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PACIFIC EARTHQUAKE ENGINEERING RESEARCH CENTER

Validation of Finite Fault Simulations for NGA-East Using the SCEC Broadband Platform

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Key points:

- Validations for 7 events were done on the SCEC Broadband Platform following the methodology of Graves and Pitarka, 2010:

1988 Saguenay	2005 Riviere du Loup	2000 Tottori
1994 Northridge	1989 Loma Prieta	1979 Imperial Valley
1999 Chi-Chi		

- Objective: to test the predictive capabilities of the method in a “blind” fashion by comparing simulations with well recorded events; while using the BBP for all URS simulations.

- This presentation briefly covers the required changes/inputs to the BBP for a new validation event using the URS modules, and then shows some results from NGA-East.

- Results are shown as “Goodness of Fit” plots of the mean and standard deviation of spectral acceleration residuals

What steps are required for a new "validation event" on the BBP?

1) Compile recorded data to validate against (done externally i.e. outside of BBP)
   - Time series must be converted to BBP format, NS/EW components

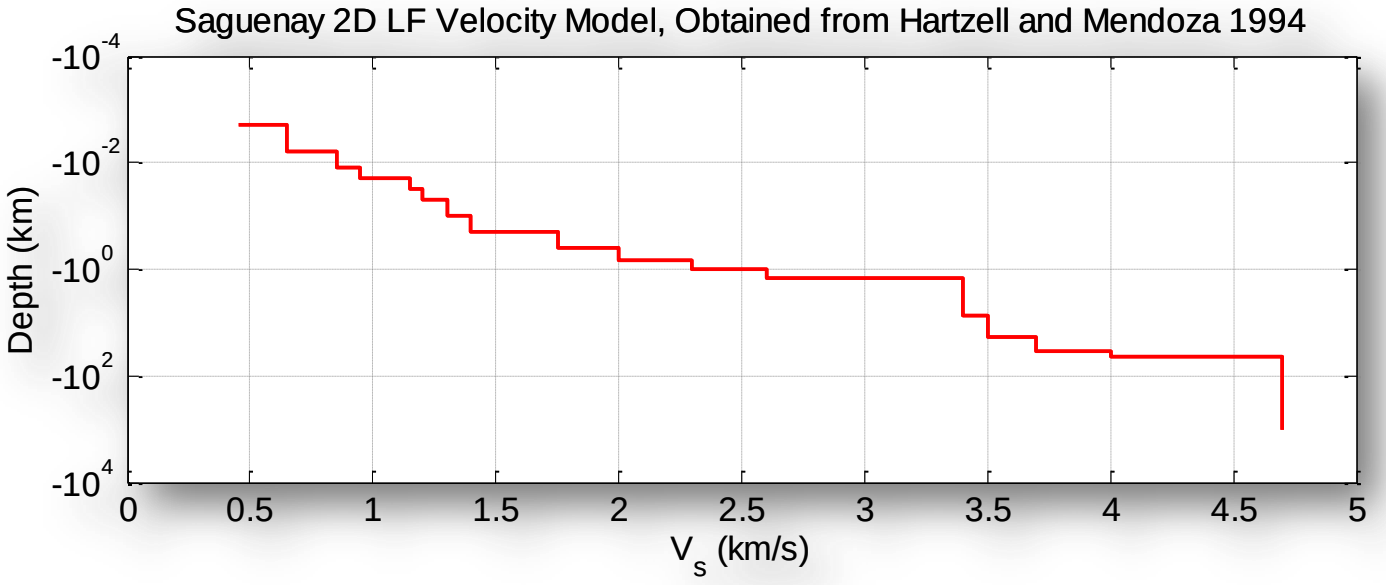
2) Create recorded stations list – locations to compute synthetics (external)
   - Includes lat/lon, station name, Vs30, RclstD

```
# List of strong motion recording sites for 1988 Saguenay Eqk
# Column 1: station longitude
# Column 2: station latitude
# Column 3: station name/code
# Column 4: closet distance to fault plane (km)
# Column 5: Vs30 (m/s) (usually from NGA)
# Column 6: low freq. corner (Hz)
# Column 7: high freq. corner (Hz)
# Column 8: station operator/owner
# Column 9: data source
#
 -70.50570      47.44180        BSPQ    88.308  566     0.330   41.0    peer    peer.berkeley.edu
 -71.01230      48.49020        CHIQ    46.083  656     0.670   50.0    peer    peer.berkeley.edu
 -70.15270      47.65530        LMBQ    89.993  760     0.330   43.0    peer    peer.berkeley.edu
 -70.32670      47.54830        LMQ     87.534  467     0.500   50.0    peer    peer.berkeley.edu
 -71.27600      46.77910        QCQ     147.241 750     0.330   32.0    peer    peer.berkeley.edu
 -69.99660      47.47530        ROUQ    110.617 760     0.400   50.0    peer    peer.berkeley.edu
 -71.99170      48.32840        SANQ    64.085  760     0.800   50.0    peer    peer.berkeley.edu
```

What steps are required for a new "validation event" on the BBP?

3) Create 2D velocity model for the region (external)
   - With lat/lon boundaries, velocities, density, and quality factors. HF & LF versions.

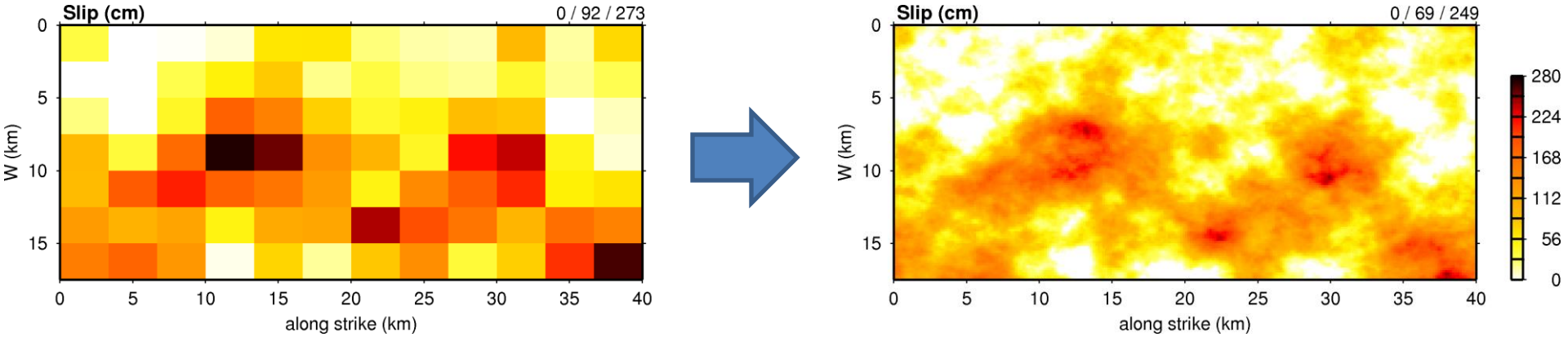
4) LF Green's Functions (external)
   - Calculated for given velocity structure, with parameters for source type, wavenumber sampling interval, etc.
   - Must be created for distance and depth ranges required for source and site locations
   - HF GF's computed automatically upon each validation run on BBP



What steps are required for a new "validation event" on the BBP?

5) Create LF rupture model in SRF format (external *OR* within BBP)

- Externally:
  - Coarse representation of slip amplitude and rake obtained from slip inversion, filtered to preserve long wavelength features, then extended to fine grid using Mai and Beroza (2002) spatial correlation functions with random phasing for shorter wavelengths
  - Parameters to define slip-rate function, risetime, number of sub-elements, corner frequency, etc.
- Or within BBP:
  - Kinematic Rupture Generator using spatial correlation functions
  - Must supply simple rupture description file – Magnitude, dimensions, dip, etc.



What steps are required for a new "validation event" on the BBP?

6) Upload items 1-5 to SCEC's intensity
   - Save to the proper locations under bbp_2g_gf/urs/data/[EVENT]

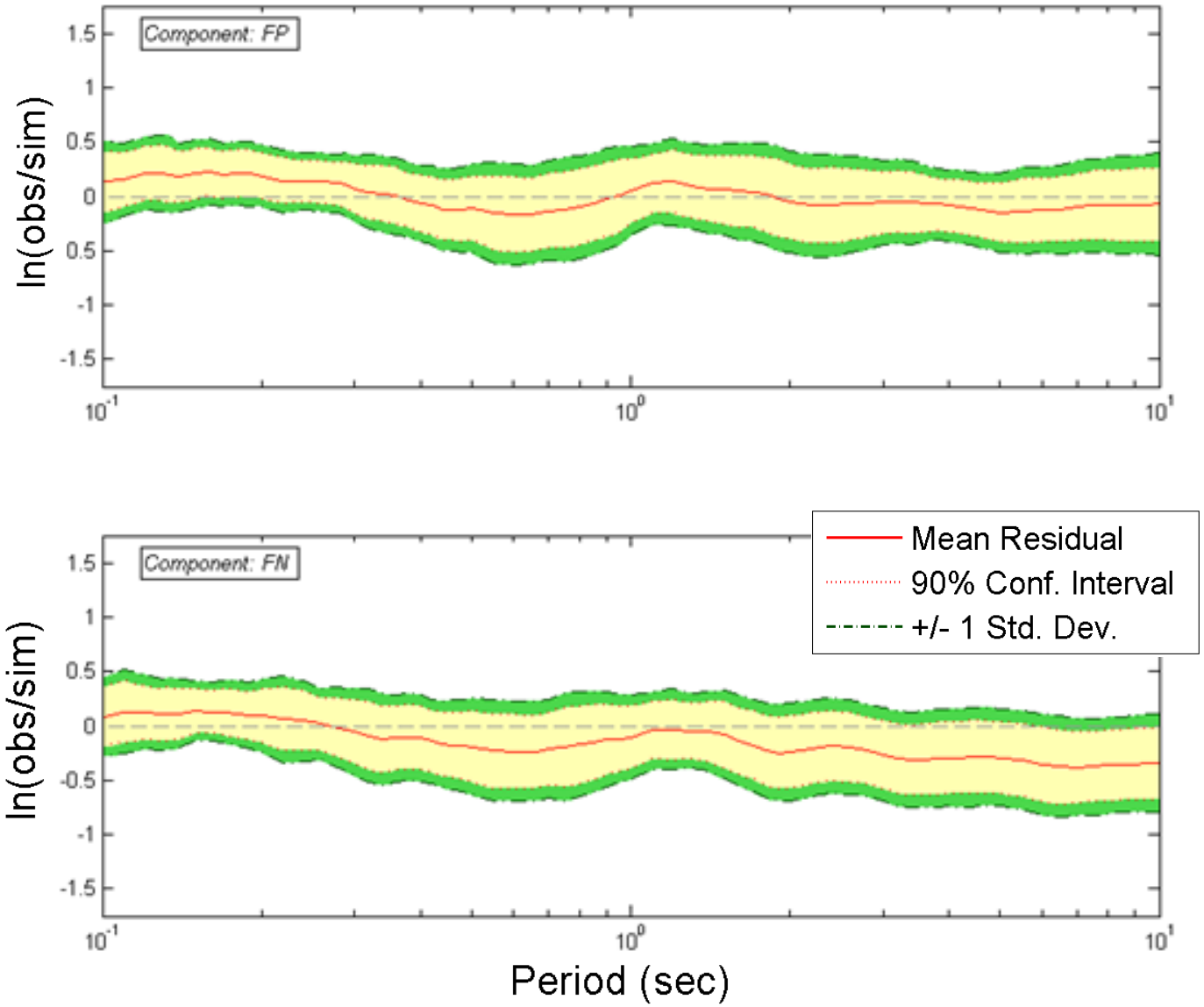
7) Configure BBP settings for event
   - Multiple python scripts require editing in order to set many parameters, GF lat/lon boundaries, Δσ, κ, other event characteristics, etc.
   - Main scripts:

     validation_cfg.py, region.py, jbsim_cfg.py, hfsims_cfg.py, hfsims.py, wcc_siteamp_cfg.py

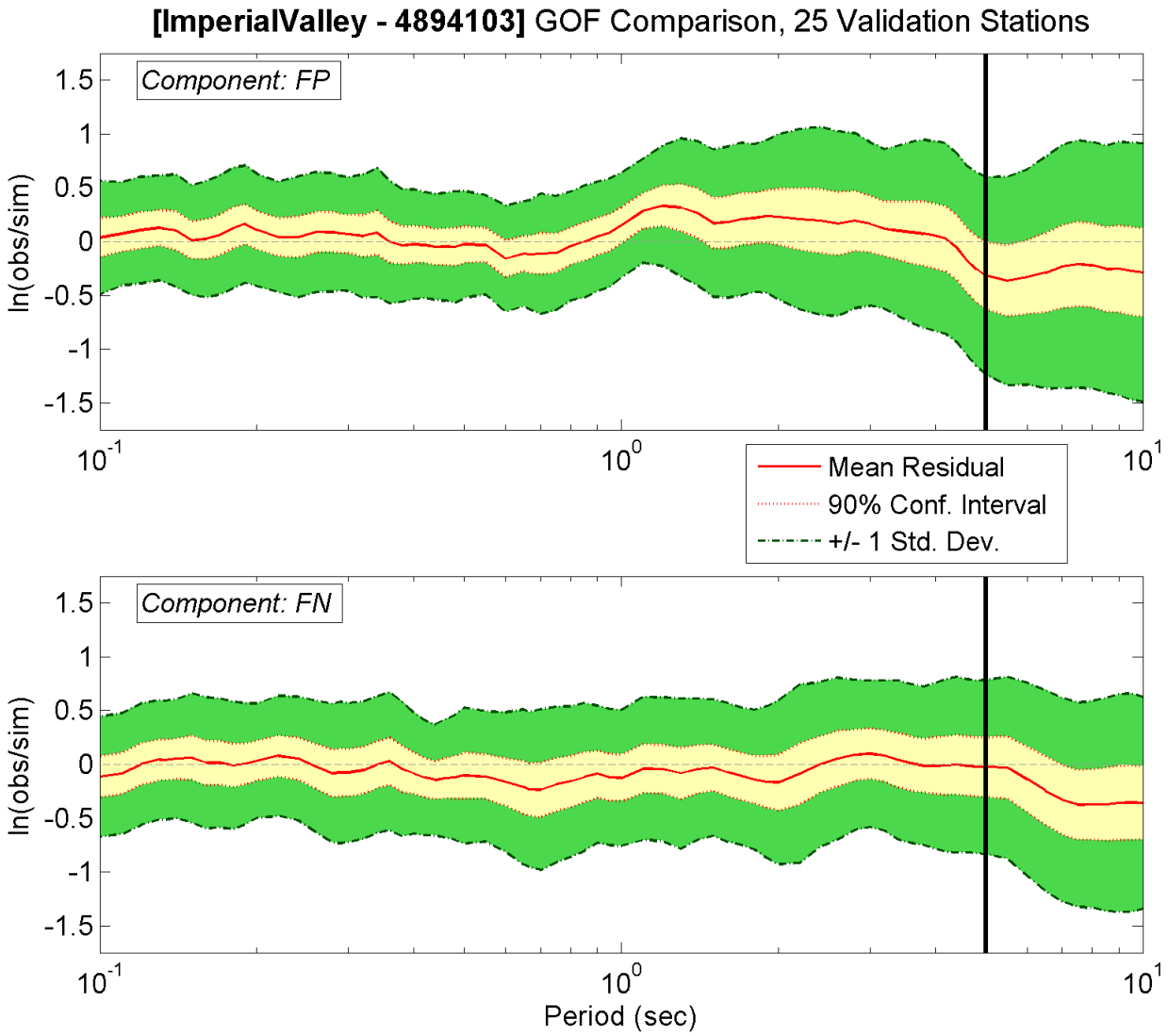
8) Simulate on intensity
   - Follow general platform validation directions
   - Will be prompted to select event, station list, rupture model, etc.
   - URS HF, LF, and Site Amp modules will be run
   - BBP automatically saves synthetic waveforms and computes SA goodness of fit curves

Results: Goodness-of-fit (GOF)

Average over 7 events, equal weight to each



Event I: Imperial Valley



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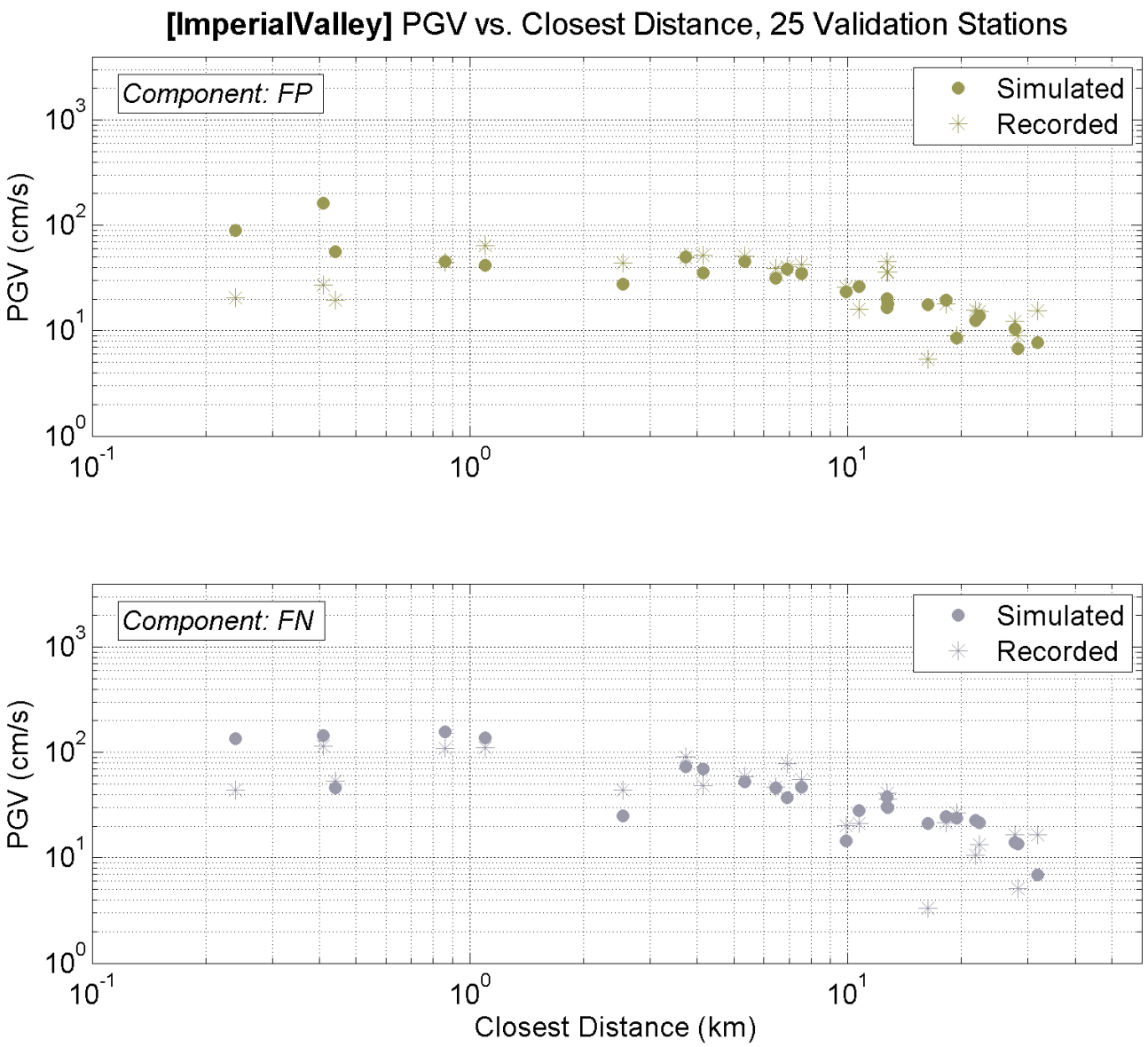
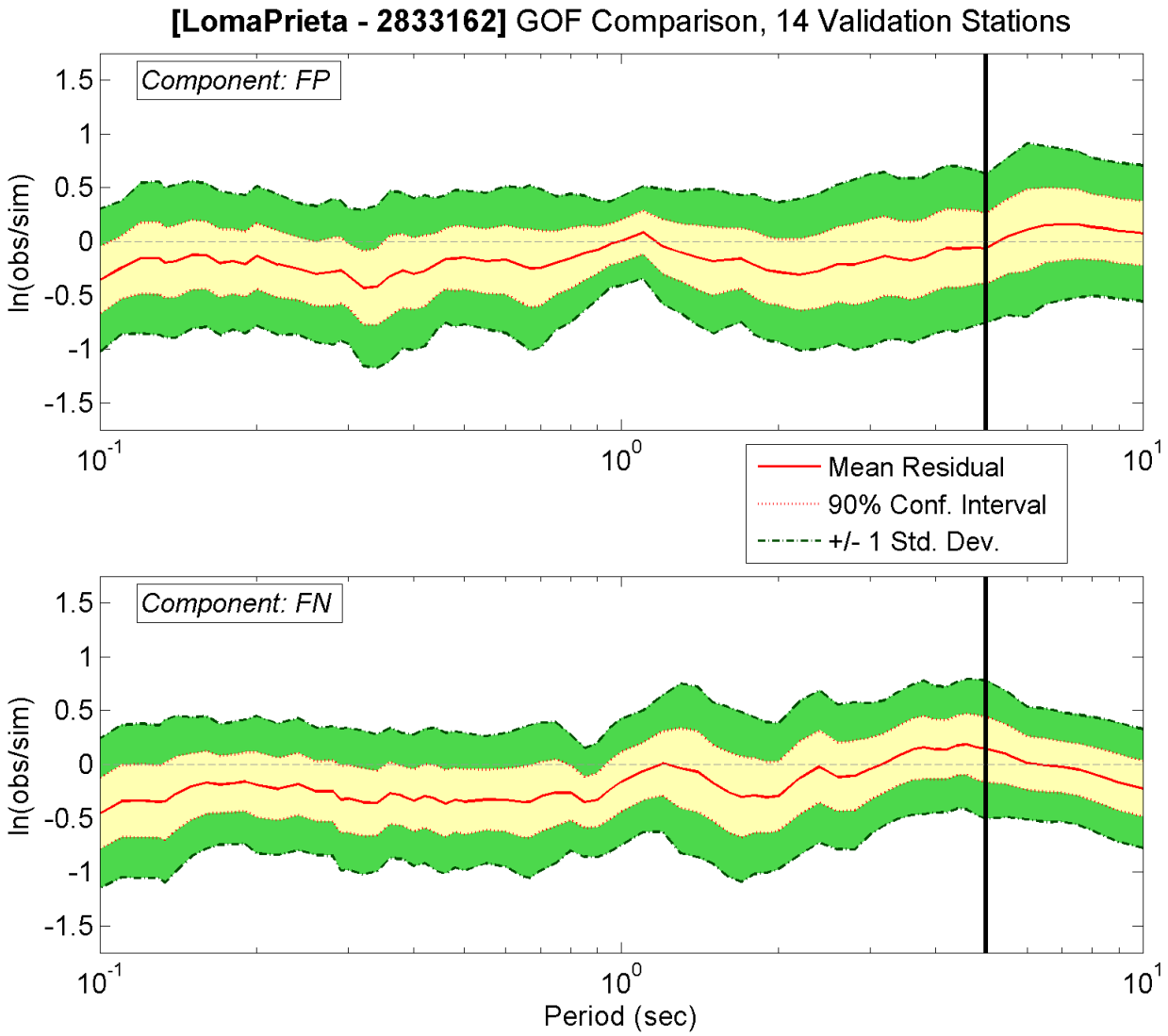


Event II: Loma Prieta



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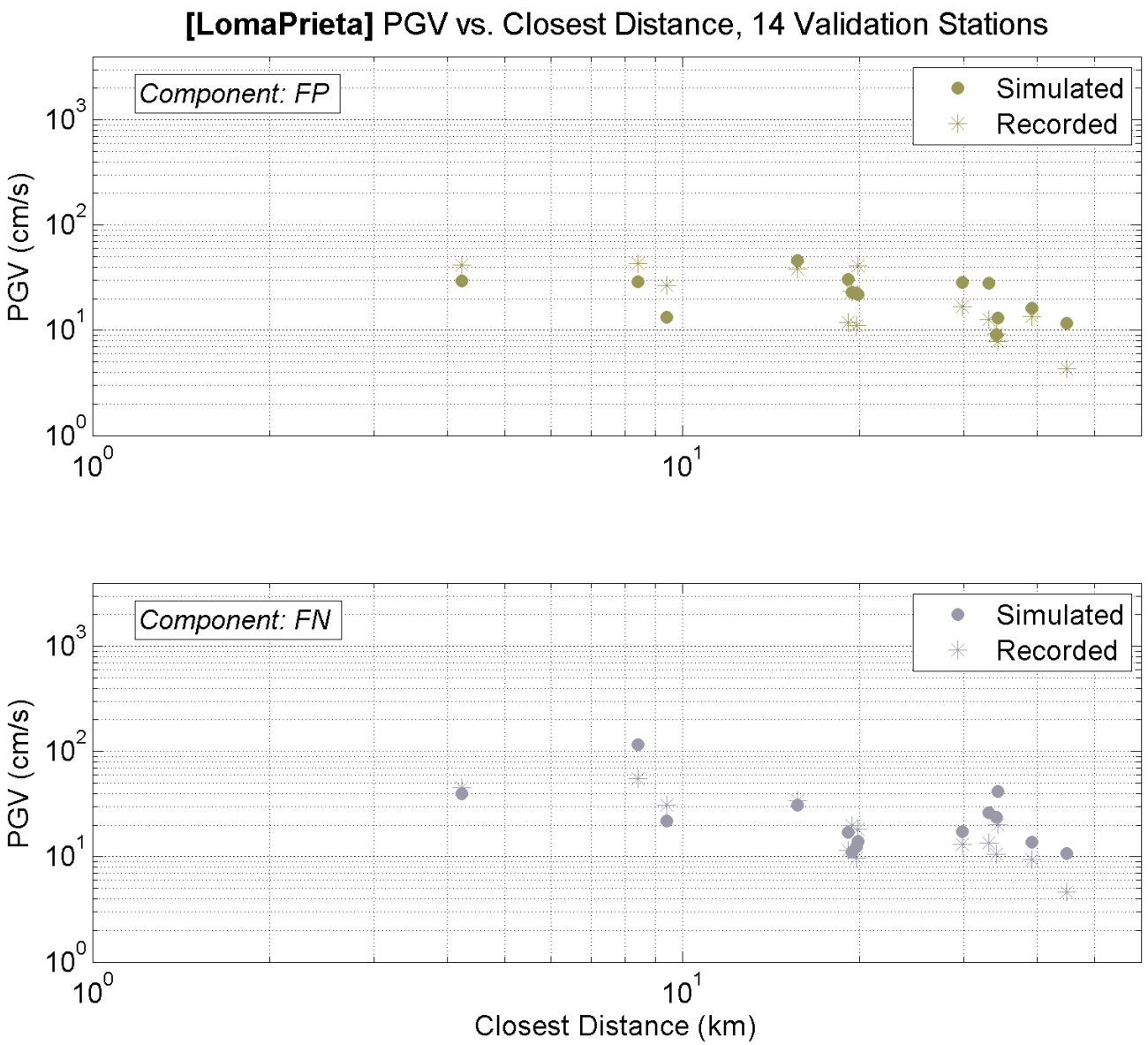
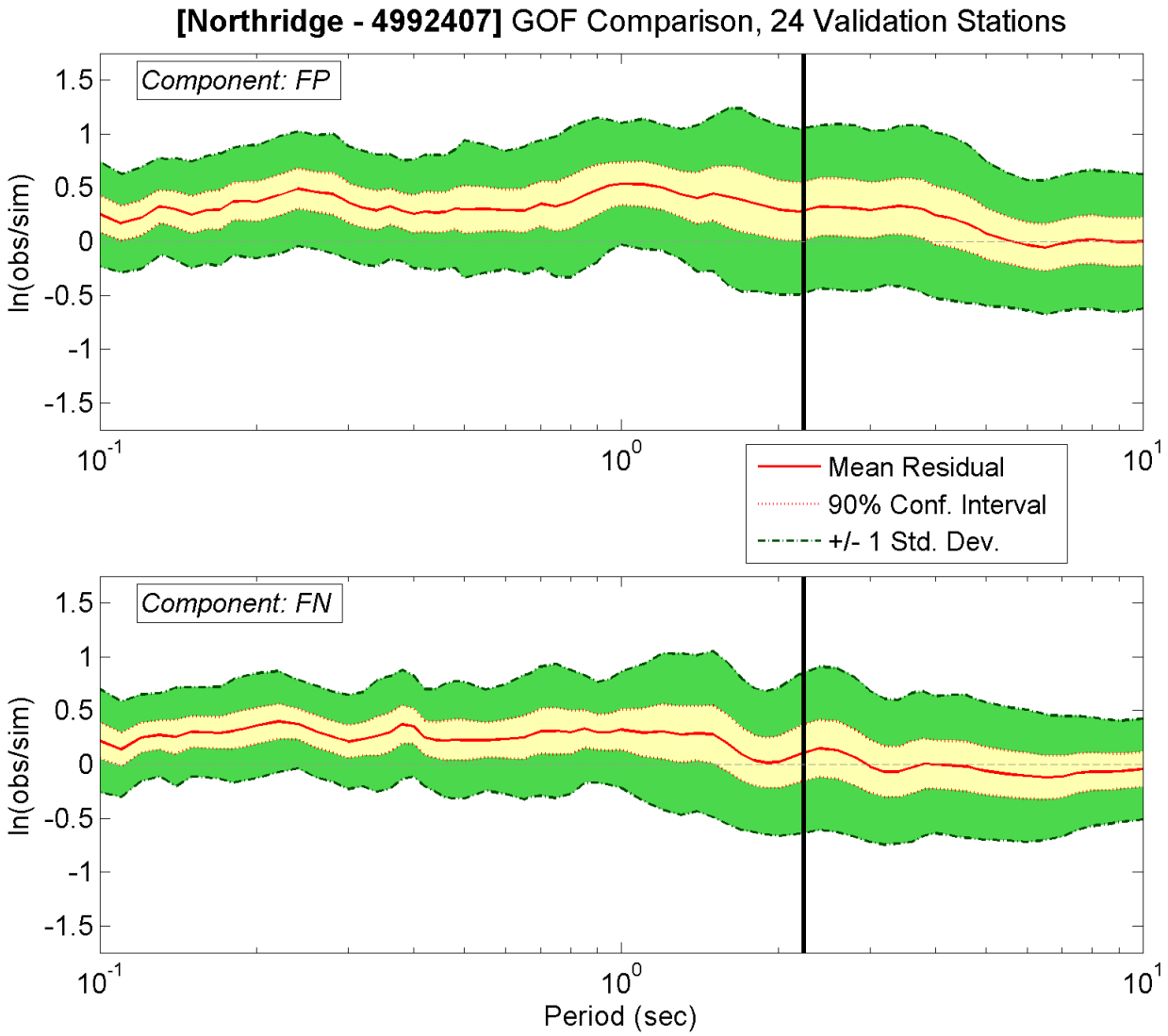


Event III: Northridge



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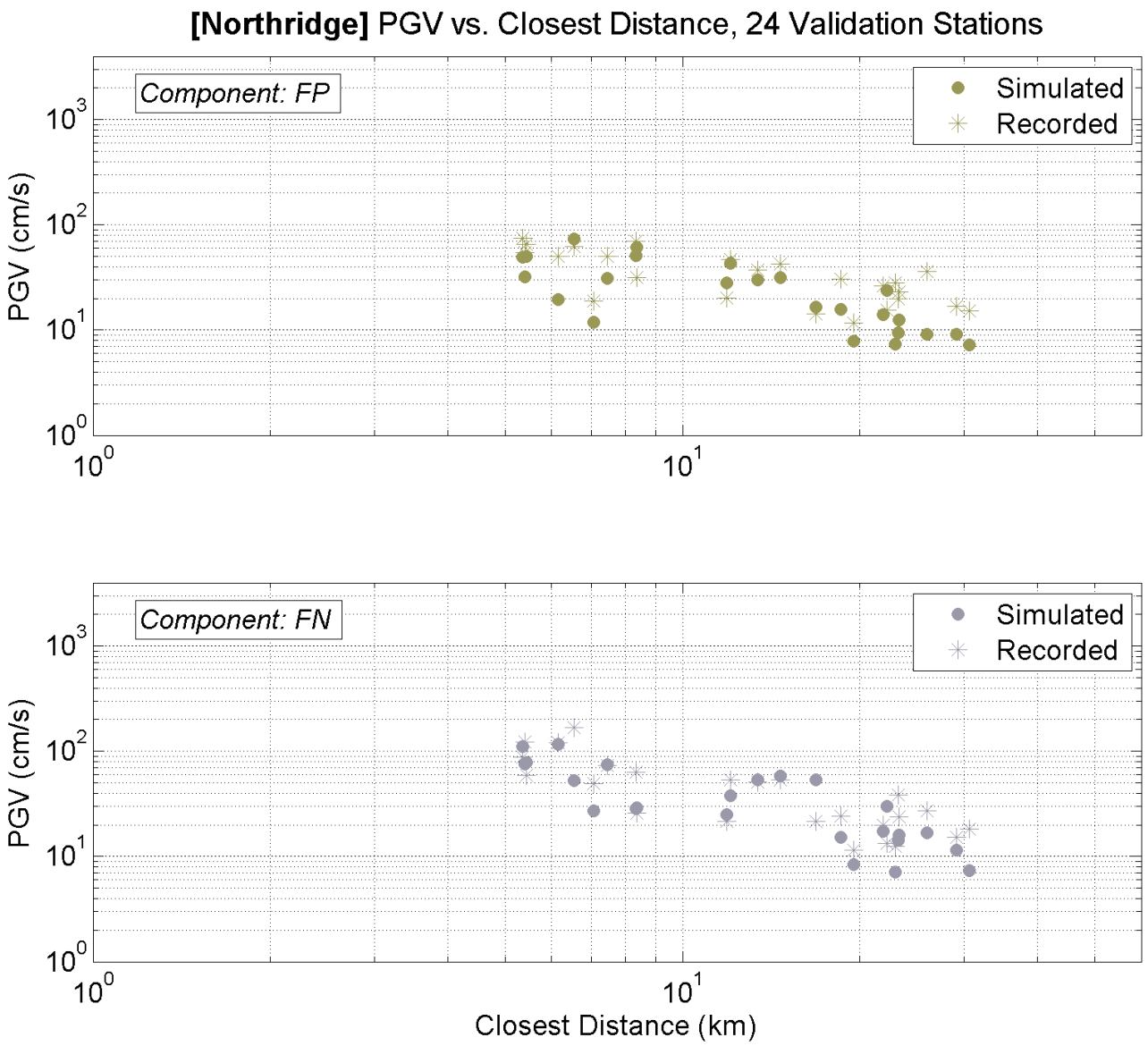
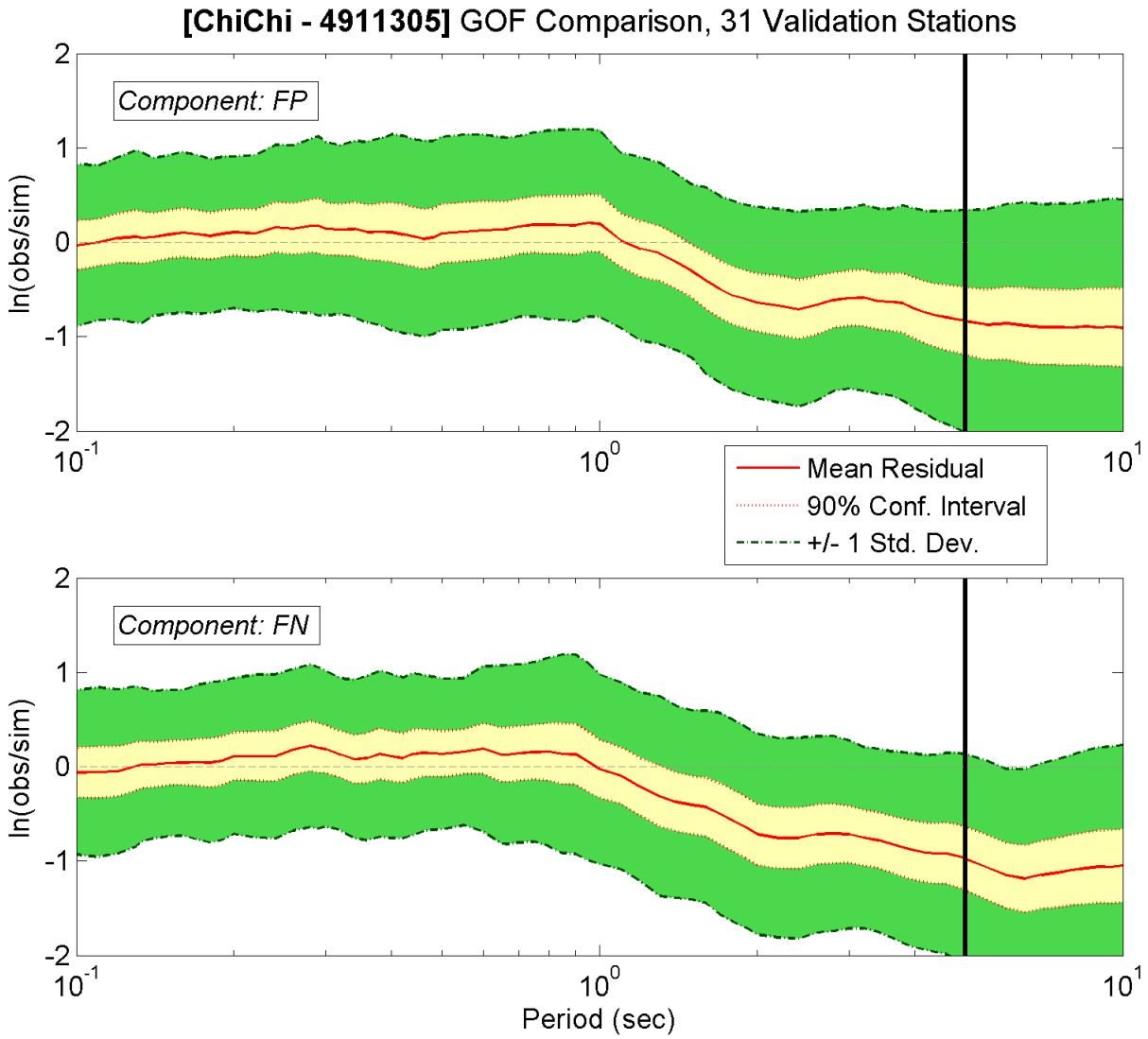


Event IV: Chi-Chi



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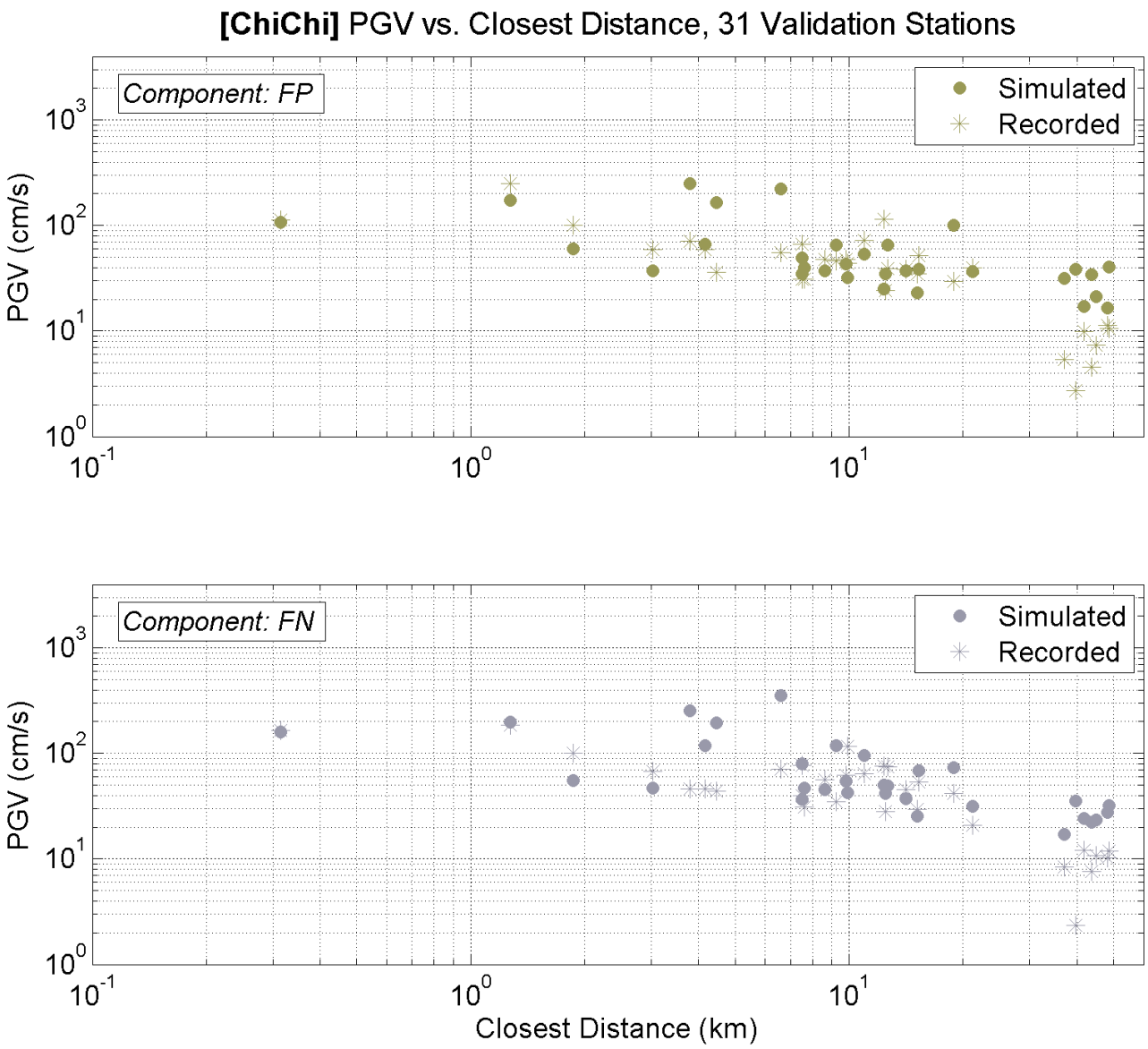
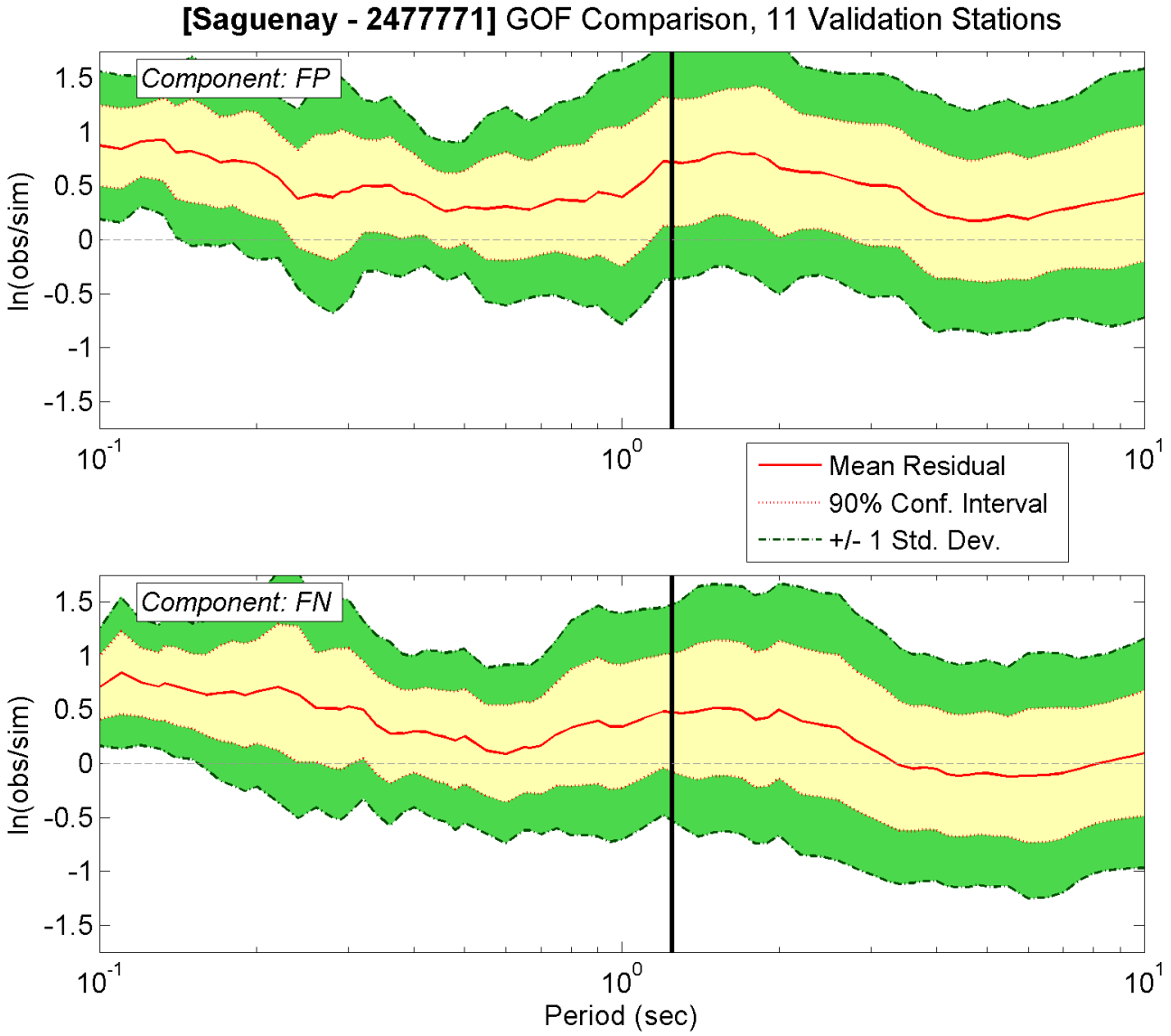


Event V: Saguenay



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Saguenay