

Issues to Consider

- **Concerns with weekly combination strategy**
- **Concerns with combining satellite-based LOD with VLBI UT1&/LOD**

Concerns with Weekly Multi-Technique Combinations

- **Over-use of tie information**
 - Ties are measured infrequently – really global information
 - So, tie vectors should be used for global (cumulative) combination
 - Weekly use would lead to over-weighting
- **Weakness of network inter-connectability**
 - VLBI sessions do not always use overlapping networks
 - VLBI network can only be strongly linked through long-term solution
 - SLR could have similar problems too

Suggestions for Alternative Approaches

- **1st step -- form long-term reference solution:**
 - Based on time series over, say 20 years
 - Include all techniques, EOPs, Ties
 - Derive X , V , $EOP(t)$
- **2nd step -- operational weekly update process:**
 - Rigorous method: weekly increment & back-substitution
OR
 - Approximate method: align weekly technique solutions to reference solution, then combine weekly

Rigorous Weekly Update

- **Weekly increment & back-substitution**
 - Add new week to the long-term solution
 - X , V , $EOP(t)$ can change
- **Advantages:**
 - Rigorous results
 - Cumulative solution always available
- **Disadvantages:**
 - Computationally intensive
 - Reference solution will change weekly (slightly)

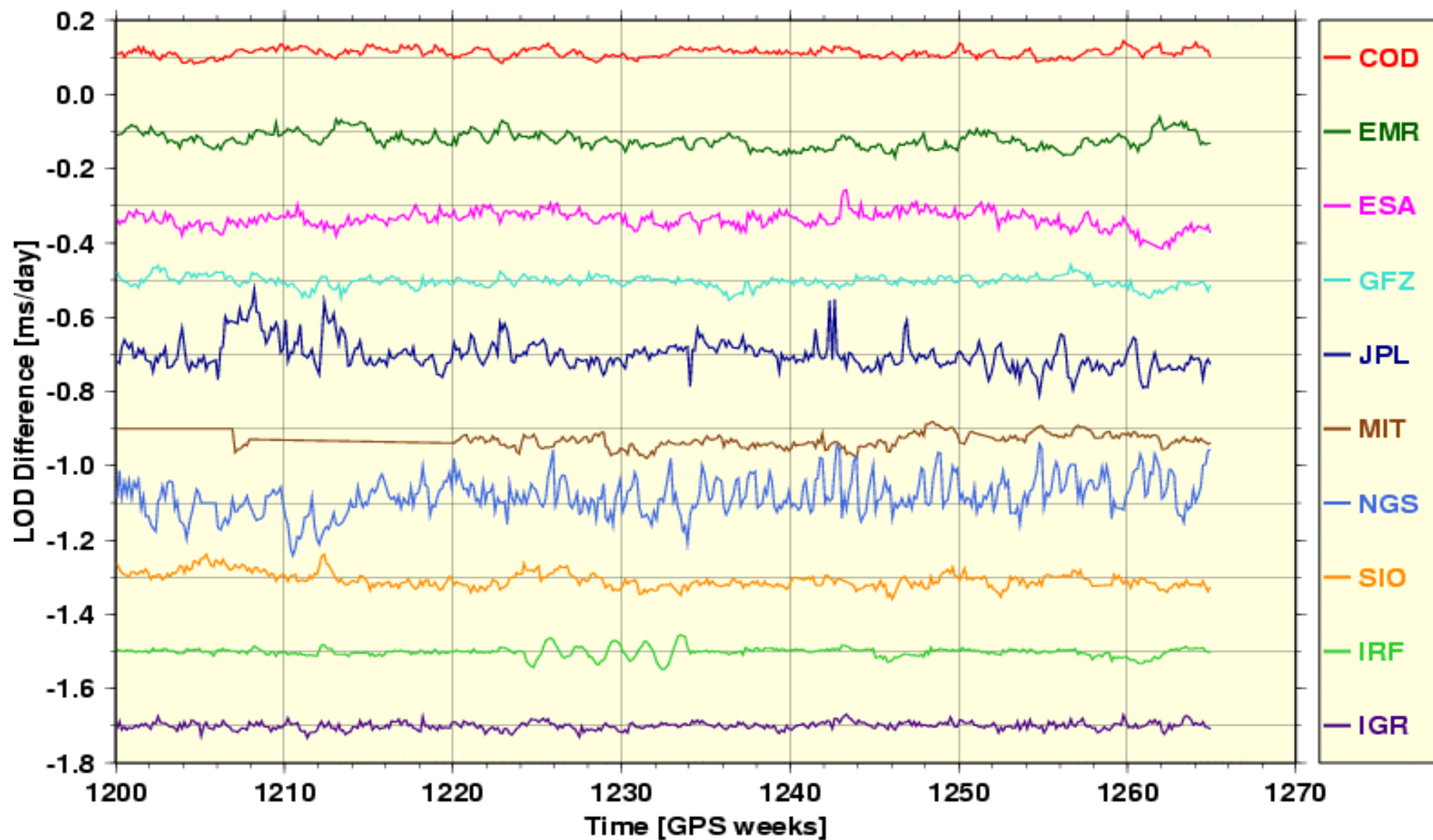
Approximate Weekly Update

- **Align weekly technique solutions to reference solution, then combine**
 - Must select reference stations for each technique to use for weekly alignments
 - Derive combined EOP(t) for new week (reference solution held fixed)
 - New reference solution is needed from time to time (annually?)
- **Advantages:**
 - Computationally efficient
 - Reference solution will not change often
- **Disadvantages:**
 - Weekly updates not fully rigorous

Concerns with Combining Satellite-Based LOD with VLBI UT1&/LOD

- **Only get UT1 results when VLBI data are available**
 - Satellite techniques cannot observe UT1, only LOD-like variations
 - But users usually want daily UT1 & LOD results
 - To derive UT1 from LOD requires integration => random walk errors (or worse)
- **Simple rigorous methods inadequate for LOD**
 - Usually assume systematic effects related to network only
 - But LOD biases from satellite techniques mostly due to orbit modeling effects, not network
 - LOD biases correlated in time & between different analysis groups

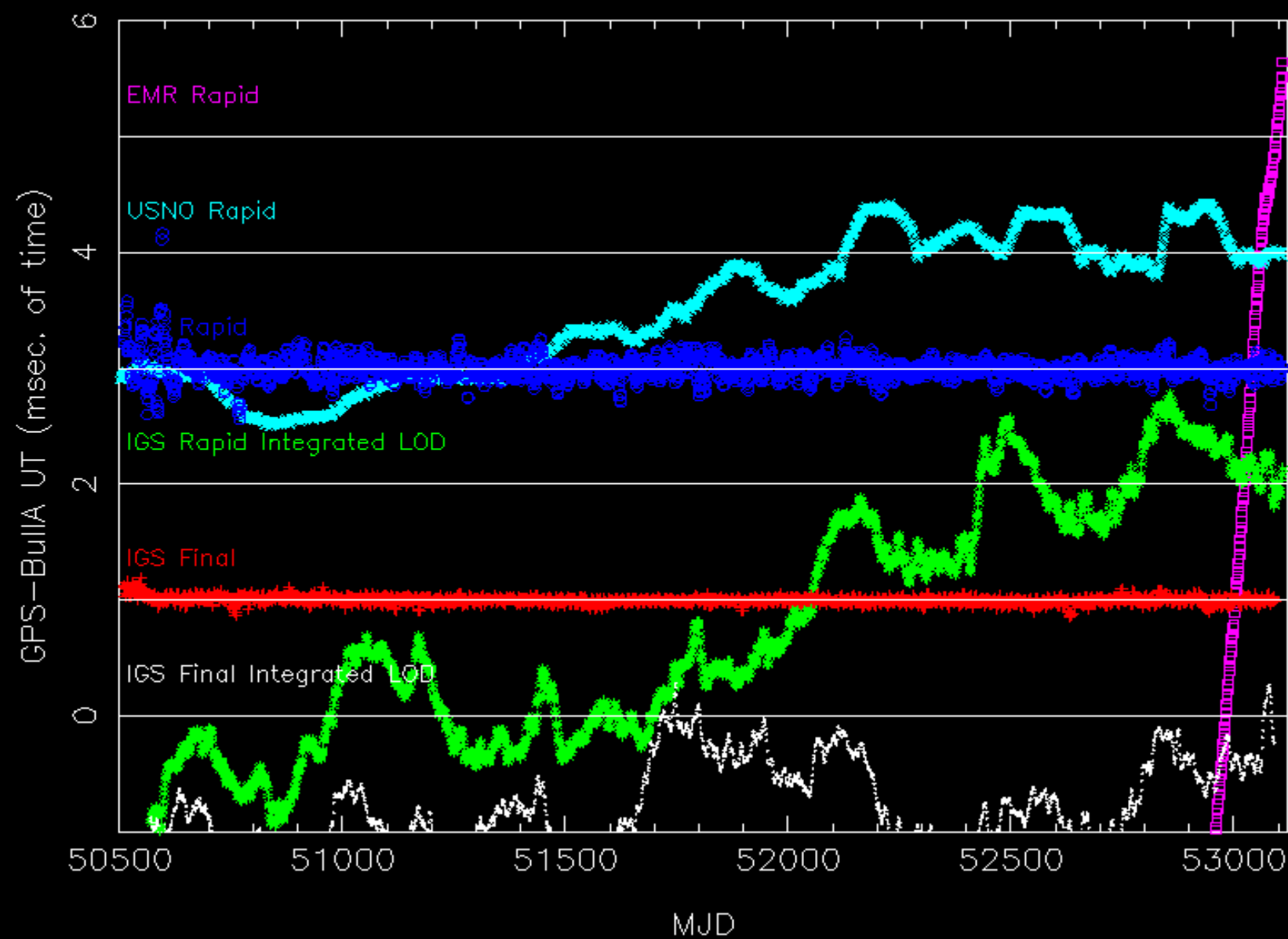
AC Final LOD Differences with IGS Final



Alternative LOD Combination Approaches

- **Add LOD bias parameters (rigorously)**
 - Also need *a priori* constraints & temporal correlations
 - Implement as Kalman filter or piece-wise least squares
 - Greatly increases computational burden
 - Results depend on quality of *a priori* constraints
- **Or use non-rigorous methods for UT1/LOD**
 - Should do UT1/LOD combination from VLBI rigorously
 - But can merge satellite information in non-rigorously
 - Various methods possible for this process
- **UT1-like GPS time series from USNO can only be used non-rigorously (not connected to TRF)**

Biases Removed



GPS Calibration and Prediction

