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# Rigidity of Nubia from combined GPS and DORIS solutions: Implication to Africa Reference Frame (AFREF)

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As with many major tectonic plates, the interior of the Nubian plate is affected by (relatively rare) large earthquakes and recent volcanism outside of its boundaries in northern or eastern Africa. This may indicate some level of internal deformation of the plate. Quantifying this internal deformation is important for studies relying on stable Nubia as a reference frame, such as geophysical studies aimed at quantifying its relative motion to surrounding plates or geodetic studies aimed at defining the upcoming Africa Reference Frame (AFREF). Most other well-instrumented continental interiors seem to show very small – if any – internal deformation, in spite of seismic activity. Thanks to a significant increase in space geodetic instrumentation in Africa and improved data analysis strategies, it is now possible to test this for Nubia and determine the amount of current deformation within the Nubian continental interior.

We combine up to 16 years of GPS data and 17 years global DORIS solution to derive a new position/velocity solution for Africa. The resulting velocity field describes horizontal plate motion at 120 GPS and 9 DORIS sites operating in Africa. We use our combined velocity field to estimate internal deformation within Nubia, both horizontal and vertical. As a by-product, we use the resulting velocity field to update the angular velocity estimate for the Somalian plate and smaller sub-plates Victoria and Rovuma and compare the Somalia-Nubia relative velocity with the current global velocity model GEODVEL.

Our proposed model provides a robust bound on the rigidity of the Nubian plate and the kinematics of the East African Rift system, and is therefore an important contribution to AFREF.