Long-Term Stability of the ITRF Origin and Scale

- Datum definition for time series analysis
- Stability of the
  - IVS VLBI scale
  - ILRS SLR origin & scale
- Comparison to external solutions and models
- Conclusions

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Analyzed data and models

- **IVS VLBI sessions 1980 – March 2007**
  - **Scale temporal behaviour**
- **ILRS SLR weekly solutions 1993-March 2007**
  - **Scale and origin temporal behaviour**
- **IGN/OCA SLR weekly solutions (Coulot et al., 2007)**
  - **Range bias estimated using temporal decorrelation method**
  - **Compare with ILRS scale**
- **Displacements models**
  - **GPS+OBP (Wu, 2006): Global inversion of GPS residuals & Ocean bottom pressure variations for loading displacements**
  - **Loading model (van Dam, 2007) : Hydrology + non-tidal Ocean + Atmosphere**
  - **Compare model Geocenter motion and scale with SLR**
- **Impact of GPS Abs. Ant. Ph. corrections on an ITRF-like combination**

Datum Definition for Time Series stacking (CATREF Software)

- **Consider Transfo. Param. as unknowns in Normal Eq. Sys.**
- **Estimate time series of Transfo. Param. & long-term solution**
- **Considering linear transf. parameter *P* :**

$$P(t) = P(t_0) + \dot{P}.(t - t_0) \qquad \textbf{(1)}$$

- **Eq. 1 could be solved by linear regression:**

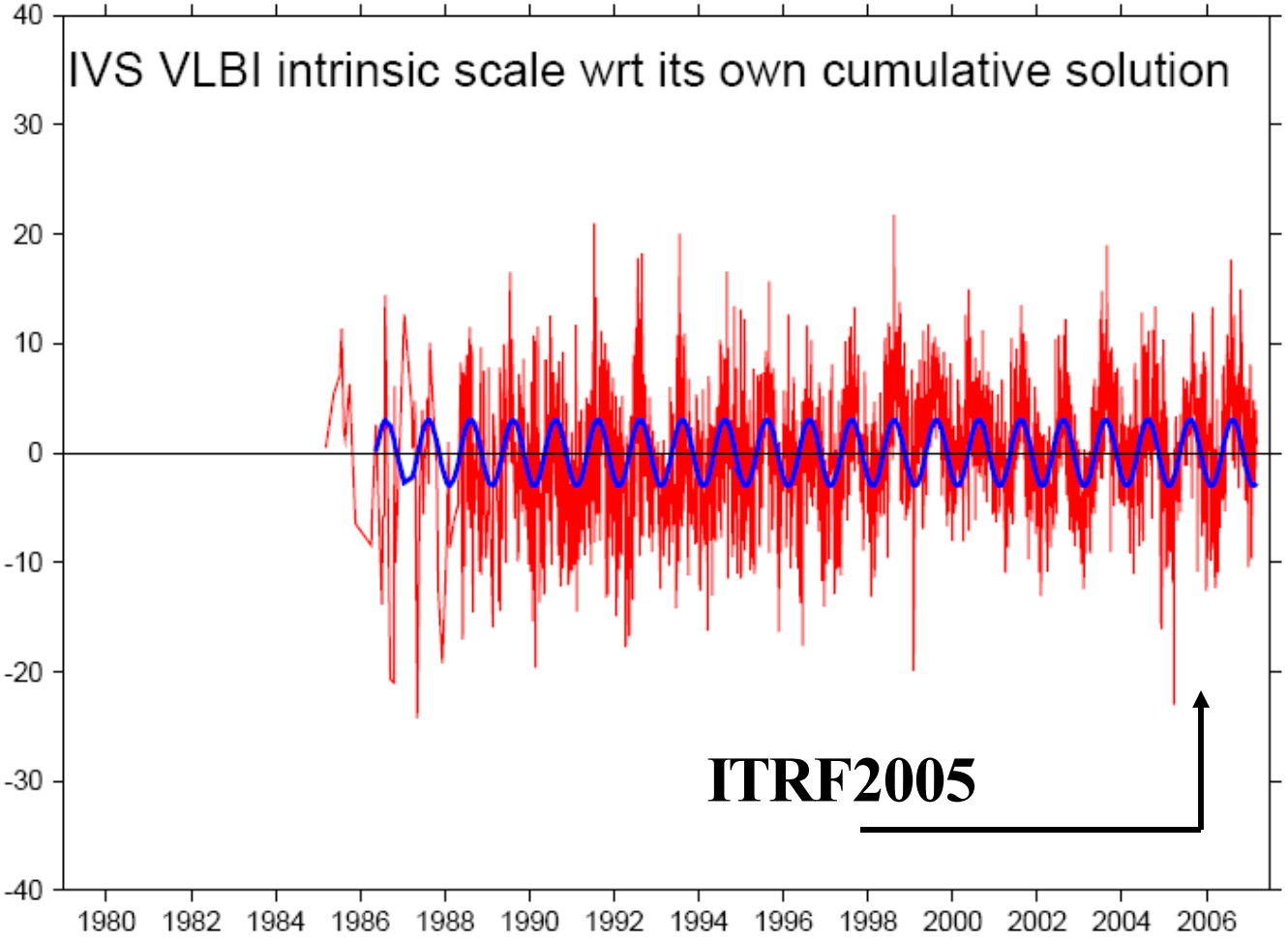
$$\begin{pmatrix} K & \sum_{k\in K}(t_k - t_0) \\ \sum_{k\in K}(t_k - t_0) & \sum_{k\in K}(t_k - t_0)^2 \end{pmatrix} \begin{pmatrix} P_k(t_0) \\ \dot{P}_k \end{pmatrix} = \begin{pmatrix} \sum_{k\in K} P_k \\ \sum_{k\in K}(t_k - t_0)P_k \end{pmatrix}$$

Intrinsic conditions:

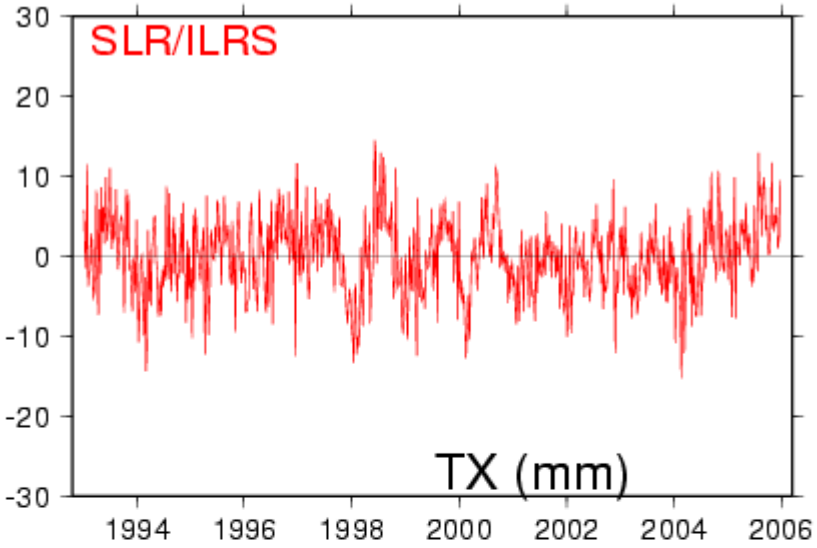
$$P(t_0) = 0 \quad \textbf{&} \quad \dot{P} = 0 \quad \textbf{or}$$

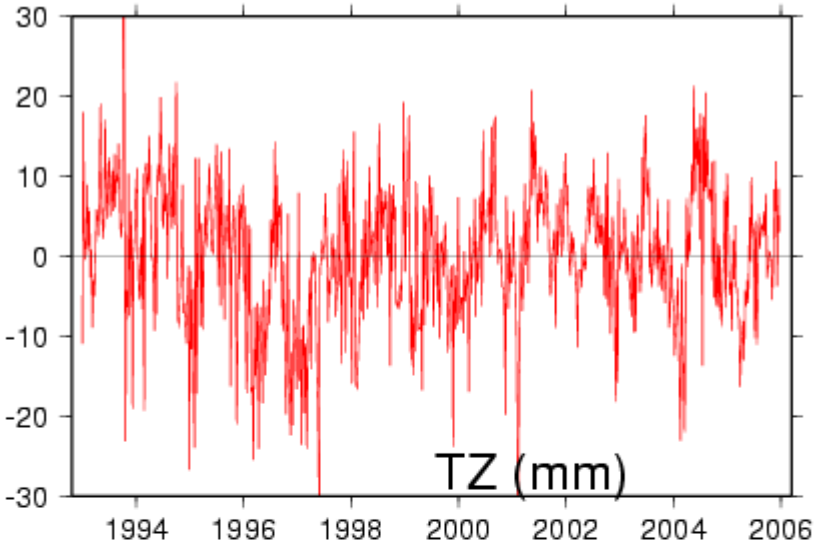
$$\begin{cases} \sum_{k\in K} P_k(t_k) = 0 \\ \sum_{k\in K} \frac{P_k(t_k)}{(t_k - t_0)^{-1}} = 0 \end{cases}$$

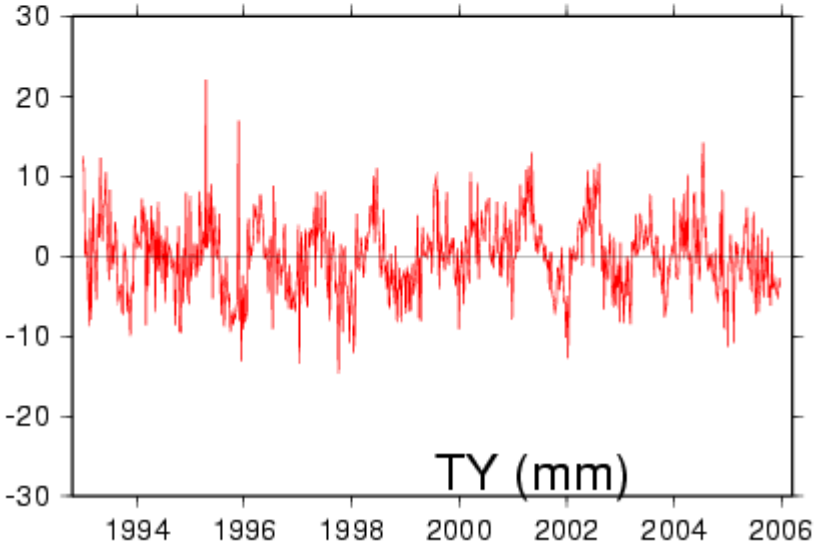
IVS Intrinsic Scale

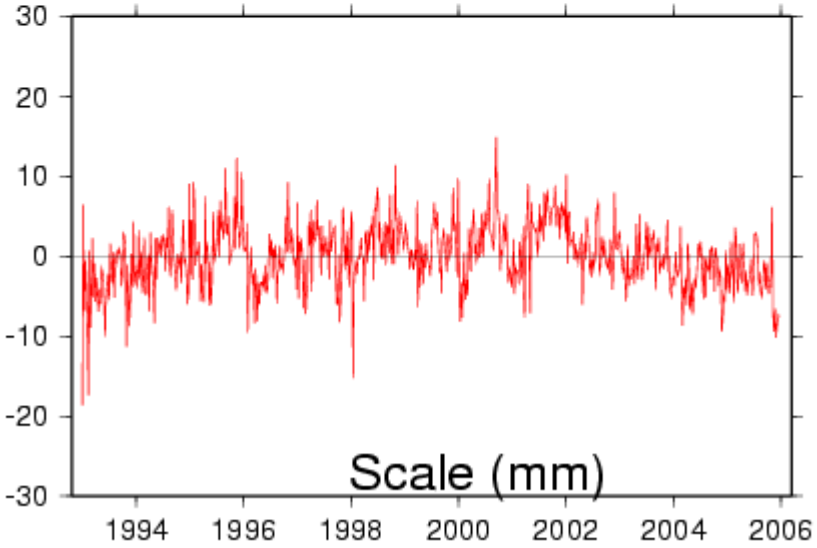


ILRS SLR Inrinsic Origin and Scale

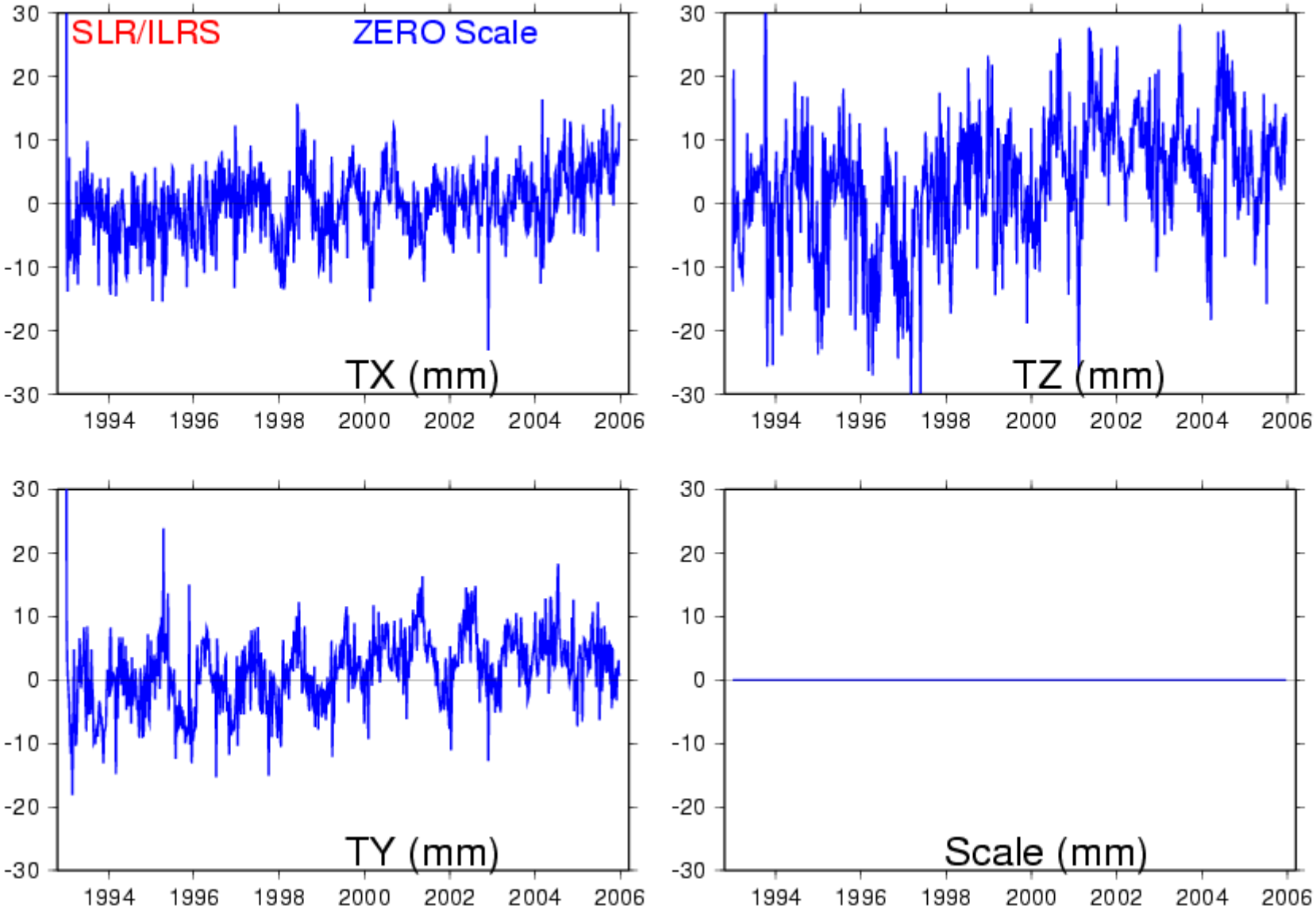




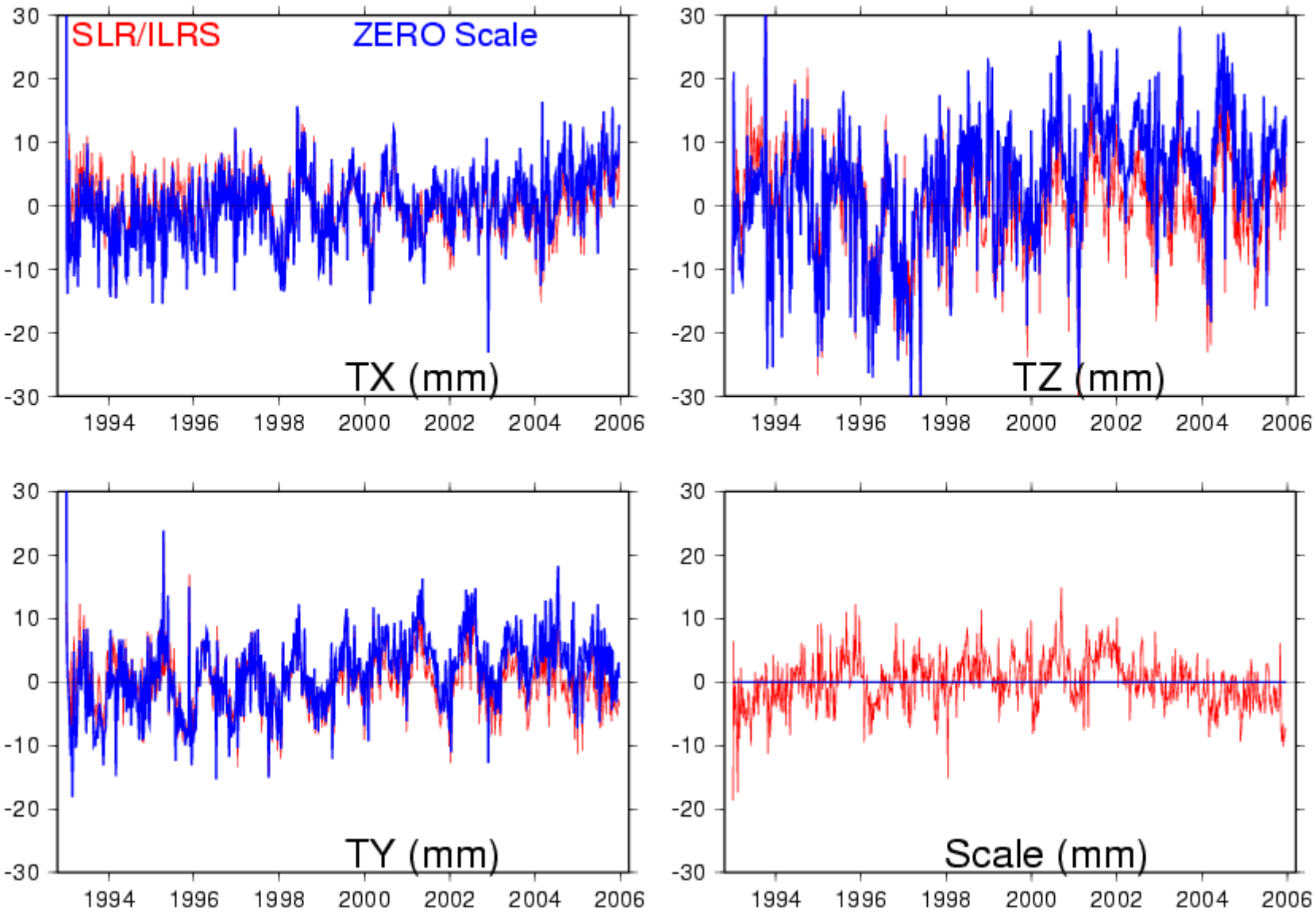




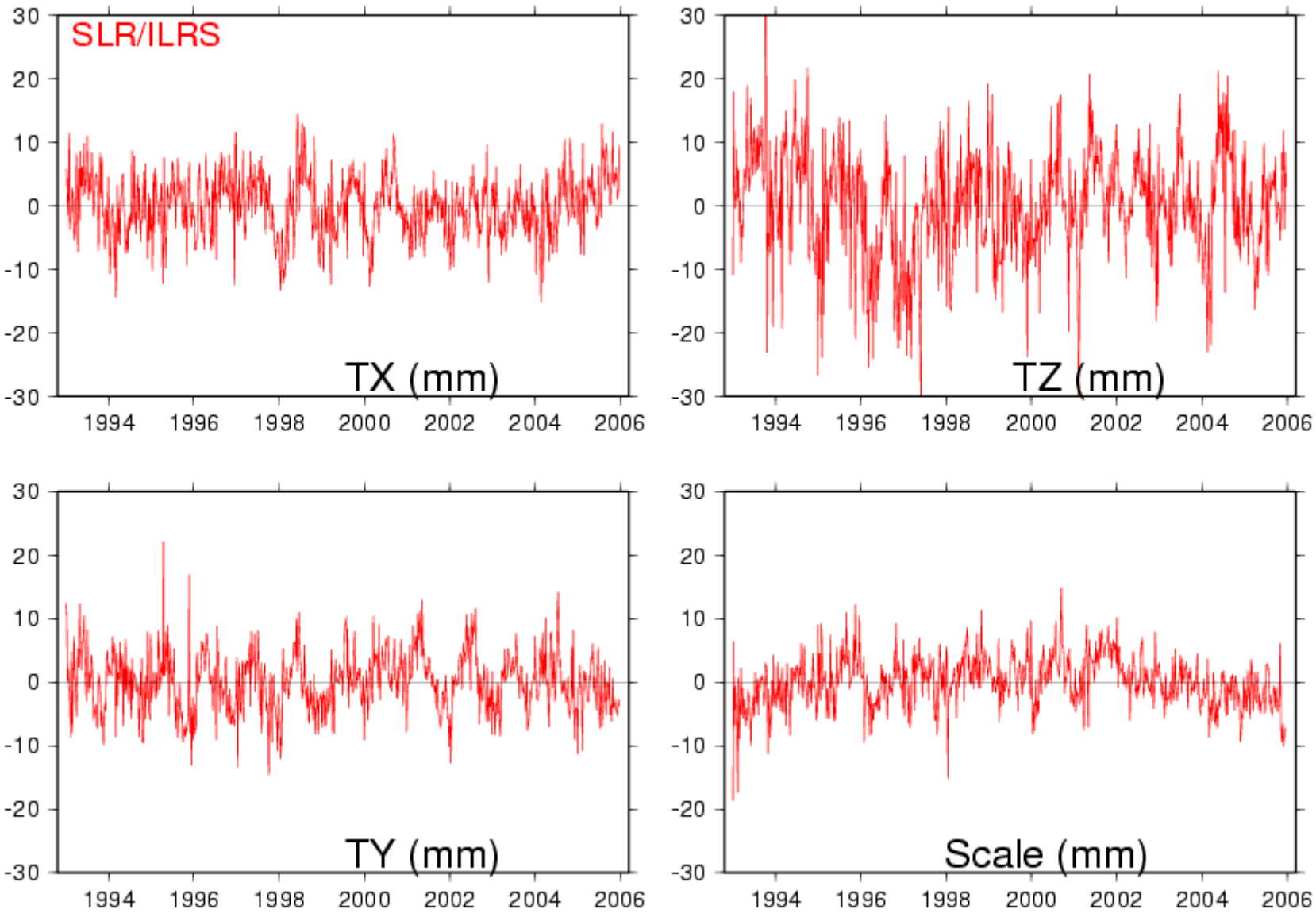
ILRS SLR Intrinsic Origin and zero Scale



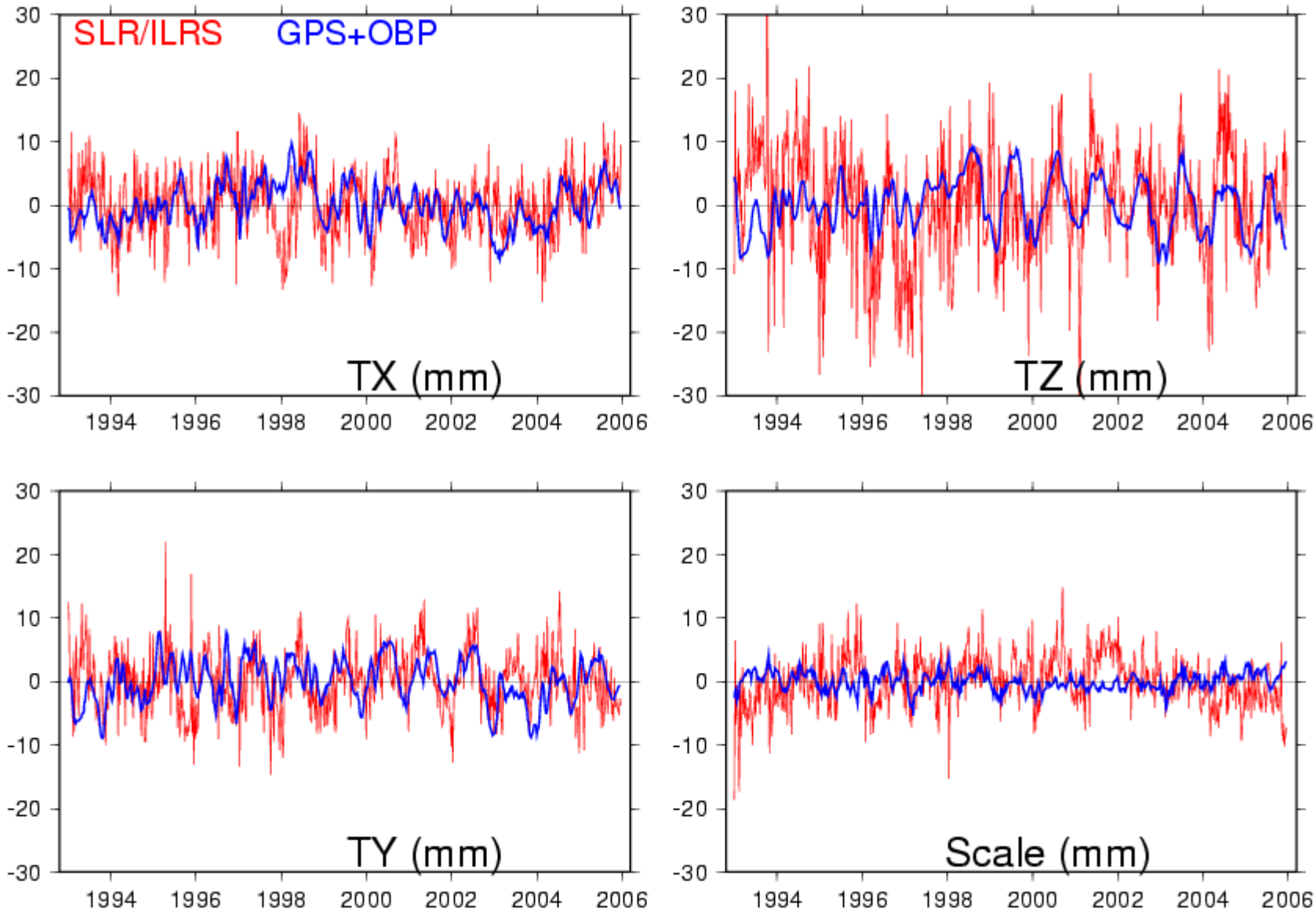
ILRS SLR Inrinsic Origin and Scale



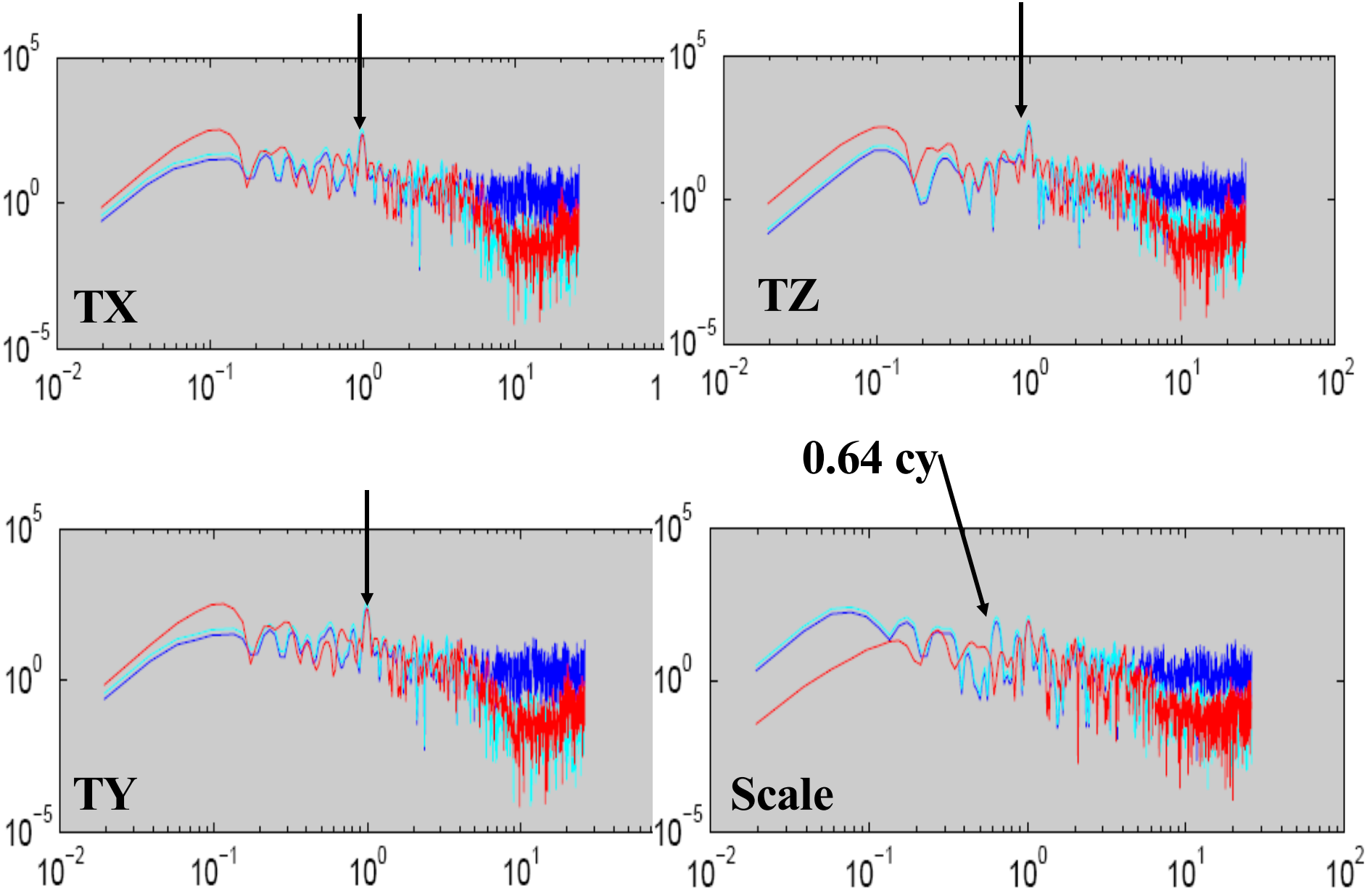
Geocenter ILRS SLR vs models



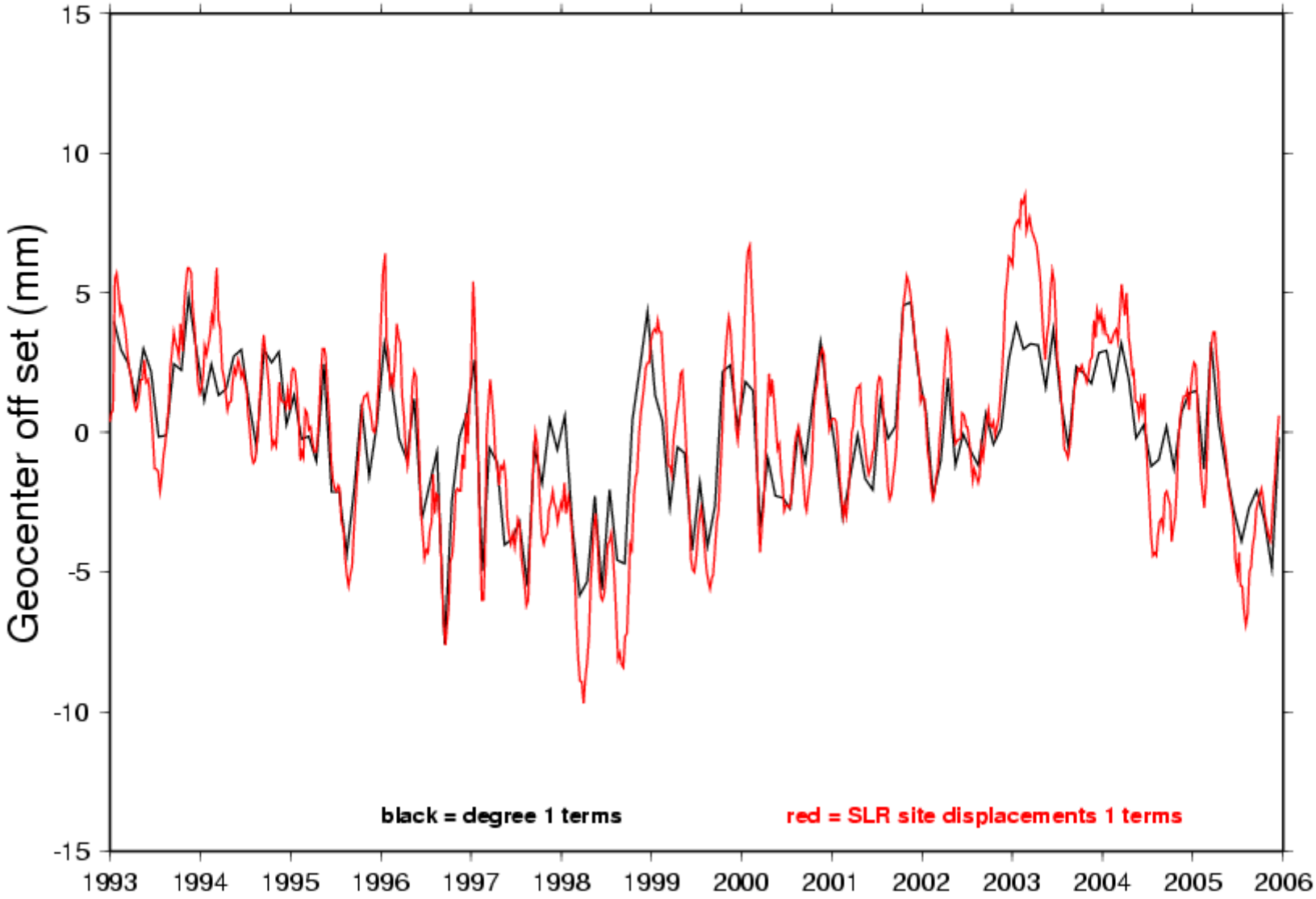
Geocenter ILRS SLR vs GPS+OBP model



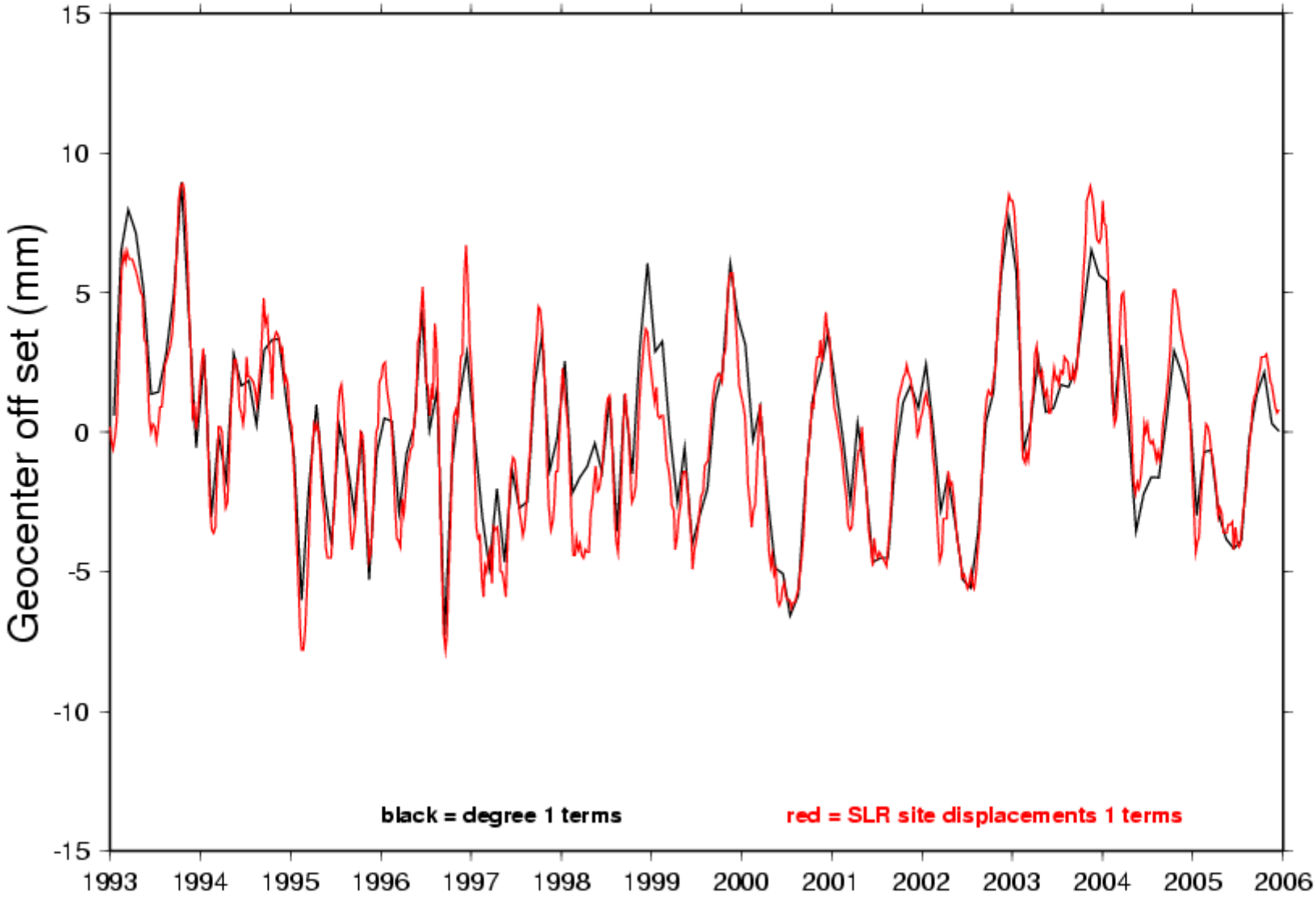
ILRS SLR & GPS+OBP Power Spectrum



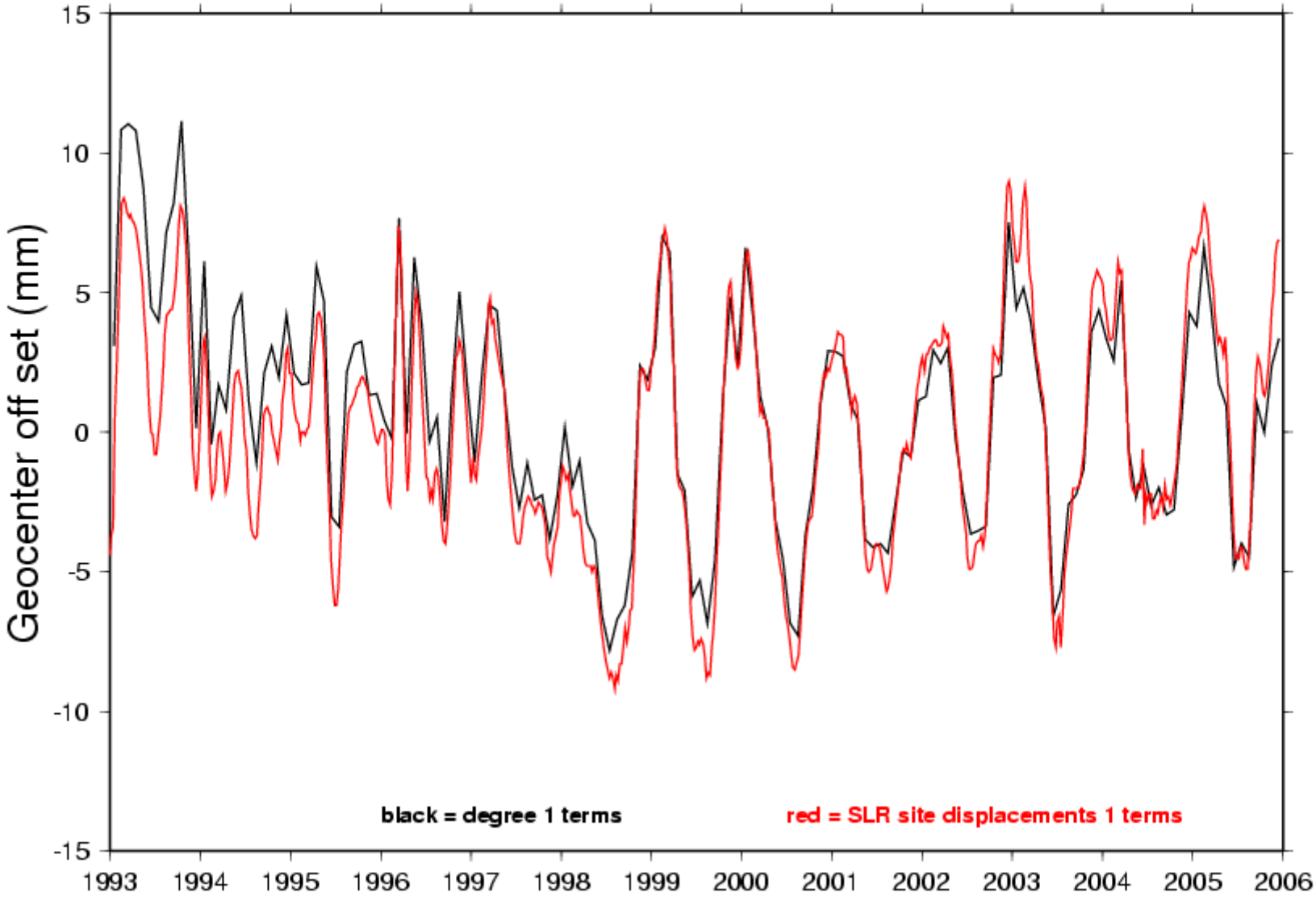
Geocenter Translations for TX



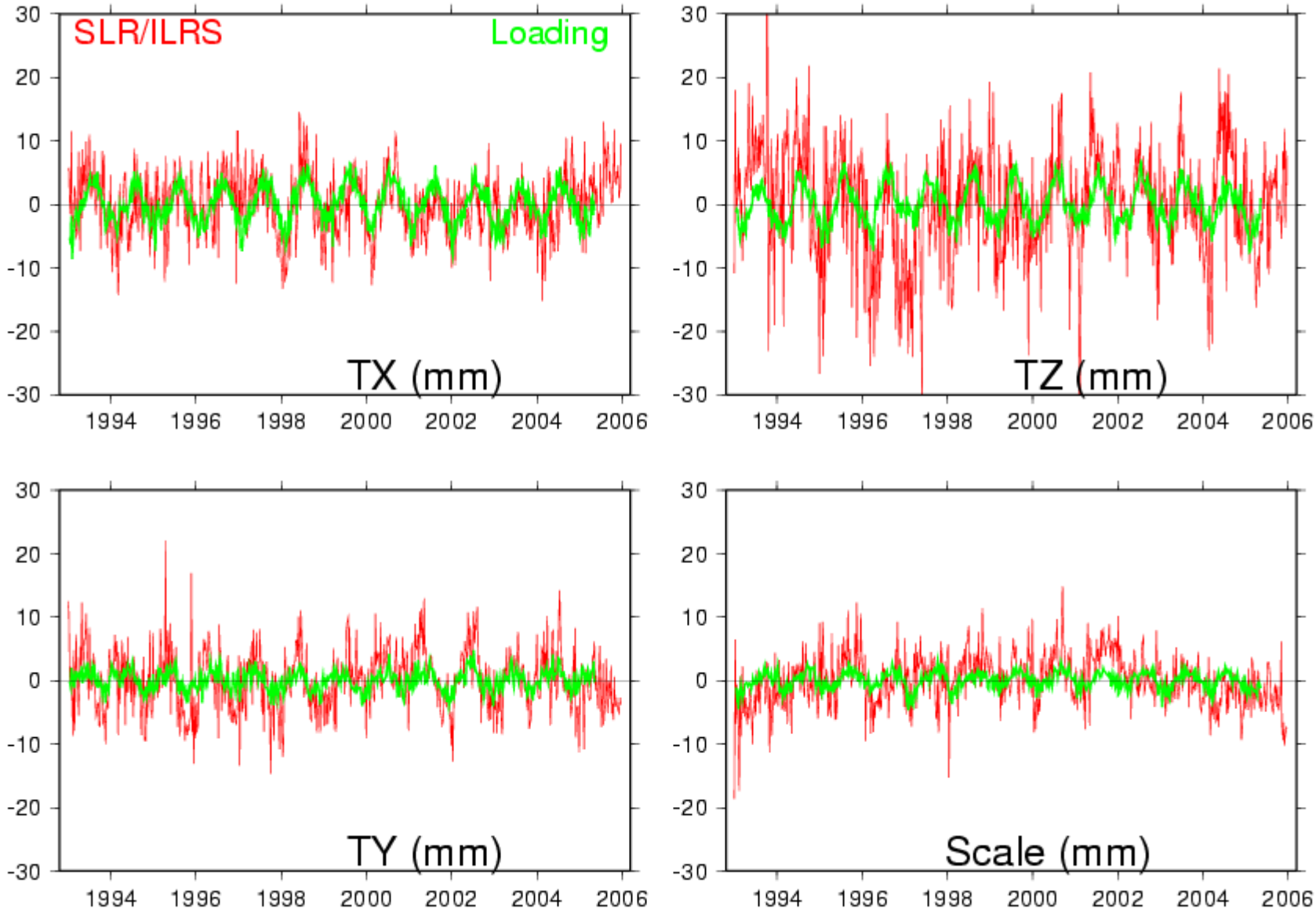
Geocenter Translations for TY



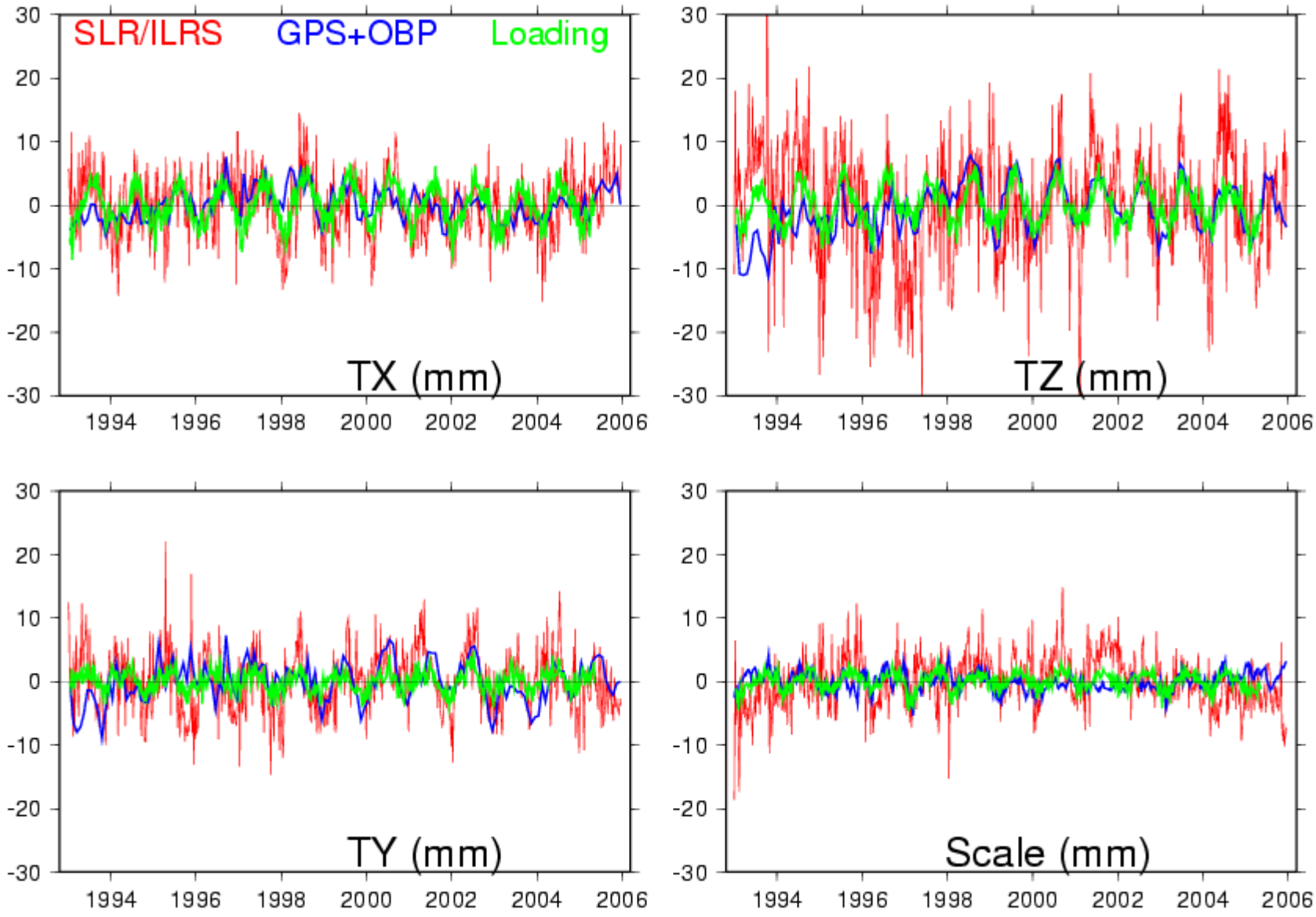
Geocenter Translations for TZ



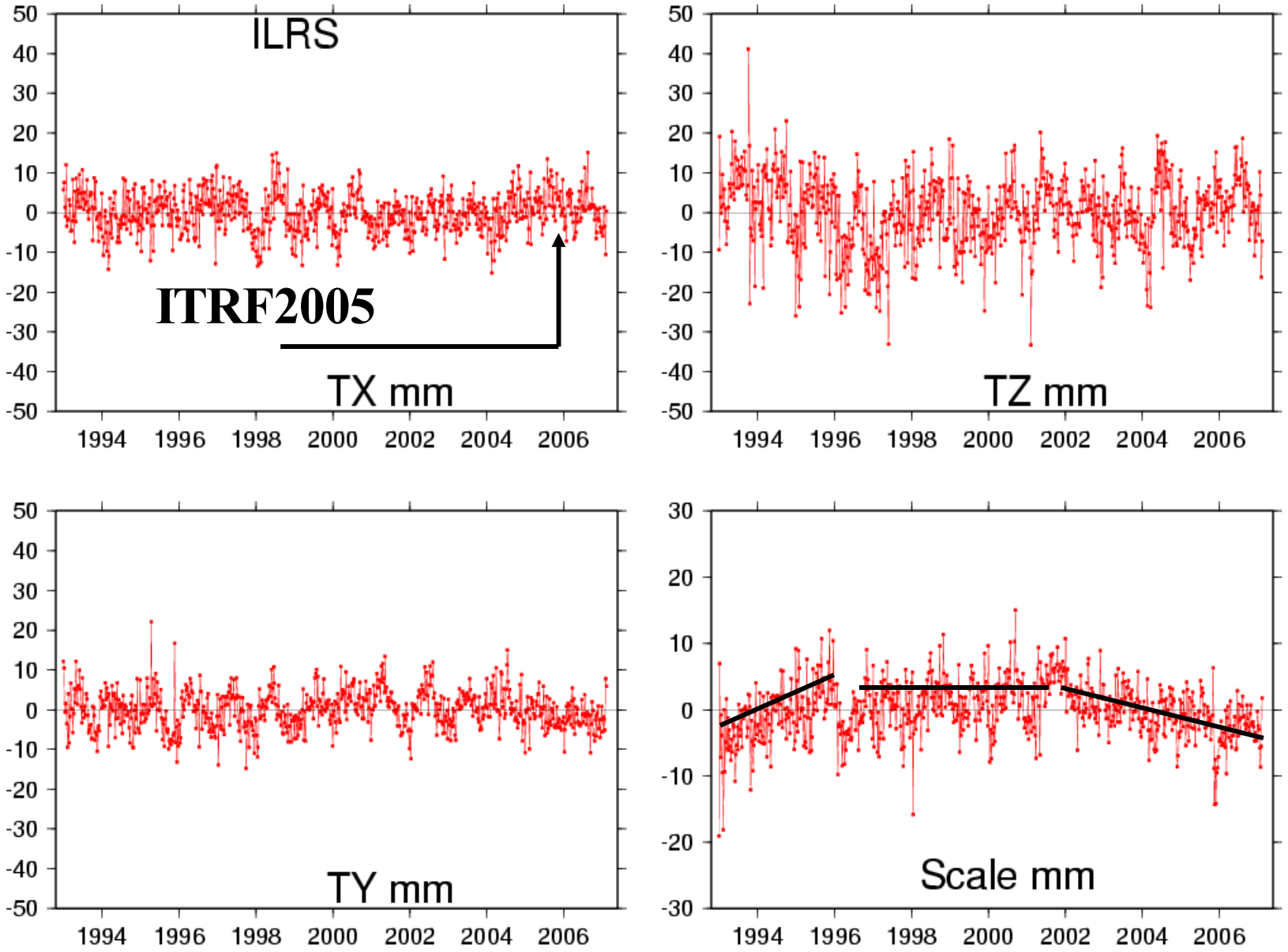
Geocenter ILRS SLR vs Loading model



Geocenter ILRS SLR vs GPS+OBP and Loading models

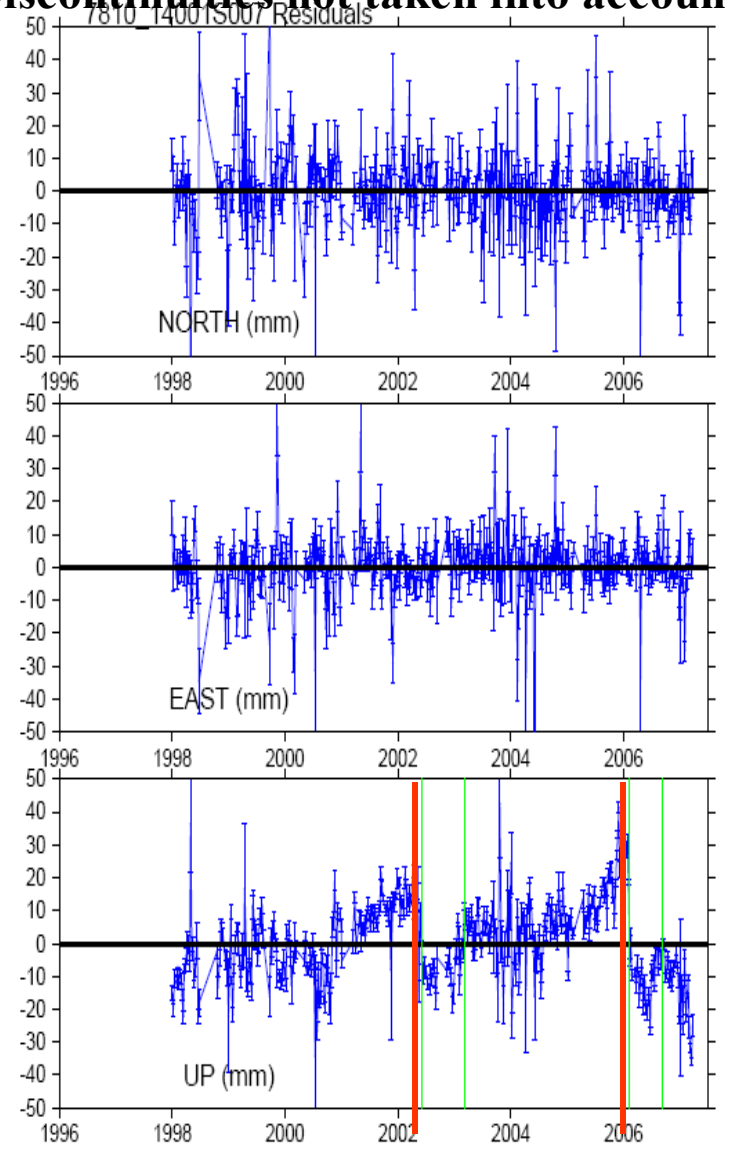


ILRS SLR Intrinsic origin and scale (ITRF2005 + 64 weeks)

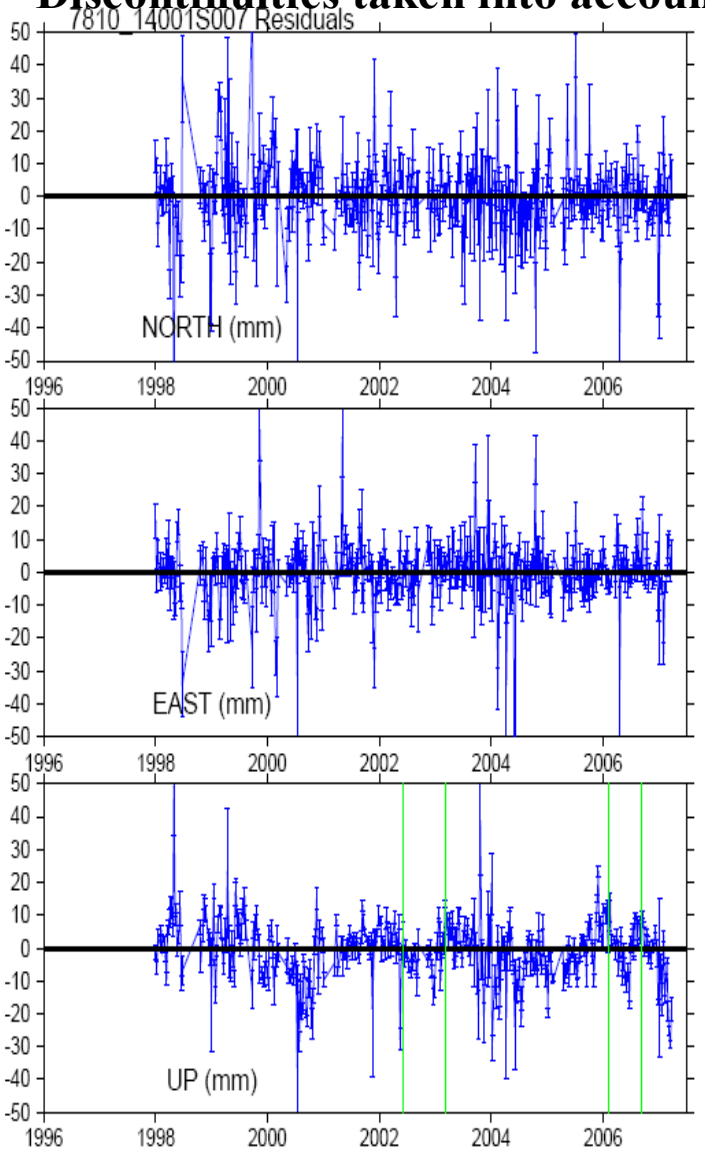


Zimmerwald SLR Station

Discontinuities not taken into account

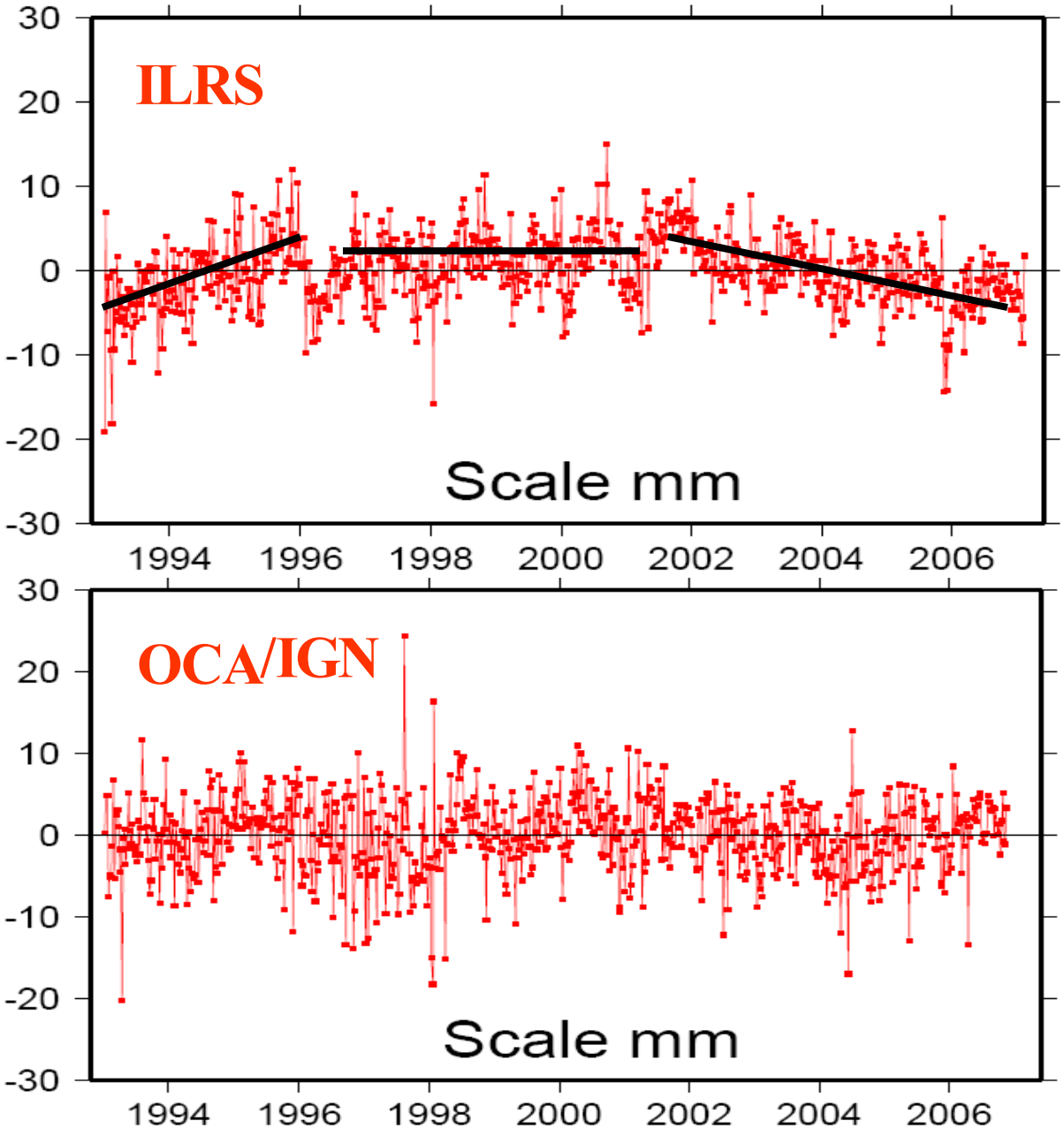


Discontinuities taken into account

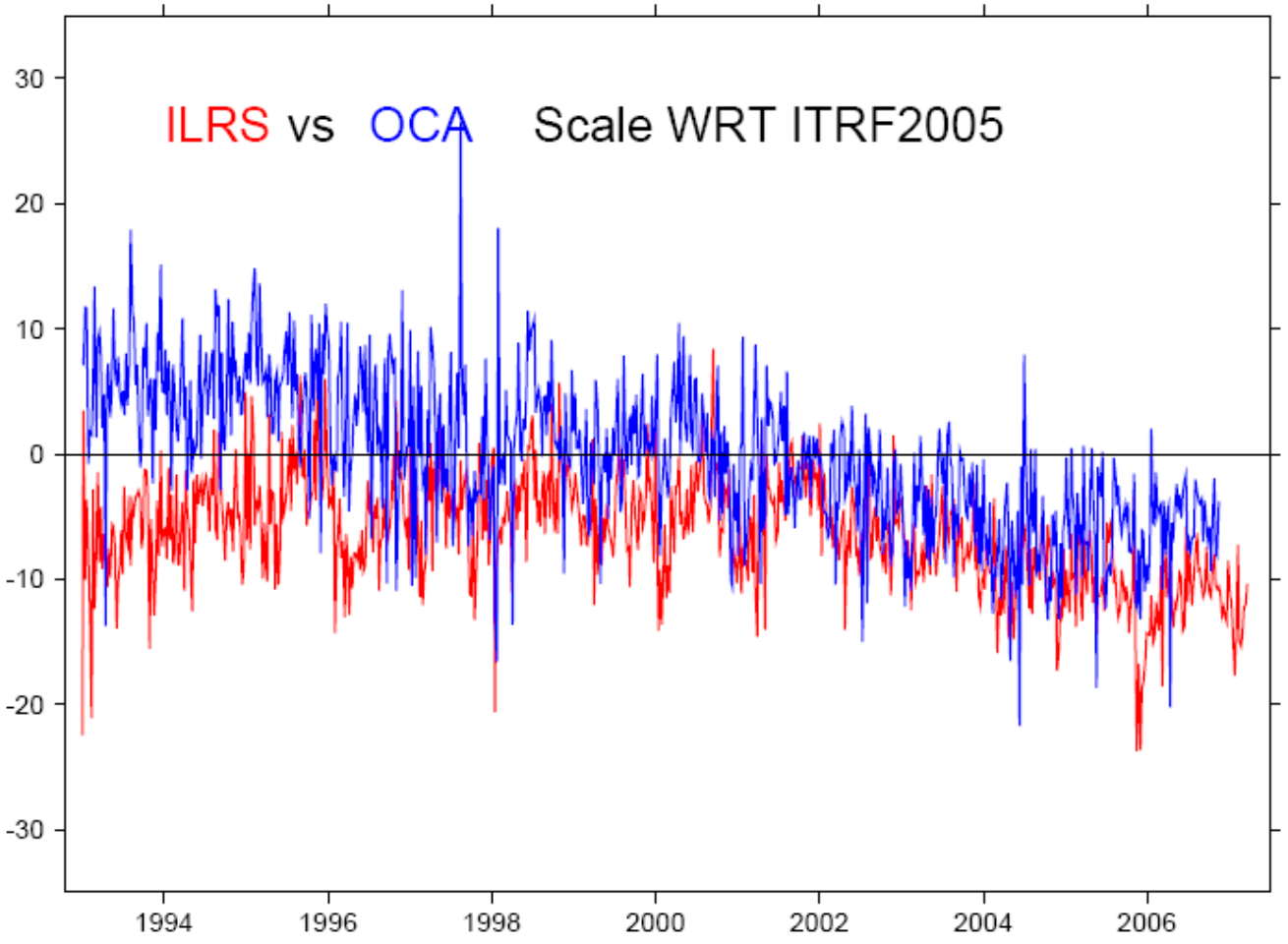


Range Bias events

Intrinsic ILRS vs OCA scales

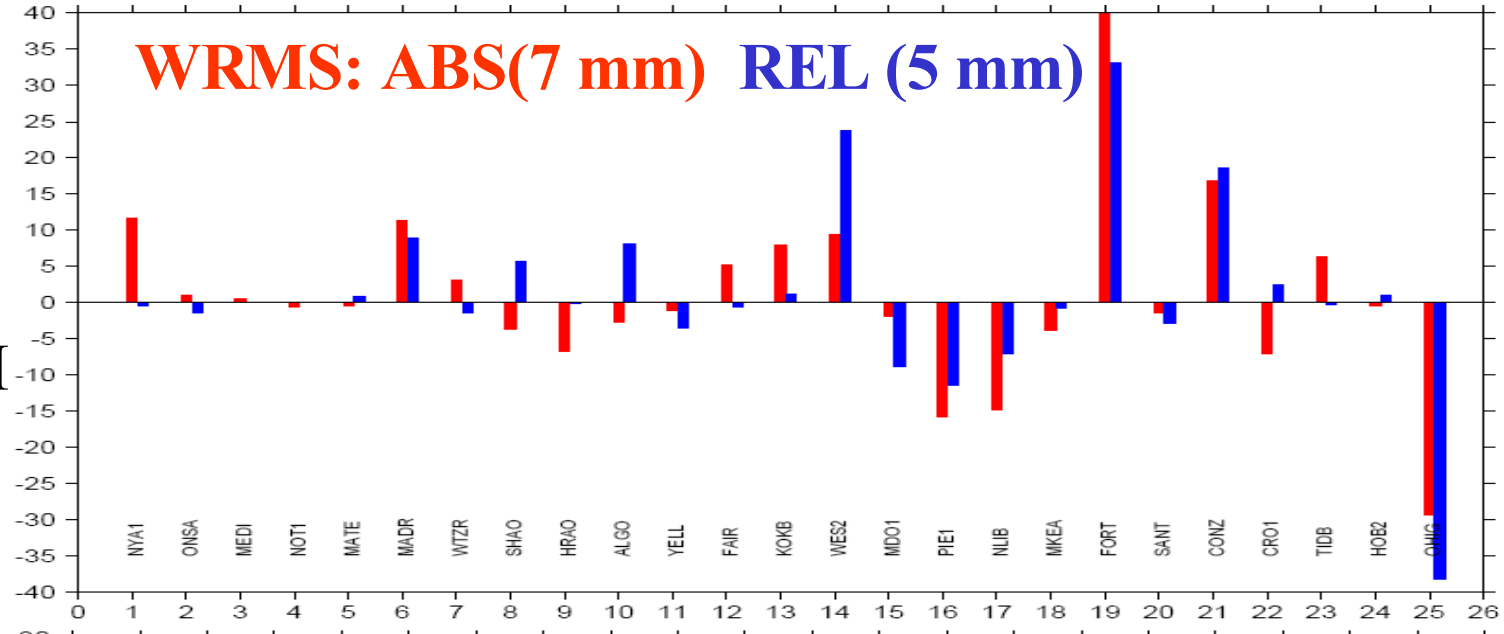


ILRS vs OCA scales wrt ITRF2005

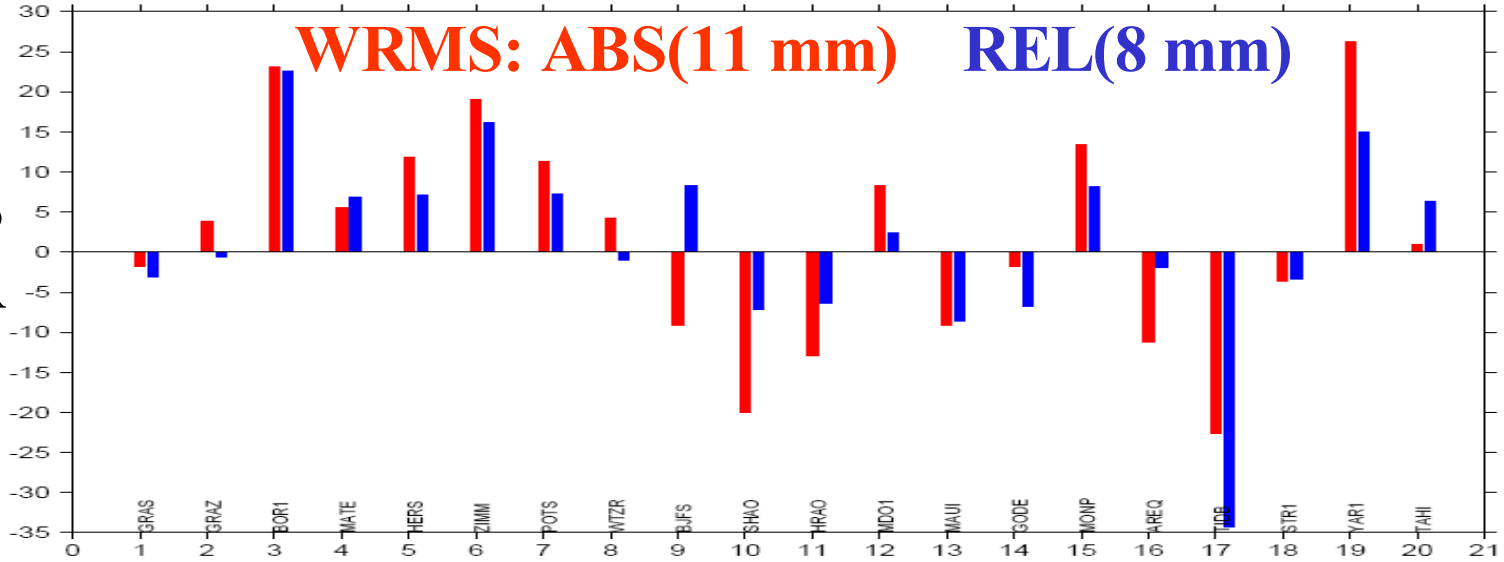


GPS ABS vs REL APCV ? : Up Residuals: Tie - Space Geodesy

GPS VLBI



GPS SLR



Local tie weights as in ITRF2005

Conclusions

- **We showed evidences that SLR weekly translations and scales should be estimated for the ITRF**
- **Despite its poor network, apparent geocenter motion is embedded in SLR weekly solutions**
  - **Good agreement with GPS+OBP and Loading models**
- **Range Bias effect on SLR scale (?)**
  - **Extended ILRS time series still show a scale bias/drift wrt ITRF2005 (VLBI scale)**
- **VLBI scale:**
  - **Seasonal variation due to thermal expansion!**
  - **Troposphere modeling (?)**
- **GPS scale is "heterogeneous", because of Antenna-based PCV until all data reprocessed**
- **GPS-APCV and tie agreement is unclear !!!**