Grids & Datums

REPUBLIC OF CHILE

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Originally inhabited by the Araucanians, the northern part of Chile was conquered by the Incas during the 15th century, *A.D.* The Spanish Conquistador, Diego de Almagro invaded in 1536-37, and Pedro de Valdivia began the settlement of Santiago in 1541 under the viceroyalty of Peru. The independence of Chile was assured by the victory of the soldier and statesman Jose de San Martín at Maipo in 1818, thanks to *Webster's New Geographical Dictionary.* According to the *CIA World Factbook*, Chile is slightly smaller than twice the size of Montana, it is bordered by Argentina (5,150 km) (*PE&RS*, December 1999), Bolivia (861 km) (*PE&RS*, July 2001), Peru (160 km) (*PE&RS*, May 2006), and on the west by the South Pacific Ocean (6,435 km). The lowest point is the Pacific Ocean (0 m), and the highest point is Cerro Aconcagua (6,962 m). Chile has low coastal mountains with a fertile central valley and the rugged Andes in the east; the climate is temperate with desert in the north and is cool and damp in the south. Chile also claims Easter Island (Isla de Pascua) and Isla Sala y Gomez.

In 1881, the Army General Staff was reorganized and the Army Geographic Service (*Servicio del Ejercito Geográfico*) was created. Surveys and 1:25,000 scale planetable mapping commenced in 1891 with the establishment of the *Oficina Geográfica*. A variety of ellipsoids have been employed in the Republic of Chile, the original one used by the Army was the Bessel 1841 where: a = 6,377, 397.155 m and $1/f$ = 299.1528128. The northern part of Chile that includes Iquique, Tocopilla, and Antofagasta comprises the *Region Salitrera* or Saltpeter Region where historically nitrates have been mined. Originally won by conquest from Bolivia and Peru, the classical triangulation in that northern region was computed on the Clarke 1866 ellipsoid where a = 6,378,206.4 m, and b = 6,356,583.8 m. The fundamental origin point was at the now destroyed astronomical observatory of Cerro Santa Lucía. The Catastro Salitrero Transverse Mercator (Gauss- Krüger) grid had a Central Meridian (λ_o) = 69° 38' 46.52" West of Greenwich, a Scale Factor at Origin (m_o) = unity, a False Northing Latitude of Origin (φ_{FN}) = 20° 37' 15.05" South, a False Easting = nil, and a False Northing = 1,420,472.60 m. (The grid origin was not at the old observatory of Cerro Santa Lucía and specifically at "Pilar de Pintado," but at the 1st order triangulation station of the net.) The azimuth from Pintados to Noria was: a_o = 323° 58' 15.18" reckoned from the North. According to a memo to the U.S. Army Map Service and the Inter-American Geodetic Survey in 1952 from Col. Rodolfo Concha Muñoz, "the observations were made in Iquique and a geodetic connection was made between Iquique and Pintados-Astronómico." The chain of triangulation figures span latitudes from 18° S to 26° S, and curiously were published on the Normal Mercator projection, according to an *Instituto Geografico Militar* report to the International Union of Geodesy and Geophysics in September of 1936. Chile south of 26° S was published on the Gauss-Krüger Transverse Mercator projection and was referenced to the International 1924 ellipsoid where a = 6,378,388 m and $1/f$ = 297. The old triangulation of Chile was based on an origin point at the (now destroyed) old astronomical observatory of Santiago at Quinta Normal. The IGM Gauss-Krüger Transverse Mercator projection, reported to have been used from 1858 to 1924 on the Bessel 1841 ellipsoid, had a Central Meridian (λ_o) = 70° 41' 16.894" West of Greenwich, a Scale Factor at Origin (m_o) = unity, a False Northing Latitude of Origin (φ_{FN}) = 33° 26' 42.453" South, and a False Easting and False Northing = nil. This grid origin, I believe, corresponds to Quinta Normal. A revised fundamental point of origin at the Reppsol transit telescope was later constructed a few meters away from the old origin point.

Using a grid system adopted in 1924, the Chilean IGM TM Belts 1-3 referenced to the International 1924 ellipsoid had for Belt 1: λ_o = 69° W, False Easting (FE) = 1,500 km, Belt 2: λ_o = 72°W, (FE) = 2,500 km, and Belt 3: Belt 2: λ_o = 75° W, (FE) = 3,500 km.

Lt. Col. Mario Ugarte Olea, technical deputy director of IGM, sent a detailed letter to me on 09 July 1982 in which he detailed operational military mapping of his nation. For 1:50,000 scale mapping, the Provisional South American Datum of 1956 with origin at La Canoa, Venezuela was used for Chilean mapping between the latitudes of 17° 30' S and 43° 30' S. Note that the origin point at La Canoa, Anzoátegui Province, Venezuela is where Φ_o = 08° 34' 17.170" North, Λ_o = –63° 51' 34.880" West of Greenwich, and the defining azimuth to station Pozo Hondo (a_o) = 40° 22' 45.96". Note that the PSAD56 position of "Pilar de Pintado" (Cerro Santa Lucía as listed above) is: φ = 20° 37' 33.092" South, λ = 69° 39' 21.807" West of Greenwich, thanks to John W. Hager in a note to me on 01 July 1982.

From the latitudes of 43° 30' S and 56° 00' S, the South American Datum of 1969 was used where the origin at station Chua is Φ_o = –19° 45' 41.6527" South, Λ_o = –48° 06' 04.0639" West of Greenwich. Other scales of mapping compiled by IGM were reported to be referenced to the UTM grid and the coverage was based on the same basic latitudinal divisions for classical geodetic datums.

The SIRGAS project is a continental effort to convert all local South American datums to the WGS84 Datum. Originally conceived and spearheaded by Dr. Muneendra Kumar, now retired as the Chief Geodesist of DMA/NIMA/NGA, this system of observations and adjustments will eventually bring the entire continent of South America into a unified coordinate reference system. Chile is an active participant in this international project, and transformation parameters will likely be publicly available within the next few years.

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