

Analysis by DEOS of the SW part of the  
EUREF network

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# GPS at the DEOS group

- **Yearly GPS campaigns**
  - ✓ **Azores**
  - ✓ **SE Asia (GEODYSSEA and Sulawesi)**
  - ✓ **Italia (Umbria)**
- **Permanent sites**
  - ✓ **1 Faial – Azores**
  - ✓ **2 Sulawesi – Indonesia (a third one this year)**
  - ✓ **1 Angola (during the current year)**
- **Daily Processings**
  - ✓ **IGSNET**
  - ✓ **GIN**
  - ✓ **EUREF**
- **Software**
  - ✓ **Gipsy**
  - ✓ **Gamit**

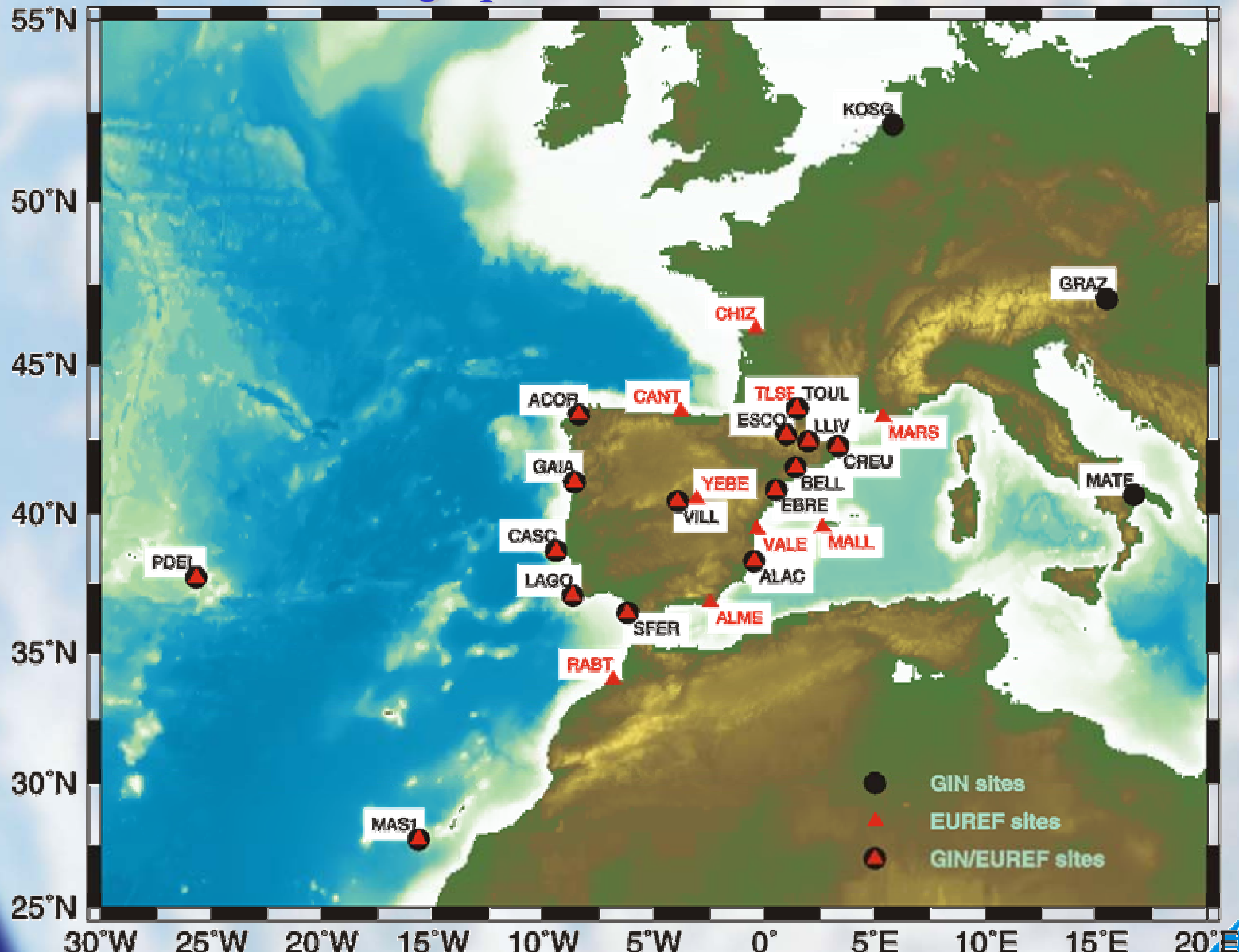
# Daily Processings

## GIPSY software

- **IGSNET - 41 sites**
  - ✓ Global network (mainly Europe but including East of North-America, South-America, Africa, Siberia and SE Asia)
  - ✓ FN strategy
  - ✓ Compute daily solutions for sites managed by DEOS (KOSG, WSRT, IRKT, NTUS)
- **GIN - 18 sites**
  - ✓ SW Europe (concentrated on Iberia)
  - ✓ PPP strategy
  - ✓ Setup under the scope of a Ph.D. project
- **EUREF - 22 sites**
  - ✓ SW Europe (concentrated on Iberia)
  - ✓ FN strategy
  - ✓ Processing the same core as GIN network

# GIN & EUREF networks

## Geographical distribution





# GIN & EUREF networks

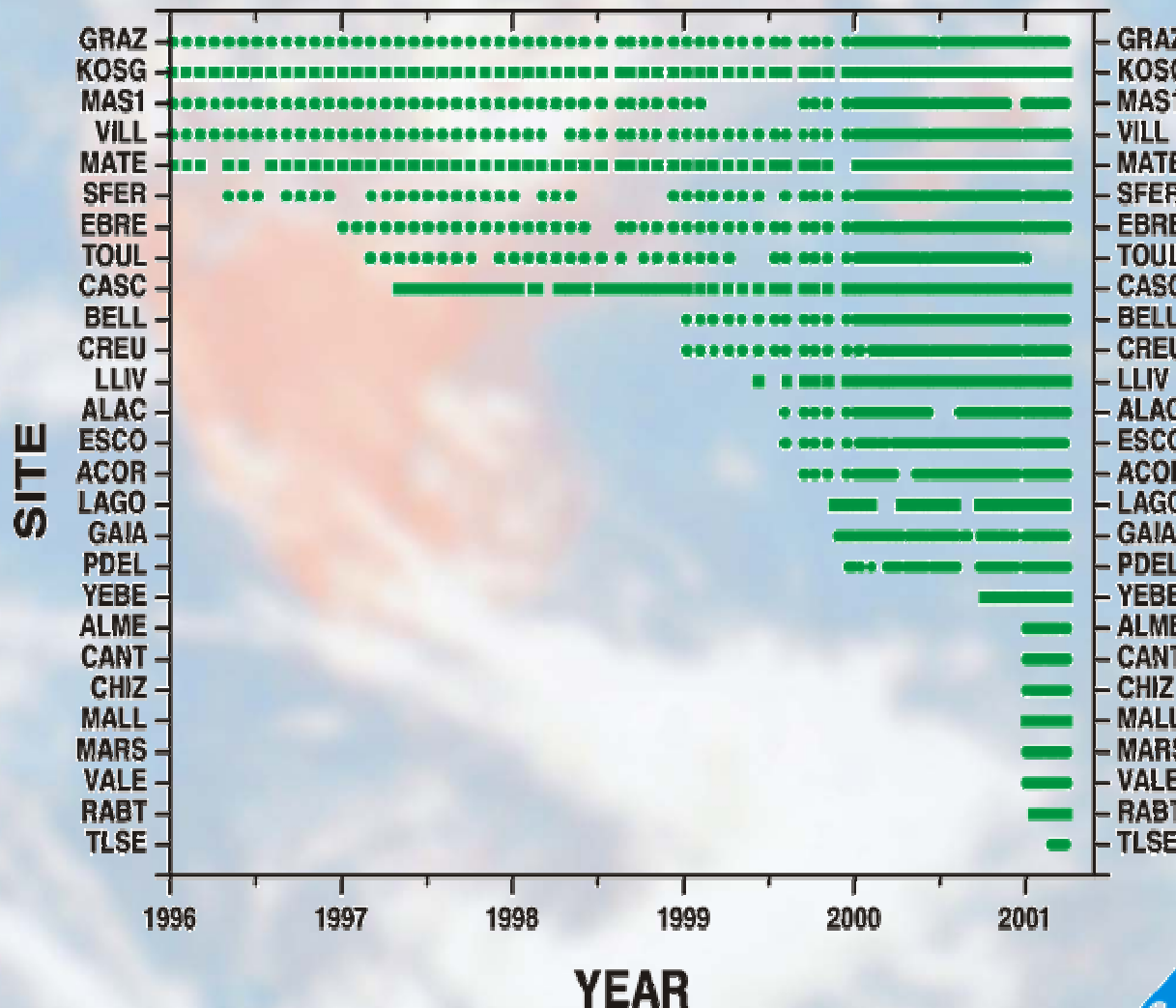
## Processed data

- **Gin**

- Started in Jun 2000
- 1 week per month 1996-1999
- Daily processing since Jan 2000
- Currently preprocessing the DEOS-EUREF network

- **Euref**

- Started in Jan 2001
- DEOS official LAC (13<sup>th</sup>) March 2001
- Daily processing since Jan 2001



# GIPSY

JPL (Jet Propulsion Laboratory)

## **Processes undifferenced data, estimating corrections to the receivers and satellites clocks**

- ✓ **No station coordinates constrained**
- ✓ **Antenna phase center offset and variations were accounted for as given by IGS (Calibration set IGS\_01)**
- ✓ **Data of GPS satellites in sun eclipse removed**
- ✓ **Ocean loading parameters applied**  
(provided by H.-G. Scherneck, Onsala Space Observatory, Sweden)
- ✓ **Niell troposphere mapping used; wet troposphere part estimated as a stochastic parameter**
- ✓ **The station coordinate solutions computed are ambiguity free**

# Strategies

## FN & PPP

- **FN (Free Network Solution)**

- ✓ All network processed in one run
- ✓ IGS orbits
- ✓ Estimation of clock corrections of the satellites and receivers
- ✓ Correlations between sites are estimated
- ✓ Compute time is exponentially proportional to the number of processed sites

- **PPP (Precise Point Positioning)**

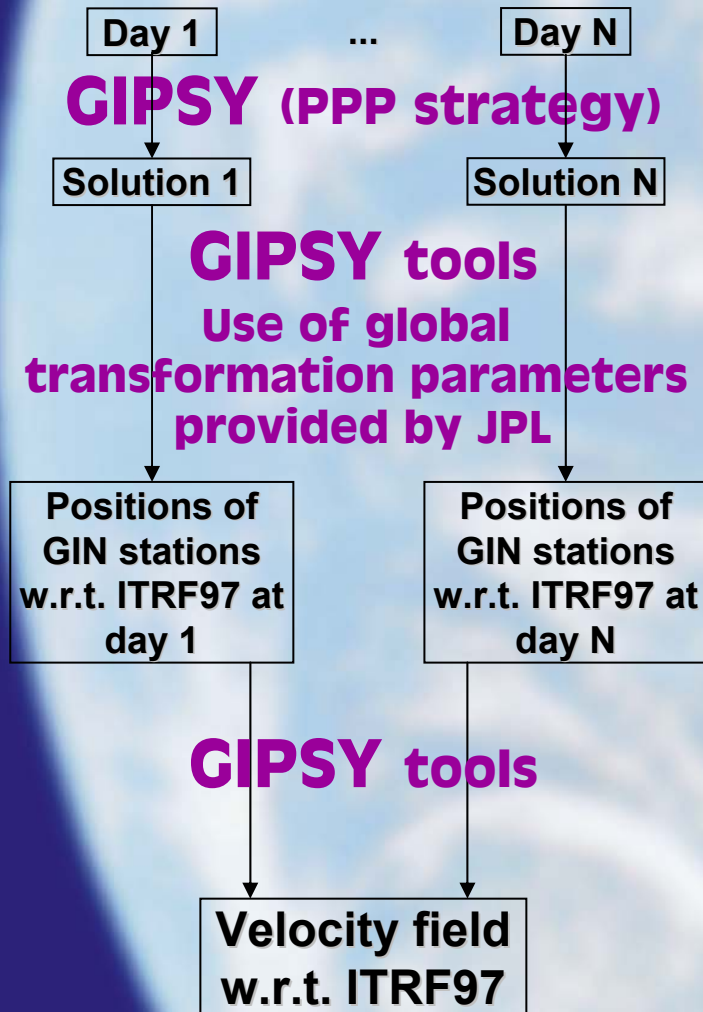
- ✓ Each site individually processed
- ✓ JPL orbits
- ✓ Uses satellite clock corrections provided by JPL
- ✓ No correlations explicitly estimated between sites
- ✓ Efficient from computational point of view



# Methodology

## GIN & EUREF network

### GIN



### EUREF





# Automatic Processing

## EUREF network (daily tasks)

- **Daily tasks**

- ✓ **download of rinex data at BKG and IGN (14 days delay)**
- ✓ **download of JPL orbits (14 days delay)**
- ✓ **estimation under GIN of PPP solutions. Problematic sites marked for the FN processing (21 days delay)**
- ✓ **translation (with outliers deletion and cycle slips detection) of all rinex files into a combined Gipsy – QM – file (21 days delay)**

# Automatic Processing

EUREF network (weekly tasks)

- **Weekly tasks (3 weeks delay)**
  - ✓ **download IGS orbits (Sunday morning)**
  - ✓ **estimation using FN of the daily solutions (Sunday afternoon)**
    - ✓ **in case of problems, GIN results provide information to identify suspicious sites**
  - ✓ **iterative processing to detect outliers (Monday morning)**
    - ✓ **sites with large residuals are removed from the QM file and the day reprocessed**
  - ✓ **creation of the sinex and summary files and update of the apriory table files. (Monday afternoon)**
  - ✓ **submission of the results to BKG (later in the week)**

# Automatic Processing

Example of outlier deletion: week 1112

Day 0 – 1<sup>st</sup> run

NAME	N (mm)	E (mm)	V (mm)
ACOR	-1.4	2.0	-6.2
BELL	-2.6	2.1	3.2
CANT	1.1	-6	.4
CASC	2.3	-4.9	-5.8
EBRE	.2	5.7	-7.6
GAIA	2.3	5.0	5.9
LAGO	-5	-3.0	11.0
LLIV	.1	-1.2	-2.7
MALL	2.8	-1.0	7.5
MAS1	1.6	.5	2.7
PDEL	-5.0	5.2	2.7
TLSE	.7	-2.2	-.8
VALE	-1.6	1.2	3.0
YEBE	.2	2.0	6.2
ALAC	-1	-6	-4.0
ALME	-4.5	.2	4.9
CHIZ	4.3	-3.0	-5.2
MARS	1.1	1.3	3.8
SFER	-.4	2.3	1.0
<b>RABT</b>	<b>-.3</b>	<b>-17.6</b>	<b>-30.5</b>
WRMS	2.3	4.0	7.4

Day 0 – 2<sup>nd</sup> run

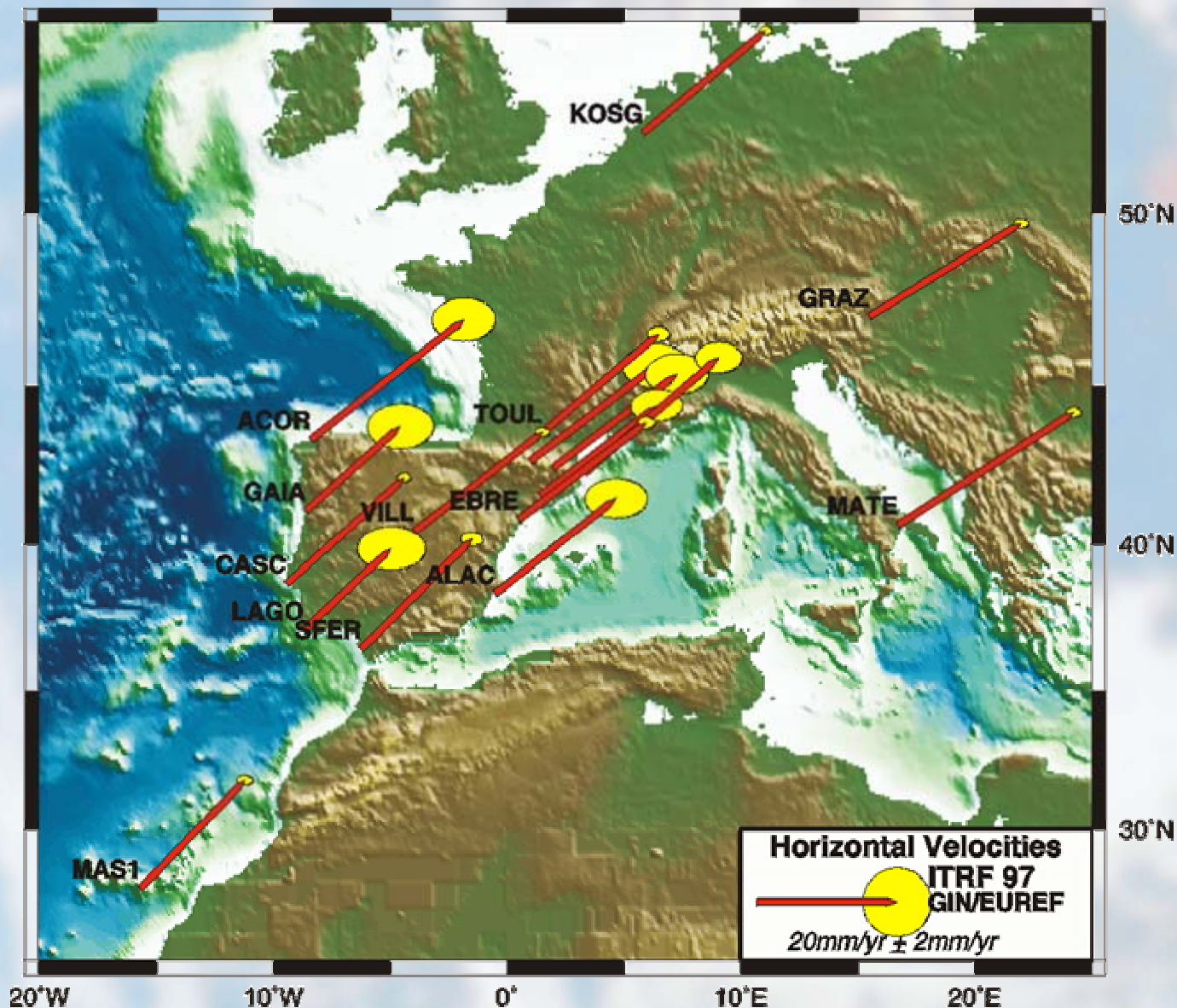
NAME	N (mm)	E (mm)	V (mm)
ACOR	-1.2	1.8	-5.5
BELL	-2.8	1.8	2.6
CANT	1.0	-9	1.0
CASC	2.5	-5.6	-7.2
EBRE	.0	5.4	-8.5
GAIA	2.5	4.6	5.5
LAGO	-5	-3.8	8.7
LLIV	.0	-1.4	-3.1
MALL	2.4	-1.3	5.9
MAS1	1.6	1.9	3.2
PDEL	-3.2	4.0	2.4
TLSE	.5	-2.4	-.4
VALE	-1.9	.9	1.4
YEBE	.1	1.6	5.4
ALAC	-3	-1.0	-6.0
ALME	-4.8	.4	2.3
CHIZ	4.1	-3.2	-3.6
MARS	.9	1.1	4.0
SFER	-.6	1.5	1.7
WRMS	2.1	2.8	4.8

RABT	N (mm)	E (mm)	V (mm)
day 0	-.3	-17.6	-30.5
day 1	1.5	-.7	-2.5
day 2	1.0	-1.5	5.9
day 3	-1.7	2.1	6.2
day 4	-.5	3.3	7.3
day 5	1.4	-1.3	-11.9
day 6	-2.7	-.7	.0



# Estimated Velocities

## GIN&EUREF NETWORK - ITRF97





# Future

## Planned Improvements

- **Automatic selection of problematic sites**
  - ✓ Using of the daily PPP solution
  - ✓ Comparison with the daily predicted position
- **Integration with the EPN Special Project: “Time Series”**
  - ✓ weekly computation of positions and velocities using the combined EUREF solution in ITRF2000
  - ✓ Detection of abnormal behaviors:
    - ✓ Daily performance (short period signals)
    - ✓ Trend deviations (long period signals)
- **Submission of troposphere solutions**
  - ✓ To be implemented in June 2001