IGS GPS Developments in Southern Africa
Southern regional network of the African Reference Frame (AFREF)

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Can Africa time be real-time?

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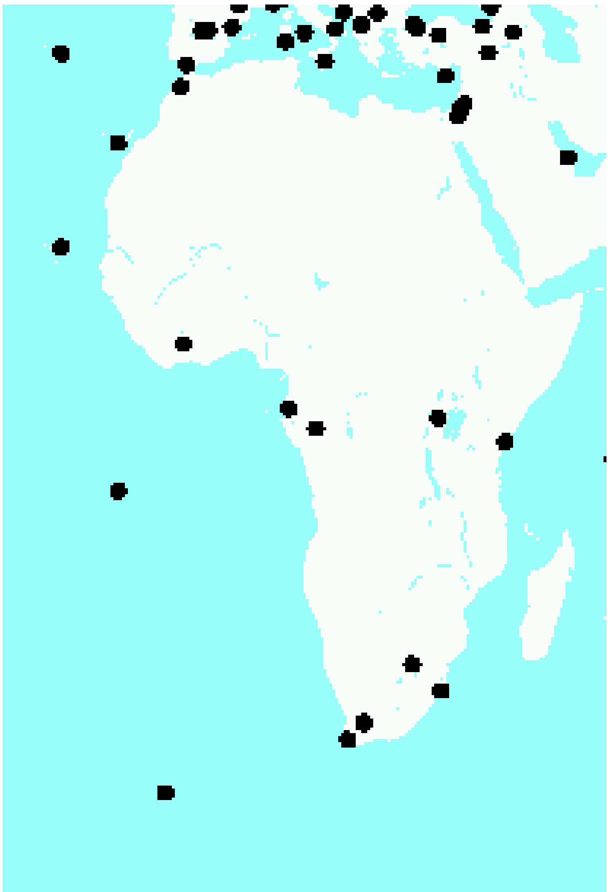

Figure 1. **IGSCB map of Africa, indicating IGS GPS stations (source: http://IGSCB.jpl.nasa.gov)**

1. SADC

The Southern African Development Community (SADC), is a sub-regional organisation whose member countries (a total of fourteen) are South Africa, Swaziland, Lesotho (Figure 3), Mozambique (Figure 4), Namibia (Figure 5), Zimbabwe (Figure 6), Botswana (Figure 7), Angola (Figure 8), Democratic Republic of Congo (Figure 9), Malawi (Figure 10), Mauritius (Figure 11), Seychelles (Figure 12), Tanzania (Figure 13) and Zambia (Figure 14). All maps are adapted from WorldMap.com.

The directorates or objectives of SADC (*http://www.sadc.int/index.htm*) cover sectors such as

- Trade, Finance, Industry and Investment;
- Food, Agriculture and Natural Resources;
- Social and Human Development and Special Programmes.

These directorates all have direct impact on the SADC macro-and microeconomic health. Most of these objectives cannot be reached in an optimal way without due care being given to issues of land, where a national surveying and mapping capability is of paramount importance. Furthermore the promotion and development of science and technology to enhance competitiveness within the SADC region can only benefit the peoples of Africa if a scientific component is embedded in the SADCREF.

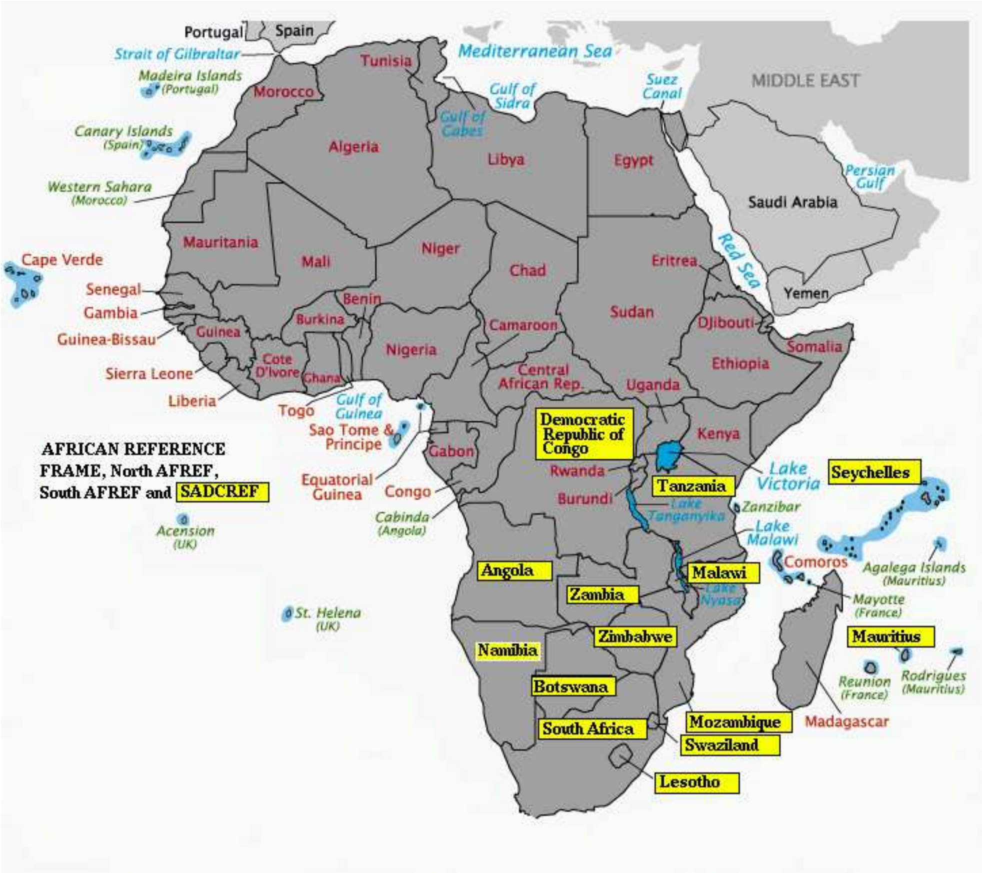

Figure 2. **The proposed South African Development Community Reference Frame (SADCREF). SADC consists of 14 member states, of which only two are currently equipped with IGS GPS stations. These 14 member states basically form the southern part of Africa. SADCREF will form part of AFREF and will be instrumental in facilitating and implementing the southern component of AFREF. HartRAO, in collaboration with JPL is in the process of establishing a station in Madagascar at Antananarivo. Although Madagascar is not a SADC member, this will be an important station in the southern AFREF. Map is adapted from WorldMap.com.**

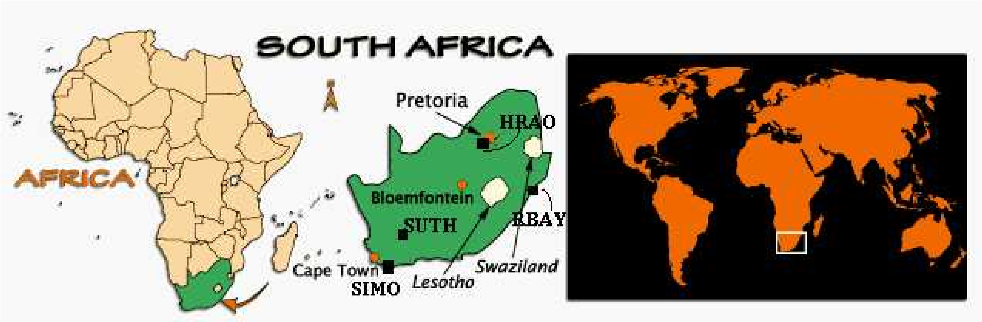

Figure 3. **South Africa has six IGS stations, HRAO and HARB at Hartebeesthoek (north of Johannesburg), RBAY at Richardsbay (colocated with a tidegauge), SUTH and SUTM at Sutherland (colocated with GFZ Potsdam, superconducting gravimeter) and SIMO at Simonstown, colocated with a tidegauge. South Africa covers an area of 1 221 000 square kilometres and has a population of 43.1 million. Enclosed within the borders of South Africa, but independent countries are Lesotho and Swaziland. Capital city of Lesotho is Maseru, the country has an area of 30 555 square kilometres and a population of 2.1 million. Swaziland's capital is Mbabane, the country's area is 17 364 square kilometres and Swaziland has a population of 970 000.**

Figure 4. **Proposed stations for Mozambique: Maputo and Beira. Station baseline would be approximately 700 km. Baselines to Hartebeesthoek would be about 500 km and 960 km for Maputo and Beira respectively. Mozambique has an area of 799 380 square kilometres and a population of 16.8 million.**

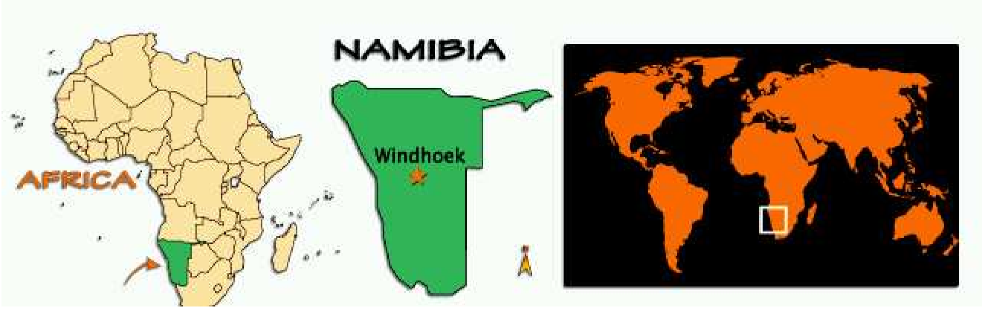

Figure 5. **HartRAO has installed a GPS station in Windhoek (located on the site of the Surveyor General) but the equipment needs to be upgraded before meeting IGS standards. An old Trimble receiver is currently operational, but 24 hour data is not available. Namibia has an area of approximately 822 269 square kilometres and a population of 1.77 million. GFZ Potsdam is providing a new receiver as part of a collaborative project between HartRAO and GFZ, which will be installed during May 2002.**

Figure 6. **Proposed IGS site for Zimbabwe. The capital (Harare) is further north and close to Beira and Lusaka which have been identified as future sites. It would therefore be more appropriate to locate the station at Bulawayo. Zimbabwe covers an area of 390 757 square kilometres and has a population of 13.1 million.**

Figure 7. **Proposed station for Botswana, located at Maun. The capital (Gaborone) is located only 240 km from HRAO, therefore a suitable site would be futher north, towards central Botswana. Having a station at Maun would facilitate monitoring of the Okavango Basin and Makgadikgadi. Botswana has a total area of 582 000 square kilometres and a population of 1.6 million.**

Figure 8. **Proposed station for Angola in Luanda, the capital city. Baseline to MSKU in Franceville, Gabon is 850 km. Baseline to HRAO is approximately 2280 km. Angola is very large and an additional station might be useful, perhaps located at Namibe or Menongue. The country has an area of 1 247 000 square kilometres and a population of 12.9 million. The official website is** *www.angola.org*.

Figure 9. **Proposed station for the Democratic Republic of Congo (DRC). Kinshasa or Kananga. Kinshasa is not far (360 km) from an existing IGS station in Gabon (Franceville, MSKU), therefore Kananga may be a better option. The DRC is large, with an area of 2 435 409 square kilometres and a population of 49.3 million.**

Figure 10. **The Surveyor General of Malawi has requested HartRAO to assist in the installation of an IGS station. (MAWI) could possibly be located at Lilongwe or Blantyre. Malawi has an area of 118 484 square kilometres and a population of 10 million.**

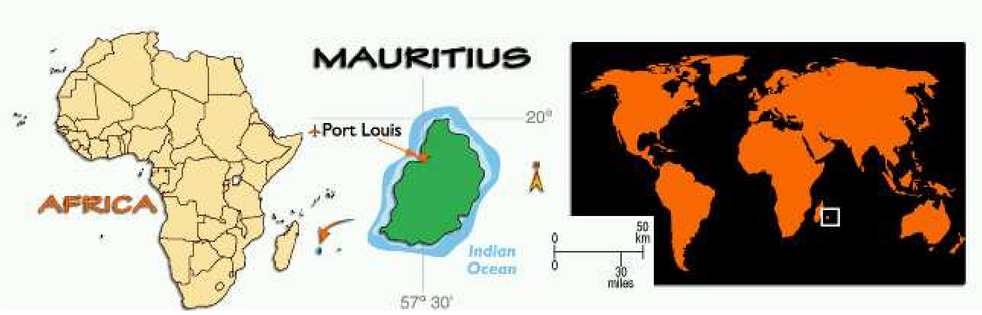

Figure 11. **Proposed station for Mauritius, located at the capital Port Louis. Mauritius covers an area of 2 040 square kilometres and has a poulation of 1.18 million. Baseline to HRAO is about 3300 km.**

Figure 12. **Seychelles is already equipped with an IGS station (SEY1) which is located in La Misere, on Mahe Island. The islands cover an area of 455.3 square kilometres and have a population of about 80 000.**

Figure 13. **Proposed site for Tanzania (TANZ), located at Dodoma. Baselines to Beira 1400 km, HRAO 2400 km. The country has an area of 945 200 square kilometres and a population of 32 million. Dar es Salaam (on the coast) might be considered for an additional IGS site, considering the size of the country and possible collocation with a tide gauge.**

Figure 14. **ZAMB, located at Lusaka. Baseline to HRAO is 1140 km, to Beira and Maputo in Mozambique 840 km and 1200 km respectively. Zambia covers an area of 752 612 square kilometres and has a population of 10.4 million.**