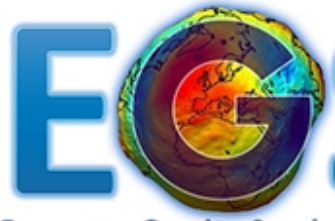

EGSIEM

European Gravity Service for Improved Emergency Management

Reference Frame Products

Andreja Susnik, Rolf Dach, Andrea Maier, Daniel Arnold

HORIZON 2020

Introduction

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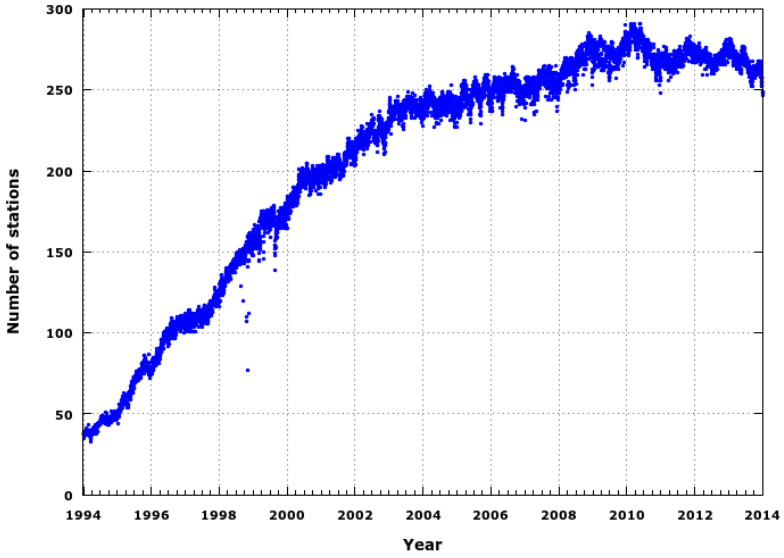
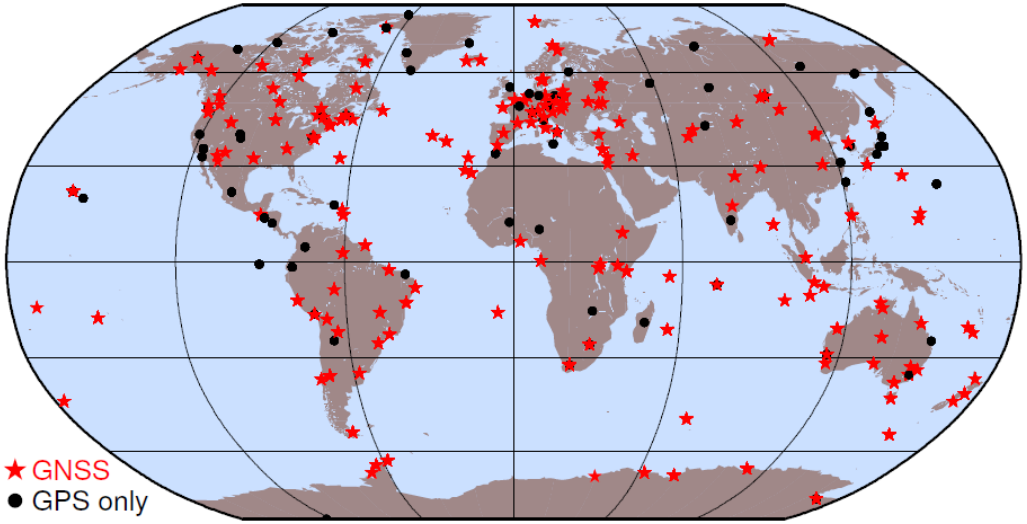
- for consistent series of GNSS satellite clock corrections, orbits, Earth rotation parameters and station coordinates were homogeneously processed for the interval between 2000 to the end of 2014, using the latest development version of the Bernese GNSS software





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Introduction

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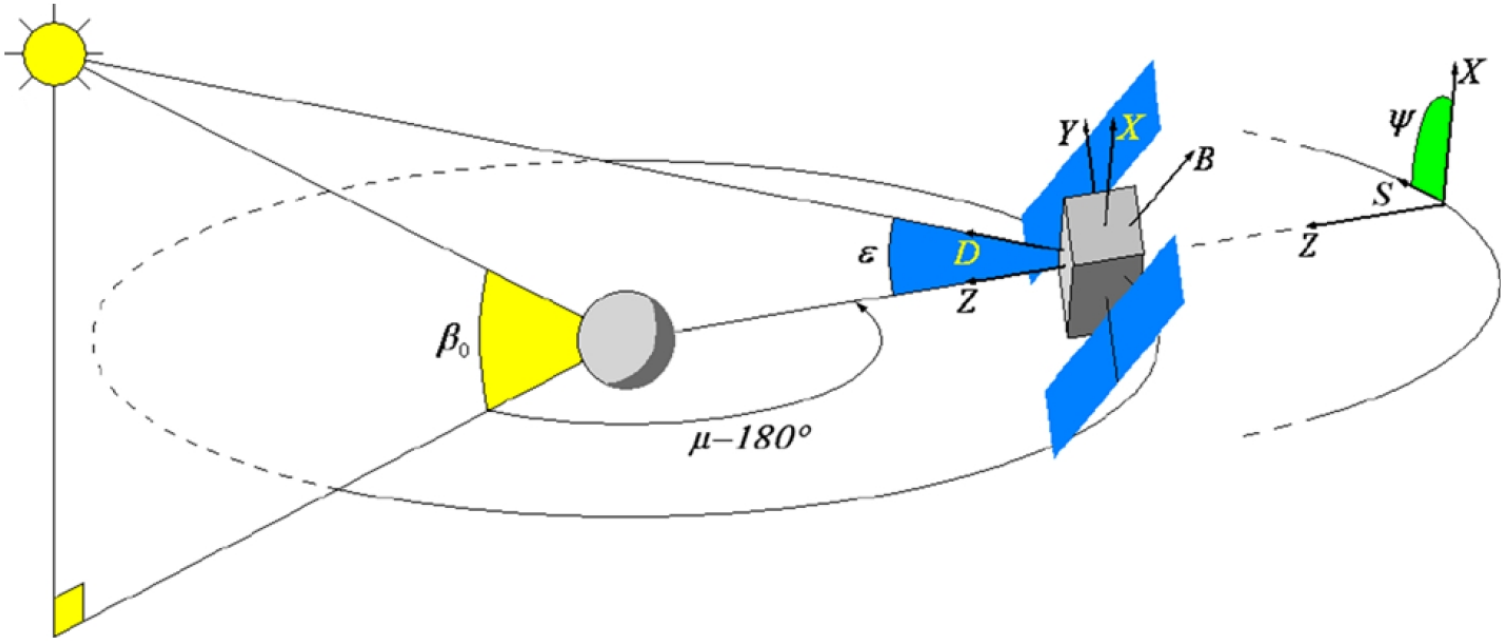
- in order to provide the best reference frame products, the latest GNSS orbit model was used (Arnold et al., 2015) for the full period of reprocessing efforts



	Parameters estimated in		
	D	*Y*	*B*
Original ECOM	constant	constant	constant, 1-cpr
Extended ECOM	constant, 2-cpr, 4-cpr	constant	constant, 1-cpr

Processing Scheme

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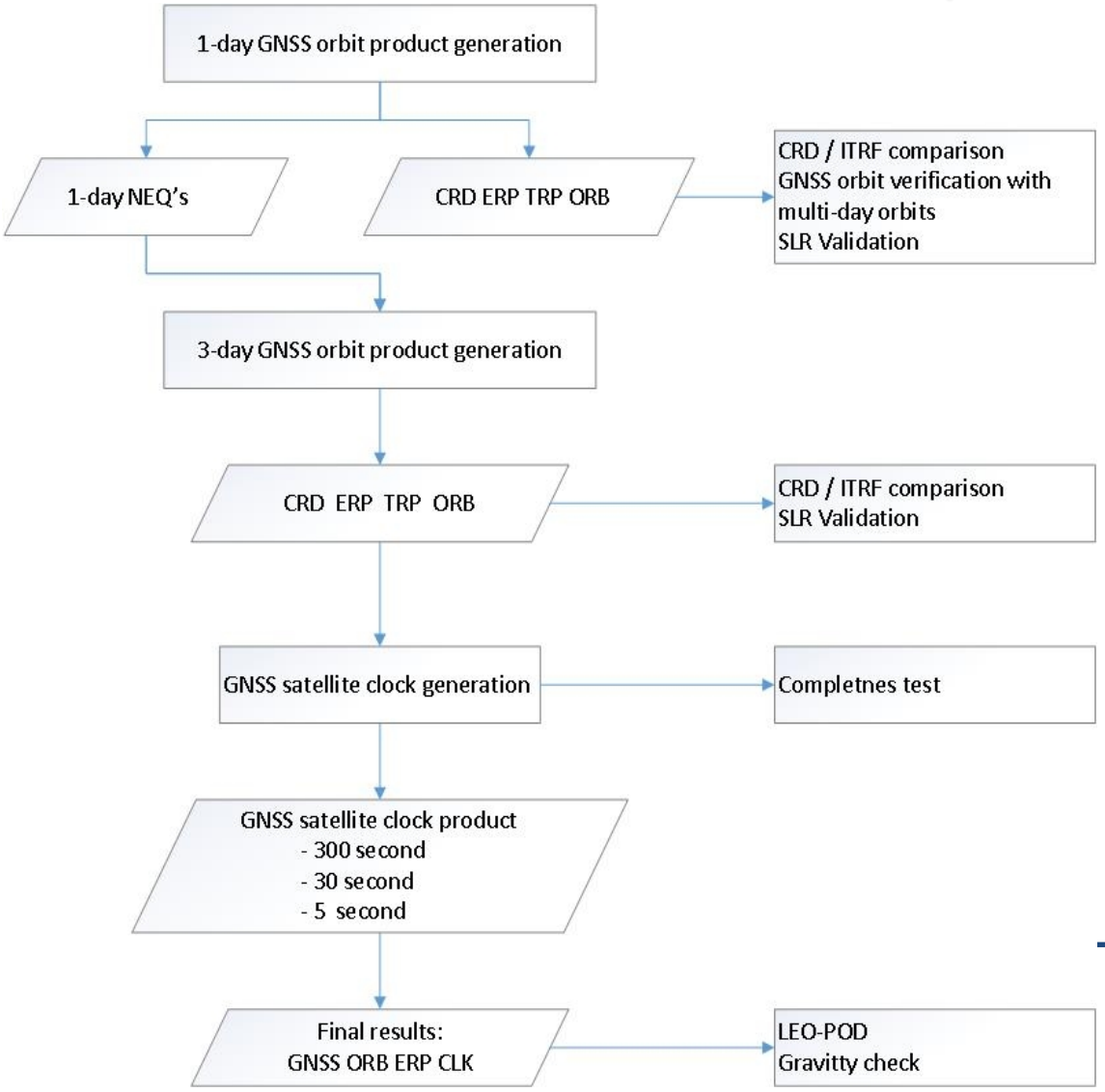

- as the basis for the GRACE orbit determination, based on its onboard GPS receivers, GNSS satellite orbits, Earth rotation parameters (ERP's) and GNSS satellite clock corrections (at 30 and 5 s sampling rate), attached to the IGb08 reference frame are computed
- during the processing several quality control steps were established

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Processing Scheme

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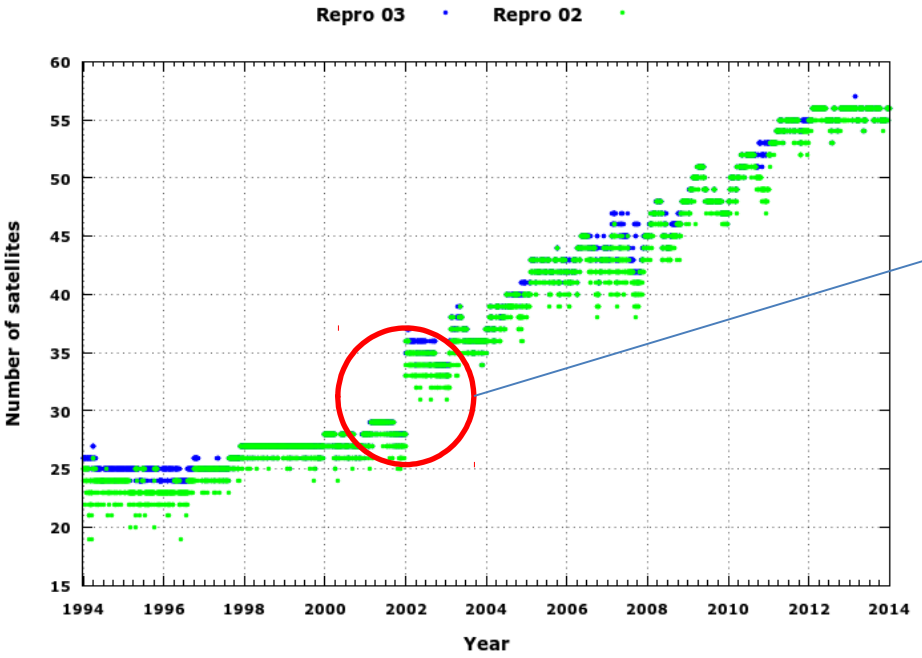
1-day GNSS orbit product generation

- original GNSS observations in RINEX files (RINEX2 format)
- as a priori orbit information the results from repro02 were used and completed with alternative sources (i.e., broadcast orbits)
- based on repro02, all known RINEX inconsistencies are corrected
- full pre-processing and ambiguity resolution scheme is applied (DD, receiver and satellite clocks are pre-eliminated)



Inclusion of GLONASS

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Processing Scheme

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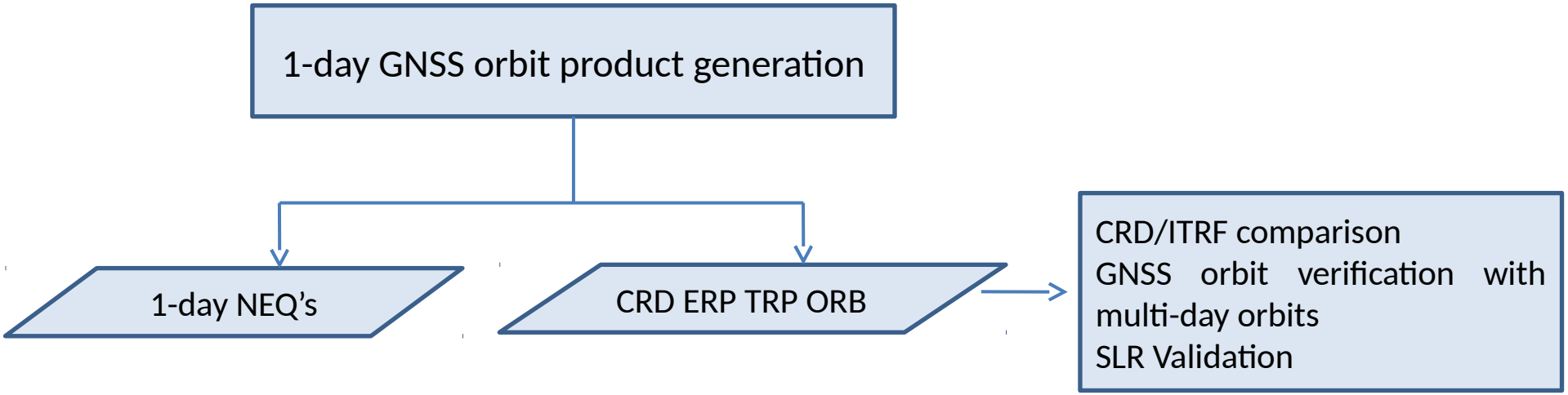
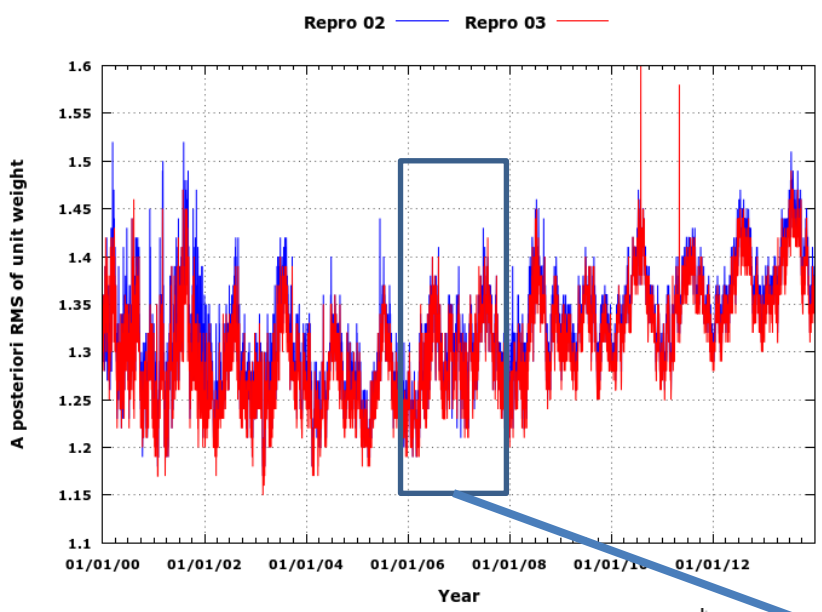


- main product are 1-day NEQ's, containing GNSS satellite orbit parameters, ERP's, coordinates and troposphere zenith path delay parameters



EOSIEM

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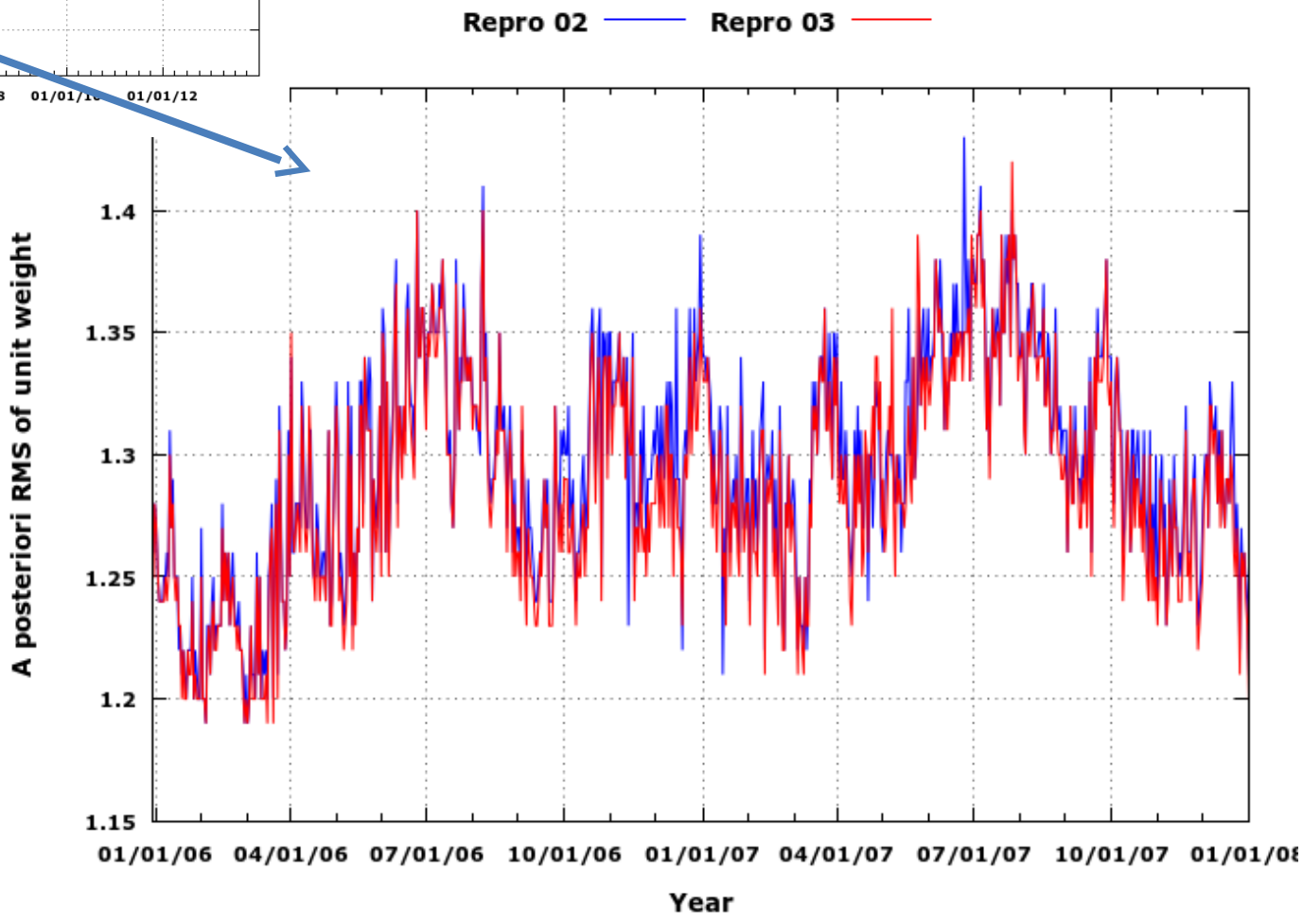

EOSIEM

SLR validation

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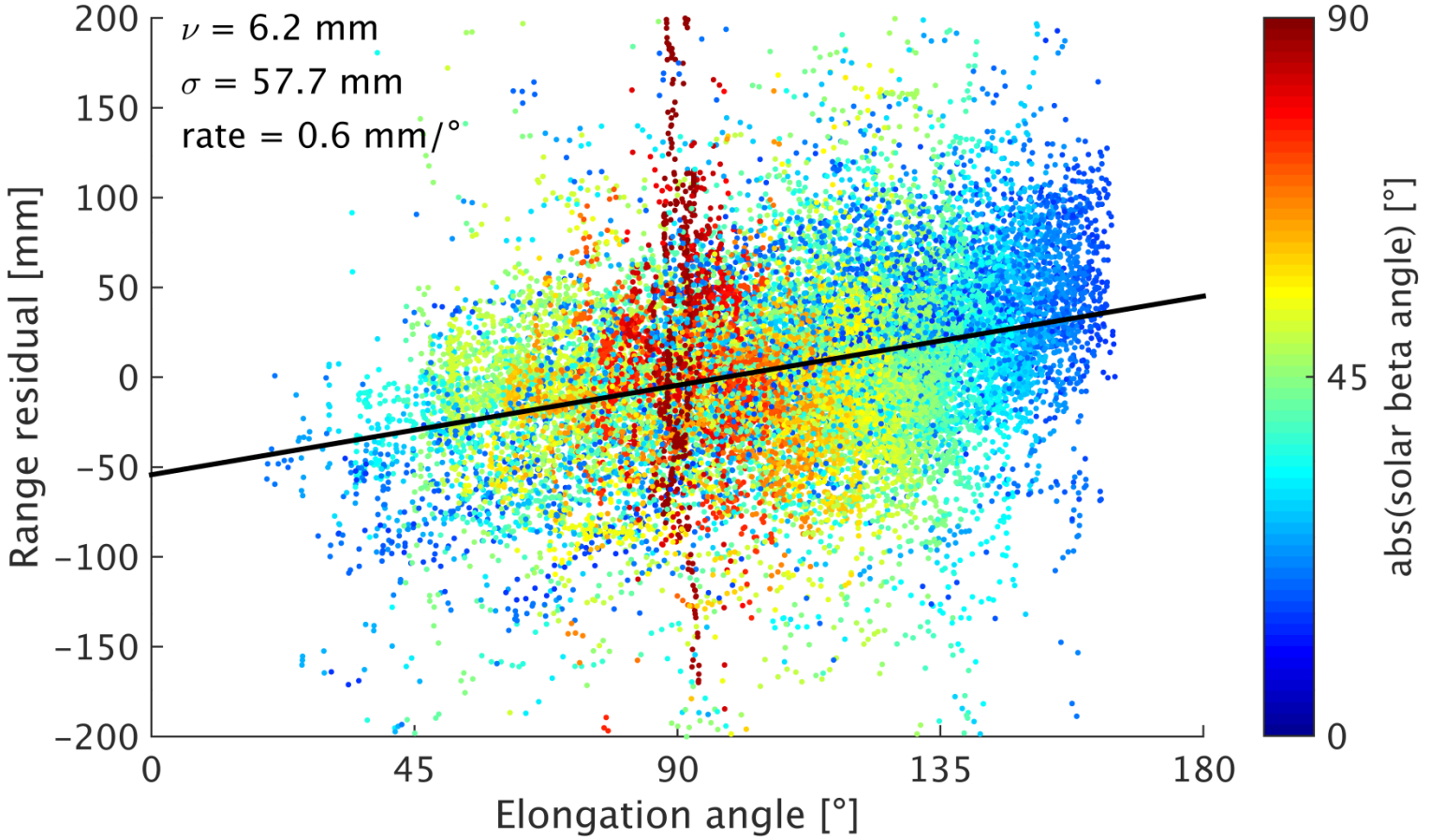

SLR validation

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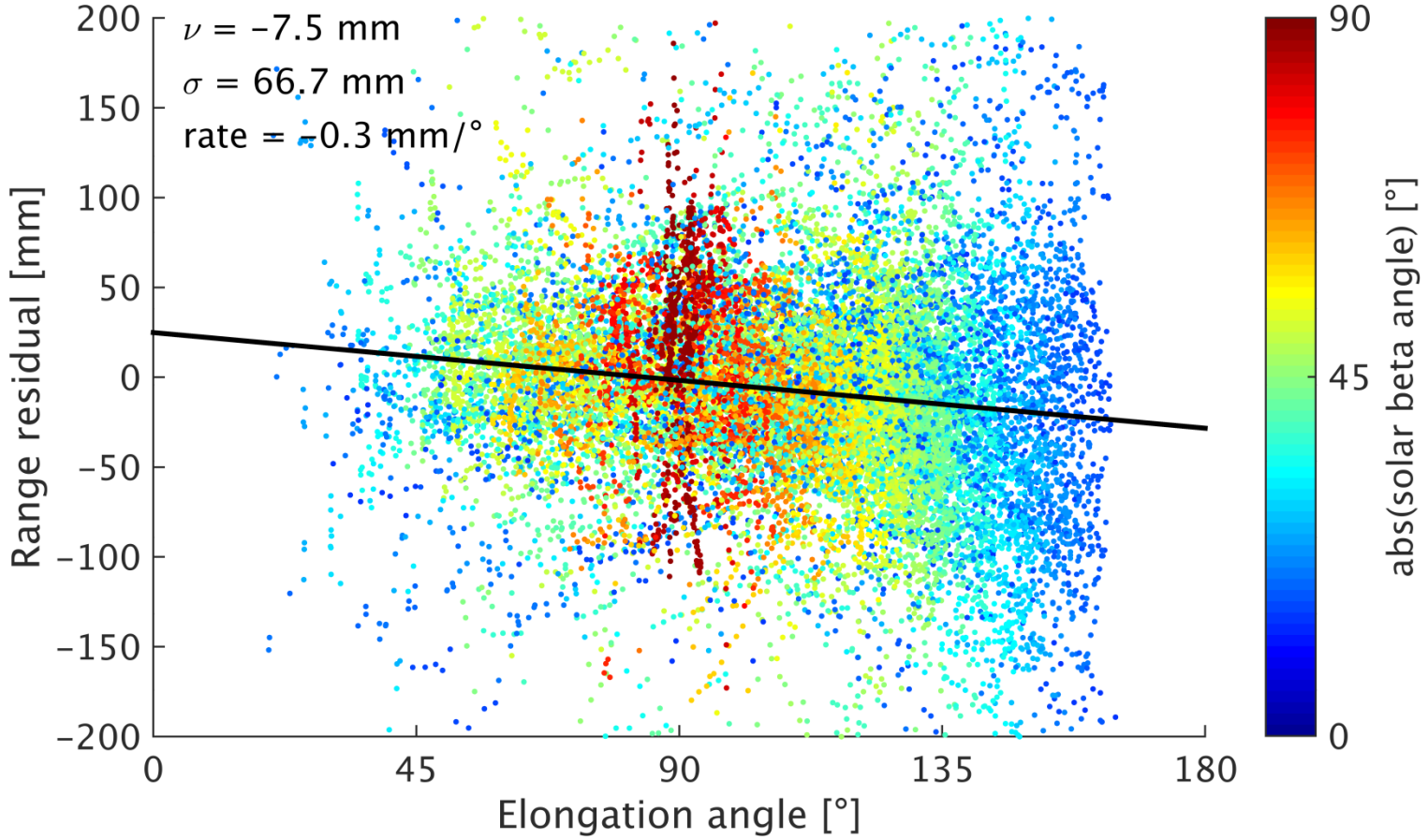
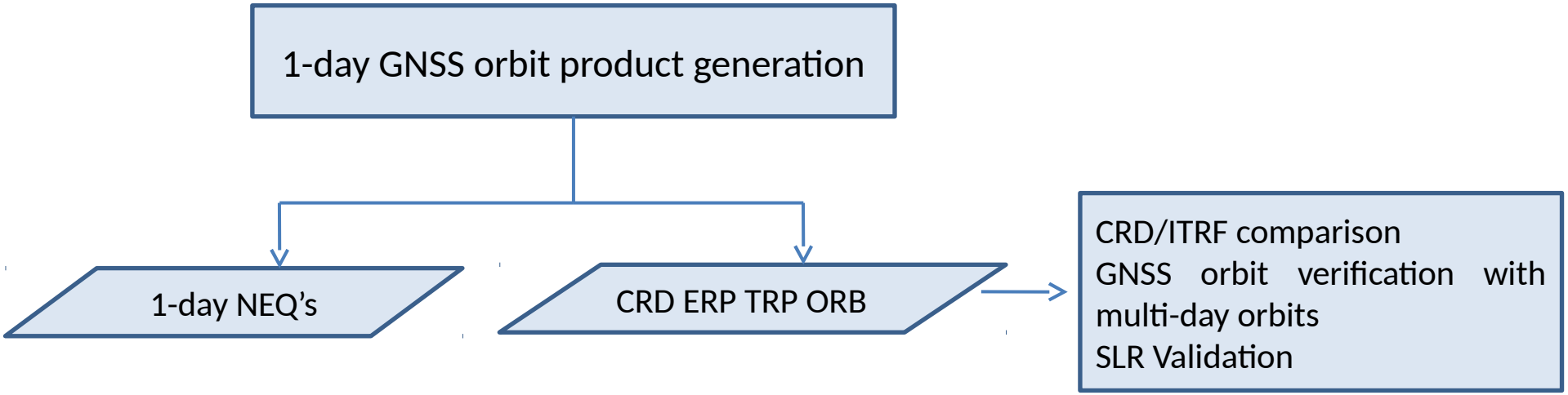
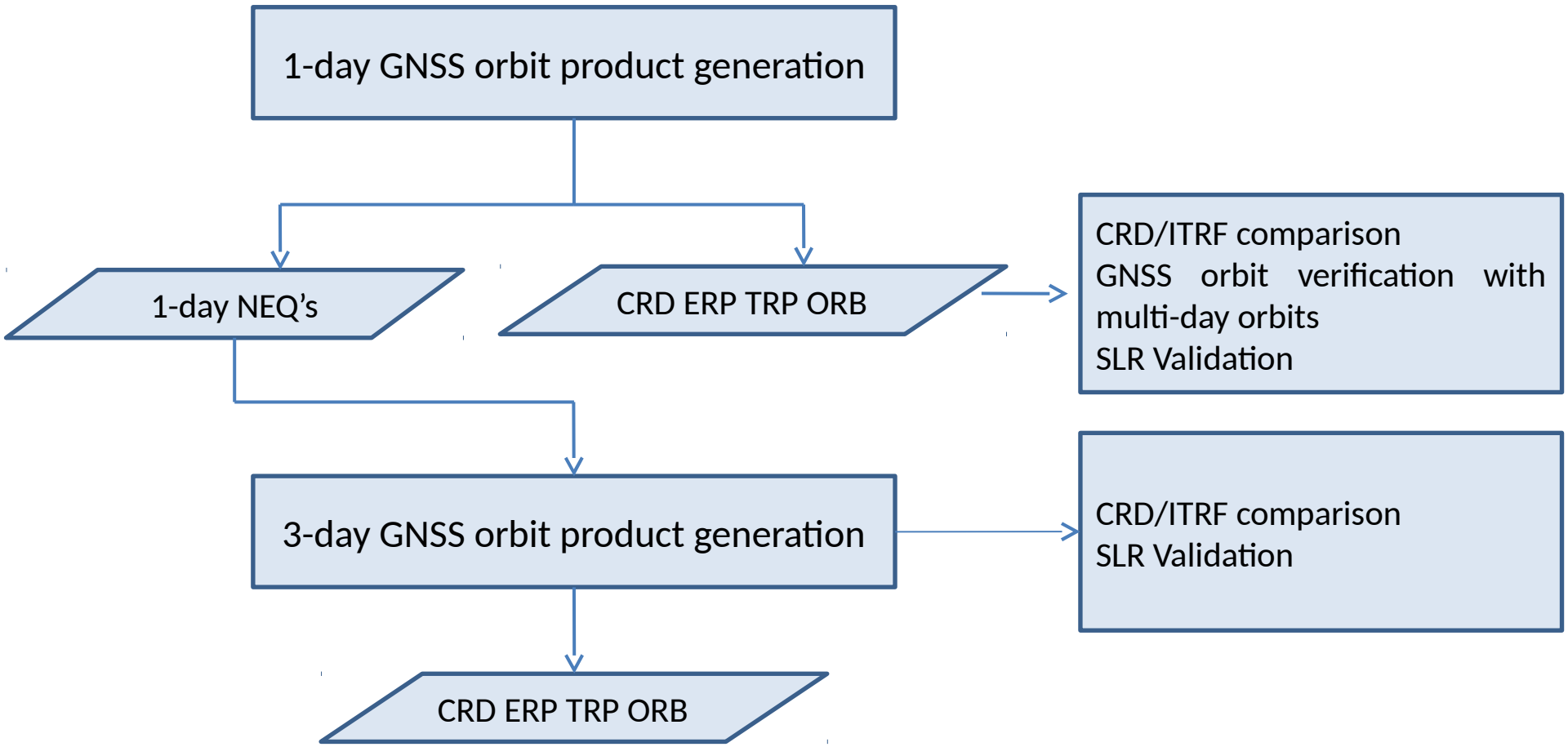


Processing Scheme



- in next step the consistency of three subsequent one-day orbits is verified
- additionally, a verification of the station related parameters is performed
- all remaining RINEX inconsistencies are corrected
- after these preparatory steps three subsequent NEQs are combined and solved to a three-day long-arc solution

Processing Scheme



Processing Scheme

- in the next step, GNSS satellite clock generation is performed
- the procedure is based on Bock et al. (2009) and it has been extended in the frame of the project to a GPS and GLONASS combined processing scheme

Processing Scheme

European Gravity Service for Improved Emergency Management

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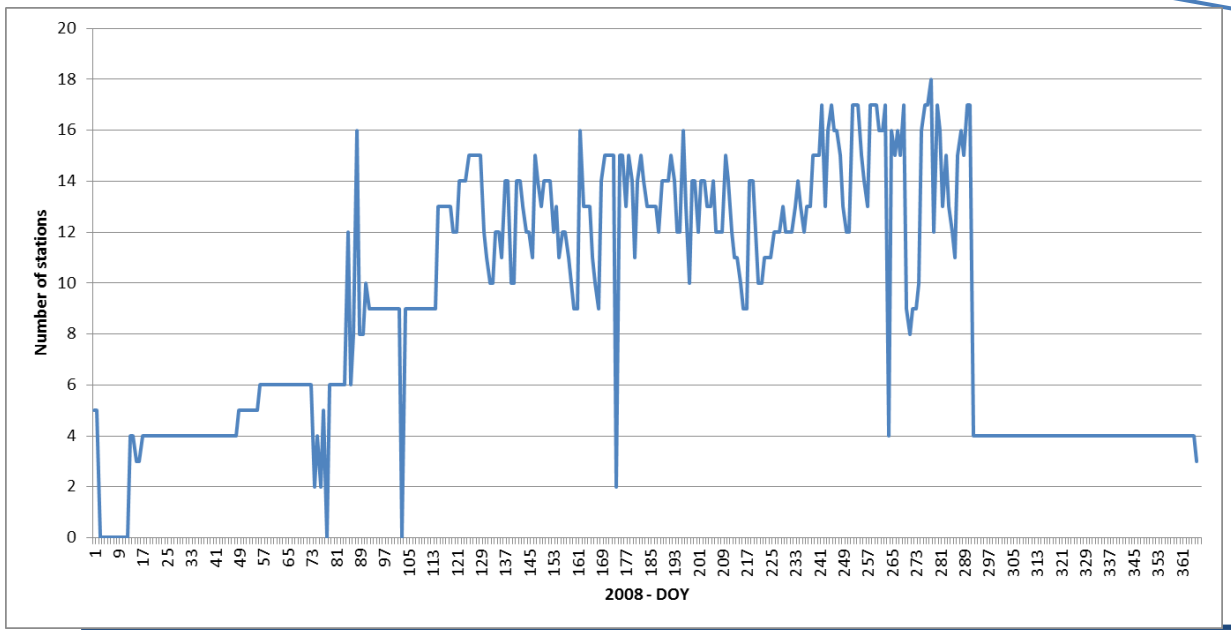

- due to very sparse availability of GLONASS data, we have included GLONASS from 2008 onwards in 30 s satellite corrections, while before 2009 GLONASS is completely excluded

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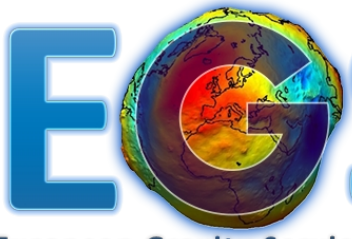
GNSS satellite clock generation



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Pre-processing

Clean code + phase
Smooth code

screening of post-fit residuals

Screening
station-by –station
1. Phase only
2. Code only
3. Phase + Code

low-rate clock solution

3 global clusters
45 stations/cluster

combination +merging

5- min clocks

high-rate clock solution

EHRI from 5 min to 30 s

EHRI from 30 s min to 5 s

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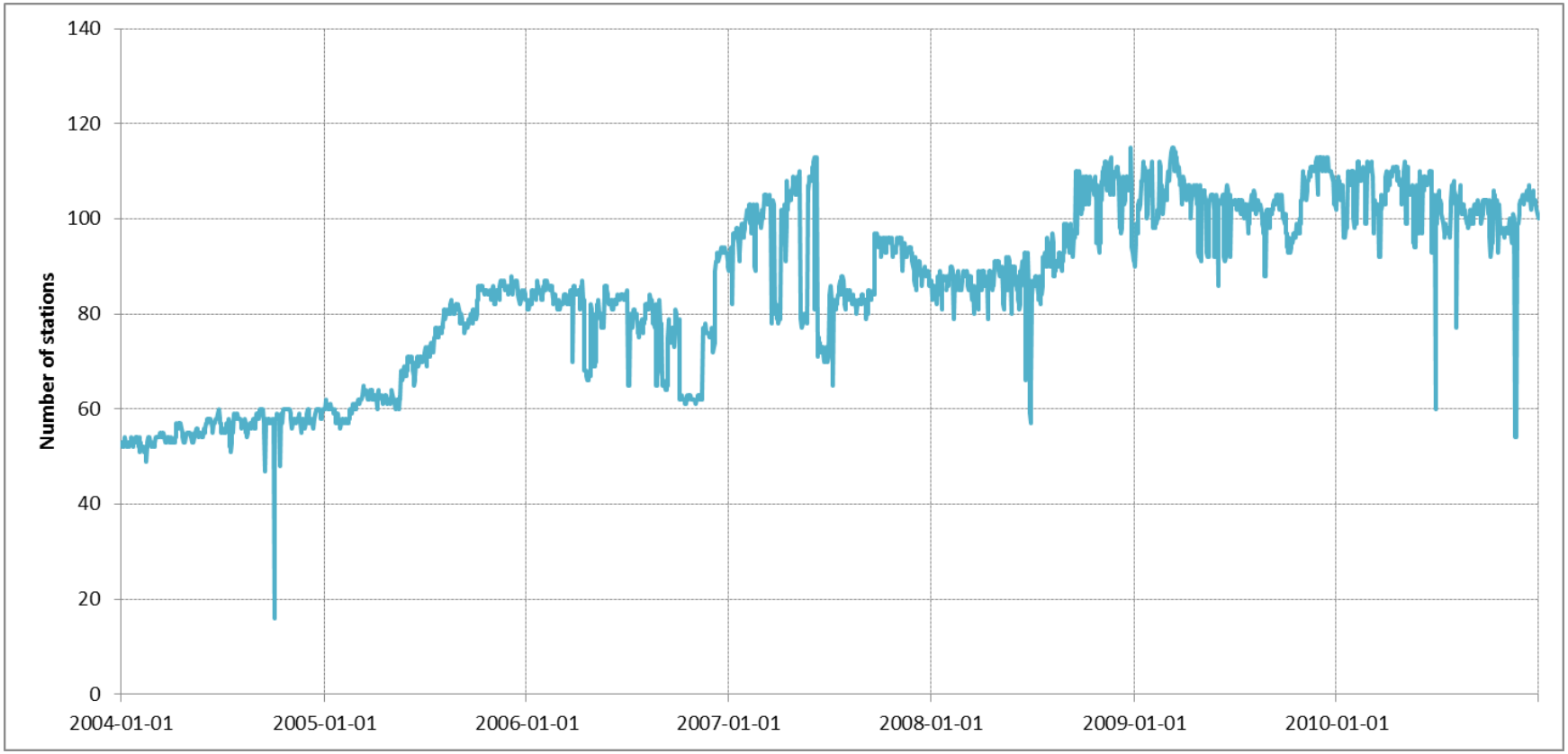

High-rate RINEX2 station data availability at AIUB datapool, for the period between 2004-2010

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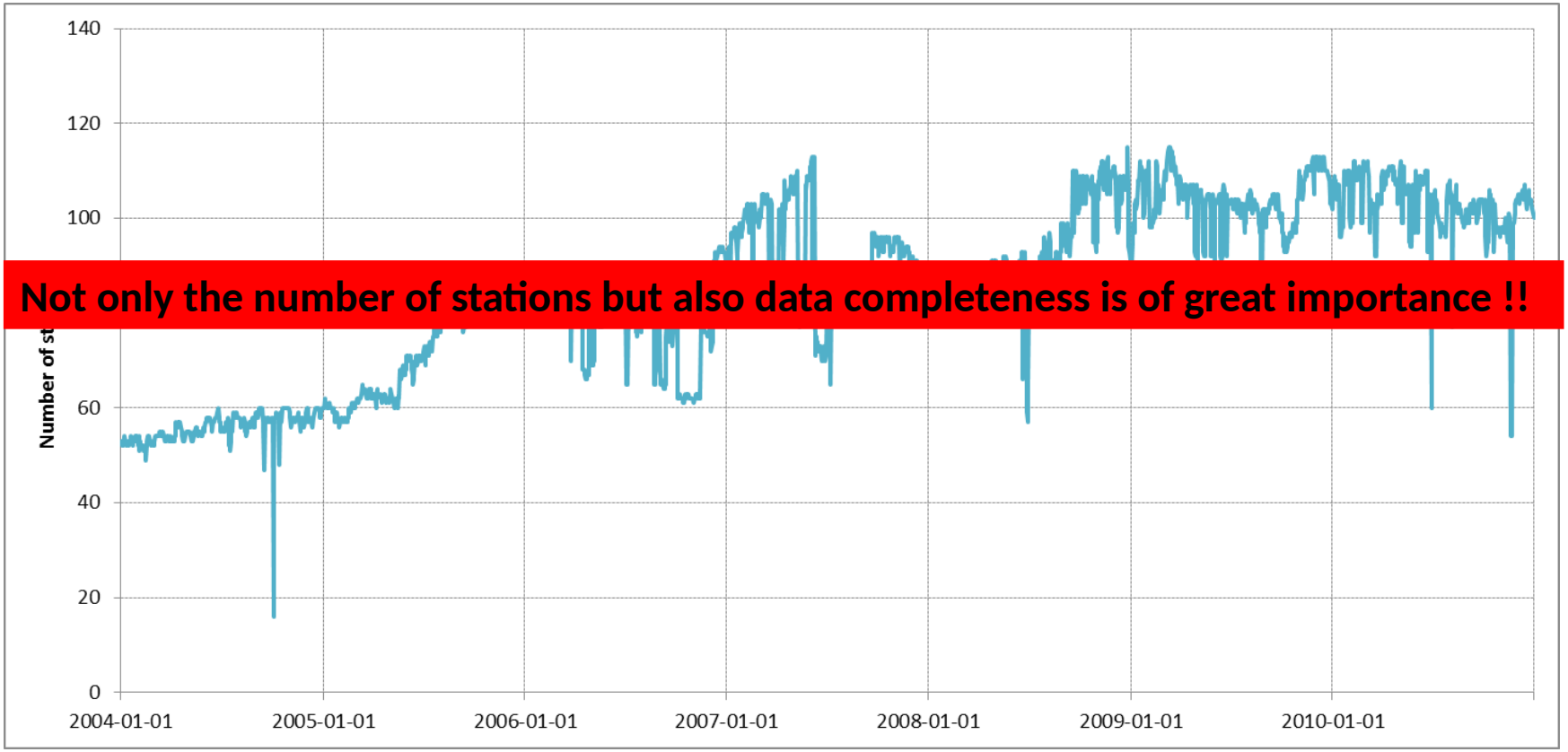
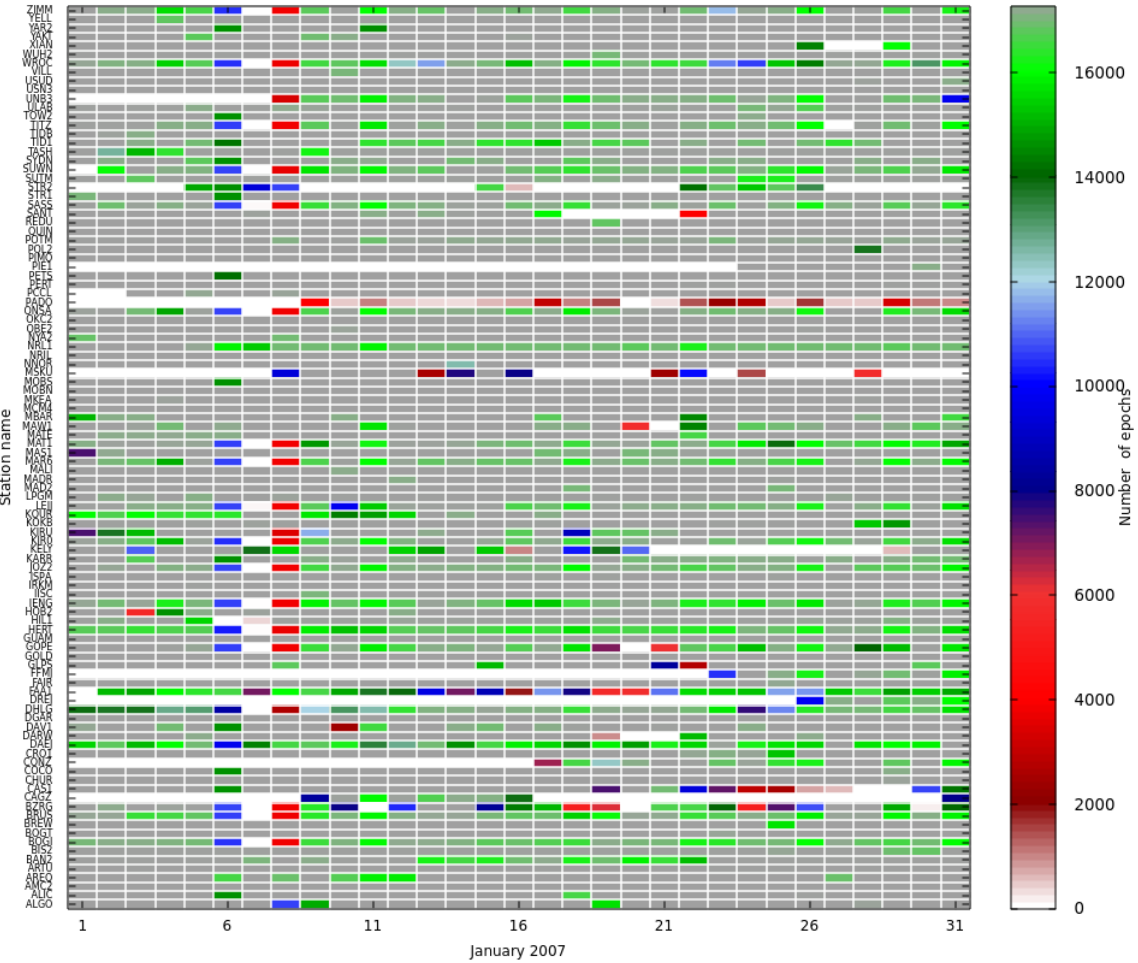


Not only the number of stations but also data completeness is of great importance !!

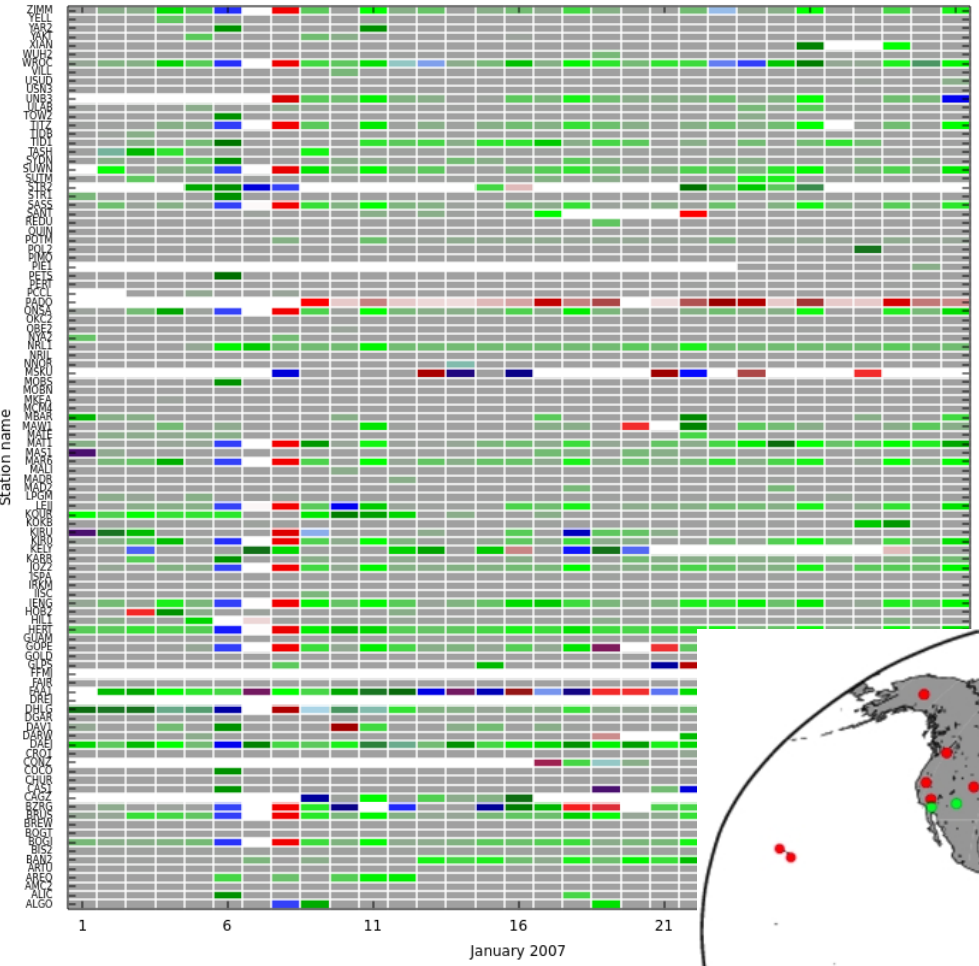
High-rate RINEX2 station data availability at AIUB datapool, for the period between 2004-2010



ty Service for Improved Emergency Management

grey color present full completeness

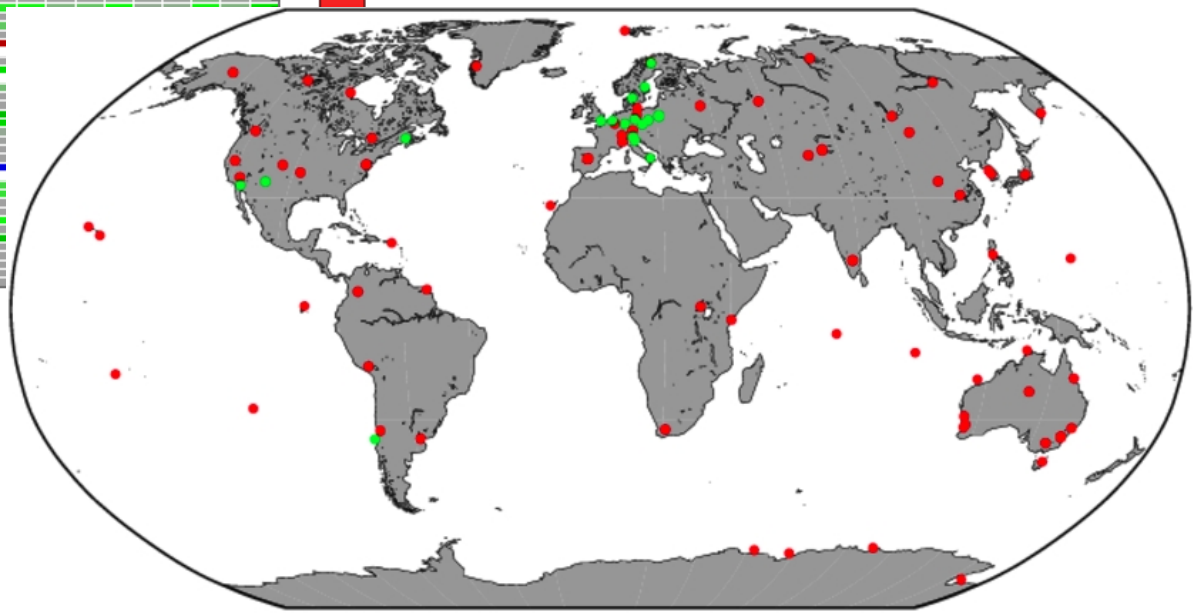
HORIZON 2020



ty Service for Improved Emergency Management

7 Januar 2007

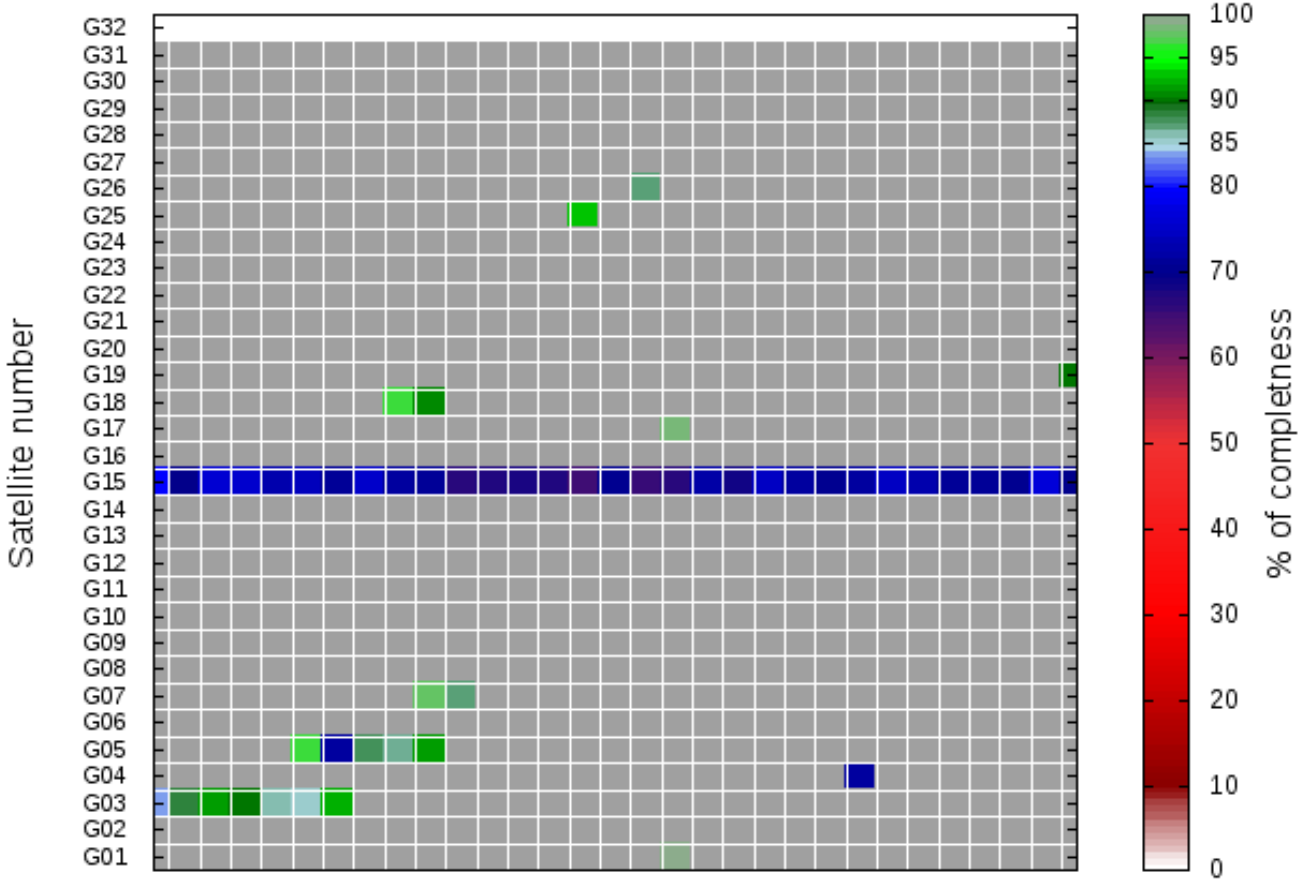
27 Januar 2007



grey color present full completeness

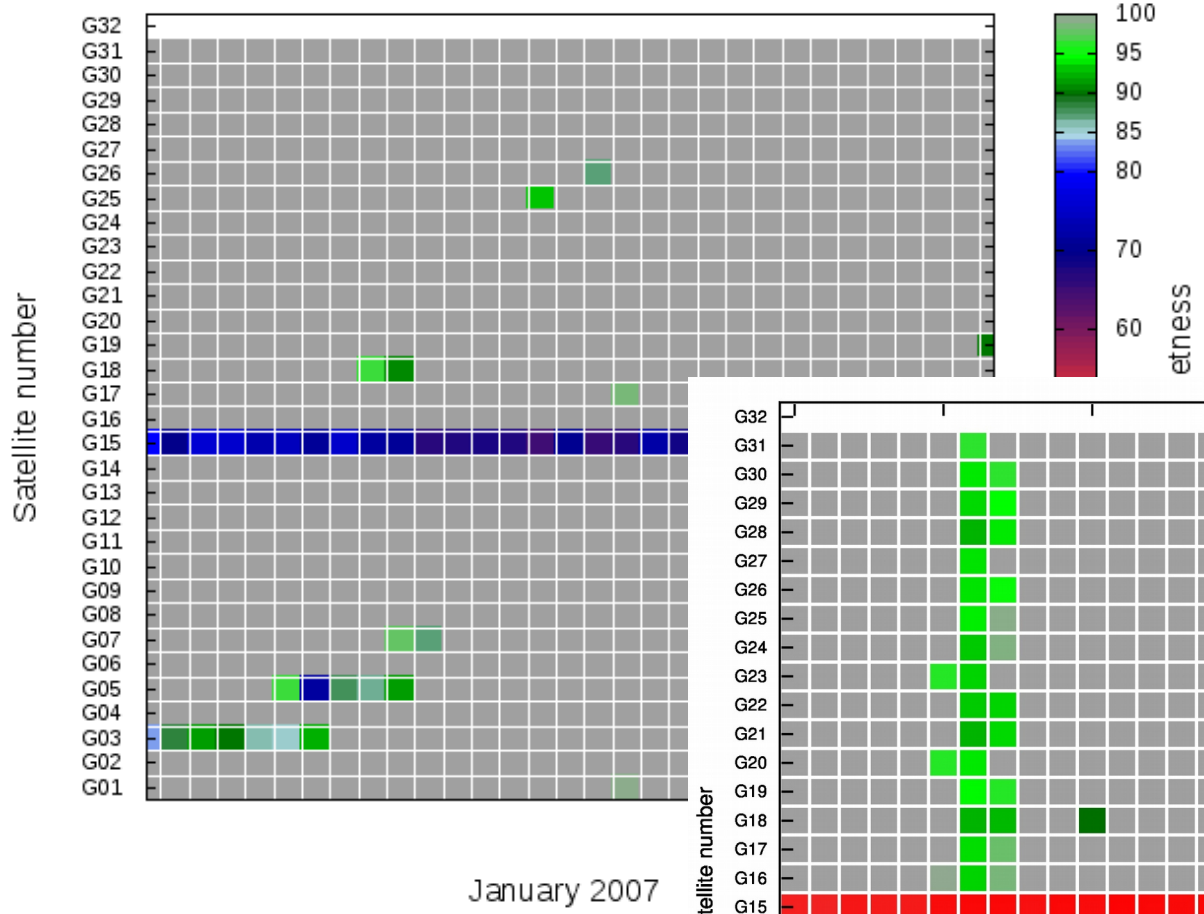
HORIZON 2020

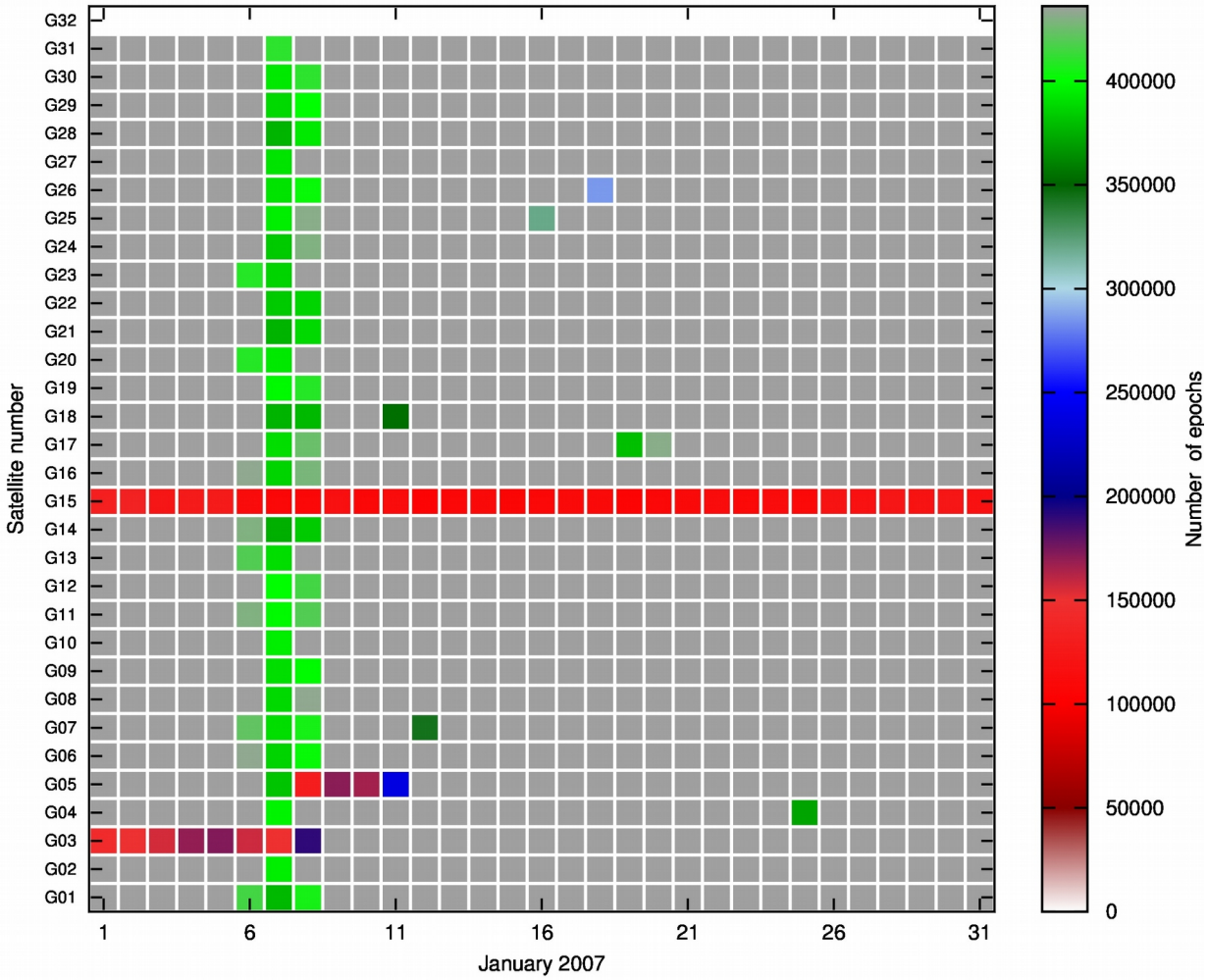
5s clock product completeness



grey color present full completeness

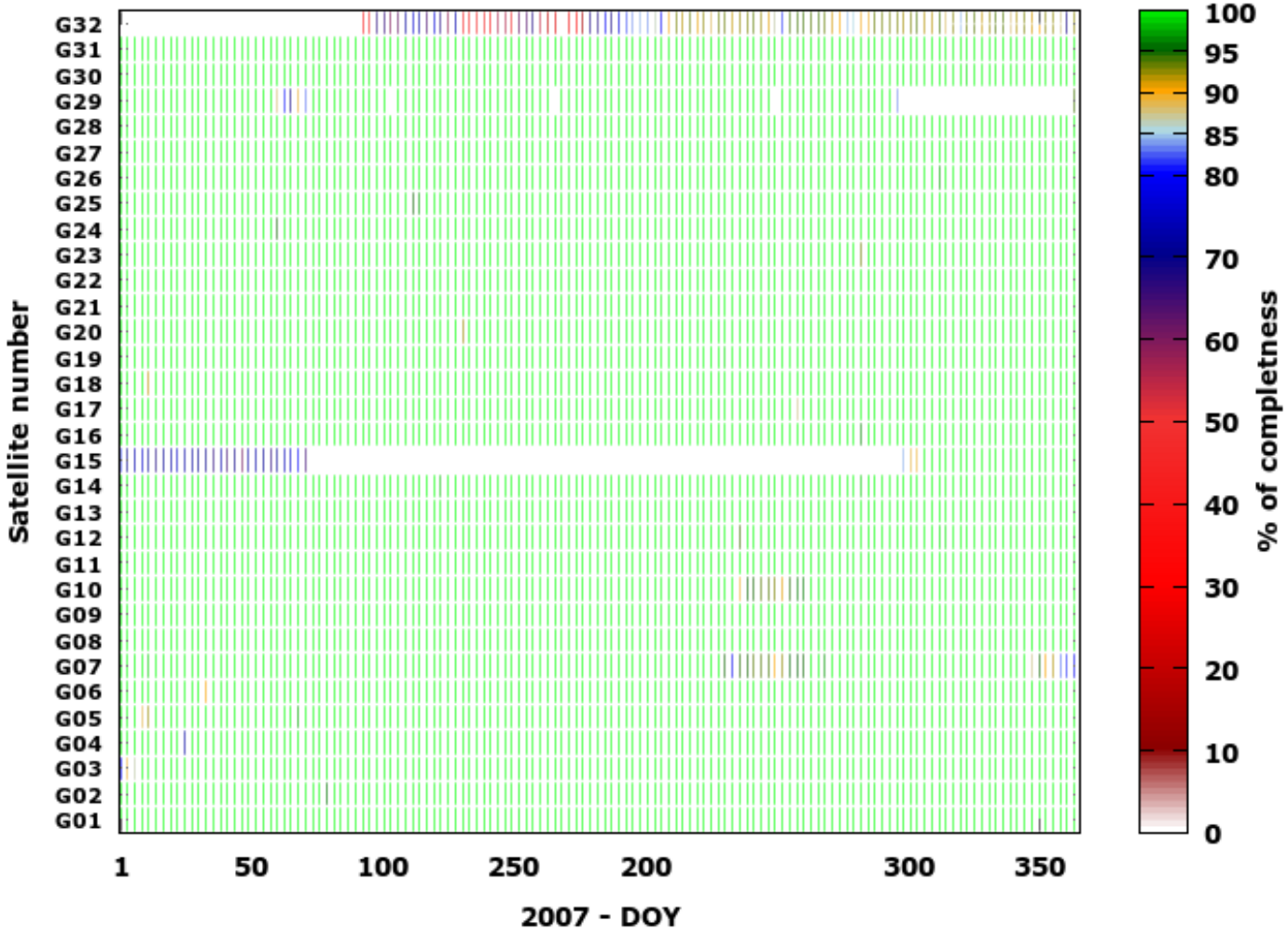
January 2007



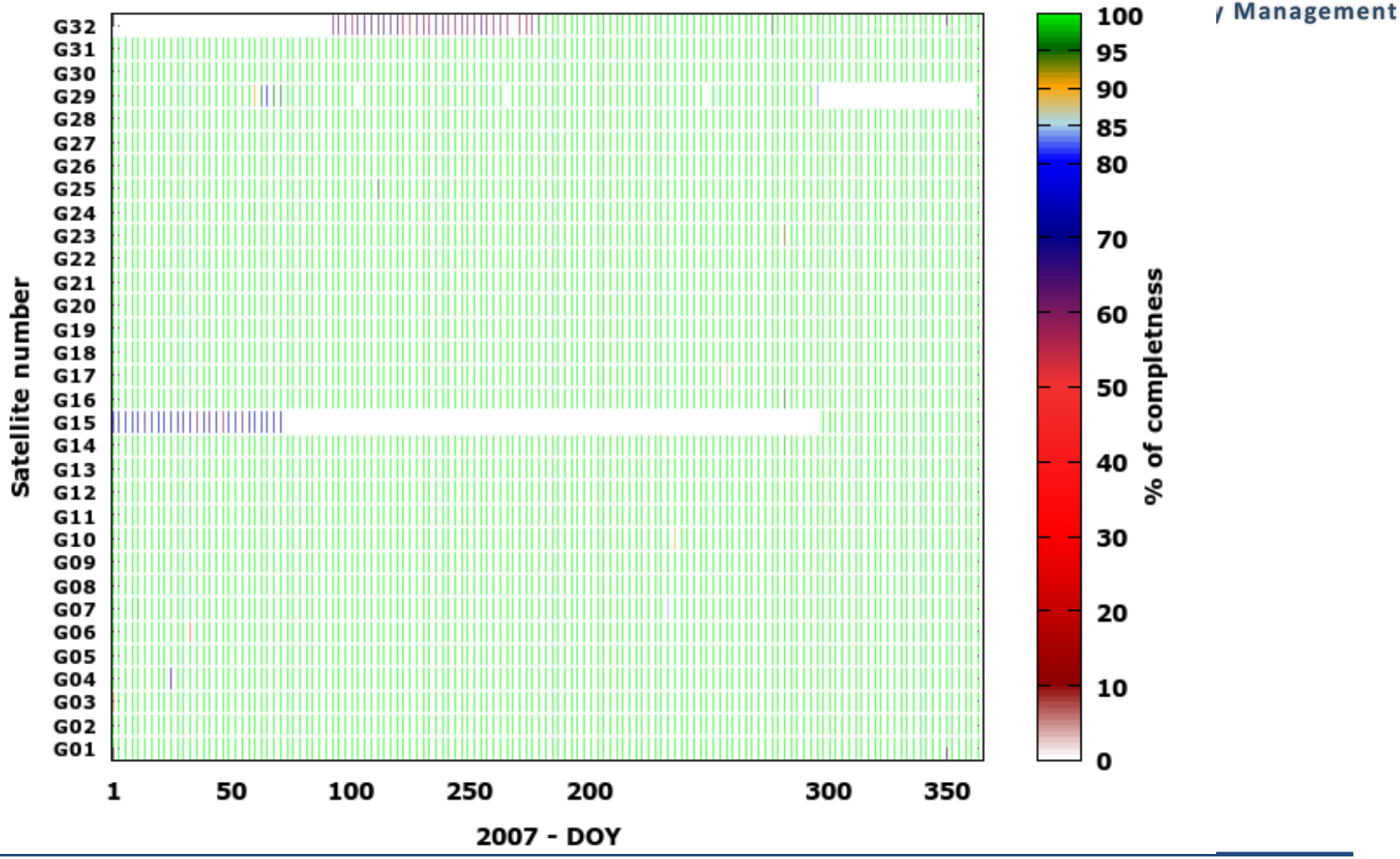


grey color present full completeness

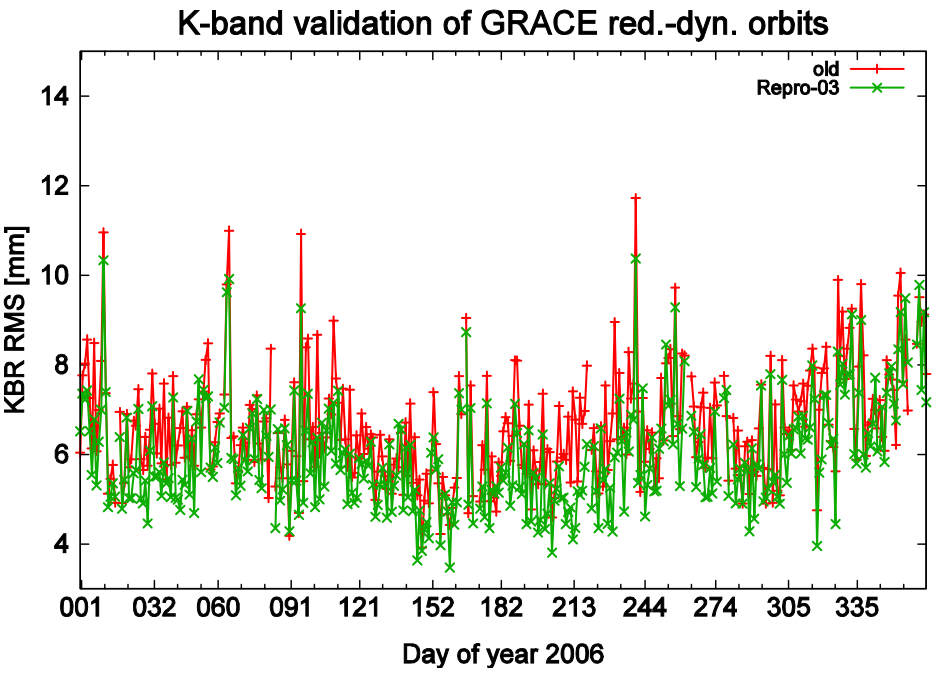
5s clock product completeness

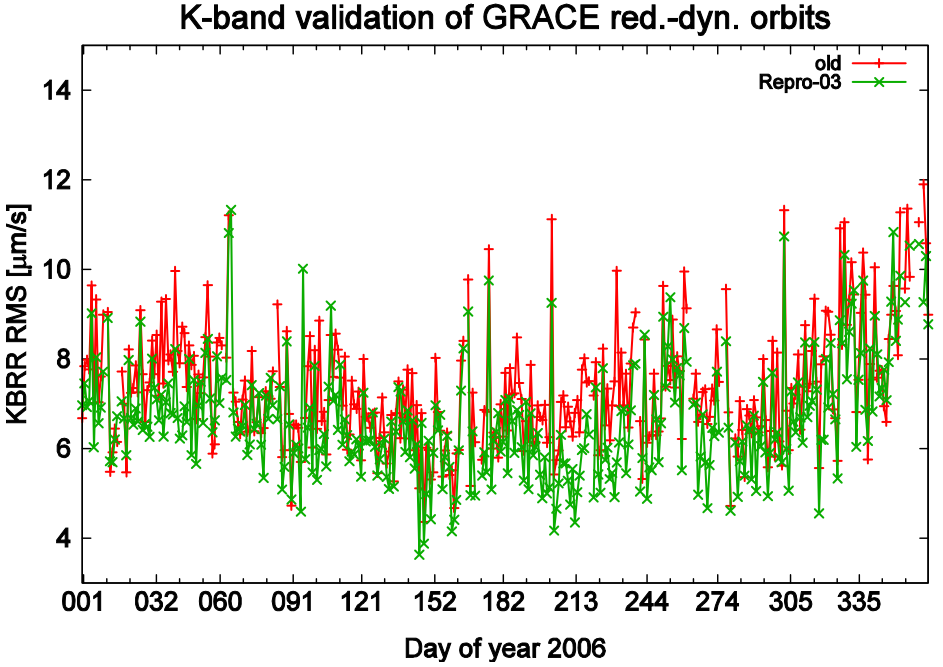


30s clock product completeness



Validation by GRACE Orbit Determination





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Validation by GRACE Orbit Determination

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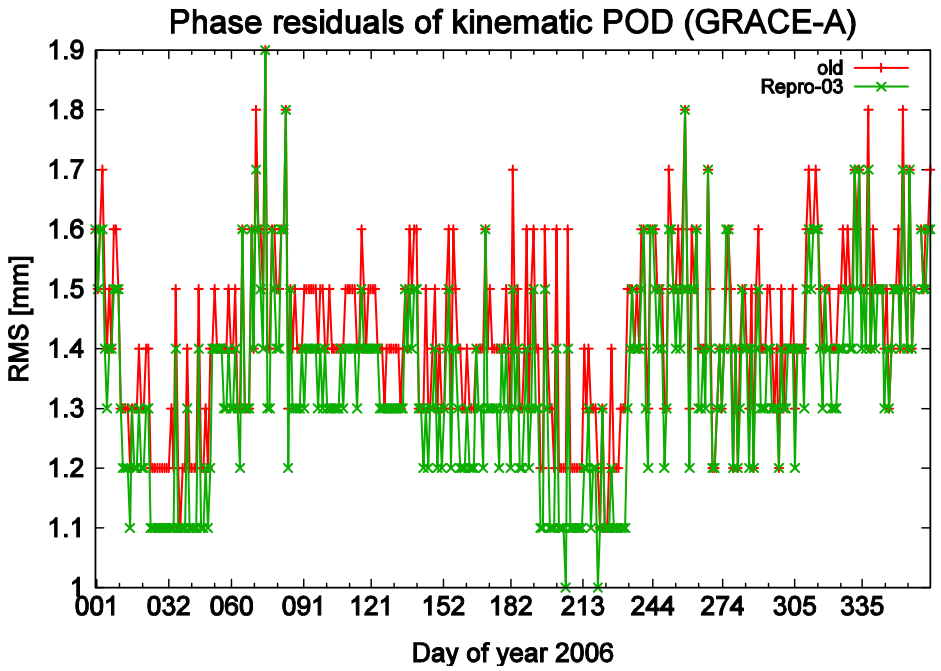

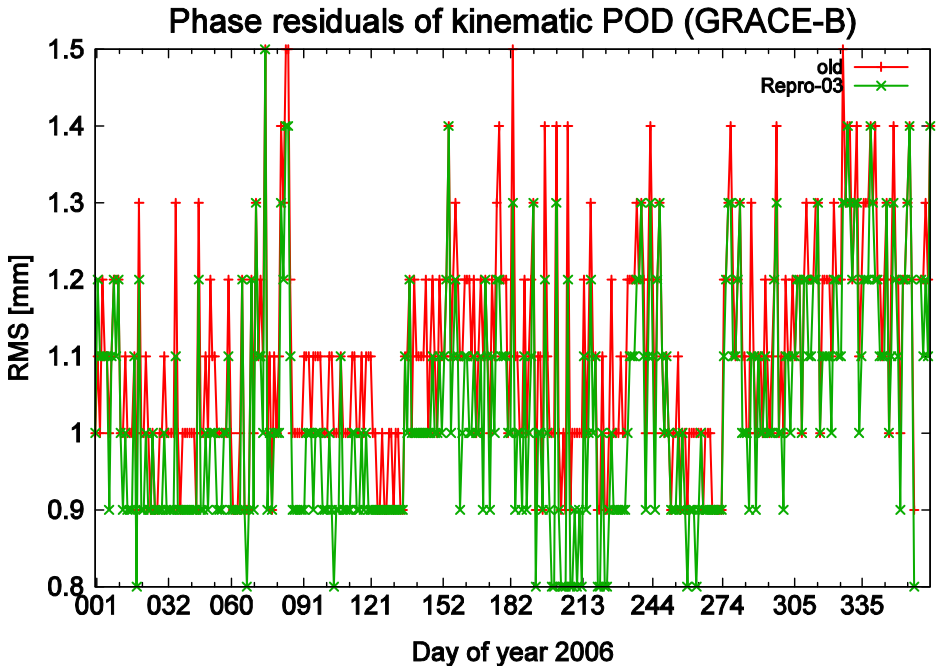

Validation by GRACE Orbit Determination

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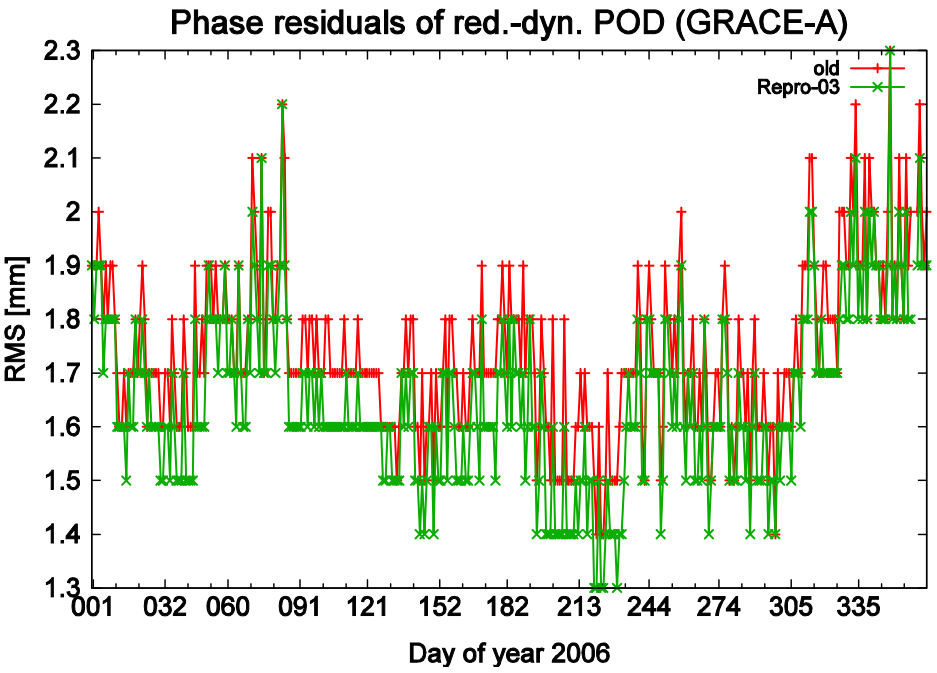

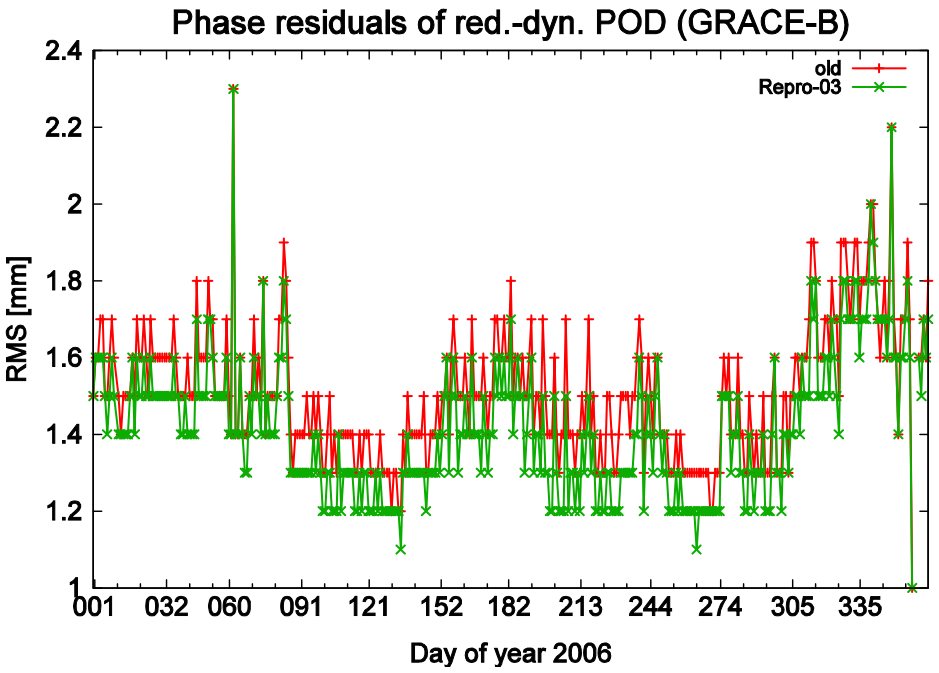

Products

European Gravity Service for Improved Emergency Management

- Reference Frame Products:

  ftp://ftp.unibe.ch/aiub/users/susnik/.data/2006/

  ftp://ftp.unibe.ch/aiub/users/susnik/.data/2007/

- GRACE orbits:
  - will be available by the end of the month