Grids & Datums

DOMINICAN REPUBLIC

by Clifford J. Mugnier, C.P., C.M.S.

Visited by Christopher Columbus in 1492, the island of Hispaniola became the center of Spanish rule in the West Indies. The native Indians were expatriated by the Spaniards and were then replaced by African slaves. The western part of the island was occupied by buccaneers in the 17th century and was ceded to France in 1697 (St. Domingue, now Haïti), while the eastern part remained under Spanish rule (Santo Domingo). Eventually the entire island came to be ruled by Haitian President Jean-Pierre Boyer from 1822 until the eastern two-thirds revolted and formed the Dominican Republic in 1844. The latest constitution was adopted in 1966.

The area of the Dominican Republic is slightly more than twice the size of New Hampshire. The coastline is 1,288 km long, and its only land boundary is with Haïti (275 km). The terrain is comprised of rugged highlands and mountains interspersed with fertile valleys. The lowest point is Lago Enriquillo (–46 m), and the highest point is Pico Duarte (3,175 m).

The first map of Santo Domingo, Hispaniola was compiled by Columbus in 1492. Around 1500 Juan de la Cosa mapped the entire island. Hydrographic surveys were conducted by the French Hydrographer Francés Amedee-Francais Frezier from 1719-1725. The first medium scale map was by Sir Robert Schomburgh in 1858; the second was prepared by General Casimiro N. de Noya in 1906, and it was revised in 1921. The Second Brigade of the U.S. Marine Corps mapped the country in 1922 based on prior surveys performed by the U.S. Geological Survey from 1919-1921. The third comprehensive map of the Dominican Republic was compiled by Ing. Casimiro Gómez, and it was published by the Rand McNally Company in 1938. In 1940 the *Instituto Geográfico y Geológico de la Universidad de Santo Domingo* was formed. Later reorganized as the *Instituto Cartografico Universitario*, a joint agreement was signed in 1946 with the Latin American branch of the U.S. Army Map Service, the Inter American Geodetic Survey (IAGS). Although the initial Astro station was observed at Samaná Fort, the IAGS carried the North American Datum of 1927 into the island of Hispaniola through a classical triangulation chain that eventually spanned the entire West Indies. The Samaná Fort Datum is likely the same as the North American Datum of 1927, and the reference ellipsoid is the Clarke 1866 where $a = 6,378,206.4$ m, and $1/f = 294.9786982$.

When the IAGS established First Order triangulation stations in the nations of the Caribbean and Latin America, they also developed plane coordinate systems as a service to the cadastral surveyors of each nation. The system devised for the Dominican Republic was based on the same rationale that the U.S. Coast & Geodetic Survey used for the State Plane Coordinate Systems of the United States. The rule of thumb was that for regions that are predominately north-south in extent; the Transverse Mercator projection was used. For regions that are predominately east-west in extent, as is the Dominican Republic, the Lambert Conformal Conic projection was used. Furthermore, to facilitate computations by cadastral surveyors, the maximum scale factor for a zone was designed to be better than 1 part in 10,000. The excellent system developed by the IAGS for the Dominican Republic has a maximum scale factor of 1 part in 11,238 for the entire country! The Lambert Conformal Conic for the Dominican Republic is defined by the following parameters: Central Meridian, $\lambda_o = 71°\ 30'$ West, Latitude of Origin, $\varphi_o = 18°\ 49'$ North, Scale Factor at Origin, $m_o = 0.999911020$, False Northing = 277,063.657 m, False Easting = 500 km. The NIMA now obsolete TR 8350.2 document gives the 3-parameter datum shift for the Caribbean from NAD27 to WGS84 as: $\Delta X = -3$ m ± 3 m, $\Delta Y = +142$ m ± 9 m, and $\Delta Z = +183$ m ± 12 m, and is based on 15 stations as of 1991.

In 1996, the U.S. National Geodetic Survey performed a GPS survey of the Dominican Republic. One of the points published by NGS was of an existing mark at the Naval Academy in Santo Domingo Province where: $\varphi = 18°\ 28'\ 02.92622"$, $\lambda_o = 69°\ 52'\ 32.11417"$ West of Greenwich, and $h = -16.537$ m, and these coordinates are on the North American Datum of 1983. Sometime since then, the Dominican Republic has published a document, "Coordenadas de la Red de Estaciones Permanentes," "Coordinates of the Network of Permanent Stations." The document details the coordinates of 262 points with one duplicate labeled as NAD27 and ITRF 2000 along with a 7-parameter transformation shown on a separate page. I was quite impressed with such a detailed document until I compared coordinates of a common point between the NGS publication and the Dominican publication. The NGS coordinates for the "Naval Academy" on the NAD83 **are identical** to the Dominican coordinates for "Academia" that are labeled "NAD27." The latitudes and longitudes for the points incorrectly listed as NAD27 are shown in degrees-minutes-seconds. The latitudes and longitudes for the points listed as ITRF are shown in decimal degrees, but in fact are "packed" degrees-minutes-seconds! I tried transformation solutions between 8 of the points listed with extended precision to see if I could make sense of what column represented what datum and what ellipsoid. Nothing matched the published 7 parameters of the Dominican government! Regardless of which set of coordinates I used for either the GRS80 ellipsoid or the Clarke 1866 ellipsoid, 3-parameter solutions and 7-parameter solutions never matched (closer than 100+ meters) to what is published, whatever it is. Until some clarification is issued by the Dominican government, users are cautioned against using the published Trig List and Datum Shift parameters. I recommend using the obsolete NIMA values; at least the user will be within a few feet of the truth.

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