

SEMANA GEOMATICA 2009

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

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SESSION: GNSS PRODUCTS

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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



- 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

magicGNSS BETA

QUALITY DATA, ALGORITHMS AND PRODUCTS FOR THE GNSS USER COMMUNITY

abpo
algo
amc2
areq
artu
bogt
brus
cas1
dgar
faal
gold
guam
hrao
ieng
ispa
karr
kiru
kokb
kour
mac1
mali
mas1
maw1
mkea

Map Satellite Hybrid

Username:
Password:
Log in

With *magicGNSS* you can:

- Use current or past data from a predefined set of [core stations](#)
- [Process](#) any available data to generate precise orbits, clocks, tropo and station coordinates
- Organize your processing scenarios and results in a simple way

Currently supports **GPS** data in RINEX format. **Galileo** (GIOVE) and **Glonass** available soon.

[Try More!](#)

A product by **gmv**

Currently 36 core stations

Done

INSIDE THE USER ACCOUNT

The screenshot shows the magicGNSS web application interface. At the top, the browser address bar displays <http://magicgnss.gmv.com/>. The page header includes the magicGNSS logo, the text "ODTS | COMP", and user information: "*pro* johnsmith@magicgnss | My Stations | My Account | Date Converter | Log out". A usage notification states: "You are using 57 Mb (1.14%) of your 5000 Mb. If you need help please contact us at magicgnss@gmv.com".

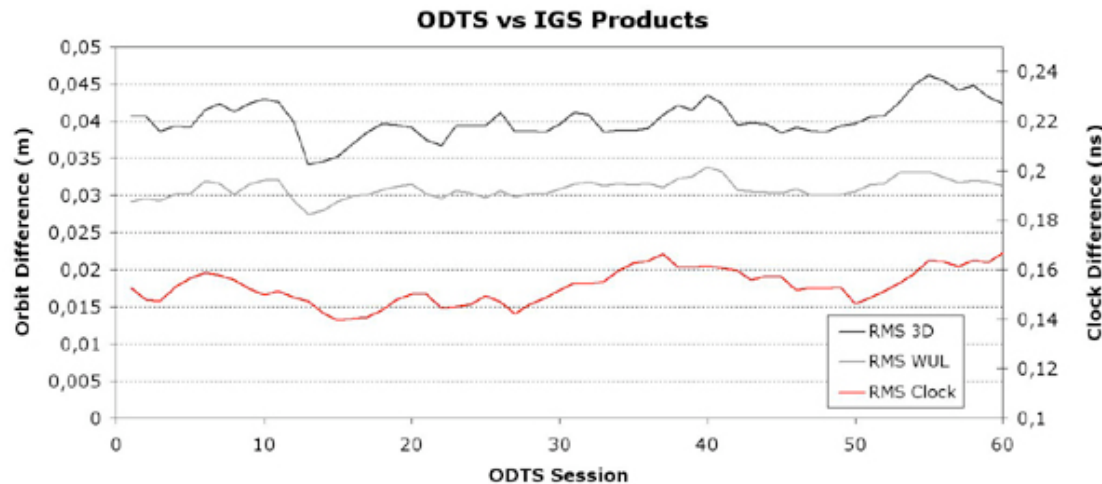
The main content area is divided into two sections:

- My Scenarios:** Contains buttons for "New", "Copy", and "Run". Below is a table with columns "Name" and "Run Time":

Name	Run Time
<input checked="" type="checkbox"/> New Scenario	
<input checked="" type="checkbox"/> Test 1	2008/12/02
<input checked="" type="checkbox"/> My Scenario	2008/12/02
<input type="checkbox"/> Welcome to ODTS!	2008/09/04
- My Stations:** Features a list of station names with checkboxes, a world map with station markers, and a file upload section. The station list includes: algo, amc2, areq, artu, atjn, bogt, dgar, gold, guam, hrao, ieng, ispa, kiru, tidb, usn3, usud, and yell. A tooltip for the "atjn" station shows: "Station Name: atjn", "Data Rate: 1 sec", "atjn320k00.08o", "atjn300k15.08o", and "atjn320k30.08o". The file upload section shows a file named "atjn320k45.08d.Z" with "Choose File", "Add another file", "Remove", and "Upload" buttons.

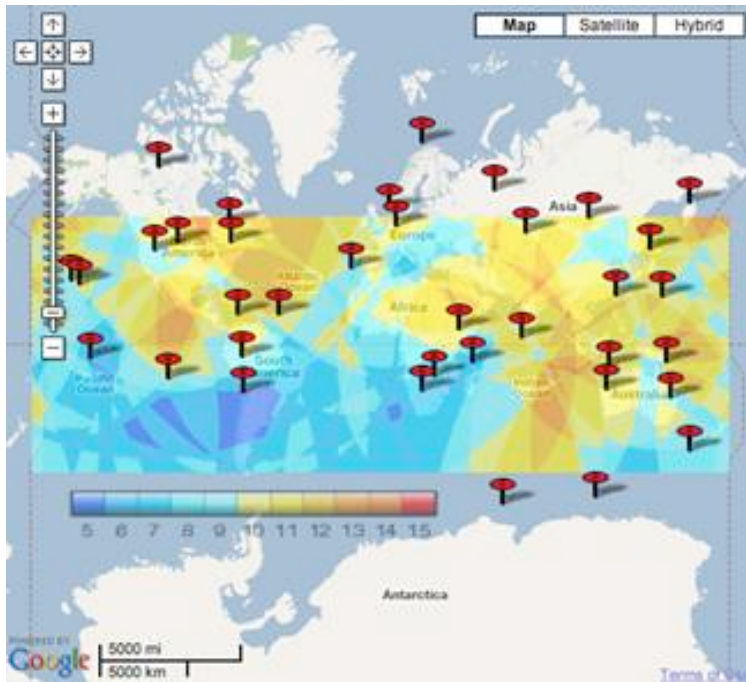
OUTPUT PRODUCTS

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

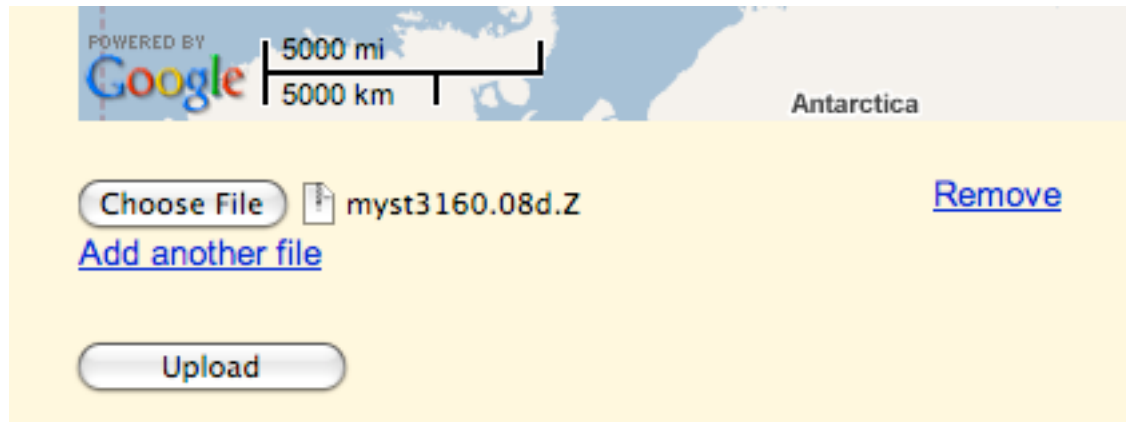
INPUT DATA



- **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



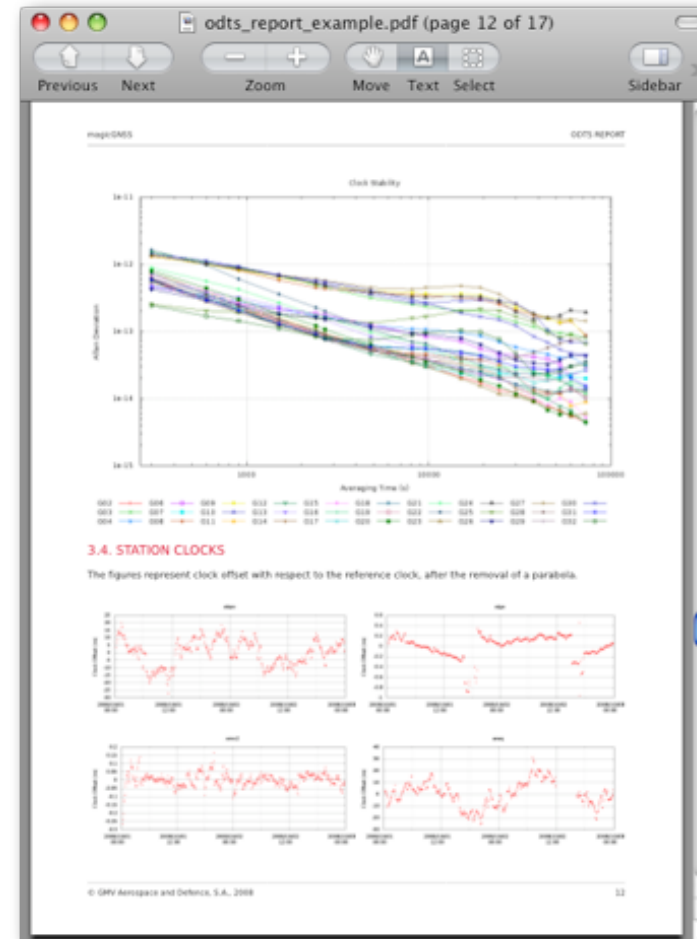
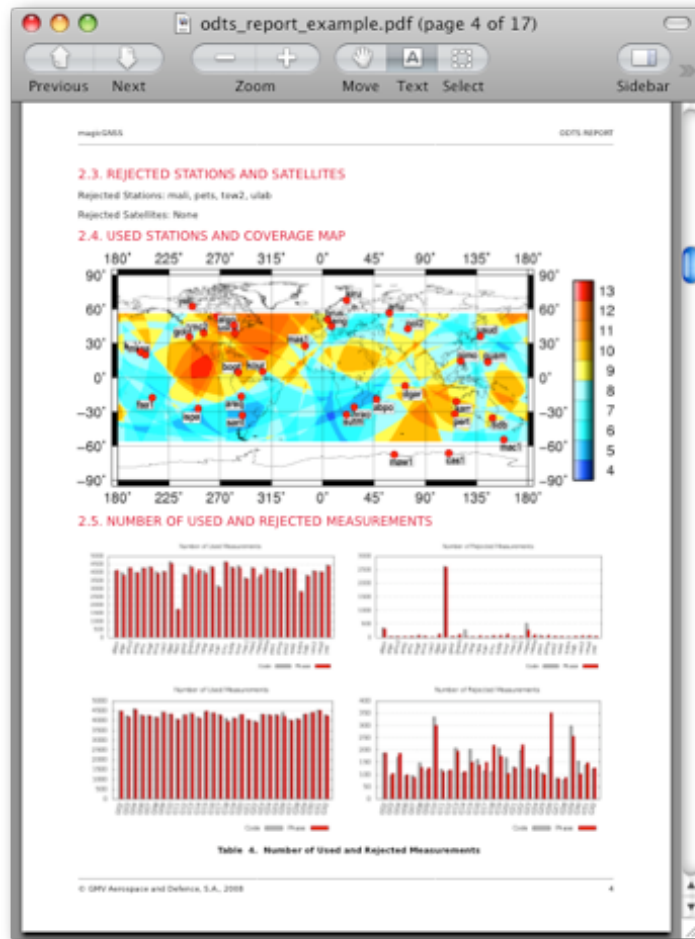
- Upload via **web** through the *magicGNSS* user account
- Upload via **ftp** also possible (easy batch upload and automation)
- RINEX 2.10 and 2.11 format versions are supported
- Normal observation files and Hatanaka files
- Compressed files in .Z, .gz, and .zip formats
- The following data rates 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)

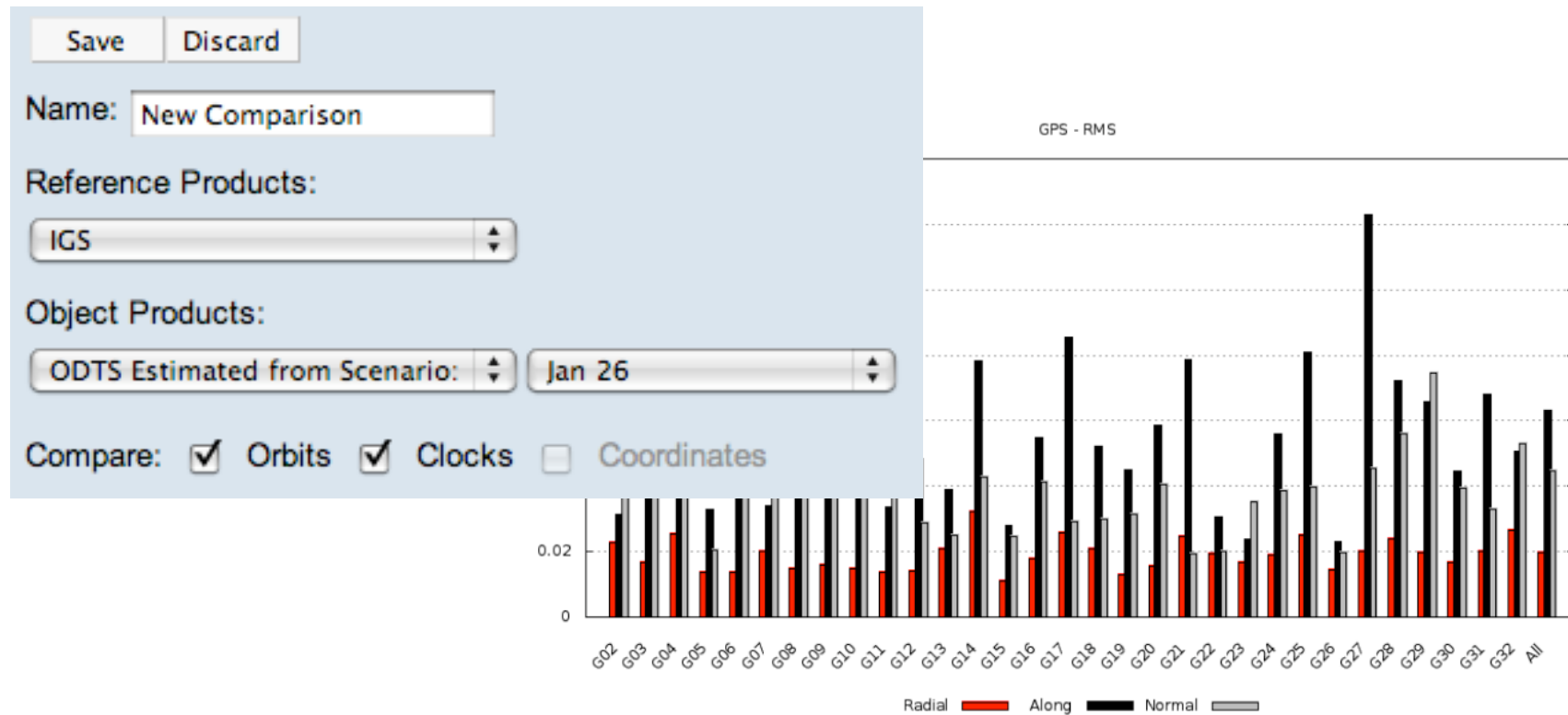
THE ODTS REPORT

- 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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