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Complex strain accommodation mechanisms during rift linkage: an example from the central Afar, East Africa

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The Afar rift, at the northern part of the East African Rift System (EARS), is a classic natural laboratory to study the formation of sea-floor spreading centers. Several geo-physical monitoring studies have been conducted mainly following the 2005 Dabbahu-Manda Harraro (DMH) and the 1978 Asal segments volcano-seismic crises. The two segments are located at the tips of the Red Sea and the Gulf of Aden rifts, respectively, hence how the two segments propagate towards each other is crucial to our understanding on deformation during rift linkage. To this end, we use GPS data from central Afar to model the strain and rotation rates in the region. Our results show that both the DMH and Asal segments are characterized by high shear strain and rotation rates, in agreement with independent geophysical and geological observations. No significant strain concentration occurs between the two rift propagators. By combining our results with previous geophysical observations, we suggest that linkage between the DMH and Asal segments occurs via E-W oriented strike-slip fault at the tip of DMH and a broad region of NW-SE oriented normal fault bounded en echelon grabens, which are almost parallel to the Asal segment. Our preliminary results show that the style of deformation in the central Afar region is more complex and distributed than at ocean ridges where rift segments connect with localized transform faults. However, our results may inform on how transform faults initiate.