

# ITRF2008



Zuheir Altamimi  
IGN, France



# Technique contributions

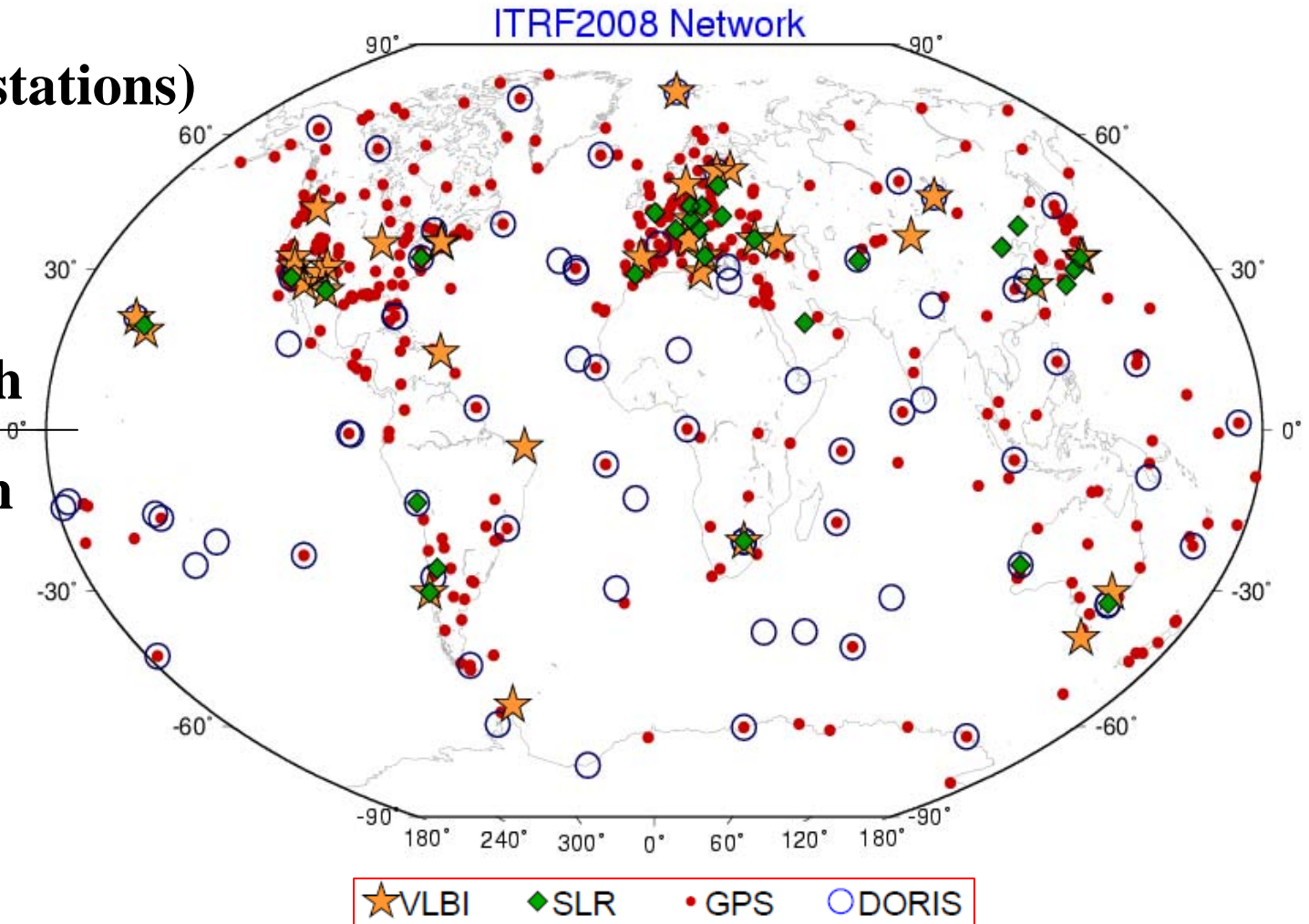
- **IVS: (1980.0 – 2009.0) : Full EOP set (91 sites)**
- **IGS: (1997.0 – 2009.5) : PM, PMrate, LOD (492 sites)**
- **ILRS: (1983.0 – 2009.0) : PM, LOD (89 sites)**
- **IDS: (1993.0 – 2009.0) : PM, LOD (67 sites)**
  
- **New local ties since ITRF2005:**
  - **Tahiti : GPS SLR DORIS**
  - **Tsukuba: GPS VLBI**
  - **Herstmonceaux: GPS SLR**
  - **Medicina & Noto : GPS VLBI**
  - **Greenbelt: VLBI SLR GPS DORIS**
  - **Maui/Haleakala**
  - **San Fernando : GPS SLR**

# ITRF2008 Network

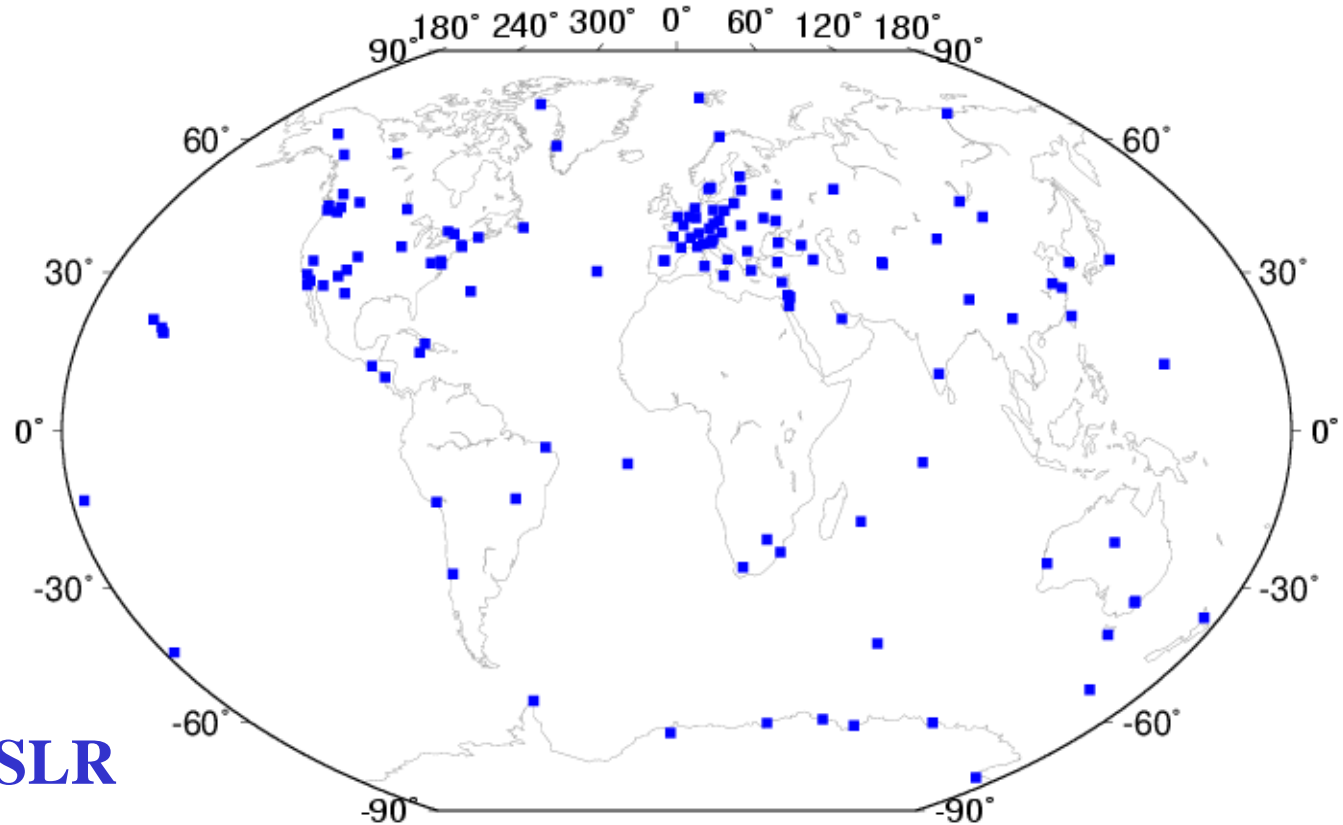
579 sites (920 stations)

461 Sites North

118 Sites South



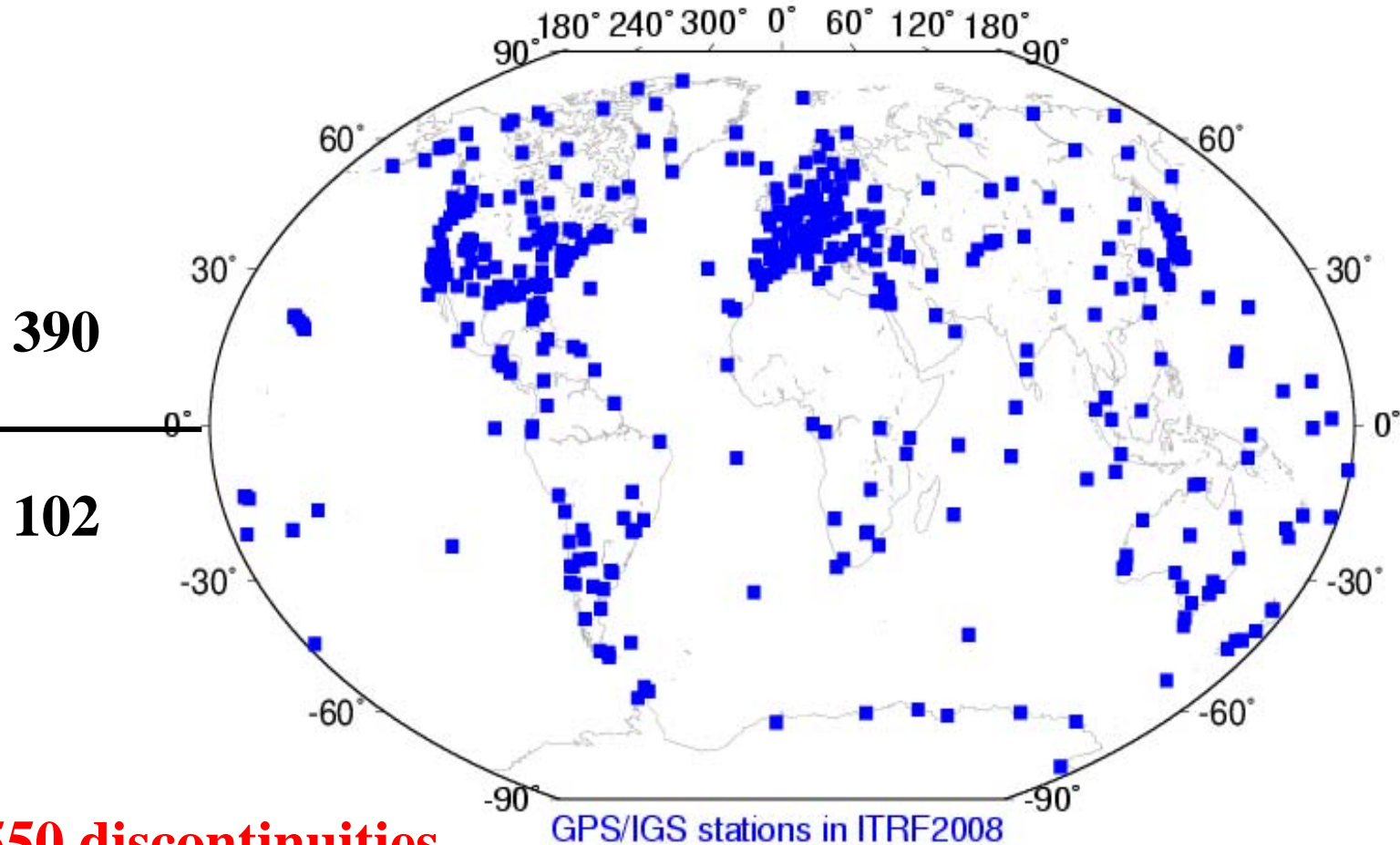
# ITRF2008 Datum Specification



- **Origin:** SLR
  - **Scale :** Mean of SLR & VLBI
  - **Orientation:** Aligned to ITRF2005
- using 179 stations located at 131 sites:

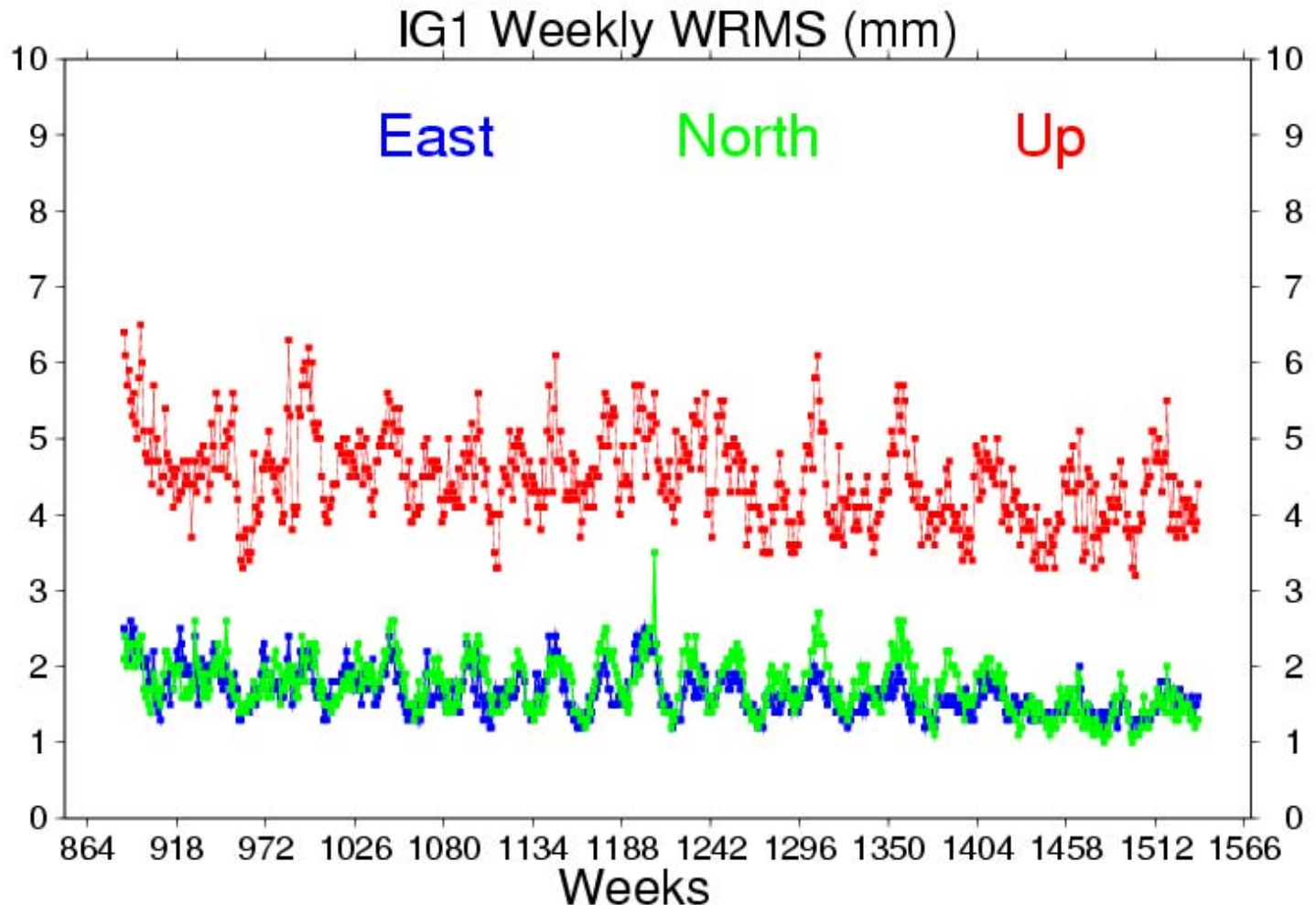
104 at northern hemisphere and 27 at southern hemisphere

# ITRF2008: GPS/IGS Site distribution

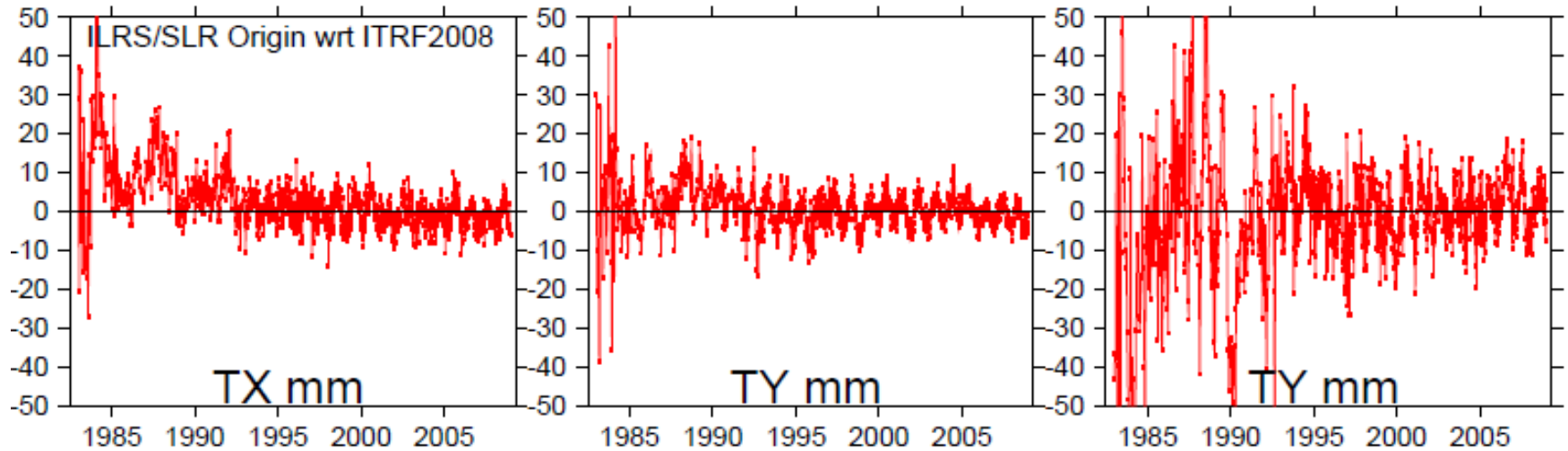


**550 discontinuities**

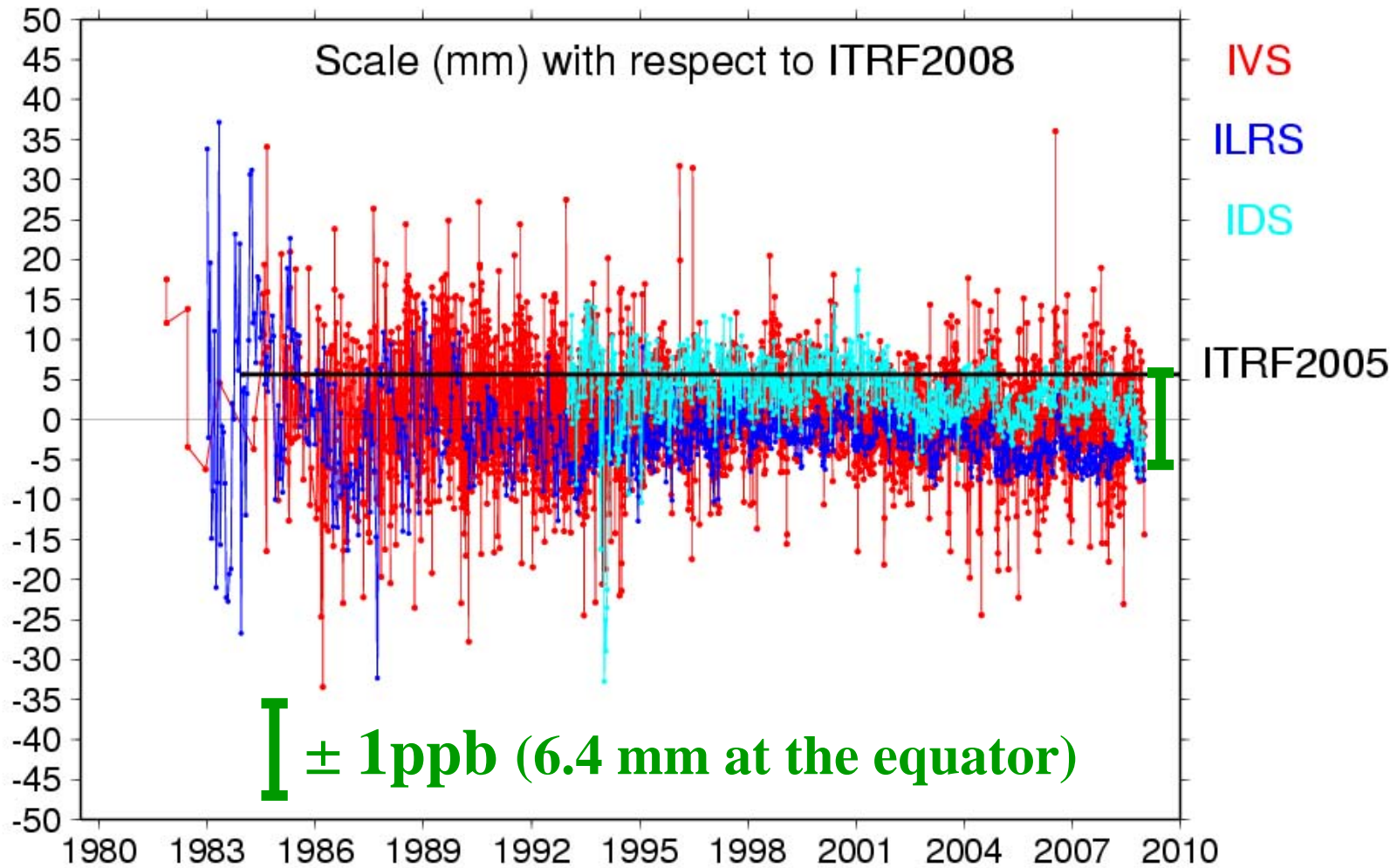
# IG1 internal precision (1997.0 - 2009.5)



# SLR-ILRSA Origin wrt ITRF2008



# ITRF2008 Scale: mean of VLBI and SLR

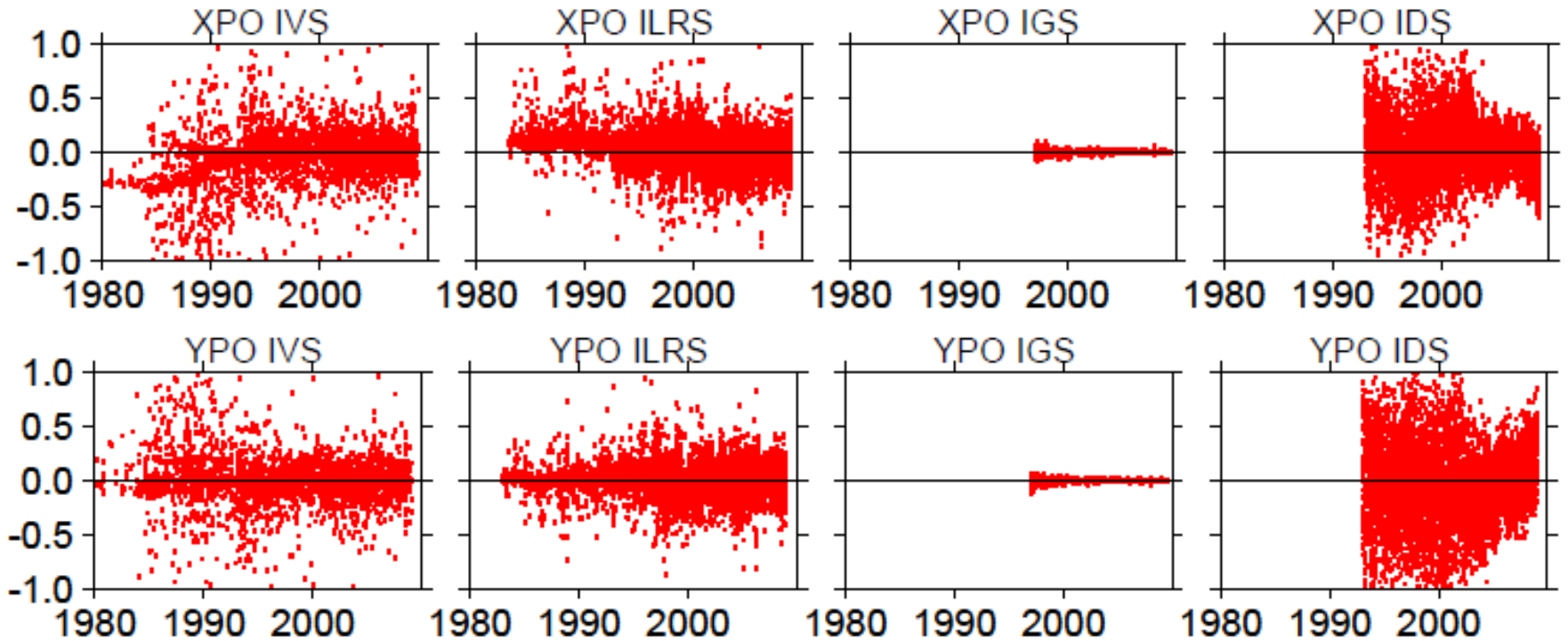




## Scale FORMAL errors ( $1 \sigma$ ) via ties to GPS

	<b>Scale ppb</b>	<b>Scale rate ppb/yr</b>
<b>VLBI</b>	<b><math>\pm 0.10</math></b>	<b><math>\pm 0.01</math></b>
<b>SLR</b>	<b><math>\pm 0.12</math></b>	<b><math>\pm 0.01</math></b>
<b>DORIS</b>	<b><math>\pm 0.20</math></b>	<b><math>\pm 0.03</math></b>

# ITRF2008 PM residuals



## WRMS in $\mu\text{as}$

	X-pole	Y-pole
GPS	10	10
DORIS	239	353

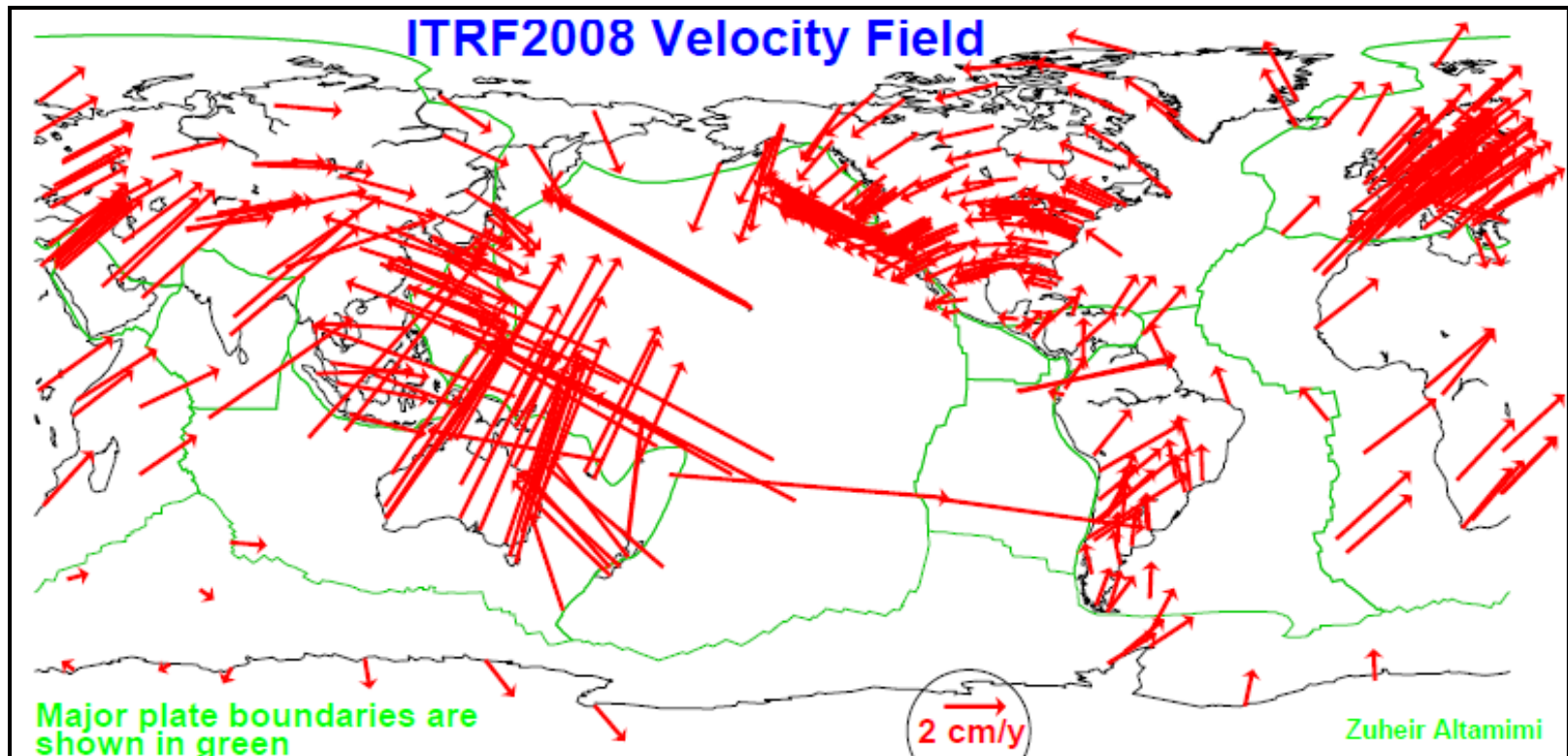
	X-pole	Y-pole
VLBI	142	120
SLR	144	128

# Transformation Param Fm ITRF2008 To ITRF2005

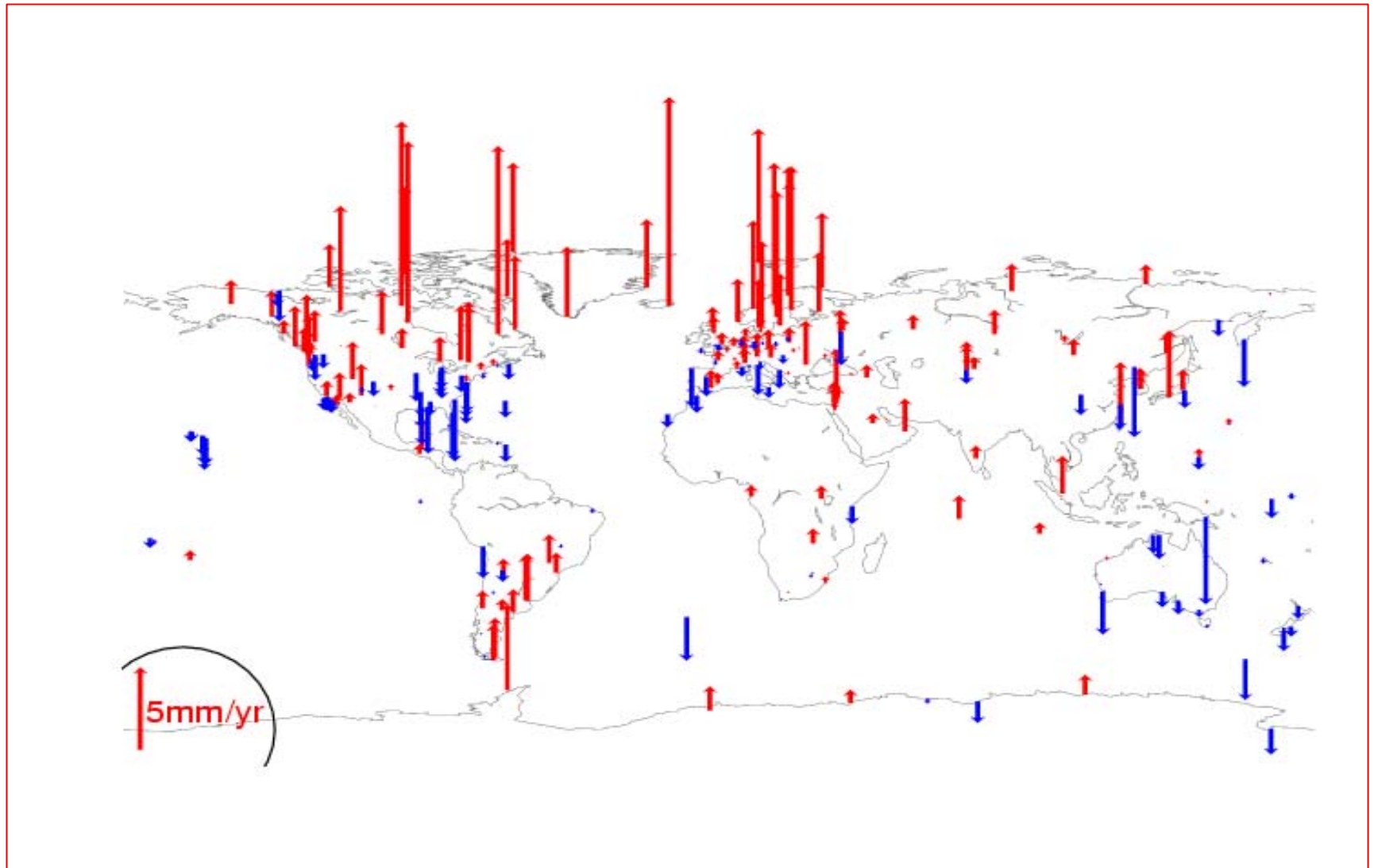
<b>Tx</b> <b>mm</b>	<b>Ty</b> <b>mm</b>	<b>Tz</b> <b>mm</b>	<b>Scale</b> <b>ppb</b>	<b>At epoch 2005.0</b>
<b>-0.5</b> <b>± 0.2</b>	<b>-0.9</b> <b>± 0.2</b>	<b>-4.7</b> <b>± 0.2</b>	<b>0.94</b> <b>± 0.03</b>	

<b>Tx rate</b> <b>mm/yr</b>	<b>Ty rate</b> <b>mm/yr</b>	<b>Tz rate</b> <b>mm/yr</b>	<b>Scale rate</b> <b>ppb/yr</b>
<b>0.3</b> <b>± 0.2</b>	<b>0.0</b> <b>± 0.2</b>	<b>0.0</b> <b>± 0.2</b>	<b>0.00</b> <b>± 0.03</b>

# ITRF2008 Horizontal Velocity Field



# ITRF2008 Vertical Velocity Field



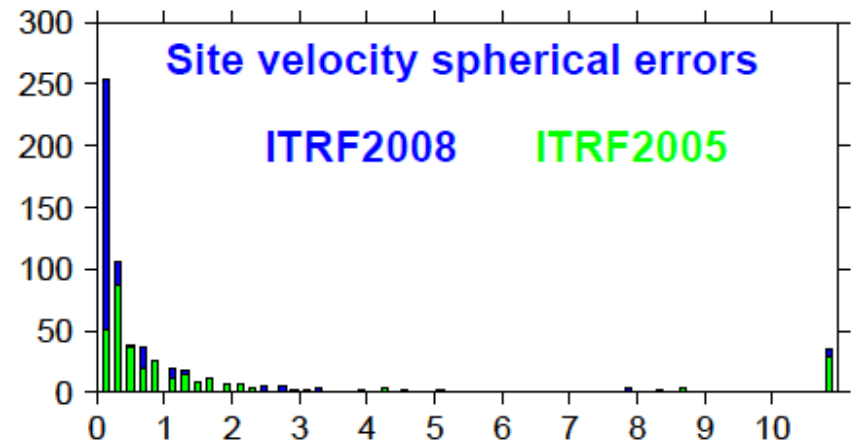
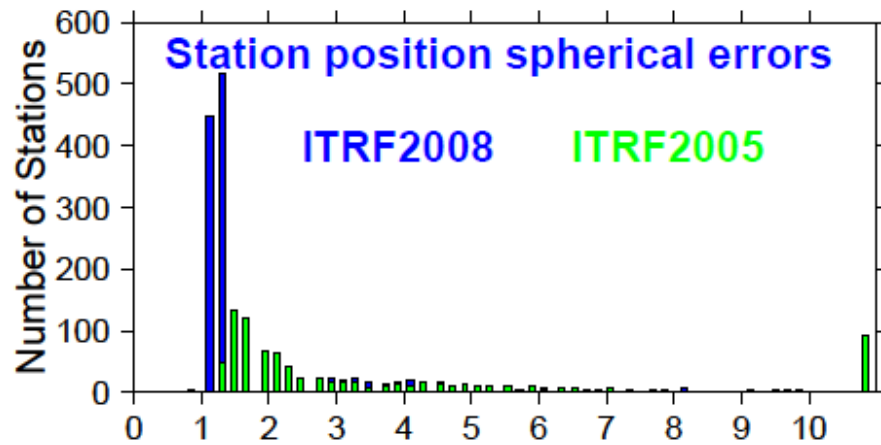
# Accuracy of ITRF2008 Origin

- **Defined by SLR only**
- **Agreement with ITRF2005**
  - 4.7 mm in Z-translation at epoch 2005
  - 0.3 mm/yr drift in X-translation
- ==> **“Accuracy”**: 1 cm over the time-span of SLR observations

# Accuracy of ITRF2008 Scale

- **Defined by the average of VLBI and SLR**
- **Difference btw the two technique solutions:**
  - 1.05 ppb at epoch 2005.0
  - 0.049 ppb/yr
- **==> “Accuracy”: 1.2 ppb (8 mm) over the common time-span of VLBI and SLR observations**

# ITRF2008 precision gain



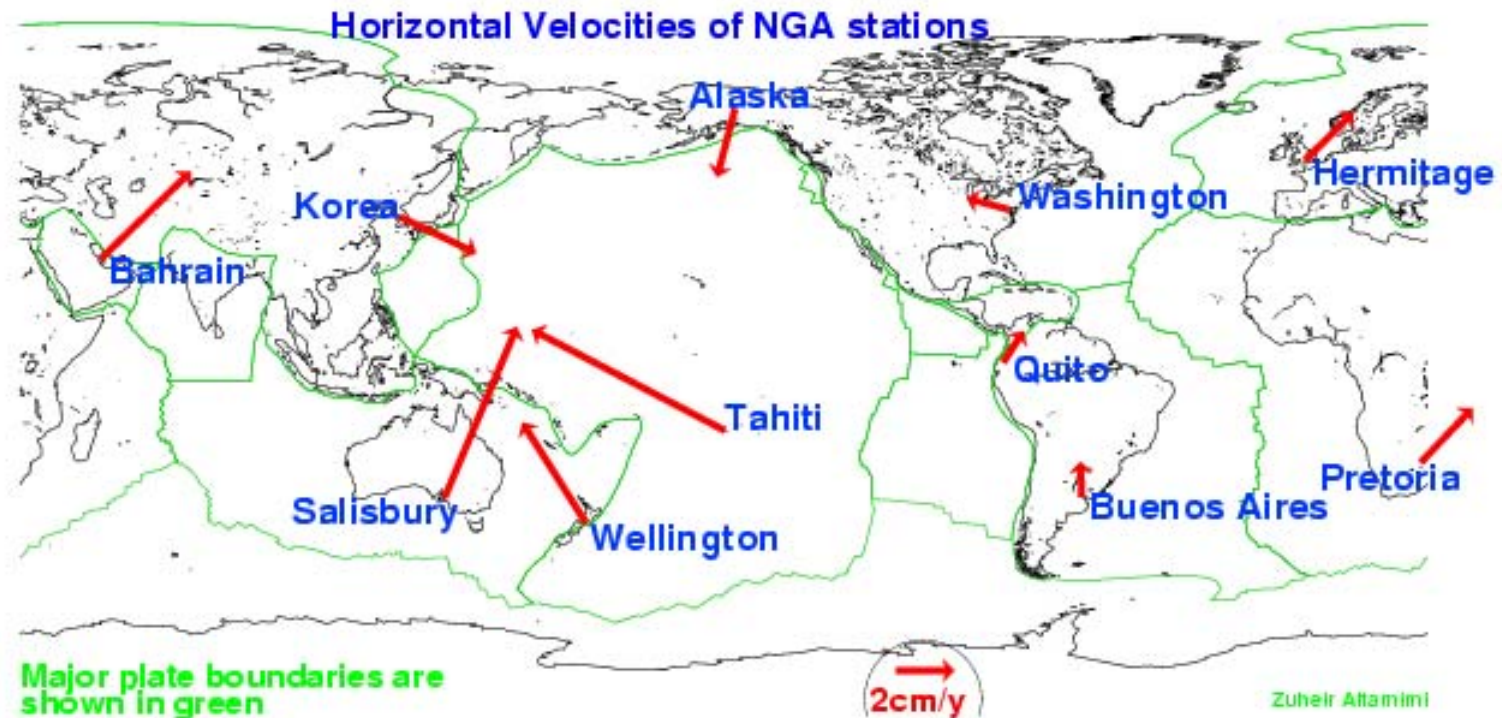


# Uncertainties of the Transfer of SLR origin and SLR&VLBI mean scale to GPS frame

<b>TX</b> <b>mm</b>	<b>TY</b> <b>mm</b>	<b>TZ</b> <b>mm</b>	<b>Scale</b> <b>mm</b>
<b>0.6</b>	<b>0.5</b>	<b>0.6</b>	<b>0.6</b>

# WGS84 - NGA Stations in ITRF2008

NGA: National Geospatial-Intelligence Agency



$$X(t) = X(t_0) + \dot{X}(t - t_0)$$

# Conclusions

- **ITRF2008 is an improved solution, compared to ITRF2005**
- **Accuracy of ITRF2008 origin&scale: ~ 1 cm**
- **Future Improvement: Technique-specific systematic errors to be mitigated**
  - GPS uncalibrated radome
  - VLBI antenna gravitational deformations
  - SLR range/timing biases
  - DORIS beacon reference point behavior ?