

Measuring post-rifting deformation in Afar, Ethiopia

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Summary

In January/February 2014, 4 x GS10 GNSS receivers were used as part of a wider GNSS campaign in Afar, Ethiopia. The particular focus of the GEF instruments was to carry out campaign measurements in the vicinity of the 2005-2010 Dabbahu Rifting episode (Wright et al., 2012). The scientific aim was to understand the post-intrusion response of the lithosphere.

Research facilitated by this loan

The GEF loan supplemented a wider GNSS campaign (Figure 1). This included data from 6 continuously-operated instruments in the area, run in collaboration with Addis Ababa University and ENS Paris, and a French-led campaign focused on measuring deformation to the south of the 2005-2010 rifting episode.

Project Outcomes

The instruments performed very well and collected incredibly valuable data. Many of the sights that were occupied had not been measured since 2008, and so the observations have really helped us improve our understanding of deformation in space and time around the rift. We can see very clearly at some of the sights (E.g. Figure 2) that the deformation transient caused by the rifting episode is beginning to decay away - the time constant of this decay is on the order of 10 years, and data from the 2014 campaign is the first time in which displacement rates have not looked constant with time.

The GEF instruments were used to measure data at the following sites:

DA03, DA06, DA10, DA10A, DA14 - a series of benchmarks on a profile perpendicular to the rift. Accessing these sites involved trekking with camels from outside the rift zone.

DA25, DABT, DARA, DASL, ERTA, DATR - these sites covered a broader area around the rift and could be accessed by vehicle.

Outputs

Preliminary results were presented at:

Tim J Wright, Eric Calais, Yukitoshi Fukuhata, Ian Hamling, Elias Lewi, Carolina Pagli, and Hua Wang, Time-dependent plate boundary deformation in the Afar Rift, KAUST workshop on imaging and active tectonics of the red sea region, Saudi Arabia, 10-13 March 2015

Tim J Wright, Witnessing the birth of Africa's new ocean, 2015 Rosenstiel Award Lecture, University of Miami.

We are working towards compiling all the results in a conference publication; at the moment, considerable effort is still required in building a model that can successfully explain all the observations from GNSS as well as InSAR.

Data Archiving

We are currently holding the data in local archives at Leeds, ENS Paris, IPG Strasbourg, and Addis Ababa University. In line with NERC data policy, we will make the data available via the UNAVCO data archive by January 2016 (i.e. two years after data collection).

References

Wright TJ; Sigmundsson F; Pagli C; Belachew M; Hamling IJ; Brandsdóttir B; Keir D; Pedersen R; Ayele A; Ebinger C; Einarsson P; Lewi E; Calais E (2012) Geophysical constraints on the dynamics of spreading centres from rifting episodes on land, *Nature Geoscience*, 5, pp.242-250. doi: 10.1038/ngeo1428

Nooner SL; Bennati L; Calais E; Buck WR; Hamling IJ; Wright TJ; Lewi E (2009) Post-rifting relaxation in the Afar region, Ethiopia, *Geophysical Research Letters*, 36, . doi: 10.1029/2009GL040502

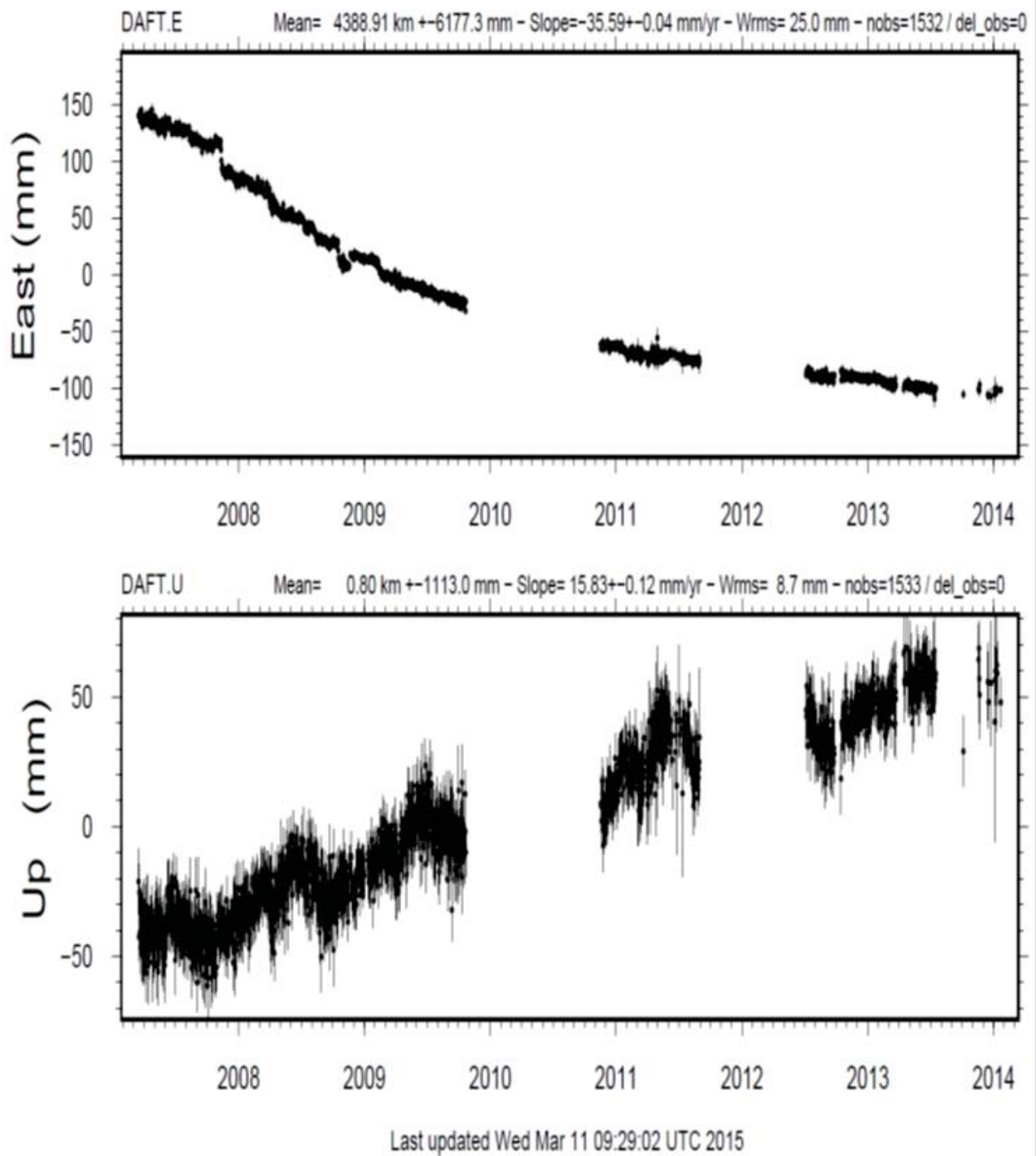


Figure 2

GPS position time series for site DAFT relative to Nubia.