

# Observations of large-scale frame deformations and related effects

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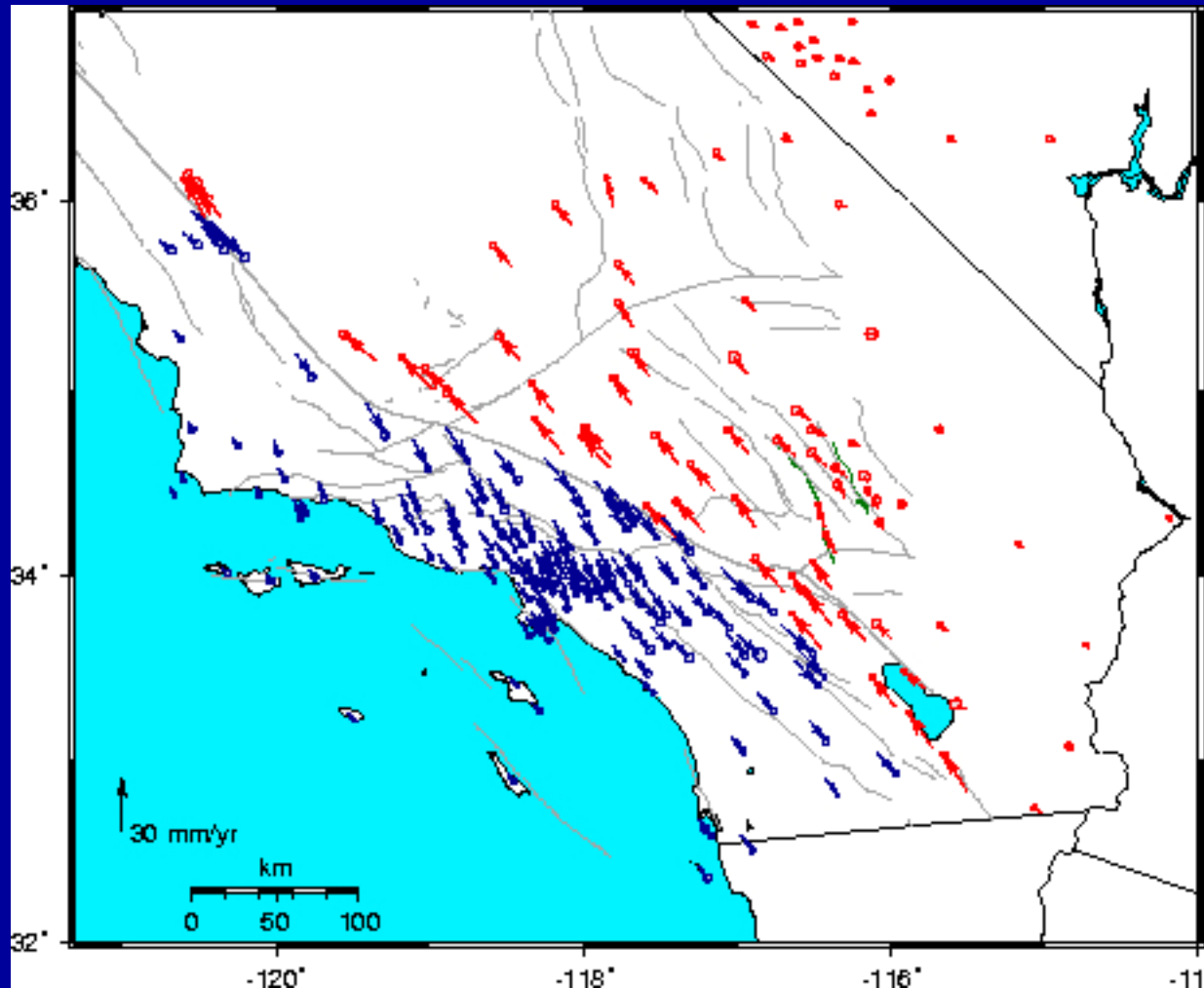
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<http://geoweb.mit.edu/~tah>

# OVERVIEW

- Examine reference frame realizations on different scales
  - Compare Southern California Integrated GPS network (SCIGN) with Continental scale frame
  - Histogram of repeatability
  - Time series
  - Effects of loading

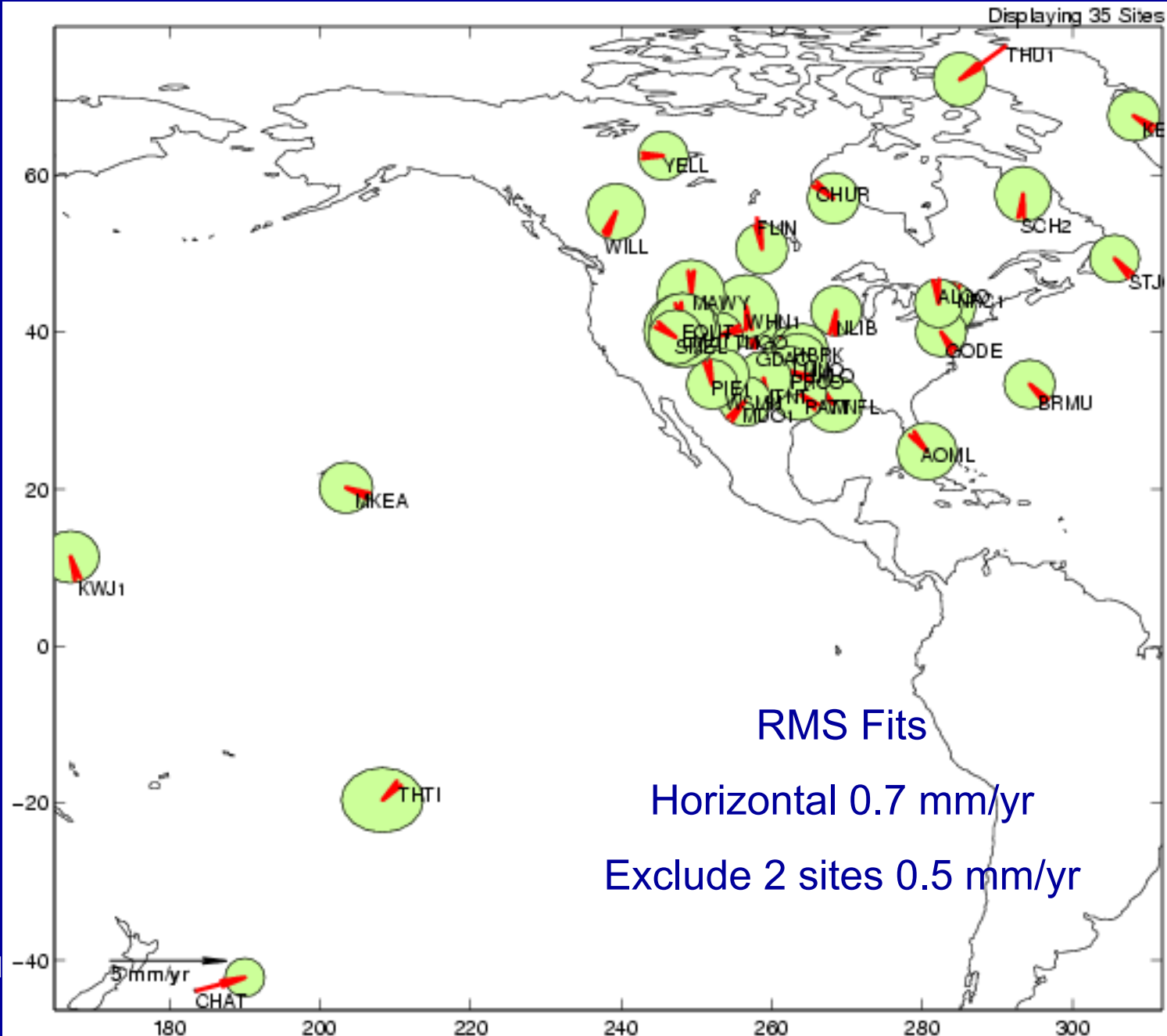
# Velocities from SCIGN Network

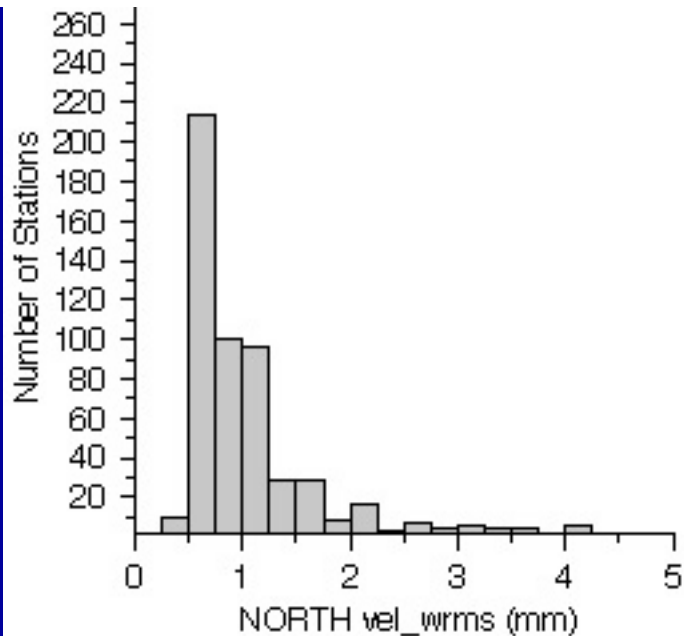


SCIGN is  
network of 250  
stations in  
Southern  
California

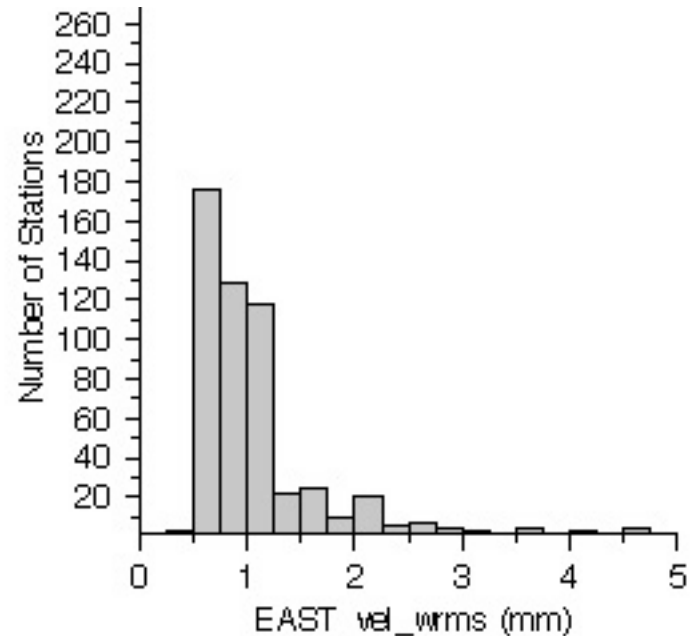
Data analyzed  
by JPL and  
SIO.  
Combined  
product  
generated

# Pacific North America Frame

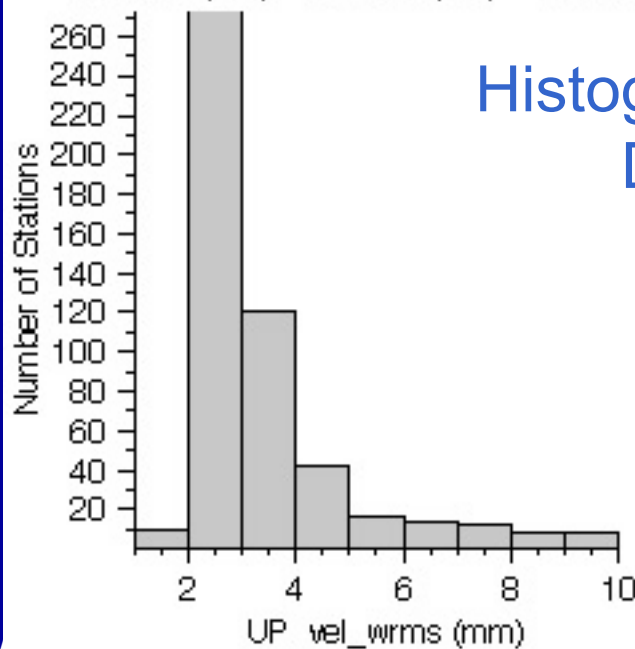




Mean (mm) : 1.1    Sigma (mm) : 1.0    Stations: 545  
 50% < 0.8 (mm)    70% < 1.1 (mm)    95% < 3.0 (mm)



Mean (mm) : 1.2    Sigma (mm) : 1.0    Stations: 545  
 50% < 0.9 (mm)    70% < 1.1 (mm)    95% < 2.9 (mm)

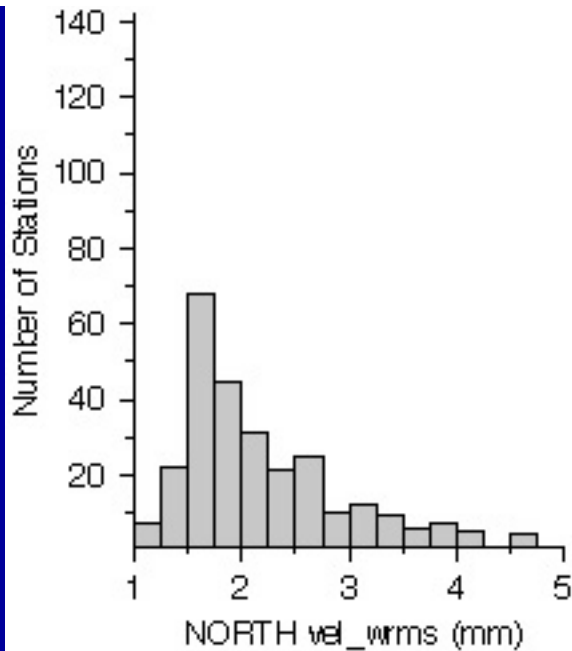


Mean (mm) : 3.6    Sigma (mm) : 3.9    Stations: 545  
 50% < 2.8 (mm)    70% < 3.4 (mm)    95% < 7.5 (mm)

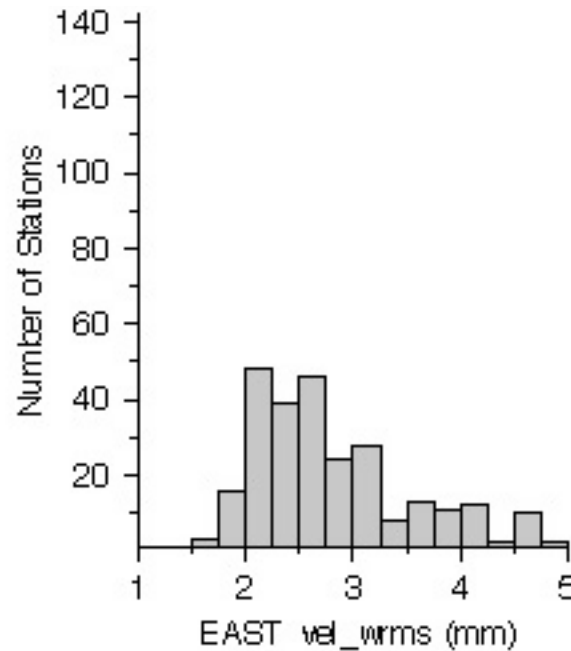
## Histogram of SCIGN Repeatability Daily Position estimates

Frame realization uses on  
sites in SCIGN region

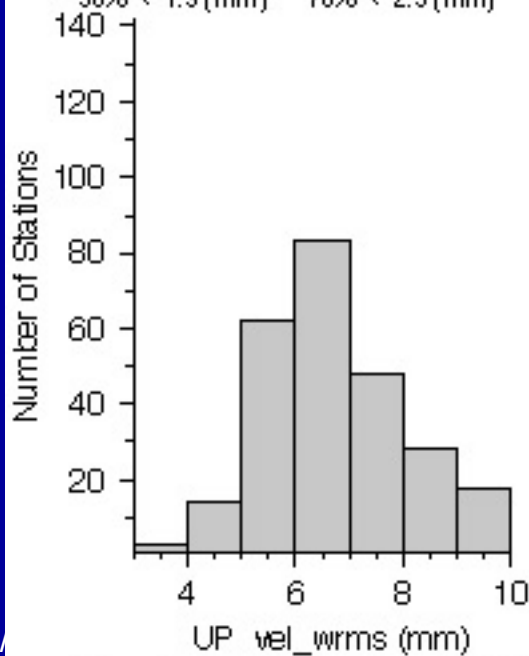
Median NE 0.9 mm,  
Height 2.8mm



Mean (mm) : 2.4    Sigma (mm) : 1.6    Stations: 285  
 50% < 1.9 (mm)    70% < 2.5 (mm)    95% < 4.6 (mm)



Mean (mm) : 3.2    Sigma (mm) : 2.1    Stations: 285  
 50% < 2.7 (mm)    70% < 3.2 (mm)    95% < 5.4 (mm)



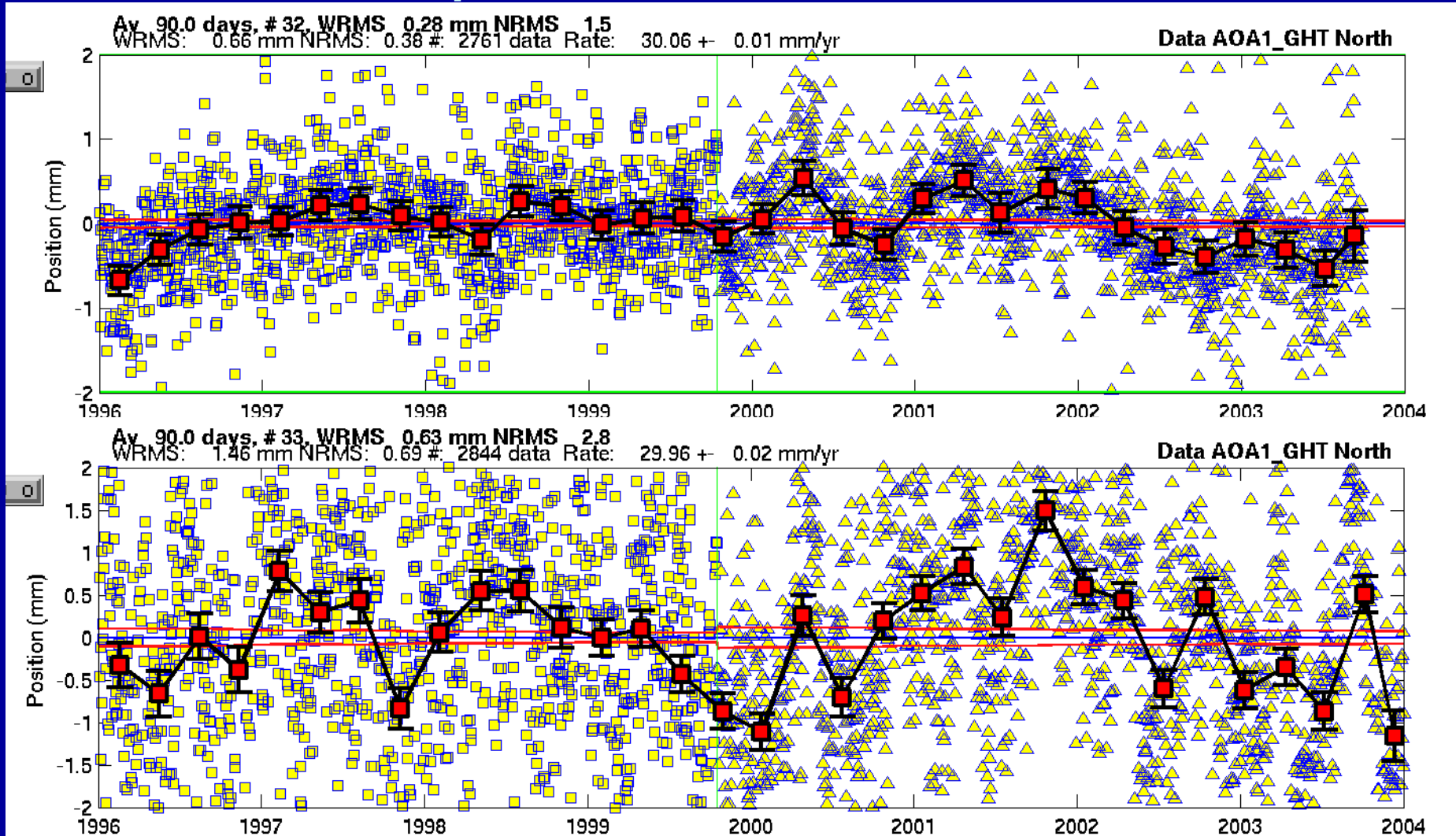
Mean (mm) : 7.4    Sigma (mm) : 2.9    Stations: 284  
 50% < 6.7 (mm)    70% < 7.8 (mm)    95% < 12.3 (mm)

## Repeatability in NA/Pacific frame

Frame realization using sites in Pacific and North America

Median NE 1.9-2.7 m  
 Height 6.7 mm

# Example: AOA1 Time series



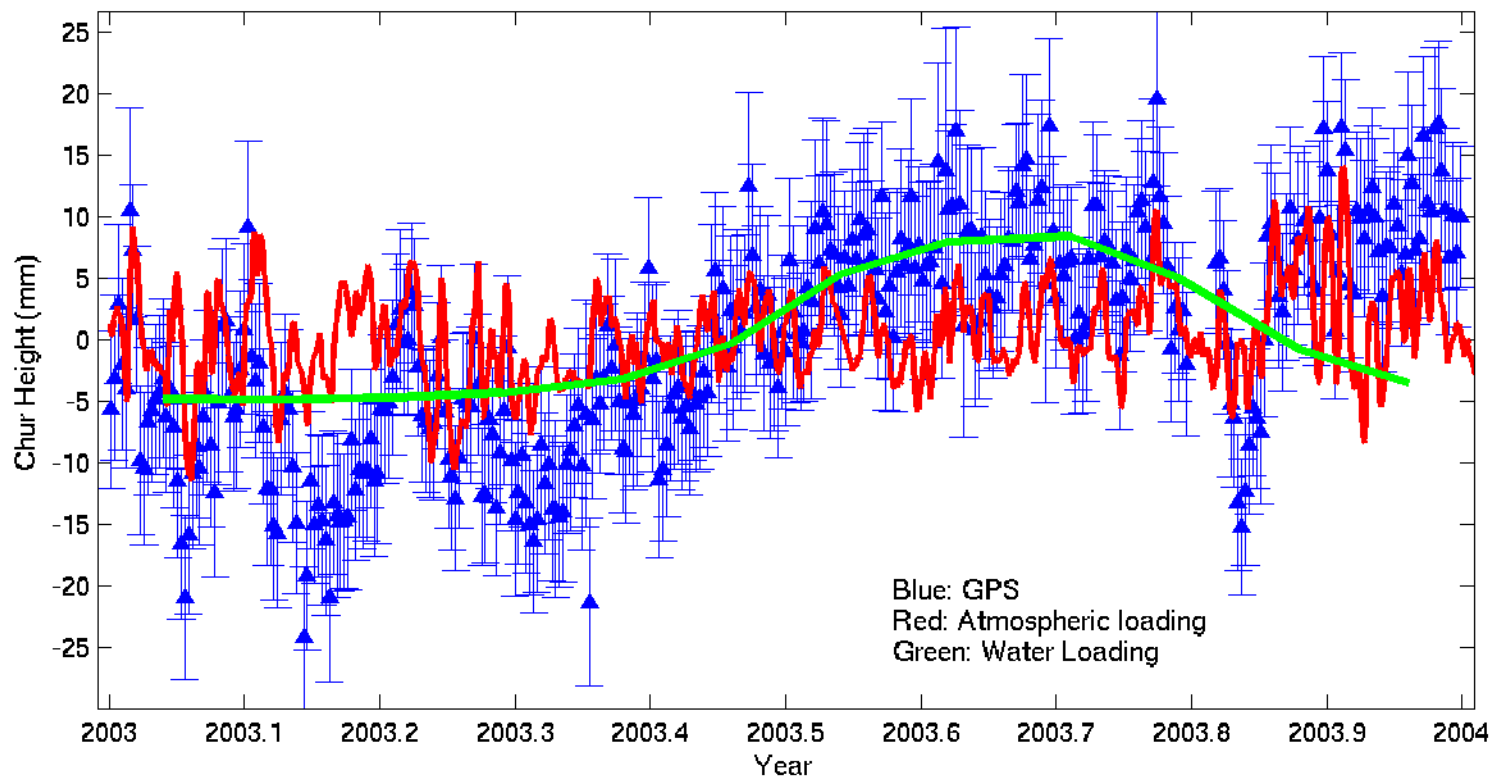
# Comparison of Local versus Continental Frame realization

- Despite difference in scatter of estimates, long term velocities match quite well
- For AOA1: Local and Continental Realization (RMS mm, Rate mm/yr)

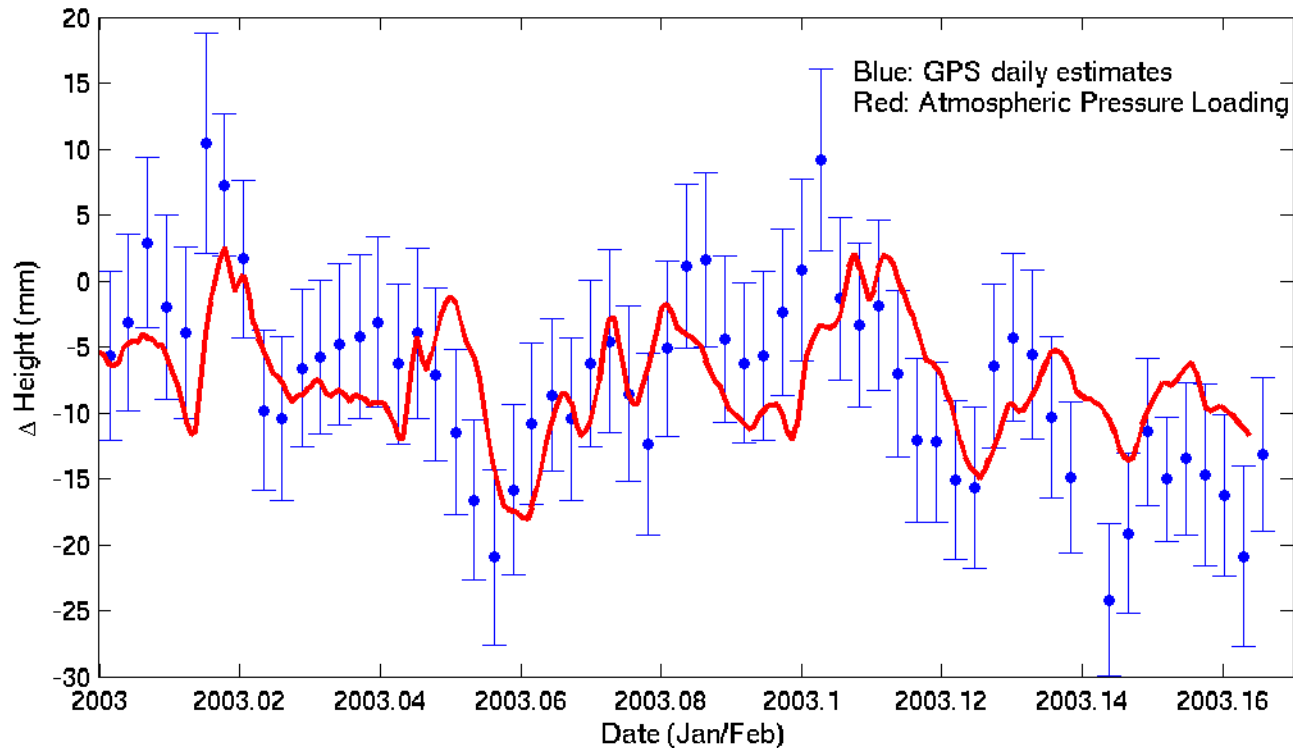
	RMS	Rate	RMS	Rate
North	0.7	30.1	1.5	30.0
East	0.7	-27.5	2.2	-27.6
Height	2.6	-1.4	5.5	-1.7



# Loading signals Churchill Canada (1-year 2003)

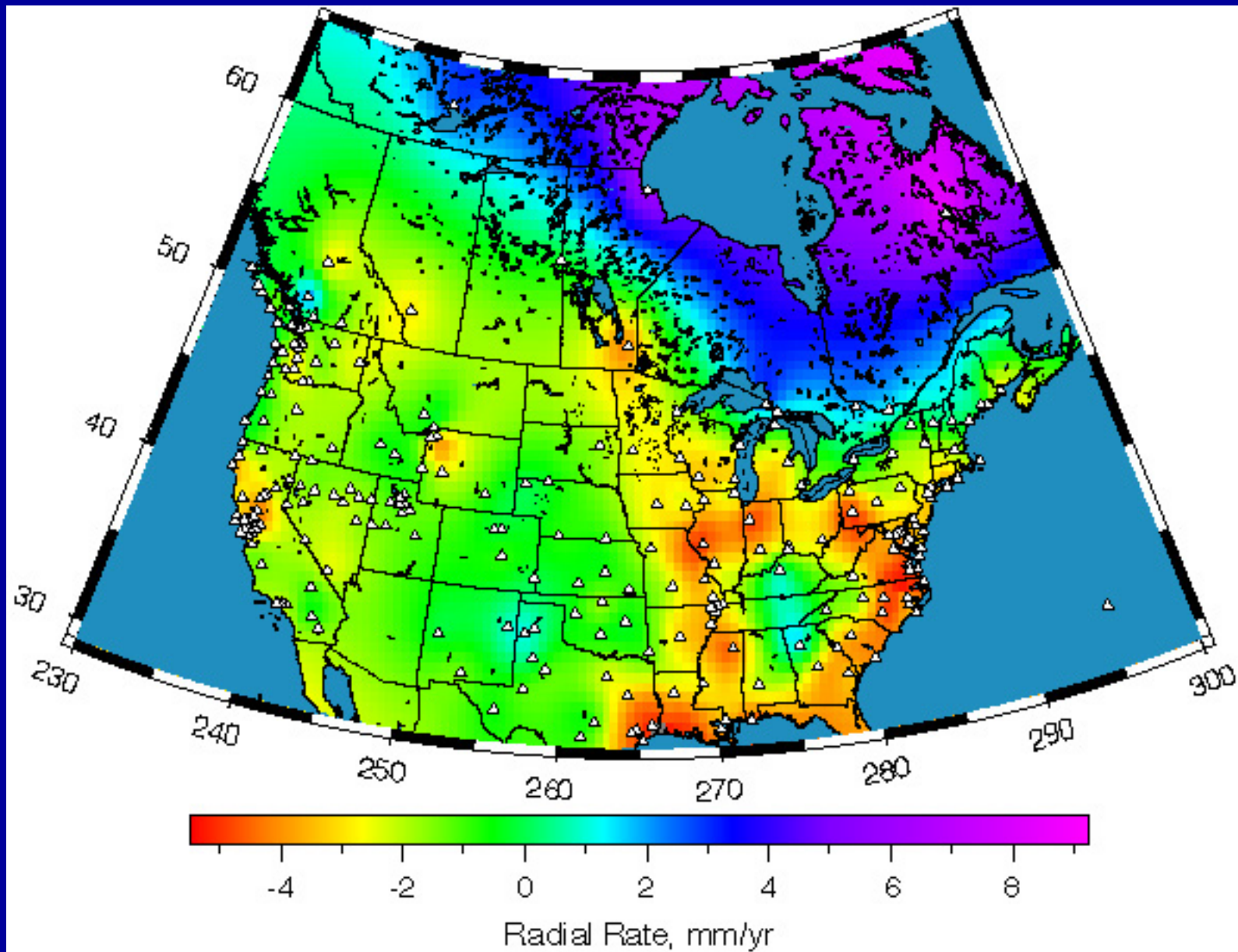


# 2-months Churchill

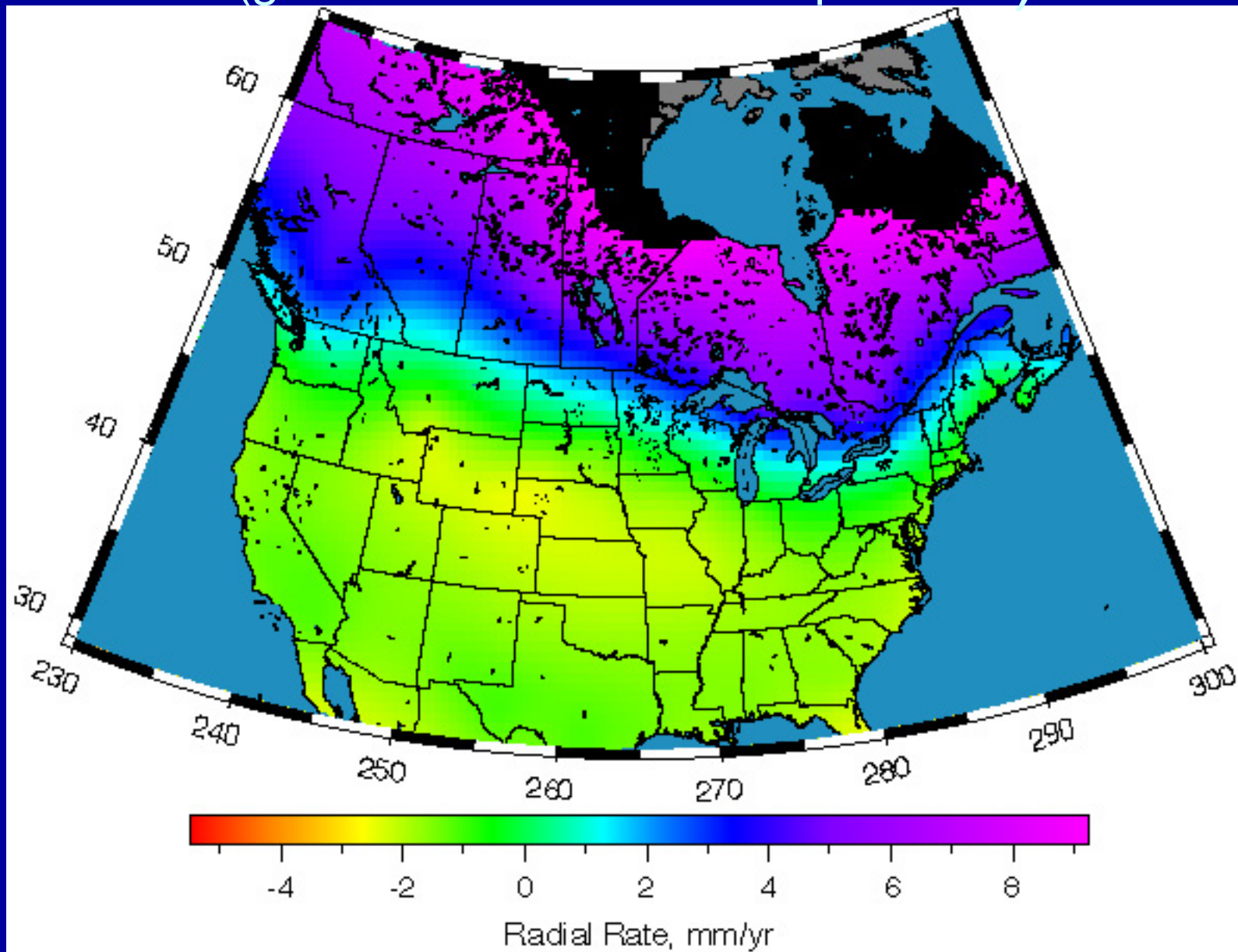


Some caution with admittance of sub-daily load variations into GPS daily average. For tides much larger admittance than might be expected (often up to 30%)

# Interpolated GPS Secular Vertical motions



# Postglacial Rebound Model (generated from GPS site positions)



# Conclusions

- Frame realization on 600 km scale networks with translation and rotation generates time series with smaller RMS than continental or global realizations (factors of 2-3 smaller: <1 mm versus 2-3 mm)
- Secular realization is more robust than daily frame realizations (seasonal effects average after few cycles)
- Rates of motions however are very similar for long time series: Question: Which times series should be used to generate noise statistics?
- Effects of loading are very evident: How best to incorporate into frame realization. When applied, what is precise meaning of coordinates especially if there are several different groups generating load estimates.