Real-time projection visualisation with Indicatrix Mapper QGIS Plugin

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Abstract

The Indicatrix Mapper plugin created by Wirth & Kun presents the tiss-indicatrix. The tiss-indicatrix term is derived from the Tissot-ellipses, it is a quick-and-dirty Tissot-indicatrix realization introduced by Szabó & Wirth. The tiss-indicatrix uses circles of constant radius instead of the original infinitesimal circles (Tissot-indicatrix). (Goldberg & Gott, 2007)

The plugin projects the tiss-circles from a reference sphere to a selected projection. The software uses On The Fly (OTF) transformation method. Then we can study the distortions of the circles in a blink. The QGIS contains approximately 2 700 categorized projections.

On Figure 1 the reader can see the exported QGIS layers as KML (Keyhole Markup Language) files imported to Google Eath Pro.

The Figure 2 shows the mentioned layers in QGIS Wien software enviroment with thematic worldmap about countries in the background.

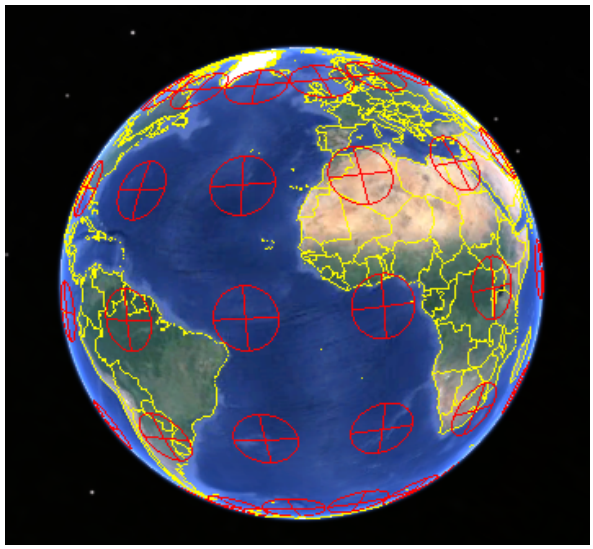


Figure 1 : the 800 km tiss circles on a reference quadric (from Google Earth Pro)

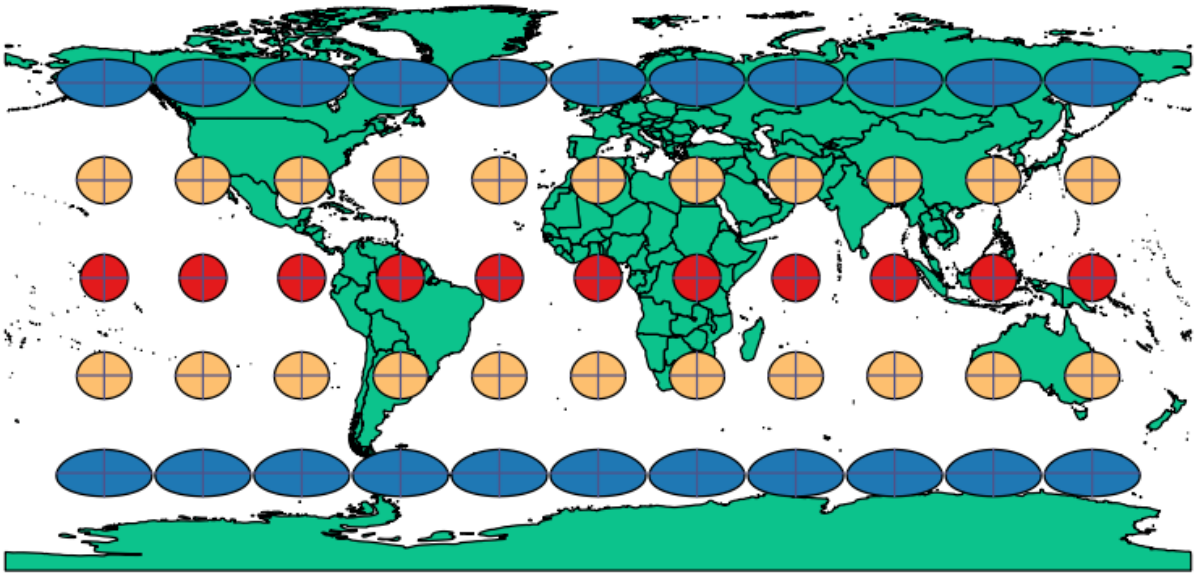


Figure 2 : tiss circle and line layers in QGIS 2.8 in WGS84 global geographic coordinate system (EPSG:4326)

Then by opening CRS (Coordinate System) settings we can transform our layer on the fly (OTF) with the support of PROJ4 library. We can do investigations on any projections from the popup list in a blink by selecting. Figure 3 and 4

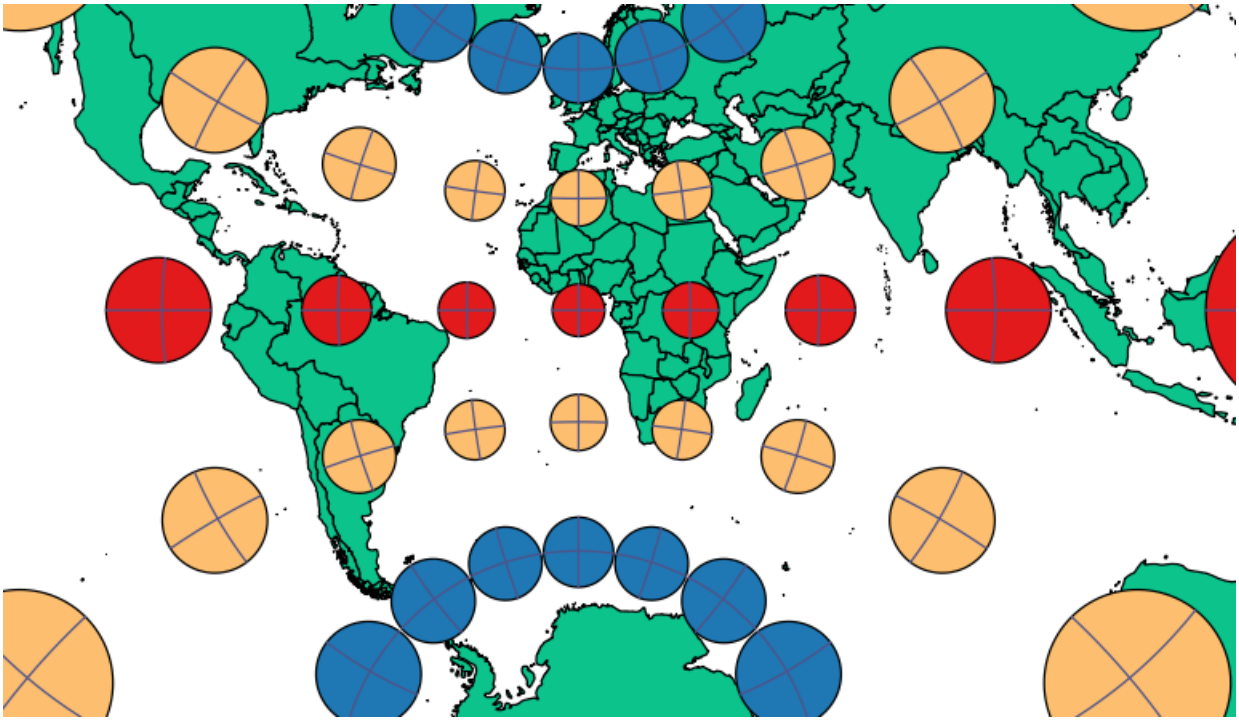


Figure 3 : after OTF in a stereographic projection (Sphere Stereographic, EPSG:53026)

In Figure 3 the reader can see that the transformations of the circles are still circles, thus stereographic is a conformal projection, meaning that it preserves

angles.

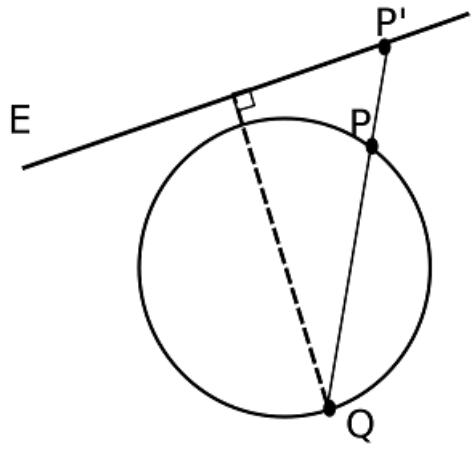


Figure 4 : stereographic projection of a sphere from a point Q onto the plane E, shown here in cross section

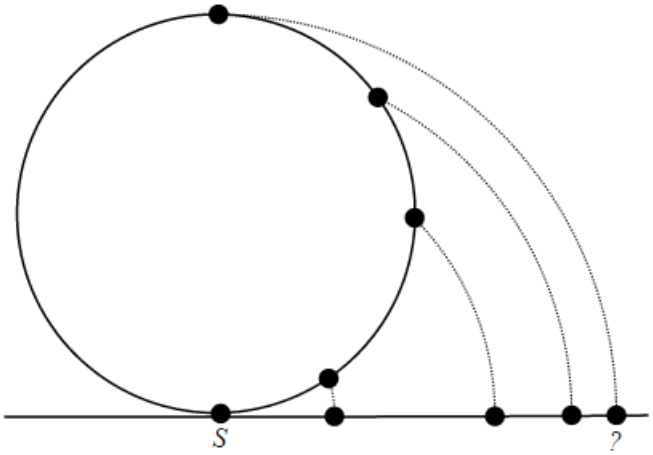


Figure 5 : a cross sectional view of the sphere and a plane tangent to it at S. Each point on the sphere (except the antipode) is projected to the plane along a circular arc centered at the point of tangency between the sphere and plane.

Figure 4 illustrates the procedure of projecting happened in Figure 3. After switching the QGIS project coordinate system on the fly to a Lambert azimuthal equal-area projection (Figure 5) loads the map of Figure 6.

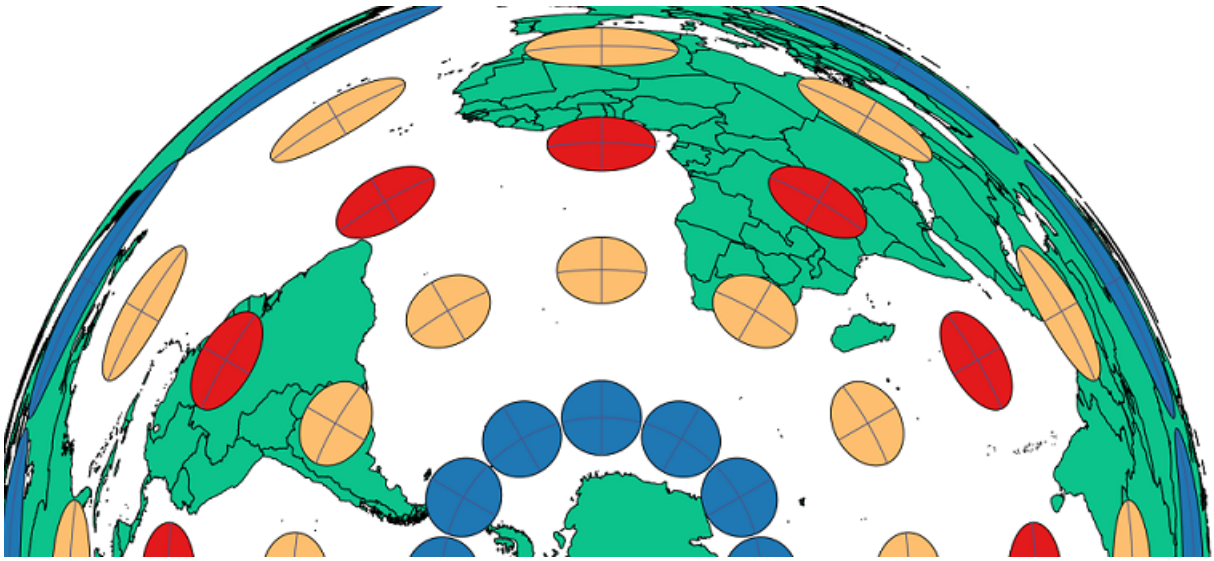
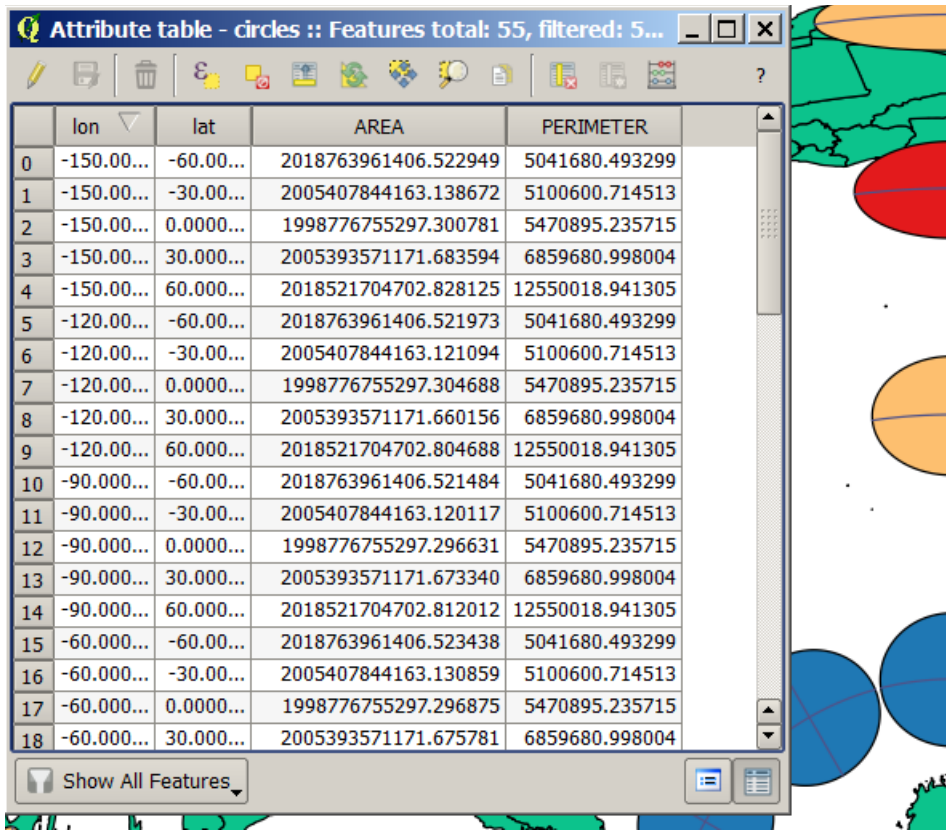


Figure 6 : South Pole Lambert Azimuthal Equal-Area Projection in QGIS (EPSG:102020)

Finally we can calculate the areas of polygons in the given project coordinate system to proof it's equal-area being.



	lon	lat	AREA	PERIMETER
0	-150.00...	-60.00...	2018763961406.522949	5041680.493299
1	-150.00...	-30.00...	2005407844163.138672	5100600.714513
2	-150.00...	0.0000...	1998776755297.300781	5470895.235715
3	-150.00...	30.000...	2005393571171.683594	6859680.998004
4	-150.00...	60.000...	2018521704702.828125	12550018.941305
5	-120.00...	-60.00...	2018763961406.521973	5041680.493299
6	-120.00...	-30.00...	2005407844163.121094	5100600.714513
7	-120.00...	0.0000...	1998776755297.304688	5470895.235715
8	-120.00...	30.000...	2005393571171.660156	6859680.998004
9	-120.00...	60.000...	2018521704702.804688	12550018.941305
10	-90.000...	-60.00...	2018763961406.521484	5041680.493299
11	-90.000...	-30.00...	2005407844163.120117	5100600.714513
12	-90.000...	0.0000...	1998776755297.296631	5470895.235715
13	-90.000...	30.000...	2005393571171.673340	6859680.998004
14	-90.000...	60.000...	2018521704702.812012	12550018.941305
15	-60.000...	-60.00...	2018763961406.523438	5041680.493299
16	-60.000...	-30.00...	2005407844163.130859	5100600.714513
17	-60.000...	0.0000...	1998776755297.296875	5470895.235715
18	-60.000...	30.000...	2005393571171.675781	6859680.998004

Figure 7 : after calculating geometric indices (area, perimeter). The attribute table convinces us about keeping area after projection, because the perimeter varies besides area isn't.

As conclusion we can say that QGIS Indicatrix Mapper plugin can give a new approach in map projection education instead of representing neverending formulas.

References

- ✔ Goldberg & Gott, Flexion and Skewness in Map Projections of the Earth, 2007, www.physics.drexel.edu/~goldberg/projections/goldberg_gott.pdf