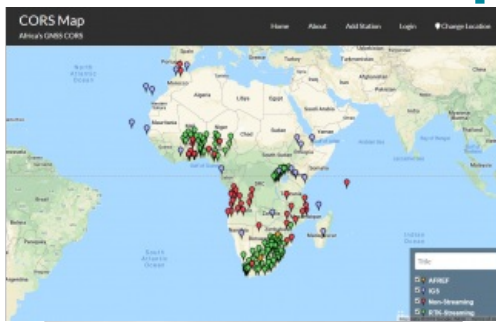


A TRUE REFLECTION OF INTERNATIONAL COOPERATION BETWEEN GEOSPATIAL PROFESSIONALS

Developing a Fully Fledged CORS Map for Africa

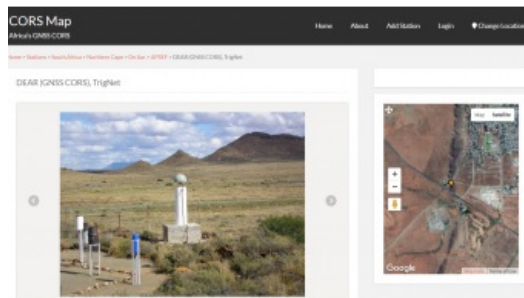


Continuously operating reference stations (CORS) are permanent GNSS stations that log and disseminate GNSS observations continuously to meet various user needs. CORS networks have been going up all over the world in the last decade to help establish geodetic reference frames, monitor tectonic movement as well as helping surveyors to do real-time positioning. This article zooms in on Corsmap, an initiative that was founded by three geomatic professionals to be a one-stop shop for all CORS installations in Africa.

There are many online maps that provide information about CORS networks in Europe, North America and the Australasian region. For instance the US National Geodetic Survey maintains a CORS map of all the permanent GNSS

stations in North America and a few other selected countries. When it comes to Africa, however, the situation is vastly different. Some information is available from the International GNSS Service (IGS), the African Geodetic Reference Frame (AFREF) and Space and Earth Geodetic Analysis Laboratory (SEGAL) maps, but these maps are mainly focused on scientific applications and, as such, do not provide a full picture of what is out there. Moreover, there is a deplorable dearth of metadata concerning CORS installations. Most of the time it is simply a point on the map.

 Africa's GNSS CORS.



It is difficult to find a single database that offers information about all the CORS installations in Africa. It is an uphill task to begin with to have such a database given the vast number of private, public or institutional CORS providers. However, a centralised database is paramount so as to avoid a patchwork of online maps of these key installations.

Crowdsourcing

Crowdsourcing could be a powerful tool towards this end. This is what the founders of Corsmap are trying to achieve by mapping all the CORS installations on the African continent. Corsmap is not just about providing information about all the permanent GNSS stations in Africa; it is also about enriching the experience by giving the user as much information as possible concerning a particular GNSS installation.

Some of the Corsmap features include:

- Numerous ways of discovering station information quickly, such as pinpointing a location with a cursor or searching by keywords
- Easy and simple ways to add or edit station information for users

- Ensuring a lot of metadata is displayed once a location has been pinpointed (e.g. base station provider contacts, website, information on RTK and RINEX, photo of the base station and its background, etc.)
- A station detail page giving a brief introduction about a particular base station
- Zoomable pinpoint locations which can be zoomed to street level
- A community forum which enables users to register and add station information.



GNSS CORS station with a Trimble antenna.

Whilst providing a lot of metadata, what the map does not provide is coordinates of the stations and access to the data. Instead, the map points the user to the base station provider, where this information can be obtained.

So far, Corsmap has been able to crowdsource data for 180 CORS installations in 25 countries including South Africa, Angola, Mozambique, Rwanda, Uganda, Kenya, Ghana, Nigeria, Benin, Burkina Faso and more. However, contacts have only been made with custodians in four of these countries, namely South Africa, Ghana, Mozambique and Uganda. This means that the information from the other 21 countries has been sourced by the Corsmap founders themselves from other online maps and RINEX repositories, but the information has not been verified and controlled by the people on the ground. The Corsmap team is keen to encourage all African countries to provide the missing or unverified CORS information to help them update the map for the public good.

Many countries such as Botswana, Namibia, Egypt, Tunisia, Algeria, Ethiopia and Ivory Coast remain unmapped. In some cases the language barrier poses a problem, although most of the time the lack of response from contacts seems to be the biggest challenge.



Most surveyors in Africa use base and rover setups when doing their RTK surveys.

Fair share of lemons

Populating Corsmap has not been an easy task. The founders have faced a lot of challenges: many e-mails have gone unanswered, many calls not taken, many LinkedIn requests ignored, but the few positive responses have been worth every effort by the Corsmap team. It has been a stark reminder that good things come with their fair share of lemons.

Despite the lemons which have been used to make lemonade, there have been some amusing moments as well, such as one user who claimed to have base station information for a particular country, only for him to provide the team with a link to their own Corsmap website. This particular incident was not only comical, but also reaffirmed the dearth of CORS base station installations in Africa.

Uploading the base station data

Since the base station data as currently constituted has been obtained by the founders themselves, there is an undisputed need for maintenance and keeping the information current and relevant. Corsmap therefore depends on a network of trustworthy and reliable people to critique the information already provided. Data integrity is key. It is better to provide limited yet accurate base station information than to have a flood of information that is not factual and truthful.



CORS station Sofala in Mozambique.

Looking ahead, it is the Corsmap team's dream to have such a network of dependable people uploading the base station data themselves. This will be a true reflection of international cooperation between geospatial professionals. Interestingly, perhaps, the Corsmap founders have created the online map without actually ever having met face to face. Clement is based in California (USA), Eldar in Australia and Derrick in Kenya. Their conversation started on LinkedIn, and the online map is the product of extensive e-mail correspondence and Skype meetings, mostly at odd hours of the day.

Precision agriculture

Permanent GNSS stations can open up a world of opportunities in many sectors. Since African economies are mainly agriculturally based, the mass adoption of precision agriculture would increase the output tremendously. Machine control is another industry waiting to be unravelled in Africa. These industries are reliant on CORS installations providing GNSS observables to their machines.

Most surveyors in Africa use base and rover setups when doing their RTK surveys. This means the initial cost of equipment is high should a surveyor think of becoming an independent contractor. If more of these CORS installations were known and, in the case of a lack of CORS, could be speedily installed, the initial cost of acquiring geodetic GPS would be halved.

Datum realisation

Last but not least, datum realisation is of paramount importance and CORS networks help to provide that. Each country in Africa needs to have at least one high order station providing data continuously to the African Geodetic Reference Frame (AFREF) in order to have a unified reference frame for the continent. This has been a continuous challenge since the beginning of the AFREF project and one where Corsmap can potentially help in identifying the gaps.

As the Corsmap team continue to map permanent GNSS stations in Africa, their eyes are set on building a central database of CORS stations for the global community: a database that is people centred since crowdsourcing is a permanent cog in its wheel. It is a journey that has begun and will hopefully have a happy ending. If you would like to be part of the narrative, join the Corsmap community forum.

For more information visit www.corsmap.com.



CORE station in De Aar, Northern Cape, South Africa.