

# VLBI ANALYSIS WITH THE MULTI-TECHNIQUE SOFTWARE GEOSAT

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NORWEGIAN MAPPING  
AUTHORITY

POSITIONING DATA – FOR SOCIETY'S BENEFIT

IVS GENERAL MEETING  
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# NY-ÅLESUND GEODETIC OBSERVATORY



- Geodetic techniques
  - VLBI (1994-)
  - 2 GPS(IGS) (1991-)
  - SCG (1999-)
  - TG (1976-)
  - DORIS (1987-)
- Campaigns
  - AG (1998-)
  - Local network (1998-)
  - Local ties
  - Stability measurements
- Additional: Prare, GPS ++, L&R

Want to upgrade to VLBI2010!



## MOTIVATION

- NMA- Mainly data producer
- GPS analysis
- VLBI solutions from external sources
- Inconsistency in software and results
- FFI: Multi technique software Geosat
- NMA initiated use of the Geosat-VLBI module



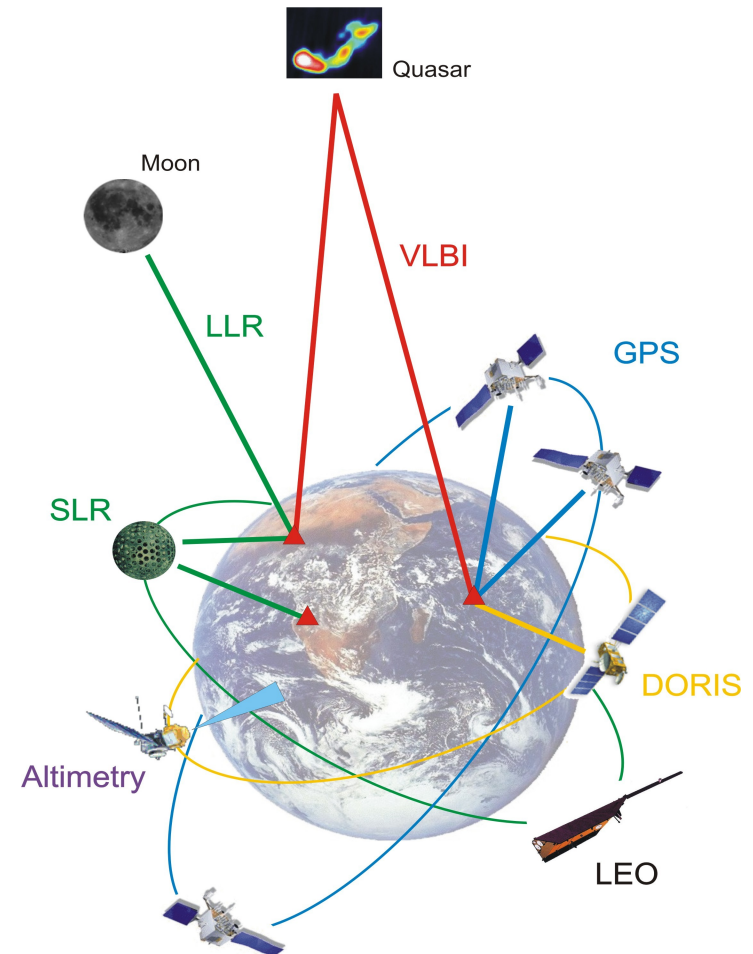
# GEOSAT MULTI-TECHNIQUE SOFTWARE

## ■ Included:

- VLBI
- GPS/GNSS
- SLR
- ++

## ■ Currently working with:

- Upgrade: Altimetry module
- Include: GOCE/GRACE



From: [http://www.iag-ggos.org/about\\_ggos/](http://www.iag-ggos.org/about_ggos/)



## GEOSAT VLBI PROCESING

- Preliminary level
  - Convert from NGS-files to internal format
  - Establish a priori parameter values and statistics
- Session level
  - Calculate OMC and partial derivatives
  - Process OMC with a UD/KF
    - Constant + stochastic parameters => **IVS**
- Multi-year level
  - Multiple session SRIFs + SRIF/KF → Global solution



## GEOSAT MODELS

- IERS Convention 2003 with updates
- Ocean loading (Scherneck & Boss)
- Atmospheric loading (Petrov & Boy)
  
- Signal propagation: 4D raytracing with ECMWF NWM.
  - No mapping function! Direct interpolation (t,elev,azim) in raytracing file.

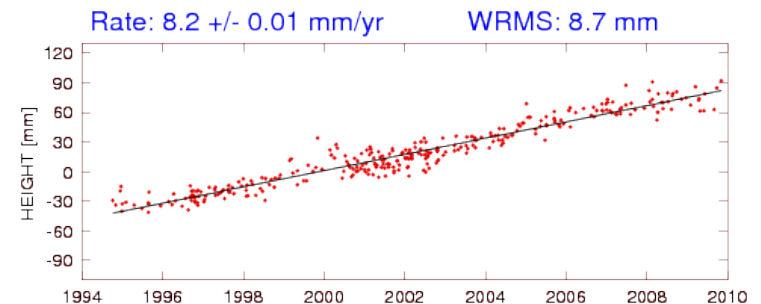
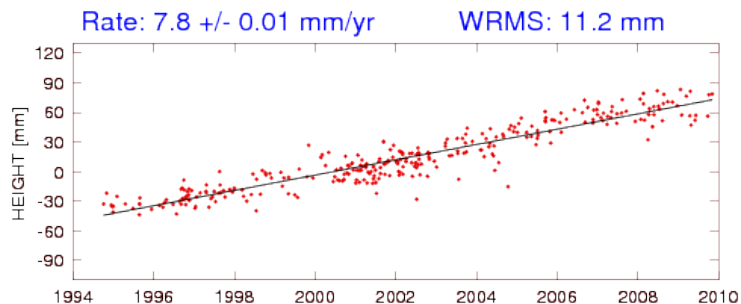
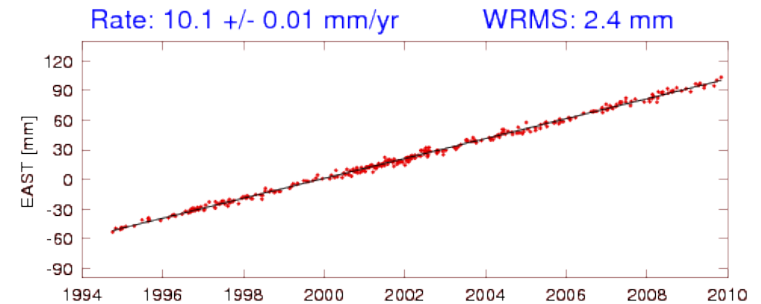
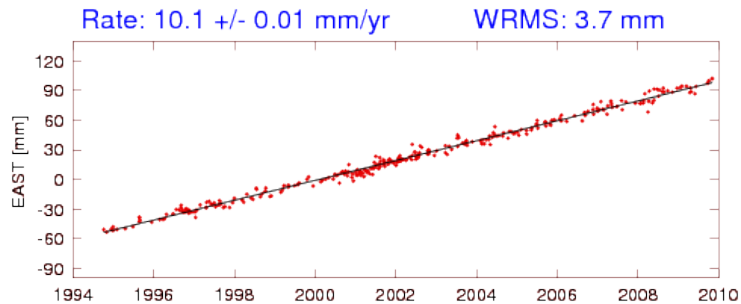
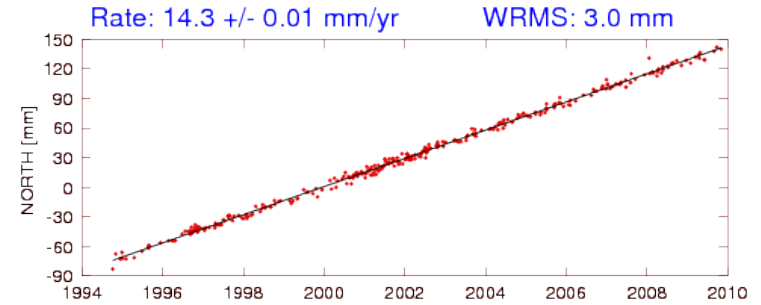
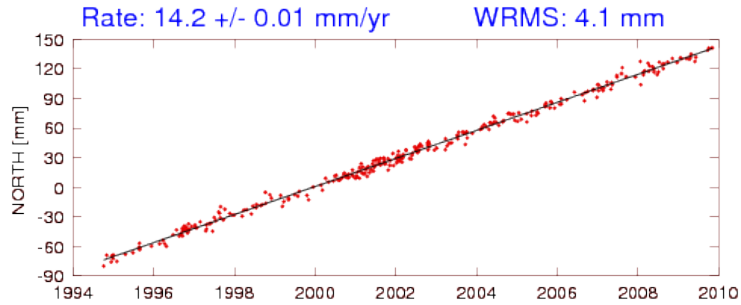


## STATUS AT NMA

- Long term goal: VLBI+GNSS+SLR+ALT+GOCE/GRACE
- Short term goal: Contribute to IVS comb
  - GEOSAT/VLBI at NMA: Initial stage. Still issues to investigate.
  - Preliminary results
  - Iterative process
    - Comparison NMA vs IVS analysis centres by Sarah Boeckmann
  - Apply for IVS-analysis centres



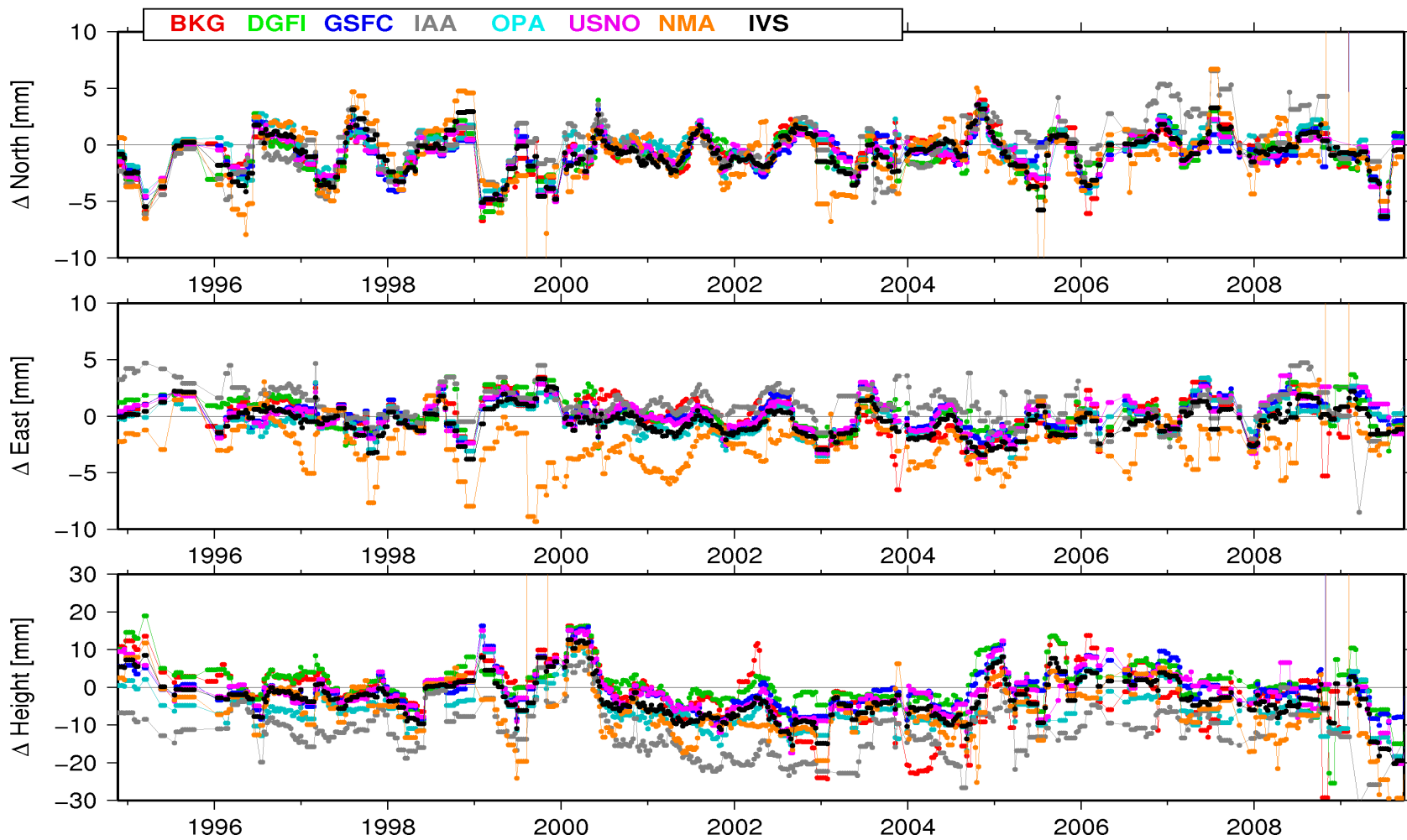
# TIME SERIES -- NY-ÅLESUND





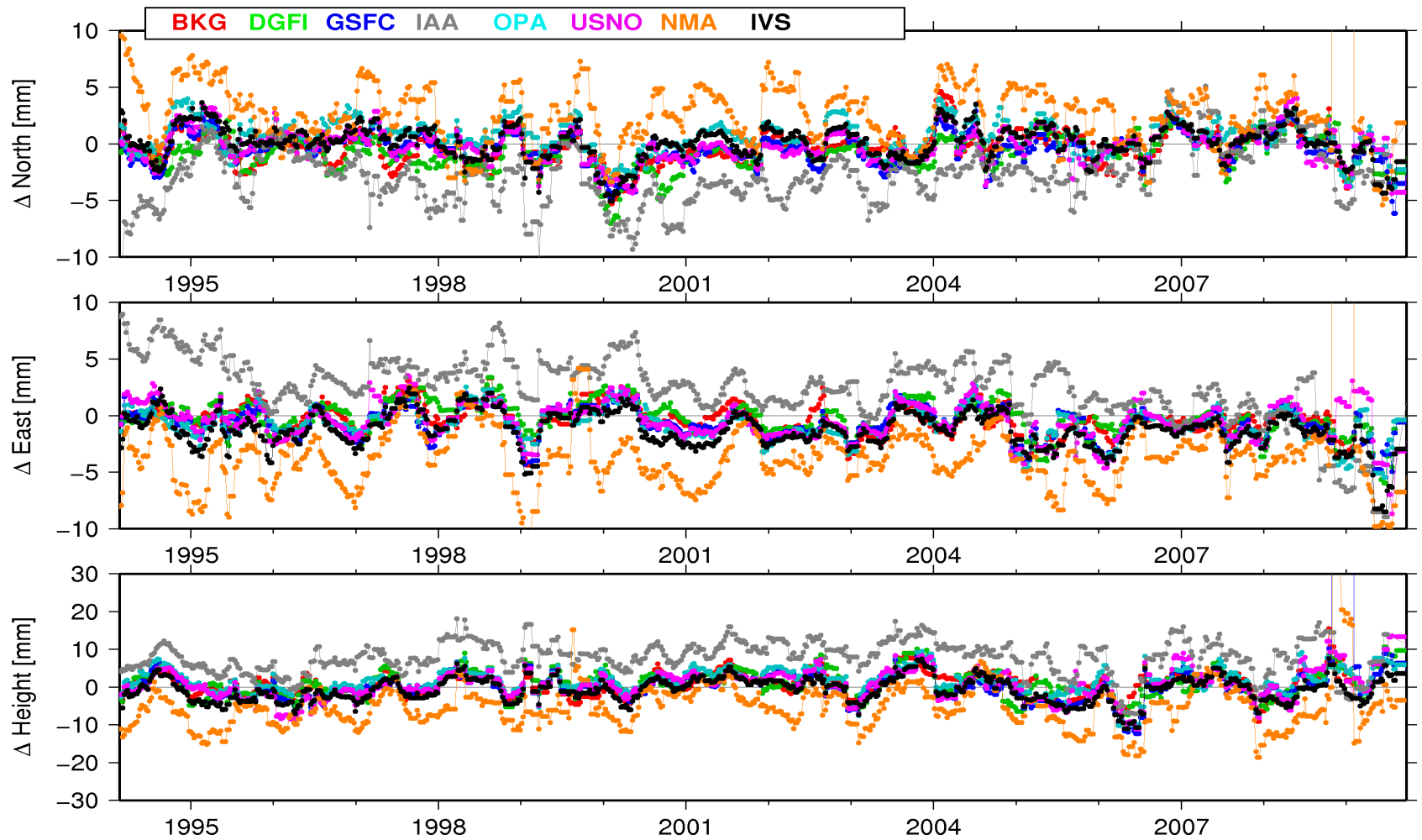
# RESIDUAL TIME SERIES -- NY-ÅLESUND

NYALES20 (90 day smoothed)

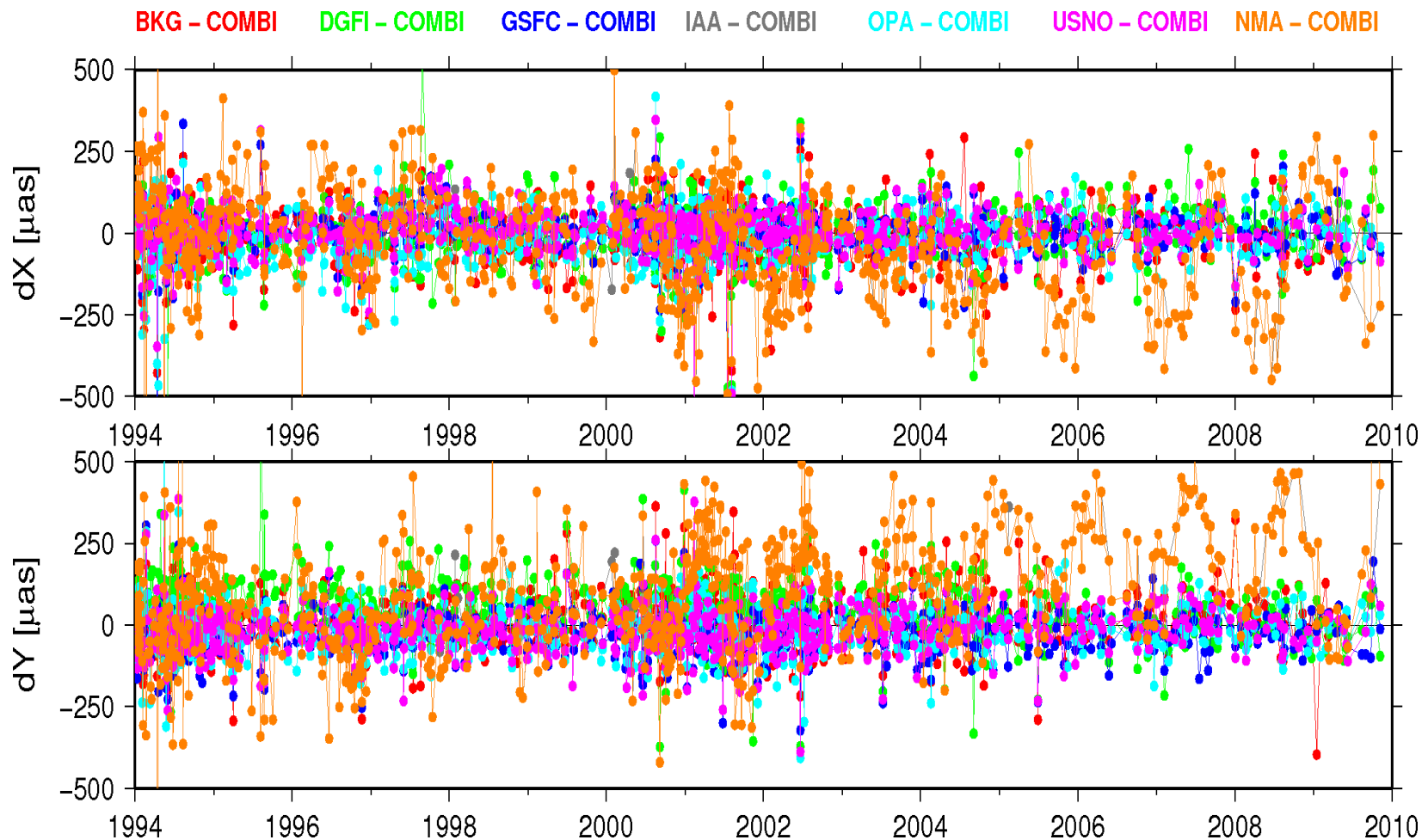


# RESIDUAL TIME SERIES -- WETTZELL

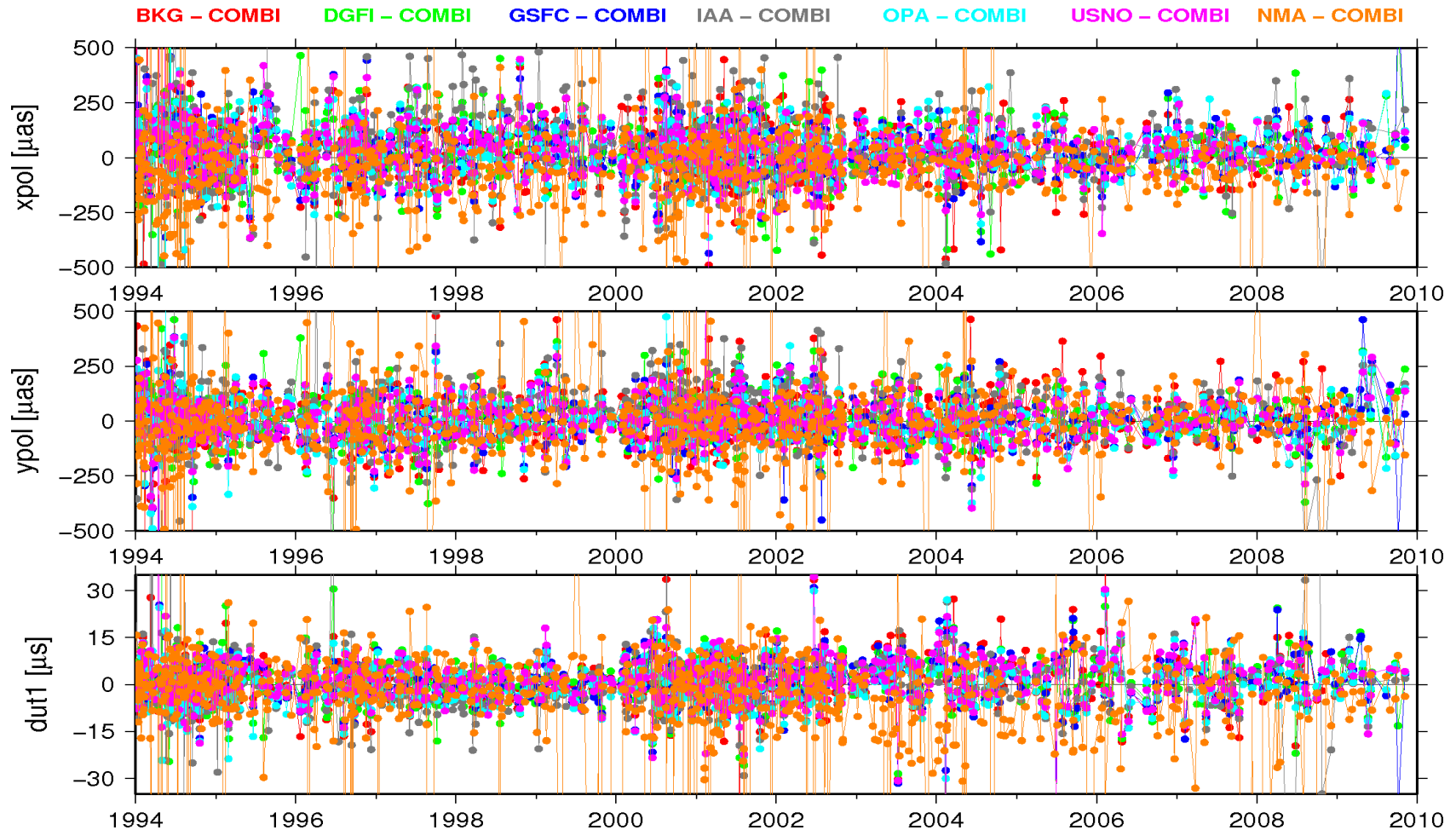
WETTZELL (90 day smoothed)



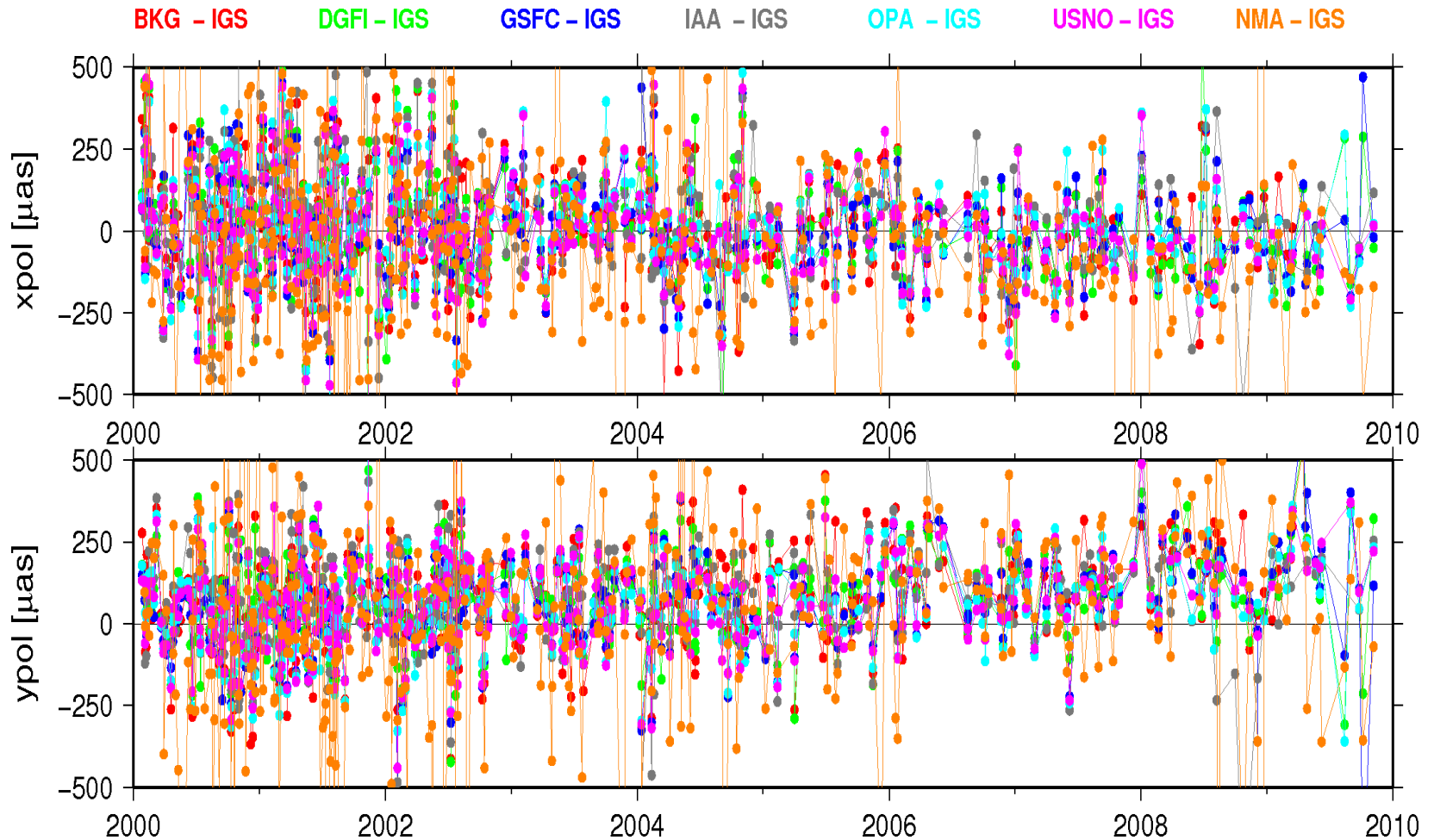
# NUTATION VS. IVS-COMBINED



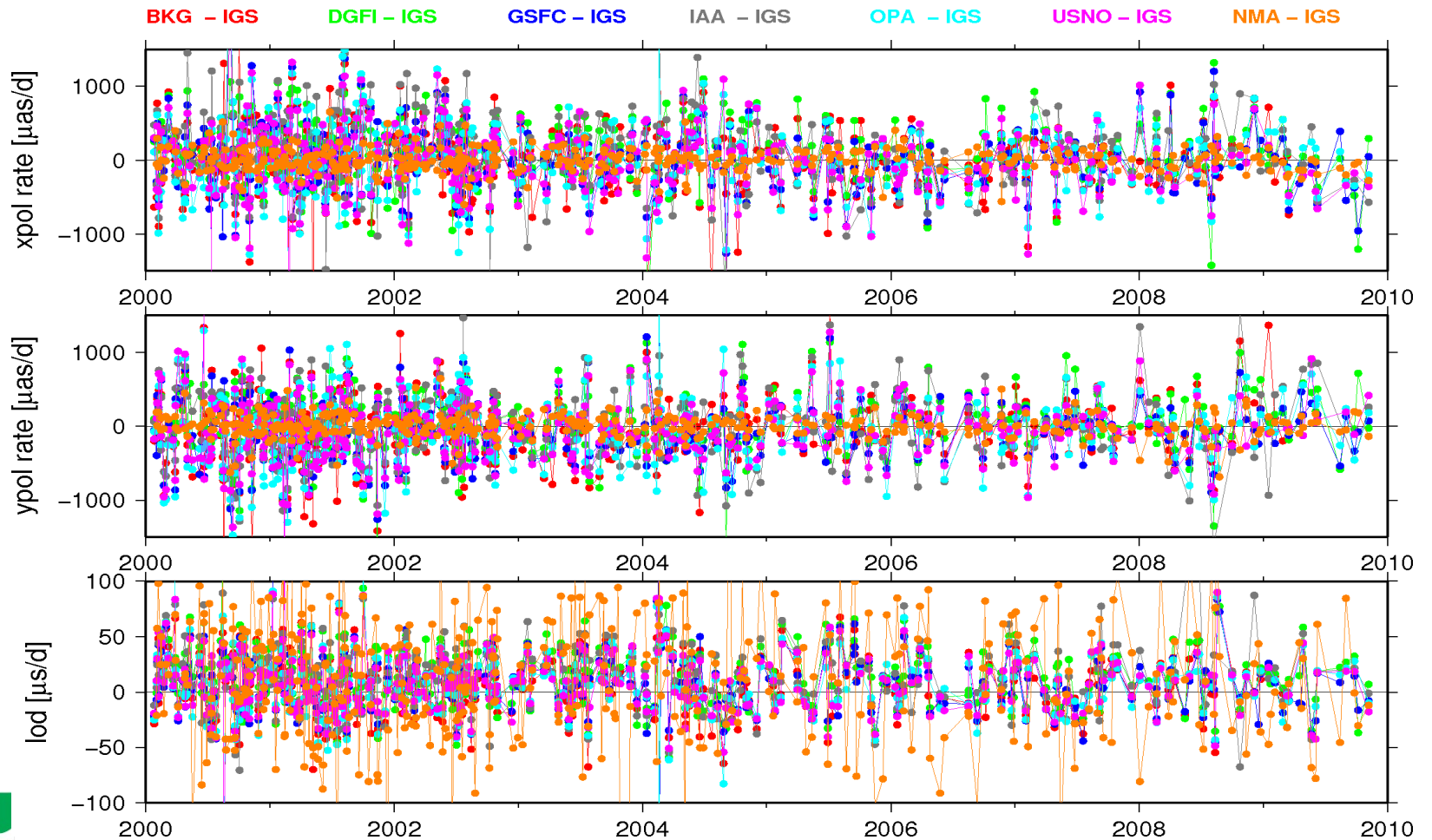
# POLAR MOTION VS. IVS-COMBINED



# POLAR MOTION VS. IGS



# POLAR MOTION RATE VS. IGS



## SUMMARY COMPARISON

- Station dependent systematical differences in station coordinates
- Annual signal in nutation parameters
- PM vs. IVS good
- PM vs. IGS noisier
- Very good agreement in PM rate vs. IGS



## DISCUSSION

- Systematic differences
  - ▶ GMF instead of raytracing
  - ▶ Estimate gradients?
  - ▶ Pre-synch of clocks (at omc level)?
  - ▶ Data editing/outliers
  - ▶ Consistency problems with externally generated CRF (Estimate sources?)
- Still issues to be investigated
- Soon: NMA as IVS analysis center





**THANK YOU FOR THE ATTENTION!**

