Program of the X. Hotine-Marussi Symposium

Monday, 13 June 2022

07:30 – 09:30 Registration

09:30 – 10:00 Opening Session

10:00 – 10:30 **Coffee Break**

10:30 – 12:45 I. Advanced numerical methods in geodesy (*R. Čunderlík and Z. Minarechová*)

10:30 – 10:45 *Holota P, Nesvadba O*: General curvilinear coordinates, Laplace's operator with topography dependent coefficients and analysis of the iteration solution of the GBVP

10:45 – 11:00 *Kollár M, Ambroz M, Ožvat A, Mikula K, Čahojová L, Jarolímek I, Šibík J, Šibíková M*: Numerical methods for segmentation, classification and monitoring of Natura 2000 habitats by Sentinel-2 satellite images

11:00 – 11:15 *Yi S, Sneeuw N*: A novel spatial filter to reduce north-south striping noise in GRACE spherical harmonic coefficients

11:15 – 11:30 *Patlakis K, Tsoulis D*: Efficiency of very-high degree spherical harmonic series computational methods

11:30 – 11:45 *Macák M, Minarechová Z, Mikula K, Čunderlík R, Tomek L*: Solving the oblique derivative boundary-value problems by the finite element method with mapped infinite elements

11:45 – 12:00 *Janák J, Korekáčová B, Kollár M*: Nonlinear filtering of GRACE monthly gravity field models

12:00 – 12:15 *Bucha B:* Integral of solid spherical harmonic expansions at grid cells residing on undulated surfaces

12:15 – 12:30 *Čunderlík R, Kollár M, Mikula K*: Geodesic mean curvature flow for nonlinear diffusion filtering of the satellite-only MDT

12:30 – 12:45 Discussion

12:45 – 14:15 **Lunch Break**

14:15 – 16:15 II. Theory of geodetic reference frames and Earth's rotation (*Z. Altamimi*)

14:15 – 14:30 *Afrasteh Y, Sacher M, Slobbe DC, Verlaan M, Klees R, Guarneri H, Keyzer L, Pietrzak J, Snellen M, Zijl F*: Including the model-based hydrodynamic leveling data in realization of the European vertical reference system

14:30 – 14:45 *Ashry M, Shen WB, Shen Z, Pengfei Z, Ruby A, Abdelmotaal HA*: Towards an Africa height reference system using relativistic geodetic approaches

14:45 – 15:00 *Carrion D, Grigoriadis V, Vergos GS, Barzaghi R*: A joint test on IHRF in Greece and Italy

15:00 – 15:15 *Jia S*: Earth rotation parameters determination by high-, middle- and low-orbit satellites

15:15 – 15:30 *Schreiner P, Koenig R, Neumayer KH, Glaser S*: On integrated reference frame determination from multi-technique observations to Sentinel-3A, -3B, -6A and to the Galileo and GPS satellites

15:30 – 15:45 *Gross R, Abbondanza C, Chin TM, Heflin M, Parker J*: Sequentially estimating terrestrial reference frames: theory and practice

15:45 – 16:00 *Altamimi Z, Rebischung P, Collilieux X, Métivier L, Chanard K*: ITRF2020 and how to model the nonlinear station motions?

16:00 – 16:15 Discussion

Tuesday, 14 June 2022

09:00 – 10:45 III. Theory of multi-GNSS parameter estimation (*A. Khodabandeh*)

09:00 – 09:15 *Teunissen PJG, Verhagen S*: PDF evaluation of elliptically contoured integer ambiguity residuals

09:15 – 09:30 *Fortunato M, Mazzoni A*: Code-based absolute position and variometric velocity for real-time robust PVT estimation

09:30 – 09:45 *Khodabandeh A, Teunissen JPG, Psychas D*: A new multi-epoch processing strategy for PPP-RTK users

09:45 – 10:00 *Alghisi M, Biagi L*: Precise urban positioning: simulations of scenarios by hybridizing GNSS and 5G

10:00 – 10:15 *Sośnica K, Zajdel R, Bury G, Kazmierski K*: Separation of tidal, orbital, and draconitic signals in GNSS time series

10:15 – 10:30 Discussion and Poster:

- *Mikoś M, Kazmierski K, Sośnica K*: Systematic patterns in clock parameters from multi-GNSS precise point positioning
- *Odolinski R, Teunissen PJG, Khodabandeh A*: GLONASS FDMA single-baseline RTK positioning using the best integer equivariant estimator

10:30 – 11:00 **Coffee Break**

11:00 – 12:15 IV. Multi-sensor and time series data analysis (*K. Sośnica and A. Klos*)

11:00 – 11:15 *Strugarek D, Sośnica K, Bury G, Zajdel R*: Determination of global geodetic parameters based on SLR observations to Swarm satellites

11:15 – 11:30 *Monti R, Reguzzoni M, Rossi L, Barzaghi R, Caldera S*: Comparison of low-cost GNSS and free SAR solutions for infrastructural monitoring

11:30 – 11:45 *Korte J, Schubert T, Brockmann JM, Schuh WD*: On the estimation of time variable AR processes with linear root motion of the characteristic polynomial

11:45 – 12:00 *Dorndorf A, Kargoll B, Paenholz JA, Alkhatib H*: Bayesian robust multivariate time series analysis in nonlinear regression models with vector autoregressive and t-distributed errors

12.00 – 12.15 Discussion and Posters:

- *Najder J, Sośnica K, Strugarek D*: Quality assessment of geodetic parameters based on simulated observations to future SLR satellites
- *Nowak A, Najder J, Zajdel R, Sośnica K*: Quality of orbit predictions for low-Earth orbit, geodetic, and navigation satellites

- *Bury G, Sośnica K, Zajdel R, Strugarek D, Hugentobler U*: Transfer of the geodetic datum through space-ties onboard GNSS satellites

12:15 – 14:00 **Lunch Break**

14:00 – 16:15 V. Theory of global gravity field modelling (*M. Reguzzoni and M. Šprlák*)

14:00 – 14:15 *Yin Z, Sneeuw N*: Solving the multi-body boundary value problem with CFD techniques

14:15 – 14:30 *Šprlák M, Han SC, Pitoňák M, Novák P*: GRAIL and LOLA satellite data resolve the long-lasting convergence/divergence problem for the analytical downward continuation of the external spherical harmonic series

14:30 – 14:45 *Pitoňák M, Šprlák M, Novák P*: Estimation of height anomalies from derivatives of the gravitational potential using a spectral combination method

14:45 – 15:00 *Macák M, Mikula K, Čunderlík R, Minarechová Z*: Gravity field modelling by the numerical methods using the second derivatives of disturbing potential given directly as the boundary condition

15:00 – 15:15 *Reguzzoni M, Vitti A, Rossi L, Koç Ö, Migliaccio F, Benciolini B:* On the comparison between time-wise and space-wise approaches in evaluating satellite gradiometry mission performances

15:15 – 15:30 *Ebadi S, Weigelt M, Jäggi A, Meyer U, Arnold D, Mayer-Gürr T*: Bridging the data gap between GRACE and GRACE-Follow On by focusing on the contribution of SLR to combined hlSST+SLR solutions

15:30 – 14:45 *Ditmar P*: GRACE data processing: how to properly apply the spherical harmonic expansion to GRACE data when mass anomalies in polar areas are the target?

15:45 – 16:00 *Fatolazadeh F, Eshagh M, Goita K*: Development of spectral combination theory for spatiotemporal downscaling of terrestrial and groundwater storage variations estimated from GRACE models

16:00 – 16:15 Discussion and Poster:

- *Tziavos IN, Mamagiuanno EG, Pitenis AE, Natsiopoulos DA, Vergos GS, Grigoriadis V, Sideris M*: Downward continuation of filtered GOCE SGG data to a mean sphere and the Earth's surface

16:30 – 17:30 **Poster Session I.** and Open Bar

Wednesday, 15 June 2022

09:00 – 10:15 VI. Probing Earth's inner structure using geodetic methods (*R. Tenzer and D. Sampietro*)

09:00 – 09:15 Rossi L, Reguzzoni M, Lu B, Fadel I, Sampietro D, van der Meijde M: Global Moho gravity inversion by Wiener deconvolution in the spherical harmonic domain: updates and improvements to the GEMMA model inversion algorithm

09:15 – 09:30 Lu B, van der Meijde M, Fadel I, Afonso JC, Reguzzoni M, Rossi L, Sampietro D, Cammarano F, Julia J: A new global crust model: ECM22

09:30 – 09:45 Tanaka Y, Klemann V, Martinec Z: An estimate of the effect of 3D heterogeneous density distribution on coseismic deformation using a spectral finite-element approach

09:45 – 10:00 Capponi M, Sampietro D: The XORN project: experimental joint gravity and magnetic inversion

10:00 – 10:15 Discussion and Posters:

- *Dashtbazi A, Voosoghi B, Bagherbandi, Tenzer R*: A high-resolution global Moho model from combining gravimetric and seismic data by using spectral combination methods
- *Bagherbandi M, Amin H, Wang L, Shirazian M*: Viscosity of the mantle inferred from geoid and post-glacial rebound in Greenland
- *Abrehdary M, Sjöberg LE*: The non-isostatic effect in isostatic-gravimetric Moho determination – is it needed?
- *De Gaetani CI, Shali HH, Ramouz S, Safari A, Barzaghi R*: Iranian Moho depth evaluation using GOCE gradient data and least squares collocation

10:15 – 10:45 **Coffee Break**

10:45 – 12:30 VII-A. Geoid and quasigeoid: present and future I. (*P. Novák*)

10:45 – 11:00 *Sansò F, Barzaghi R, Reguzzoni M*: Molodensky's and Helmert's theories – two equivalent geodetic approaches to the determination of the gravity potential

11:00 – 11:15 *Sideris MG, Sansò* F: The equivalence of the linearized original and 'Helmertised' geodetic boundary value problems of Stokes and Molodensky

11:15 – 11:30 *Sjöberg LE*: Geoid or quasigeoid? – a short comparison

11:30 – 11:45 *Kingdon R, Vaníček P, Santos M, Sheng M, Foroughi I*: The quasigeoid: Why Molodensky heights fail

11:45 – 12:30 Discussion

12:30 – 14:00 **Lunch Break**

14:00 – 14:30 VII-B. Geoid and quasigeoid: present and future II. (*P. Novák*)

14:00 – 14:15 *Huang J, Wang Y*: Numerical aspects of local and regional geoid and quasi-geoid determination

14:15 – 14:30 Discussion

14:30 – 15:30 VIII. Theoretical aspects of heights and height systems (*R. Barzaghi*)

14:30 – 14:45 *Sansò F, Barzaghi R, Reguzzoni M*: Is the normal height a nonholonomic coordinate?

14:45 – 15:00 *Vaníček P, Santos M, Kingdon R, Foroughi I, Sheng M*: Why a height theory must be rigorous and correct

15:00 – 15:15 *Sneeuw N, Berge-Nguyen M, Crétaux JF*: Physical heights of inland lakes

15.15 – 15.30 Discussion

16:00 – 21:00 **Social program**

Thursday, 16 June 2022

09:00 – 10:30 IX-A. Estimation theory and stochastic modelling I. (*P. Teunissen*)

09:00 – 09:15 *Klees R, Slobbe DC*: Analysis of the full noise variance-covariance matrix of a least-squares local quasi-geoid model

09:15 – 09:30 *Zaminpardaz S, Teunissen PJG*: Detectability versus identifiability of biases: a study in the context of deformation analysis

09:30 – 09:45 *Slobbe DC, Afrasteh Y, Verlaan M, Sacher M, Klees R, Guarneri H, Keyzer L, Pietrzak J, Snellen M, Zijl F*: A noise model for model-based hydrodynamic leveling data

09:45 – 10:00 *Hu Y, Fang X*: Linear estimation under the Gauss-Helmert model: geometrical interpretation and general solution

10:00 – 10:15 *Murshan M, Devaraju B, Nagarajan B, Dikshit O*: Comparing ordinary Kriging with least squares collocation to calculate the regional mean sea surface model: Eastern Mediterranean Sea

10:15 – 10:30 *Jazaeri S, Schaffrin B, Snow K*: A simple TLS-treatment of the partial EIV-model as one with singular cofactor matrices

10:30 – 11:00 **Coffee Break**

11:00 – 12:45 IX-B. Estimation theory and stochastic modelling II. (*P. Teunissen*)

11:00 – 11:15 *Devaraju B, Sneeuw N:* A linear algebraic approach for developing metrics to evaluate performance of filters on the sphere

11:15 – 11:30 *Schuh WD, Korte J, Schubert T, Brockmann JM*: Modeling of inhomogeneous spatio-temporal signals by least squares collocation

11:30 – 11:45 *Qin Y, Fang X*: On the exact and efficient solution of the Huber function for geodetic applications

11:45 – 12:00 *Li B*: The bias-corrected statistics for hypothesis testing in linear ill-posed models

12:00 – 12:15 *Lima SK, Safari A, Ramouz S, Reguzzoni M, Rossi L*: Modelling the Earth's gravity field by least squares collocation: an investigation into using non-homogeneous-anisotropic covariance functions

12:15 – 12:30 *Borghi A, Barzaghi R*: Covariance functions in windowed least-square collocation

12:30 – 12:45 Discussion and Posters:

- *Schubert T, Schuh WD*: Anisotropic finite covariance functions on the sphere for predicting ocean currents from altimetric sea level anomaly data
- Piretzidis D, Kotsakis C, Mertikas SP, Sideris MG: Spatio-spectral characteristics of polynomial covariance models on the sphere

12:45 – 14:15 **Lunch Break**

14:15 – 16:30 X. Geodetic methods in Earth system science (*N. Sneeuw and M. Crespi*)

14:15 – 14:30 *Klos A, Kusche J, Dobslaw H, Dill R, Leszczuk G, Gerdener H, Lenczuk A, Bogusz J*: Benchmarking of GPS stations for reliable detection of environmental changes

14:30 – 14:45 *Borlinghaus M, Neyers C, Brunn V, Brockmann JM*: Refinement of spatio-temporal finite element spaces for mean sea surface and sea level anomaly estimation depending on prior information

14:45 – 15:00 *Brockmann JM, Borlinghaus M, Neyers C, Schuh WD*: Co-estimating long-term temporal signals to reduce the aliasing effect in parametric geodetic mean dynamic topography estimation

15:00 – 15:15 *Lenczuk A, Klos A, Bogusz J*: Study of climate changes using GRACE/GRACE-FO data – terrestrial drought severity index analysis

15:15 – 15:30 *Devaraju B, Bharath K, Reddy N*: Revisiting the spatial resolution of GRACE-derived total water storage changes

15:30 – 15:45 *Mohasseb HA, Shen WB, Abd-Elmotaal HA*: The sustainability of groundwater in overstressed aquifers in northern Africa and Arabian Peninsula using GRACE and hydrological models

15:45 – 16:00 *Bar O, Even-Tzur G*: Feature-voting technique in deformation analysis

16:00 – 16:15 *Ravanelli M, Occhipinti G, Crespi M*: A complete approach towards real-time GNSS ionospheric seismology

16:15 – 16:30 Discussion and Posters:

- *Nastula J, Śliwińska J, Kur T, Wińska M, Partyka A*: Hydrological angular momentum determined from climate data
- *Novák A, Janák J, Mikula K*: Observability of local hydrological signal by gPhoneX gravimeter
- *Neyers C, Brockmann JM, Schuh WD*: About the potential of satellite-based one-dimensional geostrophic current observations to improve the separation of the mean dynamic topography and geoid undulation
- *R. Devoti R, Barbarossa S, Bruni S, Pietrantonio G*: Tides and spurious signals in GNSS reflectometry

16:30 – 17:30 **Poster Session II.** and Open Bar

Friday, 17 June 2022

09:00 – 10:00 XI-A. Theory of local gravity field modelling I. (*J. Huang and H. Abd-Elmotaal*)

09:00 – 09:15 *Sjöberg LE, Abrehdary M*: On the terrain correction in geoid determination

09:15 – 09:30 *Klees R, Seitz K, Slobbe DC*: Highly accurate expressions for the harmonic correction to gravity, potential and height anomaly

09:30 – 09:45 *Yang M, Hirt C, Wu B, Deng XL, Tsoulis D, Feng W, Wang CQ, Zhong M*: Residual terrain modelling: the harmonic correction for geoid heights

09:45 – 10:00 *Abd-Elmotaal HA, Kühtreiber N, Seitz K, Heck B*: Evaluation of the AFRGDB_v2.0 and AFRGDB_v2.2 African gravity databases

10:00 – 10:30 **Coffee Break**

10:30 – 12:00 XI-B. Theory of local gravity field modelling II. (*J. Huang and H. Abd-Elmotaal*)

10:30 – 10:45 *Barzaghi R, Koç Ö*: Downward continuation of airborne gravity data by least squares collocation with planar covariance models

10:45 – 11:00 *Foroughi I, Goli M, Pagiatakis S, Ferguson S*: 3D spherical geodetic boundary-value problem using airborne vector gravity measurements

11:00 – 11:15 *Novák P, Pitoňák M, Šprlák M*: Regional geoid modelling using new observables and methods

11:15 – 11:30 *Foroughi I, Vaníček P, Kingdon R, Goli M, Sheng M, Santos M*: The sub-centimetre geoid, despite the topographical density

11:30 – 11:45 *Carrion D, Barzaghi R, Crespi M, Grigoriadis V, Jacobsen K, Kelly K, Kuhn M, Nagi R, Palcu D, Slobbe CD*: The impact of DTM/DBM land-sea transition for geoid computation: a test case in southern Italy

11:45 – 12:00 Discussion and Posters:

- *Panou G, Korakitis R*: Rectangular polynomial analysis applied to a local gravity field
- *Abd-Elmotaal HA, Kühtreiber N*: Terrain correction software optimized for window remove-restore technique with a verification example for Africa

12:00 – 13:00 **Closing Session**

List of poster presentations

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- *Dashtbazi A, Voosoghi B, Bagherbandi, Tenzer R*: A high-resolution global Moho model from combining gravimetric and seismic data by using spectral combination methods
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