Republic of Iceland

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

Iceland’s first inhabitants were Irish monks who regarded the island as a hermitage until the early 9th century. “Lyoveldio Island” was permanently settled mainly by Norwegians and by some British Isles Vikings in 874 AD. The National Assembly or “Althing,” was the world’s first parliamentary system in 930. Christianity was adopted (under threat of sword!) in 999, and Iceland united with Norway in 1262. Leif Eiriksson was born in Iceland, and he sailed from Greenland to become the first European to reach North America (Vinland the Good) in 1000. In 1380, Iceland united with Denmark, and by Act of Union in 1918, became an independent kingdom in personal union with Denmark. Iceland became a constitutional republic and independent from Denmark on 17 June 1944.

The terrain is mostly plateau interspersed with mountain peaks and ice fields. The coast is deeply indented by bays and fiords. With a coastline of 4,988 km, the highest point is Hvannadalshnúkur (2,119 m). The land area of Iceland is slightly smaller than Kentucky. The maritime claim is 200 nautical miles or to the edge of the continentalmargin, and the territorial sea claim is 12 nautical miles. Iceland’s maritime claims use the “straight baseline system,” which are ellipsoidal loxodromes (rhumb lines) that connect 31 points on the coastline perimeter.

According to the National Land Survey of Iceland or Landmælingar Íslands (LMÍ), “It is believed that Guðbrandur Þorláksson, the bishop at Hólar, was the first Icelander to be involved in mapmaking. Guðbrandur lived from 1541 to 1627 and measured the global position of Hólar with amazing precision. A map named after him was published in 1590.

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noticed that one reference published by LMÍ includes a Danish paper authored by another Buchwaldt in 1976.) The datum shift parameters (in standard military “3-parameter Molodensky” form) from the Reykjavik Datum of 1900 to the WGS 84 Datum are: \[ \Delta \phi = -0.0000195, \Delta \lambda = -636 \text{ m,} \]
\[ \Delta Y = +21 \text{ m,} \Delta Z = -934 \text{ m.} \]
An official notice states, “All maps on a scale of 1:100,000 published by Landmælingar Islands are currently provided in Reykjavik 1900 datum. In the available map scales Reykjavik 1900 differs significantly from WGS84. … In case of the 1:50,000 map scale the available maps are provided in two different series first published before and after 1955. For those published after 1955 the horizontal datum is Hjörsey55 as indicated in the map legend. For those published before this threshold the phrase Horizontal Datum is based on the Astronomic Station of Reykjavik: 21°55’51.15" West of Greenwich, 64°08’31.88" indicates the Reykjavik 1900 datum. For a variety of technical reasons it is impossible to obtain transformation parameters with high accuracy and nationwide validity. However, for navigational purposes (e.g. hiking) a set of transformation parameters has been derived from graphical comparisons. Although they proofed (sic) to be useful for orientation with the LMÍ maps they do NOT provide geodetic accuracy! In average, from WGS84 towards Reykjavik 1900, a point requires a horizontal shift of approx. 200m westwards resp. 25m southwards (±25m).”

The same document that originally listed the Reykjavík Datum of 1900 included another, the Akureyri Datum of 1900. Thanks to John W. Hager: “For Akureyri I have latitude (\(\phi\)) = 65° 40’ 15.2" N ±0.2" or 15.8" N ±0.1” and longitude (\(\lambda\)) = 18° 05’ 12.6’’ W ±09.0” … I was in Akureyri earlier this year and tried, using my GPS, to locate the position but was not able to do so. Time was very limited. Suspect that the point is in the area of the botanical gardens and the hospital.” Although this apparent “astro” station represents an obsolete local datum, the U.S. Army Map Service (AMS) noticed that several 1:100,000 scale maps in the region of the town of Akureyri “did not agree with the control values by several seconds (of arc – Ed.).” This notation was dated 20 December 1946 by William W. Baird, AMS.

When Denmark was occupied during WWII, Iceland petitioned for independence. That was granted in 1944 as mentioned above, and the United Kingdom and the United States subsequently moved in because of wartime concern for the island’s vulnerability. An interim datum was computed apparently for cartometric purposes and is locally termed the Reykjavik 1945 datum referenced to the Hayford 1909 (International 1924) ellipsoid. In 1955, a new classical triangulation and
A geodetic survey was initiated by Denmark and the United States. The following year, the LMÍ was founded. The new survey established the Hjörsey Datum of 1955 where: $\Phi_o = 64^\circ 31' 29.26"$ N and $\Lambda_o = 22^\circ 22' 05.84"$ West of Greenwich and the ellipsoid of reference is the Hayford 1909 (International 1924) where: $a = 6,378,388$ m and $1/f = 297$.

The grid system devised by AMS for the new datum was the Icelandic Gauss-Krüger Transverse Mercator with four belts (1-4) where the central meridians, $\lambda_o = 15^\circ W$, $18^\circ W$, $21^\circ W$, and $24^\circ W$, the scale factor at origin, $m_o = 1.0$, and the False Easting of each belt = 500 km. However, it appears that LMÍ ignored the Transverse Mercator devised by AMS and instead utilized another Lambert Conformal Conic zone where: the latitude of origin, $\phi_o = 65^\circ 00' N$, the central meridian, $\lambda_o = 18^\circ$ West of Greenwich, and the scale factor at origin, $m_o = 1.0$ (another tangent conic), and the False Easting = False Northing = 500 km. The datum shift parameters published by NGA in TR8350.2 from the Hjörsey Datum of 1955 to the WGS 84 Datum are: $\Delta a = –251$ m, $\Delta f = –0.14192702$, $\Delta X = –73 m \pm 3 m$, $\Delta Y = +46 m \pm 3 m$, $\Delta Z = –86 m \pm 6 m$, and this solution is based on 6 points. A 7-parameter Bursa-Wolfe transformation published by LMÍ from the Reykjavik Datum of 1900 to the Hjörsey Datum of 1955 (rotations changed to the U.S. Standard – Ed.) is where: $\Delta X = +629.920$ m, $\Delta Y = +74.710$ m, $\Delta Z = +1028.364$ m, $R_x = –4.154'$, $R_y = +0.269'$, $R_z = +2.279'$, $\Delta s = –3.729.$

A geodetic surveying campaign was carried out by "Icelandic and German agencies for the purpose of establishing a new horizontal geodetic datum in Iceland. The work culminated in a GPS-campaign named ISNET93 during 3-13 August 1993. The associated new geodetic datum is named ISN93. It will replace the Hjörsey-1955 datum established by terrestrial observations in 1955-56." (GPS-mælingar í grunnstöðvanet 1993). A 7-parameter Bursa-Wolfe transformation published by LMÍ from the Reykjavik Datum of 1900 to the ISN93 (rotations changed to the U.S. Standard – Ed.) is where: $\Delta X = +556.020$ m, $\Delta Y = –168.701$ m, $\Delta Z = +942.364$ m, $R_x = –4.154'$, $R_y = +0.269'$, $R_z = +2.279'$, $\Delta s = –3.729$, and the ellipsoid of reference is the GRS 1980 where $a = 6,378,137$ m, and $1/f = 298.257222101$. LMÍ does offer a free interactive coordinate transformation service (cocodati) through the Internet. The new grid system adopted is the secant Lambert Conformal Conic projection with standard parallels $65^\circ 45' N$ and $64^\circ 15' N$, and central meridian $19^\circ W$. False Eastings = False Northings = 500 km at $65^\circ N$ and $19^\circ W$. The GPS network consists of 119 stations, of which 63 are pillars and the remainder are benchmarks in bedrock. Thanks to Gunnar Porbergsson for his historical accounts of the Icelandic datum relations recorded in exquisite detail.

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