

# Grids & Datums

## REPUBLIC OF MALAWI

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"Hominid remains and stone implements have been identified in Malawi dating back more than 1 million years, and early humans inhabited the vicinity of Lake Malawi 50,000 to 60,000 years ago. Human remains at a site dated about 8000 BC show physical characteristics similar to peoples living today in the Horn of Africa. At another site, dated 1500 BC, the remains possess features resembling Negro and Bushman people. Malawi derives its name from the Maravi, a Bantu people who came from the southern Congo about 600 years ago. On reaching the area north of Lake Malawi, the Maravi divided. One branch, the ancestors of the present-day Chewas, moved south to the west bank of the lake. The other, the ancestors of the Nyanjas, moved down the east bank to the southern part of the country. By AD 1500, the two divisions of the tribe had established a kingdom stretching from north of the present-day city of Nkhonkhotakota to the Zambezi River in the south, and from Lake Malawi in the east, to the Luangwa River in Zambia in the west. Migrations and tribal conflicts precluded the formation of a cohesive Malawian society until the turn of the 20<sup>th</sup> century. In more recent years, ethnic and tribal distinctions have diminished. Regional distinctions and rivalries, however, persist. Despite some clear differences, no significant friction currently exists between tribal groups, and the concept of a Malawian nationality has begun to take hold. Predominately a rural people, Malawians are generally conservative and traditionally nonviolent. Although the Portuguese reached the area in the 16<sup>th</sup> century, the first significant Western contact was the arrival of David Livingstone along the shore of Lake Malawi in 1859.

Subsequently, Scottish Presbyterian churches established missions in Malawi. One of their objectives was to end the slave trade to the Persian Gulf that continued to the end of the 19<sup>th</sup> century. In 1878, a number of traders, mostly from Glasgow, formed the African Lakes Company to supply goods and services to the missionaries. Other missionaries, traders, hunters, and planters soon followed. In 1883, a consul of the British Government was accredited to the 'Kings and Chiefs of Central Africa,' and in 1891, the British established the Nyasaland Protectorate (Nyasaland is the Yao word for "lake"). Although the British remained in control during the first half of the 1900s, this period was marked by a number of unsuccessful Malawian attempts to obtain independence. A growing European and U.S.-educated African elite became increasingly vocal and politically active -- first through associations, and after 1944, through the Nyasaland African Congress (NAC). A new constitution took effect in May 1963, providing for virtually complete internal self-government. The Federation of

Rhodesia and Nyasaland was dissolved on December 31, 1963, and Malawi became a fully independent member of the Commonwealth (formerly the British Commonwealth) on July 6, 1964" (*Dept. of State Background Notes, 2011*).

Bordered by Moçambique (1,569 km) (*PE&RS, September 1999*), Tanzania (475 km) (*PE&RS, February 2008*), and Zambia (837 km) (*PE&RS, October 2004*), the terrain consists of narrow elongated plateau with rolling plains, rounded hills, and some mountains. The lowest point is at the junction of the Shire River and the international boundary with Moçambique (37 m), and the highest point is Sapatwa (*Mount Mlanje*) (3,002 m) (*World Factbook, 2011*).

"The South African network formed a gridiron system of triangles arranged in eight circuits. From 1906 to 1907, Captain Gordon surveyed a gap of 2 degrees in the Arc, between Simms's chain in Southern Rhodesia and the newly completed triangulation in the Transvaal. The Transvaal triangulation was joined at points Pont and Dogola, and Simms's chain was connected at Standaus and Wedza. In the meantime, thanks to Gill's further effort, funds were obtained to continue Simms's chain northwards. Between 1903 and 1906, Dr Rubin carried out this work (Gill, 1933). The large difficulties, experienced by Rubin's party, were similar to that of Simms's: problems with haze and light, strong winds, lack of roads, transport and labor. In spite of these problems, Rubin managed to extend the chain

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of triangulation for almost 800 km; from Manyangau, in Southern Rhodesia, to Mpange, in Northern Rhodesia (now Zambia). When Sir David Gill retired, in 1907, the Geodetic Survey of South Africa was completed, and the Arc of the 30<sup>th</sup> Meridian extended from the Cape to the southern shores of Lake Tanganyika. Between 1908 and 1909, a section of 2 degrees in amplitude was measured in Uganda: from the Semliki baseline, at latitude 1° North, across the Equator, to latitude 1° South. The work on the southern portion of the Arc was resumed only in 1931, when Major Hotine, picked up Rubin's points in Northern Rhodesia and, in 1933, brought the triangulation, through Tanganyika (now Tanzania), up to Urundi (now Burundi). Later, the Tanganyika's Survey Division continued the survey of the 400 km of the Arc (Rowe, 1938), between Kigoma and Uganda, across Urundi and Ruanda (now Rwanda). Since 1937, the Arc extended from the Cape to the Equator" (*Arc of the 30th Meridian, Tomasz Zakiewicz, Cairo, Egypt, April 16-21, 2005*). The Arc of the 30<sup>th</sup> Meridian is referenced

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to the Cape Datum of 1950 where the astronomic coordinates of the initial point of the Cape Datum near Port Elizabeth are for Buffelsfontein where  $\Phi_o = 33^\circ 59' 32.000''$  S and  $\Lambda_o = 25^\circ 30' 44.622''$  E. The ellipsoid of reference is the Clarke 1880 where  $a = 6,378,249.145$  m and  $1/f = 293.4663077$ .

The Moçambique – Malawi boundary is 1,569 km in length and is demarcated. It traverses Lake Nyasa for about 205 miles including lines around Likoma Island and Chisumulu Island, which are part of Malawi. Southward from Lake Nyasa to the Malosa River, the boundary extends along straight-line segments for 312 km passing through both Lake Chiuta and Lake Chilwa. It follows consecutively the thalwegs of the Malosa, Ruo, and Shire rivers downstream for 240 km. The boundary then continues northwestward to the Zambia tripoint utilizing features along the Shire-Zambezi and the Lake Nyasa-Zambezi drainage divides for most of the remainder of the distance.

The largest classical horizontal geodetic datum of Moçambique is the Tete Datum of 1960. Its origin is at the station at the NW Tete Baseline (MGM 799) where:  $\Phi_o = 16^\circ 09' 03.058''$  S,  $\Lambda_o = 33^\circ 33' 51.300''$  E. The reference azimuth to station Caroeira (MGM 40),  $\alpha_o = 355^\circ 50' 21.07''$  from south, and  $H_o = 132.63$  meters. The southern third of Malawi is covered by the Tete Datum chain of quadrilaterals. In 1995, a comprehensive adjustment of the entire geodetic network of Moçambique was initiated by Norway Mapping in collaboration with the

government. The project was concluded in January of 1998, and the result was a 32-point constrained adjustment of 759 two-dimensional triangulation points throughout the country and the designation of a new datum called MOZNET/ITRF94, compatible with the WGS84 Datum. A 7-parameter Bursa-Wolf transformation was developed, but the national model yields residual errors as high as 30 meters. Four “regional” models were developed, but these accuracies vary between 1 to 10 meters, depending on the “region.” The MOZNET 98 adjusted coordinates of Base Tete NW are  $\phi = 16^\circ 09' 07.0480''$  S,  $\lambda = 33^\circ 33' 49.7778''$  E.

The parameters published by DMA/NIMA for the Malawi Arc 1950 Datum to WGS84 are:  $\Delta X = -161$  m  $\pm 9$  m,  $\Delta Y = -73$  m  $\pm 24$  m,  $\Delta Z = -317$  m  $\pm 8$  m.



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