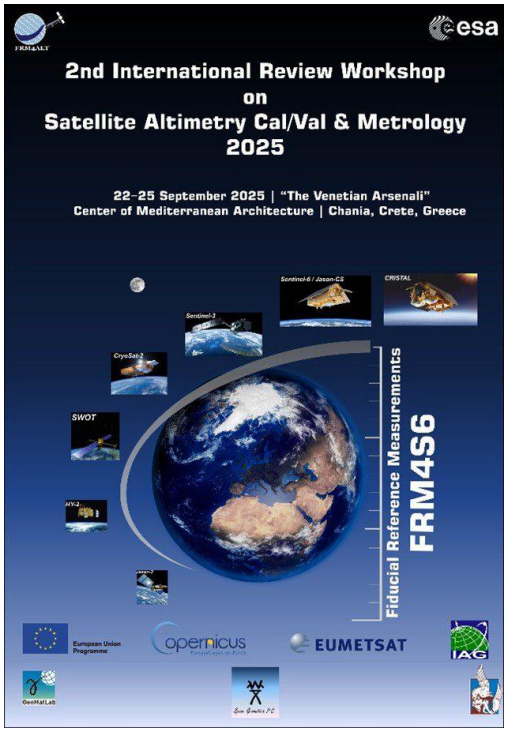

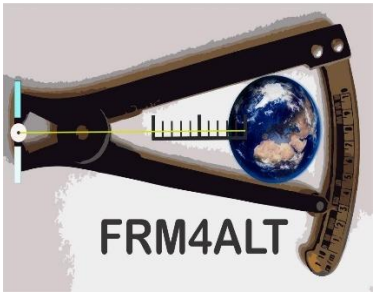

2nd International Review Workshop on Altimetry Calibration/Validation and Metrology 2025

22-25 September 2025
Chania, Crete, Greece.

Sessions
as of 14 July 2025

Sunday, 21 September 2025: 19:00–21:00

Welcome Reception, The Symposium Venue, Center of Mediterranean Architecture
Participants will have a chance to meet each other. Drinks will be offered.

Monday, 22 September, 2025: 9:00-10:00

8:30 Registration

Session 1: Metrology Reference Standards for Earth Observation & International Altimetry

Chairs: Craig Donlon & Stelios Mertikas

09:10 **Welcome & Opening Remarks**,
Stelios Mertikas
International Cal/Val Review Workshop Convener

09:20 **S1-01** **The ESA Earth Observation Ecosystem 2040+ and user needs for Fiducial Reference Systems for Reference Altimetry**
Craig Donlon
ESA/ESTEC, The Netherlands

09:40 **S1-02** **The International Association of Geodesy: Serving Science and Society for 163 Years**
Richard Gross
IAG President

10:00 **S1-65** **Towards a Robust Metrological Assessment of the Uncertainties of Sea Level Anomaly Measurements from Sentinel 6**
Emma Woolliams[1], Sajedeh Behnia[1], Xavier Loizeau[1], Connor Tynan[1], Jonathan Mittaz[2]*
[1]National Physical Laboratory, United Kingdom, [2]University of Reading, United Kingdom

10:20 **S1-64** **Getting the Right Time at the Right Place**
Dimitrios Matsakis
Masterclock Inc., USA

10:40 **S1-66** **Defining and Applying Maturity Matrices for Satellite Altimetry Observations and Related Fiducial Reference Measurements**
Sajedeh Behnia[1], Samuel Hunt[1], Thomas Erni[1], Emma Woolliams[1]*
National Physical Laboratory, United Kingdom

Coffee Break 11:00-11:30

Session 2: From Exploration to Operational and Climate Reference Missions

Chairs: Paolo Cipollini & Alegjando Egido

11:30 **S2-50** **Copernicus CRISTAL for Cryospheric Science, Oceanography and Hydrology: Status of the Mission and Cal/Val Plans**
Paolo Cipollini[1], Franck Borde[1], Jerome Bouffard[2], Tânia Casal[1], Filomena Catapano[2], Alessandro Di Bella[2], Kristof Gantois[1], Valeria Gracheva[1], Michele Scagliola[2]*
[1]ESA/ESTEC, the Netherlands [2]ESA/ESRIN, Italy

11:50 **S2-71** **The Sentinel-6 Next Generation Copernicus Altimetry Mission: Enhancing Continuity, Performance and Observational Capabilities**
Bernardo Carnicero Dominguez[1], Agathe Carpentier[1], Robert Cullen[1], Alejandro Egido[1], Valeria Gracheva[1], Marcel Kleinherenbrink[1], Martin Suess[1]*
[1]ESA/ESTEC, the Netherlands

12:10 **S2-24** **EUMETSAT Altimetry Missions, Users and Products**

Carolina Nogueira Loddo[1], Remko Scharroo[1], Cristina Martin-Puig[1], Bruno Lucas[1], Salvatore Dinardo[1], Estelle Obligis[1]*
[1]EUMETSAT, Germany

12:30 **S2-60** **Progress of the International Altimetry Service Pilot Services Towards an IAG Service**

C K Shum[1], Xiaoli Deng[2], Jérôme Benveniste[3], Stefano Vignudelli[4] and 27 IAS Members[5]*
[1]Ohio State University, USA, [2]University of Newcastle, Australia, [3]COSPAR, France, [4]CNR, Italy, [5]IAS Members from 11 countries

Lunch Break 12:50-14:10

Session 3: Absolute Reference and Ground Standards for Altimetry

Chairs: Carolina Nogueira Loddo & Filomena Catapano

14:10 **S3-40** **Transponders and Corner Reflectors for Altimeter Calibration**

Richard Francis
GerSpatial, France.

14:30 **S3-44** **Sentinel-3 Altimetry End-to-End Cal/Val over the Salar De Uyuni**

Salvatore Dinardo[1], Stefano Vignudelli[2], Ron Abileah[3], Walter H.F. Smith[4], Bruno Lucas[1], Carolina Nogueira Loddo[1]*
[1]EUMETSAT, Germany, [2]CNR, Italy, [3]iOmegak, USA, [4]University of Maryland, USA

14:50 **S3-10** **DTU25 Mean Sea Surface and its Uncertainty Characteristics from SWOT**

Ole Andersen
DTU Space, Denmark.

15:10 **S3-27** **ESA altimetry Cal/Val approach for Hydro-Cryo products: status and perspectives**

Michele Scagliola[1], Filomena Catapano[2], Alessandro Di Bella[2], Jerome Bouffard[2]*
[1]Starion, c/o ESA/ESRIN, Italy, [2]ESA/ESRIN, Italy

Coffee Break 15:30-16:00

Session 4: Uncertainties in Climate Change Monitoring

Chairs: Robert Cullen & Jerome Bouffard

16:00 **S4-37** **New challenges for the Assessment of Mean Sea Level Uncertainty Budget: Moving from Temporal to Spatio-Temporal Error Covariances**

Anna Mangilli [1], Pierre Prandi[1], Victor Quet[1], Lionel Zawadzki[2], Sarah Connors[3]*
[1]CLS, France, [2]CNES, France, [3]ESA/ECSAT, United Kingdom

16:20 **S4-31** **Global Altimetry versus Tide Gauges comparisons: current results and uncertainty budget**

*Victor Quet[1] *, Pierre Prandi[1], Francesco Nencioli[1], Lucia Rinchiuso[1], Bruno Lucas[2], Carolina Nogueira Loddo[2], Lionel Zawadzki[3]*
[1]CLS, France, [2]EUMETSAT, Germany, [3]CNES, France

16:40 **S6-61** **Quantification of Transient Vertical Land Motion at World's Tide Gauges Locations Using Satellite Altimetry for Estimates of Rapid Global Sea-Level Rise**

C. K. Shum[1], Shengdao Wang[1], Chung-Yen Kuo[2], Orhan Akyilmaz[3]*
[1]Ohio State University, USA, [2]National Cheng Kung University, Taiwan, [3]İstanbul Teknik, Turkey

17:00 **S4-12** **ARCFRESH Arctic Freshwater budget and handling uncertainties in EO observations and models**

Ole B. Andersen, ARCFRESH team*
Danish Technical University Space, Denmark.

17:20 **S4-39** **Latest Updates of the Altimeter Stability Uncertainty Budget for the GMSL Record**

Victor Quet[1], Pierre Prandi[1], Anna Mangilli*
[1]CLS Group, France.

17:40 **S4-32** **Uncertainty assessment of SWOT's systematic errors calibration algorithm: methods and validation challenges**

Benjamin Flamant[1], Étienne Jussiau[1], Pierre Prandi[1], Matthias Raynal[2], Maxime Vayre[1], Julien Renou[1]
[1] CLS, Ramonville-Saint-Agne, France,
[2] CNES, Toulouse, France.

Tuesday, 23 September, 2025

Session 5: International Ground Cal/Val Infrastructures

Chairs: Denise Dettmering & Stefano Vignudelli

09:00 **S5-70** **The ESA Permanent Facility for Altimetry Calibration**

Stelios Mertikas[1], Craig Donlon[2], Costas Kokolakis[3], Dimitrios Piretzidis[3], Fabrice Collard[4], Simon Williams[5], Achilles Tripolitsiotis[3], Xenophon Frantzis[1]
[1]Technical University of Crete, Greece, [2]ESA/ESTEC, The Netherlands, [3]Space Geomatica, Greece, [4] OceanDataLab, France, [5] National Oceanography Centre, Liverpool, United Kingdom

09:20 **S5-18** **Calibration and Validation of HY-2 Series Satellite Altimeter in Wanshan Cal/Val Site**

Yufei Zhang[1] and Hailong Peng[1]*
[1]National Satellite Ocean Application Service, China

09:40 **S5-67** **Kavaratti: ISRO's Satellite Altimetry Calibration and Validation Facility for International altimeter missions**

Surisetty V V Arun Kumar[1], Sanjib Kumar Deb[1], Aditya Chaudhary[1], K N Babu[1], Deepak Putrevu Rashmi Sharma[1], Nilesh M Desai[1],*
[1]Space Applications Centre, Indian Space Research Organisation, India

10:00 **S5-51** **Monitoring the Long-Term Performance of Radar Altimeters Using Ground-Based Transponders**

Adrián Flores de la Cruz, Albert García-Mondéjar, Ferran Gibert Gutiérrez, Adrià Gómez Olivé, Martina Gallego Jené*
isardSAT S.L. Barcelona, Spain

10:20 **S5-17** **Cross-over Cal/Val of China's HY-2 Series Satellite Altimeter with International Missions**

Hailong Peng
National Satellite Ocean Application Service, China.

10:40 **S5-08** **Global Multi-Mission Crossover Analysis: What can we learn?**

Denise Dettmering
Deutsches Geodätisches Forschungsinstitut, Technical University of Munich, Germany

Coffee Break 11:00-11:30

Session 6: Ground Cal/Val Infrastructures and Results

Chairs: Denise Dettmering & Stefano Vignudelli

11:30 **S6-04** **Enhanced Altimetry Calibration using Corner Reflectors**

Claire Maraldi[1], Etienne Ferrer[2], Thomas Moreau[2], Nicolas Cuvillon[1], Clément Courde[3], François Boy[1], Lionel Zawadzki[1], Franck Borde[4], Nicolas Picot[1], Cédric Tourain[1]*
[1]CNES, France, [2]CLS, France, [3]Geoazur, France, [4]ESA/ESTEC, the Netherlands

11:50 **S6-52** **The Montsec corner reflector: status and results of four years of measurements**

Ferran Gibert[1], Adrià Gómez-Olivé[1], Ollie Holmes[2], Albert Garcia-Mondéjar[1], Adrián Flores de la Cruz[1], Sergi Hernández[1], Richard Francis[3], Ester Vendrell[1], Mònica Roca i Aparici[1], Marco Fornari[4], Robert Cullen[4]*
[1]isardSAT, Spain, [2]isardSAT, United Kingdom, [3]GerSpatial, France, [4] ESA/ESTEC, the Netherlands

12:10 **S6-25** **Comparison of Dinardo's RCS for the Salar de Uyuni with a physical-optics model**

Ron Abileah[1], Walter H.F. Smith[2], Salvatore Dinardo[3], Stefano Vignudelli[4]
[1]jOmegak, San Carlos, CA, USA,
[2]ESSIC, University of Maryland, College Park, Maryland, USA
[3]Eumetsat, Darmstadt, Germany
[4]Consiglio Nazionale delle Ricerche (CNR-IBF), Pisa, Italy

12:30 **S6-73** **Differential Calibration of Satellite Altimeters using Corner Reflectors**

Costas Kokolakis[1,2], Dimitrios Piretzidis[2], Stelios P. Mertikas[1], Craig Donlon[3],*
[1]Technical University of Crete, Greece, [2] Space Geomatica, Greece,[3] ESA/ESTEC, the Netherlands

Lunch Break 12:50-14:10

Session 7: Ocean and Inland Waters Altimetry Calibration/Validation I
Chairs: Nicolas Picot & Salvatore Dinardo

14:10 **S7-53** **CryoSat-2 Ocean Data Analysis and Validation: GOP from BLC to BLD**

*Marc Naeije[1] *, Ernst Schrama[1], Alessandro Di Bella[2]*
[1]TU Delft, the Netherlands, [2] ESA/ESRIN, Italy

14:30 **S7-56** **Assessment of SWOT L2 Lake and Rivers products over the Rhine River and small water bodies in the Alsace and Lorraine regions (France) during the Cal/Val orbit**

Thomas Ledauphin[1], Sabrine Amzil[1], Maxime Azzoni[1], Jerome Maxant[1], Herve Yésou[1]
[1]ICUBE SERTIT, University of Strasbourg, France

14:50 **S7-20** **Provision of operational FRM measurements for Sentinel-3 over inland water: the St3TART Follow on project**

*V.Fouqueau[1] *, G.Cognot[1], R.Lopez[1], E.Lesnard-Evangelista[1], JC.Poisson[1], E. R Wooliams[3], S.Behnia[3], N.Taburet[4], J.Renou[6], M.Chapelier[6], H.Yesou[7], M.Azzoni[7], A.Tarpanelli[8], K.Nielsen[5], M.Tourian[9], M.Calzas[10], P.Bonnefond[11], C.Miller[2], M.El Hajj[2], F.Catapano[12], M.Restano[12]*
[1]vorteX-io, France, [2] Noveltis, France, [3] National, Physics Laboratory, United Kingdom, [4] CNES, France, [5] DTU Space, Denmark, [6] CLS, France, [7] SERTIT, France, [8] CNR-IRPI, Italy, [9] GIS, Institute of Geodesy, Germany, [10] DT-INSU, France, [11] SYRTE, France, [12] ESA-ESRIN, Italy

15:10 **S7-46** **Sentinel-6 performances assessment over Inland Waters during tandem phase with Jason-3, getting ready for Sentinel-6B**

Nicolas Taburet[1], Thomas Moreau[1]
[1]CLS, France

Coffee Break 15:30-16:00

Session 8: Ocean and Inland Waters Altimetry Calibration/Validation II
Chairs: Nicolas Picot & Claire Maraldi

16:00 **S8-72** **Sea-State Optical and GNSS-IR infrastructures for Significant Wave Height and Wind**
Fabrice Collard[1], Simon Williams[2] Stelios Mertikas[3], Craig Donlon[4]
[1] OceanDataLab, France, [2]National Oceanography Centre, United Kingdom
[3]Technical University of Crete, Greece, [4]ESA/ESTEC, The Netherlands

16:20 **S8-05** **Ocean wave Cal/Val and sea state characterization from Altimeters and multi-sensor synergies**
Adrien Nidou[1], Annabelle Ollivir[1], Guillaume Dodet[2], Ben Timmermans[3], Matthias Averseng[1], Charles Peureux[4], Marine de Carlo[4], Romain Husson[4]
[1]CLS, Toulouse, France, [2]Université Brest, CNRS, IFREMER, France, [3]National Oceanography Centre, United Kingdom, [4]CLS, Brest, France

16:40 **S8-07** **Insight into validation methods of SAR altimeter measurements for the provision of uncertainty estimates of river water level**
Julien Renou[1], Nicolas Taburet[1], Marie Chapellier[1], Filomena Catapano[2], Alessandro Di Bella[2], Marco Restano[3]*
[1] CLS, France, [2] ESA/ESRIN, Italy, [3]Starion, c/o ESA ESRIN, Italy

17:00 **S8-15** **Development of an integrated method to validate SWATH altimetry over inland water: A new approach from SWOT Cal/Val first results**
*V.Fouqueau[1 *], G.Cognot[1], JC.Poisson[1,] E.Lesnard-Evangelista[1], N.Picot[2], F.Boy[2], R.Fjortoft[2], L.Froideval[3]*
[1]vorteX-io, France, [2] CNES, France, [3] CNRS-INSU, France

17:20 **S8-49** **Bridging SWOT and in situ observations: coastal sea surface height assessment with airborne LiDAR during the Cal/Val Phase**
Maxence Guérin[1], Laurent Froideval[1], Christophe Conessa[1], Laurent Benoit[1], Nicolas Picot[2], Yannice Faugère[2], Pascal Bonnefond[3], Edward Salameh[1], Imen Turki[1], Benoit Laignel[1]
[1] University of Caen Normandy, France, [2] CNES, France, [3] SYRTE, Observatoire de Paris—Université PSL, France

17:40 **S8-55** **Study of dynamic of ice surface flow velocity and analyzing the location and changes in the groundline on the Müller ice shelf in Antarctic by means of offset tracking and interferometry**
Carlos Cárdenas[1], Erling Johnson[1], Alberto Prado[1]*
[1]Universidad de Magallanes, Chille.

Wednesday, 24 September, 2025

Session 9: Cryosphere Altimetry Calibration/Validation I

Chairs: Ole Andersen & Emma Woolliams

09:00 **S9-22**

Introducing the CRISTAL IN-PROVA project: Towards an in-flight validation plan for CRISTAL level-2 Hydro-Cryo products

*Claire Miller[1 *], Henriette Skourup[2], Julien Renou[3], Geir Moholdt[4], Christian Haas[5], Vincent Favier[6], Emma Woolliams[7], Jean-Christophe Poisson[8], Eva Le Merle[1], Vincent Boulenger[1], Nathan Lalloue[1], Sebastian. B. Simonsen[2], Renée Mie Fredensborg Hansen[2], Valentin Fouqueau[8], Tommy Erni[7], Sajedeh Behnia[7], Ghislain Picard[6], Nicolas Taburet[3], Mahmoud El Hajj[1], Jérôme Bouffard[10], Alessandro Di Bella[10], Michele Scagliola[9] and Filomena Catapano[10]*

[1] Noveltis, France, [2] DTU Space, Denmark, [3] CLS, France, [4] Norwegian Polar Institute, Norway, [5] Alfred-Wegener-Institut, Germany, [6] IGE, Université Grenoble Alpes, France, [7] National Physical Laboratory, United Kingdom, [8] vorteX.io, France, [9] Starion c/o ESA/ESRIN, Italy, [10] ESA/ESRIN, Italy

09:20 **S9-54**

A CAL/VAL approach for CRISTALair, the CRISTAL airborne demonstrator

*Ferran Gibert[1 *], Clara Colet[1], Aida Ferro[1], Albert Garcia-Mondéjar[1], Ester Vendrell[1], Monica Roca i Aparici[1], Adriano Meta[2], Filippo Speziali[2], Henriette Skourup[3], Sebastian Bjerregaard Simonsen[3], Michele Scagliola[4], Paolo Cipollini[5], Valeria Gracheva[5]*

[1] isardSAT, Spain, [2] MetaSensing srl, Italy, [3] Technical University of Denmark, Denmark, [4] RHEA for ESA-ESRIN, Italy, [5] ESA/ESTEC, the Netherlands

09:40 **S9-28**

Operational Fiducial Reference Measurements over Sea Ice in support of Sentinel-3 validation (ESA St3TART-FO project)

*Henriette Skourup[1 *], Renée Fredensborg Hansen[1], Sara Fleury[2], Claire Miller[3], Christian Haas[4], Emma Woolliams[5], Jean-Christophe Poisson[6], Thomas Krumpen[4], Luisa Wagner[4], Frédéric Vivier[7], Antonio Lourenco[7], Robert Ricker[8], Rolf-Ole Rydeng Jenssen[8], Tommy Erni[5], Eva Le Merle[3], Mahmoud El Hajj[3], Filomena Catapano[9]*

[1] DTU Space, Denmark,[2] LEGOS, France, [3] Noveltis, France, [4] Alfred-Wegener-Institut, Germany, [5] National Physical Laboratory, United Kingdom, [6] Vortex.io, France, [7] LOCEAN, France, [8] NORCE, Norway, [9] ESA/ESRIN, Italy

10:00 **S9-19**

Advancing Land Ice Altimetry with Sentinel-3: Performance Assessment and Error Budget Characterization

*Stine Kildegaard Rose[1 *], Sebastian Bjerregaard Simonsen[1], Jérémie Aublanc[2], Anouk Chamayou[2], Filomena Catapano[3], Alessandro Di Bella[3]*

[1]DTU Space, Denmark, [2] CLS, France, [3]ESA/ESRIN, Italy

10:20 **S9-14**

Validation Methodologies for CRISTAL In-Flight Level-2 Land Ice Products – An Overview from the CRISTAL IN-PROVA Project

*Sebastian B. Simonsen[1 *], Geir Moholdt[2], Vincent Favier[3], Emma Woolliams[4], Tommy Erni[4], Claire Miller[5], Eva Le Merle[5], Vincent Boulenger[5], Nathan Boulenger[5], and Mahmoud El Hajj[5]*

[1] DTU Space, Denmark, [2] Norwegian Polar Institute, Norway, [3]Université Grenoble Alpes, CNRS, France, [4] National Physical Laboratory, United Kingdom, [5] Noveltis, France

10:40 **S9-45**

Providing FRM measurements for Sentinel-3 altimetry over the Antarctica ice sheets: the St3TART-FO project

*Fayon Lucile[1 *], Arnaud Laurent[1], Favier Vincent[1], Le Meur Emmanuel[1], Picard Ghislain[1], Reboud Arnaud[1], Aublanc Jérémie[2], Moholdt Geir[3], Miller Claire[4], El Hajj Mahmoud[4]*

[1] Université Grenoble Alpes, France, [2] CLS, France, [3] Norwegian Polar Institute, Norway, [4] Noveltis, France

Coffee Break 11:00-11:30

Session 10: Cryosphere Altimetry Calibration/Validation II
Chairs: Ole Andersen & Emma Woolliams

11:30 **S10-06**
Quality-Assessment and Potential of Satellite Radar Altimetry in the Arctic
*Antonio Bonaduce[1 *], Fabio Mangini[1], Roshin P. Raj[1]*
[1]Nansen Environmental and Remote Sensing Center and Bjerknes Center for Climate Research, Norway

11:50 **S10-09**
Validation of SWOT's sea surface height observations in sea-ice regions – a comparison with ICESat-2
Felix L. Müller[1], Denise Dettmering[1]*
[1]Deutsches Geodätisches Forschungsinstitut, Technical University of Munich, Germany

12:10 **S10-33**
Dual-hemisphere Sea Ice Reference measurements from multiple data sources tailored for evaluation and product inter-comparison of satellite altimetry
*Ida Birgitte Lundtorp Olsen[1,8], Henriette Skourup[1 *], Renée Fredensborg Hansen[1], Heidi Sallila[2], Stefan Hendricks[3], Stefan Kern[4], Stephan Paul[3], Marion Bocquet[5], Sara Fleury[5], Dmitry Divine[6], Eero Rinne[7]*
[1] DTU Space, Denmark, [2] Finnish Meteorological Institute, Finland, [3] Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany, [4] Integrated Climate Data Center, University of Hamburg, Germany, [5] LEGOS, France, [6] Norwegian Polar Institute, Norway,
[7] Arctic Geophysics, University Centre in Svalbard, Norway, [8] National Center for Climate Research, Danish Meteorological Institute, Denmark

12:30 **S10-57**
Full-Focused SAR swath-based iceberg detection and freeboard estimation in Interferometric Altimetry Missions
*Alessio Izzo[1 *], Pietro Guccione[2], Laura Fioretti[2], Lisa Recchia[2], Davide Giudici[2]*
[1] Aresys srl, Matera, Italy, [2] Aresys srl, Vimodrone, Italy

Lunch Break 12:50-14:10

Session 11: Onboard Calibration and Ground Cal/Val Infrastructures and Results
Chairs: Alejandro Egido & Salvatore Dinardo

14:10 **S11-26**
An Instrumental Calibration comparative study of ESA Altimetry missions
*Pablo García-Arnaud[1 *], Michel Guerra[1], Albert García-Mondéjar[1], Mònica Roca[1], Ester Vendrell[1]*
[1]isardSAT S.L. Spain,

14:30 **S11-13**
A fast-time complex calibration for the end-to-end range impulse response of the Sentinel-3 and Sentinel-6 altimeter systems
Gómez Olivé A [1], Garcia P [1], García-Mondéjar A [1], Flores A [1], Gibert F [1]
Dinardo S [2], Fornari M [3], Cullen R [4], Martin Puig C [2], Scharroo R [2]
[1] isardSAT S.L. Spain, [2] EUMETSAT, Germany, [3] RHEA for ESA – ESTEC, the Netherlands, [4] ESA/ESTEC, the Netherlands

14:50 **S11-34** **Empirical Mitigation of altimeter AGC steps drift: impact on long-term wind-speed and topography retrieval stability**

*V. Quet[1 *], H. Roinard[1], B. Flamant[1], F. Piras[1], M. Alves[1], P. Prandi[1], F. Bignalet-Cazalet[2], C. Maraldi[2], A. Guerin[2], N. Cuvillon[2]*
[1] CLS, France, [2] CNES, France

15:10 **S11-23** **Performance Comparison of Corner Reflector Sites: Towards a Distributed Calibration Network**

Albert Garcia-Mondéjar[1], Ferran Gibert, Adrià Gómez[1], Adrián Flores de la Cruz[1], Mònica Roca[1], Costas Kokolakis[2], Dimitrios Piretzidis[2], Stelios Mertikas[3], Etienne Ferrer[4], Claire Maraldi[5], Richard Francis[6]*
[1]isardSAT S.L. Spain, [2]Space Geomatica, Greece, [3]Technical University of Crete, Greece, [4] CLS, France, [5]CNES, France, [6]GerSpatial SAS, France

Gala Dinner 19:00

Thursday, 25 September, 2025

Session 12: Future Satellite Altimeters and Ground Reference Cal/Val facilities
Chairs: Jerome Buffard & C.K. Shum

09:00 **S12-47** **CRISTAL campaigns: Paving the way for the next generation of operational altimetry measurements**
Tânia Casal[1], Paolo Cipollini[1], Jerome Bouffard[2], Filomena Catapano[2], Alessandro Di Bella[2], Valeria Gracheva[1], Michele Scagliola[2]
[1] ESA/ESTEC, the Netherlands, [2] ESA/ESRIN, Italy

09:20 **S12-35** **Validating spectral requirements for wide-swath altimetry: a Cal/Val chimera?**
*Francesco Nencioli[1 *], Matthias Raynal[2], Clement Ubelmann[3], Emeline Cadier[1], Pierre Prandi[1], Gerald Dibarboure[2]*
[1]CLS, France, [2] CNES, France, [3]Datlas, France

09:40 **S12-36** **Design elements for an external verification system of S6NG stability requirements**
*Pierre Prandi[1 *], Thomas Moreau[1], Victor Quet[1], Valeria Gracheva[2], Alejandro Egido, Benjamin Montiellet[3]*
[1] CLS, France, [2] ESA/ESTEC, the Netherlands, [3]Thales Alenia Space, France

10:00 **S12-42** **Validation of HR SWOT data over inland waters, an opportunity to assess the future performance of S3NG-T swath altimetry missions**
Maxime Vayre[1], Julien Renou[1], Nicolas Taburet[1], François Boy[2], Roger Fjørtoft [2], Nicolas Picot[2], Claire Pottier[2], Noémie Lalau[3]
[1]CLS, France [2] CNES, France, [3] Magellium, France

10:20 **S12-69** **Performance assessment of the GAVC DORIS station in support of satellite altimetry precise orbit determination and absolute positioning**
Jerome Saunier[1], Guilhem Moreaux[2], Philippe Yaya[2], Frank Lemoine[3], Laurent Soudarin[2], Cécile Manfredi[4], Stelios Mertikas[5]
[1]IGN, France, [2]CLS, France, [3]NASA, USA, [4]CNES, [5]Technical University of Crete, Greece

10:40 **S12-68** **How to assess the sea level rise stability uncertainty budget of Sentinel-6 Next Generation missions?**
Michaël Ablain[1], Noemie Lalau[1], Emma Woolliams[2], Alejando Egido[3]
[1]Magellium, France, [2]National Physical Laboratory, United Kingdom, [3]ESA/ESTEC, the Netherlands

Coffee Break 11:20-12:00

12:00 **International Cal/Val Review:**
Chairs: Craig Donlon, Stelios Mertikas, Emma Woolliams

Round Table: **Future needs for altimetry Cal/Val in the Earth Observation Ecosystem 2030+**

- Critically review the current methodology applied at the Permanent Facilities for satellite altimetry calibration and validation using ground-based measurements;
- What are the Future needs for altimetry cal/val in the Earth Observation Ecosystem 2030+?
- Define the needs, establish standards and provide recommendations and best practices for altimerty calibration such that all measurements and results made for monitoring the Earth, the environment, the sea level, etc., are well-characterized and linked to other areas of science and technology through a world's measurement system established and maintained under the International System of Units and Metrology Standards;
- Document procedures for Fiducial Reference Measurements in satellite altimetry so that results are traceable to SI-units, reliable in the long term, comparable worldwide, to support an objective and unquestionable monitoring of the Sea Level and Climate Change;
- Establish procedures and protocols for characterizing the uncertainty budget of all FRM instruments and derived results over the entire end-to-end duration of a satellite mission;
- Define and document procedures, protocols and best practices to evaluate differences in instrument performances under a range of conditions to maintain satellite altimetry observations, to support the Earth Observation for the future;
- Summarize all scientific achievements for satellite altimetry Cal/Val and its applications in the context of Fiducial Reference Measurements.
- Consider whether the current network is sufficient to verify stability requirements for next generation altimetry missions, and/or what new approaches are needed. Consider in-situ observational systems, including those that meet CEOS-FRM (Fiducial Reference Measurement) standards and the potential of more novel approaches. The scope includes optimising the use of tide gauges and floating buoys, and exploiting networks of transponders and corner refelctors, as well as exploring the potential of novel approaches such as the use of autonomous surface vehicles.
- Examine how and why an altimetry mission is designated as "the reference mission" for all other altimeters. The aim of the discussion will be to define the role of a reference mission to support other altimeters, and what criteria must be met for a mission to have this designated status

Poster Session

Posters will be displayed for the full duration of the Workshop, beginning on Monday morning and will remain in place through Thursday at 13:00.

SP-11 **Uncertainty estimation in altimetric derived bathymetry from machine learning models**

*Bjarke Nilsson and Ole Baltazar Andersen[1 *]*
[1]DTU Space, Denmark

SP-30 **Data-Driven Performance Assessment of Altimeters and Radiometers for Next-Generation ESA Altimetry Missions**

Alba Granados[1], Sajedeh Behnia[2], Ralf Bennartz[5], Frank Fell, Albert García-Mondéjar[1], Ferran Gibert[1], Xavier Loizeau[2], Bruno Picard[3], Chris Ray[1], Mònica Roca i Aparici[1], Emma Wolliams[2]
[1] isardSAT, S.L., Spain, [2] National Physical Laboratory, United Kingdom, [3] Fluctus SAS, France, [4]Informus GmbH, Germany, [5]Vanderbilt University, USA

SP-38 **Calibration of Multi-Mission Altimetry for Improved Regional Sea Level Products for Baltic & North Sea**

*Ludwig Schröder[1 *], Gunter Liebsch[1], Tobias Bauer[1], Joachim Schwabe[1]*
[1] Federal Agency for Cartography and Geodesy, Germany

SP-41 **Altimetric Performance Calibration over the USCLA Corner Reflector: Methods, Results, and Lessons Learned for Future Deployments**

Ferrer Etienne[1], Moreau Thomas[1], Maraldi Claire[2] Nicolas Cuvillon[2], Clément Courde[2], François Boy[2], Lionel Zawadski[2], Nicolas Picot[2]
[1]CLS, Toulouse, France, [2]CNES, Toulouse, France

SP-43 **Validation Methodologies for CRISTAL In-Flight Level-2 sea ice and iceberg products within the framework of the CRISTAL IN-PROVA Project**

Henriette Skourup[1], Renée Fredensborg Hansen[1], Christian Haas[2], Emma Woolliams[3], Tommy Erni[3], Claire Miller[4], Eva Le Merle[4], Mahmoud El Hajj[4], Filomena Catapano[5]*
[1] DTU Space, Denmark, [2] Alfred-Wegener-Institut, Germany, [3] National Physical Laboratory, United Kingdom. [4] Noveltis, France, [5] ESA/ESRIN, Italy

SP-21 **Status and recent progress of St3TART-FO in providing operational Fiducial Reference Measurements (FRM) for Sentinel-3 Hydro-Cryo Altimetry products and beyond**

Claire Miller[1], Marine Dechamp-Guillaume[2], Henriette Skourup[3], Vincent Favier[4], Eva Le Merle[1], Vincent Boulenger[1], Julien Sarrau[1], Renée Mie Fredensborg Hansen[3], Ghislain Picard[4], Valentin Fouqueau[2], Mahmoud El Hajj[1], Marco Restano[5] and Filomena Catapano[6].*
[1]Noveltis, France, [2]vorteX.io, France, [3]DTU Space, Denmark, [4]IGE, Université Grenoble Alpes, France, [5]Starion for ESA/ESRIN, Italy, [6]ESA/ESRIN, Italy

SP-58 **On EGM2008 geoid anomalies in ESA Sentinel-3 Hydro-Cryo Thematic products: Status and future perspectives**

*Marco Restano[1 *], Karina Nielsen[2], Filomena Catapano[3], Alessandro Di Bella[3], Jérémie Aublanc[4], Giovanni D'Apice[4]*
[1]Starion, Italy, [2] DTU Space, Denmark, [3] ESA/ESRIN, Italy, [4] CLS, France

SP-59 **Simulation experiments of Corner Reflector Signal Response for Satellite Altimeter Cal/Val: A Case Study over Gavdos Island**

*Dimitrios Piretzidis[1], Costas Kokolakis[1 *], Stelios P. Mertikas[1,2]*
[1] Space Geomatica P.C., Greece, [2] Technical University of Crete, Greece

SP-62 **Validation of water level sensors using computer vision and machine**

*Costas Kokolakis[1 *], Achilles Tripolitsiotis[1], Xenophon Frantzis[2], Dimitrios Piretzidis[1], Stelios P. Mertikas[1,2]*
[1] Space Geomatica P.C., Greece, [2] Technical University of Crete, Greece

SP-63 **User support and training services for EUMETSAT altimetry products**

Ben Loveday[1,2], Hayley Evers-King[1], Sally Wannop[1], Vinca Rosmorduc[3]
[1] EUMETSAT, Germany, [2] Innoflair UG, Germany, [3] CLS, France