

# Positioning in Active Deformation Zones - Implications for NetworkRTK and GNSS Processing Engines

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## SUMMARY

New Zealand's actively deforming landscape results in both gradual and imperceptible deformation to instantaneous block shifts. The geophysical processes that cause the deformation include the tectonic plate motion (slow, regular deformation), earthquake events (instantaneous coseismic deformation), post-seismic relaxation (slow regular deformation) and slow slip events (irregular deformation occurring at timescales from days to years).

Network RTK (NetworkRTK) and GNSS processing engines are current day positioning applications that need to be able to accommodate deformation that may be slow or fast, regular or irregular, in order to maintain accurate and reliable coordinates. Most commercial software can only apply velocities that are assumed to be linear. Deformation effects that are non-linear are not accounted for, which potentially leads to inaccurate coordinates.

There are two aspects that need to be considered. The first is the ability to model the reference station coordinates, e.g. NetworkRTK. Secondly, the ability to model and transform non-reference station coordinates to the local datum, e.g. the rover positions computed using NetworkRTK and the positions derived from GNSS processing engine. For reference station coordinates, geodetic time series modeling can be used to accurately model both linear and non-linear deformation. But it becomes more challenging to model non-uniform deformation at non-reference positions.

This paper considers examples in New Zealand of non-linear deformation that includes post-seismic relaxation and slow slip events.