The Benefits of Scientific Instrumentation in Africa

Endawoke Yizengaw and Jonathan Makela

Institute of Geophysics and Planetary Physics, UCLA

Department of Electrical and Computer Engineering, University of Illinois at Urbana Champaign

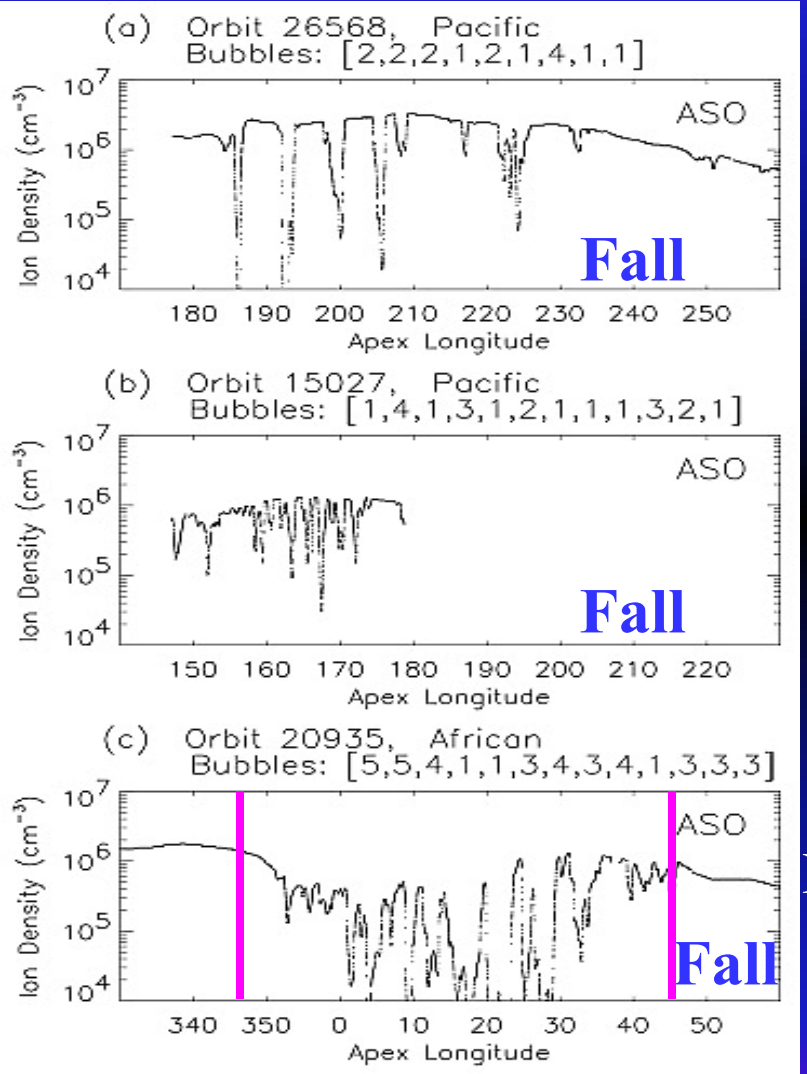
International Space Weather Initiatives (ISWI)

R. Smith, M. Moldwin, T. Fuller-Rowell, P. Doherty, J. Davila, N. Gopalswamy, U. Inan, et al.

CEDAR 2009 meeting, Santa Fe, New Mexico, 06/30/09

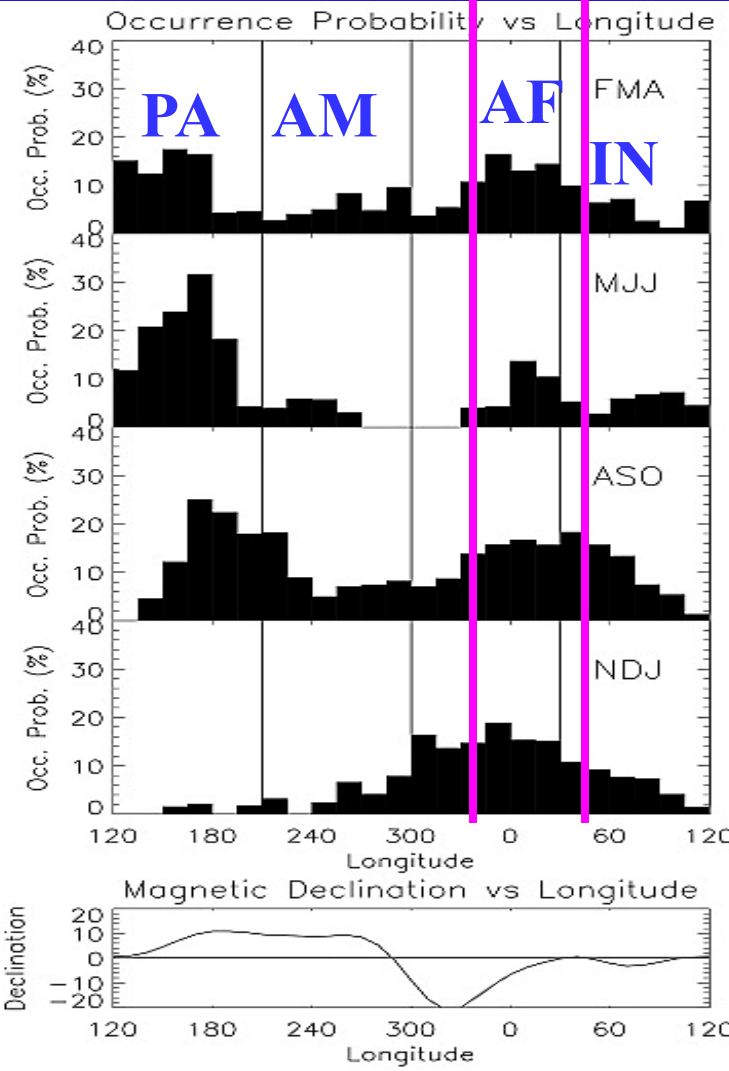
UCLA

Why Africa?

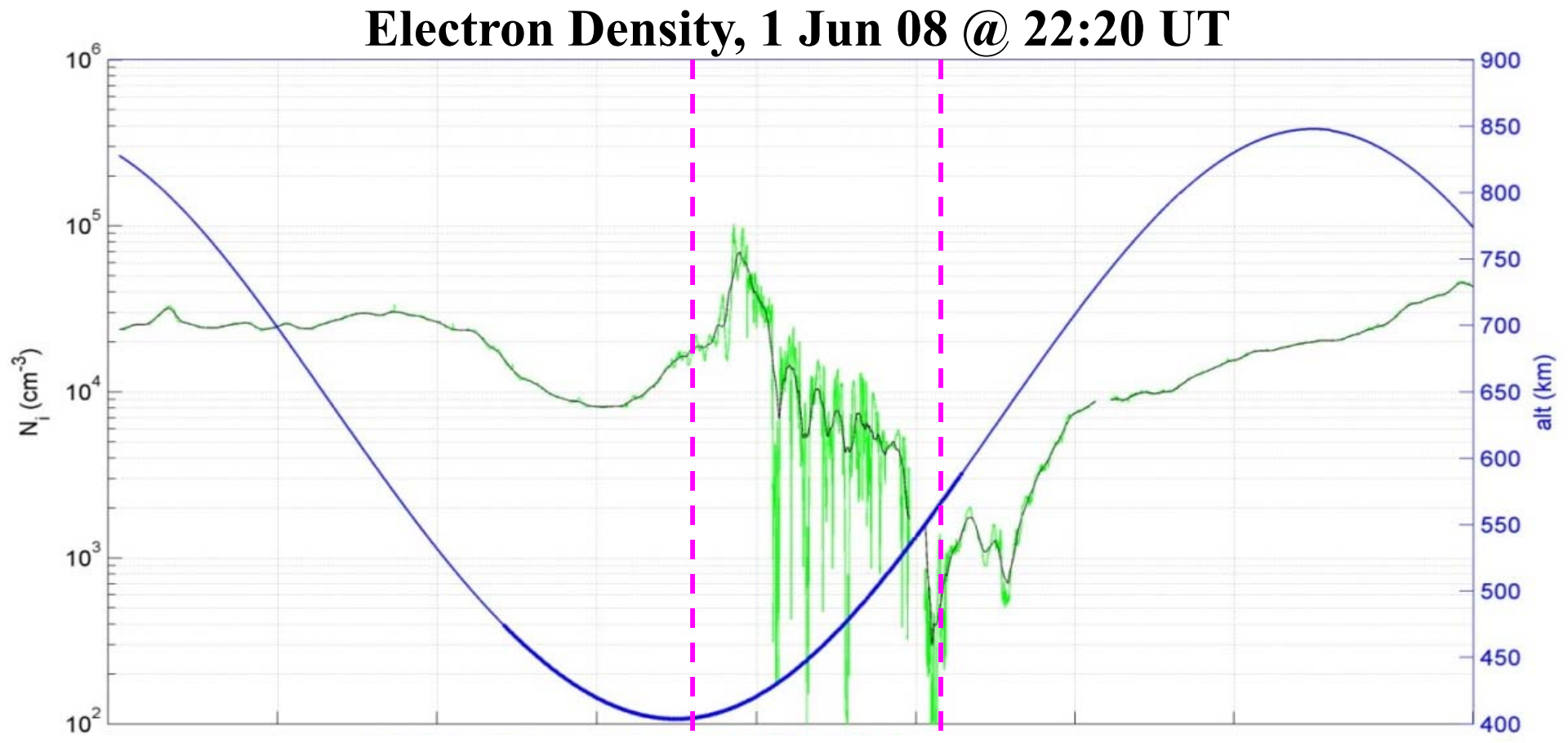


Bubbles occurrence at different longitudinal sectors using data from the AE-E satellite (Hei et al., 2005)

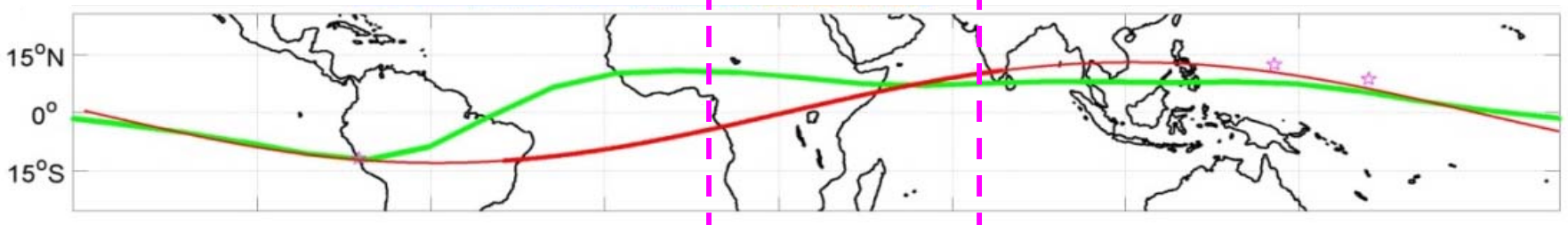
Not confirmed from the ground



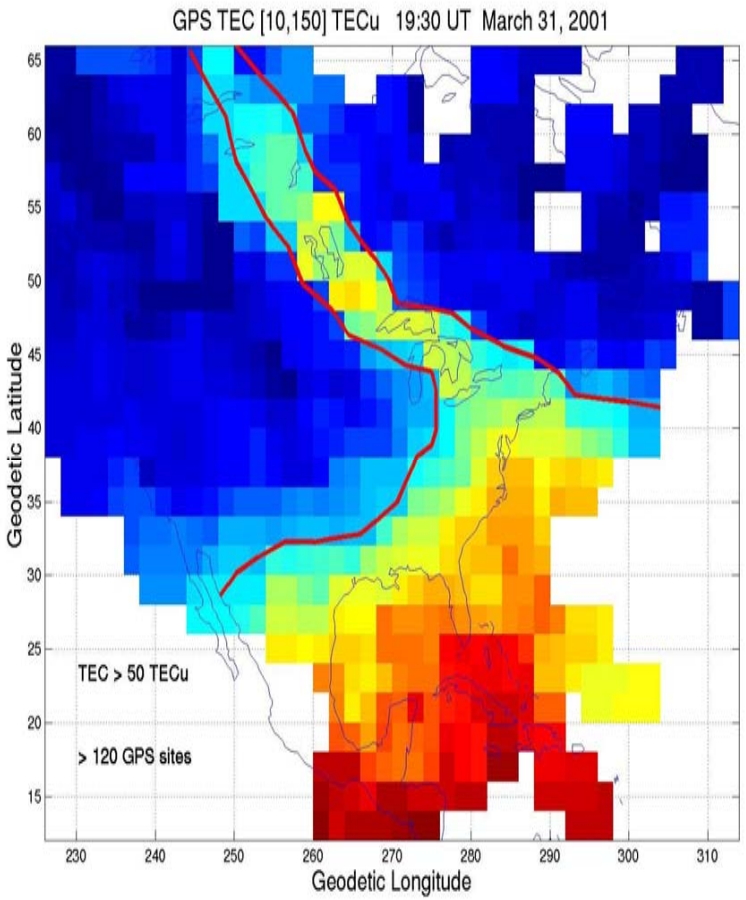
Recent C/NOFS observation over Africa

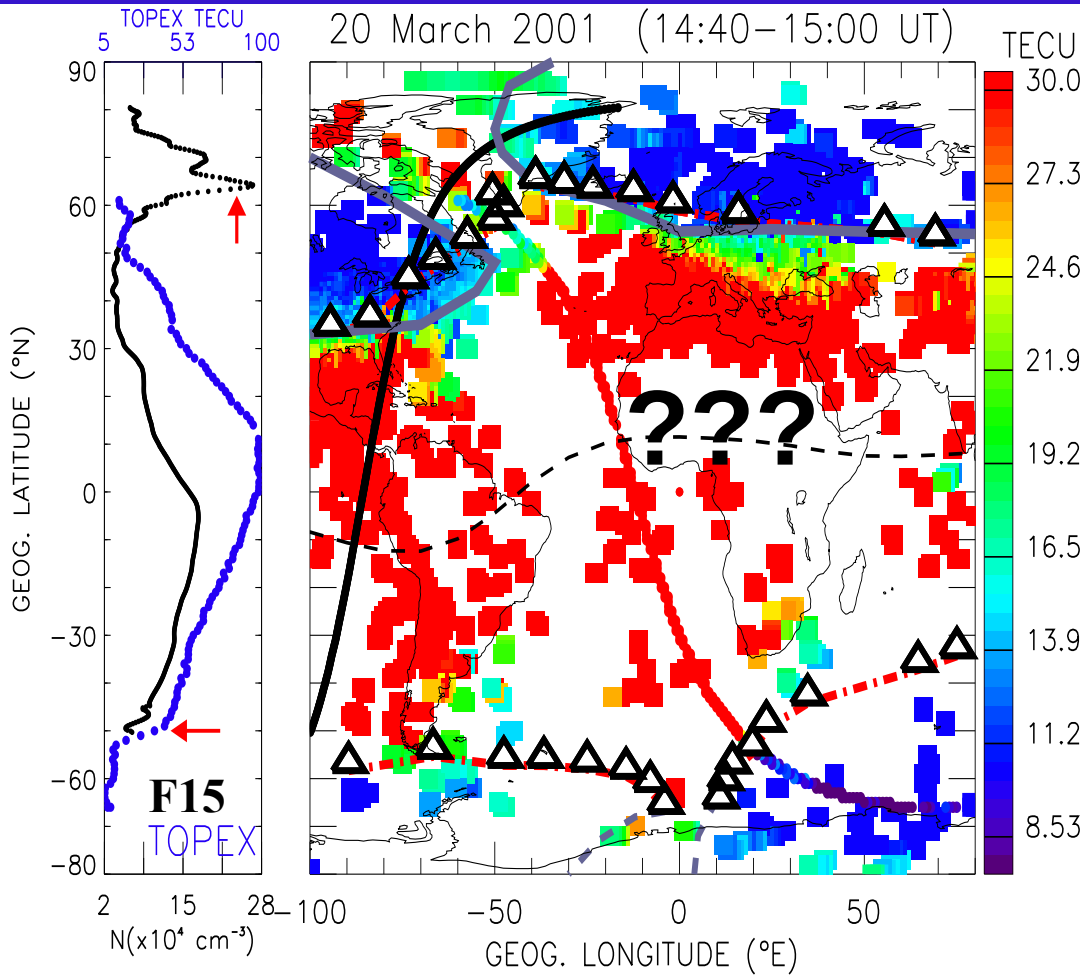


courtesy of Odile de La Beaujardière



SED/Plume base over Africa missing!

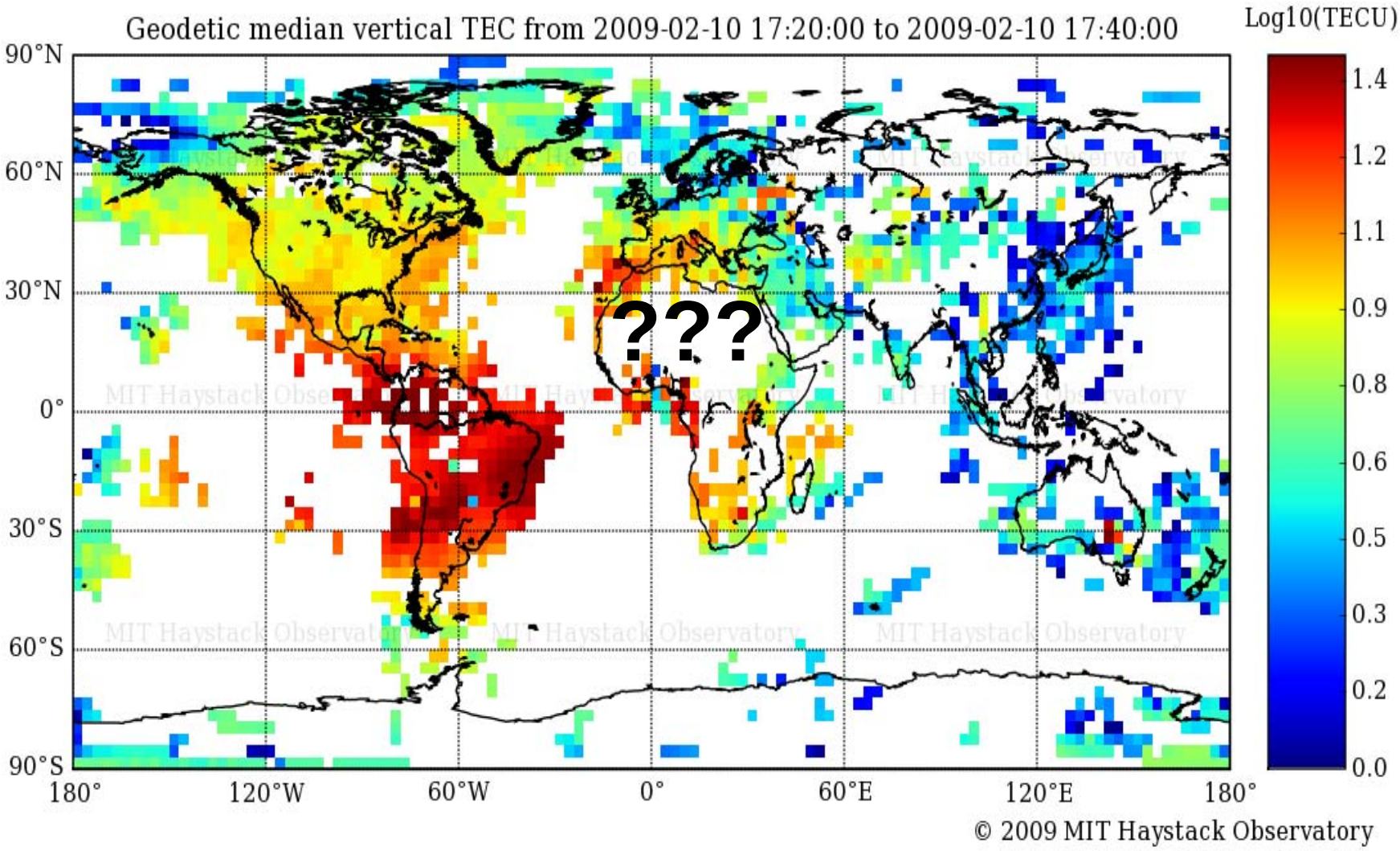




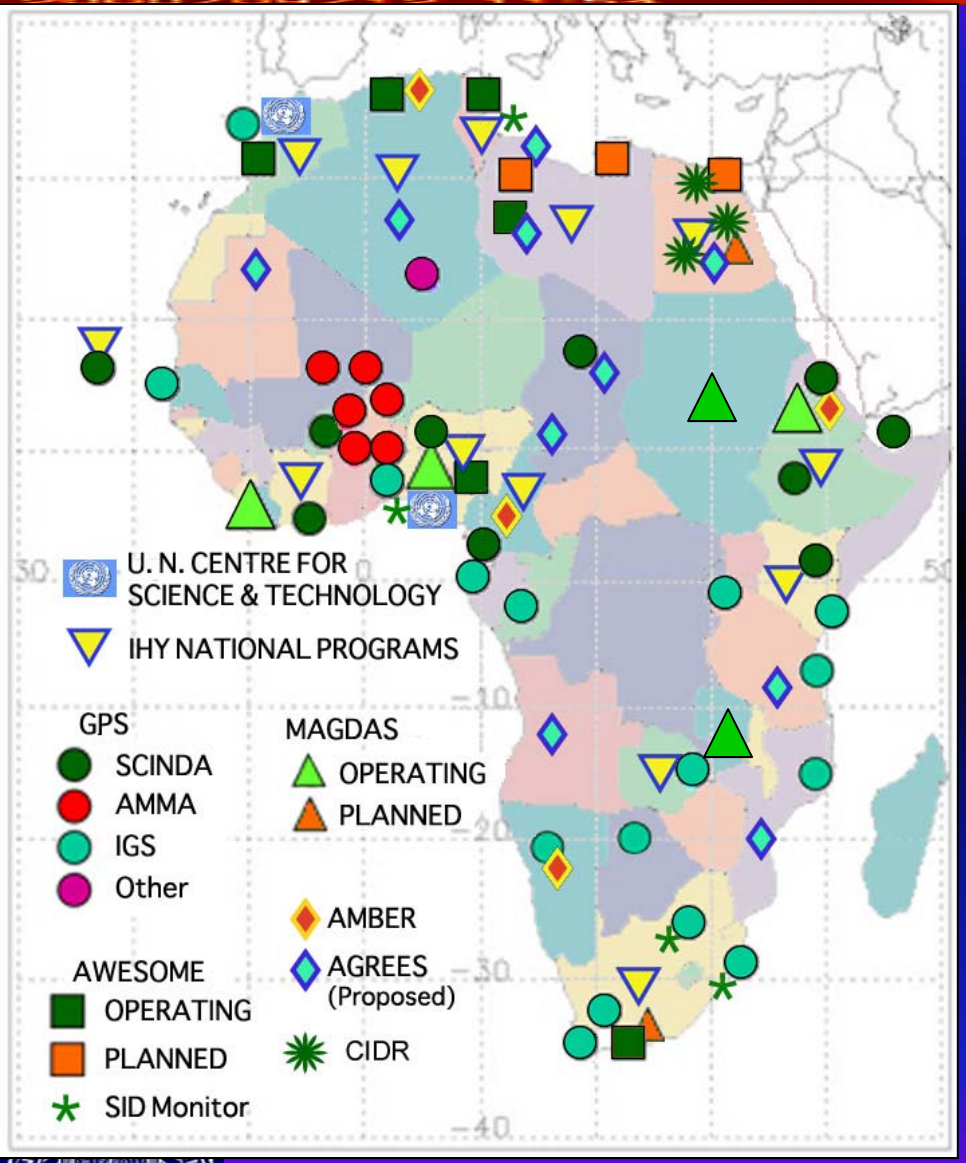
Foster et al., GRL, 2002

Yizengaw et al., JGR, 2008

Recent GPS coverage over Africa!



Instrumentation in Africa

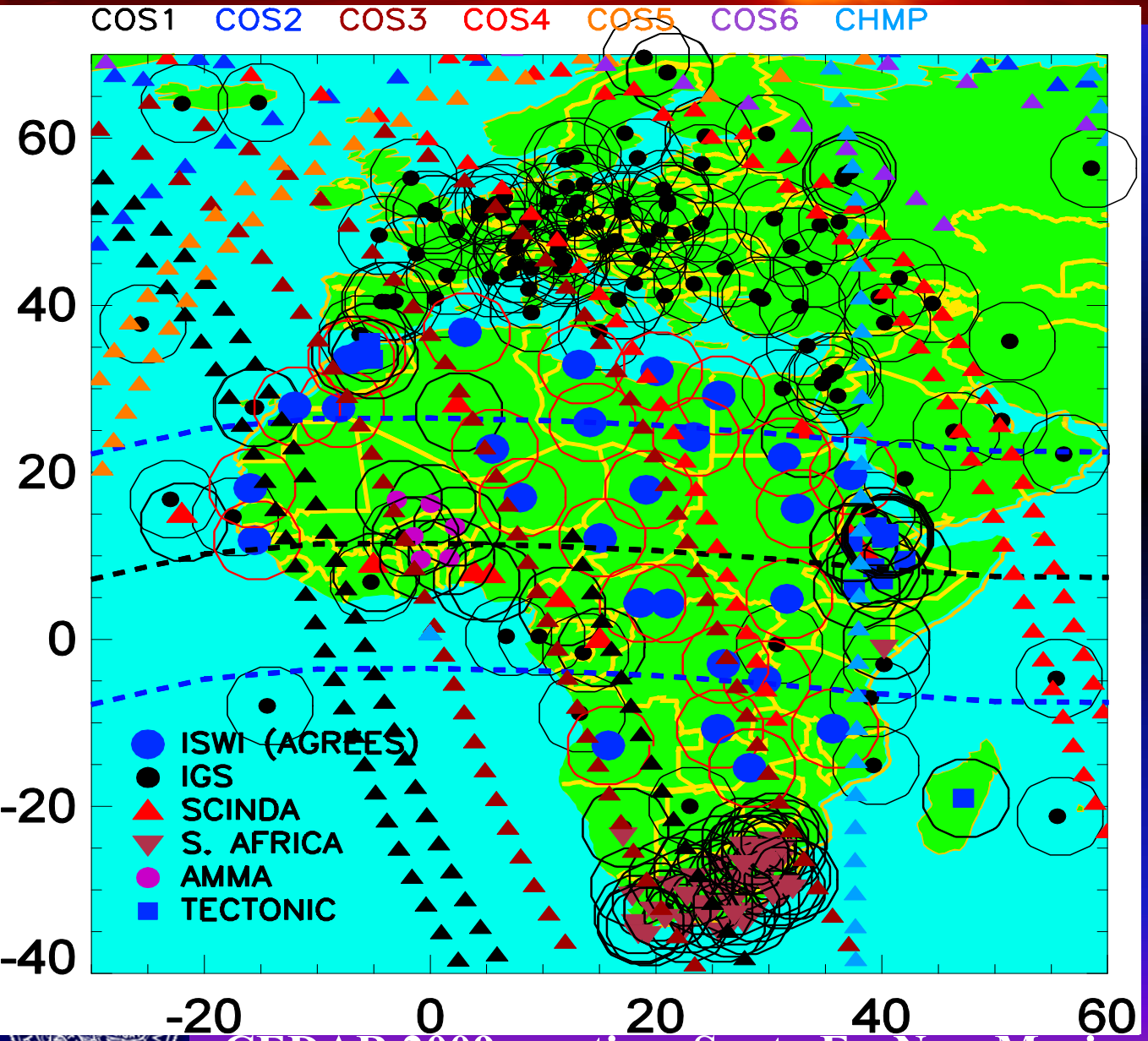


Instruments

- SCINDA, AMMA, and CIDR for TEC and scintillation measurements, Cape Verde, Ethiopia, and Egypt, and many other African countries.
- AWESOME space weather monitors deployed in Algeria, Morocco, Libya, Egypt, and South Africa.
- MAGDAS deployed in Ethiopia, Ivory Coast, Nigeria, and many other African countries.
- AMBER deployed in Algeria, Ethiopia, Cameroon, and Zambia.

IHY (http://ihy2007.org)

Future direction during ISWI



Current GPS coverage

Proposed to fill the gap

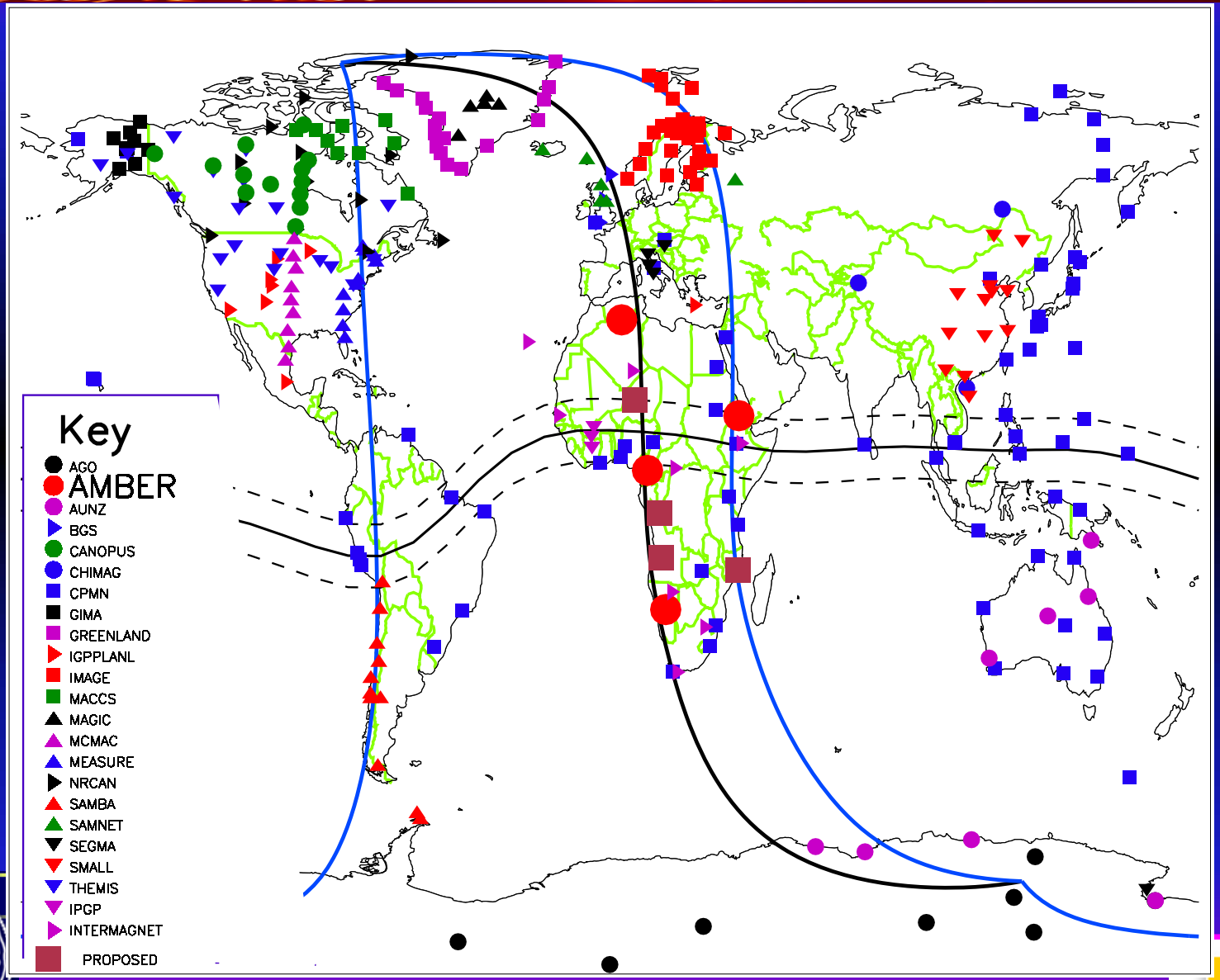
Augmented with

1hr LEO coverage

2hr LEO coverage

3hr LEO coverage

Future direction during ISWI

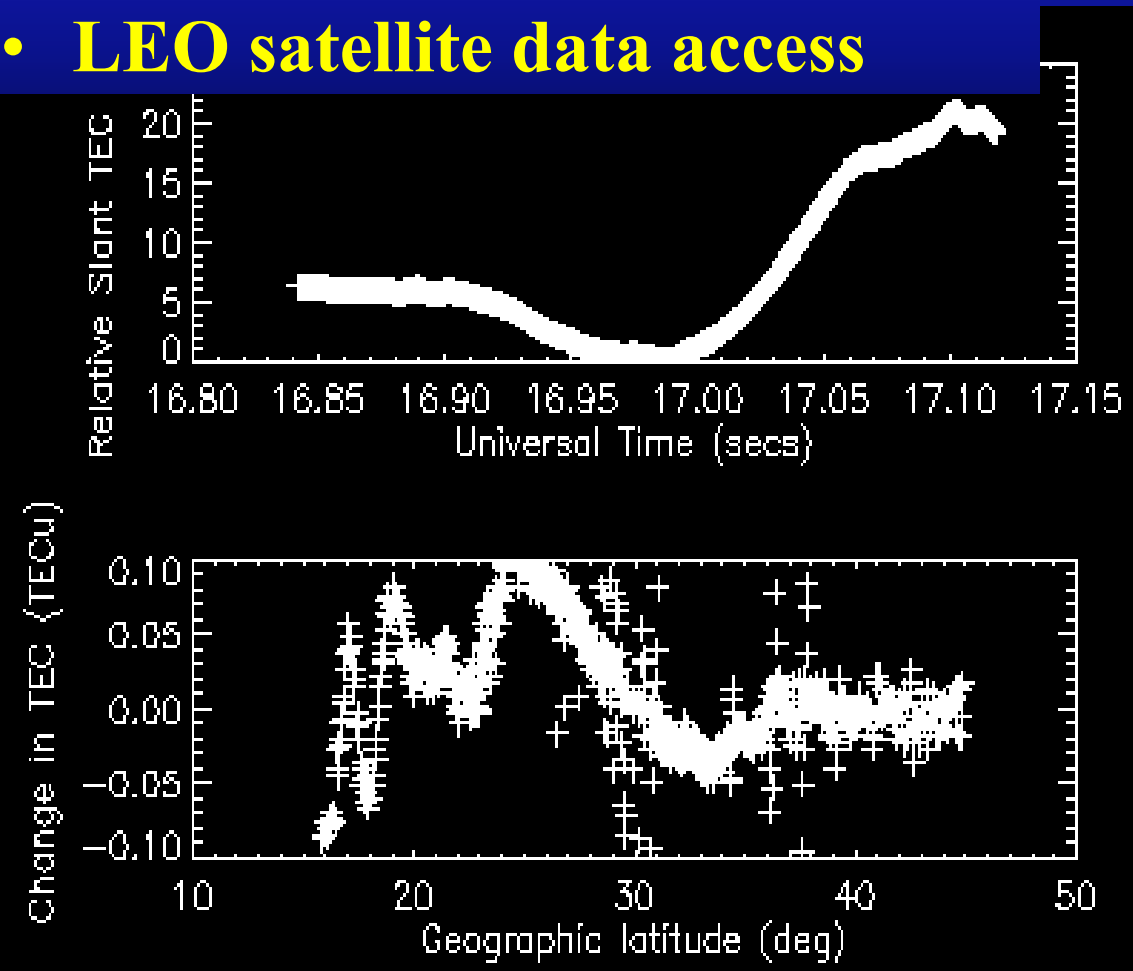


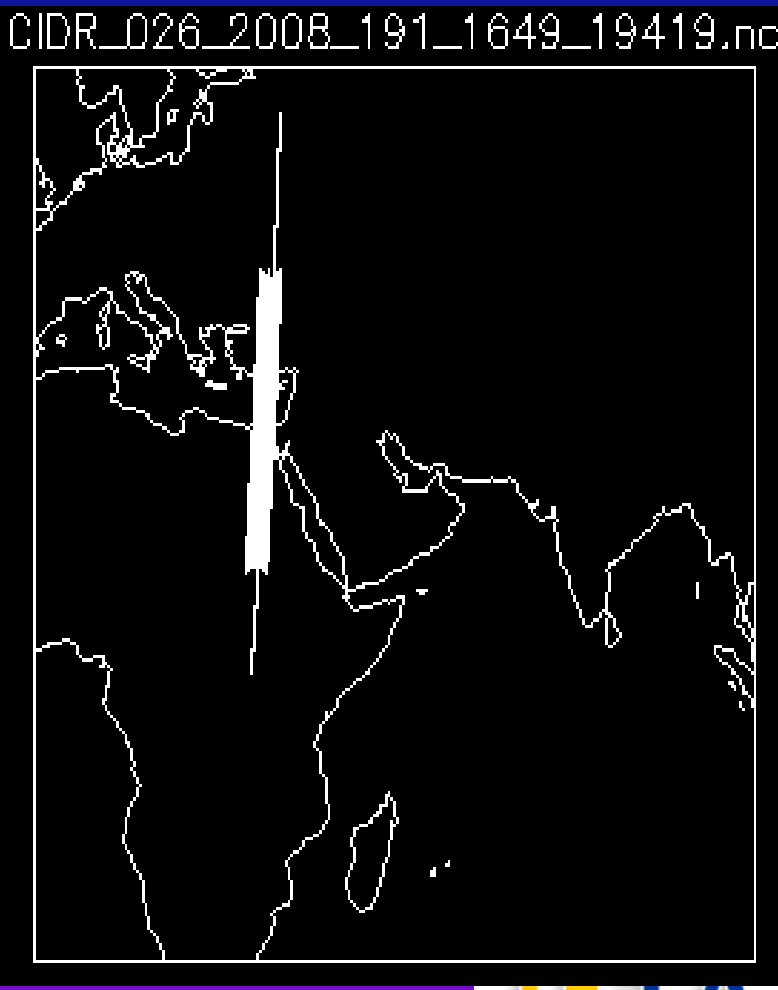
IHY initiated space science research in Africa

Instruments

- GPS receivers
- CIDR Instruments
- LEO satellite data access

Dr. Ayman Mahrous
Helwan University

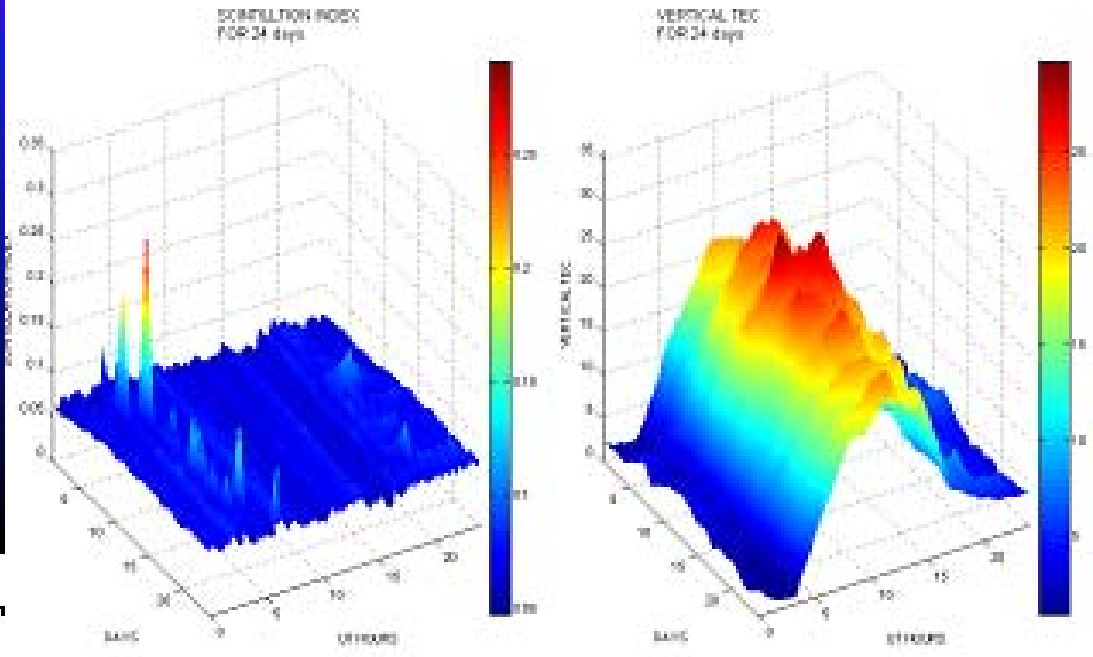


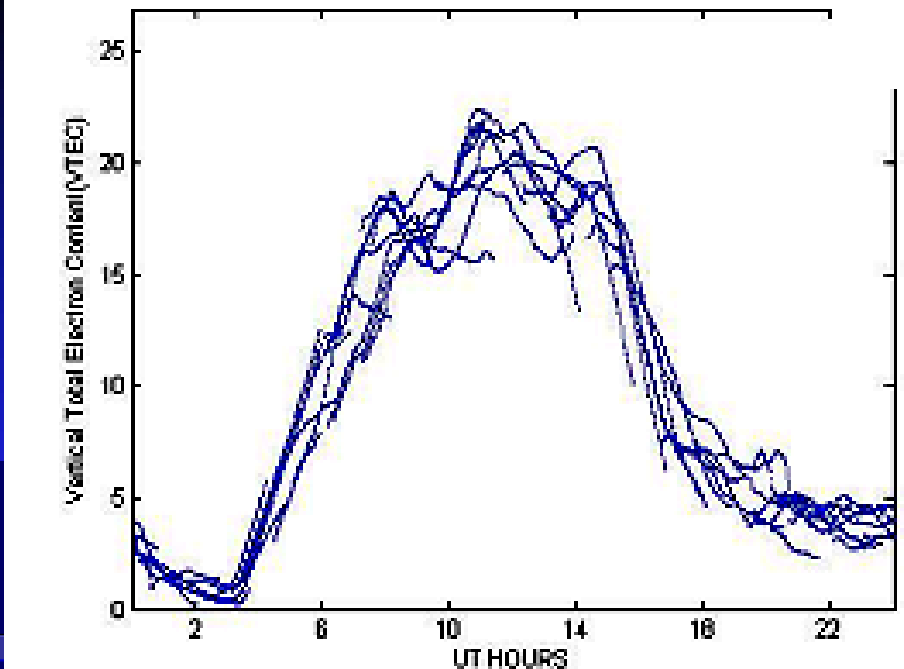


IHY initiated space science research in Africa

Instruments

- Many GPS receivers
- 3-Magnetometer
- Magnetic pulsation
- VLF receiver
- LEO satellite data access





Lead by Dr Baylie Damtie

Universities involved:

Bahir Dar University

Addis Ababa University

Mekele University

Summary and Conclusion

- In conclusion, such multi-instrument observations in the African longitudinal sector, a region that has been devoid from ground-based instruments, will provide excellent opportunity to the scientific community to understand clearly the physics behind the unique ionospheric irregularities that has been often observed by flyby LEO satellites.
- The preliminary results presented here and elsewhere shows promising in validating the observation made by LEO satellites, but more ground-based instruments are essential to clearly understand the physics behind all these unique ionospheric irregularities in the African sector.
- Instrumentations in Africa also help the African universities to strength their research facilities so that they will be able to self sustain and train their young generation in Africa and reduce brain drain.


Thank you!
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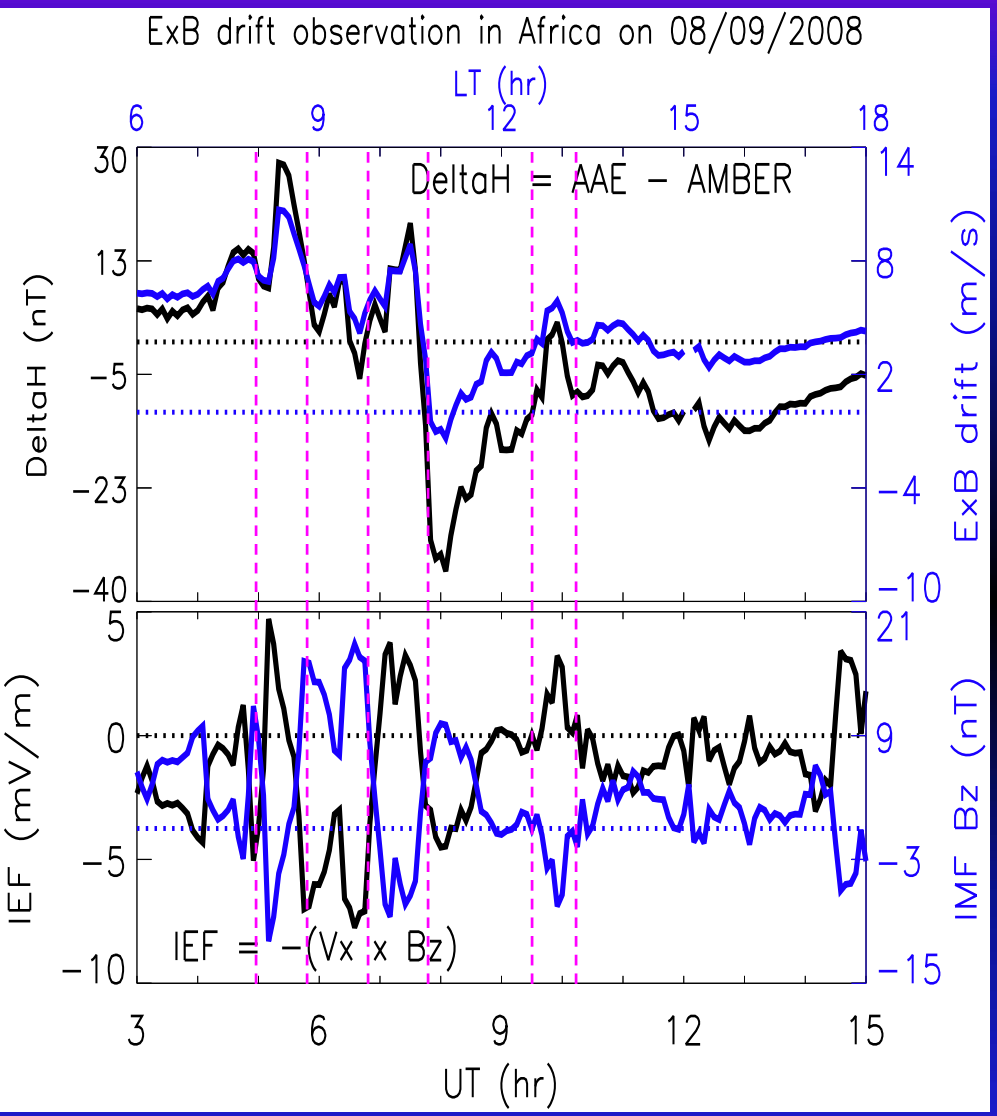
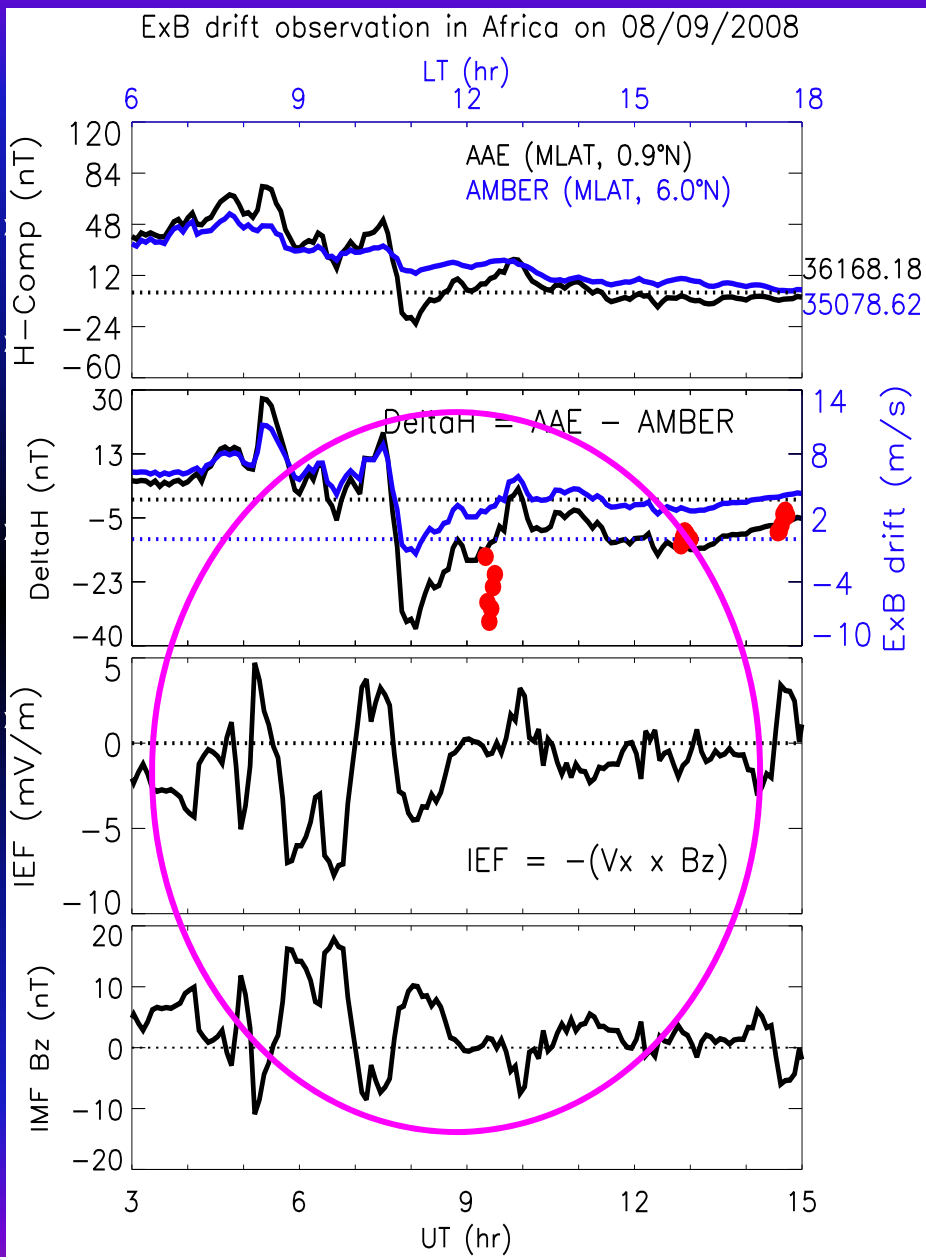
What can we do with the Magnetometers in Africa?





Kp ≤ 3, AE < 250 nT

Geomagnetic pulsation caused by ultra-low-frequency (ULF) wave

- Toroidal and poloidal (compressional) mode of ULF waves
- Toroidal and compressional mode have north-south and east-west electric field perturbation in the ionosphere when it mapped along the field line, respectively.
- Toroidal mode can only have pointing vector along the magnetic field; while compressional mode have pointing vector both in the parallel and perpendicular directions of the magnetic field.
- The compressional ULF wave can propagate all the way down to the equatorial ionosphere right across the magnetic field.

ULF wave observation at the Equator