Kumar Mapping (Kmap) System

By

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Abstract: Kumar Mapping (KMap) System is based on a "bird's-eye-view" snapshot picture of the Earth's surface in small-size ellipsoidal trapezoids. At the poles, the smaller side of the trapezoid will be zero and it will become triangular. Each trapezoid is mapped individually and independently of the adjoining neighbor. The smaller the area size, the flatter will be the trapezoid, which on paper will become a trapezium. Keeping the trapezium sides equal to the actual lengths of the latitudinal or longitudinal arcs of the corresponding trapezoid, distortions due to flattening of the bulge will be practically negligible for topographic maps, charts, and cadastral plats. The trapeziums or triangles are not converted to squares or rectangles, and maps will have true North and scale with no discontinuity in coordinates.

The Earth's ellipsoidal surface is mapped as a mosaic of small trapeziums and triangles producing seamless KMaps and/or KCharts.

Introduction

Kumar Mapping (KMap) System is designed to produce universal, no-projection, and seamless maps and charts, which are designated as "Kmaps and KCharts". Under this concept, instead of considering a large area of the Earth's curved surface and designing a suitable projection, the KMap looks at the total ellipsoidal surface in "bird's-eye-view" snapshot pictures of one small area after another. These areas will be either ellipsoidal trapezoids or triangles at the poles and are mapped as flat trapeziums or triangles with the same side lengths as the corresponding curved side. Each map will have true North and the scale distortion will be practically negligible commensurate with the mapping scale. Each Kmap will "fit" with the adjoining KMaps, both along the latitudinal and longitudinal sides. A mosaic of Kmaps will produce seamless cover for the entire Earth from pole to pole and from East to West around the globe.

The paper explains the fundamental design features of the Kmap system, which would eliminate the need for projection mapping. It also outlines the practical advantages of Kmaps are critically important to users.

Real Earth Mapping

Trapezoids, Trapeziums, and Triangles

An ellipsoidal trapezoid or triangle can be mapped as a flat trapezium or triangle, respectively (Figure 1).

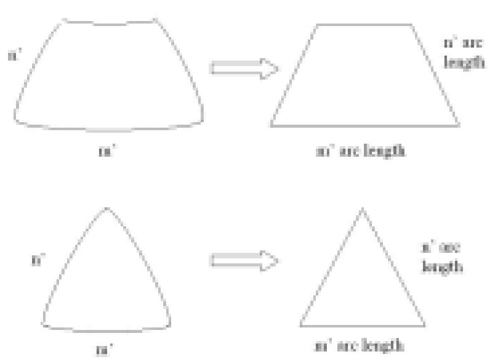

Figure 1. Trapezoids, Trapeziums, and Triangles

Note that as the longitudes converge, a variable latitudinal width for maps can be considered for the upper latitudes. Each side of the flat trapeziums or triangles will be of the same length as the corresponding curved spherical side. The difference between the shorter and the longer side of any trapezium for 15' arcs at 0 degree latitude is <1mm, increasing to about 2 mm at 80 degrees latitude at the map scale of 1:50, 000. Thus, users who are accustomed to viewing rectangular maps will not notice that they are actually looking at a trapezium.

Trapezoidal Bulge and Distortion

The bulge between the spherical curved side of "θ" arc length of any trapezoid and the corresponding chord is equal to "r (1- cosine θ/2)", where "θ" is in radians. Thus, for an arc length of 15' and a map scale of 1:50,000 along the Equator, the maximum bulge will be about 15 meters. With the magnitude of "r" being in the order of 6 Million meters, the distortion resulting from mapping a 15' trapezoid as a 15' flat trapezium will be negligible (Figure 2). For map scales of 1:24,000 or 1:25,000, the bulge for a 7.5' arc will be about 4 m, and for cadastral plats it will be almost zero. Thus, in all such cases, the distortion will be practically negligible or zero.

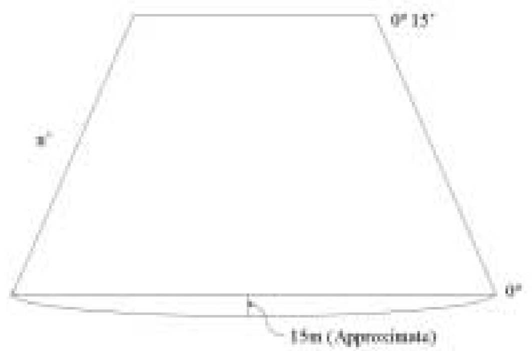

Figure 2. Ellipsoidal Bulge for 15' arc at Equator

Scale, Orientation, and Seamless Mapping

Instead of grid north and grid meters of the present projection mapping, the new system will have true north and true meters. Everything will be mapped as it 'really" exists on the ellipsoidal Earth. There will not be any discontinuity between any two adjoining trapeziums and triangles along their longitudinal/latitudinal junctions. The maps will "fit" with adjoining maps from pole to pole and from East to West around the Earth. Continuous seamless maps (Figure 3) will replace the grid zones of the projection mapping. In addition there will be no discontinuity in horizontal coordinates and heights from one map to another, adjoining or far apart.

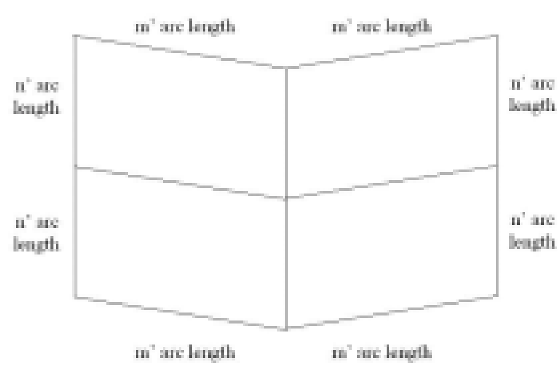

Figure 3. Seamless Mosaic of KMaps

Contouring Topography

The contours to depict topography can be drawn with ellipsoidal heights, which would be available directly from GPS surveys. These contours will depict the Earth's "real" topography.

Essential Requirement

To ensure seamless "fit" for global coverage, KMap system will require a 3-D geocentric world geodetic system defined with one ellipsoid.

Small Scale and Cadastral Mapping

With this approach, a "small" scale KMap or KChart, e.g., 1:250, 000, can be compiled as a mosaic of the corresponding larger scale Kmaps or KCharts, e.g., 1:50, 000.

Kmap system can also be used for large-scale property surveys and plats. The advantages that this method will bring to platting large cadastral area are: 1. Each mapped plat being flat with no distortions will "fit" its neighbor, and 2. GPS-surveyed geodetic coordinates for property corners and true distances and true azimuths will produce a continuous high-accuracy cadastre, thus eliminating the need to have separate plane coordinate systems from one state to another.

Computerized Application

Maps and charts created using Kmap system can be stored on CDs and viewed on a monitor as mosaics for land or marine navigation. The nautical charts will enable to calculate accurate clearances using time-invariant ellipsoidal depth of sea floor and heights of overhead structures.

Summary

The World Geodetic System (WGS) was the first step made in 1960 towards one geocentric geodetic system with a mean Earth ellipsoid to replace hundreds of local datums and their numerous ellipsoids. The geodetic approach of the KMap system is the next step for the Twenty-First century to map the real ellipsoidal Earth without projections, their grids and grid zones, and scale distortions. Seamless topographical maps and charts compiled and drawn using the KMap system with true North and scale will extend from pole to pole and from East to West around the globe. They will be with practically negligible or no distortion. Such a system would also provide accurate seamless property and cadastral mapping.

ACKNOWLEDGEMENTS

I acknowledge Professor Francis Derby, The Pennsylvania State University, and Mr. Ajit Singh, U.S. National Geodetic Survey, for their geodetic contribution and discussion in finalizing the concept.

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