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Enhancement Accuracy of UTM Grid by Redesigning to 3° Zones

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ABSTRACT

Geographers and surveyors attempted to determine each's precise shape to be accurately shown on a flat surface. Geographers and surveyors tried to determine each's precise shape to be accurately shown on a flat surface. The Earth's shape was known as "spheroid" or "flattened" until it was demonstrated that it was the consequence of an ellipsoidal shape rotating about its semi-major axis. This search aims to investigate the current topographic map system (UTM 6-degree zone) and contrast it with the proposed system (UTM 3-degree zone). The case will be discussed and searched in the following headings: the contrast between zone 3° and zone 6°. As part of our research, we rely on the accompanying index (1/1000000). The Ellipsoidal Transverse Mercator is the foundation for the UTM projection, a worldwide coordinate system adopted by the U.S. Army in 1947. From the 180th meridian eastward, it splits the Earth between 84°N and 80°S into 60 zones, each 6° broad in longitude and numbered 1 through 60. The research demonstrates that using a 3° UTM zone significantly reduces projection distortion, as seen by the smaller error margins between scale-corrected and raw lengths. The results underline the effectiveness of smaller zones in precision-critical geodetic work and confirm the significance of zone width selection in geospatial analysis. This research shows that azimuthal distortions can affect the accuracy of geodetic readings even within a 6° UTM zone. Even though these distortions are minor, they must be corrected for high-accuracy applications like exact engineering layouts, geodetic control networks, and cadastral surveys. Applying the scale factor to azimuth values makes directional data more reliable and consistent with the geodetic datum.

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1. INTRODUCTION

Researchers in geography and surveying science tried to find the actual shape of each to represent it exactly on a plane surface[1][2]. Until the shape of the Earth was proved as the shape that results from the rotation of an ellipsoidal shape about its semi-minor axis, and it was called (spheroid) or flattened [3][4][5]. Geomorphological mapping and regionalization are still essential geomorphological research techniques with many potential uses[6]. Traditional geomorphological mapping must change to be more accurate and objective in a GIS setting. Nevertheless, insufficient theoretical support exists for the definition, demarcation, and interpretation of mapping units[7]. The rigorous delineation of landform segments and the reduction of subjective elements in the segmentation process are topics that very few writers cover [8]. There is typically no theoretical synthesis or intuitive approach. However, a geomorphological information system idea requires rigorous characterization of fundamental mapping units. This is what we are trying to offer[9]. According to Crofts, "a prime aim of geomorphological mapping should be the classification and evaluation of land based on geomorphological

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mapping[10][11]." Finding the basic landform units is crucial for studying the spatial interactions between landforms, soil, vegetation, topoclimate, hydrological regime, and historical and contemporary geomorphic processes[12][13]. Land surface segmentation is one type of regional taxonomy or regionalization, typically seen as a particular instance of the general classification issue. Philosophy, information (library) sciences, and mathematics are the primary fields that generate general categorization theory. The stability of classificatory structures can be recognized as a criterion of structural quality, regardless of different acceptance metrics or a focus on the subjectivity of categorization (social constructivism). The segmentation of landforms requires this. This search aims to study the system used nowadays in topographic maps (UTM 6-degree zone) and compare it with the suggested system (UTM 3-degree zone). We will discuss and search the case under the following titles.

2. EXPERIMENTAL WORK

To draw a map of large areas of land with small scale the accuracy problem does not appear while it appears with drawing maps with large (big) and medium scale, the scientist (Mercator) discovered the cylindrical projection type in which can product unified projection maps for the world, and this projection (T.M) is used in most world places except those that lie over (80° N)latitude and (80° S)lat[14][15]; that means the areas near the north &south poles. Briefly, in this projection, the Earth is divided into 60 zones &each zone is equal to (6°) between two longitudes & (4°) between latitudes, which covers a map with its geographic dimensions with a scale of 1/1000000. This search aims to investigate the current topographic map system (UTM 6-degree zone) and contrast it with the proposed system (UTM 3-degree zone). The case will be discussed and searched under the following headings. Comparison between (zone 3°) and (zone 6°). In our study, we depend on the accompanying index (1/1000000). The country lies between (39° -48° 80″) longitude and (29° 00"- 37° 30")latitude, and it lies among (zone 6') sys. In (37°,38°, 39°) zones, the central meridian will be (39°, 45°,51°), respectively. As illustrated in Figure 1. But if we consider the country with (zone 3°) system it would lie among (44°, 45°, 46°, 47°) zones, and C.M would be (39° 42°, 45°, 48°) respectively, its illustrated below in Figure 2.

A- Comparing distances and Azimuths calculations in (zone 6°) & (zone 3°) which means the distortion difference between the two systems depended on the distortion calculations were done by the following two methods: two points with known coordinates were taken and then compute the distance between them and the C.M for (zone no. 38) with (zone 6°) system, & the distance was 300km between the point & C.M. It was dealt with scale factore, so the results were: the distortion (64m) in distances by using the formula below:

$$E/2R2= d^2/2R2$$

Then, distance was measured with (160 km) between the other point &central meridian (C.M.); and the results were nearly equal to (30 m) in distance.

B- Two points known in the (zone 6) system, compute the distance between the two points with their bearings mathematically.

And were compared by taking the same two known points by the (zone 3) system & calculating, mathematically, the distance between the two Points &their bearings, &the typical results were as shown below:-

1. Distance between the two points in a bout (295 km) and the distortion difference in distance = 102m between the two systems.
2. Distance between the points in a bout (13 1 km), and the distortion difference in distances (58 m) between the two systems.
3. Calculations of the direction difference between the two systems.

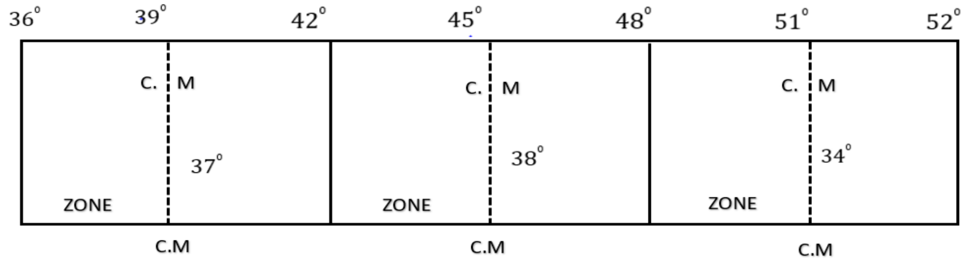

Figure 1. The country with zone 6°.

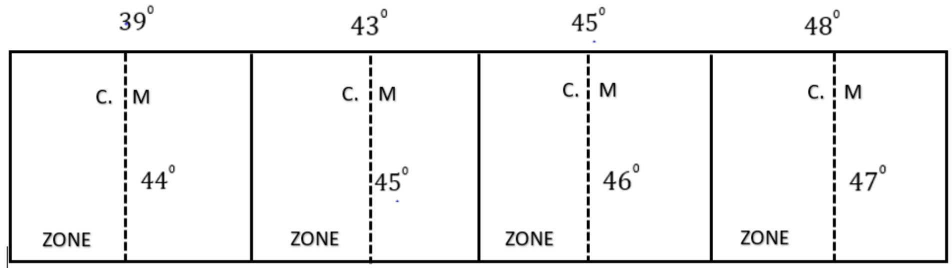

Figure 2. The country with (zone 3°).

2.1. Map Projections

Knowledge of longitude and latitude network with their computation meant to be one of the basic steps to understand the projection specifications, and then doing the projection caleulatio1 because the projections were made to draw this network therefore in the beginnings, the maps designers faced a problem which is how to represent the spherical surface with its three dimensions and convert it to the plane surface with its two dimension which is represents a map.

Therefore, finding a way to represent the spherical surface objects on the plane surface was essential. This method of representing the objects was called " projecting," and the consequent figure is the result of the projecting process.

It is called "projection," which means (a way of organizing longitude and latitude networks on a plane grid), or (a system of representing the earth surface on a plane template), or (converting a three-dimensional shape to the plane of the two-dimensional map). There are aims to be achieved by using projection.

1. The true shape: Knowing the range of distortion that happened in the objects represented on the map located on a plane surface, the type of projection that is made to represent the true shape of drawing any part of the earth's surface is called "true shape projection."
2. True Area: Maps that illustrate the spatial distributions of geographic phenomena are drawn on projections forming what is called an "equal area projection."
3. True direction: To view the zones arranged horizontally that study the essential factors in the global relationships, the projections that show the true declination or(Zenith angles) are called "True direction projections" or polar projection"
4. True distance: Here, the scale factor should be fixed at any point in all directions, and it's possible only when the latitudes and longitudes intersect at right angles.

2.2. Principle selection of projection maps

2.2.1 Choosing the projection according to the position of the area

There is a sincere relationship between the geographic position of the area intended to be drawn and the type of suitable projection, as illustrated below: -

A. One of the cylindrical projections could be a suitable choice for representing any region on a map. The equator is represented on the map as equal to its original length on the Earth's surface, so it's easy to draw the projection.

B. In order to draw a region between the equator and the pole, one of the conical projections is to be suitable, the main parallel is equal in length to the exact parallel on the earth's surface, and it is in about an arc of a circle

C. To represent a polar region, one of the azimuthal projections could be suitable, so all the meridians that meet at the pole are represented on the projection with the same lengths and angles among them on the Earth's surface.

D. In the case of representing the world or half of it on a map, it's preferred to choose the mean projections, which deal with all regions that start with specifying the out-circumference shape of the projection with a circle shape or an ellipse. The geographic structure of the map could be completed inside the projection boundary.

2.2.2. Choosing the projection according to the map's purposes

There are many purposes for drawing maps, and it is essential to choose a suitable projection that achieves the geometric specifications needed for each purpose. Geographic maps drawn with small scales are used for the following purposes.
A. Showing the distributions
B. Showing the equal directions from the appointed region
C. Showing the equal distances from the appointed region
D. Navy, by tracking the fixed direction routes
E. Navy, by tracking the shortest distance
F. Showing the (3D) shape of the Earth

2.2.3. Choosing the projection according to how vast the region to be drawn is FIRST

By drawing a continent like "Africa" on different projections like Mercator, sensor-flamed, modified equal distance, Azimuthally, equal areas, Azimuthally, stereographic, and orthographic, etc.
We find differences in the result shapes. The differences appear in the geographic structure of the map: the meridians sometimes look like straight lines or curves, and the parallels sometimes look like straight lines or curved lines. Curvature varies from projection to projection.
If we draw Afica continent and the two American seas and Ocean, and toward the east to include the Indian ocean to the Indian coasts and the eastern Indian is lands and Australia coasts, and extend to north to include the Mediterranean sea and parts from Europe and getting to the south until reaching the southern polar continent coasts by using the same projections that are suitable to represent Africa we notice that the difference in shapes is clear and it happens because of the meridian s and parallels curvature increasing wherever get far from the center towards the map edges Or by drawing any African country or region, we realize the difference between the result shapes is small and that difference between the straight line and the curved line is slight in the not very wide places, therefore, in case of
choosing a suitable projection to represent the western coast of south America between parallel 8°North to 25°south, its proffered to depend on a projection achieve the equal distance condition, and that could be obtained using: sensor flamed, simple cylindrical, conical Bonne and Multi conical projection as a result of that it's obvious that knowing the shape of region meant to be represented on map is important to choose the required projection.

2.2.4. choosing the projection to the geographic structure

Through the process of choosing Projection, many limitations must be notified (region position, map purpose, area shape and width) and to achieve those limitations, it can depend on two or three projections for the demanded purpose, therefore, the circumstances should be available: -
First: calculations: some predictions don't need complicated calculations, especially those formed by straight lines or circular arcs, and usually, the cartographers take a non-complicated calculation projection.
Second: way of drawing: - the cartographer projects the projection, which is formed by straight lines or circular arcs, because it's easy to draw.
Third: in addition to the former two important elements, it’s necessary to remember the spherical shape of the earth, and the meridians and parallel are circular arcs on earth, therefore whatever the meridians and parallel are more curved; the result map is to be closer to the real shape of the earth surface, and if the cartographies' in about to draw atlas maps, the orthographic projection is suitable for that purpose because it gives a beauty and representing the real shape of the earth surface.

2.3. Distortion of projection

Distortion may be defined as the difference in the shape of any region on a map relative to the same region on the real Earth surface; scientifically, each map could have a distortion ratio. Generally, distortion is minor in large-scale maps, 1:25000 and more, and higher in small-scale maps. it's very useful to know the magnitude of distortion, and its existence helps to avoid making mistakes through the use of maps and choosing atlas maps
to represent different phenomena. Tyner 1973 ordered many basics to be realized by the cartographer before using and choosing the base maps.

3. UNIVERSAL TRANSVERSE MERCATOR PROJECTION (U T M)

The Universal Transverse Mercator (UTM) projection and grid were adopted by the U.S. Army in 1947 for designating rectangular coordinates on large-scale military maps of the entire world. The UTM is the Ellipsoidal Transverse Mercator to which specific parameters, such as central meridians, have been applied. The Earth, between latitudes 84°N. and 80° S. is divided into 60 zones, each generally 6° wide in longitude. Bounding meridians are evenly divisible by 6°, and zones are numbered from 1 to 60 proceeding East from the 180th meridian from Greenwich with minor exceptions. Figure 3 presented the universal transverse Mercator projection.

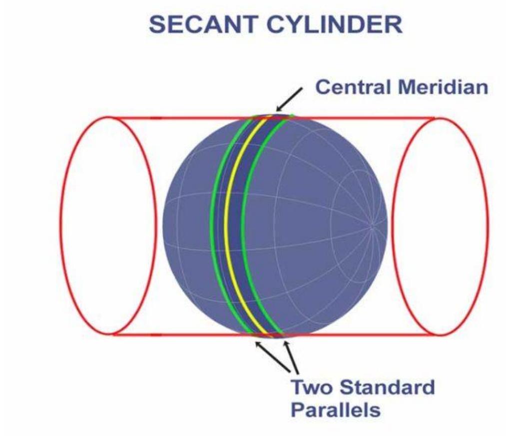

Figure 3. Universal Transverse Mercator projection.

3.1. Scale Factor

The ratio of any two corresponding lengths in two similar geometric figures is called as Scale Factor. The ratio of the length of the scale drawing to the corresponding length of the actual object is called as Scale Factor.

3.1.1 More information about Scale Factor

A scale factor is a number used as a multiplier in scaling. It can be found in the following scenarios: -

1. Size Transformation: In size transformation, the scale factor is the ratio expressing the magnification amount.
2. Scale Drawing: In scale drawing, the scale factor is the ratio of the drawing's measurement to the measurement of the original figure.
3. Comparing Two Similar Geometric Figures: The scale factor when comparing two similar geometric figures is the ratio of lengths of the corresponding sides.

The Law of scale factor:-

$$K=K_0[1+(1+C)A_2/2+(5-4T+42C+13C2-28e'2)A_2/24+(61-148T+16T2)A_6/720] \tag{1}$$

Where Ko = Scale on central meridian (e.g,0.9996 for the UTM projection).
$e`2=e2/(1-e_2)$.
$N=a/(1-e2\sin 2\emptyset)1/2$
$T=\tan 2\emptyset$.
$C = e`2\cos 2\emptyset$
$A=\cos\emptyset\ (\lambda-\lambda 0)$, with λ & $\lambda 0$ in radians

3.1.2 Scale factor for the full ground control point in zone (6°)

The ground control points in the 6° mapping zone have scale factor values that vary very little, ranging from 0.9996243 to 0.9996559. Low distortion and excellent positional precision are shown by all values being quite near to 1.0, which is characteristic of well-designed projection systems such as UTM. The geographic locations of the stations in relation to the central meridian are reflected in the modest variations in scale factors; the values are somewhat lower for farther-flung locations. These findings support the zone's appropriateness for precise mapping and surveying, and the scale factors offered are crucial for rectifying ground-to-map distance conversions in high-precision geospatial applications. K0 (in zone 6°) = 0.9996.

Table 1. Scale factor for the full ground control point in zone (6°).

Station	λ	∅	Scale factor
20073	44° 17\` 52.3\`\`	33° 24\` 14.8\`\`	0.9996525595
20080	44° 23\` 31.1\`\`	33° 20\` 14.2\`\`	0.9996394750
20081	44° 31\` 22.0\`\`	33° 22\` 23.8\`\`	0.9996242966
20088	44° 16\` 36.0\`\`	33° 18\` 17.8\`\`	0.9996559083
20108	44° 29\` 23.1\`\`	33° 14\` 09.0\`\`	0.9996469020

3.1.3 Scale factor for the full ground control point in zone (3°)

The scale factor values for the five surveyed stations in the 3° mapping zone vary very slightly, ranging from 0.9999131280 to 0.9999568758. These values are closer to 1.0 than in the 6° zone (Table 1), suggesting even less projection distortion in the 3° zone. As a smaller zone (3° vs. 6°) often decreases lateral distortion and improves mapping accuracy, this finding is consistent with predictions. Station 20081, which is the station at the furthest east longitude on the list, has the greatest scale factor (0.9999568758), while Station 20073 has the lowest scale factor (0.9999131280). Consistent with the transverse Mercator projection principles, the general trend indicates a modest fluctuation impacted by the stations' placements with respect to the 3° zone's central meridian. The ground control network's outstanding geodetic quality and appropriateness for cadastral mapping, precise surveying, and engineering applications are highlighted by the scale factor values' consistently high precision (up to 10 decimal places). When modifying ground distances, these scale factors should be used to reduce projection-related errors, particularly in regions where high spatial precision is required. K0 (in zone 3°) = 0.9991.

Table 2. Scale factor for the full ground control point in zone (3°).

Station	λ	∅	Scale factor
20073	44° 17\` 52.3\`\`	33° 24\` 14.8\`\`	0.9999131280
20080	44° 23\` 31.1\`\`	33° 20\` 14.2\`\`	0.9999302198
20081	44° 31\` 22.0\`\`	33° 22\` 23.8\`\`	0.9999568758
20088	44° 16\` 36.0\`\`	33° 18\` 17.8\`\`	0.9999496050
20108	44° 29\` 23.1\`\`	33° 14\` 09.0\`\`	0.9999487090

Table 3. the scale factor of zone 6.

Θ	Λ	K
33°	44°00`	1.000589014
	42°30`	1.000292804
	43°00`	1.000050531
	43°30`	0.999662196
	44°00`	0.999787611
	44°30`	0.999646902
	45°00`	0.99962
	45°30`	0.999964902
	46°00`	0.999727611
	46°30`	0.999862146
	47°00`	1.000050531
	47°30`	1.000292804
	48°00`	1.00058914
34°	42°00`	1.000566744
	42°30`	1.000277349
	43°00`	1.000040645
	43°30`	0.999856587
	44°00`	0.999725412
	44°30`	0.999646284
	45°00`	0.99962
	45°30`	0.999646284
	46°00`	0.999725142
	46°30`	0.994856587
	47°00`	1.000040645
	47°30`	1.000277349
	48°00`	1.000566744

3.2. Computing the Cartesian coords. From the geodetic coords. In UTM projection:

To compute Cartesian coordinates (Easting and Northing) from geodetic coordinates (latitude, longitude) using the UTM (Universal Transverse Mercator) projection, you follow a systematic transformation process. The equations below presented that.

$$S(_{\varphi})= \int_0^{\varphi} M d_{\varphi} = \int_0^{\varphi} \frac{a(1-e^2)}{(1-e^2 \ \sin 2_{\varphi})} d_{\varphi} \quad (2)$$

$$E=\frac{315}{16384} e^8 \quad (3)$$

$$\lambda\Delta = \lambda_1 - \lambda_0 \qquad \lambda o\ \lambda\lambda\ \lambda\Delta\Delta\emptyset\emptyset \quad (4)$$

$$t= \tan\emptyset_i \quad (5)$$

$$\eta_= e^2 cos^2\emptyset_i \quad (6)$$

$$N= \frac{a}{\sqrt{(1-e^2 \ \sin 2\emptyset i)}} \quad (7)$$

$$Y_i = \frac{s(\emptyset i)}{N} \quad (8)$$

$$\text{Distance}(D^2) = \sqrt{\Delta E^2 + \Delta N^2} \quad (9)$$

D` =D*S.F (D`: distance after applying scale factor) (10)

3.2.1. distance between the point & C.M in zone (6°)

The positional connections between different stations and the Central Meridian (C.M.) of UTM Zone 38 (with a central meridian of latitude θ = 36° and longitude λ = 45°) are compared using the data shown in Table 2-7-1. The table accounts for scale factor distortions included in the UTM projection system while evaluating the stations' geodetic coordinates (Easting and Northing) and calculated distance to the central meridian. The five stations' easting (E) readings fall between 4329 and 4558 meters. These numbers show their respective longitudinal locations east or west of the false easting (500,000 m), which is the norm in UTM projections. All stations are located west of the central meridian because their easting values are less than 500,000 meters. From 3,675,267.82 m to 3,696,028.38 m, the northing (N) values show a minor variation, indicating a tight spatial distribution in the north-south direction. According to calculations, the distances between each station and the central meridian range from around 294,490 m to 310,014 m.The range of the five stations is around 4329 to 4558 meters. Out of all the stations examined, Station 20108 is closest to the C.M. It is located farthest west. On the other hand, the station nearest to the center meridian is 20073. The "Distance in Scale Factor" column considers the UTM scale factor distortion while adjusting the raw distance. With variations ranging from tens to several hundred meters, the results exhibit negligible departures from the uncorrected lengths. This suggests that the impact of distortions caused by projections is very mild over this geographic range. The positional distortion brought about by projection effects is measured in the "Distortion (M)" column. Station 20073 is 102.45 meters, whereas Station 20081 is 110.64 meters. These results align with predictions in a UTM zone, where distortion gradually rises as one gets away from the central meridian.

Table 4. Distance between the point & C.M. in zone (6°).

Station	E	N	C.M zone 38				Distance between point & C.M(M)	Distance in scale factor (M)	Distortion(M)
			Λ	θ	E	N			
20073	434997.37	3696028.38	45°	36°	500000.00	3983660.39	294885.597	294783.142	102.45
20080	443705.57	3688560.05	45°	36°	500000.00	3983660.39	300421.286	300313.516	108.31
20081	455895.57	3692490.84	45°	36°	500000.00	3983660.39	294490.930	294380.288	110.64
20088	432948.00	3685044.00	45°	36°	500000.00	3983660.39	306051.824	305946.524	105.31
20108	452748.13	3677267.82	45°	36°	500000.00	3983660.39	310014.352	309905.286	109.47

3.2.2. distance between the poin & C.M in zone (3°)

This table provides a thorough examination of five geodetic stations about UTM Zone 76's Central Meridian (C.M.), which is located at latitude 36° (θ) and longitude 43°30′ (λ). A constant northing value of 3,984,700.78 m and a standard easting of 364,798.82 m are linked to the central meridian. This table aims to assess the stations' raw and corrected distances from the central meridian and the distortion by projection effects in a smaller 3° UTM zone. In this design, all measured stations are located east of the central meridian, as shown by their easting (E) values range from 432,948.00 m to 455,895.57 m. The northing (N) values show little change from north to south within the area of interest, clustering between 3,675,267.82 m and 3,696,028.38 m. Each station's distance from the C.M. falls within a very tiny range, roughly between 297,085 and 319,765 meters, which reflects the surveyed locations' relatively short longitudinal dispersion. Station 20073 records the lowest distance, while station 20108 records the furthest. In a narrowly defined 3° UTM zone, these figures show a little positional deviation from the central meridian, which is consistent with predictions. The "Distance in scale factor" column shows disturbances adjusted for UTM projection distortions. With only a few visible modifications, the adjusted distances roughly resemble the raw ones. Crucially, compared to the 6° zone previously stated. This 3° zone's distortion values, which vary from 13.20 m to 25.08 m, demonstrate how well smaller UTM zones lessen projection distortion. The decreased distortion values across all stations demonstrate that using a 3° zone (Zone 76) instead of a 6° zone significantly lessens projection-induced distortions. This decrease in distortion is essential for applications needing great positioning precision, including engineering surveys, large-scale mapping, or geodetic control networks.

Table 4. Distance between the point & C.M. in zone (3°).

Station	E	N	C.M zone 76				distance between the poin & C.M (M)	Distance in scale factor (M)	Distortion on (M)
			Λ	θ	E	N			
20073	434997.37	3696028.38	43°30`	36°	364798.82	3984700.78	297085.158	297059.350	25.08
20080	443705.57	3688560.05	4330`	36°	364798.82	3984700.78	306472.849	3064514.463	21.39
20081	455895.57	3692490.84	43°30`	36°	364798.82	3984700.78	306085.491	306067.292	13.20
20088	432948.00	3685044.00	43°30`	36°	364798.82	3984700.78	307308.471	307292.984	15.49
20108	452748.13	3677267.82	43°30`	36°	364798.82	3984700.78	319765.704	319749.303	16.40

3.3. Azimuth between the points & C.M in zone (6°)

The azimuth angles between the central meridian of UTM Zone 38 and five geodetic stations are shown in this table. The stations' overall southwest direction is reflected in the original azimuths (AZ), which range from 188° to 192°. Directional accuracy is improved by minor adjustments to the adjusted azimuths (AZ*) following the UTM scale factor. Station 20081 has the most significant distortion, with values ranging from 3′ 59.95″ to 4′ 15.11″. The findings emphasize how crucial azimuth correction is for lowering angular errors brought on by projection effects in geodetic surveying.

Table 5. Azimuth between the points & C.M in zone (6°).

station	E	N	C.M zone 38		AZ	AZ* scale factor	distortion
			E	**N**			
20073	434997.37	3696028.38	500000.00	3983660.39	192° 44` 4.16``	192° 40` 3.09``	4` 1.07``
20080	443705.57	3688560.05	500000.00	3983660.39	190° 48` 0.69``	190° 43` 53.05``	4` 7.64``
20081	455895.57	3692490.84	500000.00	3983660.39	188° 36` 47.91``	188° 32` 32.8``	4` 15.11``
20088	432948.00	3685044.00	500000.00	3983660.39	192° 39` 19.51``	192° 35` 20.86``	3` 58.65``
20108	452748.13	3677267.82	500000.00	3983660.39	188° 46` 1.51``	188° 42` 1.56``	3` 59.95``

3.4. Azimuth between the points & C.M in zone (3°)

Azimuths from five stations to the UTM Zone 76 central meridian (3° width) are shown in this table. Azimuth values indicate southeastward orientations and vary from 164° to 167°. The scale factor was applied, and only slight adjustments were seen. The distortion values were much lower than those in the 6° zone, ranging from 25.25 to 52.02. This demonstrates that shorter UTM zones are better for accurate geodetic applications because they provide better angular precision and less distortion.

Table 6. Azimuth between the points & C.M in zone (3°).

station	E	N	C.M zone 38		AZ	AZ* scale factor	distortion
			E	N			
20073	434997.37	3696028.38	364798.82	3984700.78	166° 19` 56.15``	166° 19` 4.13``	52.02``
20080	443705.57	3688560.05	364798.82	3984700.78	165° 4` 48.59``	165° 4` 7.12``	41.47``
20081	455895.57	3692490.84	364798.82	3984700.78	162° 41` 0.49``	162° 40` 35.24``	25.25``
20088	432948.00	3685044.00	364798.82	3984700.78	167° 11` 14.95``	167° 10` 44.62``	32.33``
20108	452748.13	3677267.82	364798.82	3984700.78	164° 2` 7.53``	164° 1` 37.24``	30.33``

4. CONCLUSION

From the former computations, it was obvious that the accuracy in (zone 3°) system. is more than the accuracy in (zone 6°) system; and this doesn't mean the topographic maps of (zone 6°) out of specifications of accuracy considering the further distance is measured on map not more Than (295km); in this dist. The distortion value in a bout (102 m) is within the permitted range; if we consider the accuracy of 0.2 mm. From band seven above, we conclude that expanding or enlarging the geographic region covered by one map leads to an increase in.....if we keep the scale without change, then any expansion in the geographic region must lead to a decrease in scale in return, and this could fit on the unified zone maps. The natural size of the paper of the map makes it available and suitable according to accuracy; when the tractors: - Paper size, scale, and quartering style. Measuring the map's value to make the product suitable for use and get information. If we want to make with (zone 3°), the result will be

a) When we keep the paper size regular, the geographic dimensions will be fixed due to scale: -
Example :-scale 1/100000 the geographic dimension 15' x 15'
b) The zone dimensions (region) with zone 3°will be 2°x 3° as shown below.

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