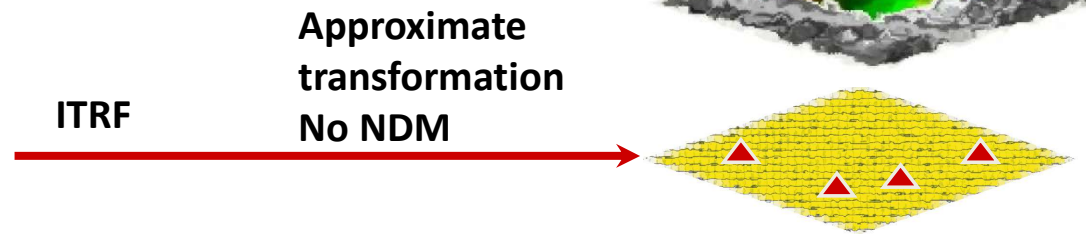
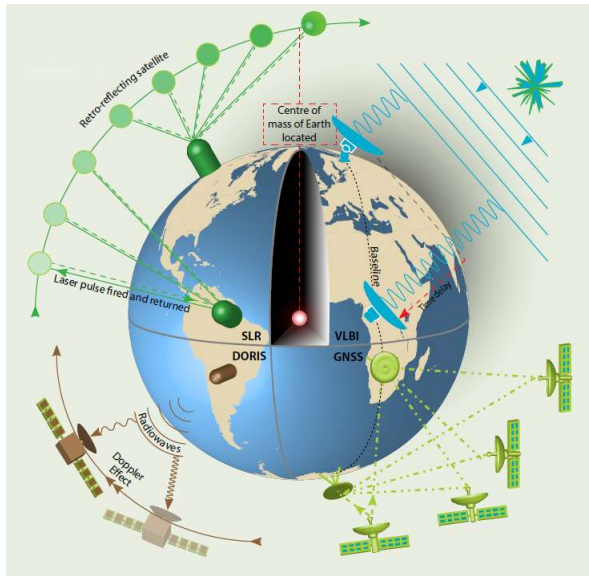
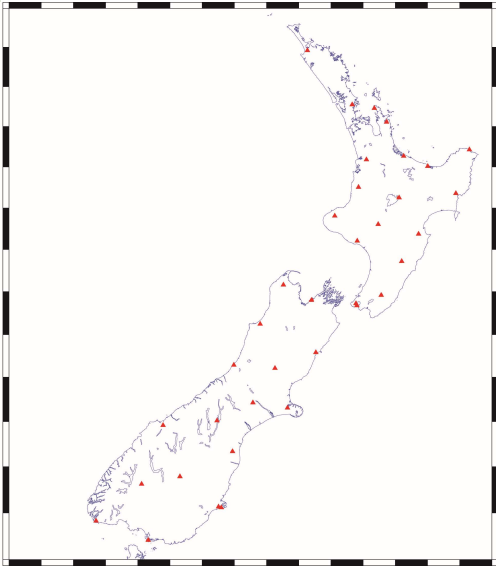
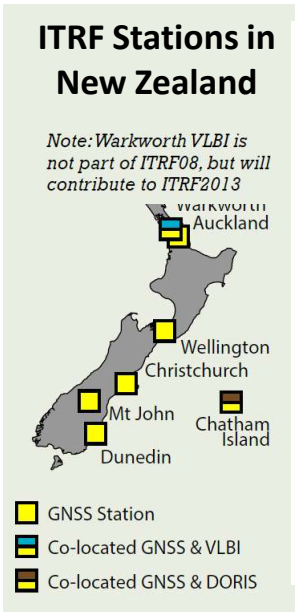
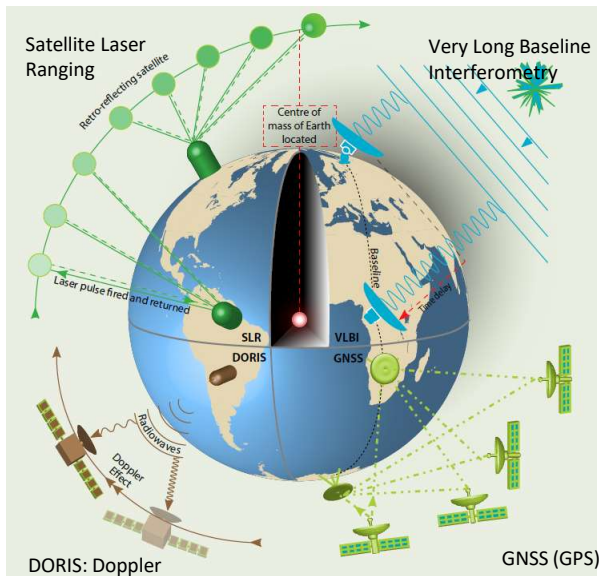




Kinematic Frames and Deformation Modelling

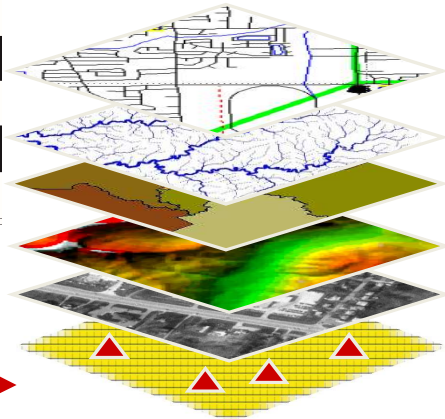


Conventional datums
 Often distorted
 no mechanism to correct for crustal deformation



ITRF2014

NDM



ITRF

Required by GPS

No deformation model

Datums and epoch dates change frequently

Nepal 2016

Stable coords

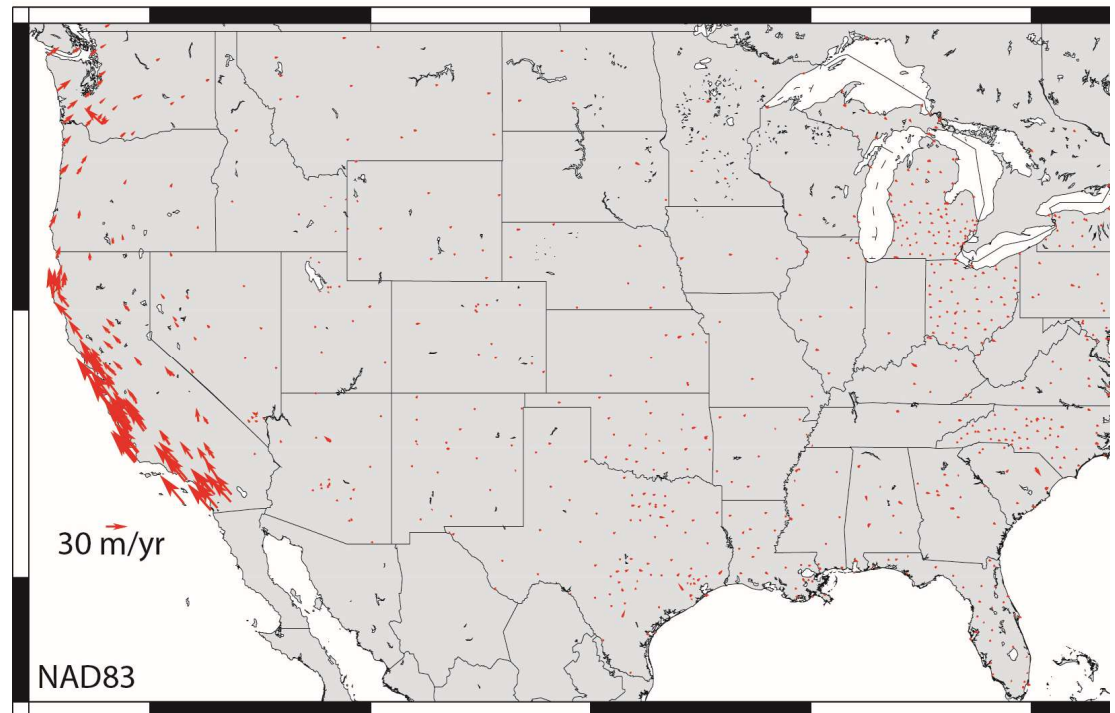
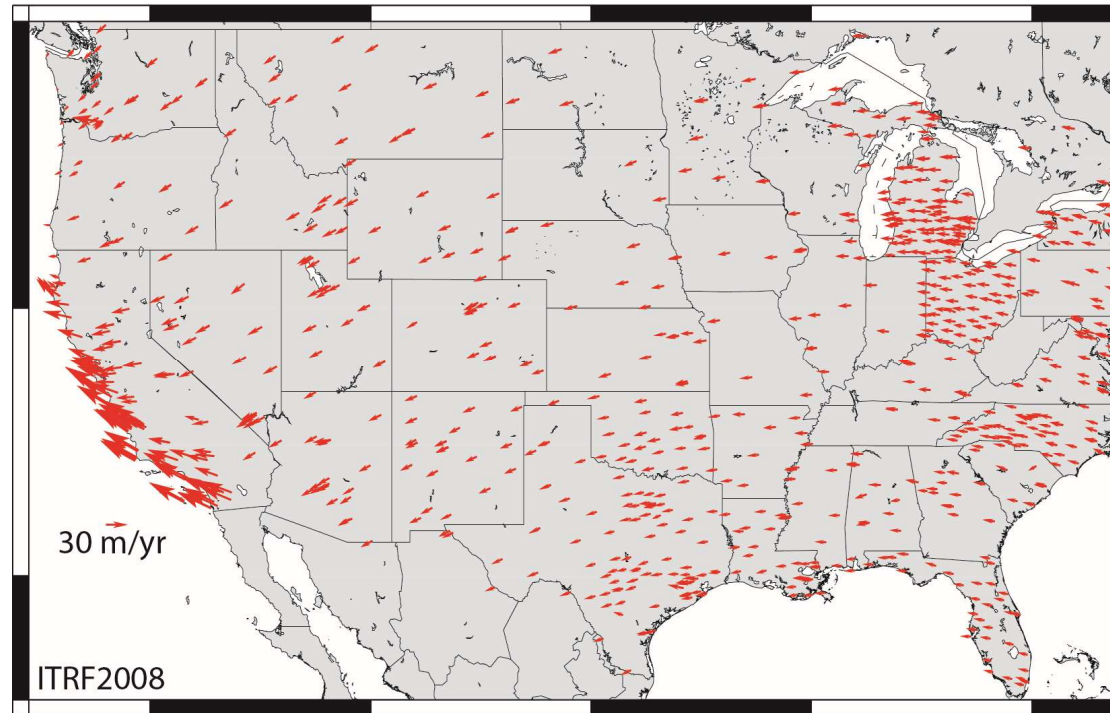
deformation model

Semi-dynamic datums

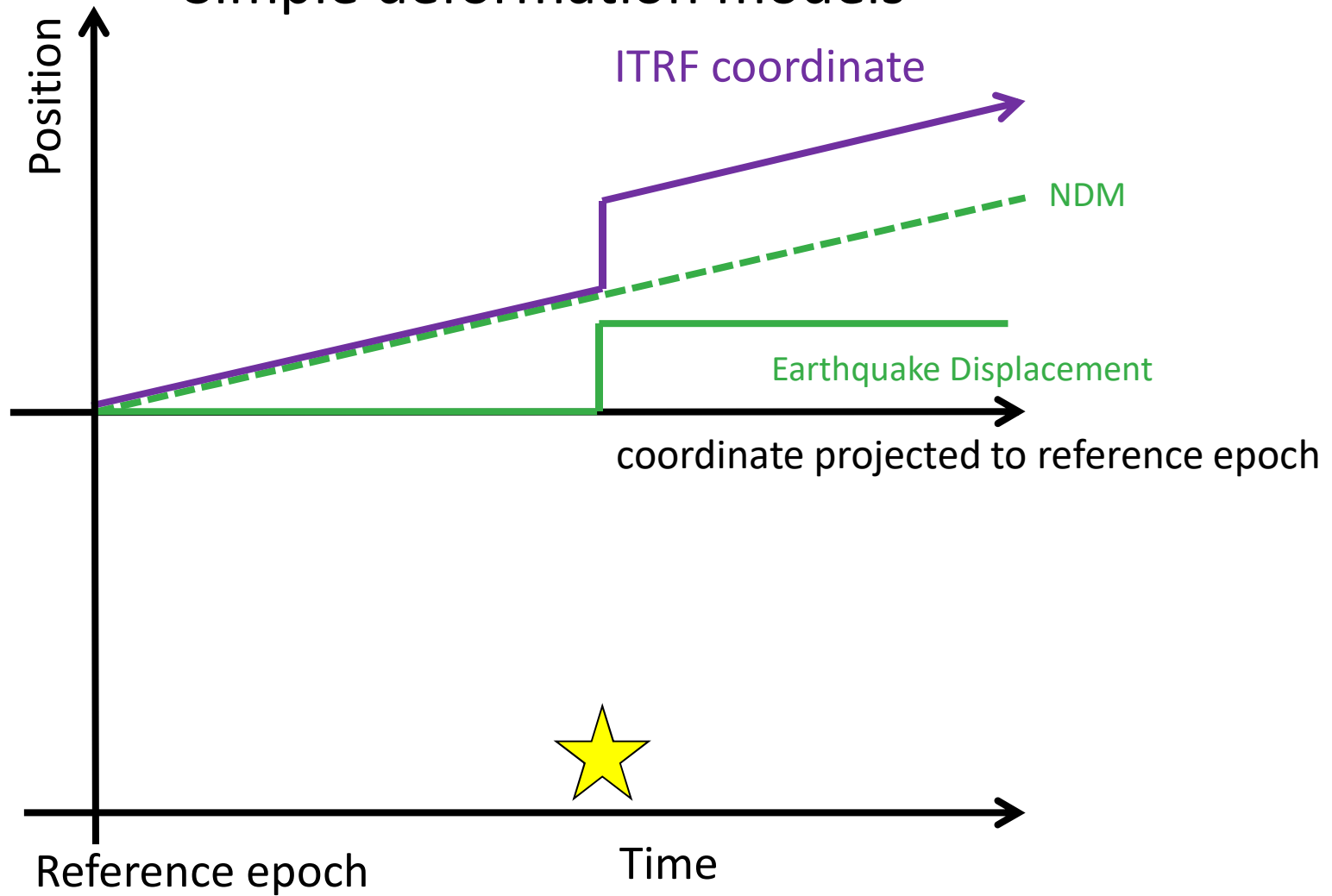
Coordinates transformed to common reference epoch using deformation model
cGNSS for active control

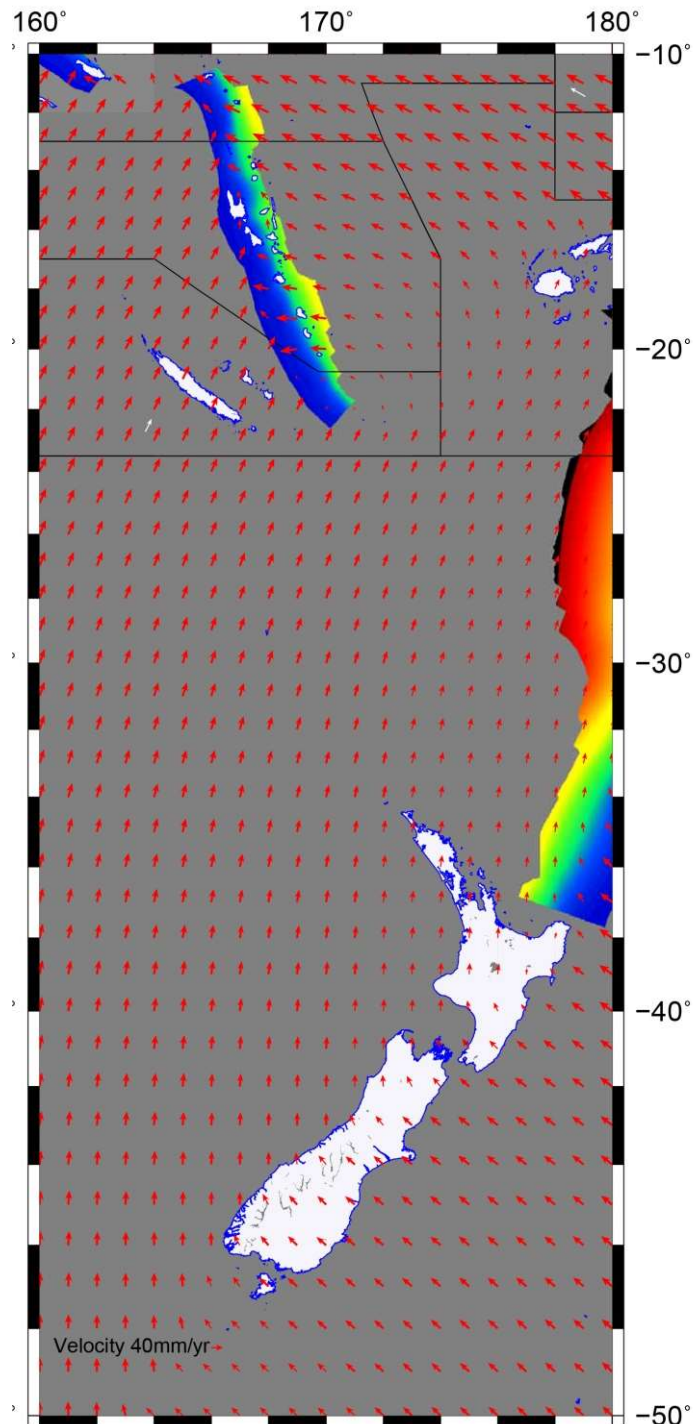
Plate fixed datums

- NAD83 –Probably the best example
- Removes the need for modeling secular velocities
- Can be combined with a deformation model



Simple deformation models



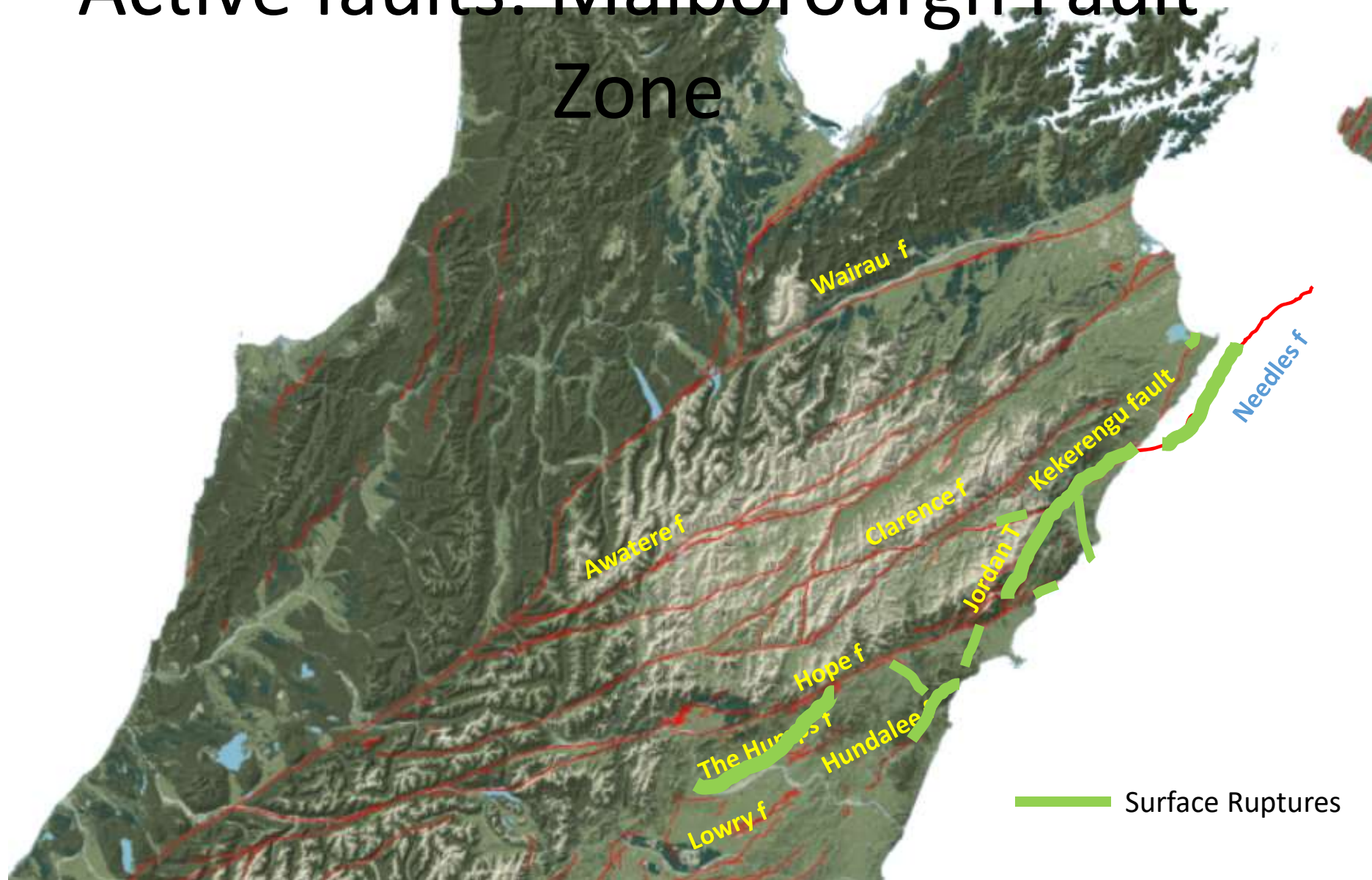


Secular Velocity Field

- Red shows global model from Kreemer et al across New Zealand and part SP
- Over much of this area vectors derived from plate models (white) are adequate
- Not in plate boundary zones

Velocity grid from Kreemer et al 2014

Active faults: Malborourgh Fault Zone



The Woodchester Wall



Leader Fault
Left lateral and
reverse of ~1.5-2m

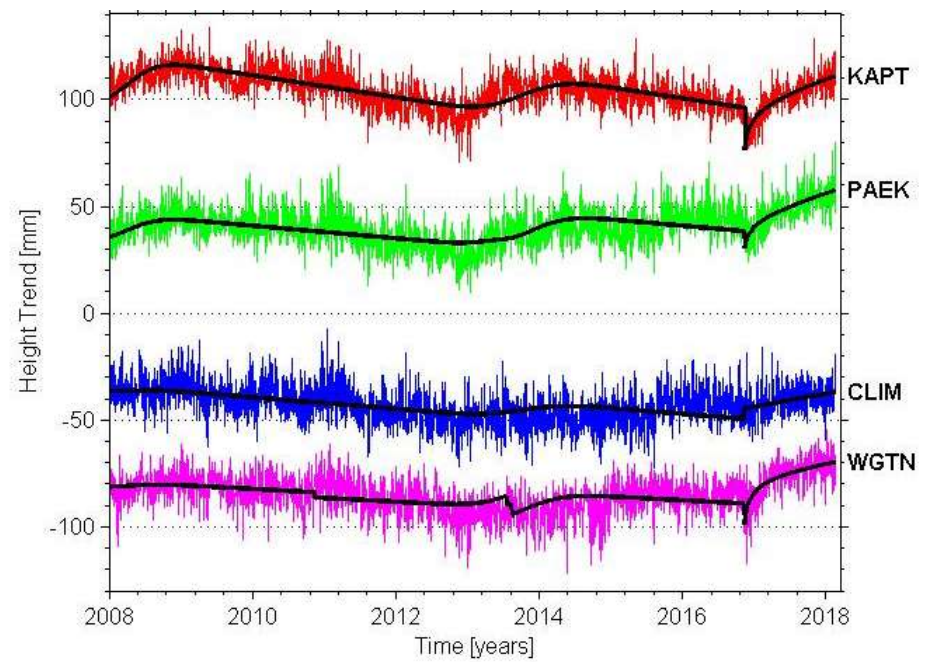
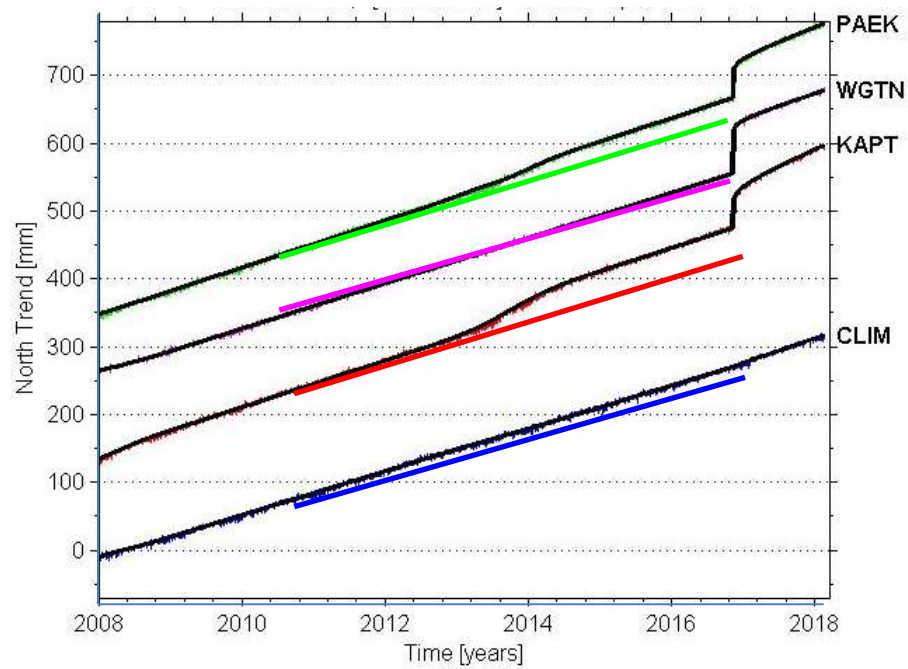
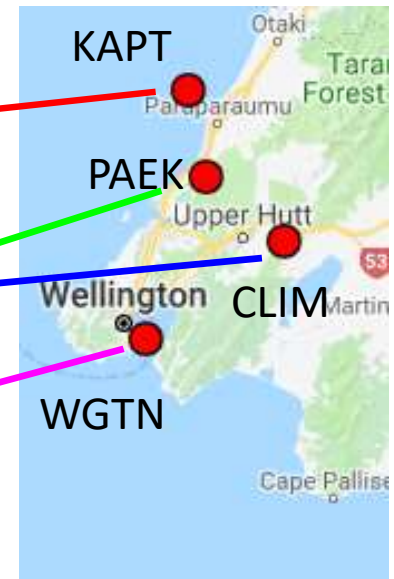
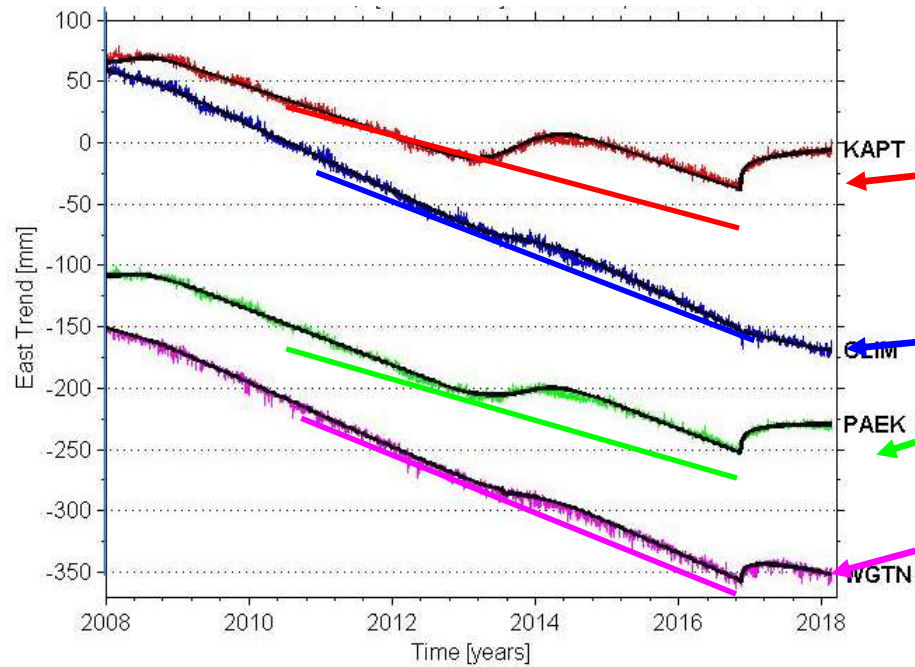
Woodchester Station

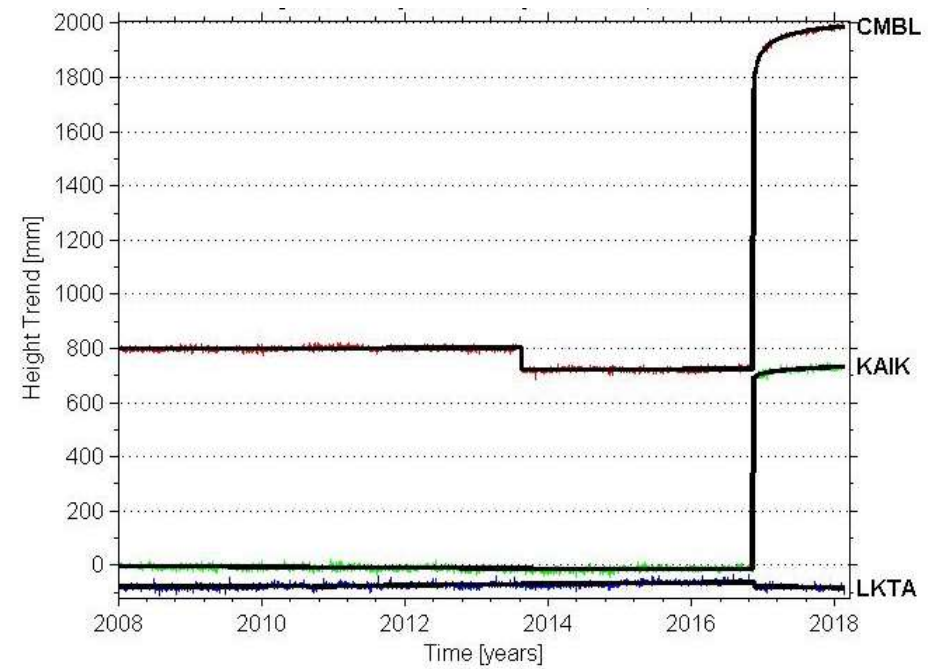
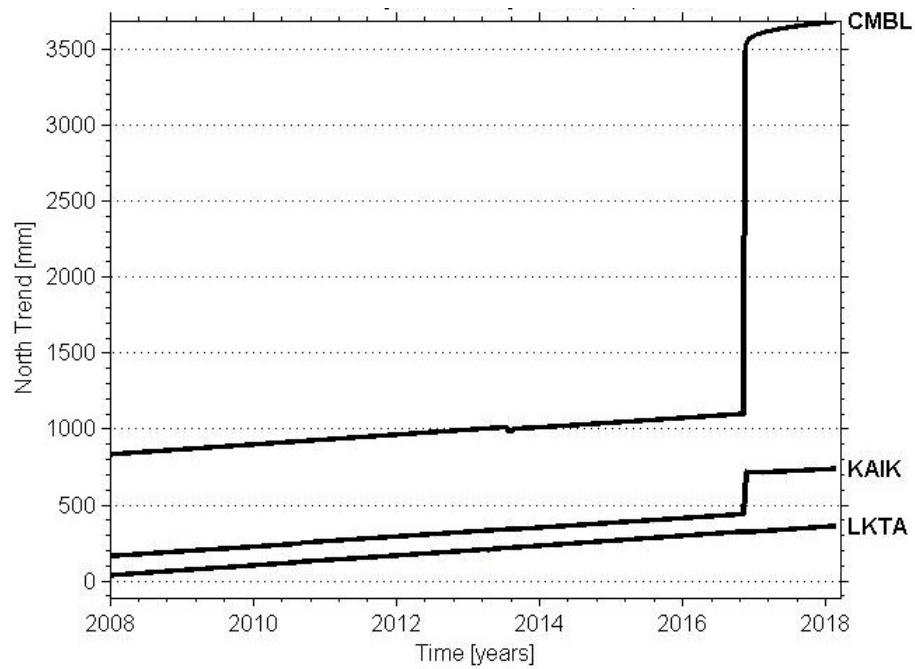
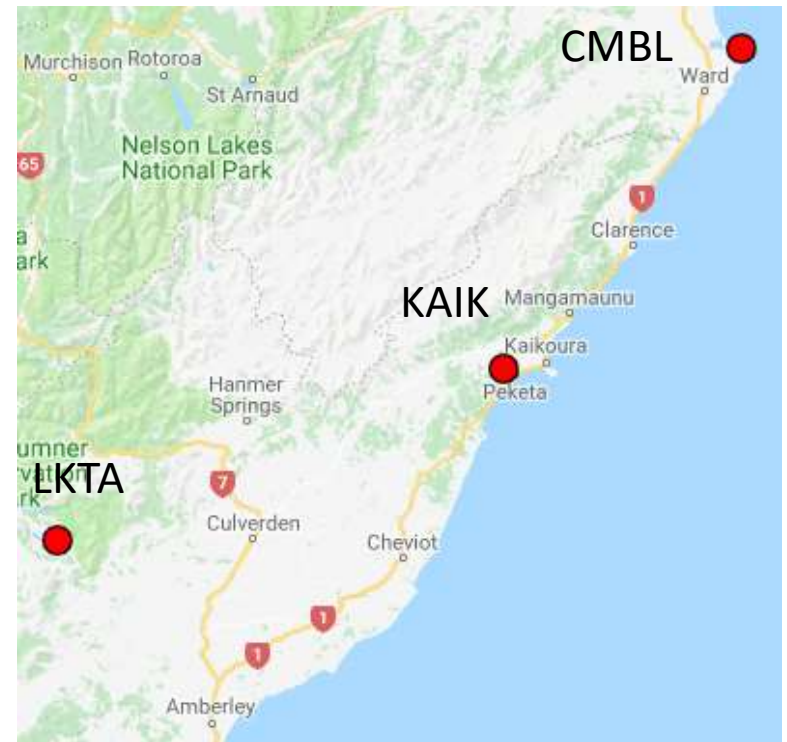
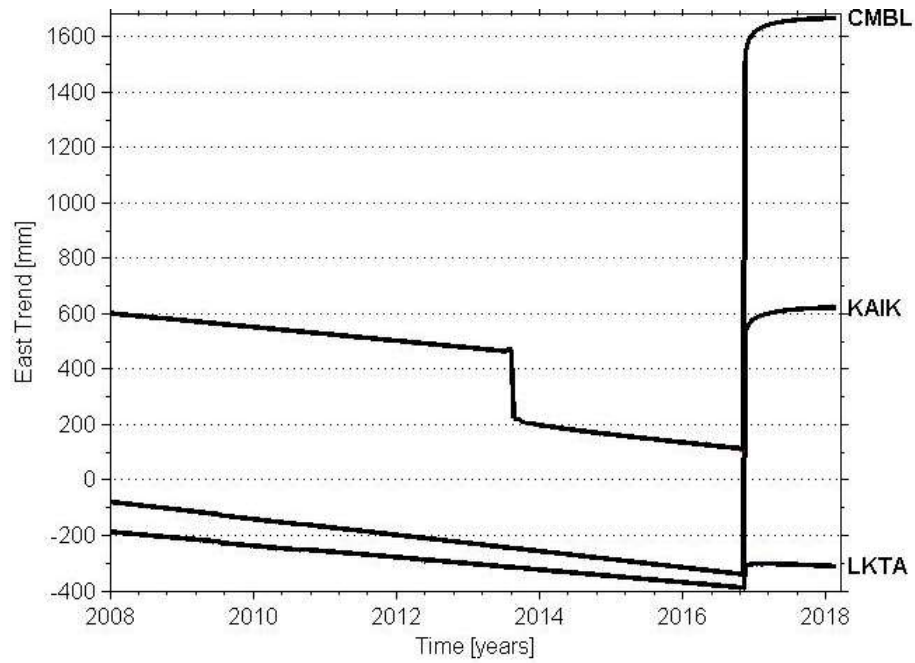
N-S trend



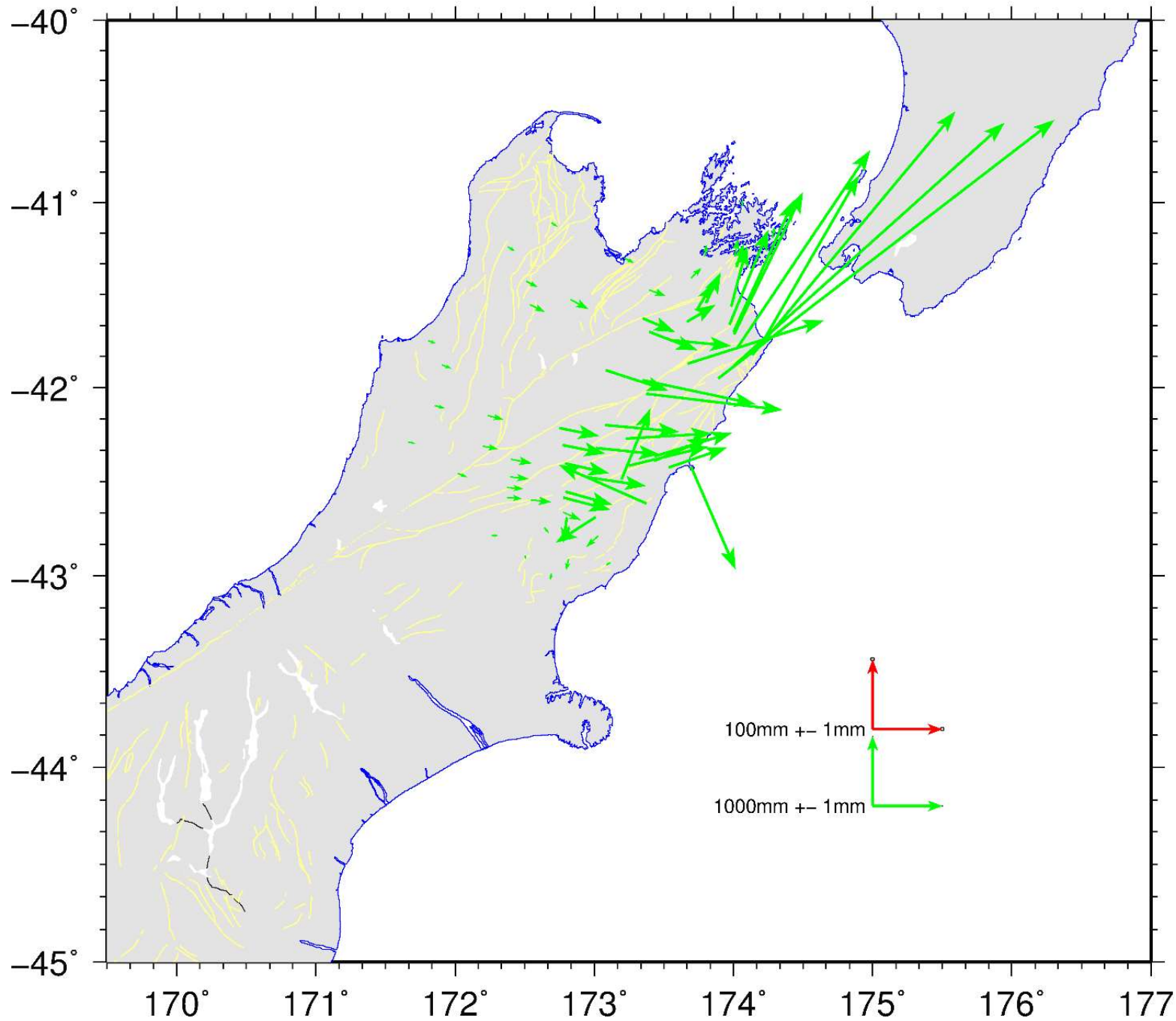
Photos: Kate Pedley

Andy Nicol

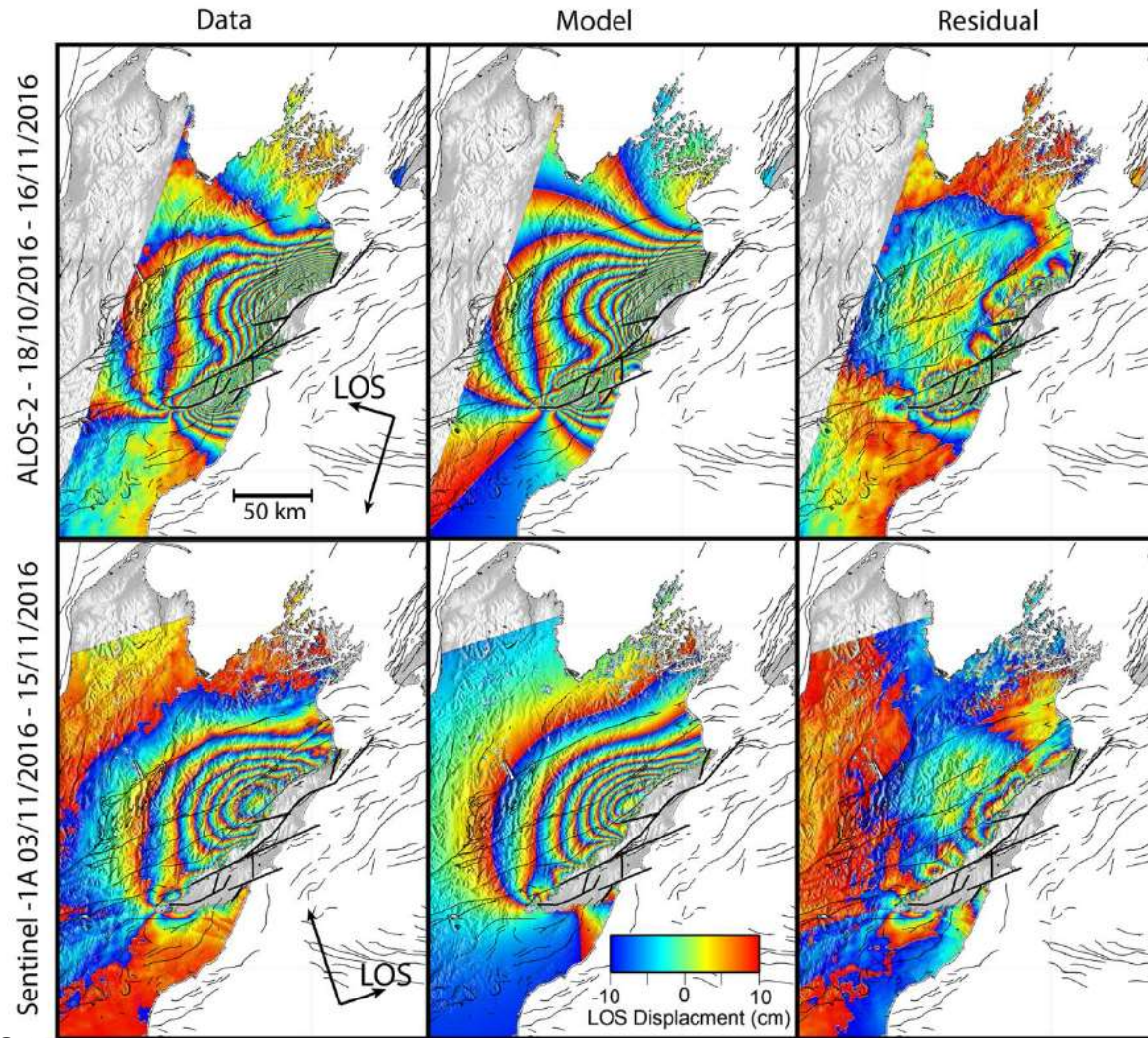




Coseismic Displacement Near Feild

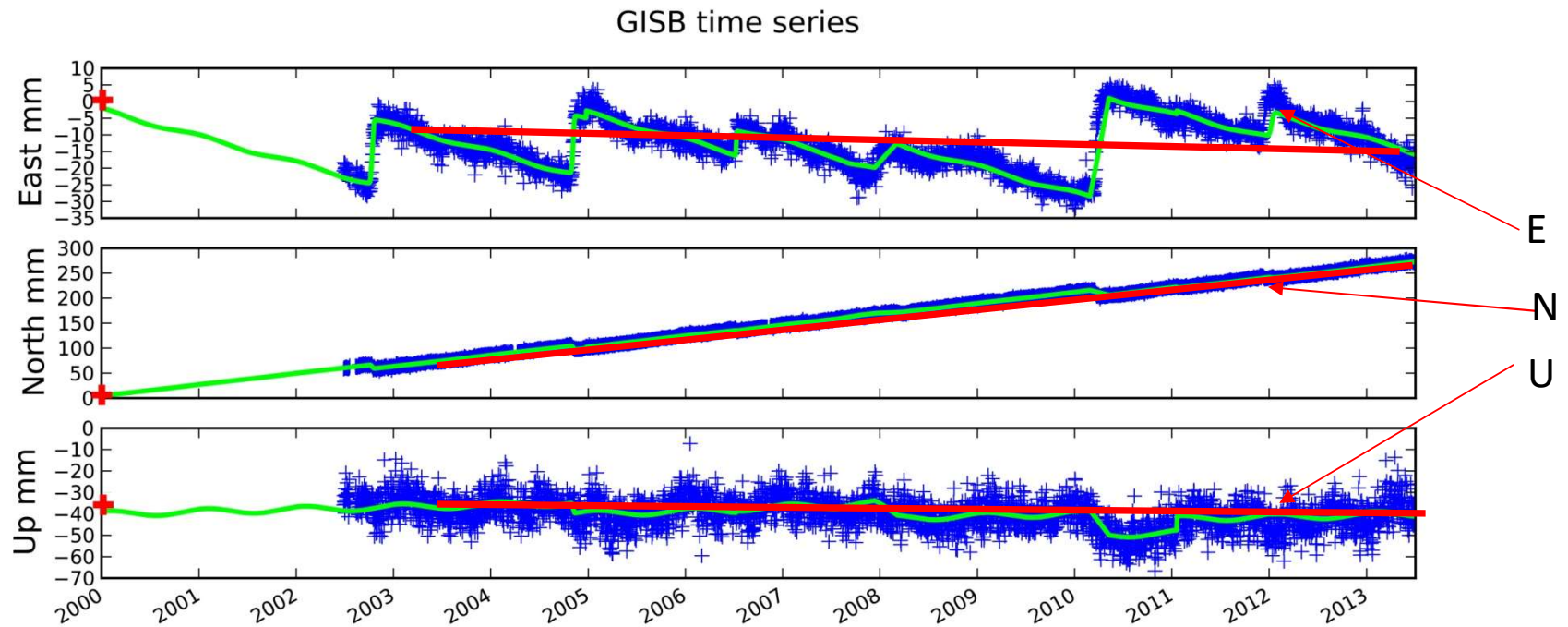


INSAR



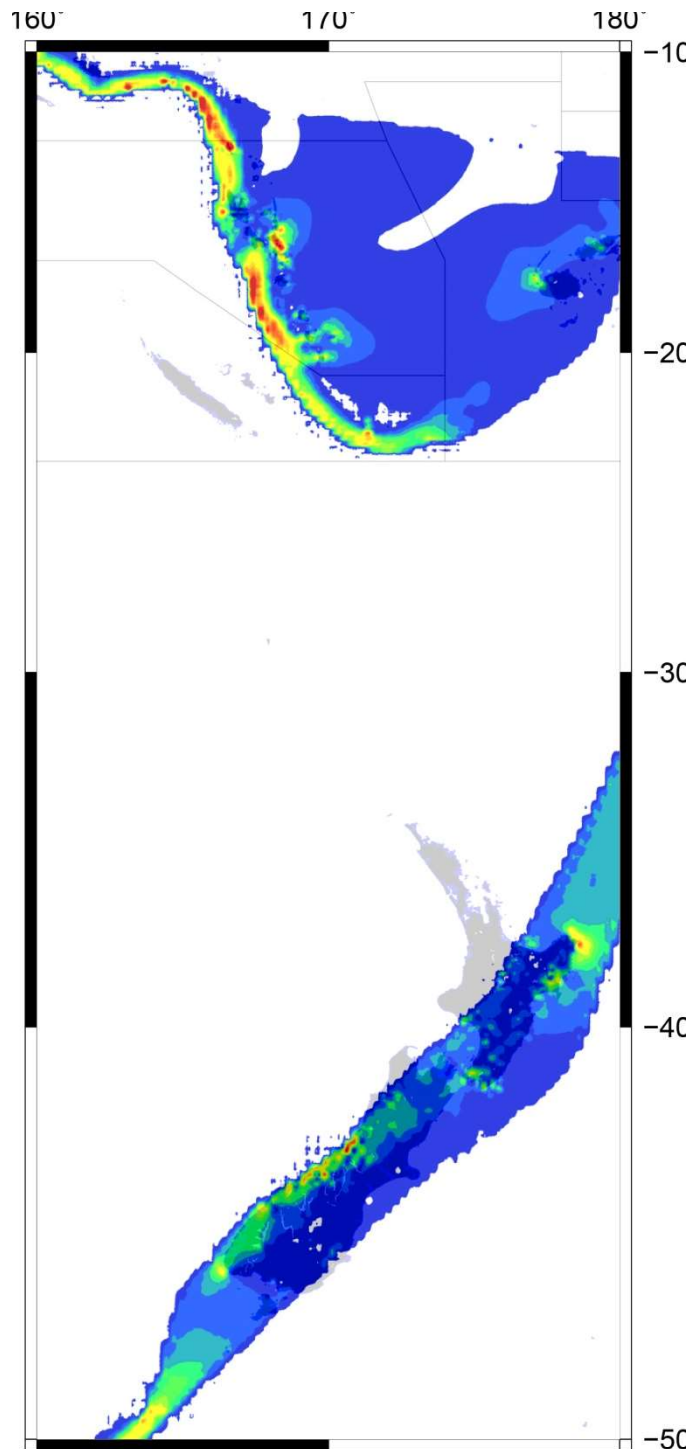
Hamling et al - 2017

SSE



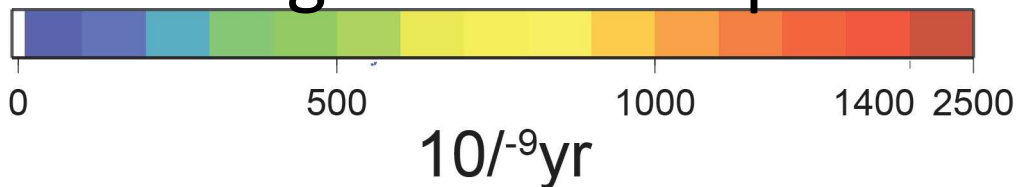
If we model the SSEs (green line) we get a very different velocity than if we average through them

SPM ENU
coordinate

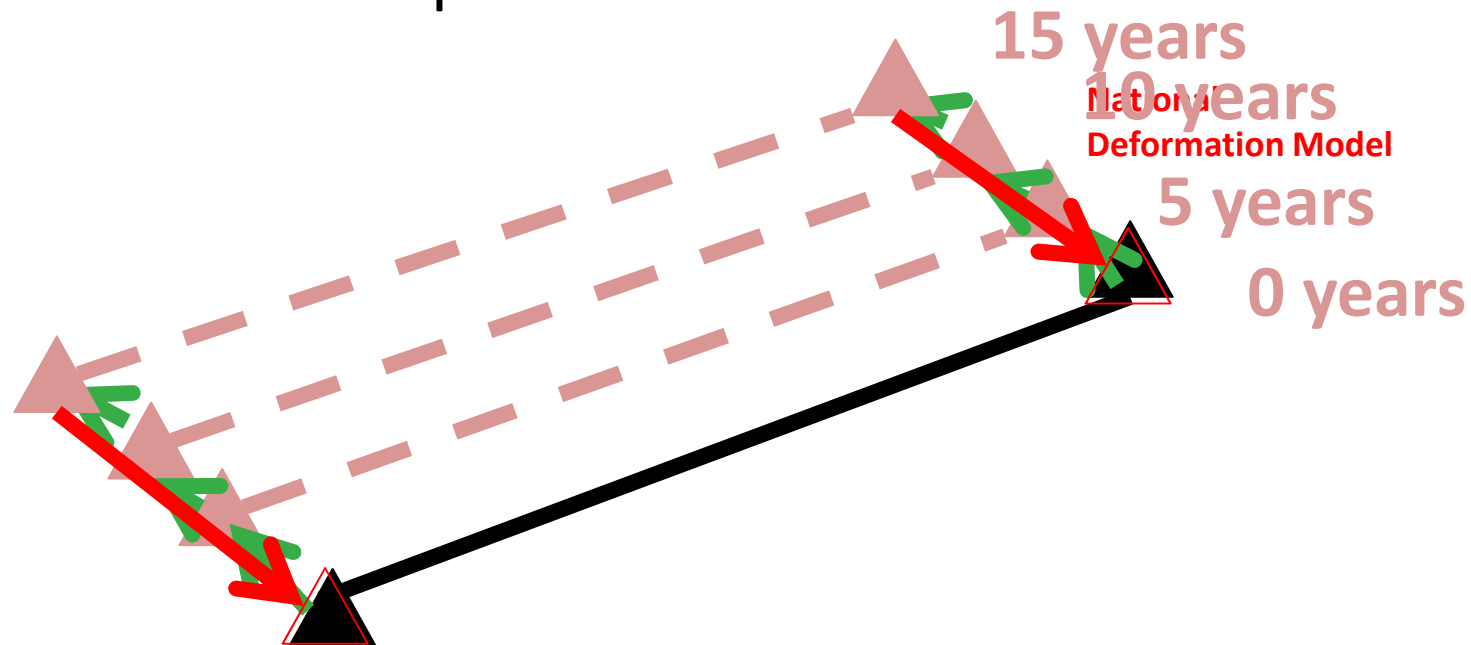






Strain rate Field

- Maximum shear strain rates show the derivative of the velocity field
- High strain rates mean that if the NDM is not applied properly distortions will build
- These can effect users even if the baselines are short
- Particularly if the epoch date is a long time in the past

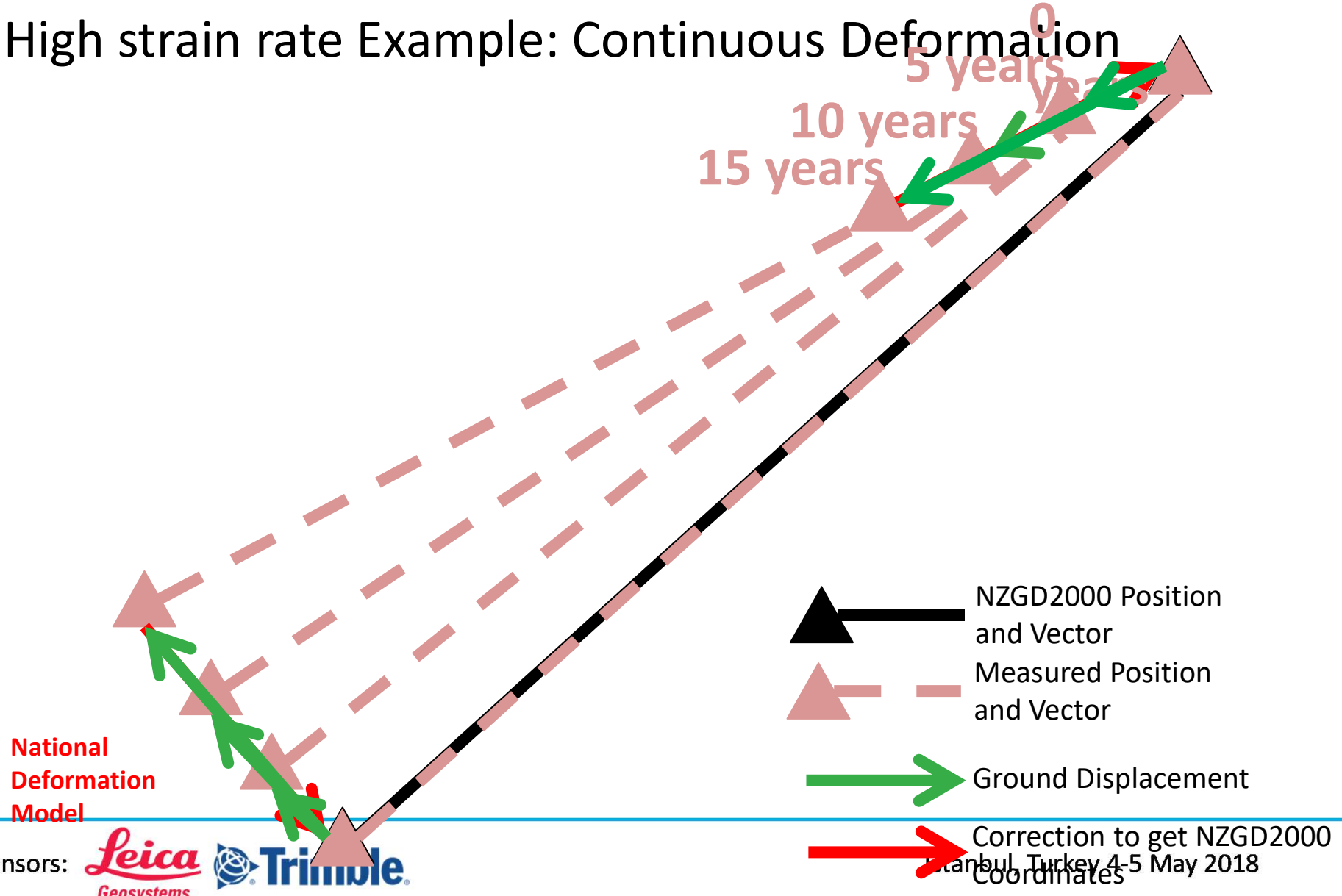


Low strain rate example



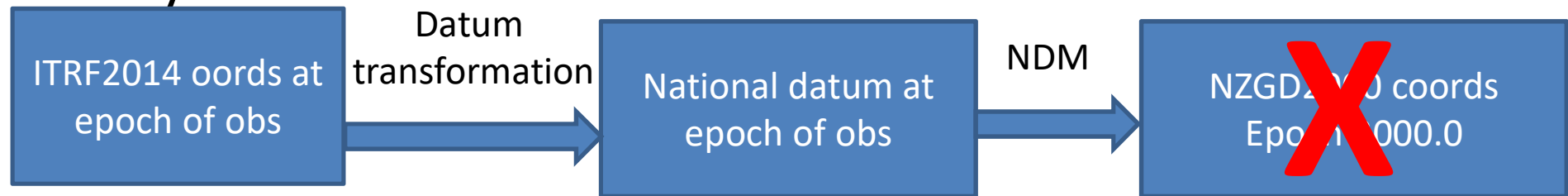
-  NZGD2000 Position and Vector
-  Measured Position and Vector
-  Ground Displacement
-  Correction to get NZGD2000 Coordinates

High strain rate Example: Continuous Deformation



Conclusions

- Deformation models can be required to shift coordinates to reference epoch of datum
- Deformation models can have
 - Secular velocities
 - Post-seismic relaxation
- Needed to support time dependent least square adjustments and datum transformations for semi-dynamic datums



Folie 17

CP1

This would be a good segway into your talk Chris.I could put an explicate plug here if you want.

Christopher Pearson; 15.08.2013