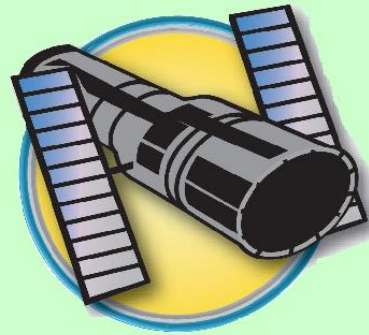
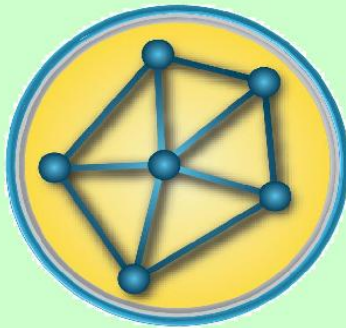


Washington State Reference Network

www.wsrn.org



CGSIC – CORS Forum
September 16th, 2008
Savannah, GA

Washington State RTN

- **WSRN (RTN) – Cooperative 90% Coverage**
- **RGPS (RTN) – Dealer / Partnerships 15% Coverage**
- **RGPS (Single Base) – Dealer / Partnerships 20% Coverage**
- **PC3N (RTN) – County Network 5% Coverage**
- **PPI (RTN) – Dealer Network 10% Coverage**

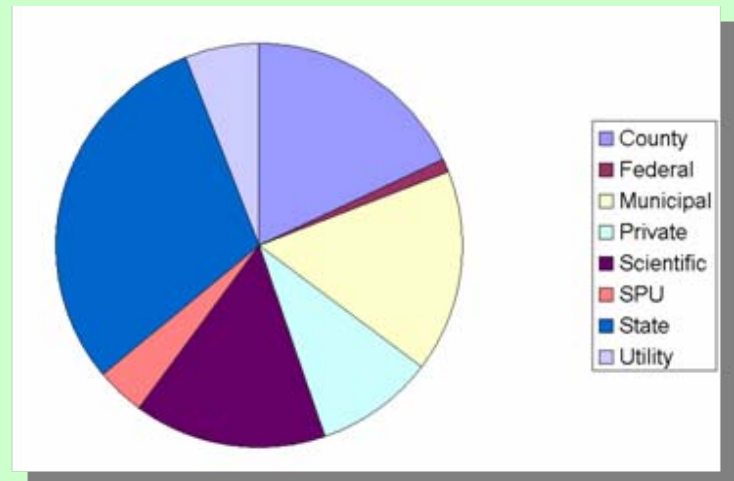
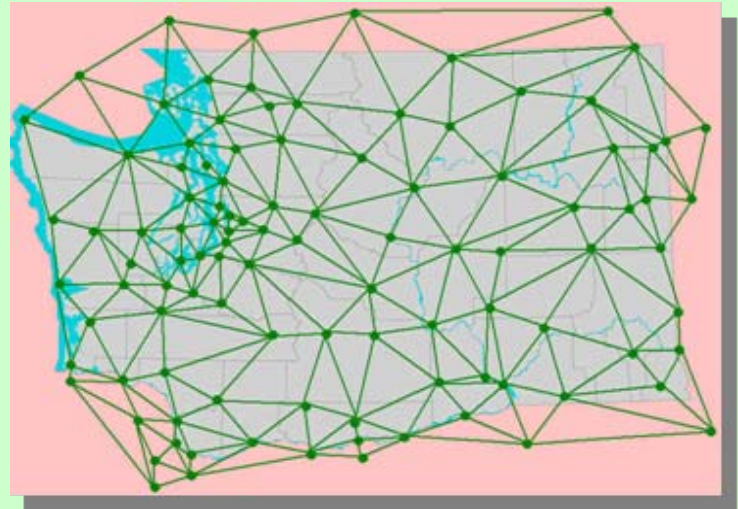
All networks on NAD83 96CORS 2002.00 and all share some station data with WSRN



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Quick Stats

- 90 of 95 Stations Completed
- 600+ Active Accounts
- 114,280 Minutes Avg. Monthly Fixed Solutions
- NAD83 – 96CORS Epoch 2002.00
- Cooperative – Public/Private
- 70+ Infrastructure Partners
- 80 Non-Infrastructure (Subscr.)
- 42 Academic accounts
- 35 Trainer / Dealer accounts



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Other Stuff that NGS Wanted Me to Add

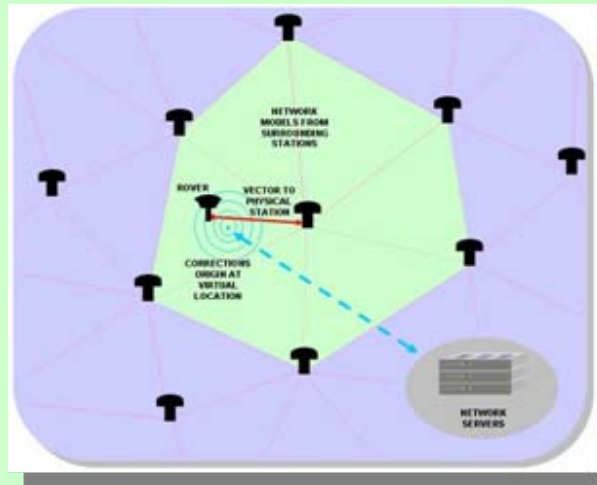
- Latencies from CORS to RTN – 0.1 – 1.25 sec. (dependent on connection type)
- Latencies tracked in GPSNet synchronizers and Wireshark
- User Accuracies – 1cm Hz 3cm Vert (Ellipsoid)
- Server pairs; 40+ CORS each, RTN mirrored offsite
- Spacing – 50km – 70km (lowest 30km highest 100km)
- IT – RTN in DMZ, commercial DSL primary connections
- 60% GNSS CORS, full upgrade by 2010



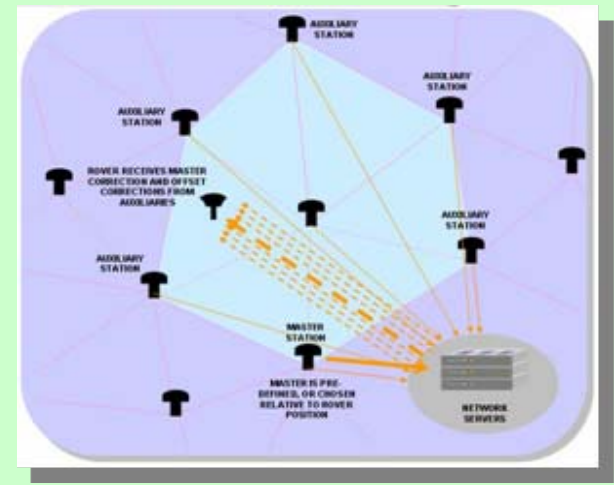
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Real-Time Services

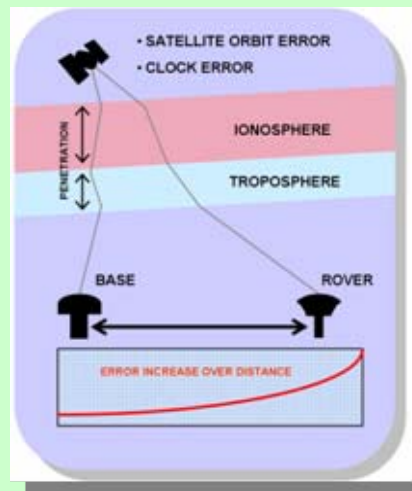
*RTCM
Standard
Corrections*



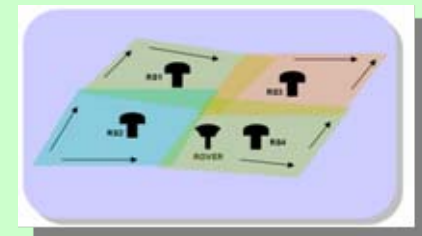
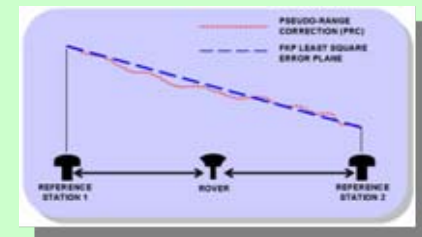
VRS



MAC (3Net)



Single-Base



FKP



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Business Model

- **Infrastructure – Partner Funded and Operated**
- **Central Processing Center – Seattle Public Utilities Funded and Operated**
- **Mirror Processing Center – Central Washington University Funded and Operated**
- **Operations Costs Offset by Subscriber Contributions**
 - » *Single Accounts - \$1,900 Annual*
 - » *Five Accounts - \$5,700 Annual*
 - » *Ten Accounts - \$10,000 Annual*
- **Academic and Trainer/Dealer – No Fee**



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Adjustment of WSRN CORS Sites to the National Spatial Reference System

Legacy Method

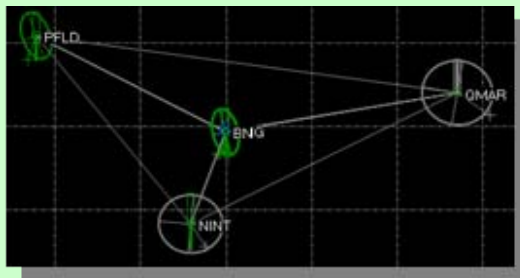
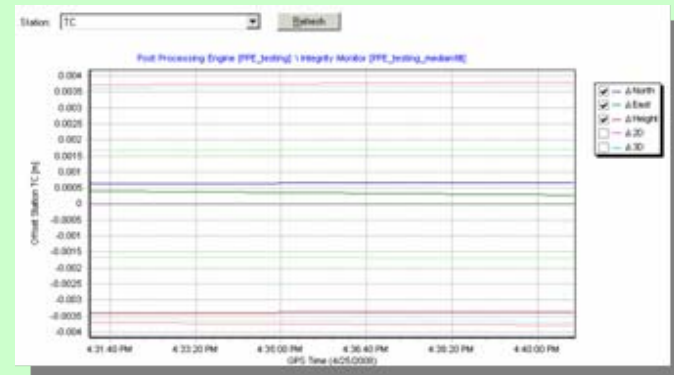
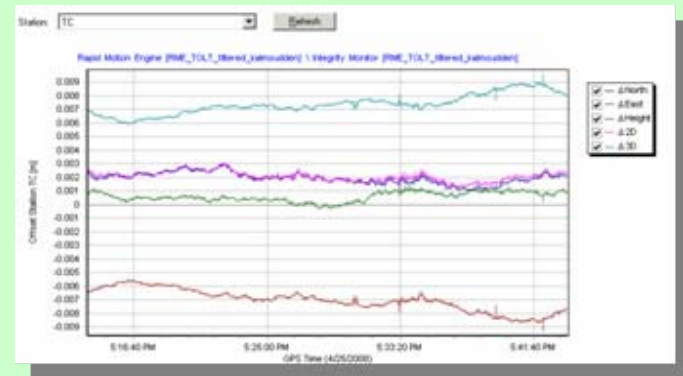
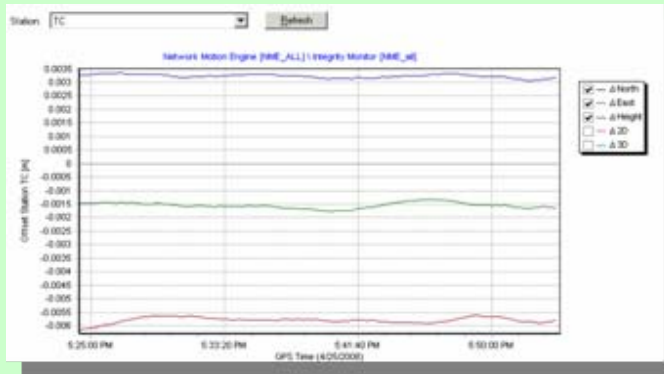
- 360 Hours Data
- 15 – 24hr OPUS (Extended Output)
- Evaluation Of NGS CORS to Hold
- Network Adjustments – External Software
- 120 Hour Internal Coordinate Monitor Evaluation
- Ongoing Internal Coordinate Monitor Evaluations



Stations positions are re-computed when out of tolerance (per Coordinate Monitor, or if any Hardware Changes or intake/changes to any adjacent stations)

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Integrity Monitor



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Adjustment of WSRN CORS Sites to the National Spatial Reference System

Integrity Monitor (IM) Method

- 360 Hours Data
- 15 – 24hr OPUS (Extended Output)
- Full Weekly NGS CORS Data
- Integrity Monitor (IM) Weekly on NGS CORS Data (Evaluate CORS to Hold)
- Weekly, Monthly, Quarterly IM PPS Sessions
- 3-Engine Real-Time IM Evaluations (alarms)
- Development of Velocity Data for Transformation Database



Legacy Evaluations will Continue to be Performed

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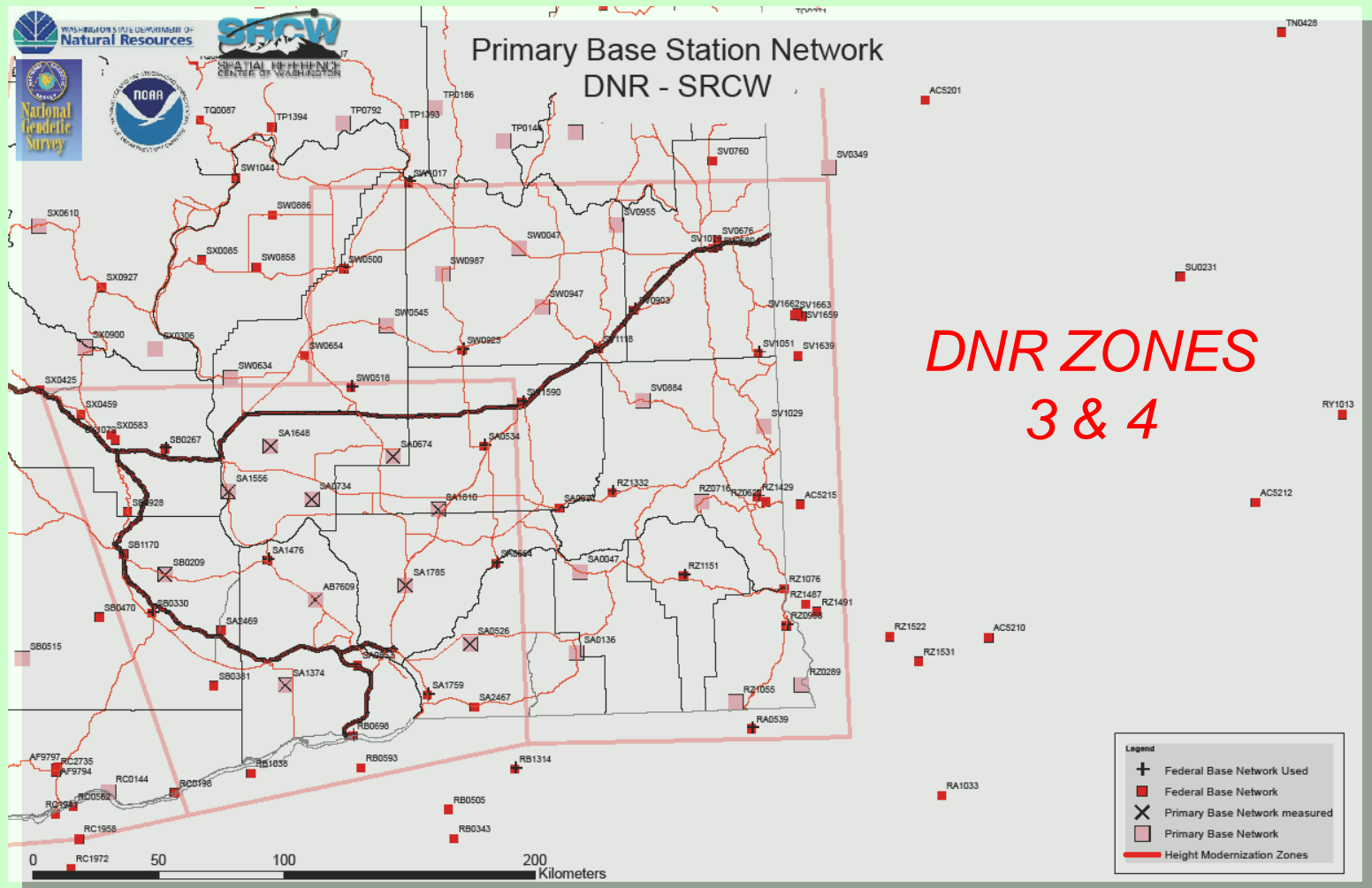
Adjustment of WSRN CORS Sites **INTO** the National Spatial Reference System

- **Height Modernization**
- **Blue-Booking of 80+ RTN CORS**
- **Submission Of 20+ RTN-CORS to NGS CORS**



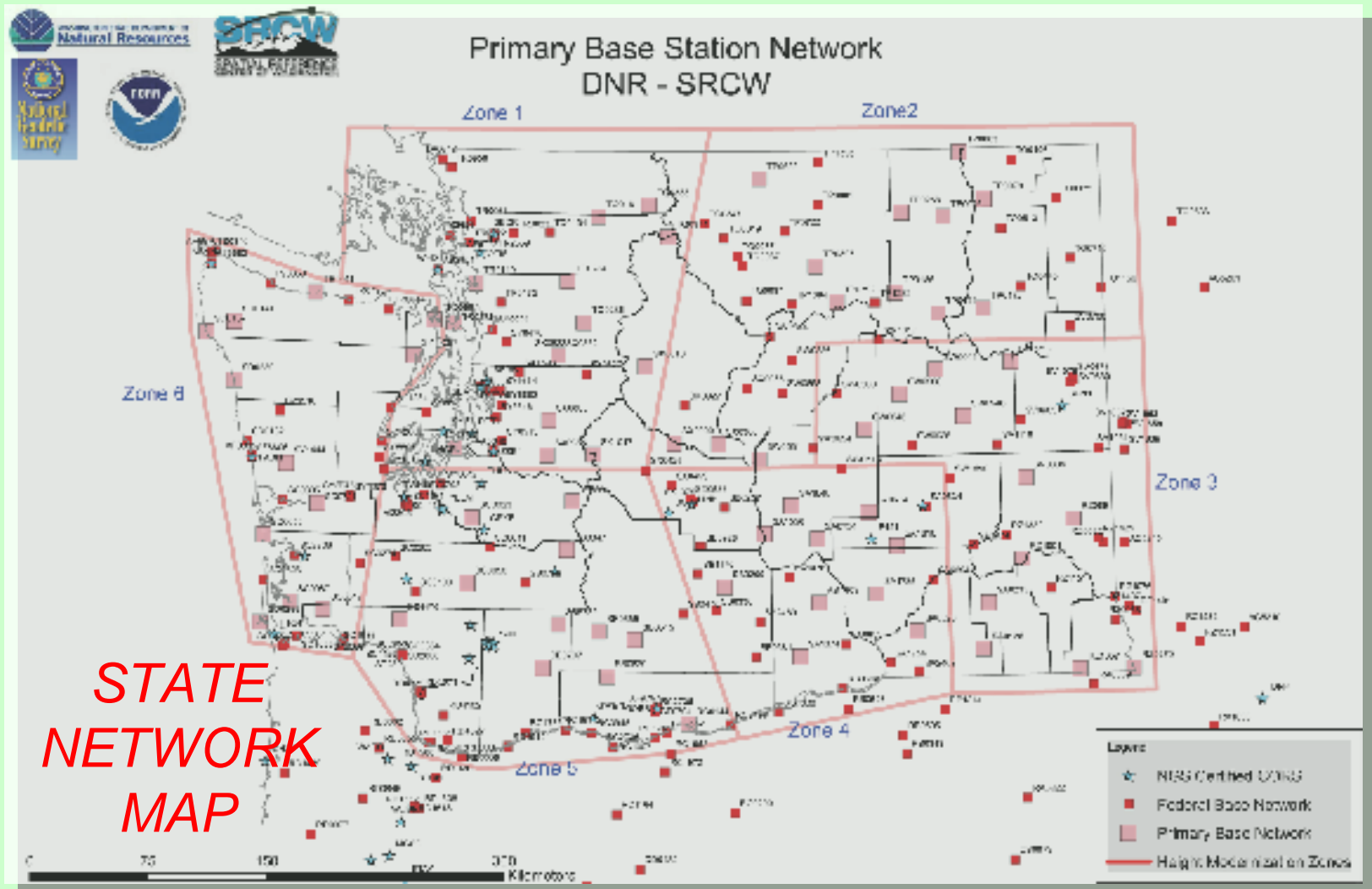
Height Modernization

Adjustment of WSRN CORS Sites INTO the National Spatial Reference System



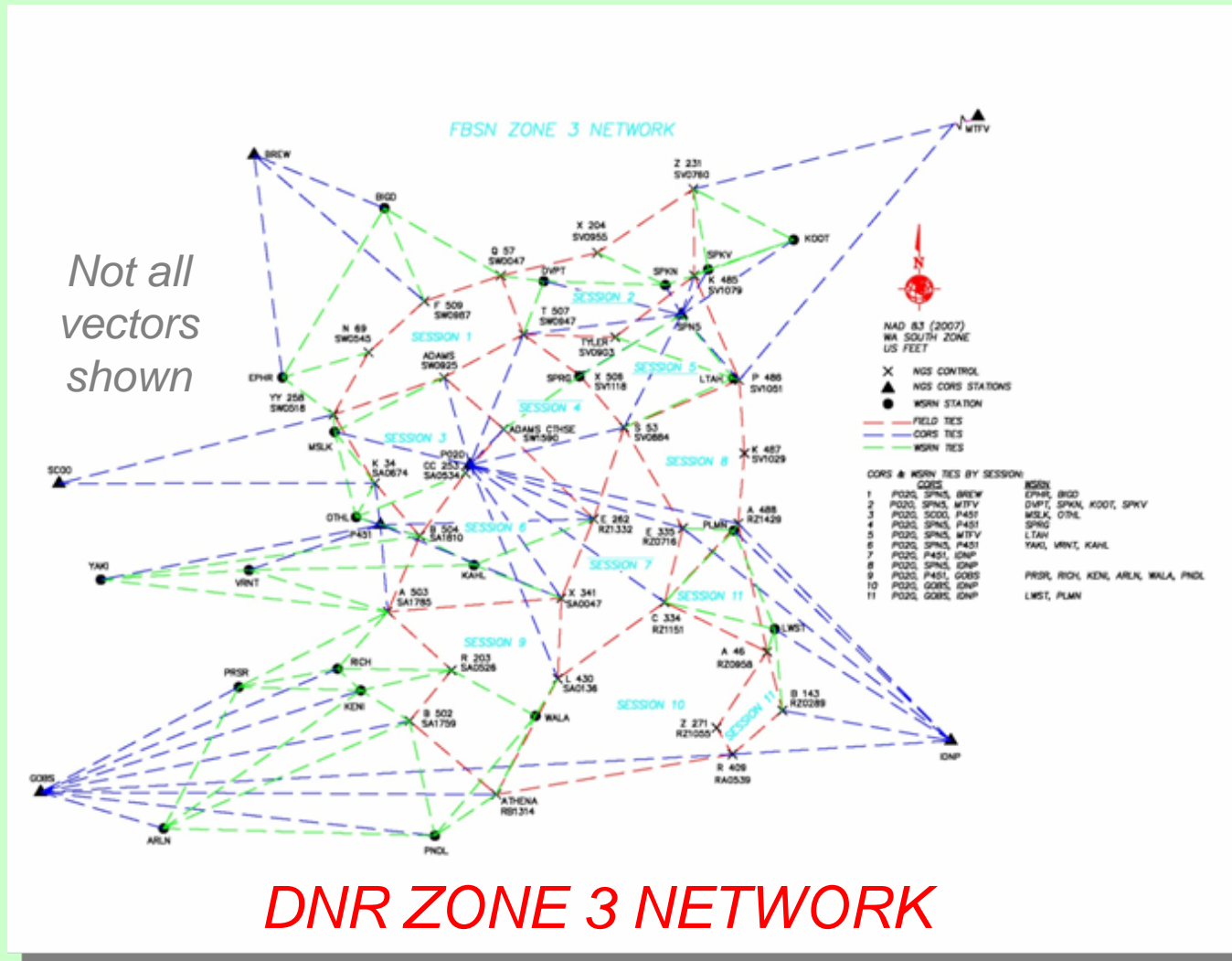
Height Modernization

Adjustment of WSRN CORS Sites **INTO** the National Spatial Reference System



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Adjustment of WSRN CORS Sites INTO the National Spatial Reference System



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Adjustment of WSRN CORS Sites **INTO** the National Spatial Reference System



WSDOT Mount – Walla Walla

This mount will be there for a few years

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Adjustment of WSRN CORS Sites **INTO** the National Spatial Reference System



*LTAH – Latah
Spokane County*

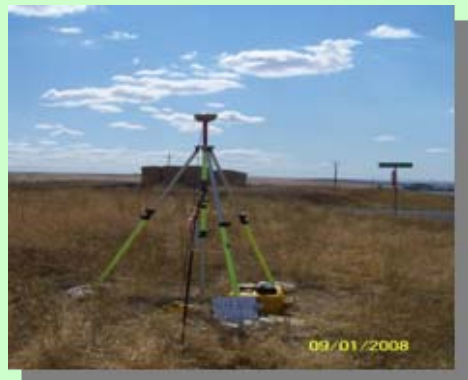
```
DI3602 DESIGNATION - LTAH CORS ARP
DI3602 PID      - DI3602
DI3602 STATE/COUNTY- WA/SPOKANE
DI3602 USGS QUAD  - LATAH (1980)
DI3602
DI3602          *CURRENT SURVEY CONTROL
DI3602 _____
DI3602* NAD 83(1986)- 47 16 56. (N) 117 08 50. (W) SCALED
DI3602* NAVD 88   - 754.185 (meters) 2474.36 (feet) ADJUSTED
DI3602 _____
DI3602 GEOID HEIGHT- -18.15 (meters)      GEOID03
DI3602 DYNAMIC HT - 754.182 (meters) 2474.35 (feet) COMP
DI3602 MODELED GRAV- 980,583.4 (mgal)      NAVD 88
DI3602
DI3602 MET CODED - SECOND - 0.1661
```



*KOOT - Kootenai
County Airport*

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Adjustment of WSRN CORS Sites **WITH** NGS Marks for Height Modernization



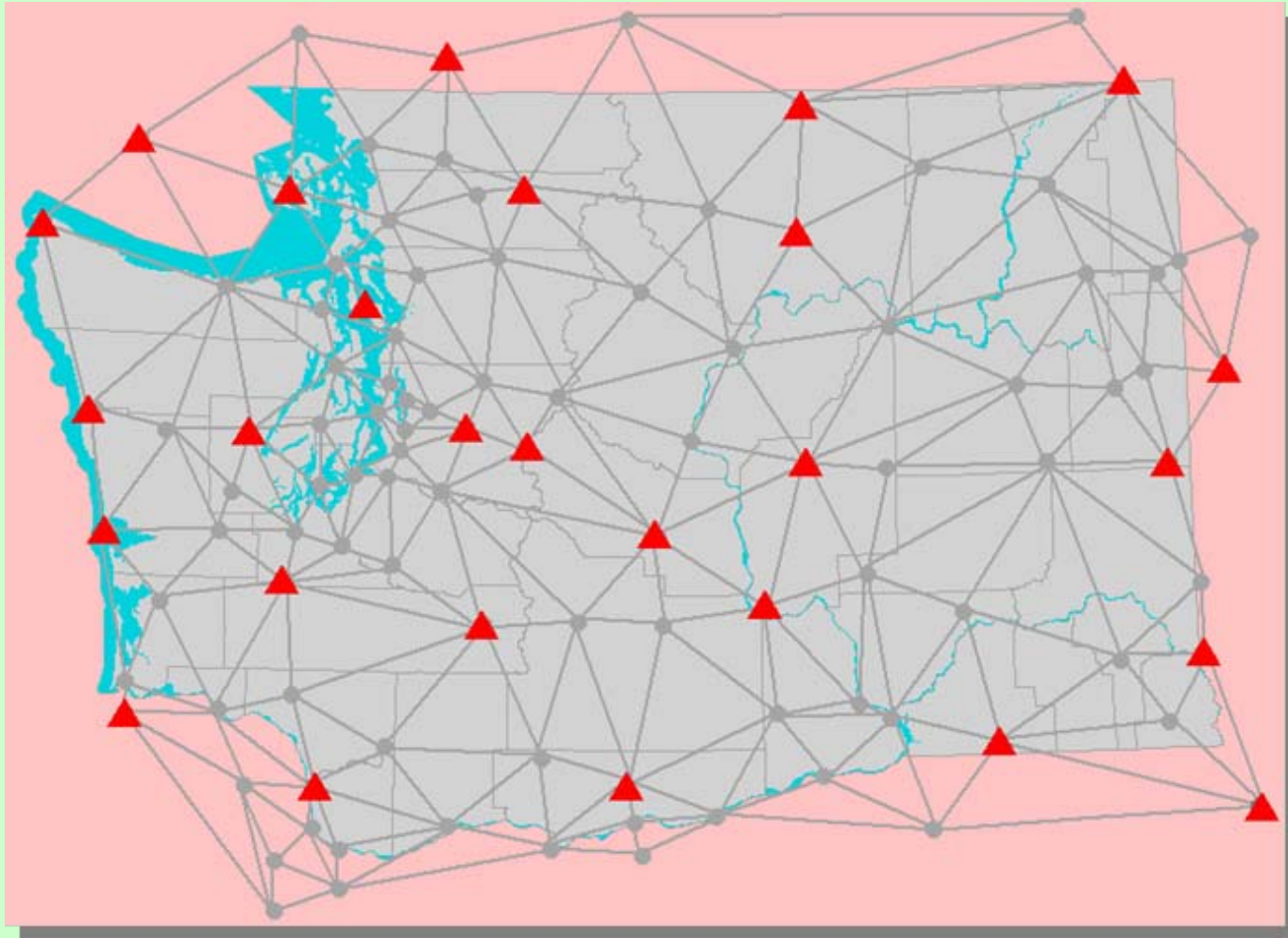
Washington State Reference Network

GIMI – GNSS Integrated Monitoring Initiative



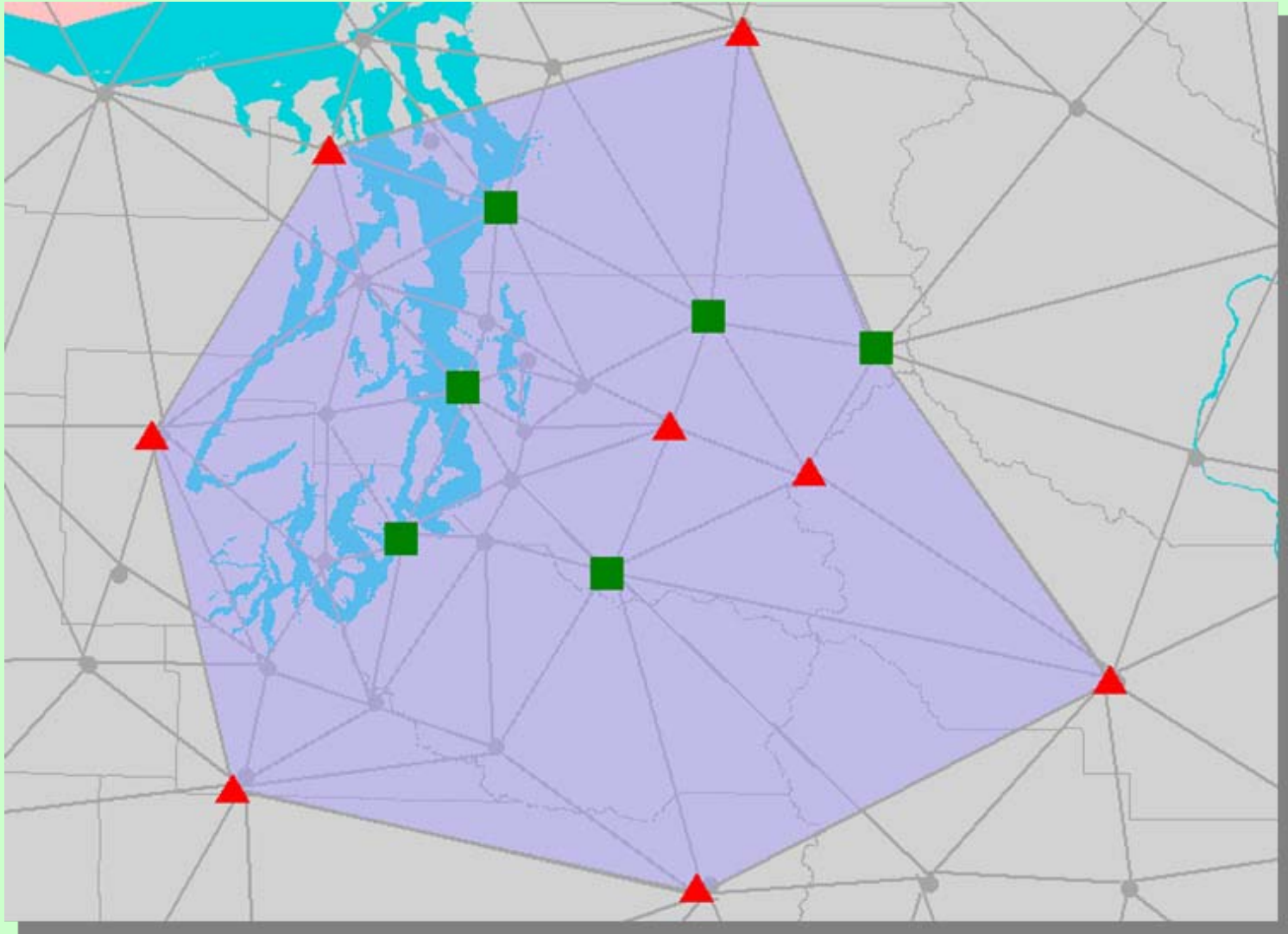
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Localized Effects of Tectonic Movements



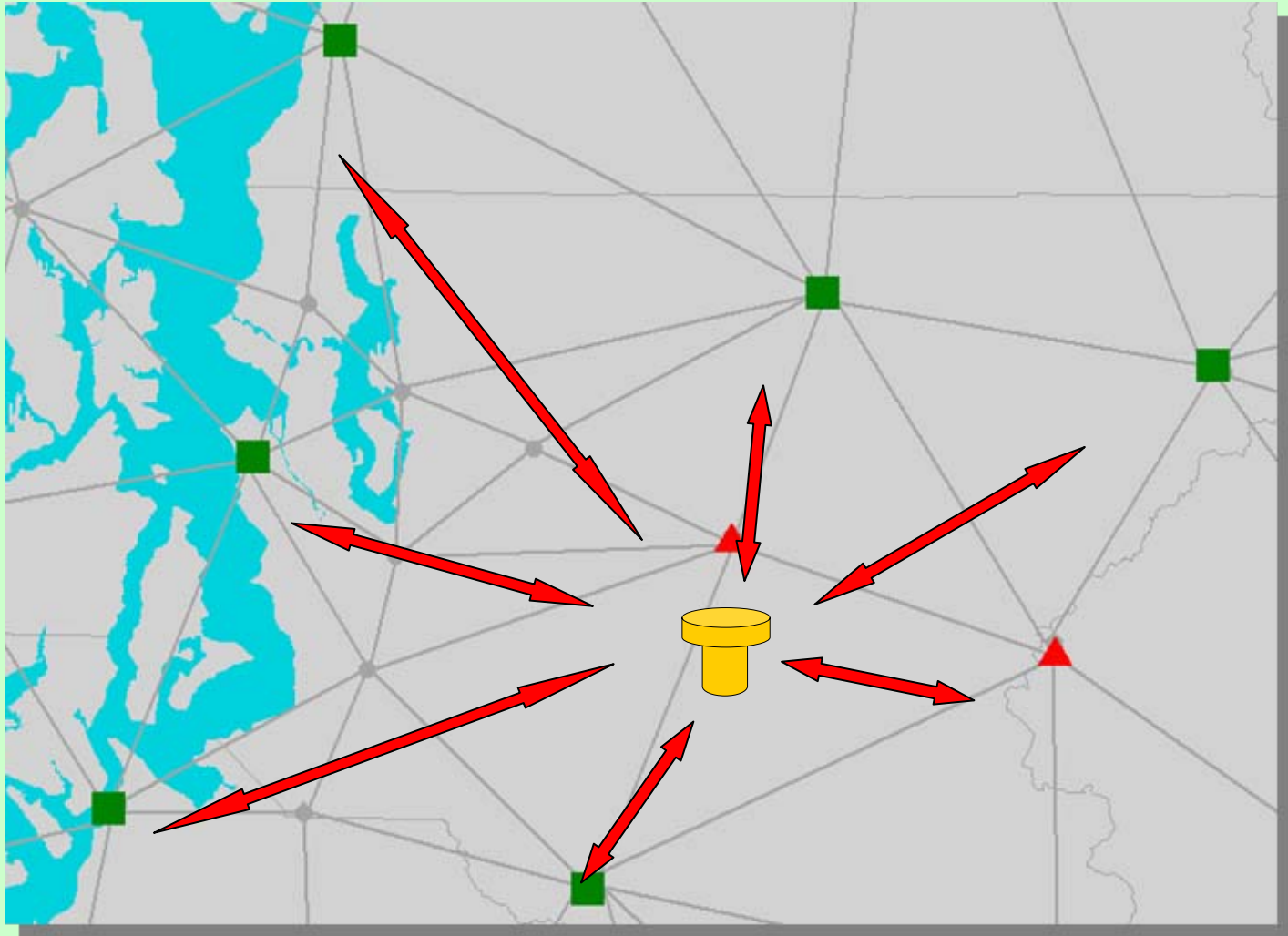
Primary Network Monitored by CWU

Washington State Reference Network



Secondary Networks Monitored by WSRN and CWU

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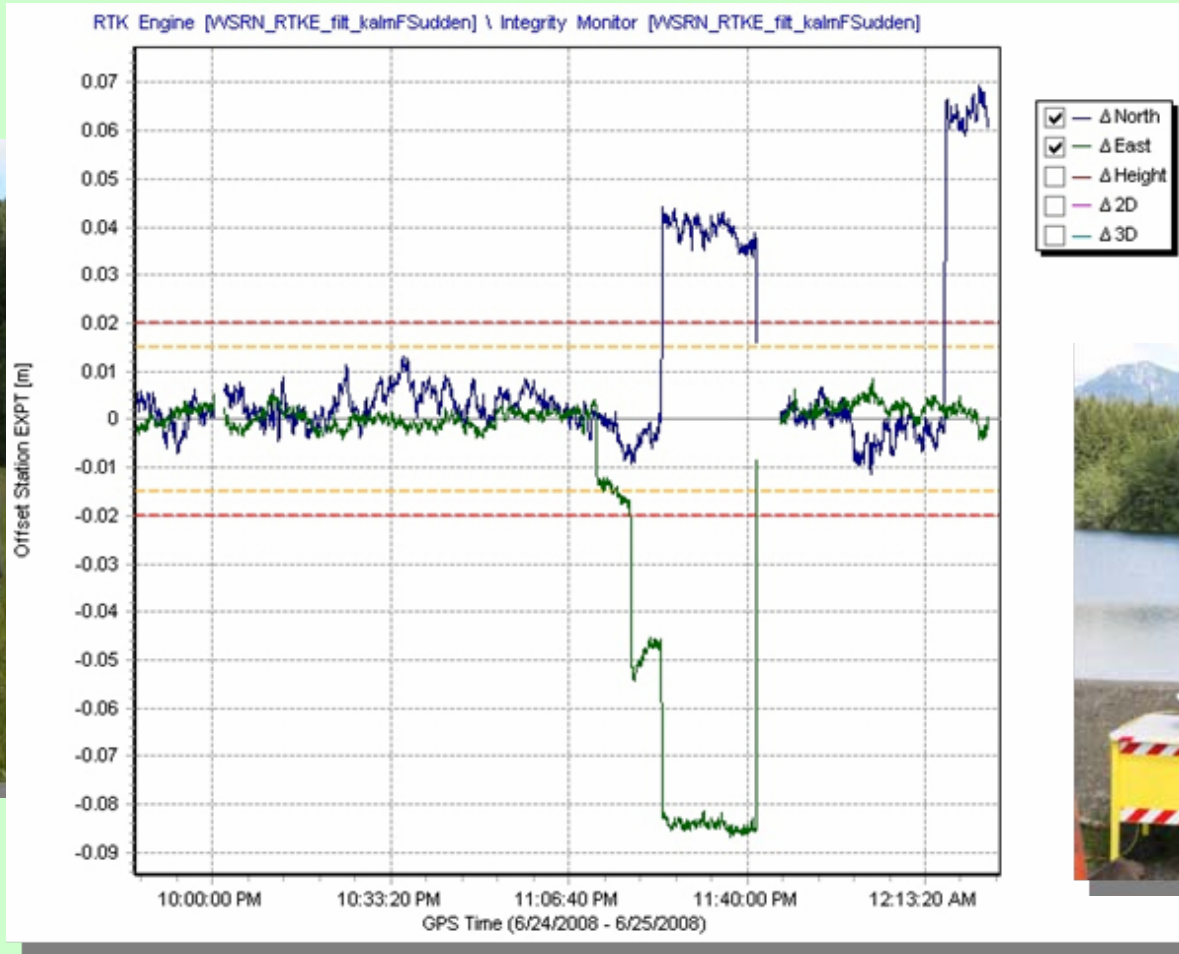


Individual Stations Monitored for Both Tectonic and Localized Motion

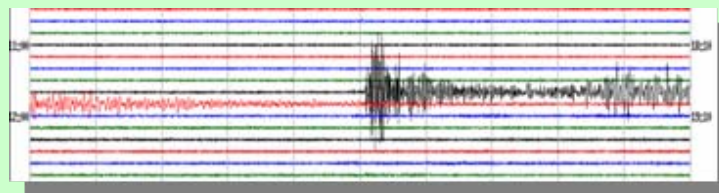
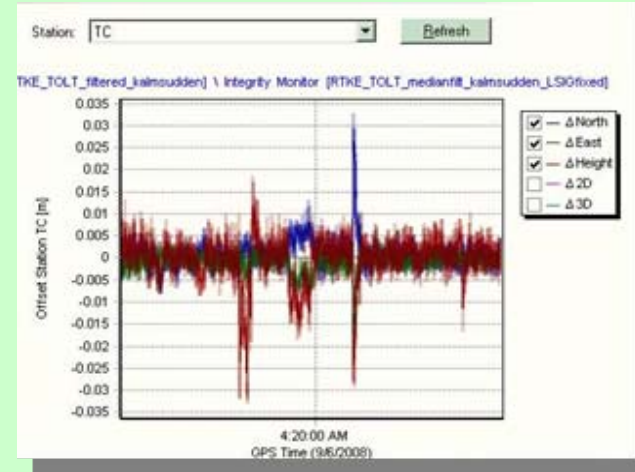
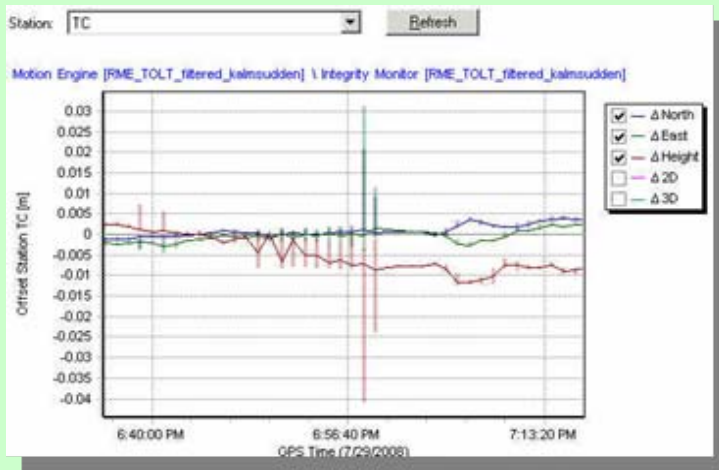
Washington State Reference Network Tolt Dam Study



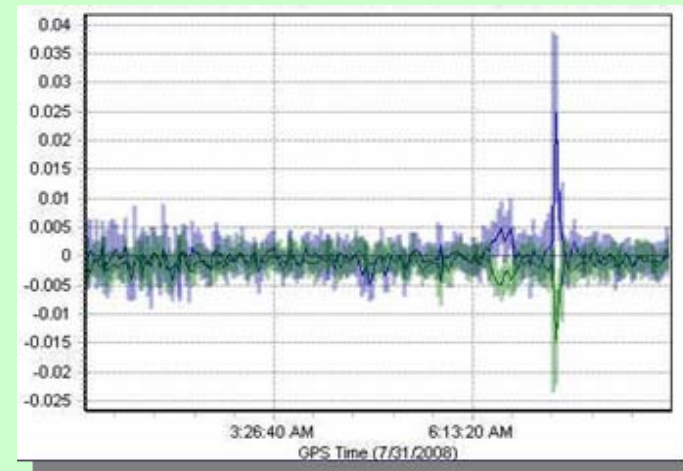
Washington State Reference Network Tolt Dam Study



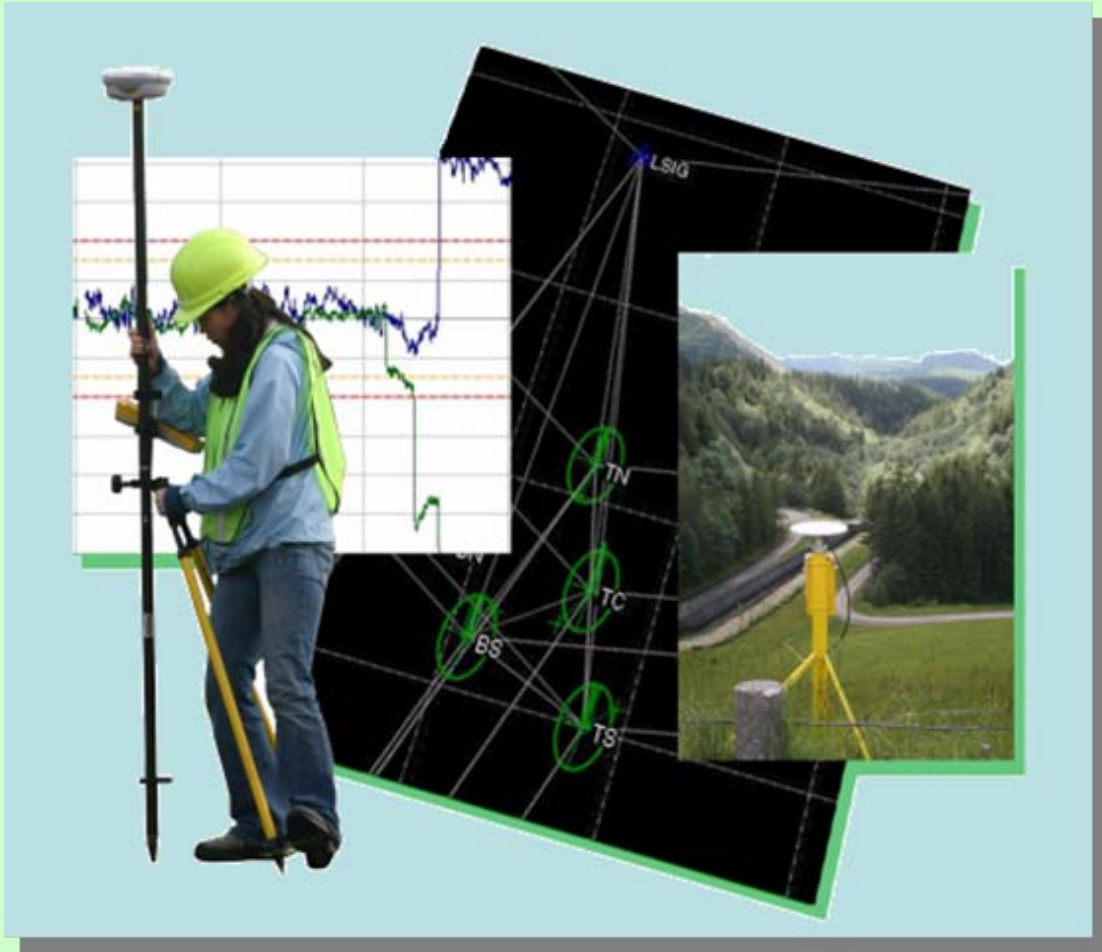
Washington State Reference Network Tolt Dam Study



USGS Seismograph



*Movement and/or Perturbations of the
Ionosphere due to Seismic Events*



Thank You
gavin.schrock@seattle.gov
www.wsrn.org