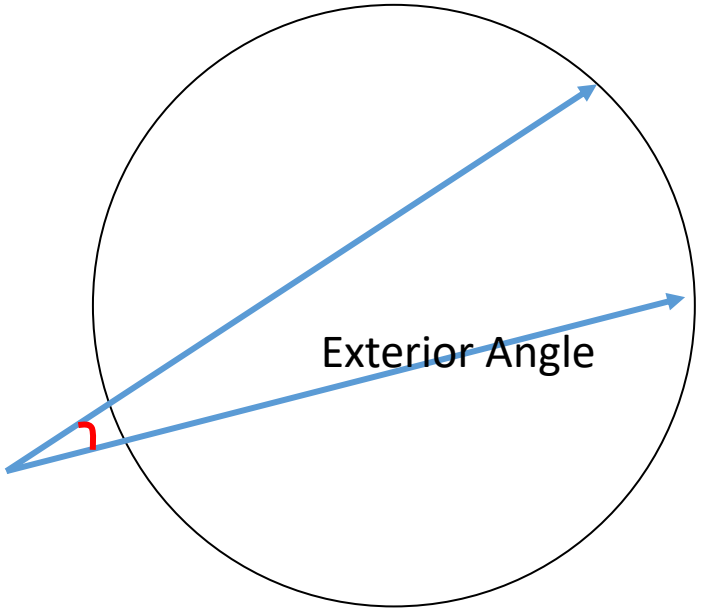


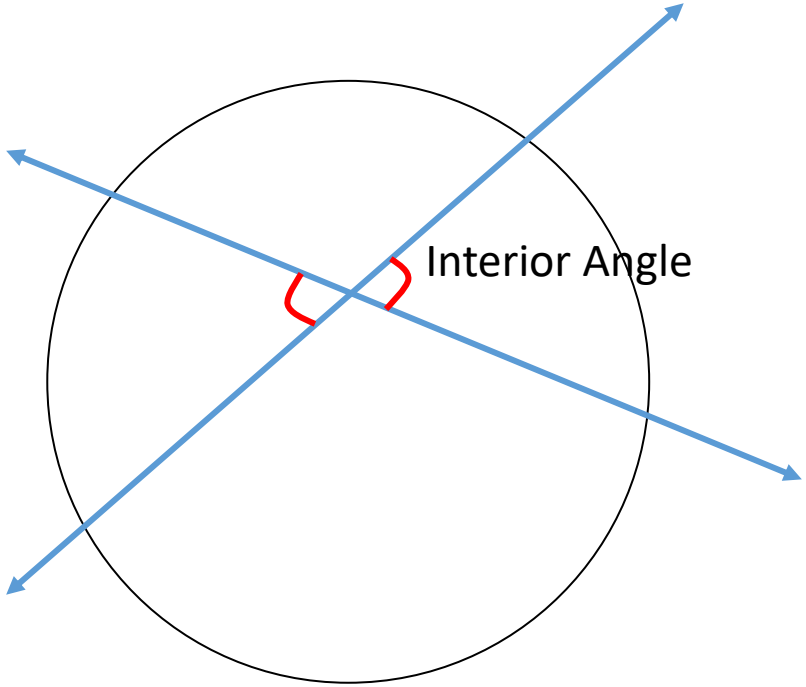
Usage

- Aviation and maritime. Used in air flights and meteorological maps.
- **Orthodrome.** The shortest path between two points determined on the earth is the orthodrome, and this path is seen as a straight line in the Gnomic projection.

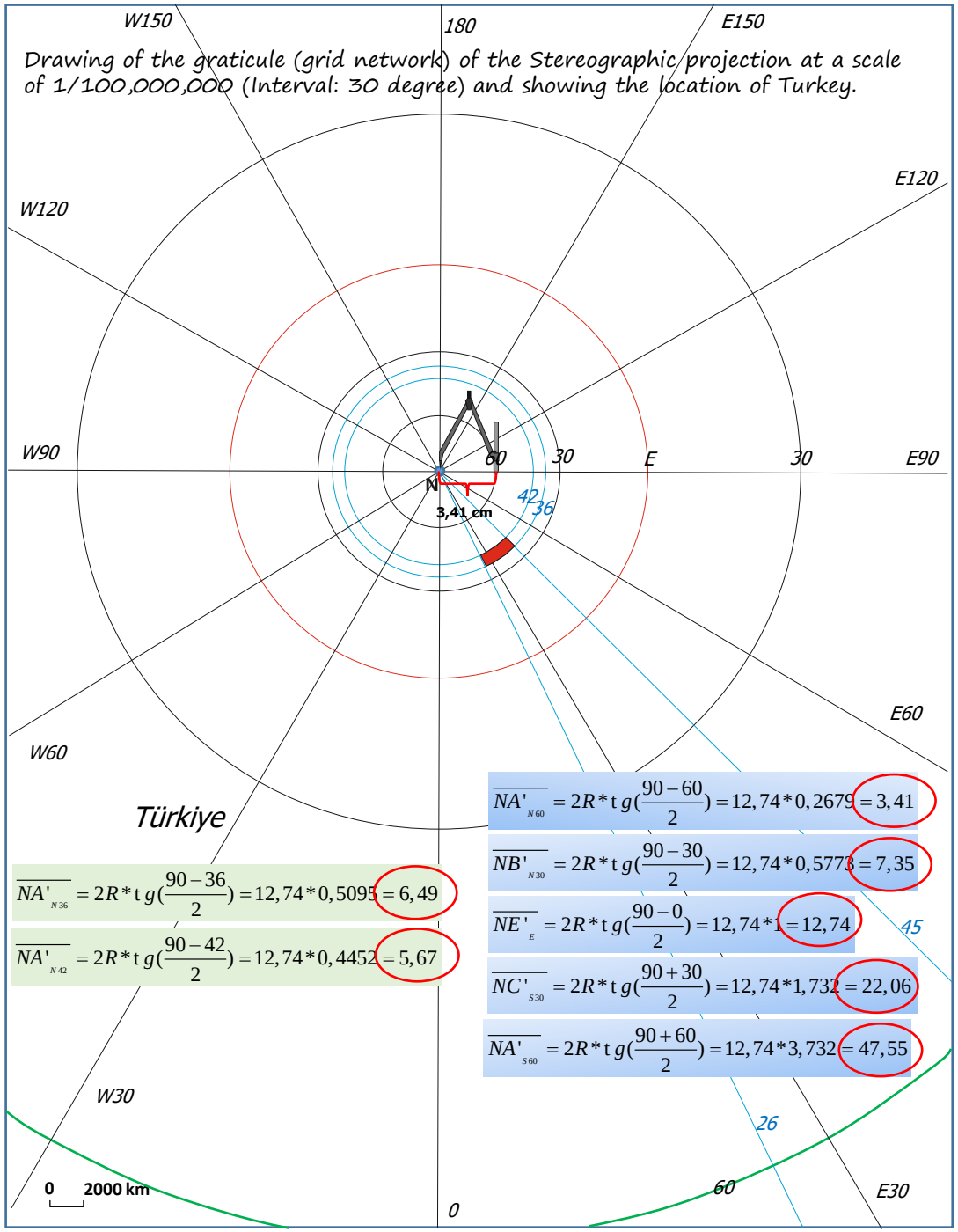

Inscribed Angle


Central Angle


Exterior Angle


Interior Angle

Stereographic Projection



$$\overline{NA'}_{N36} = 2R * tg(\frac{90-36}{2}) = 12,74 * 0,5095 = 6,49$$

$$\overline{NA'}_{N42} = 2R * tg(\frac{90-42}{2}) = 12,74 * 0,4452 = 5,67$$

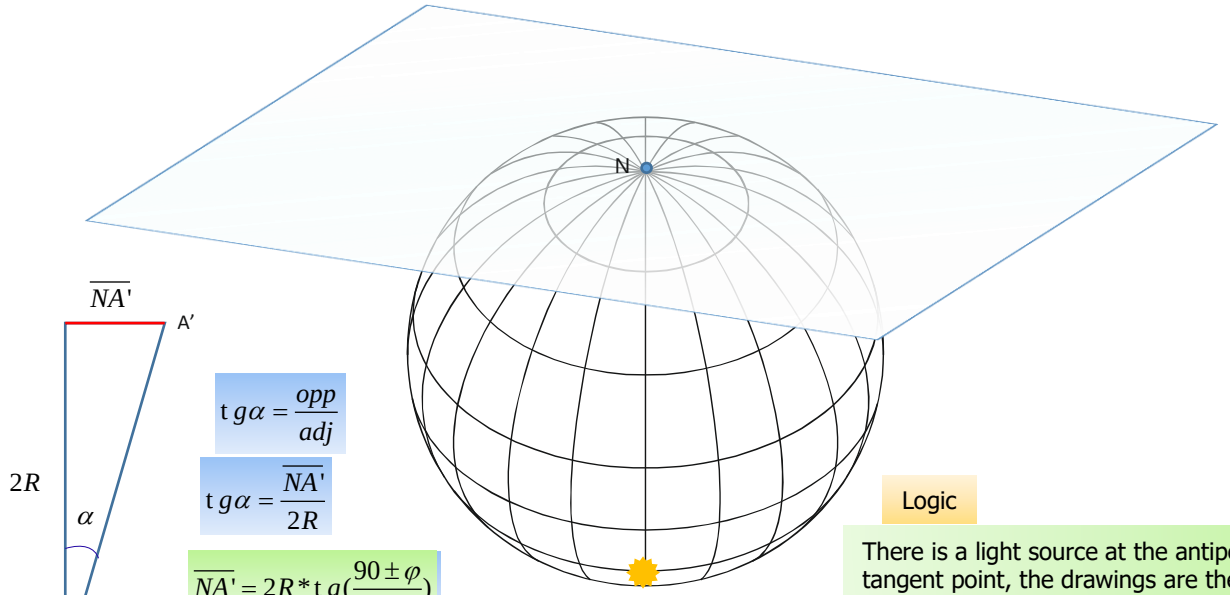
$$\overline{NA'}_{N60} = 2R * tg(\frac{90-60}{2}) = 12,74 * 0,2679 = 3,41$$

$$\overline{NB'}_{N30} = 2R * tg(\frac{90-30}{2}) = 12,74 * 0,5773 = 7,35$$

$$\overline{NE'}_{E} = 2R * tg(\frac{90-0}{2}) = 12,74 * 1 = 12,74$$

$$\overline{NC'}_{S30} = 2R * tg(\frac{90+30}{2}) = 12,74 * 1,732 = 22,06$$

$$\overline{NA'}_{S60} = 2R * tg(\frac{90+60}{2}) = 12,74 * 3,732 = 47,55$$



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

$$tg\alpha = \frac{\overline{NA'}}{2R}$$

$$\overline{NA'} = 2R * tg(\frac{90 \pm \varphi}{2})$$

Logic

There is a light source at the antipode of the tangent point, the drawings are the trace created by this light.

$$\alpha = \frac{90-\varphi}{2}$$

$$2R = 2 * 6,37 = 12,74$$

$$tg_{15} = 0,2679$$

$$tg_{30} = 0,5773$$

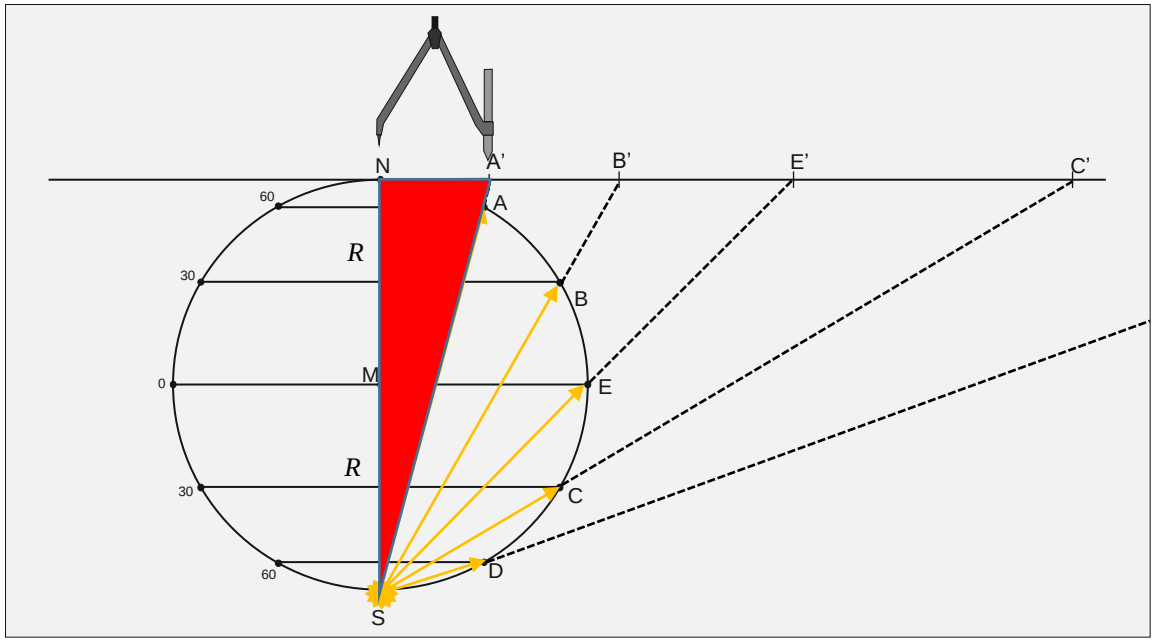
$$tg_{45} = 1$$

$$tg_{60} = 1,732$$

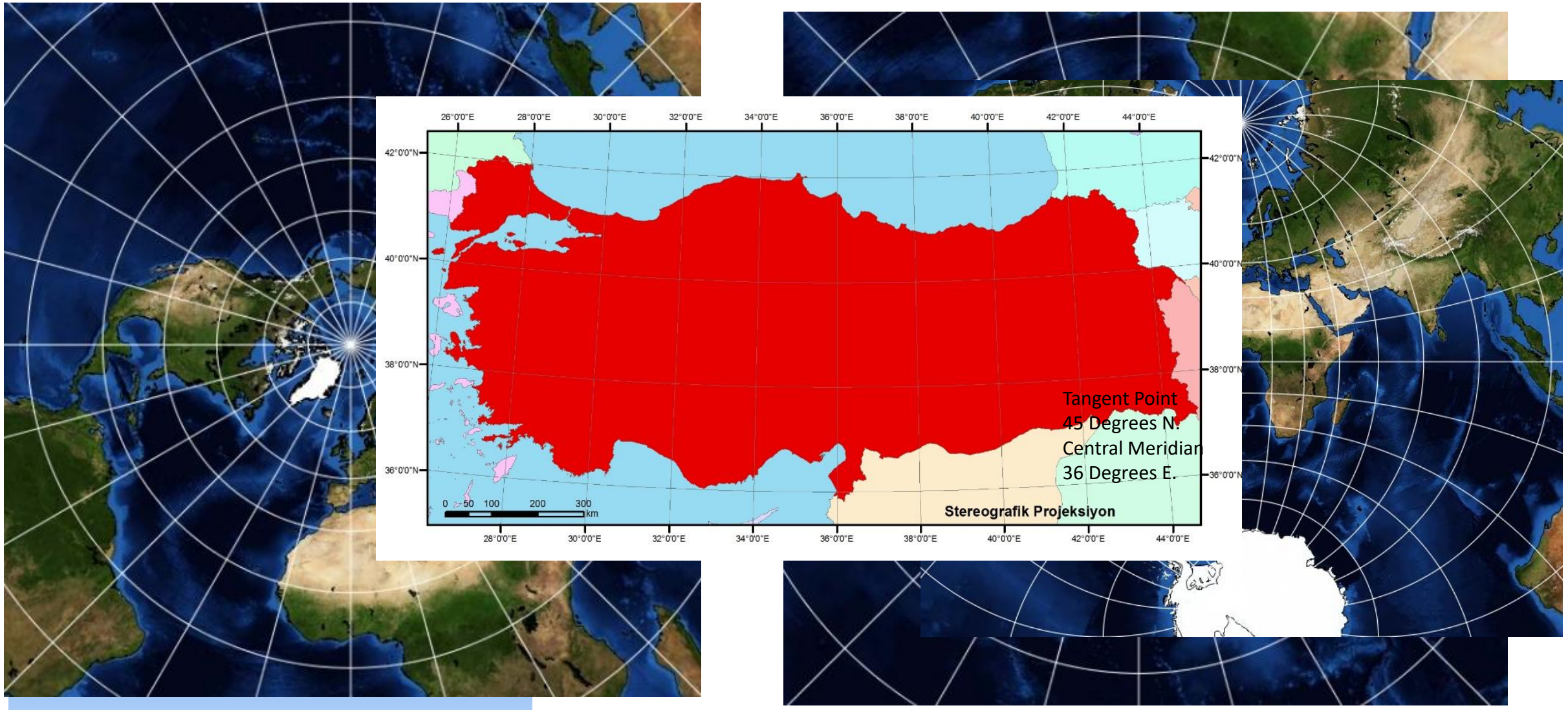
$$tg_{75} = 3,732$$

$$tg_{27} = 0,5095$$

$$tg_{24} = 0,4452$$



GIS:North, South Stereografik



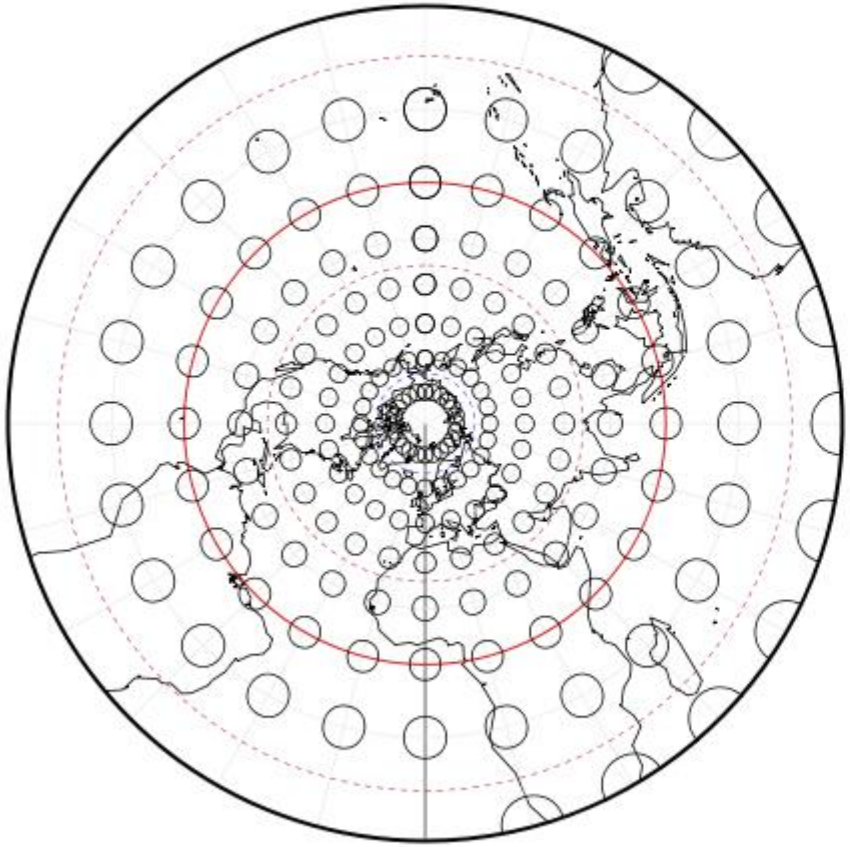
- One hemisphere conveniently; most but not all of the other hemisphere at accelerating scale.
- **Parallels are circle.**
- **Space between parallels increases away from the pole.**
- **Its meridians are radial.**
- **The angle between the meridians is equal to the angle**

Usage

- Commonly used in the polar aspect for topographic maps of polar regions.
- Oblique aspects are used to show paths of solar eclipses.
- Recommended for conformal mapping

Conformal.

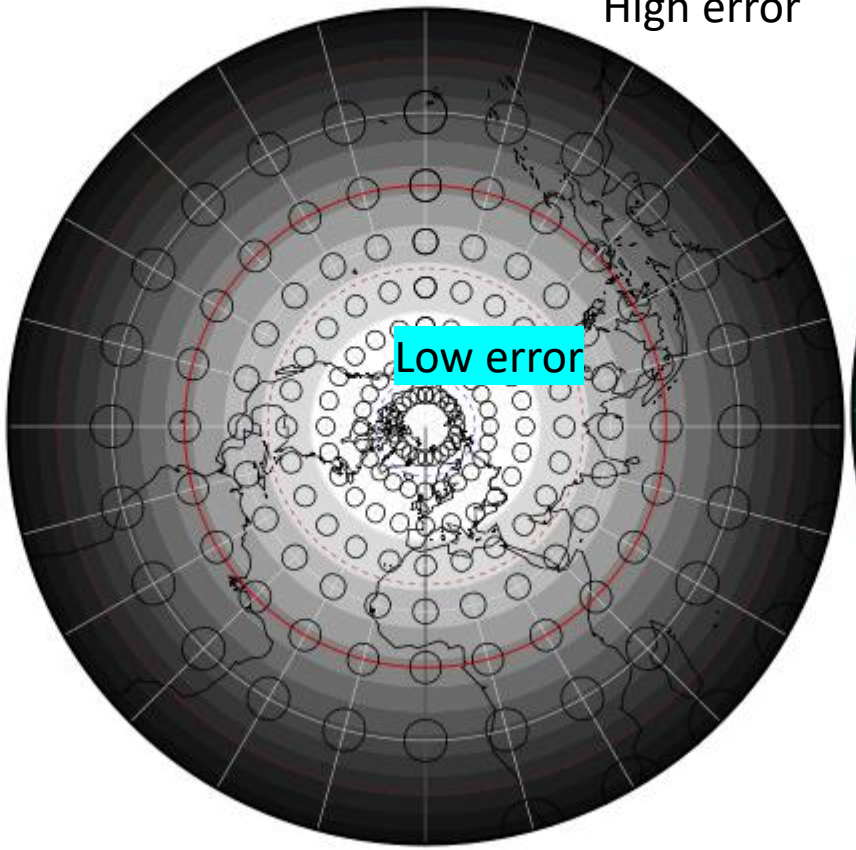
No error



Angle Distortion

High error

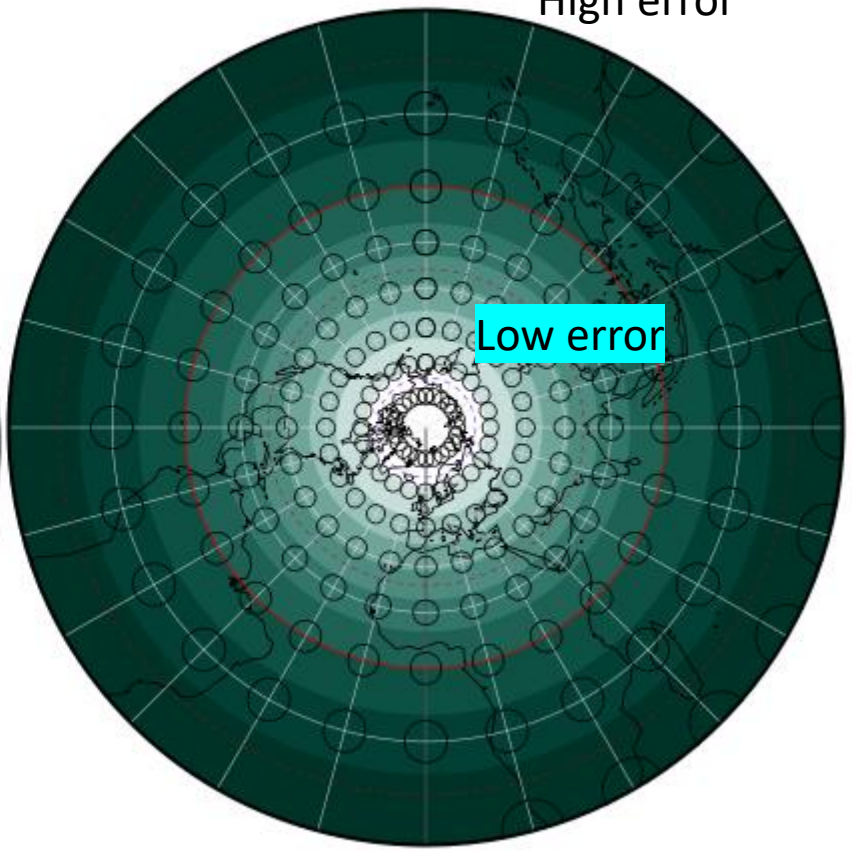
Low error



Distance Distortion

High error

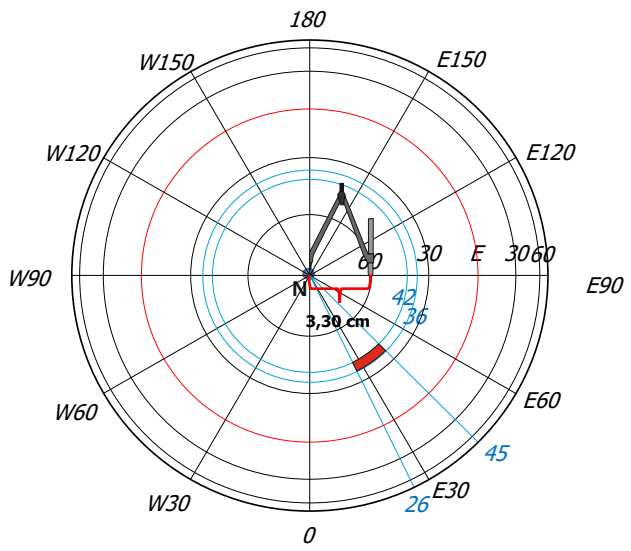
Low error



Area Distortion

Lambert Azimuthal Projection

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



Türkiye

$$\overline{NA'}_{N36} = 2R*\sin(\frac{90-36}{2}) = 12,74*0,4540 = 5,78$$

$$\overline{NA'}_{N42} = 2R*\sin(\frac{90-42}{2}) = 12,74*0,4067 = 5,18$$

$$\overline{NA'}_{N60} = 2R*\sin(\frac{90-60}{2}) = 12,74*0,2588 = 3,30$$

$$\overline{NA'}_{N30} = 2R*\sin(\frac{90-30}{2}) = 12,74*0,5 = 6,37$$

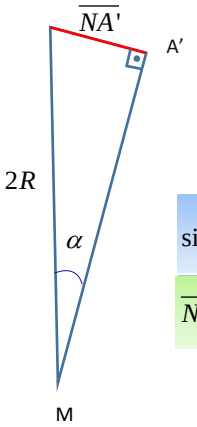
$$\overline{NA'}_{E} = 2R*\sin(\frac{90-0}{2}) = 12,74*0,7071 = 9,01$$

$$\overline{NA'}_{S30} = 2R*\sin(\frac{90+30}{2}) = 12,74*0,8660 = 11,03$$

$$\overline{NA'}_{S60} = 2R*\sin(\frac{90+60}{2}) = 12,74*0,9659 = 12,31$$

$$\overline{NA'}_{S60} = 2R*\sin(\frac{90+60}{2}) = 12,74*1 = 12,74$$

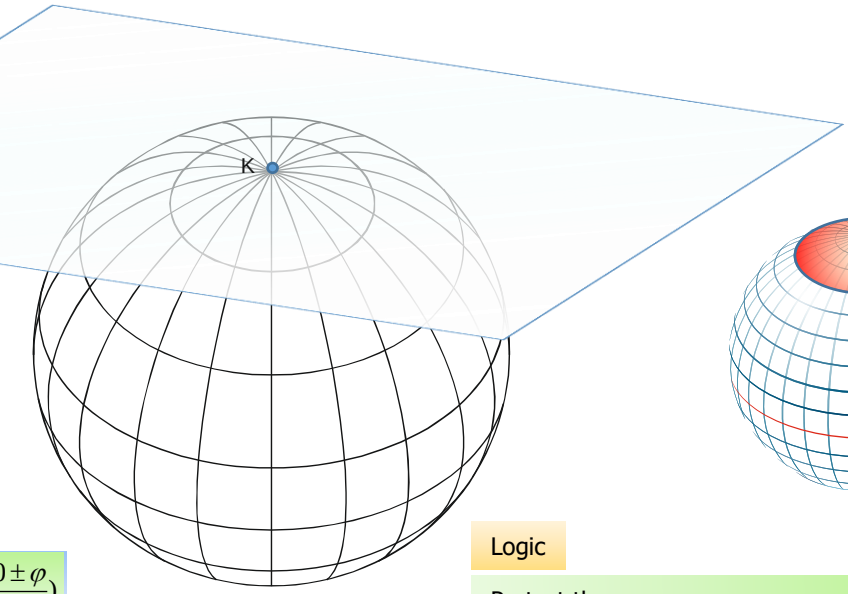
0 2000 km

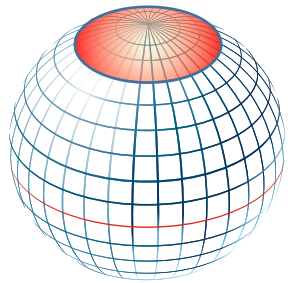


$$\sin\alpha = \frac{opp}{hyp}$$

$$\sin\alpha = \frac{\overline{KA'}}{2R}$$

$$\overline{NA'} = 2R*\sin(\frac{90\pm\varphi}{2})$$





Logic

Protect the area.
Calculates the area of the sphere cap.

$$\alpha = \frac{90-\varphi}{2}$$

$$2R = 2*6,37 = 12,74$$

$$\sin_{15} = 0,2588$$

$$\sin_{30} = 0,5$$

$$\sin_{45} = 0,7071$$

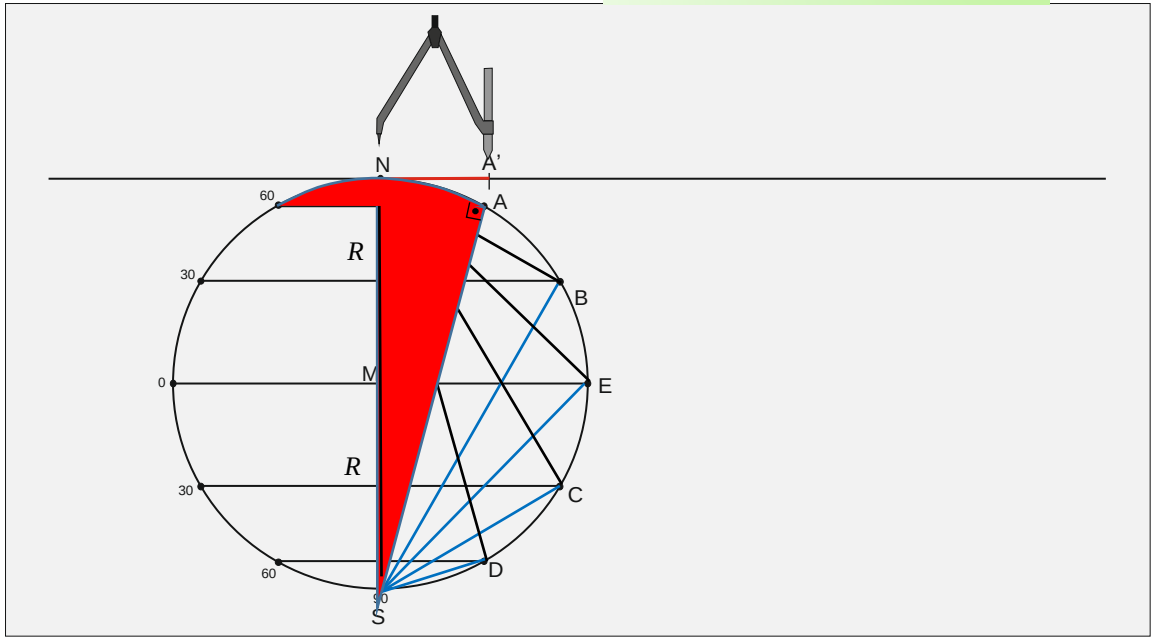
$$\sin_{60} = 0,8660$$

$$\sin_{75} = 0,9659$$

$$\sin_{90} = 1$$

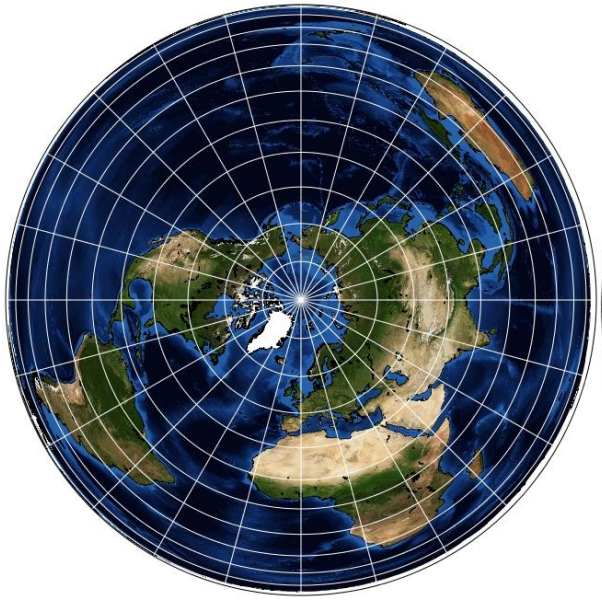
$$\sin_{27} = 0,4540$$

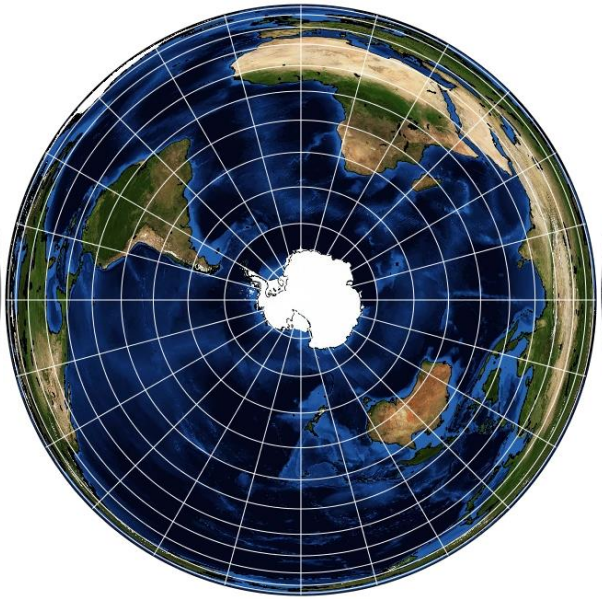
$$\sin_{24} = 0,4067$$

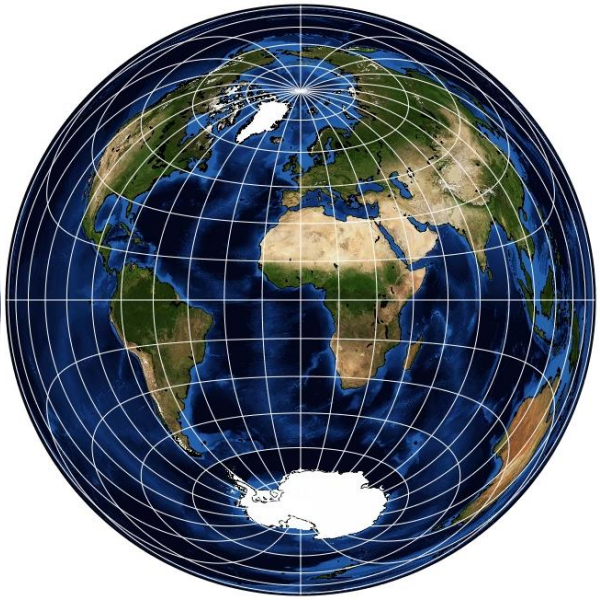


Lambert Projection (Polar Type)

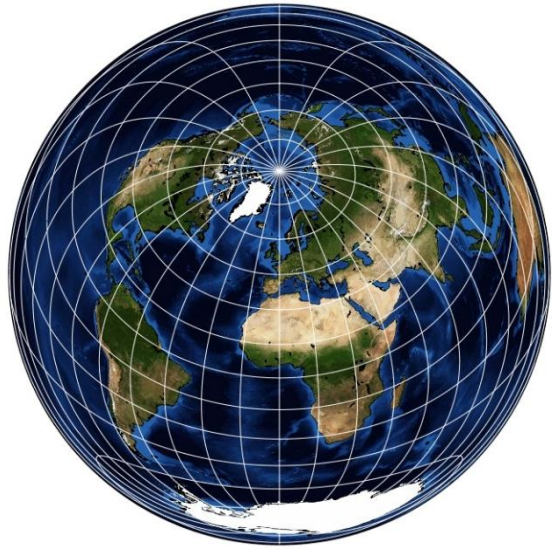
- Entire world.
- **Parallels are circle.**
- **The space of the parallels narrows as you go from the center to the periphery.**
- **Its meridians are radial.**
- **The angle between the meridians is equal to the angle values on the sphere.**
- All three types of projection are used.

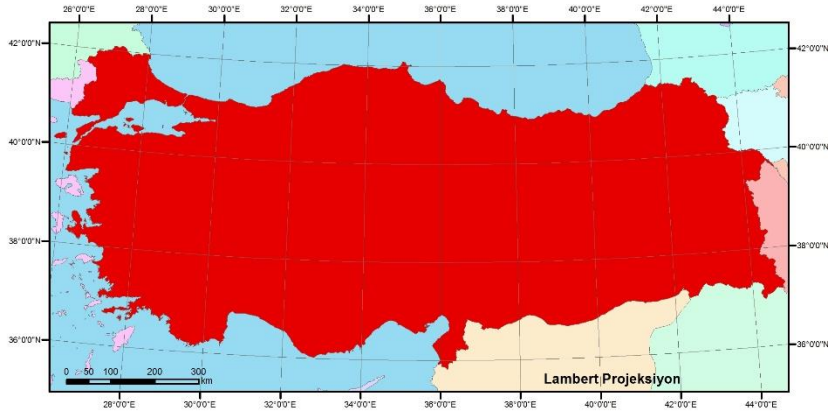






Lambert Azimuthal Equal-Area
Zenithal Equal-Area
Zenithal Equivalent
QGIS-US National Atlas Equal Area





Tangent Point
45 Degrees N.
Central Meridian
36 Degrees E.

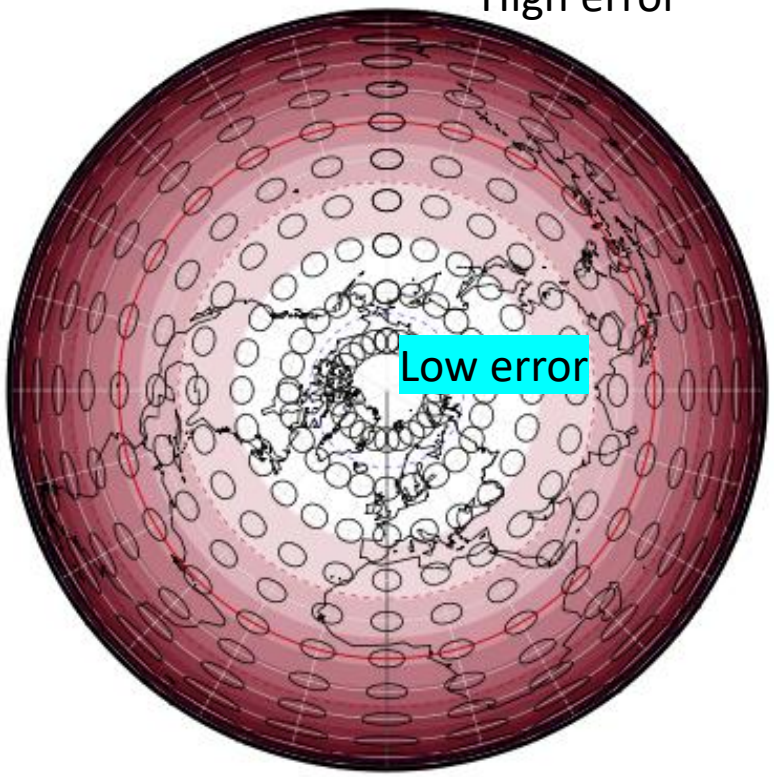
Usage

- Used in maps aimed at area protection.
- Polar type is used for poles, oblique type is used for land and ocean areas, equatorial type is used for eastern and western hemisphere hemisphere notation.

Distortions

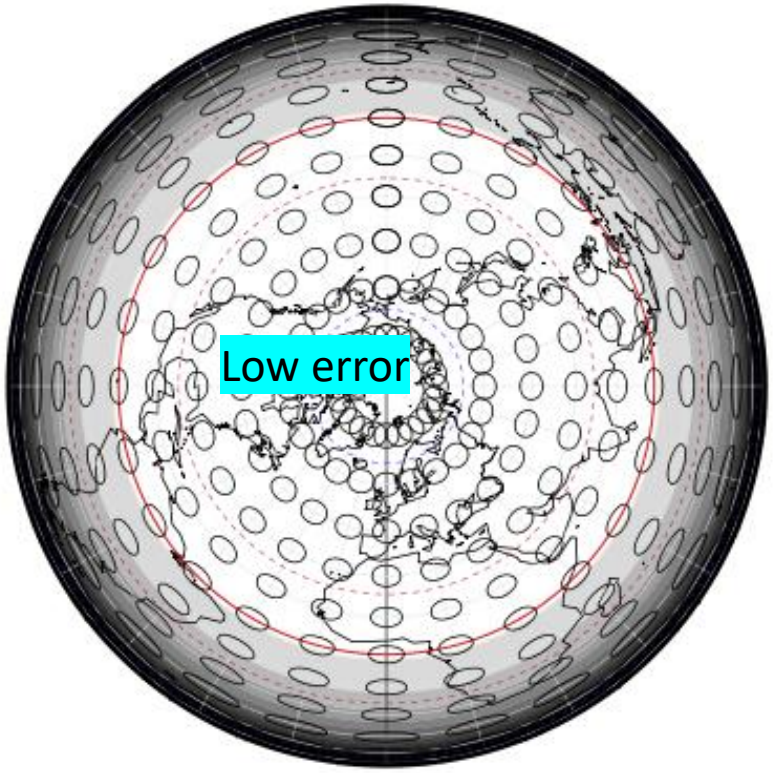
- **Equal area.**

High error



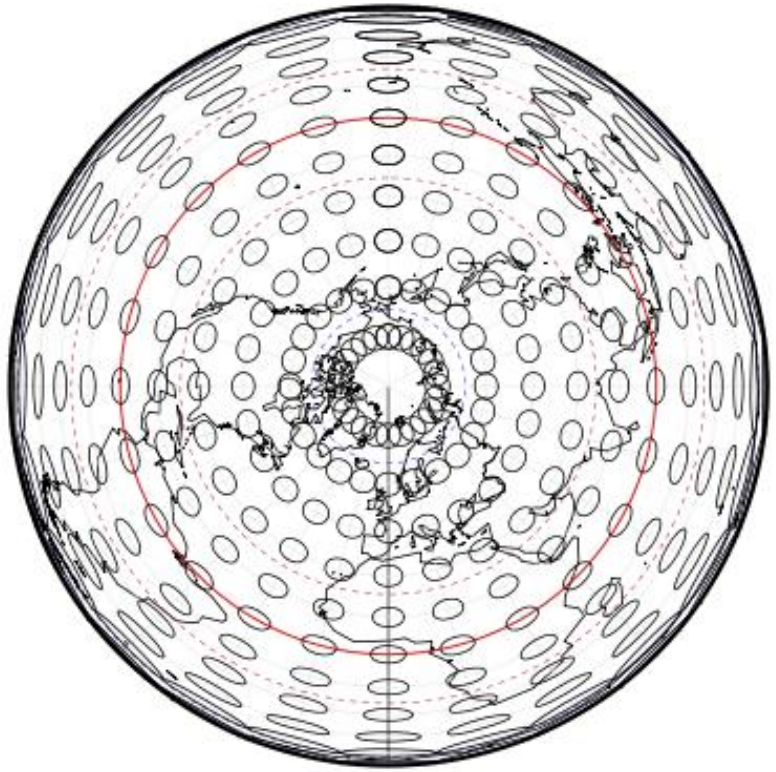
Angle Distortion

High error



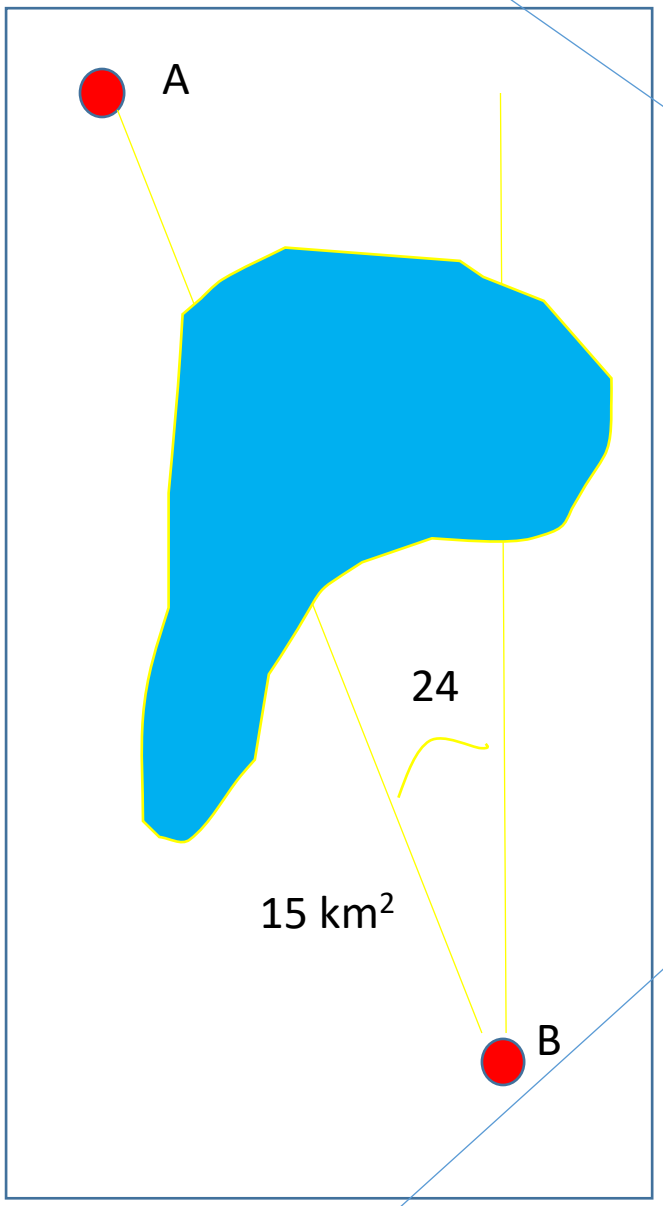
Distance Distortion

No error

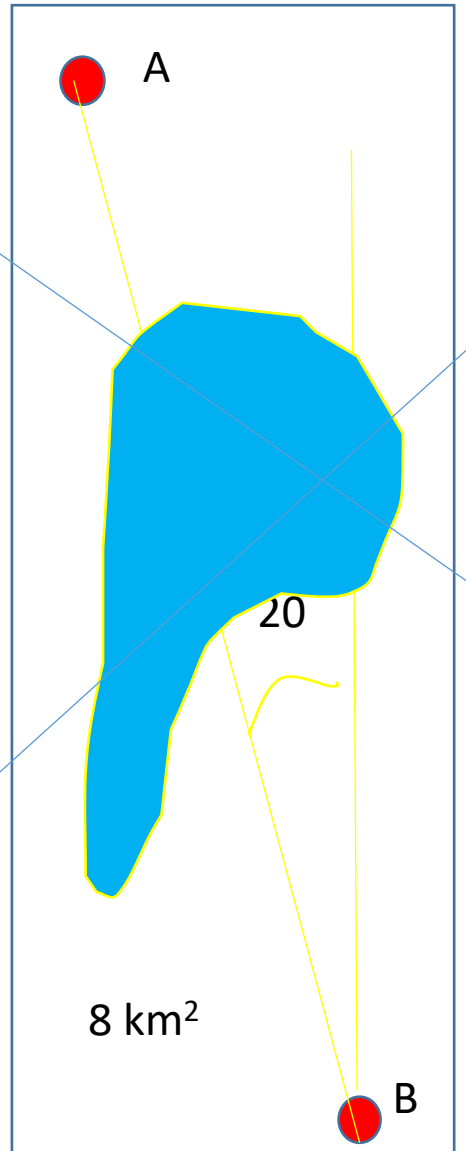


Area Distortion

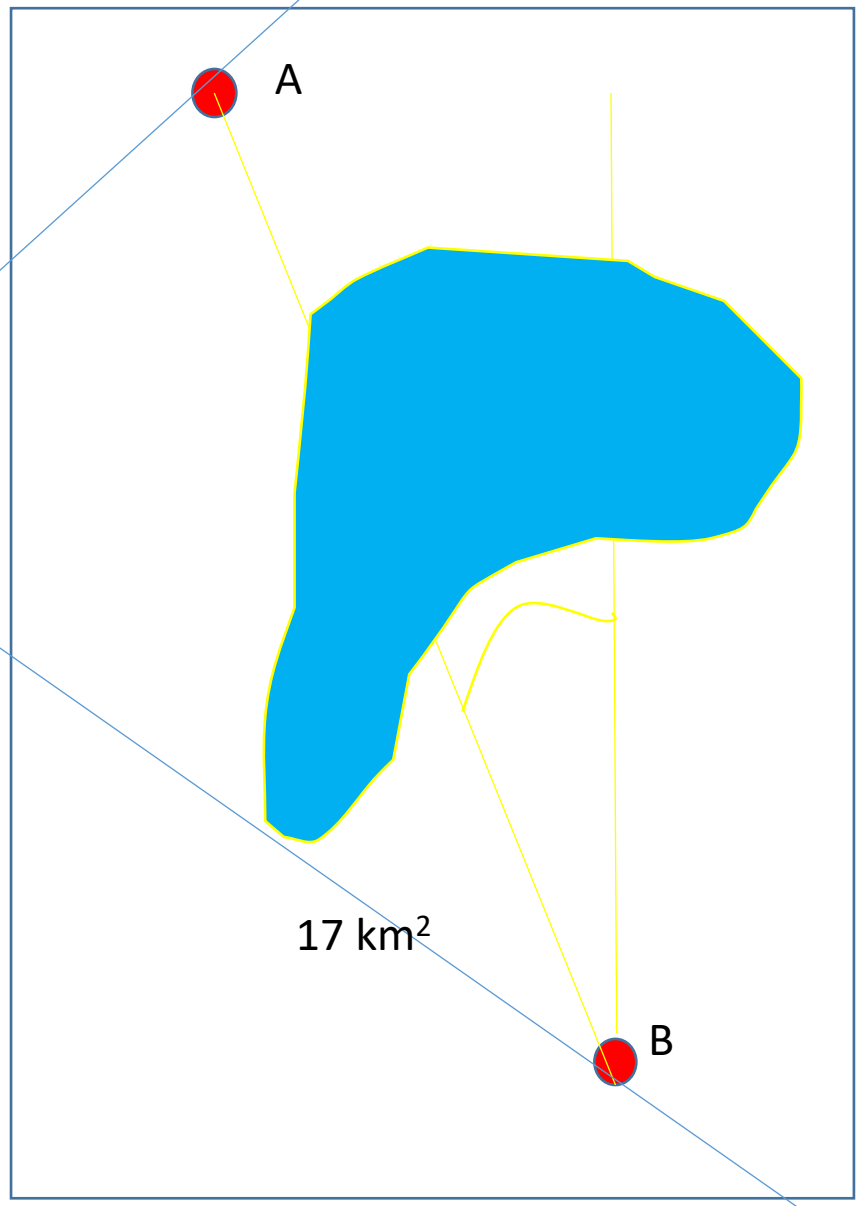
conform



Stereographic



Equidistant



Orthographic