

WP5: Status & Milestones

Deliverable 5.1: NRT service concept

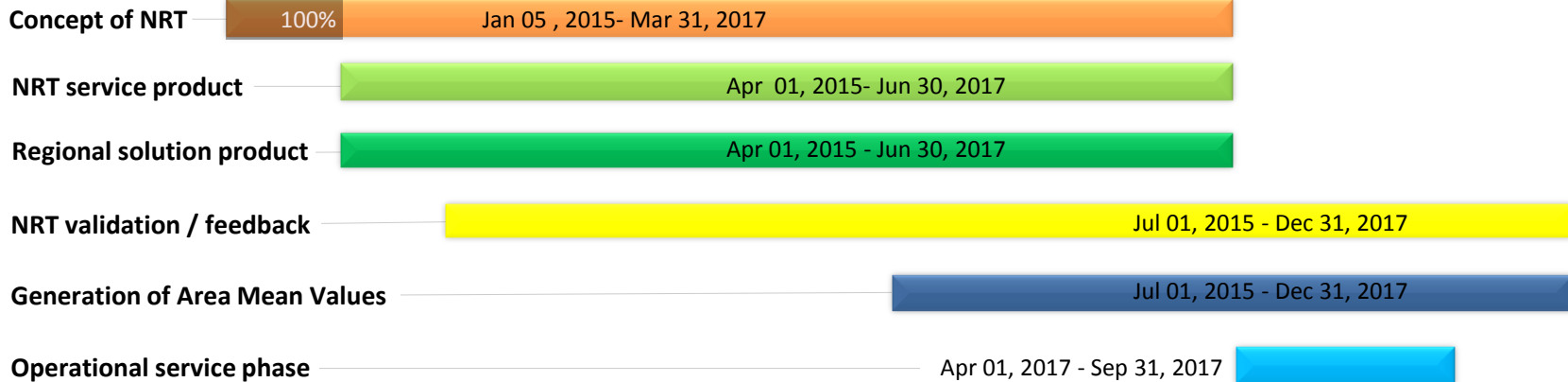
EGSIEM Meeting, University of Luxembourg

Jan 17 – Jan 18, 2016

Project Plan



Today

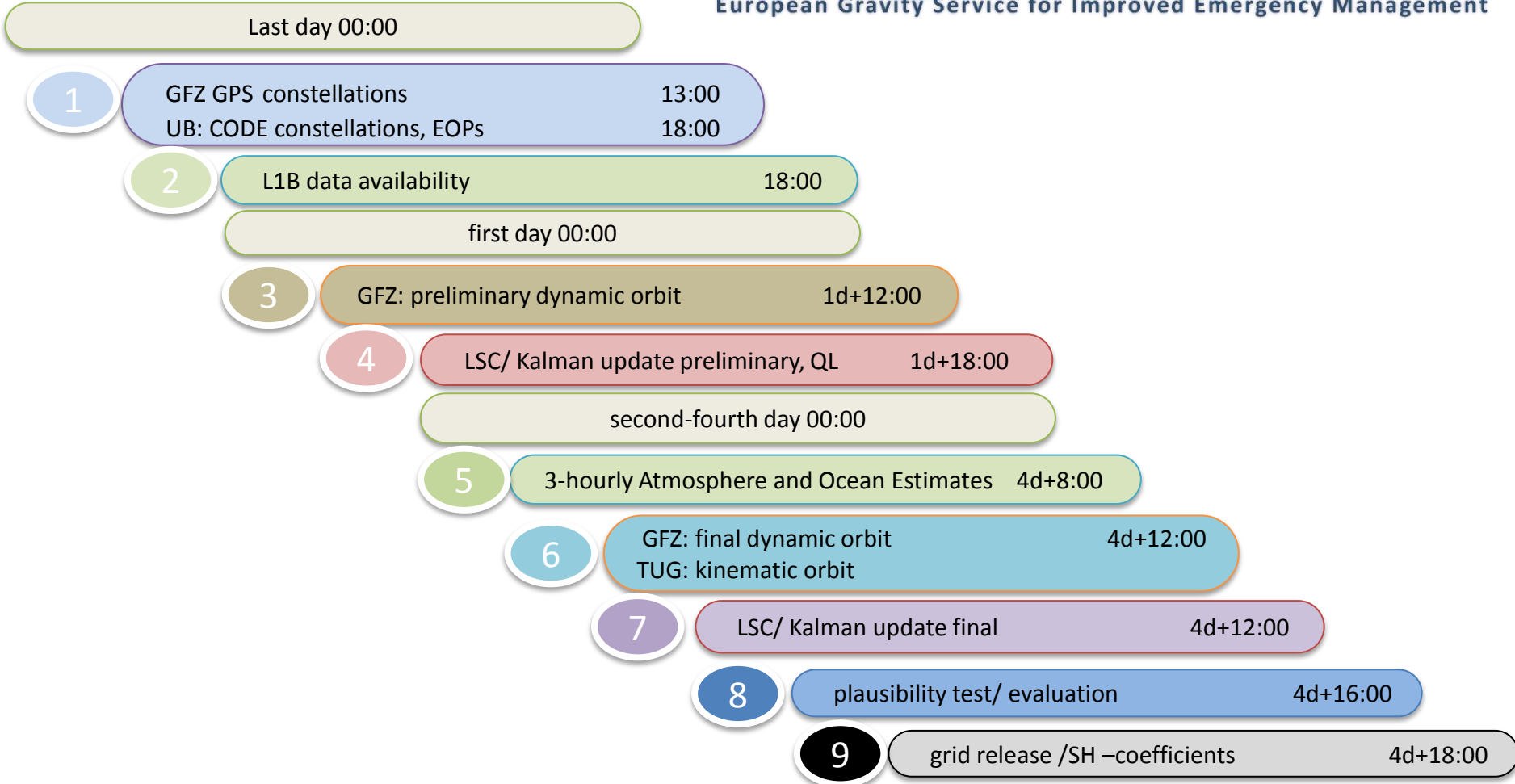


Input data for gravity recovery and latencies

Product	Source	Current Latency (IP)	Required Latency (OP)
EOP	IERS/UBERN	IERS: 1-3 days, UBERN: 14 days	IERS: 1-3days, UBERN: 17 hours
GPS Orbits/Clocks	UBERN (T3.4)	14 days	17 hours
GRACE L1B Data	JPL, Backup: GFZ	11 days	1 day *
Dealiasing Product (AOD1B) Specific hydrological basin (upon request)	GFZ	7 days	3-4 days
	WP3/6	Not available	1 day

*Needs to be clarified with GRACE-FO SDS

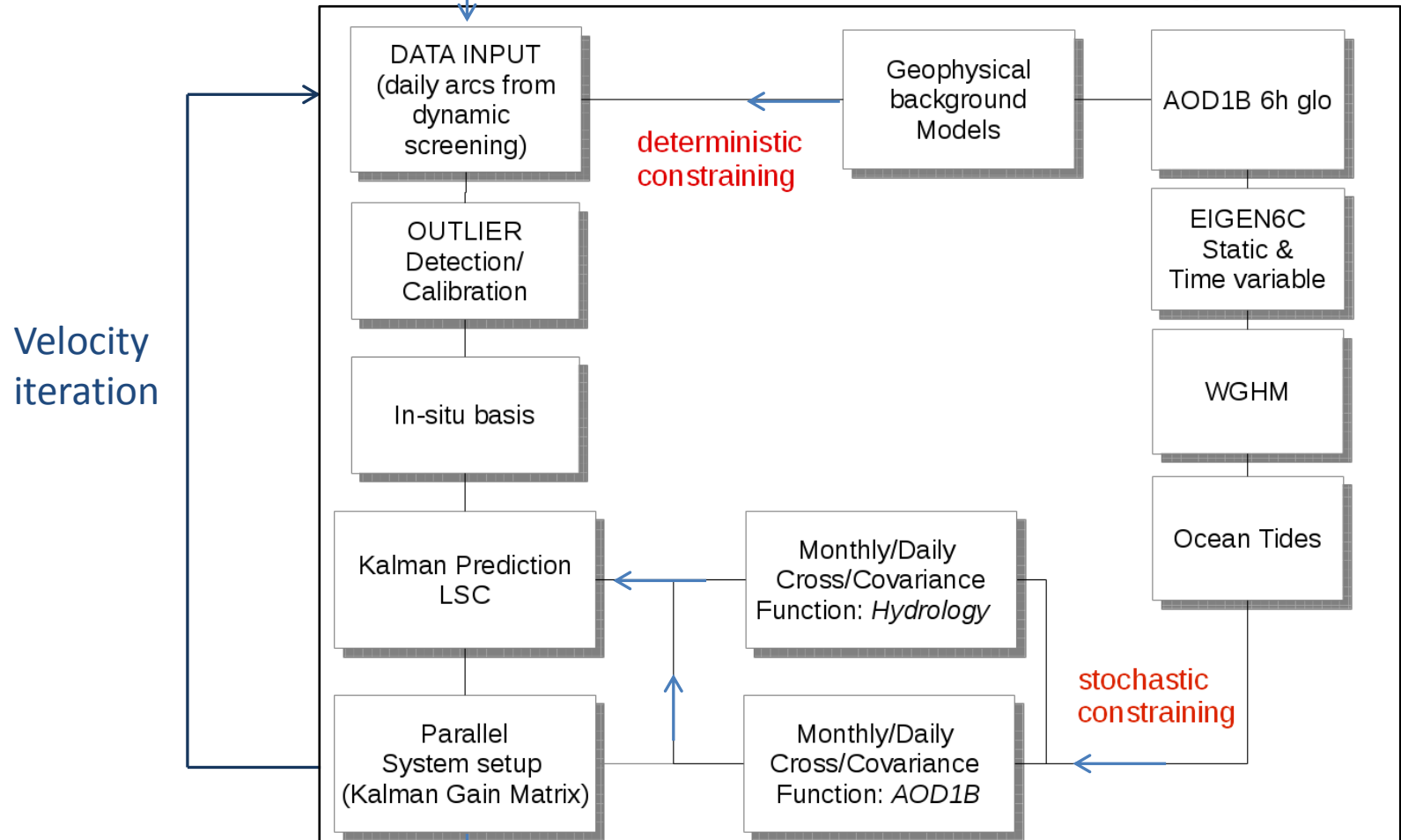
Production-flow



NRT@GFZ



European Gravity Service for Improved Emergency Management



EGSIEM Progress Meeting, University of Luxembourg Jan 17 – Jan 18, 2015



HORIZON 2020



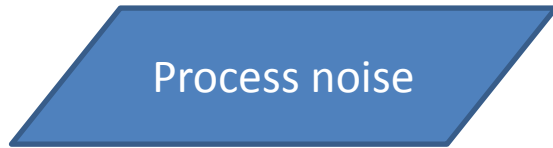
- Ocean tides (EOT11a)
- Atm tides S1,S2 (Bode/Biancale)
- Solid Earth & Pole Tides (Desai)
- 3rd body ephemerides (JPL de421)
- EOP's (Susnik et al.)
- GPS clock's (Susnik et al.)
- GAC (glo, daily, RL6: ellipsoidal approximation)

STOCHASTIC MODELLING

- GAC (glo, daily, RL6: ellipsoidal approximation, improved OMCT)
- WGHM (Döll et al., 2002-2013)
- GRACE RL05a (2002-2015)



- 2x2 daily grid
- 2x2 operational anomaly to sec/seasonal model
- 1x1 grid regional product for refined areas of interest
- Error estimates for state vector / grid values



Standard auto/cross covariance estimates

- $\text{mean}\{ \text{GAC}(\text{daily}) - \text{meanGAC} \}$ → weight:50%
- de-seasoned HYDROL. model → weight:100%
- GRACE(monthly) residuals and formal errors from sec/seas model → weight:100%

Additional RMS to construct non- stationary (variances)

- + 20% GAC
- + 25% de-seasoned HYDROL. model
- + 30% GRACE residuals (and sec/seasonal model errors)

- secular and seasonal model = fitted reference model over past 7yrs

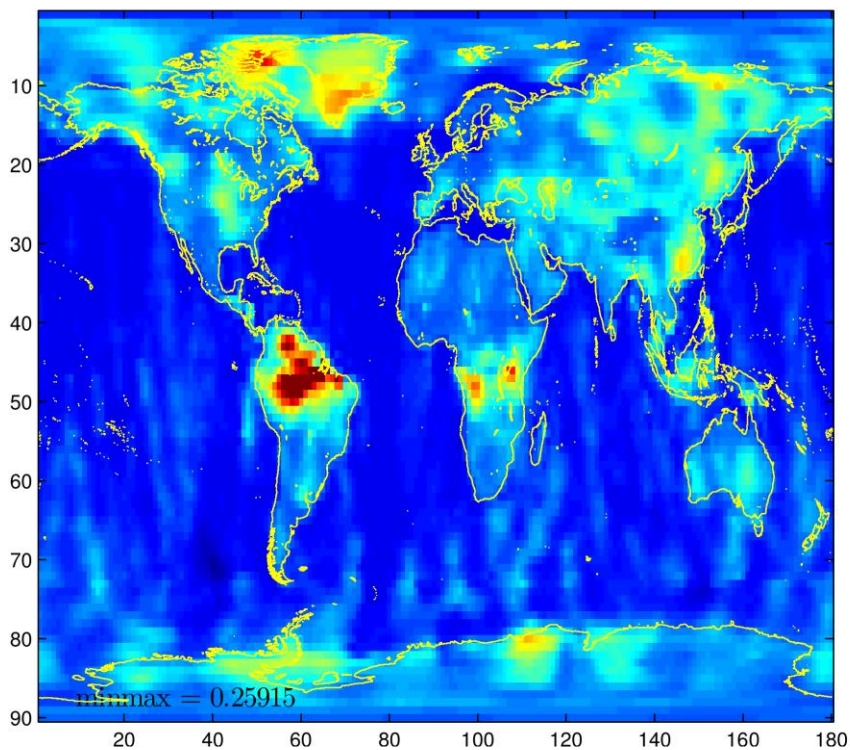
Program start

- Data acquisition
 - date/time, perturbation forces (*acc/o-tides/e-tides/lunisol/aod*), coordinates(*cis/cts*), Kband ranges
- Blunder detection (*acc*)
- Background model (gravity)
 - Static, SLR deg2, time-var (sec/seas. GRACE model: 50%, last Kalman day 50%)
- Proxy observation assembly I (pert. forces, sec/seas. model)
- Blunders, cycle/rev-param estimation (*kim*)

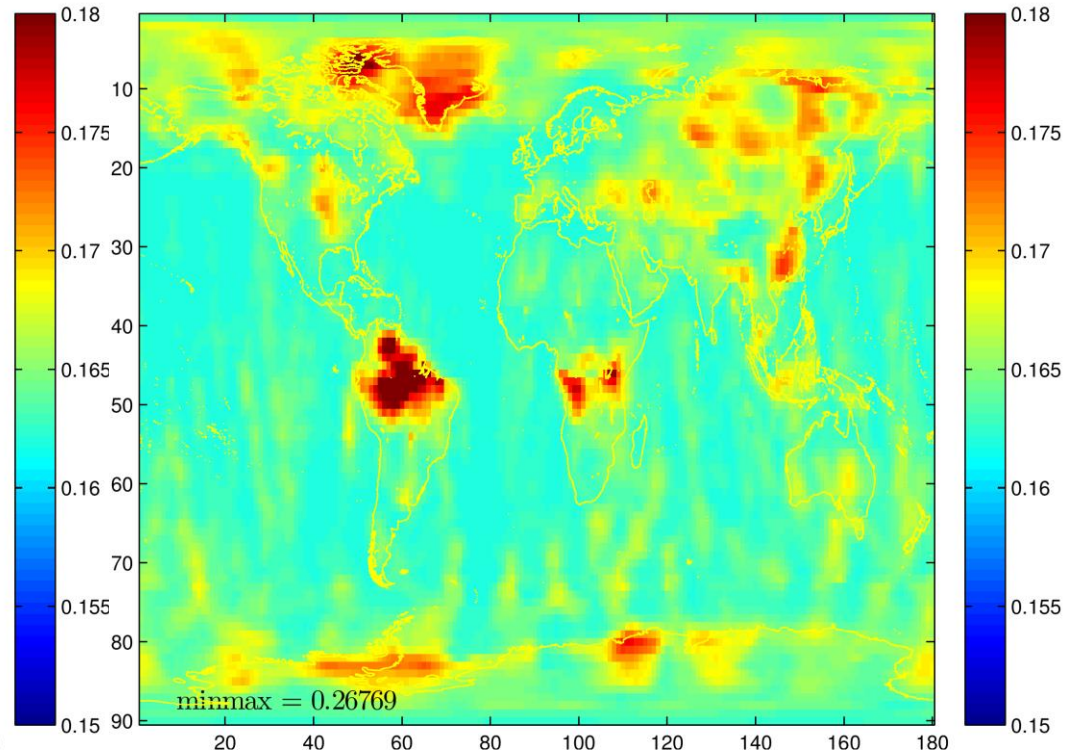
Linear system
Equations

- target grid (Reuter), corresponding to 2x2 deg
 - conversion between SH/grid
- radial basis functions assembly in grid points
- Cov-estimation
 - Proxy obs auto-correlations
 - Monthly auto/cross covariances for LS prediction
- Kalman filtering
- monthly inversion

Least Squares
Prediction

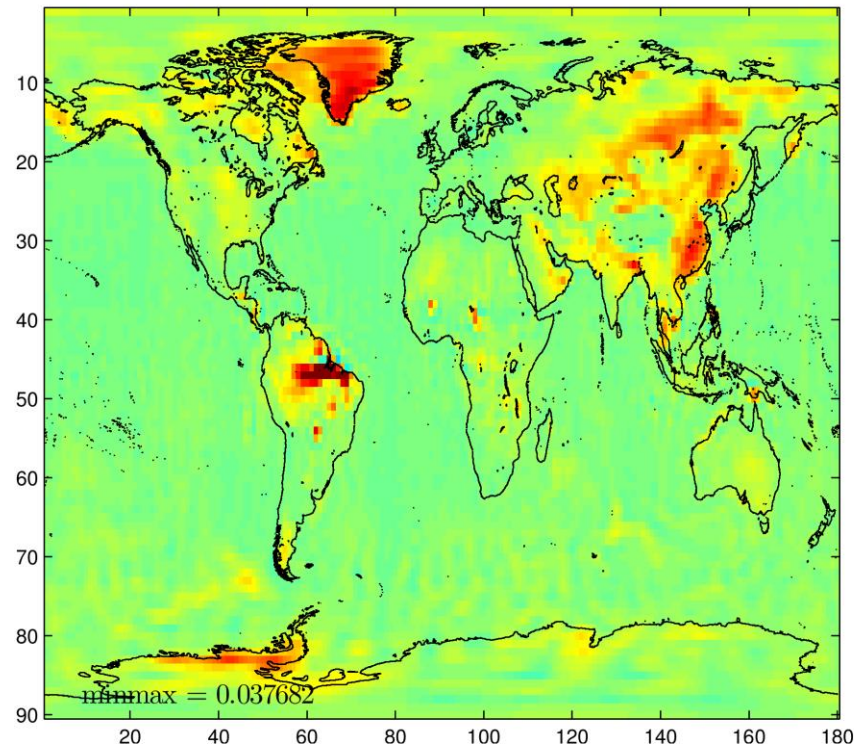


Cross-Co/Variiances (06/2005)

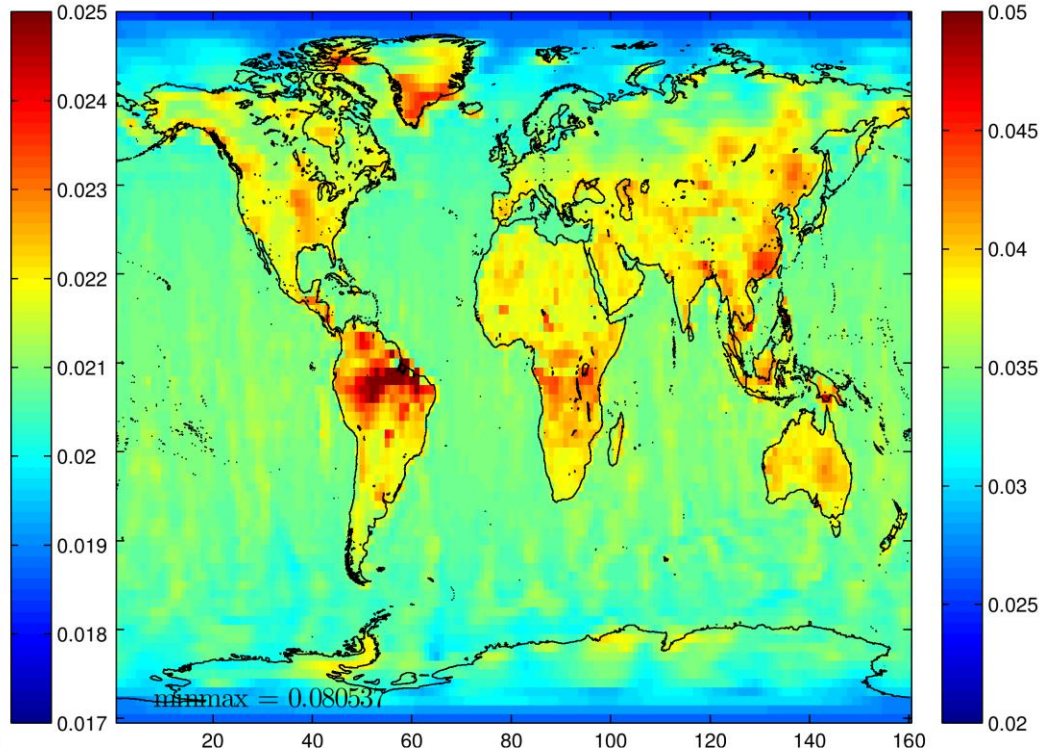


Auto-Co/Variiances (06/2005)

Kalman Process

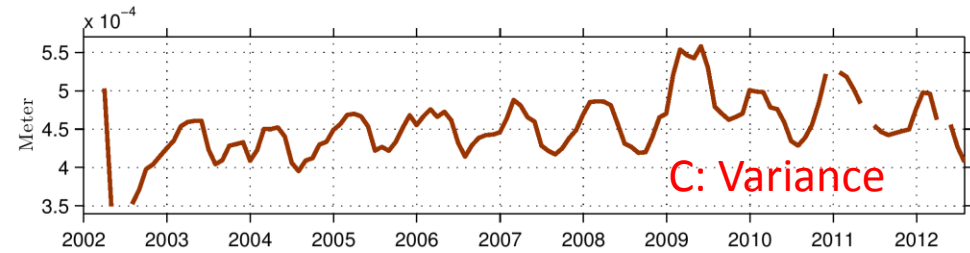
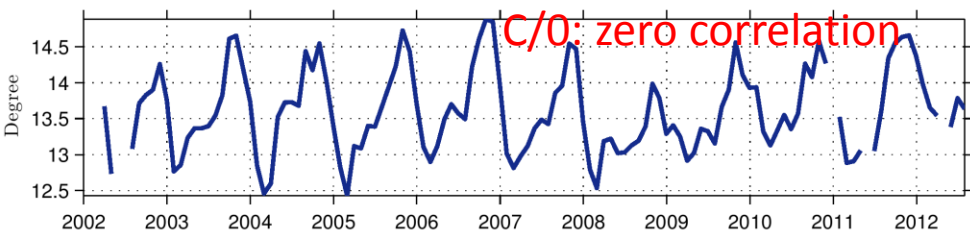
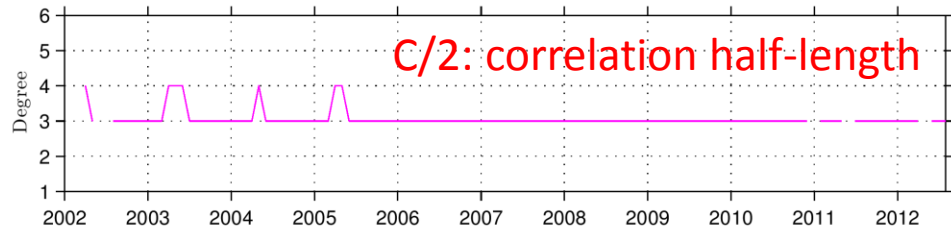
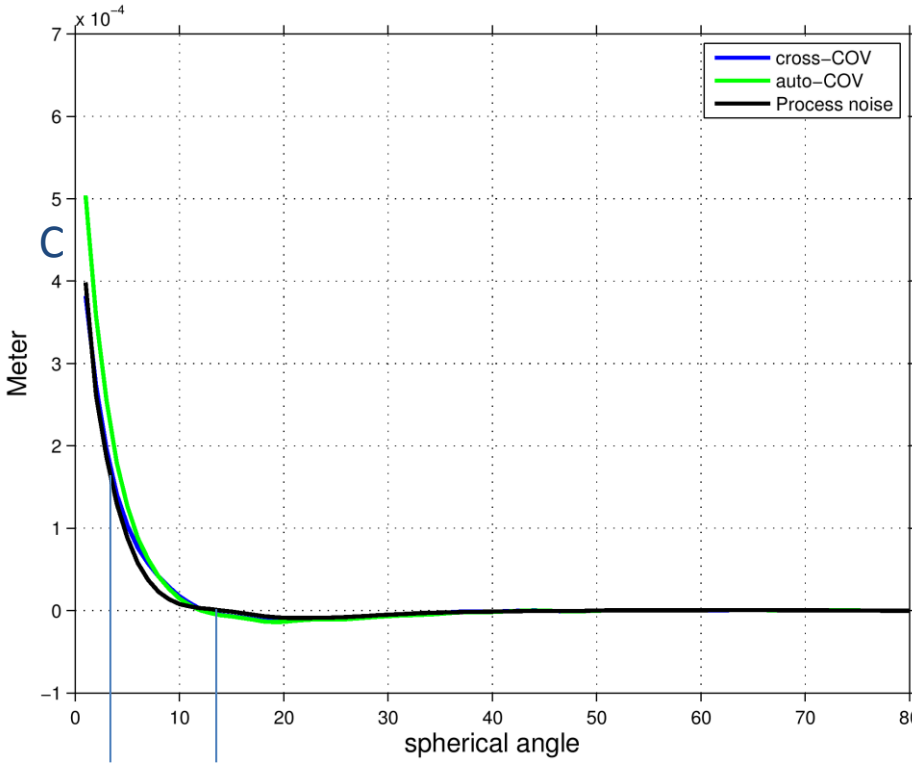


Kalman process-variances (06/2005)



Kalman state-variances (2005/06/13)
after measurement update

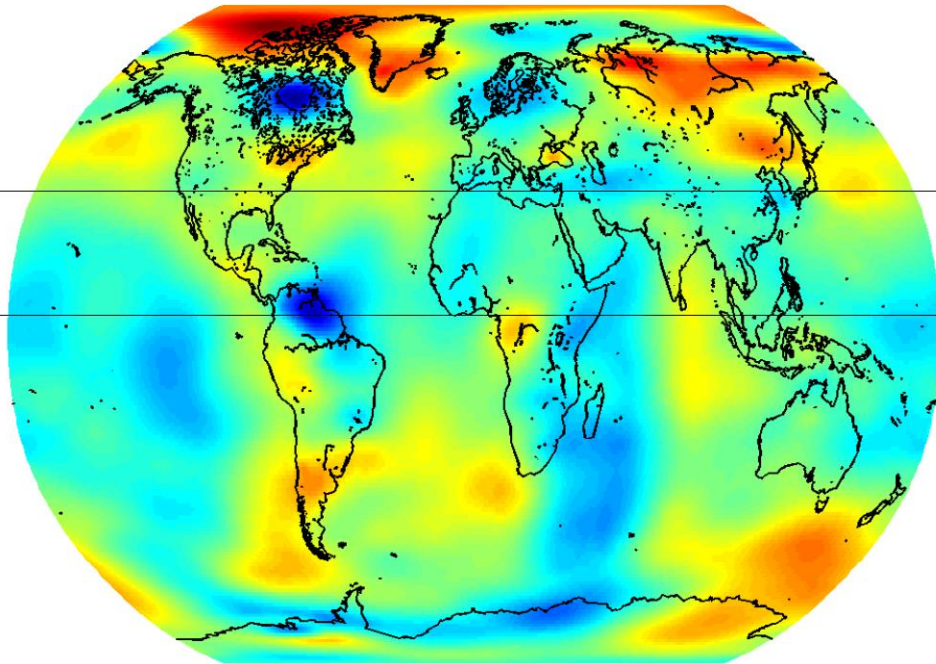
Covariances
over time



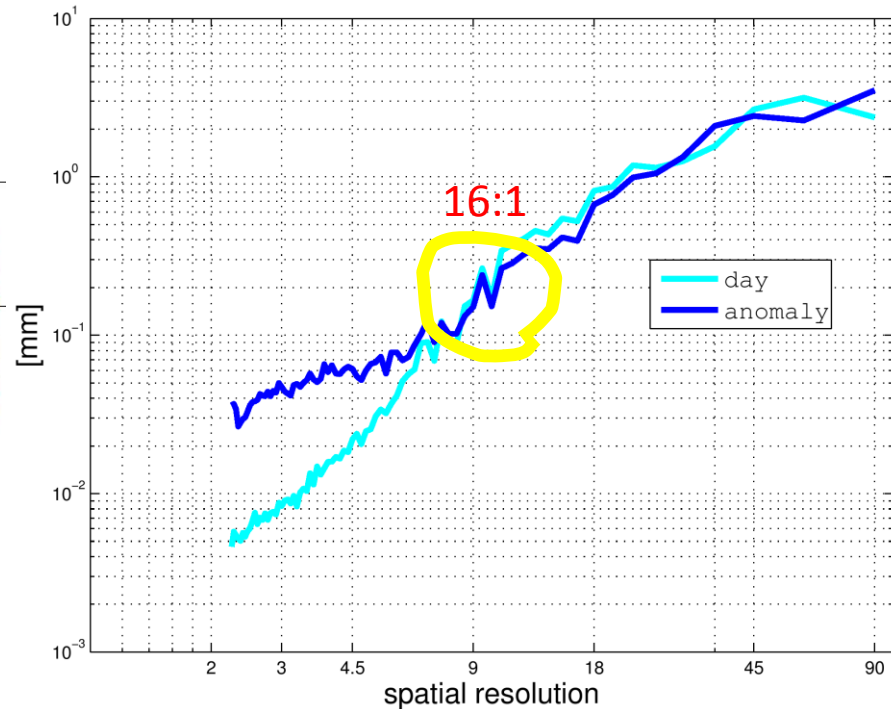
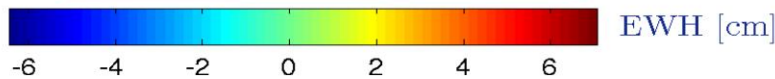
C/2 C/0

GRACE Day vs. TV- modeling (7yr – sec/seas.)

GRACE Water storage DAY

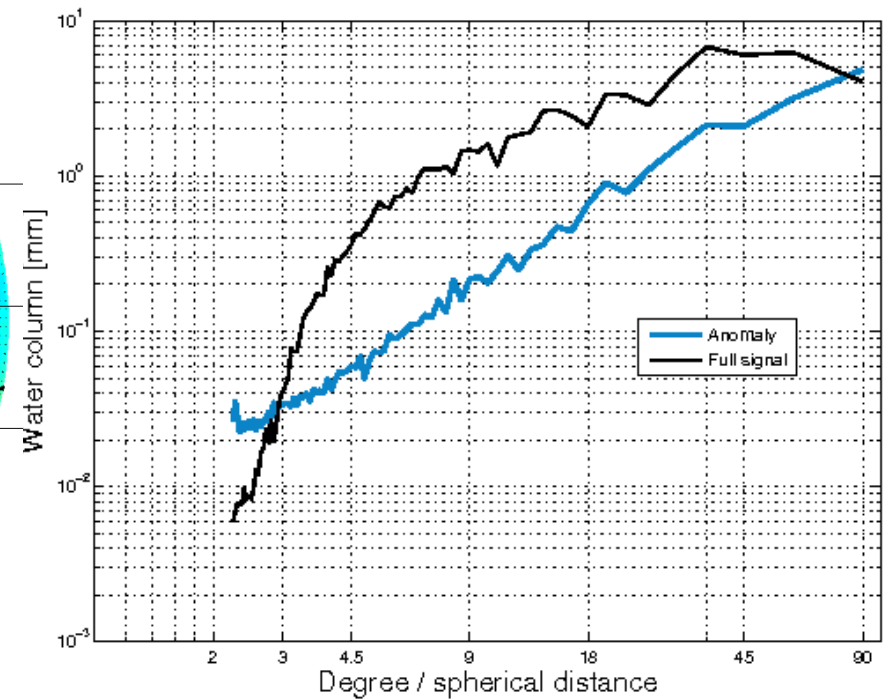
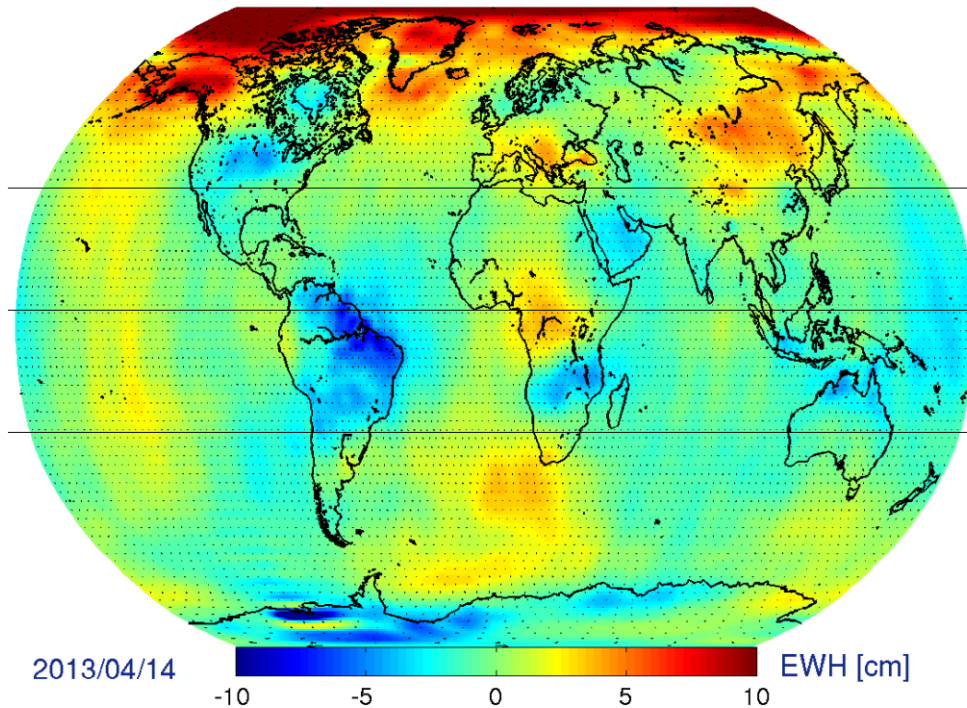


2014/06/18



Anomalies vs. TV- modeling (7yr – sec/seas.)

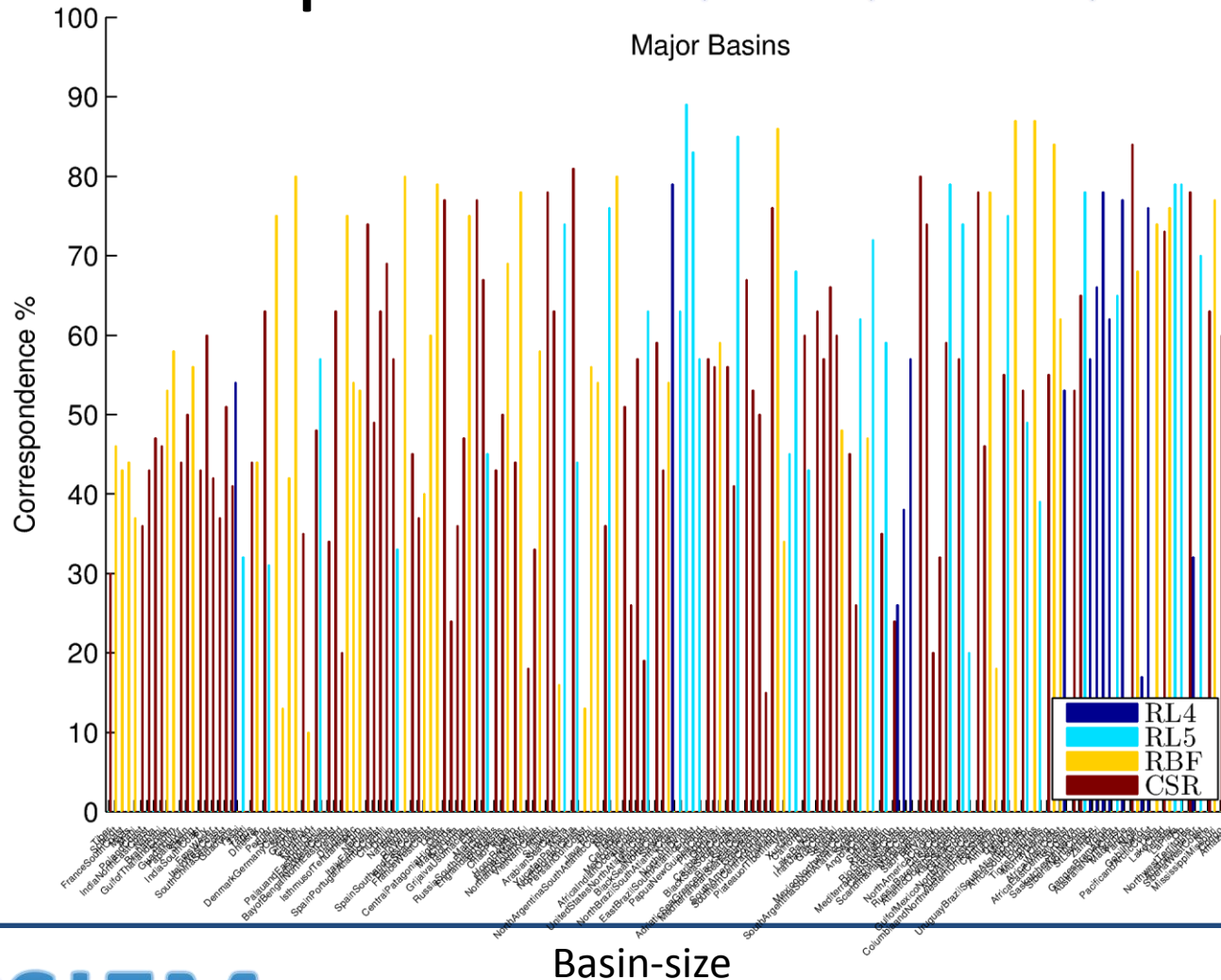
GRACE Water storage anomalies



Internal
evaluation

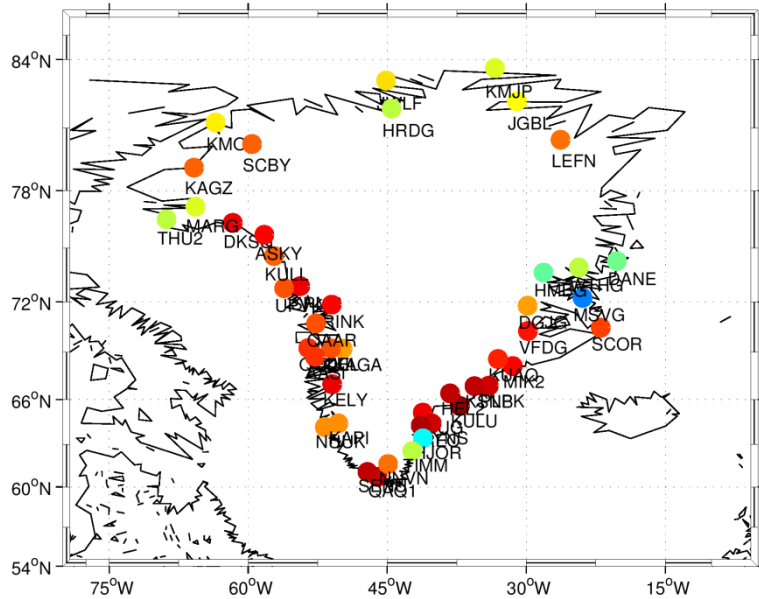
- Envisat/Jason arc-overlaps/SLR-fits
- WGHM basins coherence
- SLR deg2, (until deg4)
- GPS-GreenlandNET,
- GPS-CODE
- OBP evaluation
- Mekong in-situ inundation volumes
- EGSIEM hydrological evaluation WP6

Internal Hydro-basin comparison

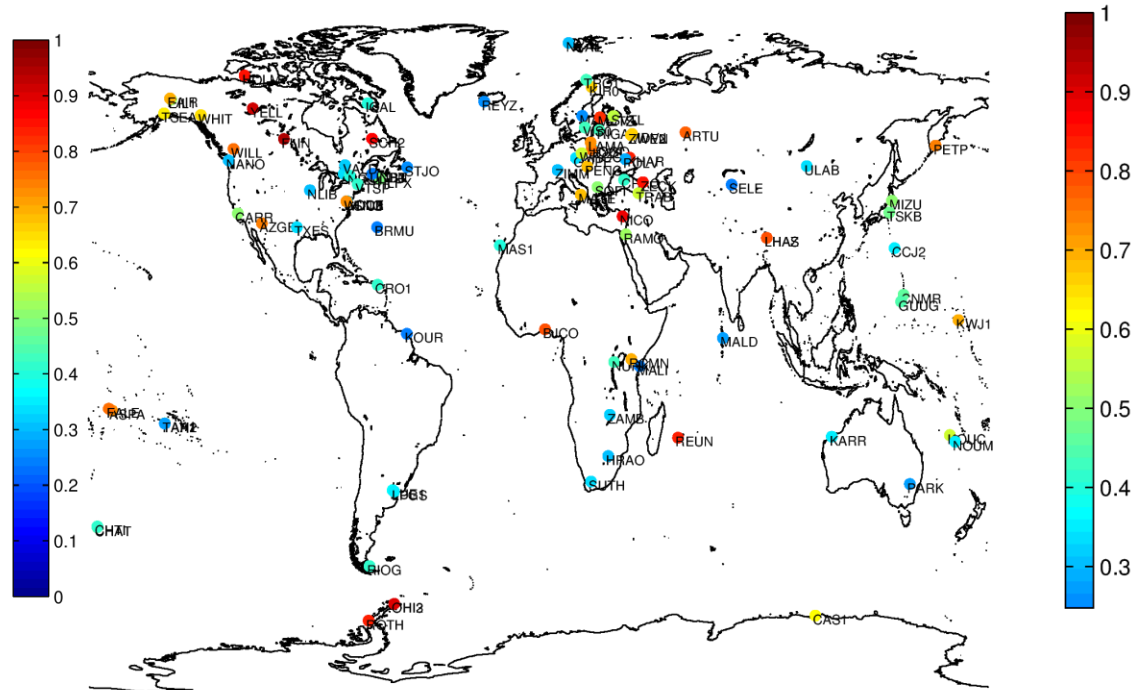


Internal GPS sites comparison

RBF80 / GNET



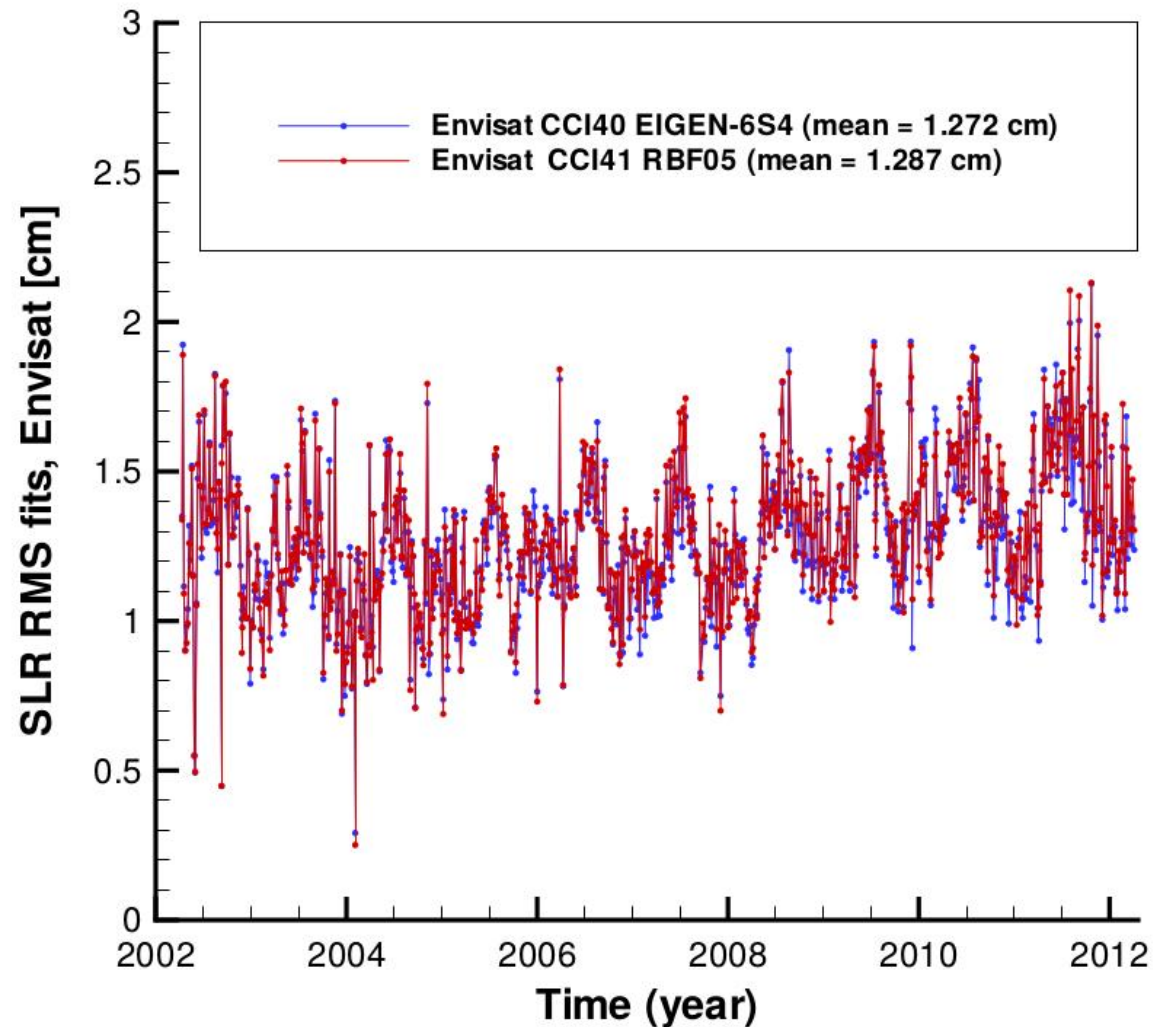
Greenland Network



CODE Network

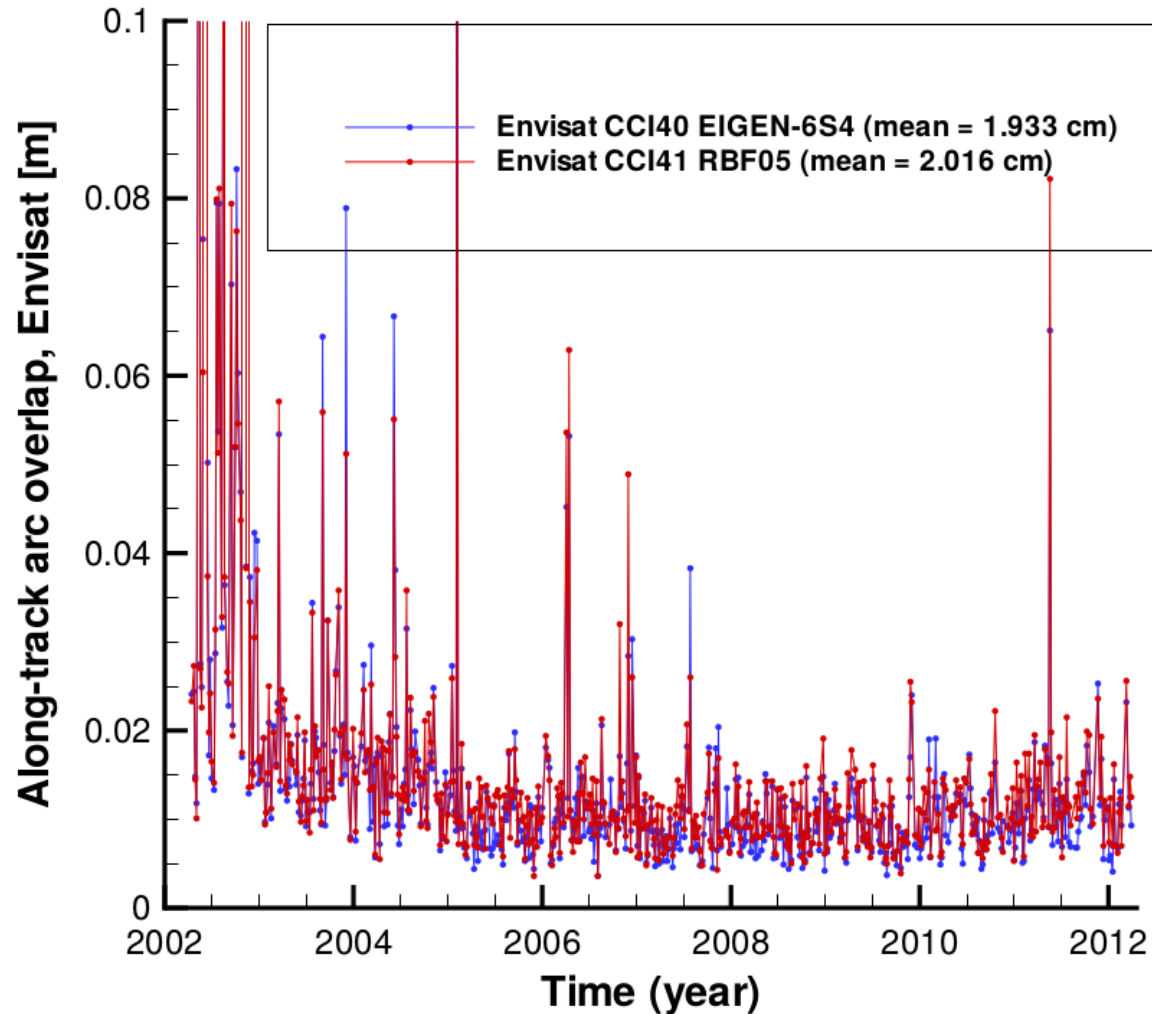
Internal Altimetry satellites orbit (SLR-fits)

SLR RMS fits



Internal Altimetry satellites orbit (SLR-fits)

Arc overlaps,
along-track



- Convergence of Graz and GFZ stochastic modeling in progress...
- Newly construction of “anisotropic” Cov. functions by combination of isotropic Cov. functs and error variances
- Non-ergodic by seasonal Covariance functions
- Use of GRACE reference model stochastic for process noise estimates
- Dynamic orbits (including K-band obs) are iterated towards the last background (day)
- Strong convergence of regularized solutions with the monthly (SDS) fields (w/o regularization)
- Further improvements expected from enhanced time-var modeling and outlier handling

Plans for service run



- Implementation of NRT and Regional Service
 - cascading solution after global solution (far zone reduction)
 - improvements in time-var background modeling
 - full switch to EGSIEM NRT products (clocks / EOP's)
- Refinements of Cov modeling and Regional Concept
 - seasonal process model / tests with Graz process model
 - improve observation de-correlation
- Interface and automatized data receivment
- Feedback loop (internal/external)

Thank you for your attention!

Test Data soon available on dedicated
ftp-site.