User's Manual for a Map of Part of Northeast Brazil based on the Digital Chart of the World, including Pernambuco, Alagôas, Ceará, Paraíba, Pernambuco, Rio Grande do Norte, and Sergipe

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Abstract

A map database of part of Northeast Brazil, including the states of Pernambuco, Alagôas, Ceará, Paraíba, Pernambuco, Rio Grande do Norte, and Sergipe, was prepared from quadrangles of the Digital Chart of the World for use with the WHEAT electronic mapping system. It was prepared from a series of electronic maps in WHEAT format prepared from the Digital Chart of the World, a set of 1:1,000,000 electronic maps based on the Defense Mapping Agency's Operational Navigational Charts. This map covers the area in Northeast Brazil entirely or largely within Universal Transverse Mercator Zone 24 and contains all the data available in the original Digital Chart of the World, code look-up tables, and a set of prepared themes and other tables to allow immediate use in WHEAT EMAP. Data layers include borders, hydrology, towns, elevation contours, roads, railroads, airports, and utilities, as well as several more miscellaneous themes. Maps at this scale are particularly well-suited for mapping areas of 20 kilometers to 1000 kilometers.

Coordinate data are in the Universal Transverse Mercator Zone 24 coordinate system. The horizontal datum is the World Geodetic System 1984 (WGS84). Feature locations are accurate to approximately 2 kilometers.

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Overview

This manual describes a small-scale – 1:1,000,000 scale – electronic map derived from the US Defense Mapping Agency's Digital Chart of the World (DCW), Version 1 (See DMA 1992). The DCW was digitized from the Defense Mapping Agency (DMA) Operational Navigational Charts, primarily intended for air navigation and military planning. Among the civilian uses of base maps at this scale are geologic reconnaissance mapping, resource management, disaster/famine relief, expedition/travel, social science and logistics. The level of detail is much higher than a typical (United States) state map and somewhat less detailed than a county map.

This map covers part of Northeastern Brazil and contains all the data available in the original Digital Chart of the World, code look-up tables, and a set of prepared themes and other tables to allow immediate use in WHEAT EMAPKGS2 (Pouch, 1994, 1996a-d, 1997). (To get WHEAT, use the World Wide Web to get to www.kgs.ukans.edu, choose Kansas Geological Survey, then Software, then WHEAT, or try going directly to http://www.kgs.ukans.edu/software/Wheat/whtmain.htm.) The user can modify these themes or design new ones to tailor the map for particular purposes. Loading all the pre-designed themes produces a cluttered map; eliminating town symbols and labels and spot elevation symbols and labels produces a much more readable map. The data are available on the KGS World Wide Server. At time of publication, the URL was ftp://crude2.kgs.ukans.edu/pub/wheat/datasets/brazil/brne24.zip .

Purpose

These portions of the Digital Chart of the World database were imported for several purposes: to aid natural resource exploitation and management in the Third World for basic needs development, to provide maps suitable for relief work in the Third World, and to provide example datasets for use with WHEAT. It is hoped that providing regional topographic maps in an easy-to-use format will facilitate groundwater exploration, agronomic planning, and the logistics of relief projects.

Data

Any errors in the original DCW data propagated into the quadrangle maps. Additional errors due to problems importing the files may have occurred. Polygons with more than 4096 points on their perimeters failed to build properly, but the topological data necessary to build them (polygon IDs of the bordering polygons) has been included in the databases as fields with names like DNAREA_AFT_IDTORIGHT and DNAREA_AFT_IDTOLEFT in the DRAINAGELINES table. Defective polygons are marked with a value of TRUE in column ISDEFECTIVE in the polygons table.

COORDINATES

For this map, the coordinate data are in the UTM24 system. The horizontal datum is the World Geodetic System 1984 (WGS84); the WGS84 ellipsoid corresponds to the Geodetic Reference System 80 (GRS80) ellipsoid. Feature locations are accurate to approximately 2 kilometers. As stated on the DMA's web site :

> Features: The absolute horizontal accuracy of the DCW for all features derived from Operational Navigation Charts (ONCs) is 2040 meters (6700 feet) rounded to the nearest 5 meters at 90% Circular Error (CE), World Geodetic System (WGS84). The accuracy of spot elevations collected from ONC source is 30 meters (100 feet). The accuracy requirements do not apply to feature symbols that are displaced as identified in MIL-STD-600001.
> (DMA's DCW page is http://164.214.2.53/publications/guides/dtf/dcw.html)

LAYERS

Most of the standard layers on a small-scale map are included in the databases. For almost all quadrangles, these includes borders, major hydrology, elevation contours and spot elevations, towns, major roads, airports, and major utility lines. Other layers are found only in some quadrangles. These include cultural landmarks, ocean features, physiography and land cover, and railroads. Which layer a particular feature is found in seems to be somewhat arbitrary: it is often necessary to examine several layers to find a feature.

Each layer may be split into as many as four different tables, based on geometric type. The geometric type is appended to the layer name to form the table name. Thus, areas in the borders coverage are found in the table BORDERSPOLYGONS, border lines and coastlines are found in BORDERSLINES, small ocean islands are found in BORDERSPOINTS, and border text can be found in BORDERS_TEXT_RAW.

In addition to the main data tables, there are "decoder" tables explaining the various type and status codes. These were left as separate tables to keep database size down and to permit easy translation.

Table 1 Layers in the Digital Chart of the World Quadrangles.

WHEAT Name	Description	DCW Name	DCW prefix
Borders	Shorelines, international borders, some intra-national borders	Political/Oceans	PO
Drainage	Major rivers and lakes	Drainage	DN
Drainage Supplemental	Small lakes and islands	Drainage Supplemental	DS
Contours	Elevation contours and spot elevations	Hypsography & Hypsography Supplemental	HY & HS
Towns	Towns, cities, and built-up areas	Populated Places	PP
Roads	Major roads	Roads	RD
Transportation Structures	Bridges, tunnels, and other such features	Transportation Structures	TS
Railroads	Major railroads	Railroads	RR
Utilities	Major utilities	Utilities	UT
Airports		Airports	AE
Cultural Landmarks		Cultural Landmarks	CL
Physiography	Cliffs, outcrops, bluffs, levees ...	Physiography	PH
LandCover	Special cover types like swamps, mines, oil fields ...	LandCover	LC
OceanFeatures	Reefs and shipwrecks	Ocean Features	OF

Suggestions for Further Processing

This set of databases consists of around 400 standard quadrangles that were imported in "batch" mode. No attempt was made to customize the databases, and many features that would be useful were left out in order to reduce size and decrease transmission times and costs. Accordingly, there are many modifications that you, the end user, should make to a database before using. Most of these can be performed easily if you have WHEAT, which is free , and Microsoft Access. It is necessary to learn the basics of table design and query design in MSAccess in order to perform most of these operations.

Activity	Purpose and Directions	Program
Add indexes	Although all the tables contain a field suitable for use as a primary key, most tables do not have a primary key defined. (The indexes were not added so as to reduce size and improve import speed.) In each table, find a field with a name that ends in _xFT_ID (where x can be A, L, P, or T) and make it the primary key	MSAccess
Project to UTM	The coordinates are usually Longitude-Latitude. Except at the Equator, a degree of longitude is a different size from a degree of latitude, so to get "correct" shapes and meaningful spatial queries, it is necessary to use some cartesian coordinate system for the map coordinates. Using WHTGCTP1 or one of the other WHEAT projection programs, convert coordinates to a cartesian coordinate system widely used in the area of interest. Choose a coordinate system that has tic marks or grid lines on commonly available maps. Usually, the best coordinate system will be UTM (Universal Transverse Mercator).	WHTGCTP1 or LLUTMN_
Eliminate duplicate points	The import process splices short chains together to form polygon perimeters, without eliminating duplicated points at the ends. Eliminating these saves space and reduces the risk of errors in distance calculations. CHNMASSG will automatically eliminate these duplicates for any XYChain field it processes.	CHNMASSG
Extract points for text	The DCW gives most text a shape line (curved line that the text should follow). WHEAT cannot use this. In order to display text, you should first convert the XYChains into loose points, and write a query that links the loose points to the text string. Then you can display the text using that query. It may help to eliminate all but the first point.	BLOB2PTS and MSAccess
Add themes	Because they don't occur in all quadrangles or were not of interest to the author, no themes were pre-defined for LandCover, Physiography, TransportationStructures, Utilities, xCulturalFeatures. Define new themes for them, if you want	EMAPKGS2 or THEMEDIT

Activity	Purpose and Directions	Program
Splice databases	Since field areas invariably cross quadrangle boundaries, no matter how big the field area or the quadrangle, you will probably want to splice two or more quadrangles together.	DBSplice *In progress*
Splice features	In the original DCW, features are cut at quadrangles boundaries. You can use the GLUTEN program to splice features together based on some field being identical.	GLUTEN *In progress*
Find centroids of polygons	It is often useful to label polygons, which requires a point location. CHNMASSG can calculate centroids of polygons. You can also calculate the area, perimeter, and a boundbox of the XYChain using CHNMASSG.	CHNMASSG
Repair damaged polygons	Some polygons failed to build properly, but the topological data necessary to build them (polygon IDs of the bordering polygons) has been included in the databases as fields with names like DNAREA_AFT_IDToRight. You can (somehow) splice these together. It is probably best to identify a series of XYChains to splice together using interactive spatial queries in EMAPKGS2 then use GLUTEN to splice them together.	EMAPKGS2, MSAccess, and GLUTEN
Eliminate queries that don't return results	Sometimes, there are no features in a particular Layer-GeometricType combination, even though a query to retrieve them and possibly a theme are defined. Using MSAccess, open each query, and if it returns an empty result set or causes an error, delete it. Delete any themes based on a bad query.	MSAccess

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Magnifying a 1:1,000,000 map to 1:100,000 increases its size, not its data content or accuracy. Do not be surprised by horizontal mis-locations of the order of several kilometers, particularly for features of military significance.

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