Geodesy has long been a specialist field. It was first of all used to understand the Earth’s shape and dimensions, then to position ourselves in the best way possible on the Earth’s surface.

But while rich countries started to create networks that enabled them to position points homogeneously across their entire territory down to the nearest decimetre, African countries remained with just a few astronomical points the accuracy of which could only be counted in decametres for many years.

As André Nonguiéma, SIG expert for the United Nations Economic Commission for Africa, says: “The heterogeneity of technical approaches used by the various countries was a real hurdle in terms of the need for analysis and regional planning. It was therefore essential to rapidly obtain a good model for global representation of the Earth’s surface which would allow us to clearly describe the geometric shape of objects as well as reference altitudes for the planet’s surface.”

The AFREF (African Geodetic Reference Framework) was created in 2002 as part of the GGRF (Global and National Geodetic Reference Frames), a worldwide project that aims to create between now and 2030 a common geodetic reference frame that can be used by all the countries in Africa. In its present form, the AFREF project consists of a network of permanent global navigation satellite systems (GNSS), spread over the whole continent so that any potential user is always within 1,000km of the nearest reference station.

But the countries’ need for a transnational reference frame has become even more evident in recent years with the creation of regional project funders who are looking to open up access to certain countries and improve the mobility of goods and people between different African countries; also factors are the adoption of the Programme for Infrastructure Development in Africa (PIDA) and a call from the African Union of African States to delimit their borders between now and 2017.

IGN FI’s geodetic expert Cyril Romieu looks back over the various technical advancements that have made the AFREF project possible. “It is of course the introduction of the first satellite positioning systems in the 1970s followed by the GPS system at the end of the 80s which will enable the creation of reference systems (mainly geographical institutes and mapping agencies) technically possible and more financially accessible. Modern GNSS technology now allows access to any national reference via several means: materialised networks using terminals, permanent GNSS stations distributing data via internet, PPP (Precise Point Positioning) type positioning.

“However, the technological progress made in topography varies widely from one African country to another, more than on any other continent. It is therefore crucial to ensure that a national reference system is accessible not only by the most advanced users with GNSS receivers in real-time GSM mode, for example, but also for those still using traditional angular measurement techniques and an optical method.”

Access to a national reference system should then be possible via either networks with a density that varies according to the location (very dense in urban areas to allow single access for all users, much
The importance of geodesy in the development of the African continent has now been taken into account and a few countries have moved ahead with their work on the subject. This is the case for Senegal, for example, a country that started taking advantage of the project to update its 1:200,000 scale national maps right from the beginning of the 2000s, with the objective of harmonising its national geodetic network.
the Senegalese Reference Network. This consists of 20 new fundamental points spread country-wide, as well as 17 old geodetic points recalculate using Circé.

The Government of Cameroon has more recently made the renewal of its national geodetic network a priority within its action plan for the 2010/2020 period and as part of a vast project covering land reform and modernisation of its cadastral plans. The country has invested in the update of its national geodetic reference network.

Until now, Cameroon only possessed local networks in each town that were neither inter-linked nor unified nationally. This meant that the existing networks were incompatible with modern positioning networks and, in particular, with GPS. Cameroon’s Ministry of Land Affairs led the project to implement a national geodetic network in 2011. Some other countries, such as Sudan along the Nile Valley, had created more local networks. At the same time, they have ensured they are compatible with international networks so as to be able to widen and modernise their networks in the future without modifying their references. A geoid model with an accuracy of 100km along the Nile valley was also created in such a way that it could be easily and coherently integrated into a sub-regional or sub-continental model at a later date.

Progress so far

Although implementation of the AFREF was a little slow at the beginning, progress on the project has been regular and noticeable since 2006 – there were 65 international GNSS service stations by the end of last year, compared to just 15 stations in 2005. However, raising the awareness of politicians and funders as to the importance of using geodetics remains difficult and is a subject at the heart of the problems faced by an emerging African continent: planning land-use, the land sector, mining, environment, agriculture, climatic changes, sustainable development and so on.

Raising awareness is more important than ever, as the benefits of having implemented a geodetic reference system will be crucial for the African continent: improving demarcation of border limits and in particular helping African states to come to a credible compromise, improving cooperation and cross-border connections, the possibility of accessing accurate spatial information alongside numerous other preoccupations such as the environment, climatic change, land tenure, aerial navigation and even national defence.

THE BENEFITS OF HAVING IMPLEMENTED A GEODETIC REFERENCE SYSTEM WILL BE CRUCIAL FOR THE AFRICAN CONTINENT

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