The Global Spatial Data Model (GSDM): A New Paradigm for Spatial Information

Prof. Earl F. BURKHOLDER, USA

Key words: Spatial data, functional model, stochastic model, digital revolution, earth-centered earth-fixed (ECEF), geodetic datums, spatial data accuracy, covariance, correlation, interoperability.

ABSTRACT

Spatial data are 3-dimensional (3-D). Modern measurement systems collect data in 3-D. Computer data bases store digital 3-D spatial data. Human perception of spatial relationships is primarily visual and intuitively related to 2-D horizontal and 1-D vertical. Conventional methods of handling 3-D geospatial data are unnecessarily complex due to 1) the traditional separation of horizontal and vertical, 2) using mixed units (angular for latitude/longitude and length for vertical), and 3) using 2-dimensional map projections to ”flatten the earth.”

A universal 3-dimensional global spatial data model (GSDM) has been defined (Burkholder 1997c) which is based upon assumptions of 3-D measurements and digital data storage. It is equally applicable world-wide, offers a simple data exchange format which supports interoperability and seamless integration, and uses standard deviations to describe spatial data accuracy. The GSDM accommodates all modes of spatial data measurement, does not distort physical distances as does a map projection, uses one set of solid geometry equations, portrays an accurate view of spatial data from any perspective selected by the user, preserves computational and geometrical integrity by using coordinate differences, stores point location information in a BURKORD^{TM} 3-D data base which optionally stores the positional covariance matrix of each point and, where the covariance matrix is stored, gives the 3-D standard deviation of each point with respect to the defined datum in the geocentric or local east/north/up reference frame. Rigorous statistics for network accuracy and local accuracy between points can also be obtained if correlations between points have been stored.

CONTACT

Professor Earl F. Burkholder, PS, PE
New Mexico State University
Surveying Engineering Department - 3SUR
Las Cruces, New Mexico 88003
USA
Tel. + 1 505 646 5375
Fax + 1 505 646 1981
E-mail: eburkhol@nmsu.edu
Web site: www.nmsu.edu/~survey/