



GPS Data Products for Solid Earth Science

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SCIGN REASoN



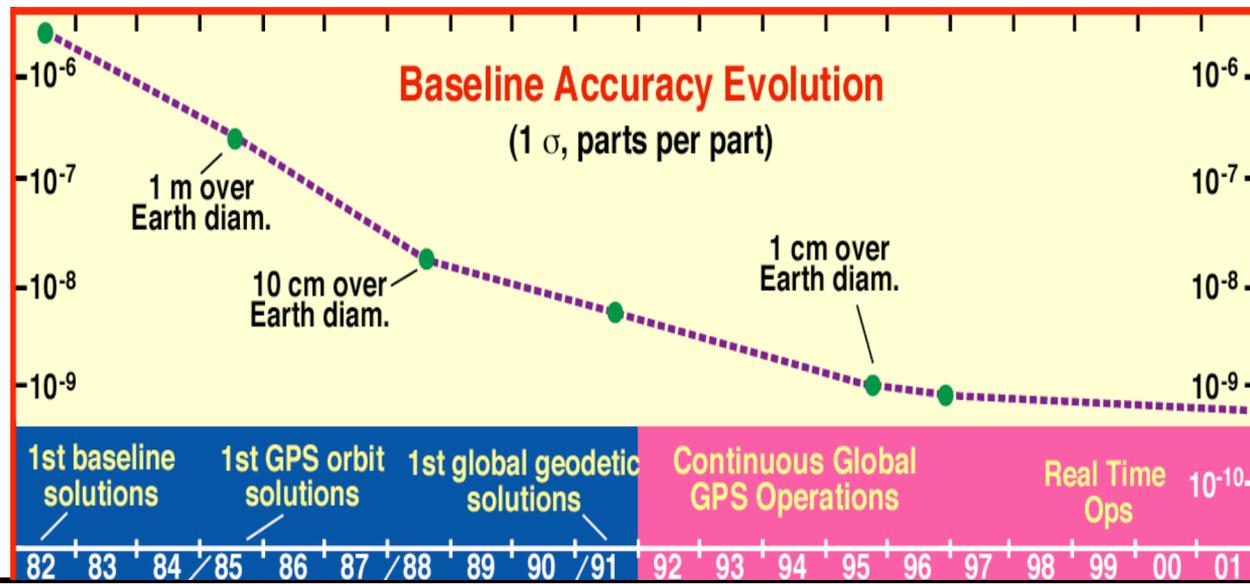
- GPS Background
- Goals of our project
 - Produce and deliver high level data products from SCIGN for non-GPS experts
- Status
 - Architecture
 - Milestones
 - Products
 - GPS Explorer





Background on GPS processing

- Expansion of global GPS networks
- Increased computer throughput
 - 1990
10 stations x 20 days of data = 1 graduate student
 - 2004
1000 stations x 20 days of data < 15 CPU days (2.4 GHz Intel processor)
- Evolution of GPS precision
~1 ppm to < 1 ppb

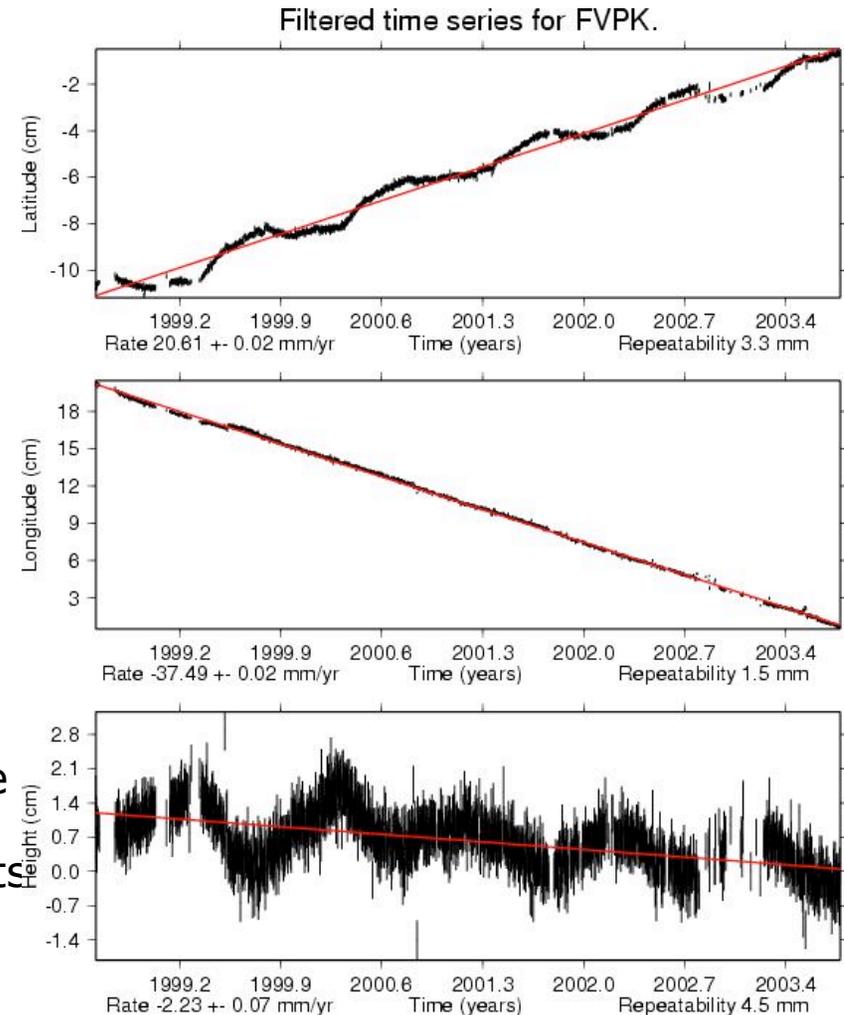




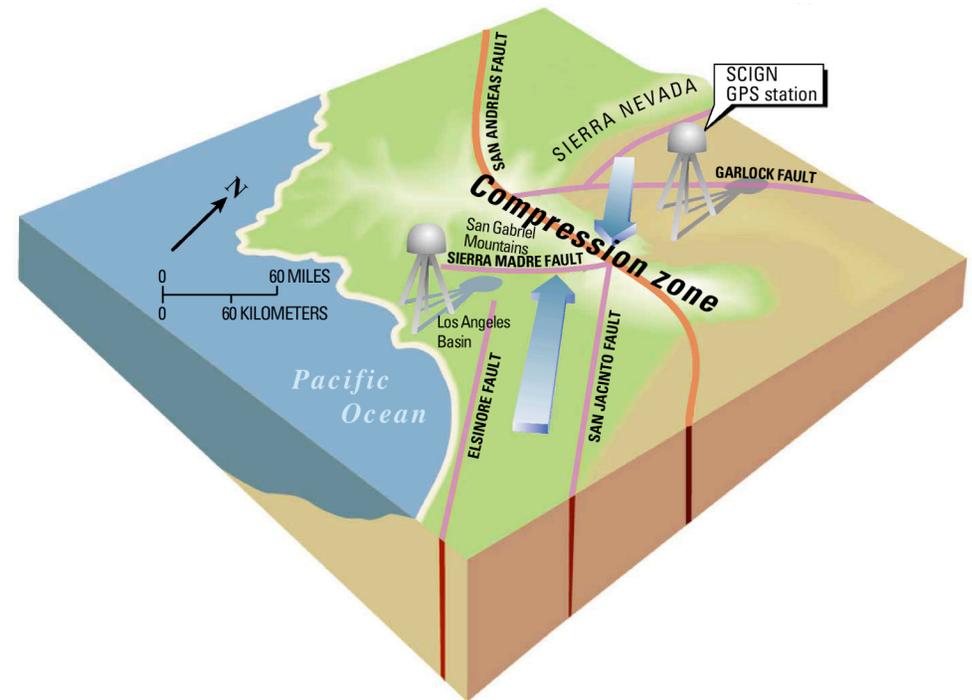
Background on GPS processing



- “New” error sources
 - Monument noise
 - Reference frame stability
 - Global scale atmospheric mass transport
 - Antenna calibrations (phase centers)
 - etc.
- “New” signals
 - Transient and non-linear
 - Tectonic
 - Hydrologic
 - Atmospheric
- User shift
 - Independent PIs/GPS experts with their private networks
 - Continuous, open networks and large observatories
 - Open raw GPS data and data products
 - GSI GeoNET solutions
 - IGS Orbits
- Expanded user base



- SCIGN
 - 250 continuous GPS receivers
 - A scientific experiment
 - A network experiment
 - Open data policy
 - Primary product
 - Raw GPS data
 - Two primary analysis centers
 - Verification and validation of network performance
 - Independently operated
 - Fundamentally different modeling approaches
 - Double-differenced (GAMIT)
 - One-way phase (GIPSY)



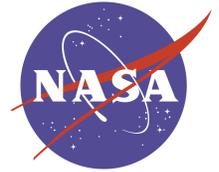
- Analysis Committee
 - Compare results from analysis centers
 - Never done before at this scale and scope
 - Resolve discrepancies
 - Reference frame
 - Data and Meta-data
 - *Produce combined product*
- Analysis Center Comparison
 - Positions ≤ 1 mm
 - Velocities ~ 0.2 mm/yr
 - Manual, annual process





SCIGN REASoN Goals

- **Generate higher level products from SCIGN data for use by the SCIGN community**
- **Apply modern IT methodology within SCIGN to:**
 - Produce and disseminate higher-level data products to a larger community of
 - Scientists
 - Government agencies (Federal, State, and Local)
 - Surveyors
 - GIS professionals
- **Build on current capabilities within SCIGN for data archiving, information systems, and data analysis to disseminate the following products:**
 - Geodetic position time series
 - Crustal motion models
 - Strain rate maps
 - Geologic fault models
 - Near-real-time earthquake response information
 - Geodetic reference systems for precise GIS and surveying
- **Improve capabilities in**
 - Archiving
 - End-user interfaces
 - Delivery mechanisms
 - Data modeling
- **Open source project based on a redundant, multi-tiered “Virtual Archive” for GPS applications.**



High Level Requirements

- Requirements
 - Data Products are “scientific publication” quality
 - Verified, validated, and reference-able
 - Processing centers and processes use the same input data and meta data
- Goals
 - All processing retrieves data from a common source
 - Products are quantified, reproducible, and based on verified and validated data and established processes
 - Web distribution of products contains complete information on product generation (traceability)
- Objectives
 - Employ GPS Seamless Archive
 - Interface through Web services
 - Pull data at time of analysis
 - Push results into archive
 - Pull products from archive for distribution
 - Provide full accounting of product
 - Provide tools/recipes for product reproduction
 - Provide On-demand analysis



Products



- Verified and validated combined solution
 - Time series of station positions (2005)
 - Velocity field (2006)
 - Strain maps (2007)
 - Geophysical parameters - e. g., fault parameters, aquifer undulations (2008)
- Access to input data sets
 - GPS raw data and meta-data
 - GAMIT and GIPSY time series
- Network performance metrics
- Web interface
 - Web services for product distribution
 - GPS Explorer
 - Exploring information content of data products
- Recipes and On-demand products



Status



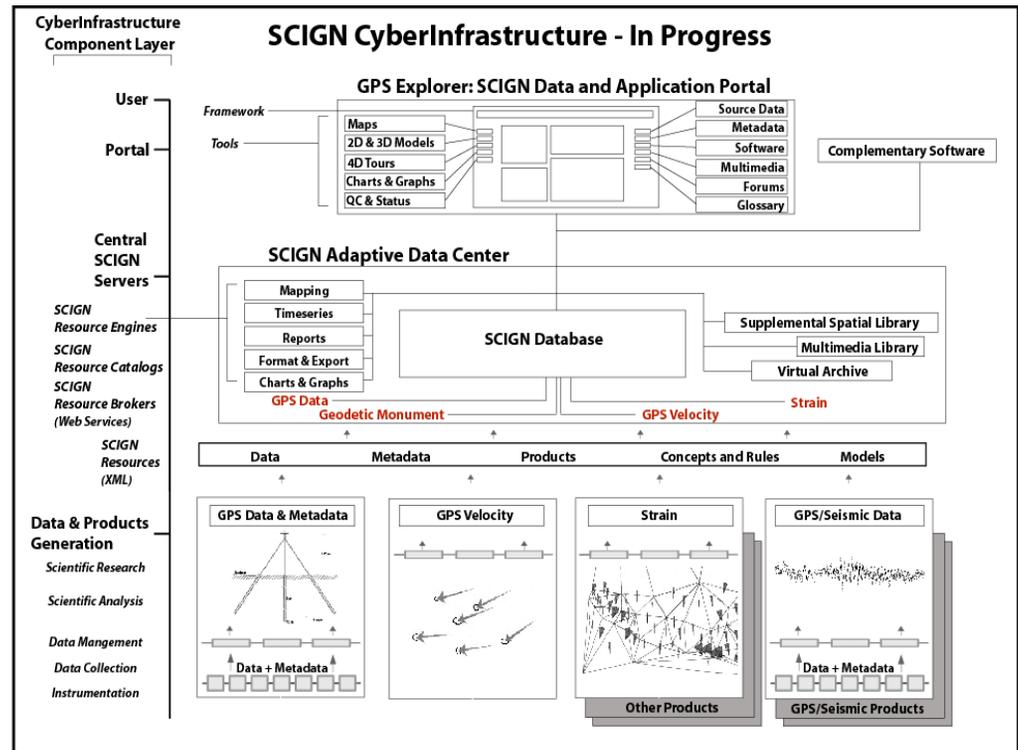
- Architecture
 - Framework is defined based on web services
 - Interfaces are being defined, developed, and documented on the web
- Combination
 - Validated QOCA against GLOBK
 - SIO and JPL solutions are being combined with QOCA
 - Producing web products using interim interfaces on a weekly basis
- GPS Explorer
 - Prototype web portal for exploring GPS data products
 - <http://reason.scign.org>
 - Combined products being posted on web on a weekly basis
- 2005 Milestones
 - Combination based on prototype web services by SCIGN annual meeting in Spring 2005
 - Combined products based on web services by July 2005



SCIGN REASoN CyberInfrastructure

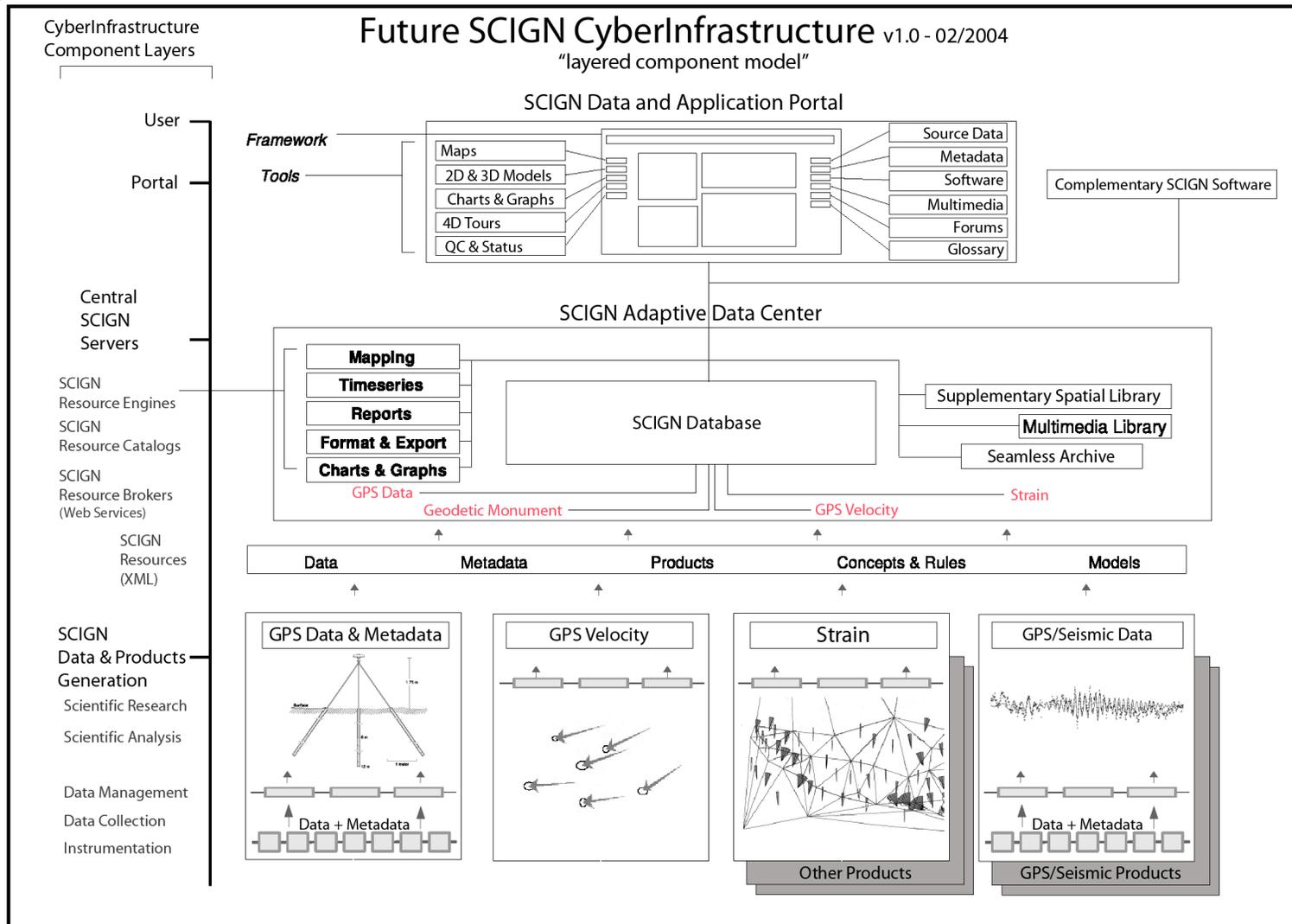


- Structured around four systems
 - Product Input
 - Seamless Archive a community based system
 - Via web services
 - GPS Data Processing
 - Verified and validated products using 2 independent systems
 - GAMIT and GIPSY
 - Product Generation
 - Based on QOCA software
 - Product Delivery
 - Via Virtual Archive
 - With web services
 - Meta data
 - Products
- Extensible to EarthScope Needs for High Level Product Generation and Distribution for
 - PBO
 - SAFOD
 - USArray





High Level Architecture





Combination Status



- Producing web products using interim interfaces on a weekly basis
- Products extend back to 6 months and counting
- Available at
 - <http://reason.scign.org/>
- Open issues to be addressed in 2005
 - Reference frame
 - Relative weighting
 - Quality assurance strategy
 - Desired latency for products
 - Sub-network strategy
 - Regional filtering strategy



GPS Explorer



- The web portal for accessing SCIGN products
<http://reason.scign.org/>
- Documents project including
 - Overall project description
 - Interface definitions
- Provides access to SCIGN Products
 - Combined solution
 - Combined solution based on
 - SIO and JPL solutions
 - Combined using QOCA
 - Graphical representation of combined time series and network performance metrics
 - Over lay data
- Updated weekly
- User Forum



SCIGN Data Portal



- [Home](#)
- [Data Products](#)
- [Tools](#)
- [Metadata](#)
- [Community/SEEDS](#)
- [About](#)

Coordinates

- ▶ [SOPAC](#)

Time Series

- ▶ [JPL](#)
- ▶ [SOPAC](#)
- ▶ [USGS](#)

Velocities

- ▶ [SOPAC Velocity Toolbox](#)
- ▶ [SOPAC Site Velocities](#)

Maps

- ▶ [SOPAC](#)
- ▶ [USGS](#)

Software

- ▶ [GAMIT at SOPAC](#)
- ▶ [GIPSY](#)
- ▶ [QOCA](#)

Resources

- ▶ [Community Forum](#)

SCIGN Data Portal: Home



- Welcome to the SCIGN Data Portal, developed as part of a [NASA REASoN](#) cooperative agreement. The Portal is designed to provide high-level GPS data products to the GPS community and beyond, using advanced information technologies. These products include position time series, crustal motion models, and strain rate maps.
- [More information](#) on the portal and this REASoN project is available.

What's New

- SCIGN Data Portal in development: [give us your feedback](#)
- JPL Status Report, 2004 SCIGN Annual Meeting: [REASoN overview](#)
- Testing production of SCIGN combined time series using [QOCA](#) combination software
- Development of web services to provide SCIGN metadata from SOPAC database directly to users, via command-line programs
- XML schema creation for uniform metadata input to [GAMIT](#) and [GIPSY](#)

REASoN Project Goals/Products

- Produce and disseminate [high-level SCIGN data products](#) (e.g., combined time series, strain/fault slip rates) using new technologies, such as [web services](#)
- GPS Explorer: an online, integrated data/metadata discovery and research tool. This is envisioned as the primary tool for access and visualization of SCIGN data products.
- Adaptive Seamless Archive System: using web services for GPS data discovery, exchange and storage to enable the next generation of the Global Seamless Archive Center ([GSAC](#))
- An open-source project, the "Virtual Archive", which uses web services and other new technologies for improved data archive administration and access
- Provide contextual spatial services (GIS) layers to the GPS community

Participating Agencies

(note: this project supports [SEEDS](#) efforts)



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Summary



- Developing a system for producing and delivering high level GPS data products for SCIGN
 - Based on verifiable and validated processes
 - Reliable, reproducible, and documented
 - Use a process that is extensible to larger networks
- Products to be delivered using
 - Modern information technology
 - Web services and interfaces
 - And an interactive web portal for exploring information content of products
- Interim system is running at <http://reason.scign.org/>



End
