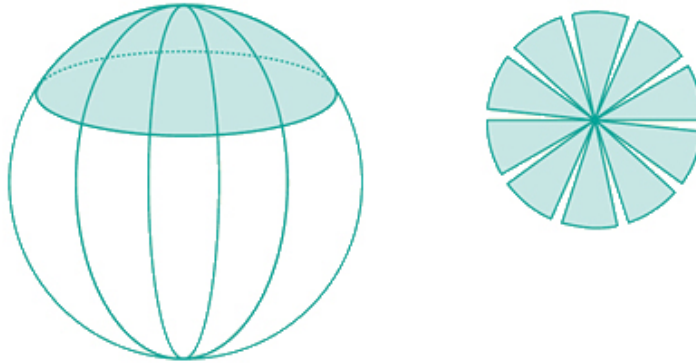


## 2. PROJECTION SYSTEMS - B) SCALE DISTORTIONS

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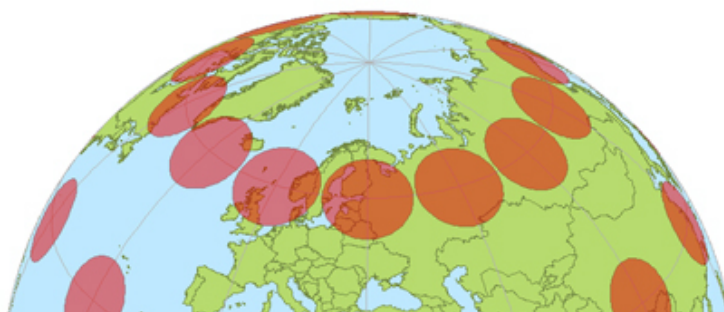
Unfortunately, any map projection is associated with scale distortions. There is no way to flatten out a piece of ellipsoidal or spherical surface without stretching some parts of the surface more than others (figure below). The amount and which kind of distortions a map will have depends largely - next to **size of the area** being mapped - on the **type of the map projection** that has been selected.



Source: [Geometric aspects of mapping](#), ITC

Since there is no map projection that maintains correct scale all over the map, it may be important to know the extent to which the scale varies on a map. The map user therefore, should be aware of the distortions if he or she computes distances, areas or angles on the basis of measurements taken from these maps.

Scale distortions can be measured and shown on a map by ellipses of distortion. The ellipse of distortion, also known as **Tissot's Indicatrix**, shows the shape of an infinite small circle with a fixed scale on the Earth as it appears when plotted on the map.

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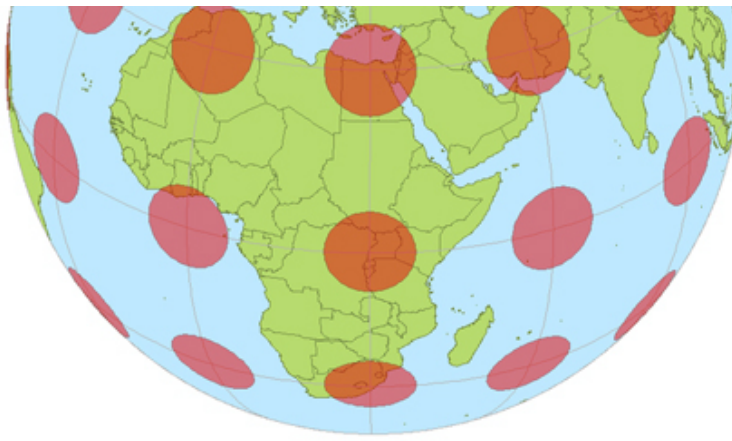
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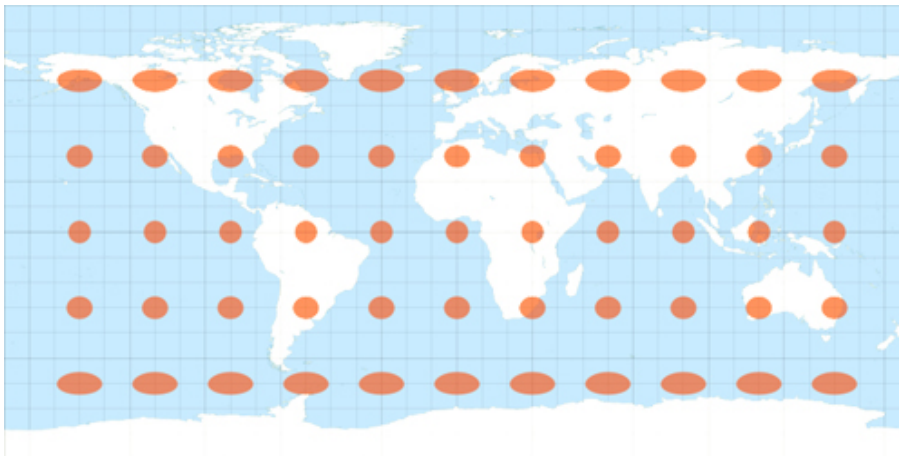
|

[5. Satellite-based positioning \(a/b\)](#)



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The indicatrices on the map in the figure below have a varying degrees of flattening, and the areas of the indicatrices on the map are not the same, which means that the distortion property of the map projection is therefore equidistant.



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Scale distortions for both, tangent and secant map surfaces, are illustrated in the figures below. Distortions increase as the distance from the central point (tangent plane) or closed line(s) of intersection increases.

