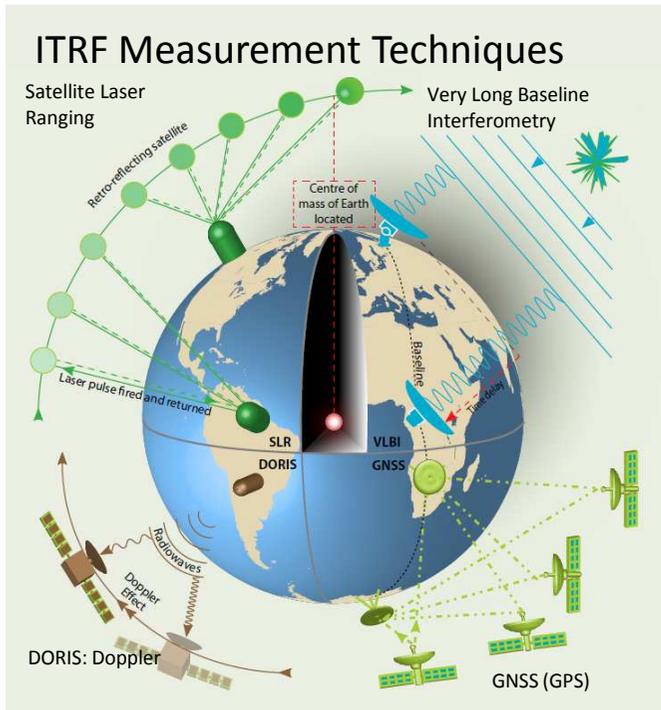




*Recent progress towards a  
modernized geodetic datum for  
Nepal*

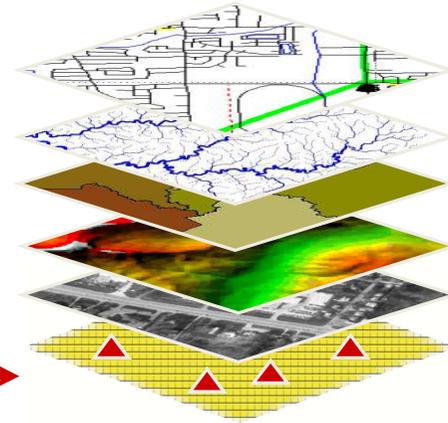
---

Chris Pearson  
Niraj Manandhar



**ITRF2014**

**NDM**



**Required by GPS**

**No deformation model**

**Datums and epoch dates change frequently**

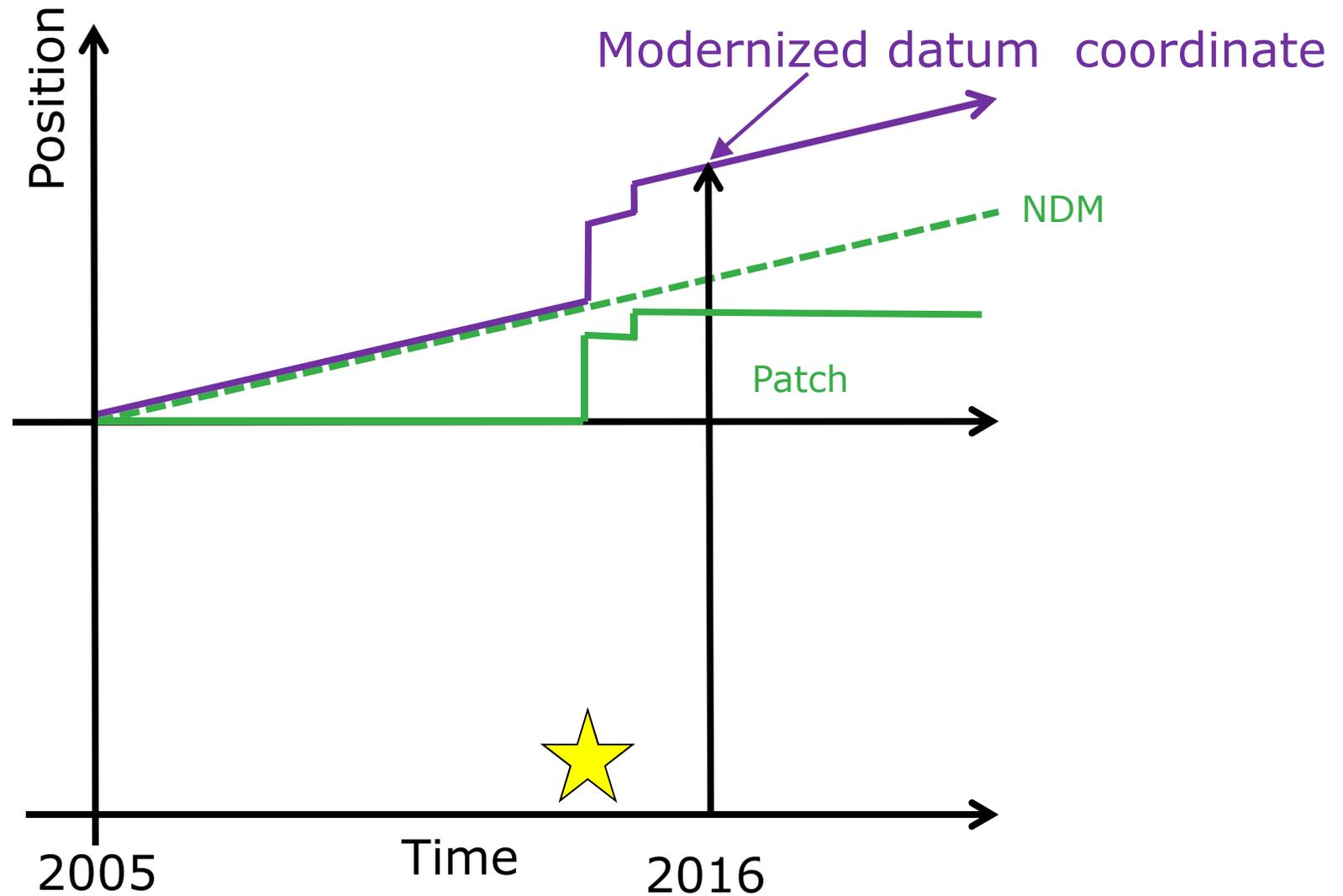
**Modernized datum for Nepal**

**Stable coords**

**deformation model**

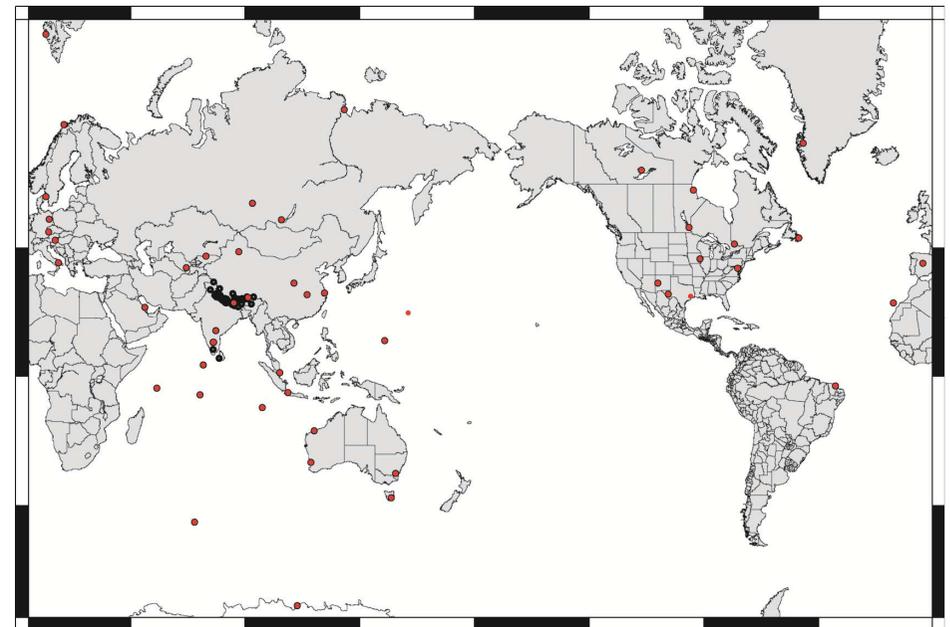
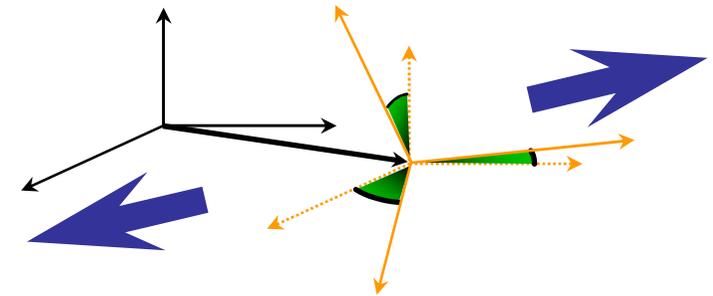
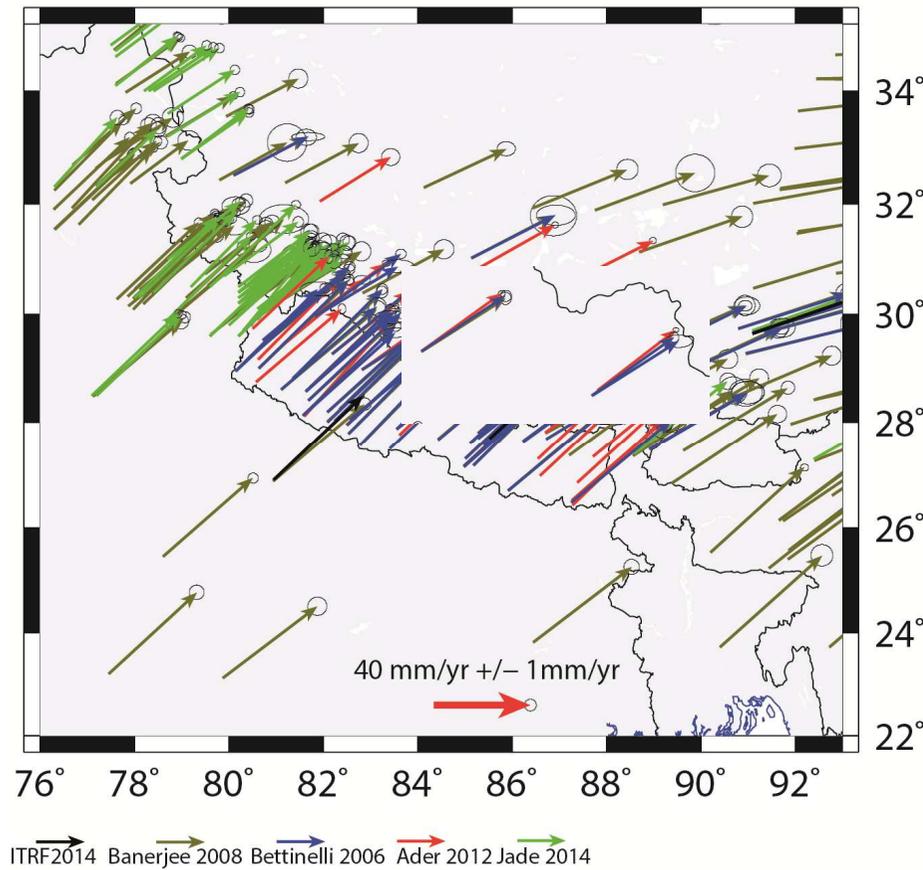
Modernized geodetic datum aligned with ITRF2014  
 Coordinates transformed to 1 Jan 2016 using the a  
 national deformation model

# How the NDM works



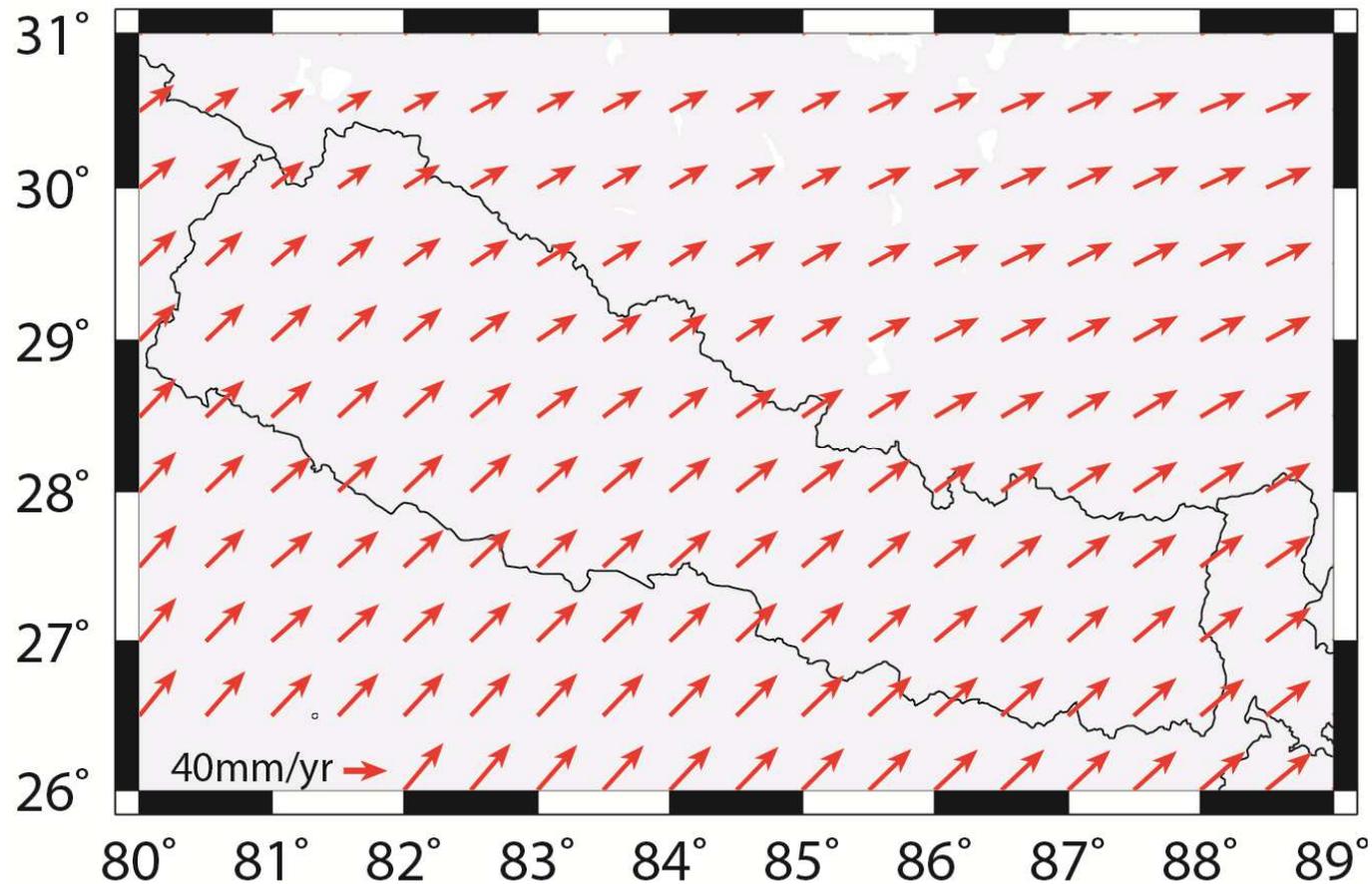
# Secular velocity field

- Velocity from four recent studies were aligned with the ITRF2014 velocities



## velocity model

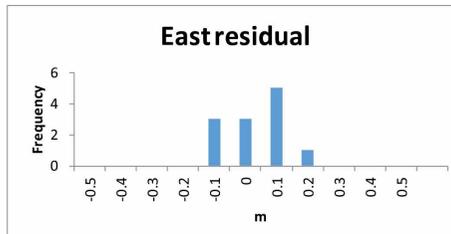
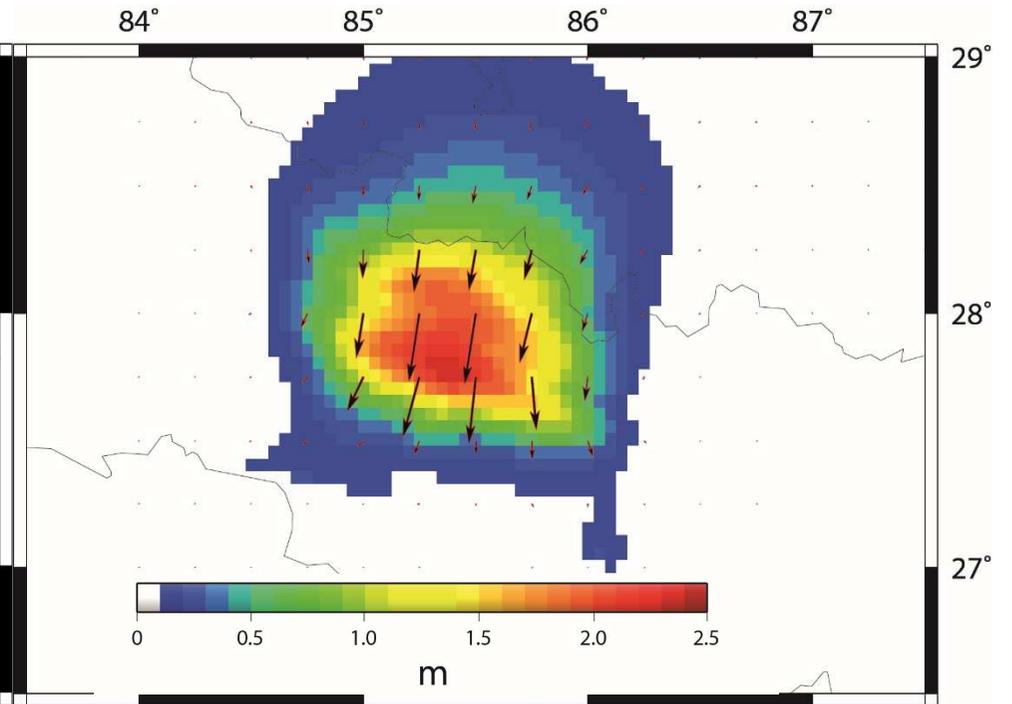
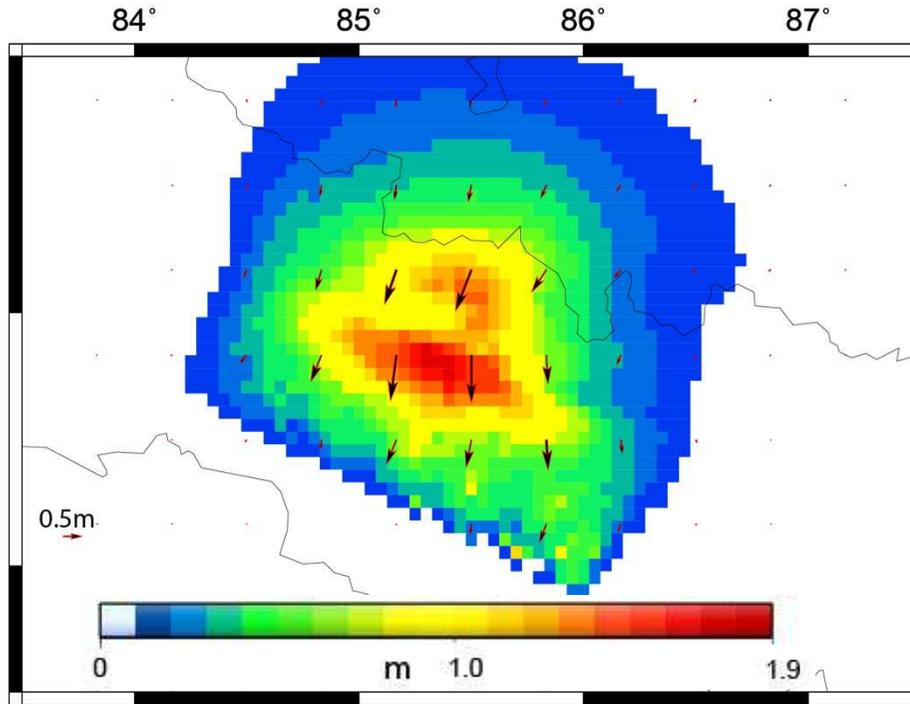
- The combined velocity field was used to produce a grid file with a density of 20 points/degree



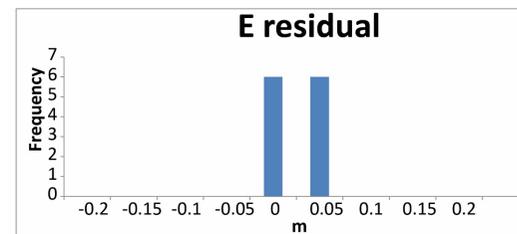
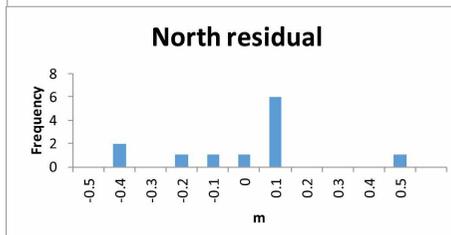
# Two possible models for Gorka Earthquake

Galetzka et al. 2015 (JPL)

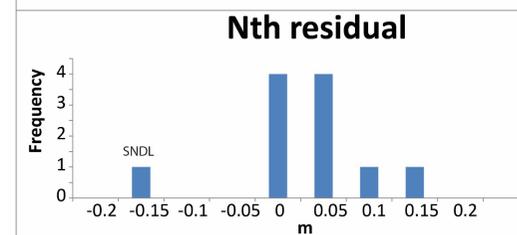
Wang et al in prep (SOPAC)



RMS	Galetzka
E m	0.21
N m	0.11
U m	0.08

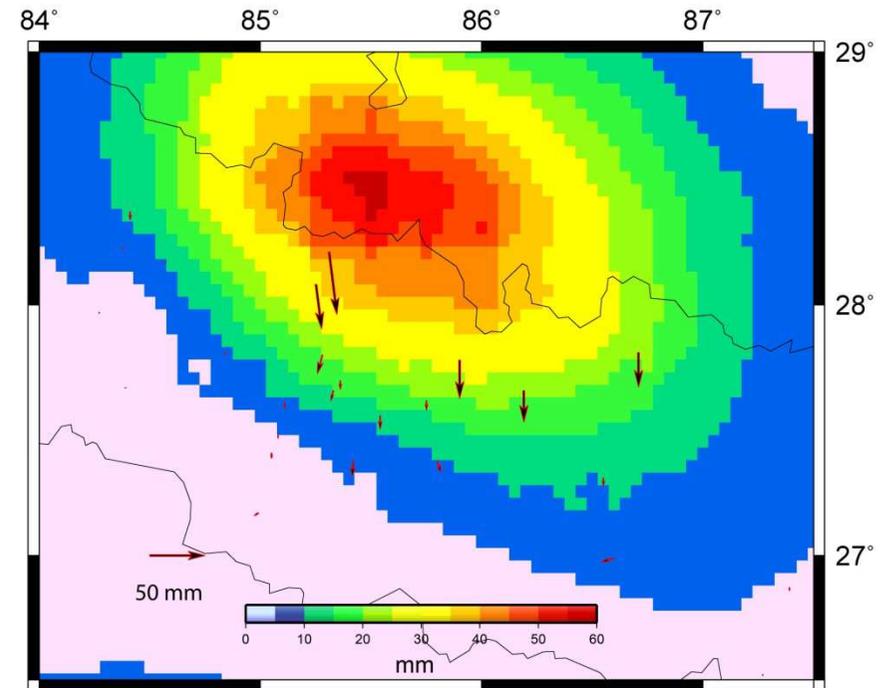
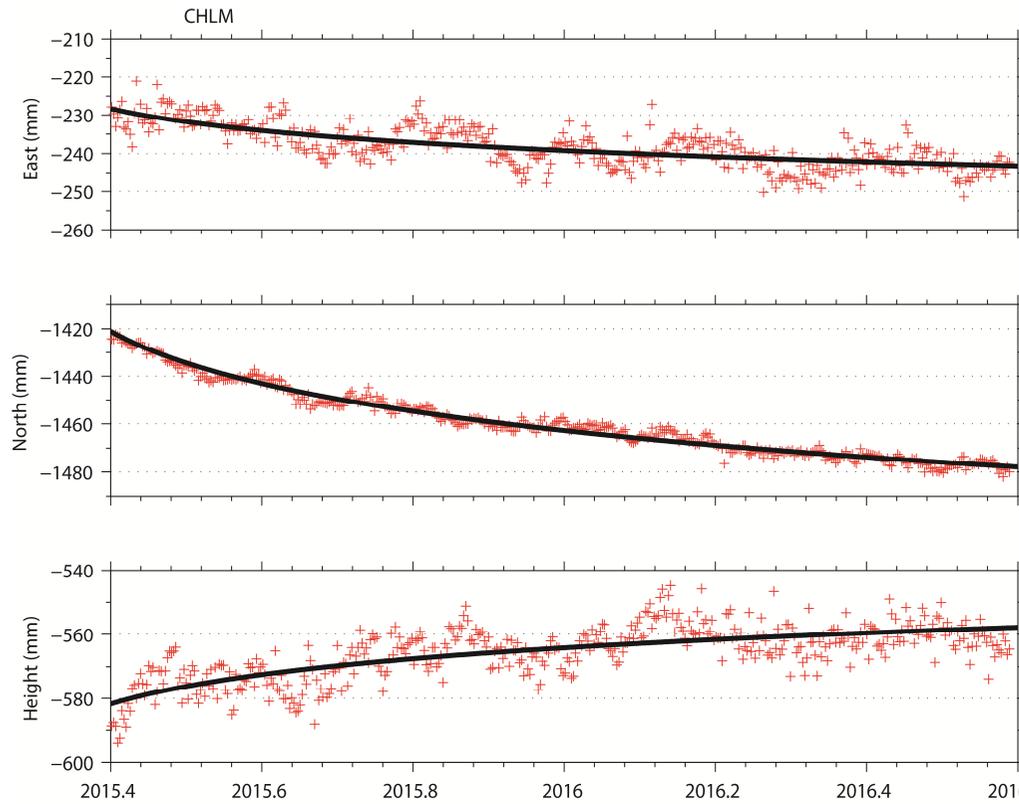


RMS	Wang
E m	0.07
N m	0.02
U m	0.03



# Post seismic relaxation

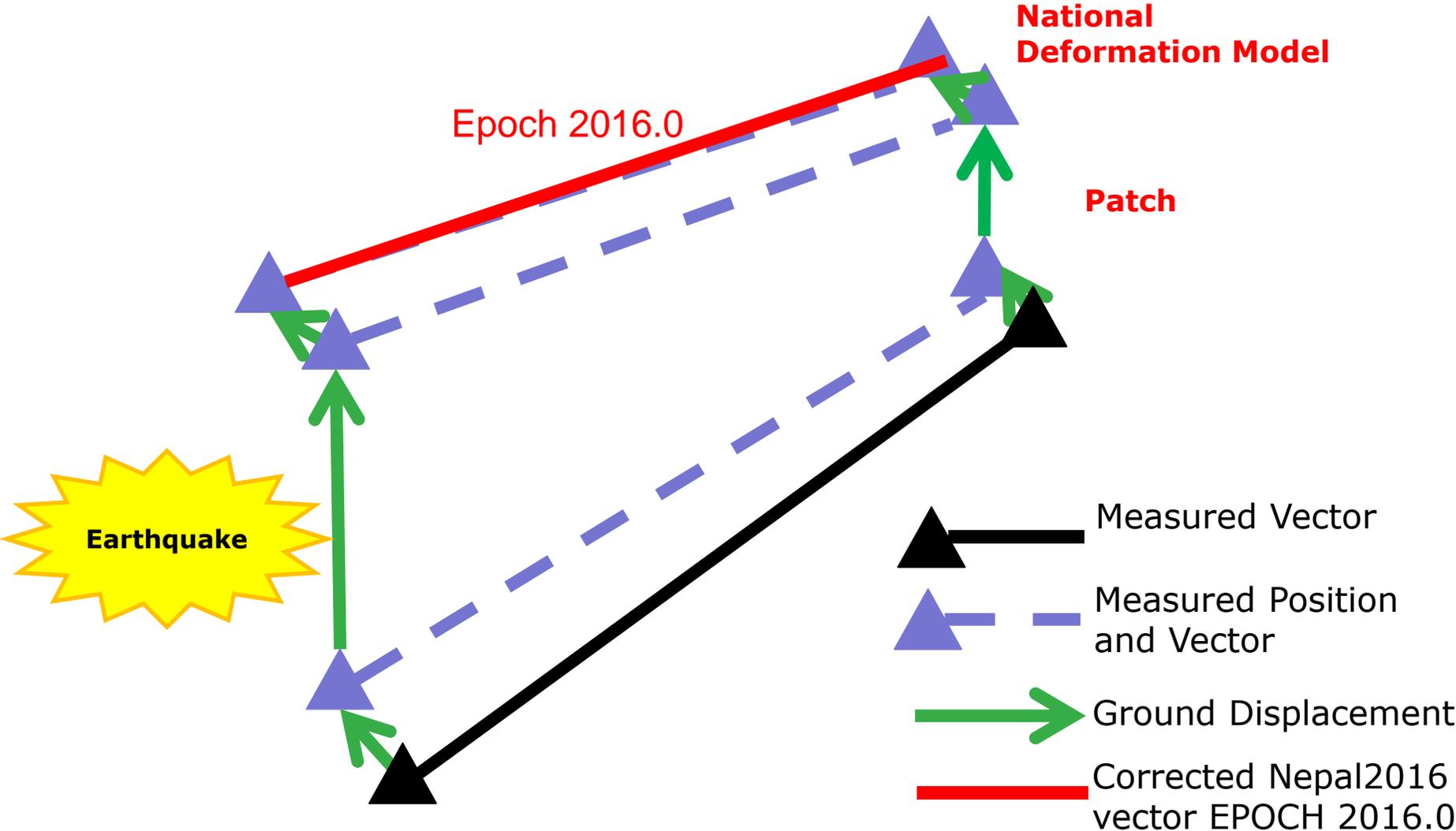
Mencin et al  
Nature Geosciences 2016



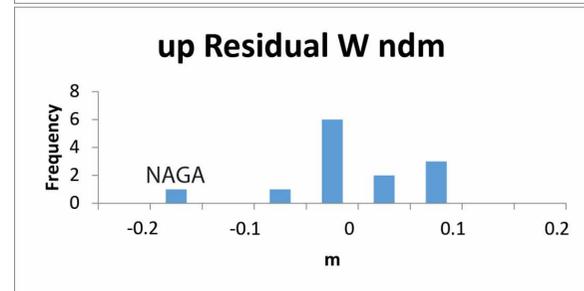
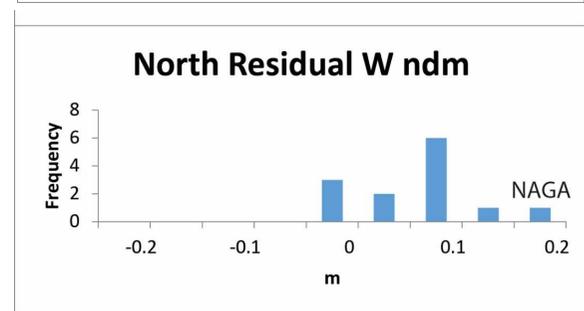
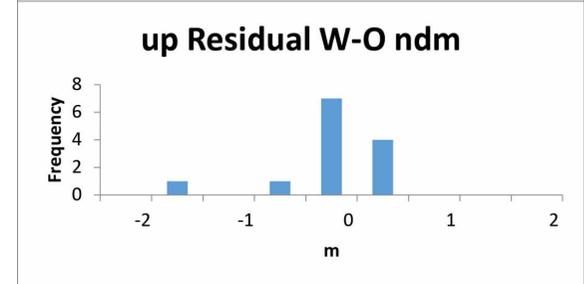
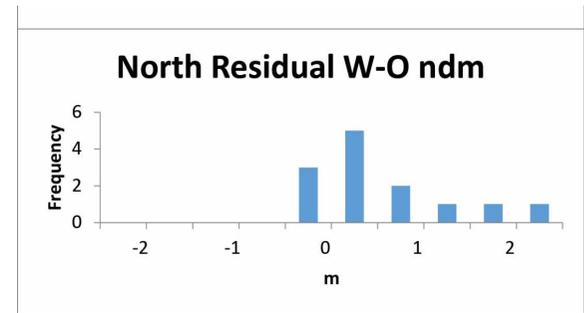
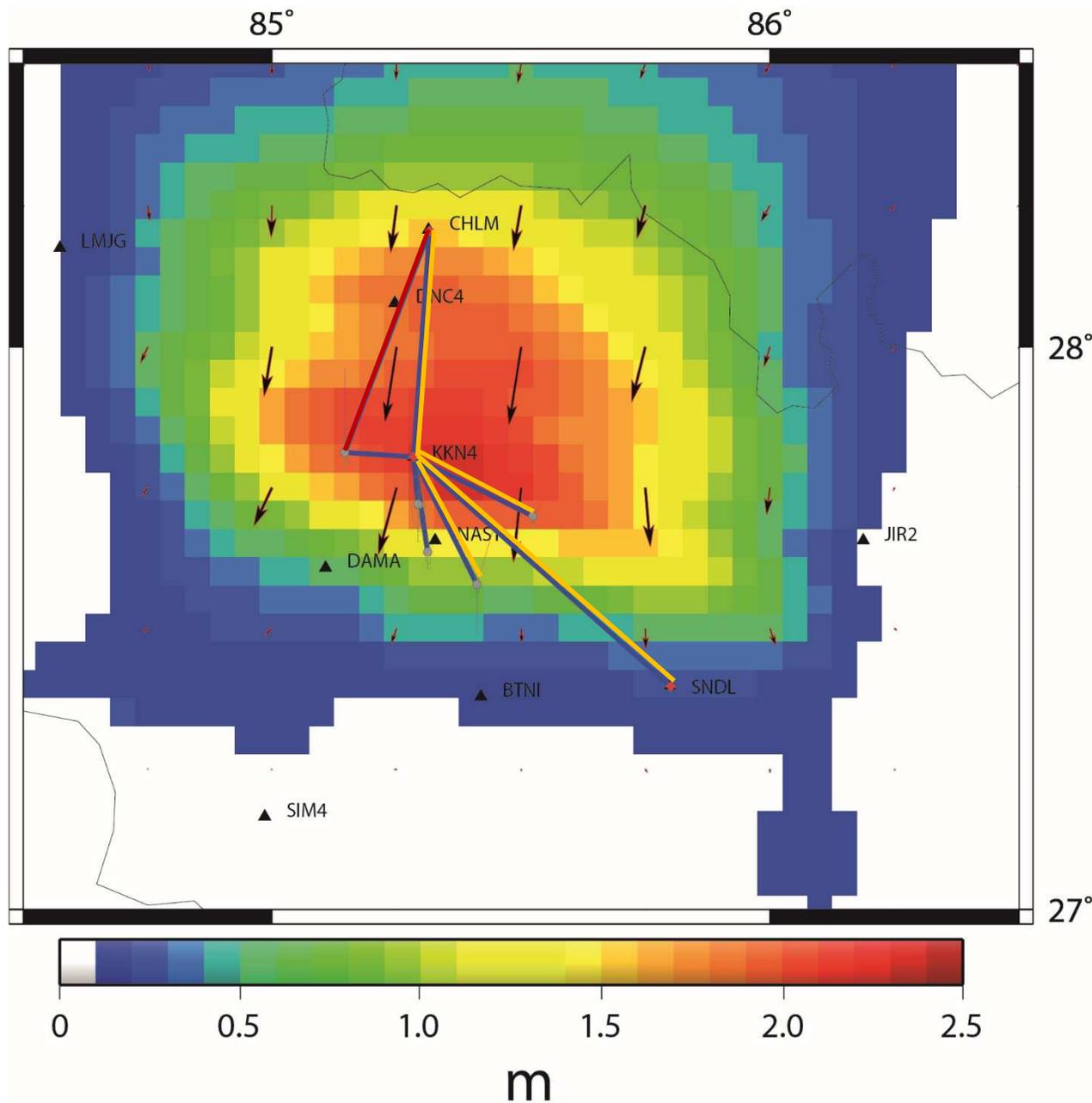
$$m_k(t) = v_k t + E_k H(t - t_i) + P_k H(t - t_i) \left(1 - e^{-(t - t_i)/43}\right)$$

# Deformation models in survey adjustments

## Example: Patch for an Earthquake

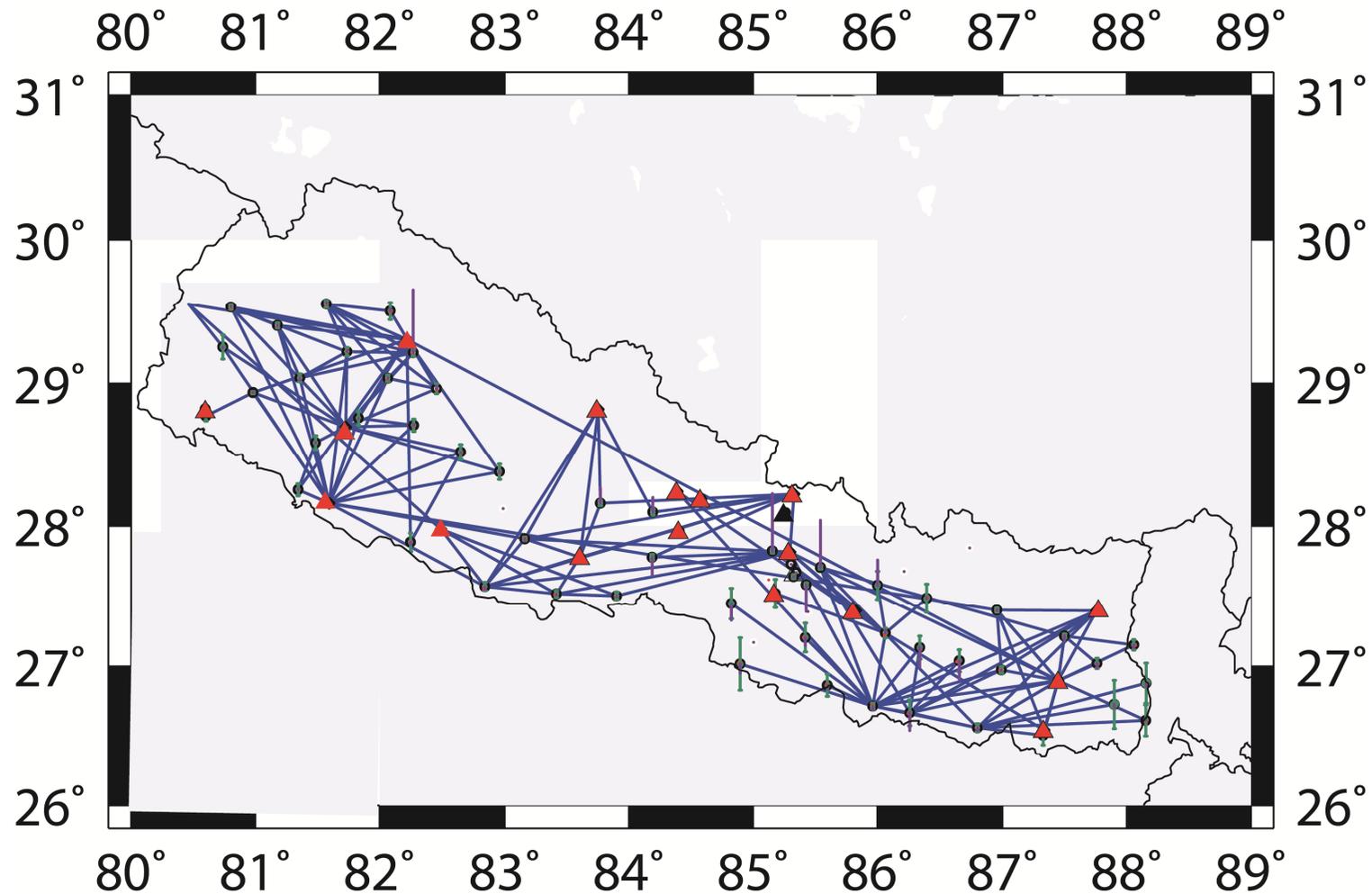


# Adjustment of GPS before and after the Gorkha Earthquake



## First Order adjustment Preliminary results

- SUE of constrained adjustment 1.25
- RMS Residuals  $E=0.01, n=0.01, u=0.05$



## Conclusions

- datum aligned to a realization of the ITRF
- common reference epoch after the recent sequence of earthquakes
- deformation model
  - Velocity model
  - Earthquake displacements
- Control
  - Top level control CORS network
  - Establish lower order control relative to the CORS
    - New marks surveyed with GPS
    - Readjust existing measurements
- correction grids to transform GIS coordinates from Nepal Everest into the new system.
- Support in commercial software

↑  
DONE  
↓

↑  
TO DO  
↓