G21B-0501

Mega-Network GPS Solutions: Producing a Consistent, Global-Scale, and High-Resolution View of Plate Tectonic Stability, Rotation, and Deformation.

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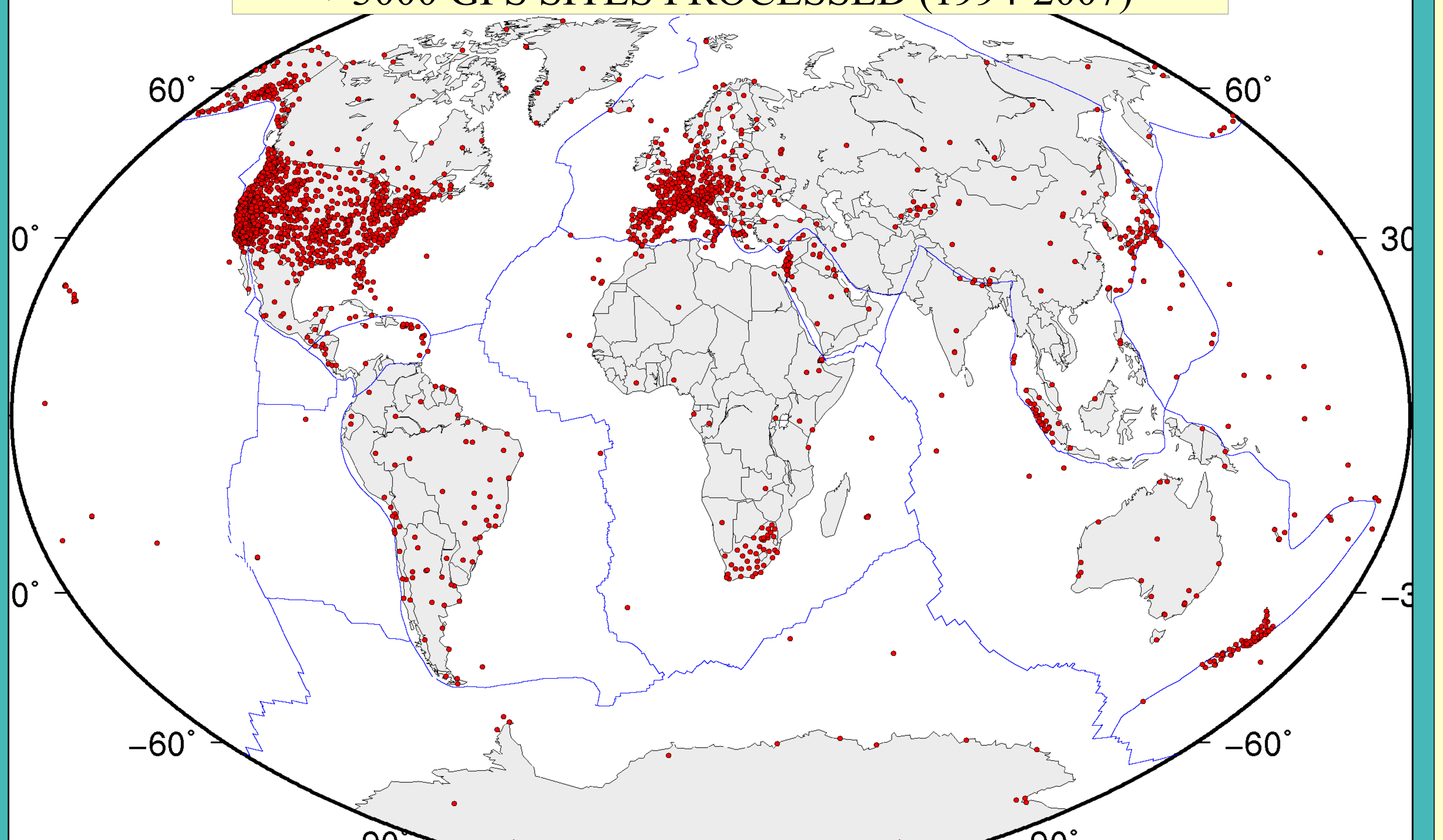
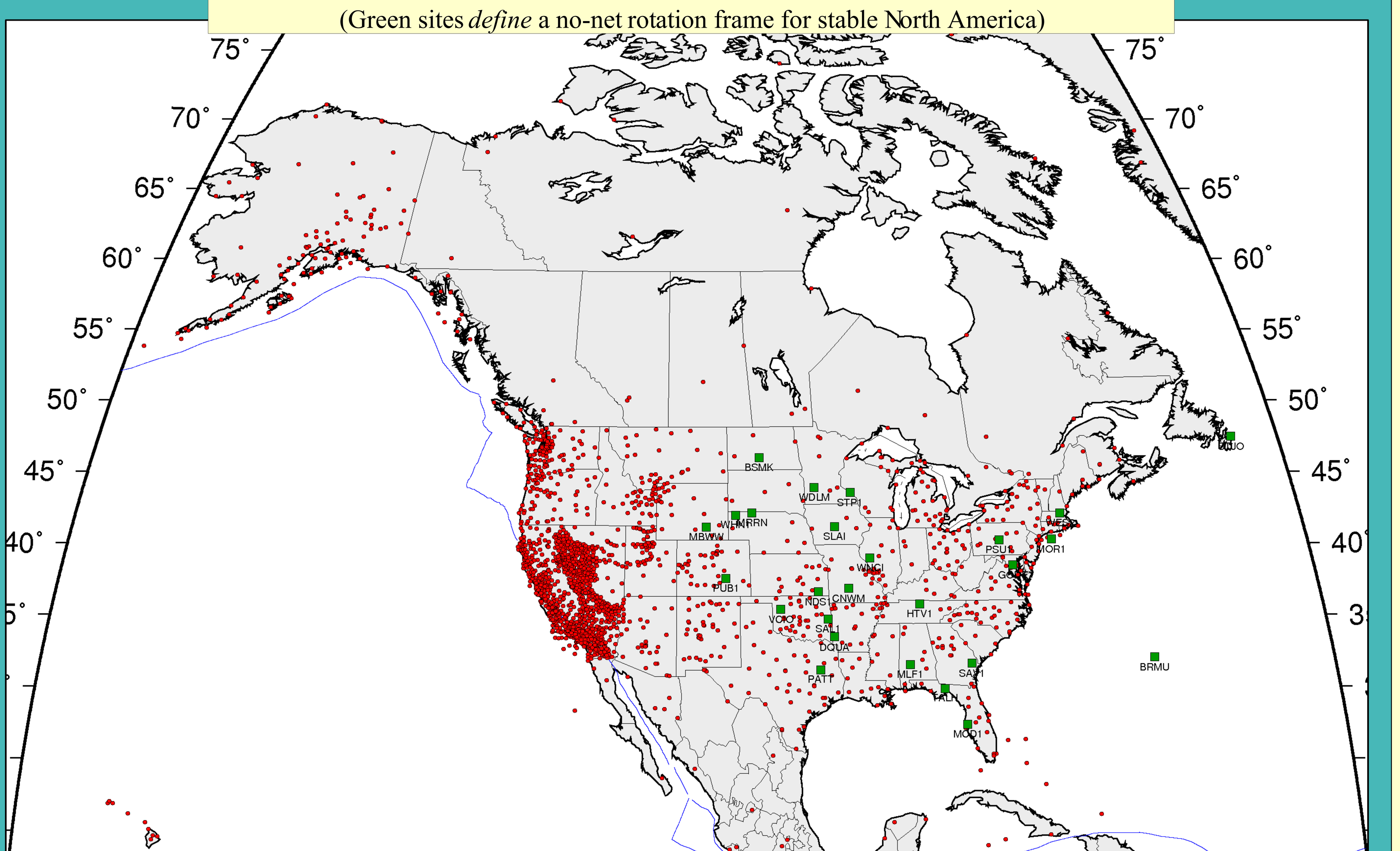
>3000 GPS SITES PROCESSED (1994-2007)



~2000 NORTH AMERICAN GPS SITES PROCESSED

(Green sites *define* a no-net rotation frame for stable North America)



OVERVIEW

We present a single self-consistent GPS solution for >3,000 stations (map, left) with **ambiguity resolution applied** for the period 1994–2007. Here we demonstrate that such "mega-network" GPS solutions provide a consistent, global-scale, and high-resolution view of plate tectonics in action.

Specifically our solution is used to investigate the stability of the North American plate, its rotation, intra-plate deformation, and deformation in the Pacific-North America Plate boundary zone. A significant improvement in precision and accuracy attributable to **ambiguity resolution** is quantified by assessing 25 reference-frame stations (shown in green in the map, middle left), which are *defined* to have no-net rotation. These sites were chosen based on geographical location (away from tectonic activity and GIA centers) and because they had no equipment changes since 2002. Only data from 2002 – 2007.2 were used to define a non-rotating NA reference frame, because in recent years orbit accuracy has improved, and all 25 stations provide a data set that was relatively homogeneous in time.

Improvement due to ambiguity resolution is assessed by:

(1) the variance of station position time series (improved precision, top right)

(2) the variance of station velocities within the North American stable plate interior (improved accuracy, right).

The software developed for this solution, AMBIZAP Version 2.0 (ftp://gneiss.nbmg.unr.edu/ambizap) was made publicly available in August 2007. The method builds seamlessly on the precise point positioning (PPP) method invented by *Zumberge et al.* in 1997, additionally providing improved accuracy at a fraction of the original computational cost. Like PPP, the computation time of AMBIZAP (including network adjustment) is linear with number of stations N, unlike previous algorithms that exhibit power-law behavior, which presents a barrier to processing $N >> 100$ (box, lower left).

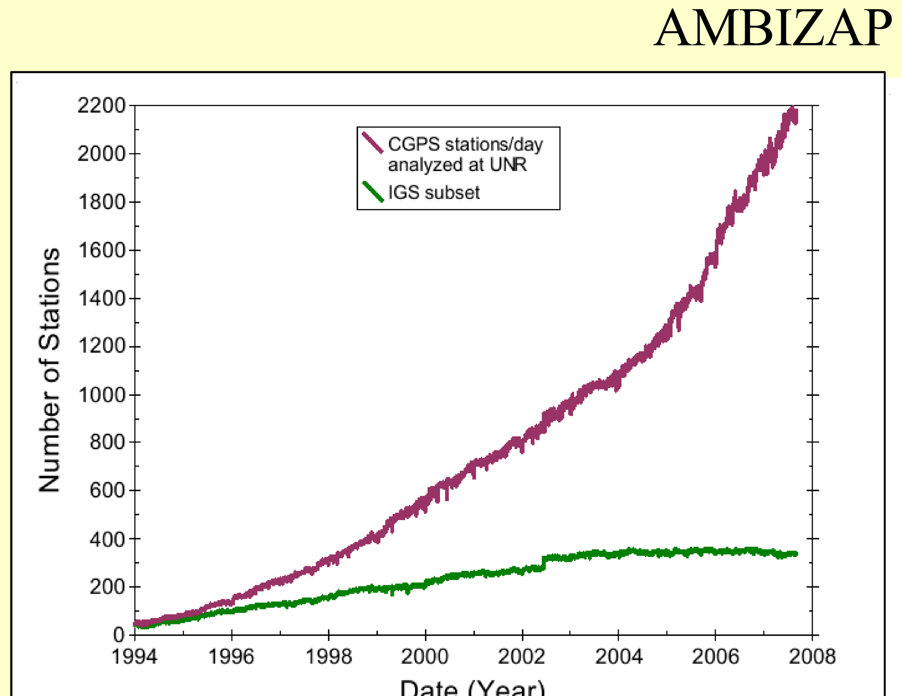
In conclusion, AMBIZAP improves repeatability in the East component (from 2.6 mm to 1.7 mm), and improves the accuracy of velocities with respect to stable North America.

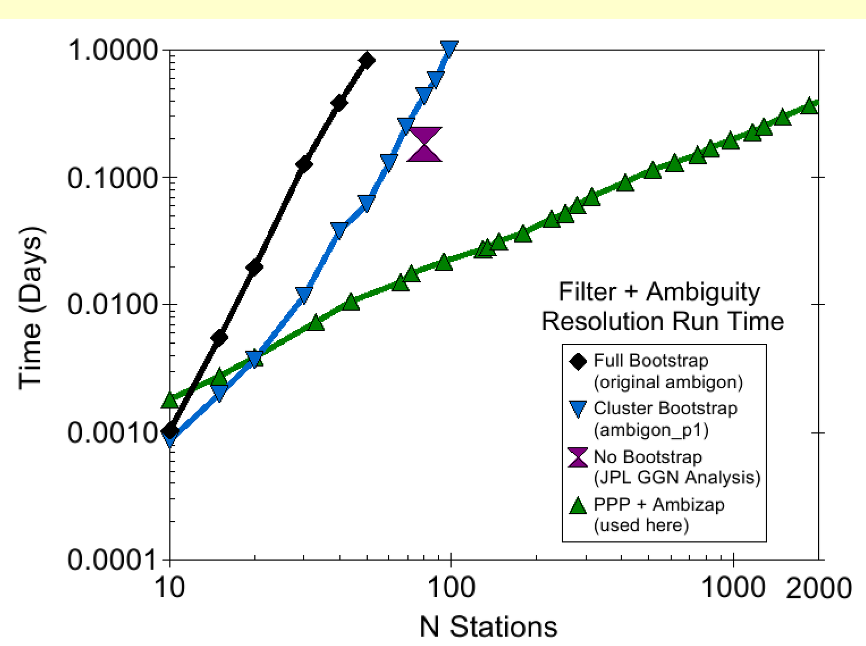
With AMBIZAP, the expected collapse of the forebulge (from ice-age deglaciation) appears to come more into focus.

For results on tectonic implications, please see neighboring poster in this session by Kreemer and Blewitt (G21B-0500: *Finding and Defining the Edges of Stable North America: Reference Frame Effects versus Real Tectonics*).

The longer-term significance of this development is that the software could be applied to N ~ 10,000 GPS networks worldwide within the foreseeable future.

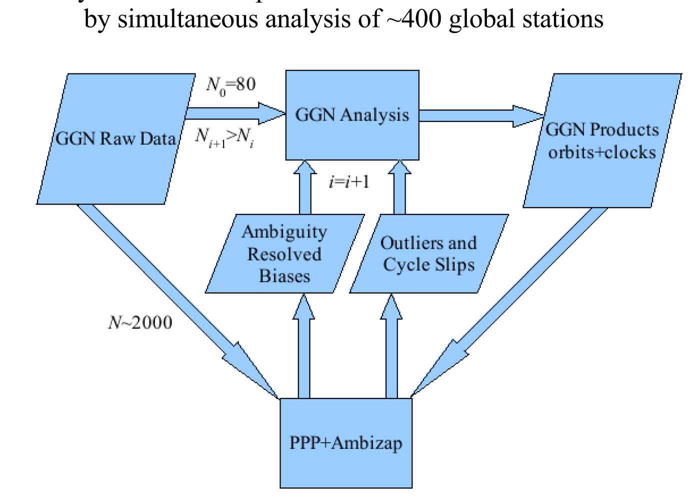
AMBIZAP processing time is LINEAR with number of stations



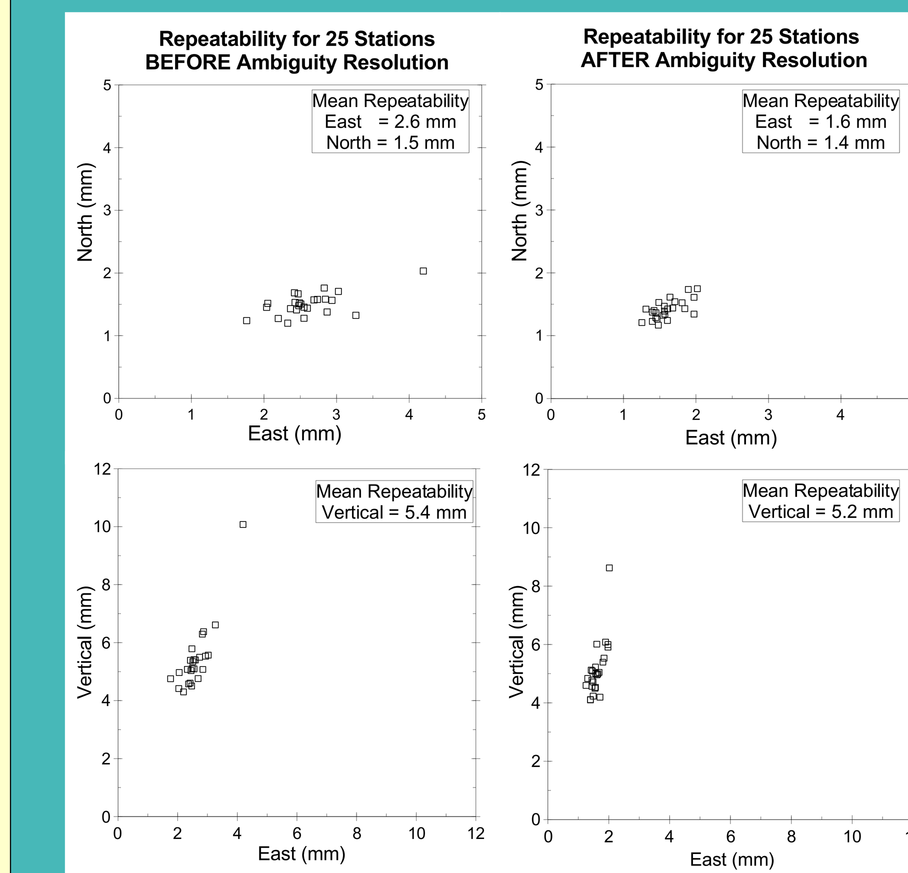


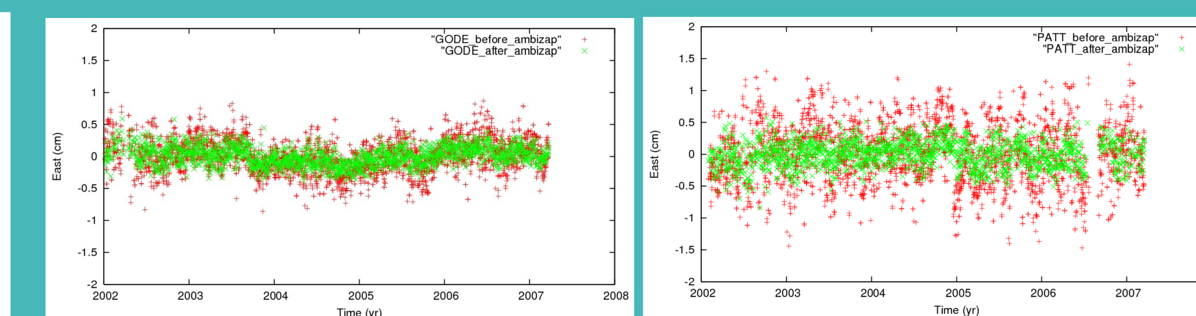
Future Development (with Willy Bertiger, JPL):

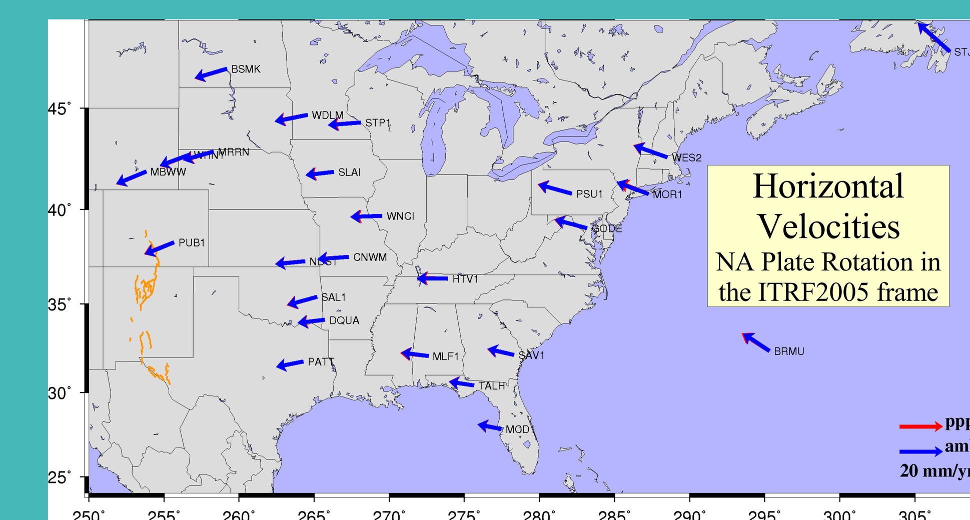
Application of Ambizap to Global GPS Network (GGN) analysis at JPL to improve IGS orbits and reference frame by simultaneous analysis of ~400 global stations



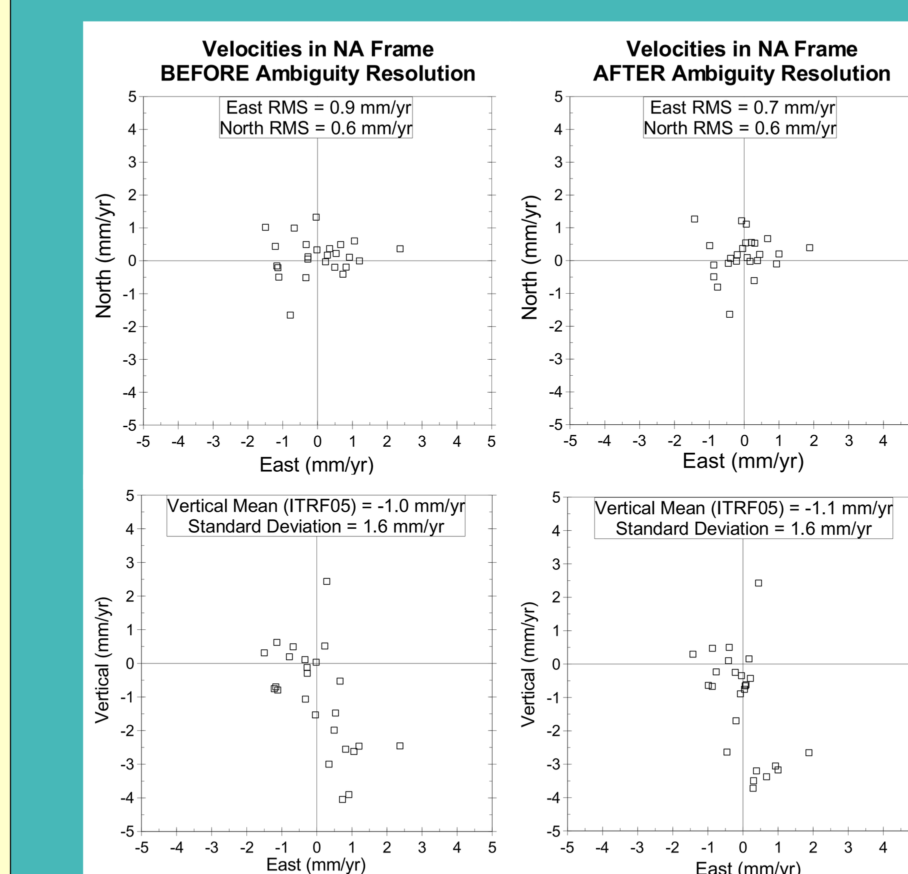
IMPROVED PRECISION: RMS scatter about constant velocity model

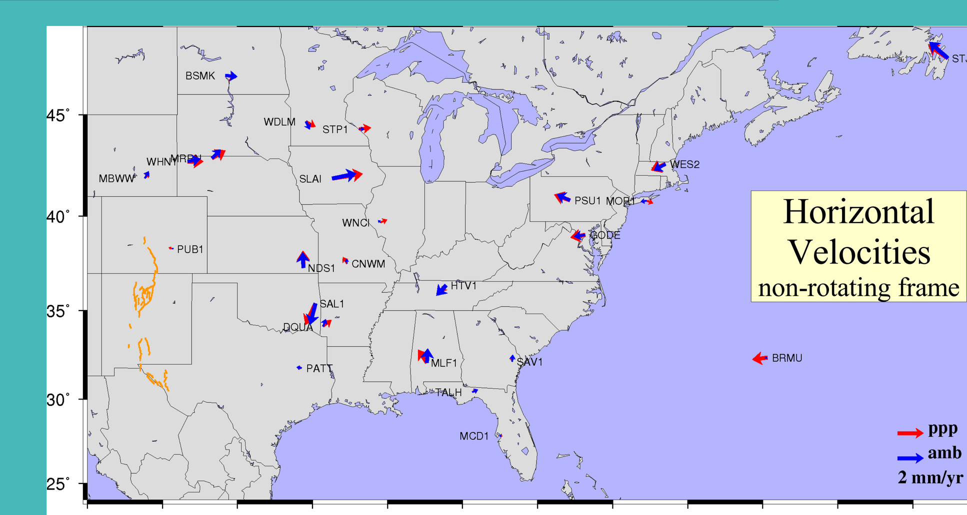


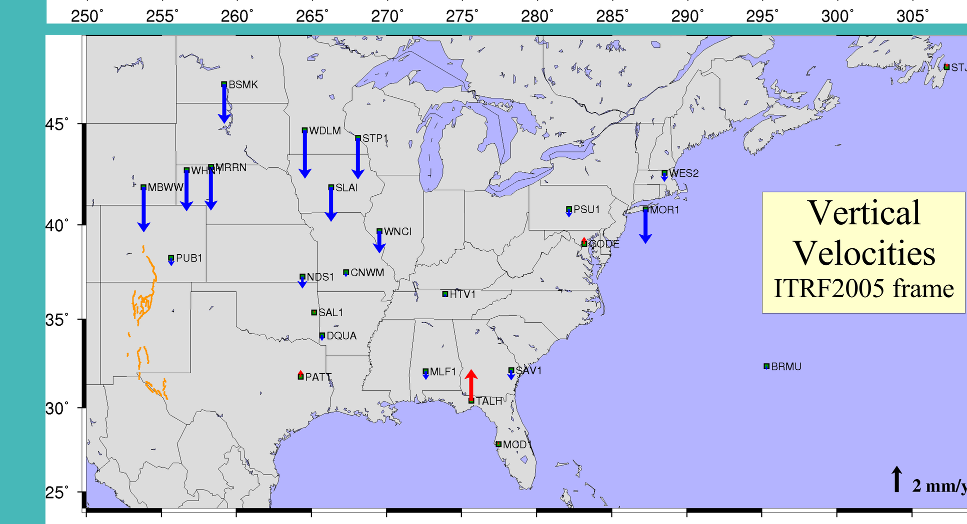




IMPROVED ACCURACY: Velocities in "stable" North America







Note: Few mm downward motion (in ITRF2005) is evidence of glacial isostatic adjustment (GIA) forebulge collapse

COMPARISON OF PLATE ROTATION VECTORS

Solutions for the rotation of stable North America with respect to reference frame ITRF2005

STUDY	LATITUDE	LONGITUDE	RATE
Altamimi et al. (2007)	-4.291±0.861º	272.615±0.571º	0.192±0.002º/Ma
This study	-5.114º	271.560º	0.186º/Ma