SEMANA GEOMATICA 2009

# magicGNSS: QUALITY DATA, ALGORITHMS AND PRODUCTS FOR THE GNSS USER COMMUNITY

MARCH 3, 2009 – BARCELONA, SPAIN

SESSION: GNSS PRODUCTS

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INNOVATING SOLUTIONS

# MOTIVATION

- To develop a **suite of software and data products** covering a wide range of GNSS user needs
- Including GNSS like **GPS**, **Galileo**, or **GLONASS**, as well as their local augmentation systems, both space-based (**SBAS**) and ground-based (GBAS)
- Supporting all the phases of GNSS projects and objectives, including service volume **simulations**, core **operational** functions, such as **orbit**, **clock** and **ionosphere** determination and prediction, added-value services like **integrity**, local **augmentation** developments, and all related performance and accuracy **analyses**

QUALITY DATA, ALGORITHMS AND PRODUCTS
FOR THE GNSS USER COMMUNITY

magic GNSS

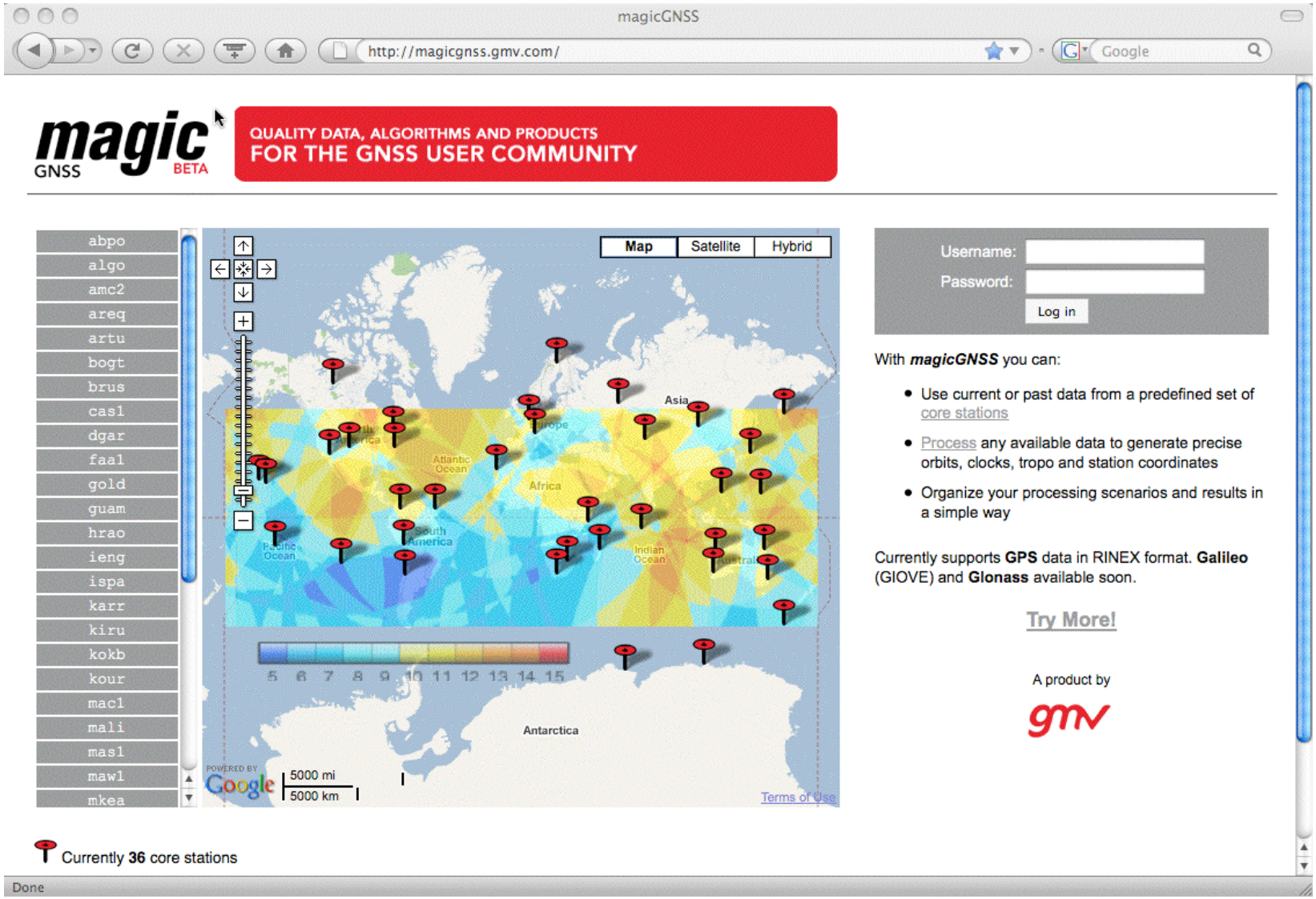
# INTRODUCING magicGNSS BETA

magic GNSS BETA

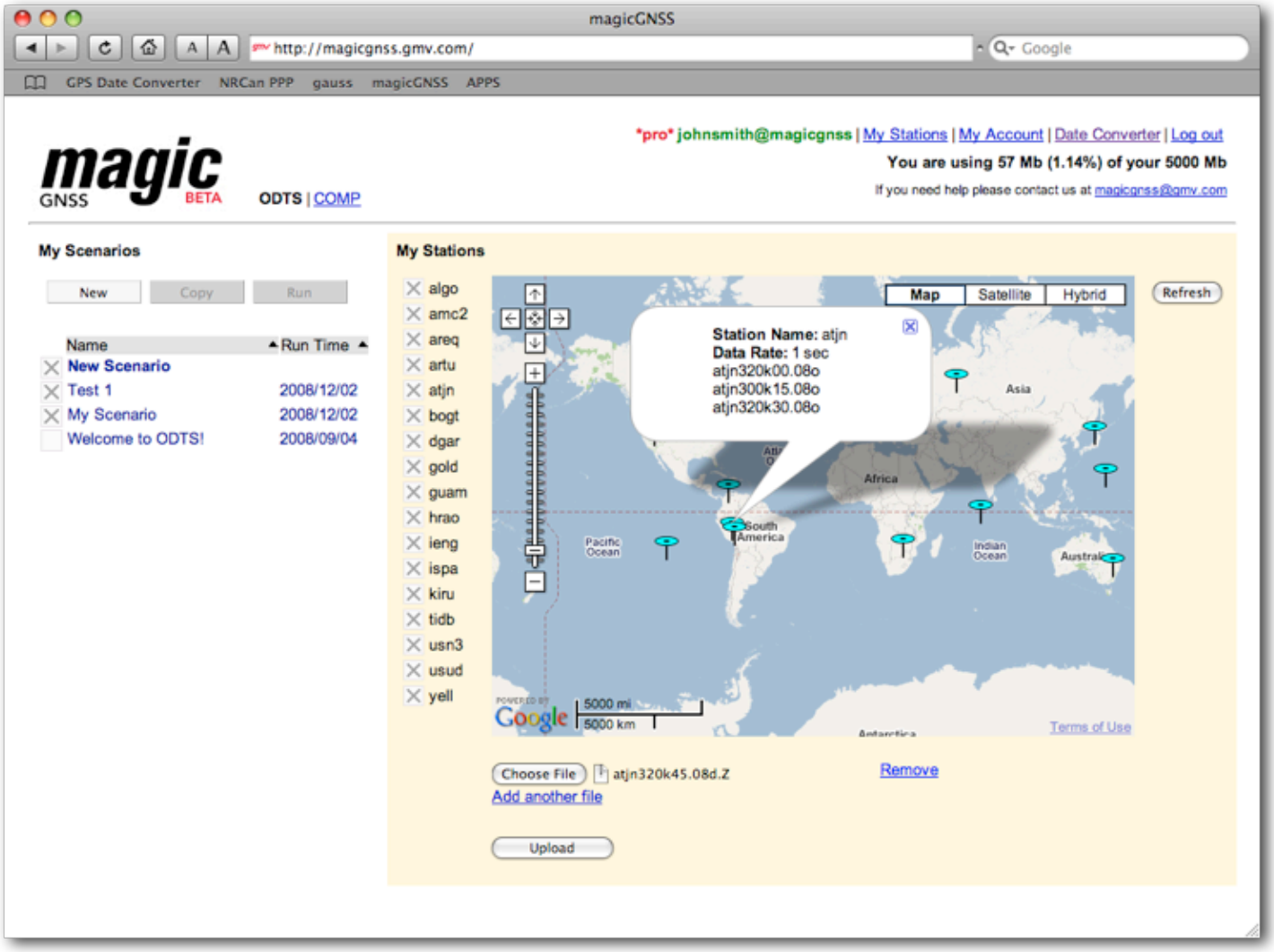
- A **free-of-charge online** service for registered users
- You can **apply for an account** online
- Provides current and past data from a predefined set of **36 *core stations***
- User station data upload also possible (**RINEX** files)
- Features a fully-functional demo version of the **ODTS algorithm** to generate precise orbits, clocks, tropo and station coordinates

magicgnss.gmv.com

# magicGNSS BETA

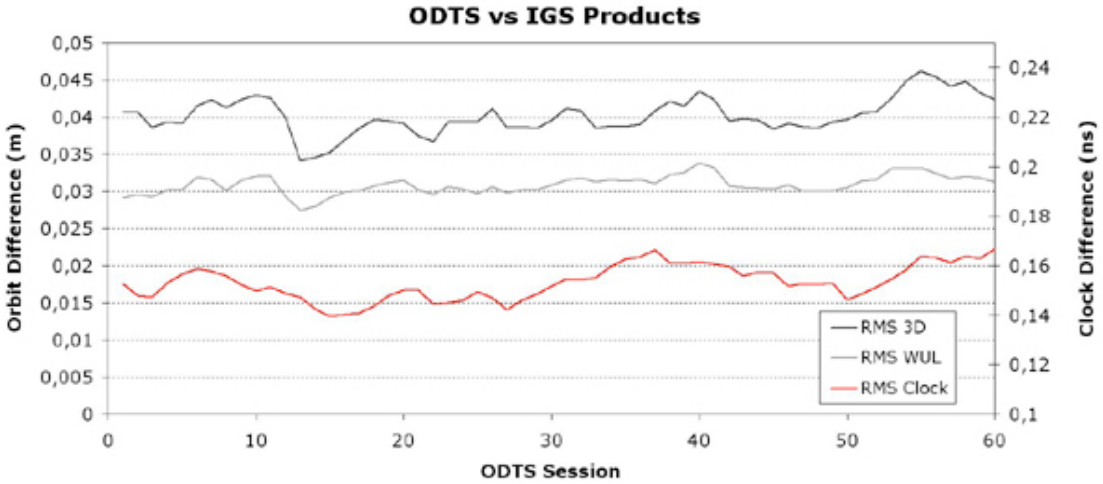


# INSIDE THE USER ACCOUNT



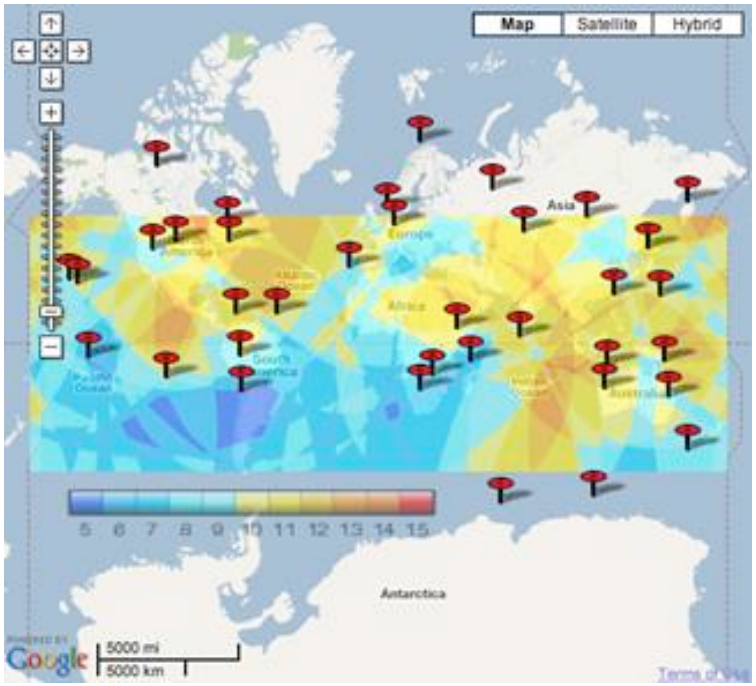
# OUTPUT PRODUCTS

| Product | Format (see IGS Formats) |
|---|---|
| Estimated satellite orbits | SP3 |
| Predicted satellite orbits | SP3 |
| Estimated satellite clocks | clock RINEX |
| Predicted satellite clocks | clock RINEX |
| Estimated station clocks | clock RINEX |
| Estimated Zenith Tropo Delay | txt |
| Estimated Station Coordinates | SINEX |
| Estimated Solar Radiation Parameters | txt |
| Estimated Earth Rotation Parameters | erp |


- Comparison with IGS *final* products (orbits and clocks)
- One week of data using 30 IGS stations
- Orbits: **4 cm** RMS
- Clocks: **0.15 ns** RMS

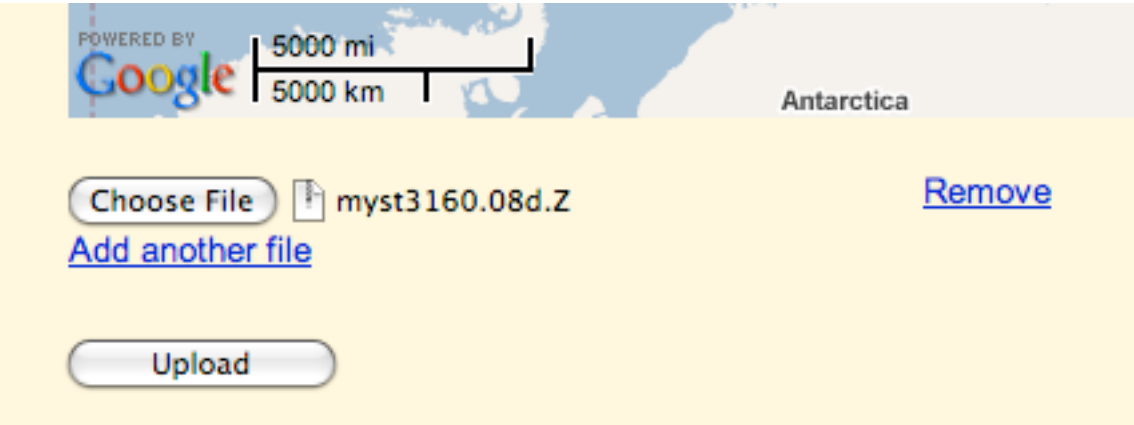
# INPUT DATA




- **36 *core stations*** currently available
- Data shared with **IGS Real Time** pilot project in which GMV participates
- Data for the last 30 days available on the server
- Until current time with a typical latency of 2 hours
- The colour map indicates the number of stations in view of the satellite at the sub-satellite point and at the GPS height (Depth-of-Coverage or DOC)
- Core stations guarantee at least DOC=5 everywhere

- Automatic processing of **NANUs** and rejection of *bad* (unhealthy) satellites
- Earth Rotation Parameters (ERPs) from IERS
- A priori station coordinates from ITRF or IGS solutions
- All key input data **downloaded automatically** at the magicGNSS server and kept in a **database**

# USER STATION DATA UPLOAD



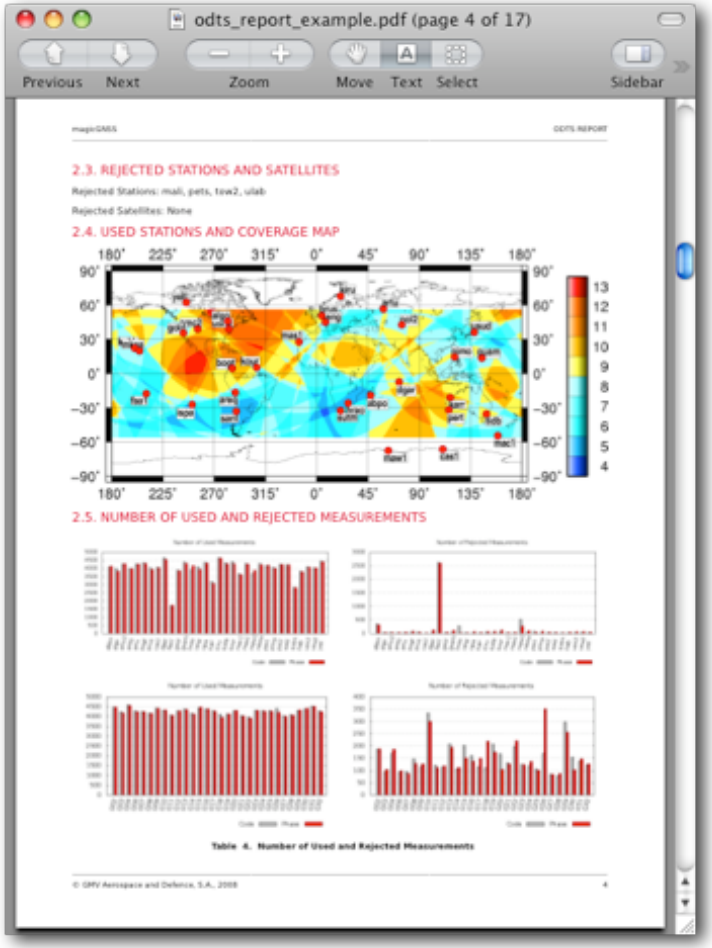

- Upload via **web** through the *magicGNSS* user account
- Upload via **ftp** also possible (easy batch upload and automation)
- RINEX 2.10 and 2.11 format versions are supported
- Normal observation files and Hatanaka files
- Compressed files in .Z, .gz, and .zip formats
- The following data rates are supported, in seconds: 30, 15, 10, 5, and 1
- Daily, hourly and 15-min RINEX files are supported
- If RINEX file does not have P1, the C1 code is automatically converted to P1 using CC2NONCC

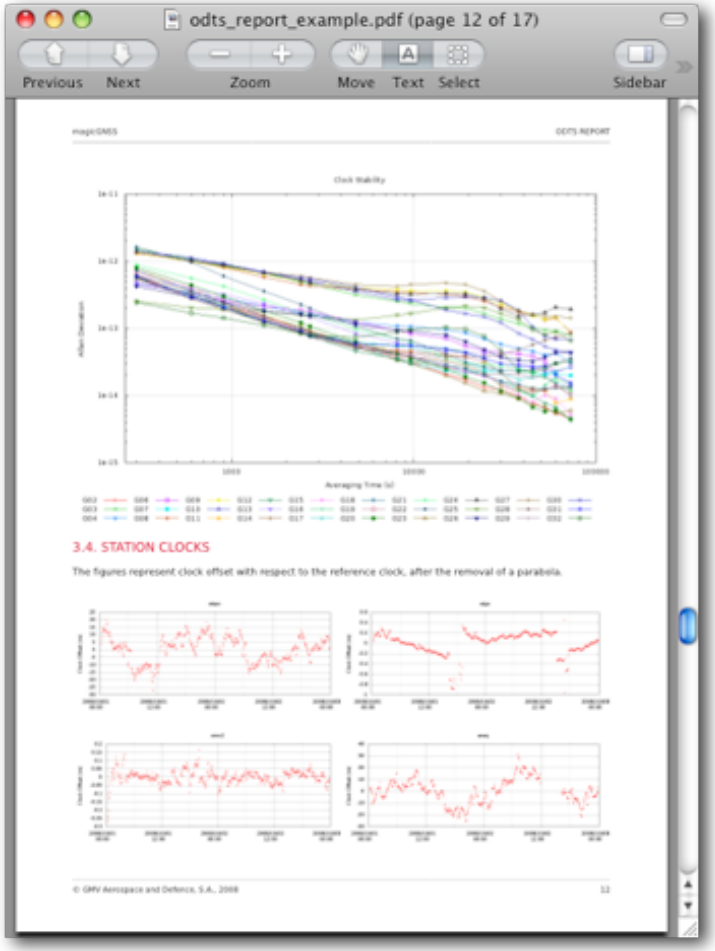
# THE ODTS ALGORITHM

- **ODTS** stands for ***Orbit Determination & Time Synchronization***
- The basic ODTS input measurements are pseudorange (**code**) and **phase L1-L2** dual-frequency **iono-free** combinations
- Based on a **batch least-squares** algorithm that minimizes measurement residuals solving for **orbits**, satellite and station **clock** offsets, phase ambiguities, station tropospheric zenith delays, and station coordinates
- The satellite and Earth dynamics are based on **high-fidelity models** including a full Earth gravity model, Sun, Moon and planetary attractions, solid Earth tides, and solar radiation pressure, including eclipses
- The orbit fit is based on the estimation of the initial state vector (position and velocity) and **5 *empirical* parameters** *for* Solar Radiation Pressure (SRP)
- Satellite and station clock offsets are estimated with respect to one **reference clock**, provided by one of the core stations (as selected by the user)
- Satellite **orbits and clocks** can be **predicted** into future time (clocks use a simple linear model)

# THE ODTS REPORT

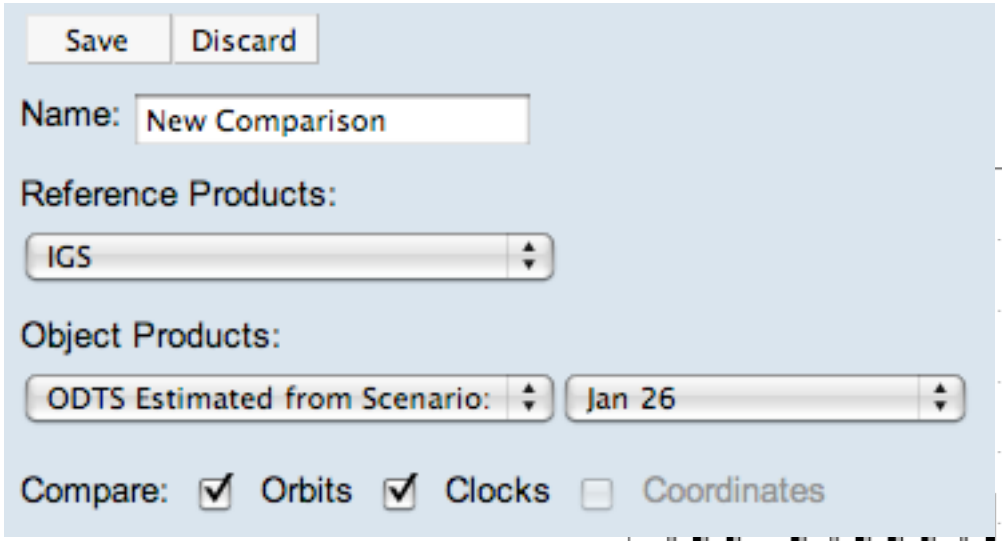
- Full report in PDF format with detailed information about measurement residuals, satellite orbits (eclipses, radiation pressure), satellite and station clocks, and station tropo and coordinates

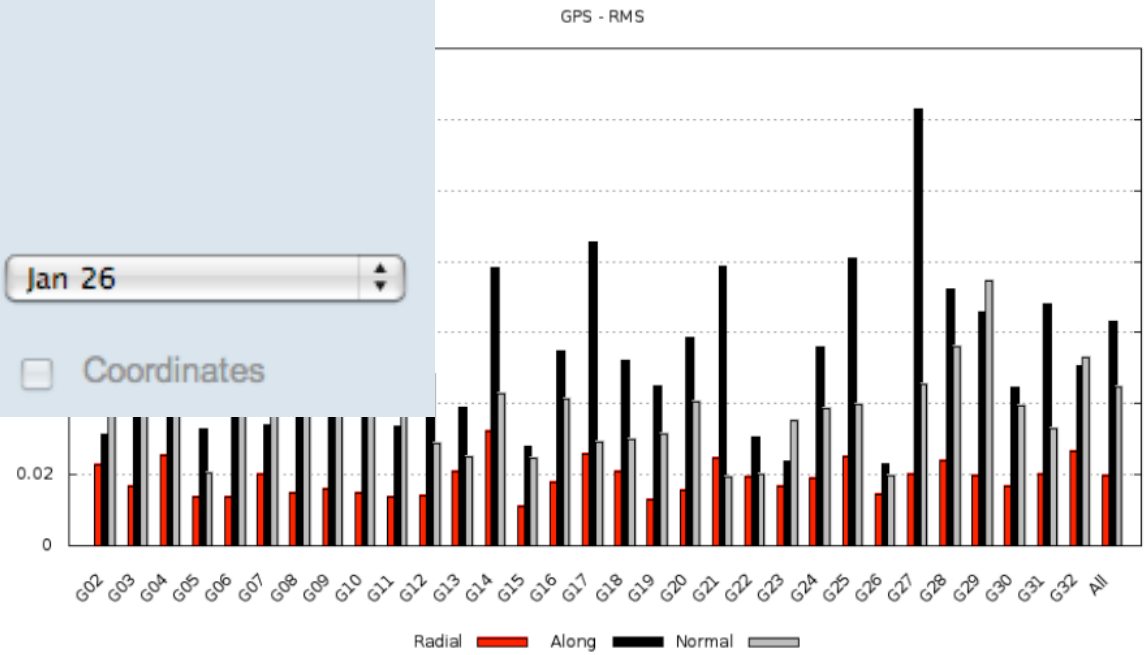


# COMPARING RESULTS WITH COMP

- COMP is a module to compare ODTS results (orbits, clocks and coordinates)
- Orbits and clocks include estimations and predictions
- Orbits and clocks can be compared against IGS *final*, *rapid*, and *ultra-rapid* products
- Two ODTS scenarios can also be compared (orbits, clocks and coordinates)
- Detailed PDF reports are generated



# CONCLUSIONS AND FUTURE WORK


- ***magicGNSS Beta*** available now at **magicgnss.gmv.com** featuring ODTS algorithm (Orbit Determination & Time Synchronization) using **GPS** data, including *core stations* and *user stations*
- **GLONASS** processing coming soon (intended before end of 2009)
- New products/modules coming this year: **Precise-Point-Positioning** (PPP) and a **SBAS** demonstrator
- Apply for an account, it is for free!

# Thank you!

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INNOVATING SOLUTIONS