



Oregon Real-time GPS Network Update

Civil GPS Service Interface Committee

U.S. States & Local Government Session

19 September 2011

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Geometronics

Photogrammetry

**Survey
Operations**

**Right-of-Way
Engineering**

**Geodetic
Control**



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Control

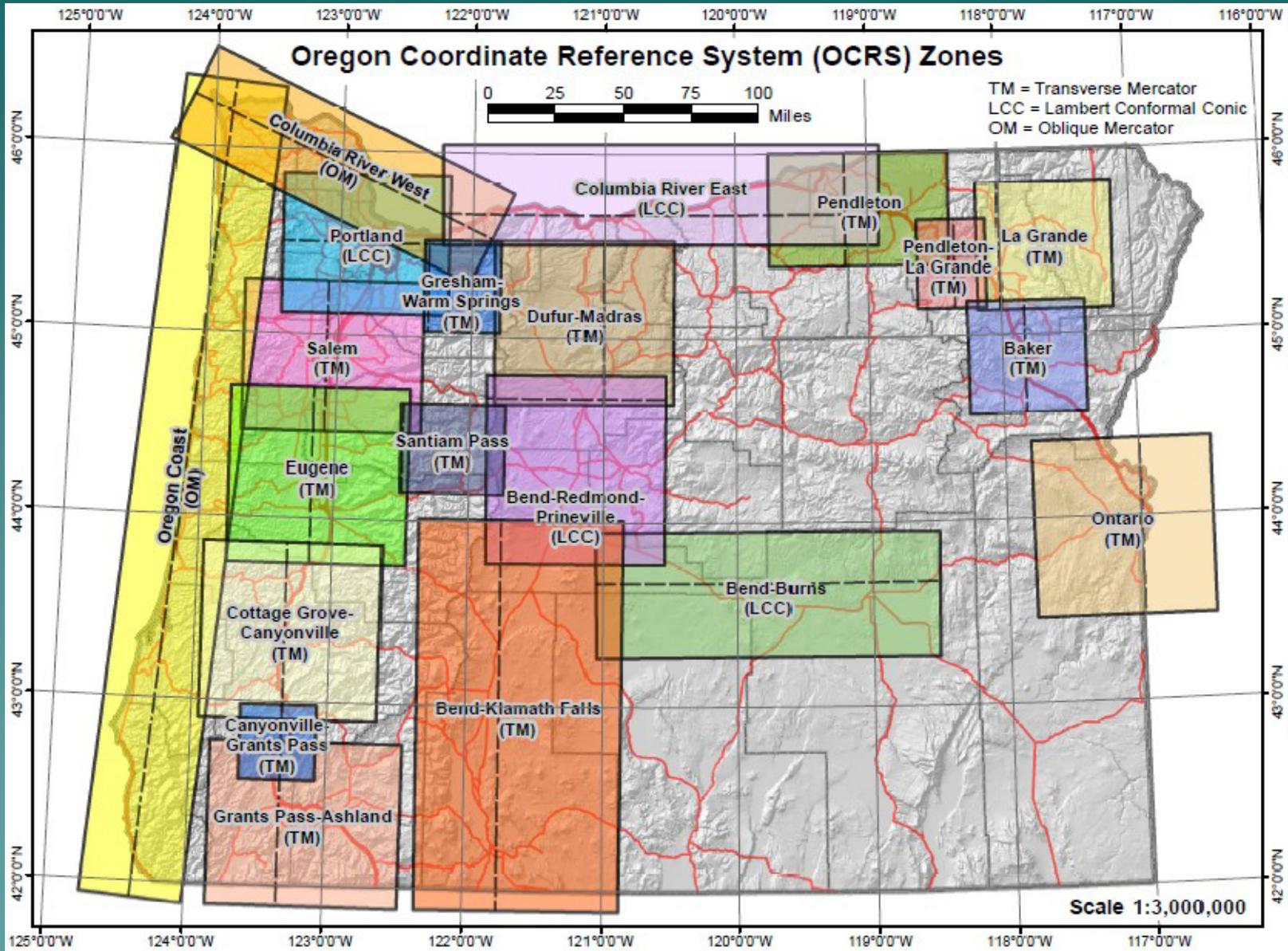


Overview

- ◆ Status of the Oregon Coordinate Reference System
- ◆ Oregon DOT transition to NAD83(2011)(Epoch 2010.00)
 - Repositioning the Oregon Real-time GPS Network
 - On-line data conversion tool

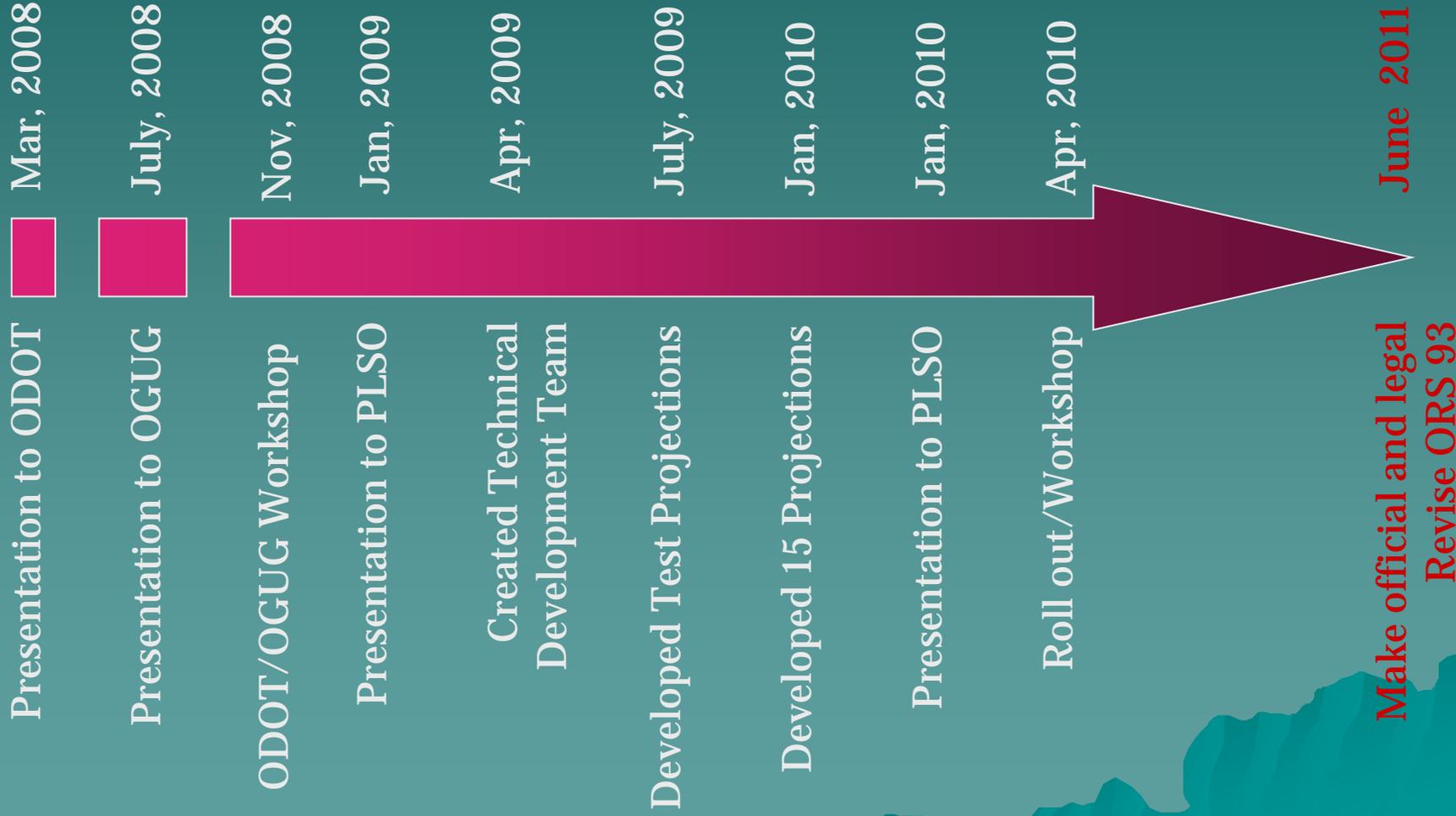


Oregon Coordinate Reference System Update





History of OCRS Development





Future Steps for OCRS

- ◆ Develop an Oregon Administrative Rule (OAR) to define the new zones
- ◆ Provide an on-line tool to analyze OCRS zones during project planning.
- ◆ Continue working with software manufacturers to have the OCRS zone parameters hard-wired into their software.
- ◆ Work with NGS to have the OCRS zones incorporated into NGS products and services.

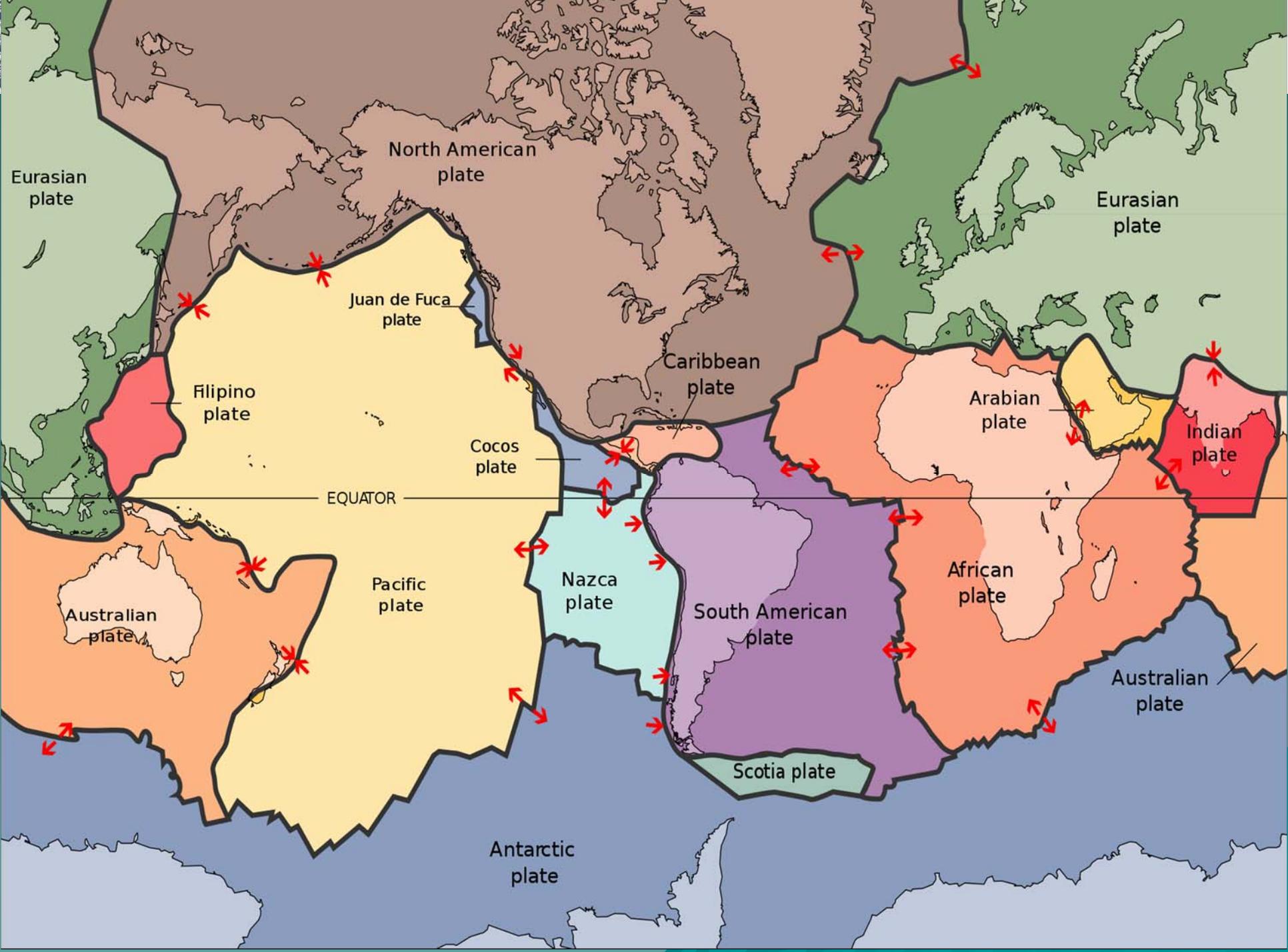
Oregon Coordinate Reference System

www.oregon.gov/ODOT/HWY/GEOMETRONICS/ocrs.shtml

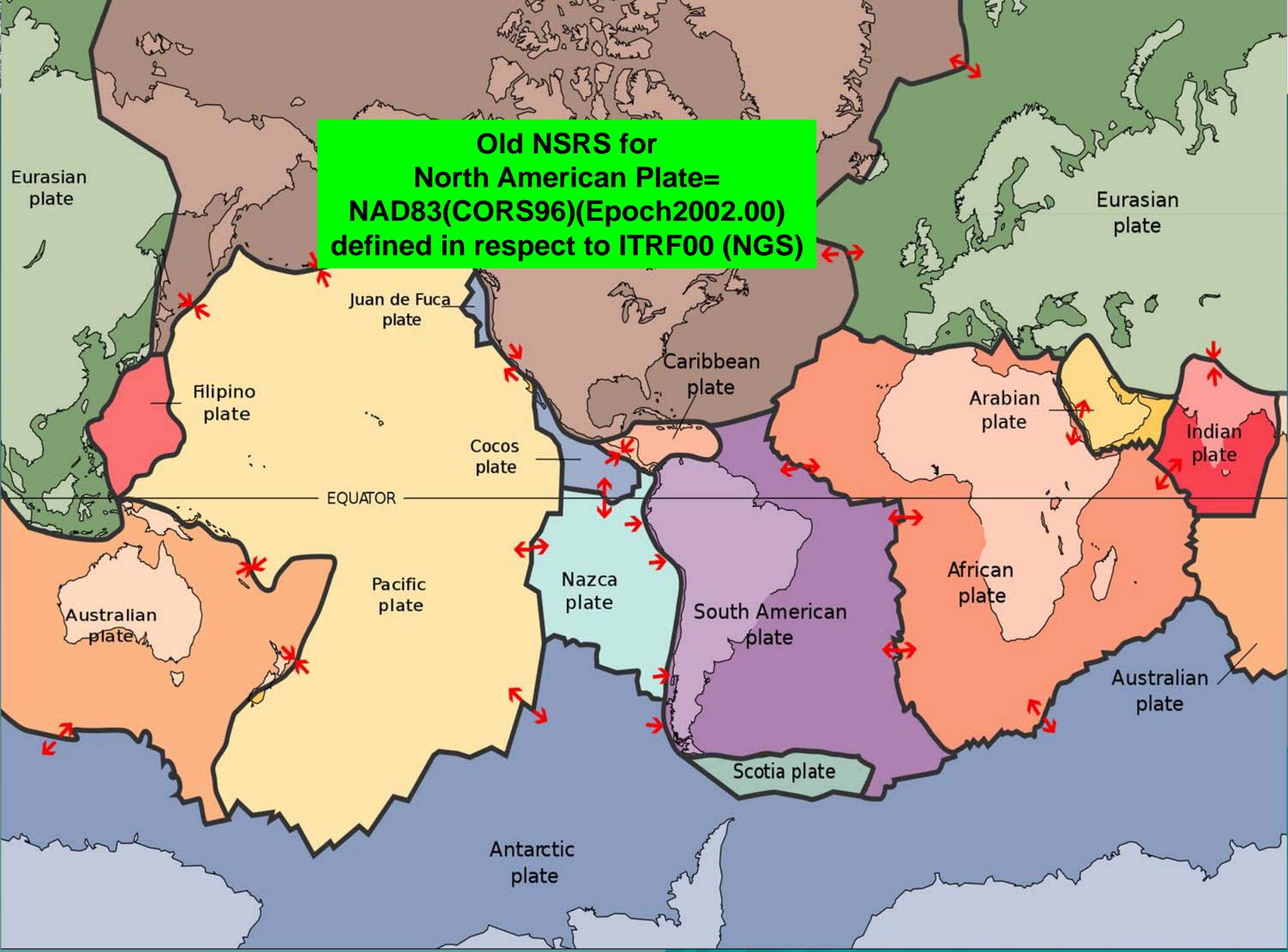


NGS Revision of CORS Coordinates

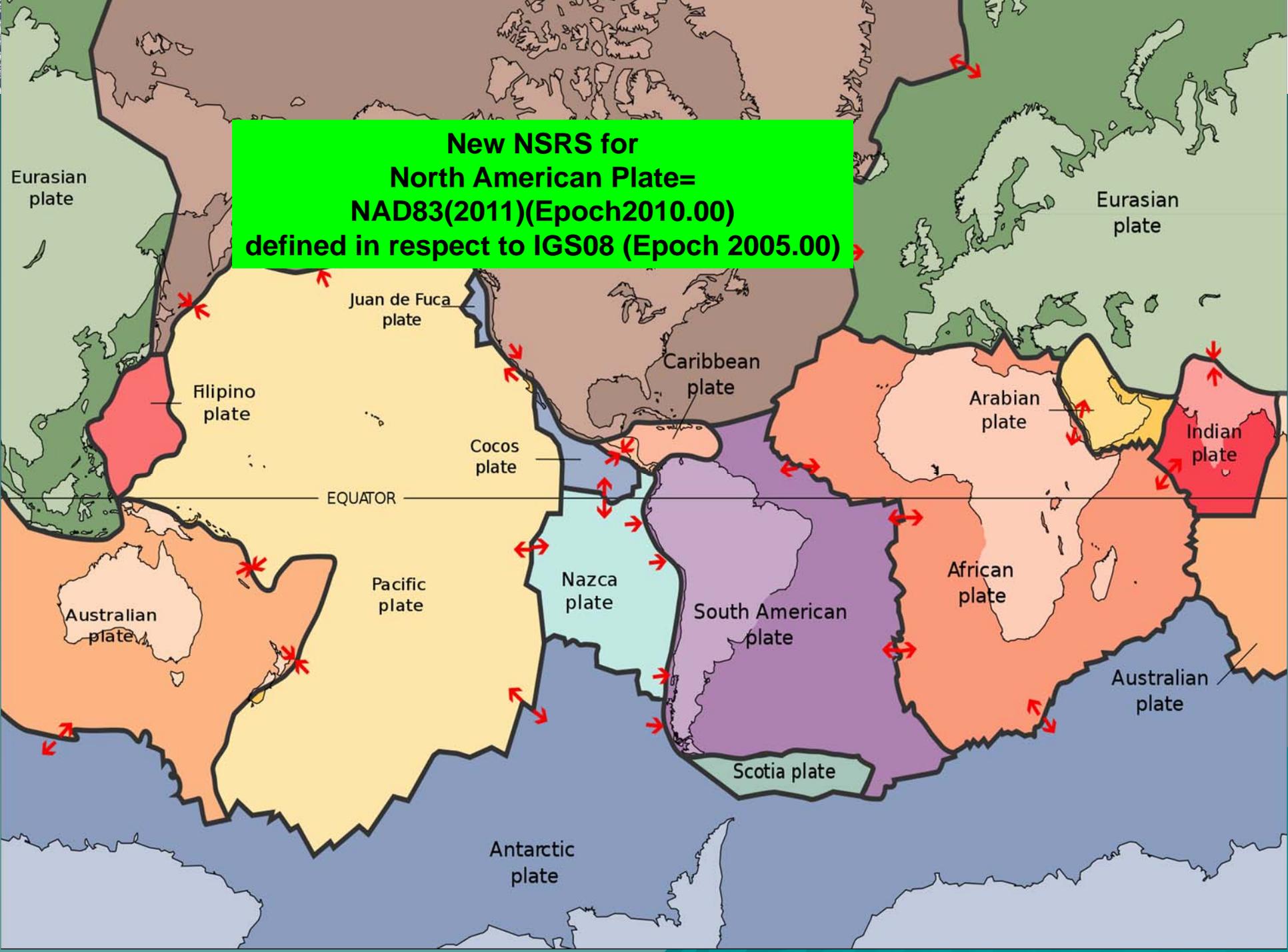
- ◆ NGS Multi-Year CORS Study (MYCS)
 - NGS completed a full reanalysis of all data from CORS and a set of selected global sites.
 - NGS computed a consistent set of CORS coordinates and GPS satellite orbits that are referred to the newly developed global framework IGS08 (Epoch 2005.00).
 - NGS then transformed the global framework IGS08 positions to a North American plate-fixed NSRS frame named **NAD83(2011)(Epoch2010.00)**.
 - ◆ Replaces NAD83(CORS96)(Epoch2002.00) for CORS positions on the North American plate.
 - ◆ Origin, scale, and orientation remain the same as other NAD83 realizations: this is not a datum change.
 - ◆ On 6 September 2011, NGS updated the NSRS positions and velocities for all CORS sites on the North American Plate to NAD83(2011)(Epoch 2010.00)
- ◆ Details on revised NGS CORS coordinates:
 - CGSIC Surveying, Mapping and Geosciences Session
 - ◆ Giovanni Sella, National Geodetic Survey, Chair
 - ◆ When: Today, September 19, 2:00 PM – 5:30 PM
 - ◆ Location: Room C-124 (this room)



**Old NSRS for
North American Plate=
NAD83(CORS96)(Epoch2002.00)
defined in respect to ITRF00 (NGS)**

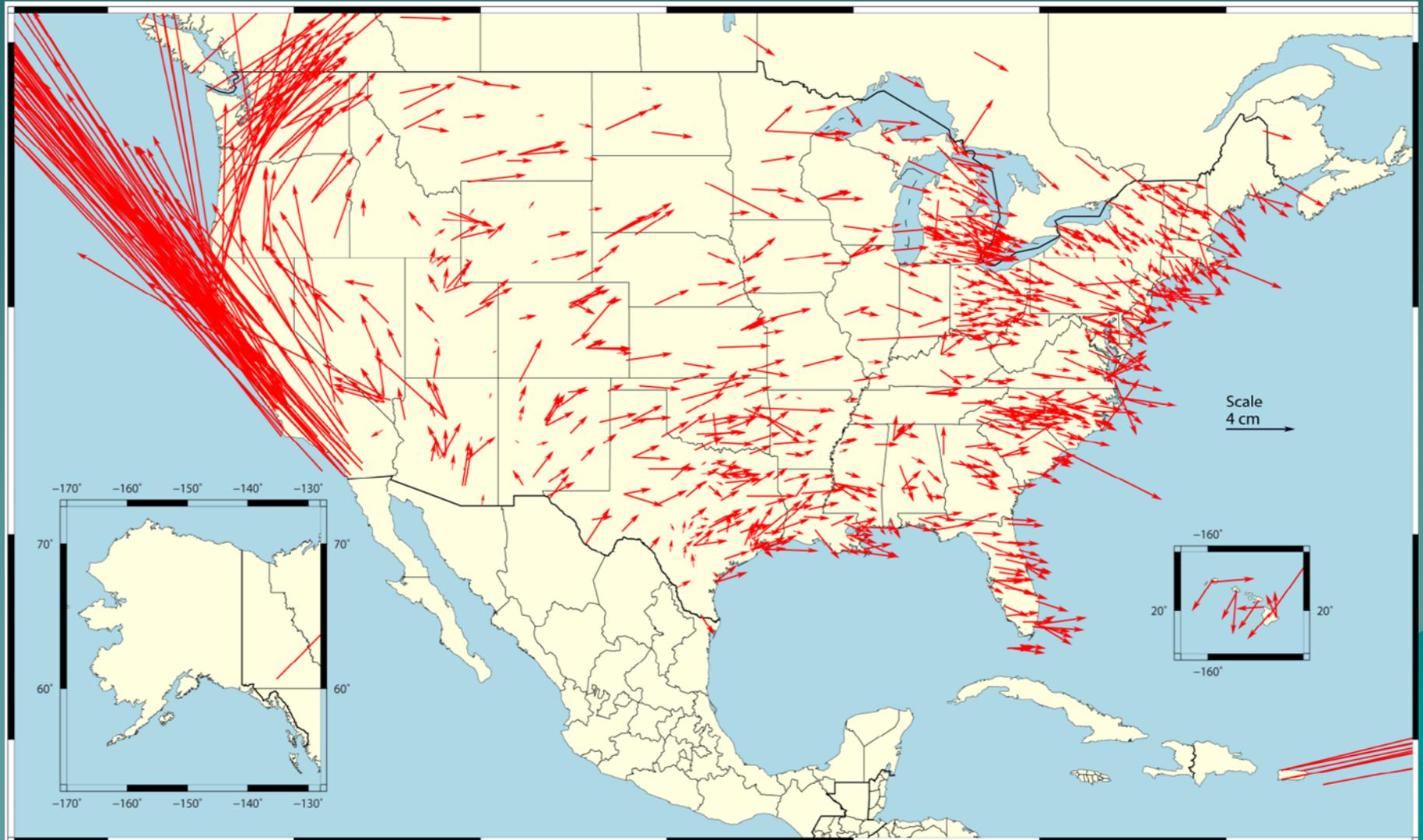


**New NSRS for
North American Plate=
NAD83(2011)(Epoch2010.00)
defined in respect to IGS08 (Epoch 2005.00)**



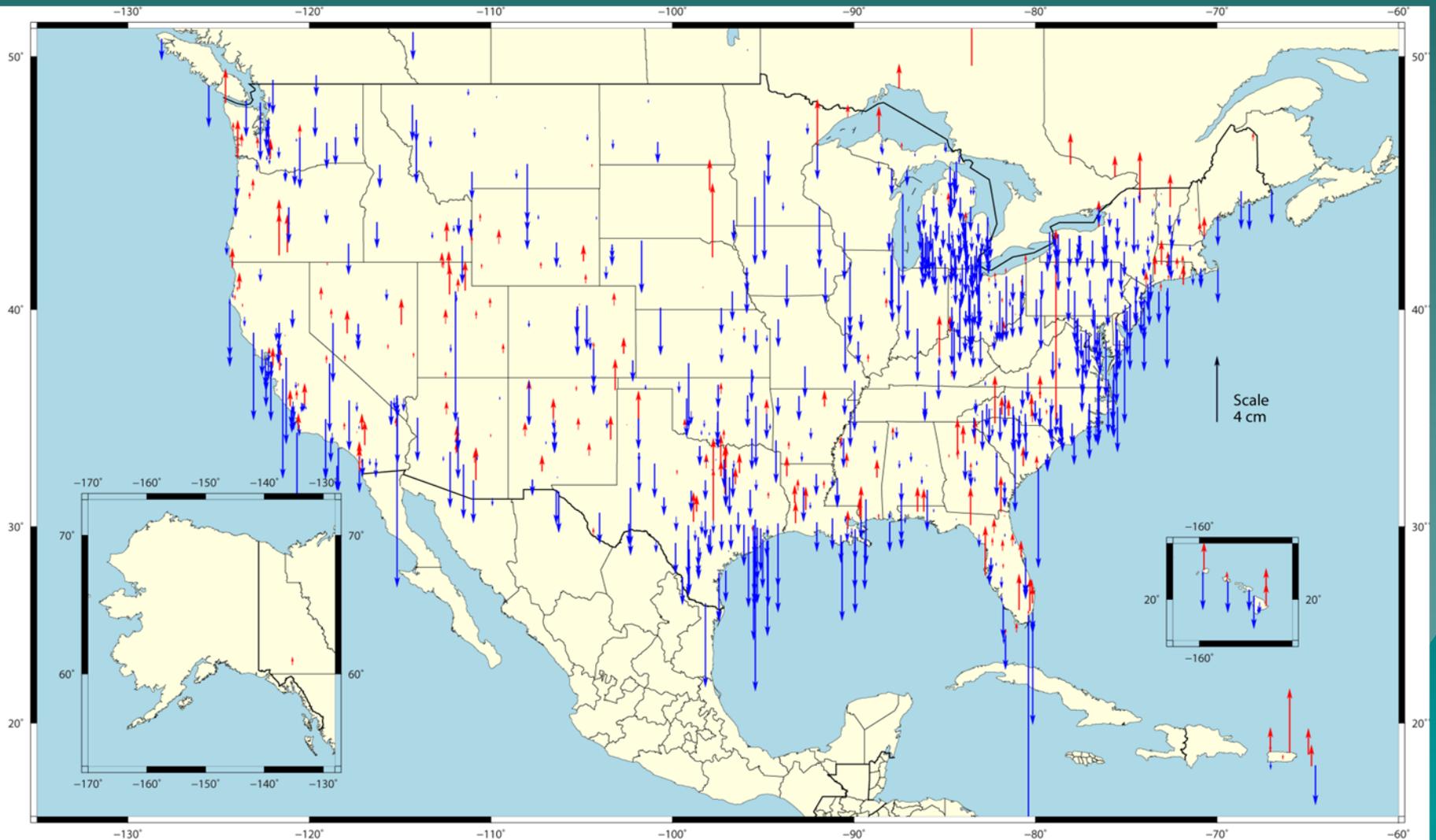


Horizontal Position Shift: NAD83(CORS96)(Epoch2002.00) to NAD83(2011)(Epoch2010.00)





Vertical Position Shift: NAD83(CORS96)(Epoch2002.00) to NAD83(2011)(Epoch2010.00)





Oregon DOT Plan to Transition to NAD83(2011)(Epoch2010.00)

- ◆ Reposition the Oregon Real-time GPS Network to Epoch 2010.00
 - THE ORGN is now and will stay aligned to the most current NGS datum realization for the National Spatial Reference System CORS stations
 - Ensures ORGN user compatibility with CORS and OPUS solutions.
- ◆ Provide Oregon with an on-line data conversion tool
 - Will allow users of the ORGN and NGS products in Oregon to move data back and forth between epoch 2002 and epoch 2010.



Goals for ORGN Repositioning

- ◆ Align the positions of the ORGN stations to NAD83(2011)(Epoch 2010.00)
- ◆ Develop & follow best practices which adhere substantially to the NGS "Guidelines for Real Time GNSS Networks"



Best Practices for Positioning the ORGN

- ◆ Coordinates will be derived from a least squares network adjustment utilizing the NGS online program OPUS-Projects
- ◆ Position in the NAD83(2011)(Epoch2010.00) datum realization
- ◆ Align the ORGN to the positions of the 10 NGS NAD 83 Multi- Year CORS Solution (MYCS) CORS sites in Oregon with “computed” positions:
 - Note: A “computed” CORS means a CORS with its velocity computed by NGS from over 2.5 years of data, as opposed to a “modeled” CORS position has its velocity determined using the HTDP model.
 - There are only 10 “computed” CORS stations in Oregon
- ◆ Also align to the ORGN to 9 additional MYCS “computed” CORS in surrounding states.
 - We are working with RTN managers in adjacent states to ensure coordinates on common stations agree between RTN networks, thus allowing rover users to work along or across state borders using a common set of coordinates.



Best Practices for Positioning the ORGN

- ◆ We will not align the ORGN purposely with passive control
 - However, once NGS completes the National Adjustment of 2011 project for passive marks, both the active and passive control will be on the same datum realization: NAD83 (2011)(Epoch 2010.00)
 - Oregon DOT will then occupy passive marks in each region of the state to develop a comparison of positions of the marks published in the NGS data base and positions derived using real-time correctors from the ORGN.



Best Practices for Positioning the ORGN

- ◆ Use NGS IGS08 ANTEX absolute antenna calibration models when processing GPS baselines in preparation for the adjustment
- ◆ Use GPS data for processing that was collected during the dry, high pressure periods
 - Late August and early September 2011 have provided ideal data conditions.
 - Will process five (5) days of twenty-four (24) hour data sets



Best Practices for Positioning the ORGN

- ◆ Seek NGS 'validation' by following procedures in the NGS "Guidelines for Real Time GNSS Networks"
 - We are working with Bill Henning of the NGS Real-time GNSS Network support team as this validation process develops.



Best Practices for Positioning the ORGN

- ◆ Monitor the positions of all ORGN stations in real-time to assure positions do not vary more than 1 cm horizontally or 2 cm vertically.
 - Leica GNSS QC in conjunction with Leica GNSS Spider software.
 - Publish QC monitoring results on ORGN website.
- ◆ Publish the NAD83(2011)(Epoch 2020.00) positions of all ORGN sites at both the 95% and 99.997% confidence levels (based on OPUS Projects output).



OPUS-Projects BETA

National Geodetic Survey



OPUS-Projects gives users web-based access to simple management and processing tools for projects involving multiple sites and multiple occupations. The advantages of OPUS-Projects are:

- Data uploading through OPUS.
- Customizable data processing via the PAGES software suite.
- Visualization and management aids.

OPUS-Projects Manager Training will be held in San Diego on July 11-12, 2011. **Registration** is now open for to all federal, state, local and private organizations.

Create a new project.

RESTRICTED to trained project managers. If you have completed OPUS-Projects training, you are registered and may create a new project. All others, see the **Training Schedule**.

Configure, edit, and process individual network sessions.

Project Identifier:

Session Keyword:

Your Email:

Manage, edit, process, and publish the project.

Project Identifier:

Manager Keyword:

Website Owner: National Geodetic Survey / Last modified by the OPUS-Projects Team

Tools/OPUS Menu

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OPUS-Projects (OP)

- ◆ A valuable addition to the NGS OPUS suite
- ◆ Currently in beta format
 - NGS is integrating Epoch 2010.00 positions for CORS and ANTEX IGS08 antenna calibrations
- ◆ OP Provides:
 - Uploading of GPS data via the OPUS portal
 - Processing baselines via NGS PAGES software
 - Least squares adjustment of data via GPSCOM software
 - Google Earth-based map view of project and baselines
 - Improved positioning over OPUS-Static averaging of single base line positions
- ◆ Software author: Dr. Mark Schenewerk, NGS



OPUS-Projects Training

- ◆ Currently NGS requires attendance to a formal OPUS-Projects (OP) training class in order to access and use OP.
- ◆ Mark Armstrong, NGS Geodetic Advisor for Oregon has taught two OP classes
 - July 2011: ACSM, San Diego (with Dr. Mark Schenewerk)
 - August 2011: Oregon State University, Corvallis, OR
- ◆ NGS Corbin Training Center schedule
 - <http://www.ngs.noaa.gov/corbin/calendar.shtml>



Controlling CORS

Session : 2010-215-Min Constrained REDM 3D Results From : Session Solution

Controls

Show File

Send Email

Set up Processing

LEGEND

MARKS: ● meet preferences ● exceed preferences ⊗ not included ⊗ have error

CORS: ▲ meet preferences ▲ exceed preferences ▲ not included

Baselines: —————

LEGEND

MARKS

- burn
- cabl
- chzz
- corv
- ddsn
- gobs
- idnp
- idpo
- idtd
- mdmt
- ors2
- p367
- p376
- pnhh

Add MARKS

CORS

- ▲ fts6
- ▲ gwn6
- ▲ hlid
- ▲ linh
- ▲ lwst
- ▲ modb

Add CORS

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Controlling CORS by State

- ◆ **Oregon:** BURN, CABL, CHZZ, CORV, DDSN, MDMT, ORS2, P367, P376, REDM
- ◆ **Washington:** GOBS, PABH, SC00
- ◆ **Idaho:** IDTD, IDPO, IDNP
- ◆ **Nevada:** SHLD
- ◆ **California:** YBHB, PTSG,



Outline for Processing ORGN 2011 in OP (developed by Mark Armstrong)

- ◆ Check 19 controlling CORS stations
 - Create OP project
 - Submit the 19 controlling CORS stations
 - Submit data files for 19 control CORS
 - Use OP to seed the official Epoch 2010.00 position for each controlling CORS
 - Process baselines
 - Perform least squares adjustment on controlling CORS stations:
 - ◆ Minimally constrained
 - ◆ Constrained
 - Review reports and differences of adjusted and published seeded positions for the 19 controlling CORS.



Outline for Processing ORGN 2011 in OP (developed by Mark Armstrong)

- ◆ Adjust ORGN and other CGPS stations
 - Create new OP project
 - Submit the 19 controlling CORS and also the ORGN and other CGPs sites to OP
 - Submit data files for all stations
 - OP Project Manager will seed the official Epoch 2010.00 position for each controlling CORS
 - Process baselines
 - Perform least squares adjustments on controlling CORS stations:
 - ◆ Minimally constrained
 - ◆ Constrained
 - Review reports for outliers, solution quality



A minor change was made to the manager's preferences window. There is a chance that the old format for this window is stored in your browser's memory which will cause the window to improperly display itself now. If this happens, simply refresh/reload the preferences window. If the problem persists, contact the **OPUS-Projects Team** (2011-09-14)

A small but non-trivial change in the information a project keeps about itself has been implemented. This change should not affect normal operations, but if you believe you've detected any adverse issues, please contact the **OPUS-Projects Team** (2011-09-08)

Session : Results From :

Controls

? ← ↻

Show File

Send Email

Set up Processing

LEGEND

MARKS:
● meet preferences
 ⚠ do not meet preferences
 ⊗ are not included
 ⊗ have error

CORS:
⚠ meet preferences
 ⚠ do not meet preferences
 ⊗ are not included

Baselines: —

LEGEND

MARKS

- arln
- ⚠ ashl
- ⚠ bend
- ⚠ bly1
- chem
- ⚠ cptt
- entr
- fwbd
- ⚠ gpts
- gras
- half
- ⚠ kfrc
- ⚠ lapn

Add MARKS

CORS

- ⚠ burn
- ⚠ cabl
- ⚠ corv
- ⚠ dcso
- ⚠ ddsn
- ⚠ fts5

Add CORS

POWERED BY

50 mi

100 km

Map data ©2011 Europa Technologies, Google - [Terms of Use](#)



Oregon Data Conversion Tool



Oregon Data Conversion Tool

NAD83CORS conversion - [Data Viewer]

File View Controls Help

Input Parameters

Input Point File (*.txt, *.csv)
Points: C:/programs/n83cors-build-desktop/mytestdata - Copy.csv

Output
Mode: 1 = NAD83CORS96 -> NAD83CORS96a

Convert!

Output Information

```

P386 From: -118.968 44.4028 1103.97 To: -118.968 44.4029 1103.95
P390 From: -118.928 43.034 1555.36 To: -118.928 43.034 1555.37
P391 From: -118.412 42.2546 1834.23 To: -118.412 42.2547 1834.23
P022 From: -118.014 45.2318 888.118 To: -118.014 45.2318 888.114
P393 From: -117.892 43.2345 1238.85 To: -117.892 43.2345 1238.85
BURN From: -117.844 42.7795 1180.91 To: -117.843 42.7794 1180.93
P394 From: -117.8 44.8349 1011.2 To: -117.8 44.8348 1011.19
P739 From: -117.726 42.0201 1378 To: -117.726 42.0202 1378.01
P013 From: -117.33 41.4287 1433.99 To: -117.33 41.4286 1433.99
P372 From: -117.252 45.4281 1208.31 To: -117.252 45.4282 1208.32
P018 From: -117.065 42.9817 1434 To: -117.065 42.9817 1433.98
Completed in 328 ms.

```

Model Display

Last Click: X = -123.0011 Y = 43.9489 Z = 1048.79

Display Controls

Reset Display

Vector Length Mult: 1500

Display Optimization: Culling

Data Gen

Show Ref Data

Label Points

Show Proc Data

Label Points

Show Base Map

Draw Triangles

Light Control

Position:

X: 0.00

Y: 0.00

Z: 0.00

Shift between datum realizations shown at each CORS-- (exaggerated distance)



What the “Tool” will do:

- ◆ Converts users positions back and forth from:
 - NAD 83(CORS96)(Epoch2002.00
 - to/from
 - NAD 83(2011)Epoch2010.00)



Who is developing the “Tool”

- ◆ Michael Olsen, Assistant Professor of Geomatics, Oregon State University, is developing the mathematical algorithms and software.
- ◆ Cooperation, input, and assistance from:
 - Oregon DOT Geometronics Unit
 - Mark Armstrong, NGS State Geodetic Advisor for Oregon



Why do ORGN users in Oregon need this Tool?

- Will ensure continuity within projects
 - ◆ User may keep a single datum realization for a project spaced over the change from the superseded to the new datum realization.
- Provides an immediate datum realization transition solution until user projects are solely within the new datum realization
- “Keep my phone from ringing off the hook!”



Summary

- ◆ Status of the Oregon Coordinate Reference System
- ◆ Oregon DOT plans to transition to NAD83(2011)(Epoch 2010.00)
 - Repositioning the Oregon Real-time GPS Network
 - On-line data conversion tool



ACKNOWLEDGEMENTS

**Randy Oberg, PLS
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**Mark Armstrong,
NGS State Geodetic Advisor for Oregon**

**Michael Olsen, Asst Professor of Geomatics
Oregon State University**



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Oregon Real-time GPS Network

www.TheORGN.net