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Optics in the Sea

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Room: Oceaanzaal

09:00-09:15 **WELCOME BY THE GENERAL CHAIRS**

Marcel Wernand	**Oliver Zielinski**	**Hans van der Woerd**
Royal Netherlands Institute for Sea Research (NL)	University Oldenburg (DE)	VU University (NL)

09:15-10:00 **PLENARY TALK**

Ocean colour, from pretty pictures to key media information on the state of our planet - the maturation of a scientific technique 1

S. Boxall, University of Southampton, National Oceanography Centre (GB).

People have gazed across the ocean as long as history itself and often pondered its colour, from deep azure blues to the murky brown waters of our estuaries. In the 1600's Hudson sketched the clarity and colour of the seas to understand what influenced their many hues. It wasn't until the early 19th century that Fresnel and Brewster began to consider refraction, reflection and polarization but these were mainly laboratory and theoretical works.

On the 20th April 1865 it was Father Angelo Secchi, the chief scientist to the Vatican, who deployed what was to become the Secchi disk – the simplest and most robust piece of oceanographic equipment, ever. He worked in astronomical spectroscopy and was tasked with testing the new device for the Vatican navy – his interest in the inner space of the oceans having been sparked by working with the meteorologist and oceanography M.F. Maury a few years earlier. [6986]

10:00-10:30 Coffee break

10:30-13:00 **SESSION I: ENVIRONMENTAL MONITORING**

Chair: M. Wernand, Royal Netherlands Institute for Sea Research (NL)

10:30-11:00 INVITED TALK

Using social media to enhance scientific engagement 3

S. Lavender[1,2], A. Lavender[1]; [1]Pixalytics Ltd (GB); [2]School of Marine Science & Engineering, Plymouth University (GB).

This abstract considers how social media can be used by the scientific community to engage with each other and the wider general public in terms of citizen science. [6972]

11:00-11:20

Vertical migration maintains phytoplankton position in a tidal channel with residual flow 5

R.G. Macdonald[1], D.G. Bowers[1], D. McKee[2], W.A.M. Nimmo-Smith[3], G.W. Graham[3]; [1]Bangor University, School of Ocean Sciences (GB), [2]University of Strathclyde, Department of Physics (GB), [3]Plymouth University, School of Marine Science and Engineering (GB).

Phytoplankton that achieve a diurnal vertical swim can maintain their position in tidal channels despite a residual flow. The optical influence of vertical migrators on tidal channels is less transitory than the influence of those not migrating vertically. [6970]

11:20-11:40 STUDENT PRESENTATION

Enhancement of spatio-temporal coverage for HAB monitoring in the Ebro Delta, NW Mediterranean ... 7

J.A. Busch[1,2], A.D. Cembella[2], M. Fernández-Tejedor[3], J. Diogéne[3], O. Zielinski[1]; [1]Institute for Chemistry and Biology of the Marine Environment, University of Oldenburg (DE), [2]Alfred Wegener Institute for Polar and Marine Research (DE), [3]IRTA (ES).

The detection of harmful algal blooms (HABs) necessitates regionally adequate observational approaches that cover a broad spectrum of temporal and spatial scales. We present results of a radiometric system as complementary to traditional techniques for surveillance of aquaculture operations in the Ebro Delta. [6968]

11:40-12:00

Development of an online detection system for determination and characterization of dissolved organic substances in water via fluorescence spectroscopy 11

D. Meier[1], R. Heuermann[2], M. Horn[1], U. Machulik[3], K. Munderloh[2], A. Spitzy[3], D. Voß[1], O. Zielinski[1]; [1]Institute for Chemistry and Biology of the Marine Environment, University of Oldenburg (DE), [2]TriOS Mess- und Datentechnik GmbH (DE), [3]Institute for Biogeochemistry and Marine Chemistry, University of Hamburg (DE).

Detection and classification of dissolved organic substances and their origin within organic polluted waste and natural surface water plays an important role in the context of environmental monitoring. Up to now one of the most important parameter is the TOC (total organic carbon), providing no direct indication of how organic matter is composed. Therefore other parameters are required, one of them dissolved organic matter (DOM). Its colored component CDOM shows characteristic optical signatures in both absorption and fluorescence enabling high resolution measurements with optical sensors. We present first results from field measurements and statistic characterization enabling a direct differentiation of water types, leading to a new in-situ fluorescence online detection sensor for dissolved organic matter. [6949]

NOTES

Room: Oceaanzaal

12:00-12:20 STUDENT PRESENTATION

Spatial and temporal distribution and dynamics of ocean surface algal blooms in coastal/oceanic waters around India 13

M. Tholkapiyan, P. Shanmugam; Indian Institute of Technology Madras, Department of Ocean Engineering (IN).

An innovative algorithm, referred as the Ocean surface algal blooms "OSABT", is developed to provide essential data for detection and optical spectral characterization of OSABs in coastal and open ocean waters and it is applied to MODIS-Aqua imagery from the Arabian Sea and its results are systematically studied. [6941]

12:20-12:40

An inter-comparison in the field between the new WISP-3 and other radiometers (TriOS Ramses, ASD FieldSpec, and TACCS) 14

A. Hommersom[1,2], S. Kratzer[1], M. Laanen[2], I. Ansko[3], M. Ligi[3], M. Bresciani [4], C. Giardino[4], J. Beltran[1], G. Moore[5], M.Wernand[6], S. Peters[7,2]; [1]Stockholm University, Department of Systems Ecology (SE), [2]Water Insight (NL), [3]Tartu Observatory (EE), [4]National Resourch Council of Italy - Institute for Electro-magnetic Sensing of the Environment (CNR-IREA) (IT), [5]Bio-Optika (GB), [6]Royal Netherlands Institute for Sea Research (NIOZ) (NL), [7]Institute for Environmental Studies (NL).

The performance of the WISP-3 radiometer was assessed during three inter-comparison field campaigns: in the Wadden Sea, the Netherlands, in Lake Peipsi, Estonia, and in Lake Vänern, Sweden. The WISP-3 radiometer reflection spectra were obtained with accuracies in the same range as well known instruments, and could be used for fast water quality assessments of Chl and SPM. [6938]

12:40-13:00

Comparison of the spectral variability of Volume Scattering Function (VSF) for the Baltic seawater and the oil emulsion 16

W. Freda, Z. Otremba; Gdynia Maritime University, Department of Physics (PL).

Optical detection of oily substances polluting the sea water requires a knowledge of the optical properties of both sea water and impurities. In this paper the spectral variability of optical properties of Baltic Sea water and the oil-in-water emulsion of crude mined from Baltic seabed are presented. [6987]

13:00-14:30 Lunch break

14:30-16:00 **SESSION II: CROWDSOURCING, TOPIC RELATED SMARTPHONE/IPHONE APPS**

Chair: J. Piera Fernandez, CNIMA - CSIC (ES)

14:30-15:00 INVITED TALK

Crowdsourcing and smartphone technology 18

L. Ceccaroni; Barcelona Digital Technology Centre (ES).

Data are no longer something people merely consume. They are something people create. Environmental monitoring should not be tackled by scientists or policy makers alone; and indeed many projects are challenging the notion that sustainability is expensive, that technology is hard to use, that data quality and quantity are exclusive. Involving the general public in observing and understanding our changing world is a crucial element for a sustainable way of facing current and future problems. [6981]

15:00-15:20

Smartphones, crowdsourcing and the colour of natural waters 20

S. Novoa, M.R. Wernand; Royal Netherlands Institute for Sea Research, Physical Oceanography, Marine Optics & Remote Sensing (NL).

Ocean colour measurements are based on multi- and hyper spectral measurements performed at sea and from space. A simpler approach to determine the colour of natural waters is by means of the Forel-Ule colour comparator scale. This scale has been applied globally and intensively by oceanographers and limnologists since the 19th century, providing one of the oldest oceanographic data sets. Present and future Forel-Ule classifications of global oceanic, coastal and continental waters, can facilitate the interpretation of these long-term ocean colour data series and provide a connection between the present and the past that will be valuable for climate-related studies. [6977]

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Room: Oceaanzaal

15:20-15:40 STUDENT PRESENTATION

Monitoring marine environments with crowdsourcing methods: Water transparency estimation using low cost technologies 21

R. Bardají, J. Piera; Marine Science Institute (ICM-CSIC), Department of Physical Oceanography (ES).

Within the framework of citizen science technologies, one goal of the *Citclops* European project is to develop new technologies to estimate water transparency related parameters. As a potential solution, a low cost instrument is proposed, integrating quasi-digital optical sensors in the open-hardware *Arduino* platform. [6955]

15:40-16:00

Image processing for automatic estimation of water transparency using crowdsourcing data 23

C. Simon, J. Piera; CSIC, Marine Science Institute, Department of Physical Oceanography (ES).

Based on crowdsourcing data, the study aims at developing a simple method to automatically compute the water transparency. With underwater camera pictures, an image processing technique should provide robust estimations of parameters related to water transparency. [6954]

16:00-16:30 Coffee break

16:30-18:00 **SESSION III: OCEAN COLOUR**

Chair: S. Boxall, University of Southampton, National Oceanography Centre (GB)

16:30-17:00 INVITED TALK

"Let there be light" 25

M. Blaas, Deltares, Marine & Coastal Systems (NL).

And God said, "Let there be light," and there was light. Light was created and separated from darkness during the first day in Genesis because light was good. As we know now, light makes live possible on earth, on land in in seawater. As the Dutch medical doctor Jan Ingenhousz postulated and proved in the eighteens century: living air is created by light and plants and that makes live possible for other organisms. [6937]

17:00-17:20

The importance of surface reflection for the perceived color of lakes and oceans 26

B. Hamre[1], Ø. Frette[1], K. Stamnes[2], J.J. Stamnes[1]; [1]Department of Physics and Technology, University of Bergen (NO), [2]Department of Physics and Engineering Physics, Stevens Institute of Technology (US).

Radiative transfer modeling and measurements in a coupled atmosphere-ocean system shows that the observed color of oceans and lakes often can be attributed to sky light that is reflected from the water surface. But strongly scattering particles in the water may enhance the amount of light leaving the water body and thus change the perceived color depending on the absorbing constituents in the water. [6976]

17:20-17:40

Ocean Color products from hyperspectral satellite data 28

A. Bracher[1], T. Dinter[1], A. Wolanin[1], A. Sadeghi[1], M. Soppa[1], I. Peeken[3], V. Rozanov[2], B.B. Taylor[1], V. Vountas[2]; [1]Helmholtz Young Investigators Group PHYTOOPTICS at the University of Bremen and Alfred Wegener Institute for Polar and Marine Research (AWI) (DE), [2]Physics and Chemistry of the Atmosphere, Institute of Environmental Physics (IUP), University of Bremen (UB) (DE), [3]Biological Oceanography, AWI and Center for Marine Environmental Sciences (MARUM) (DE), *Now at: Remote Sensing, IUP, UB (DE).*

Quantitative distributions of major functional PFTs of the world ocean improve the understanding of the role of marine phytoplankton in the global marine ecosystem and biogeochemical cycles. Chl-a fluorescence gives insight on the health of phytoplankton and is related to phytoplankton biomass. In this study, global ocean color satellite products of different dominant phytoplankton functional types' (PFTs') biomass and chlorophyll fluorescence retrieved from hyperspectral satellite data using Differential Optical Absorption Spectroscopy applied to phytoplankton (PhytoDOAS) are presented (see also Bracher et al. 2009, Sadeghi et al. 2012a). [6975]

17:40-18:00 STUDENT PRESENTATION

An evaluation of hyperspectal optical observations in the Artic: in-water and above-water 29

S.P. Garaba, O. Zielinski; Institute for Chemistry and Biology of the Marine Environment, University of Oldenburg (DE).

The need to obtain reliable remote sensing reflectance (R_{RS}) using hyperspectral technology has gained increased interest. We assess the variations in above-water and underwater estimation of R_{RS}. We also analyse how their end-products inferred from R_{RS} using bio-optical modelling and intrinsic colour differ. [6946]

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Tuesday, 19 March

Room: Oceaanzaal

09:00-10:20 **SESSION IV: RADIATIVE TRANSFER AND MODELLING**

Chair: H. van der Woerd, VU University (NL)

NOTES

09:00-09:20 STUDENT PRESENTATION

Assessment of phytoplankton communities in a shallow estuary by means of model simulations and hyperspectral data 31

E. Torrecilla, M. Ramirez-Pérez, S. Pons, J. Piera; Mediterranean Marine and Environmental Research Centre, Marine Science Institute, Spanish National Research Council (CSIC) (ES).

Several studies have demonstrated the advantages offered by hyperspectral optical data for characterizing phytoplankton biodiversity. There is a need to test whether these observations, proven useful in open ocean waters, can also be effective for the identification of phytoplankton communities in shallow estuarine waters. [6974]

09:20-09:40 STUDENT PRESENTATION

Light penetration in fjordal systems: Evaluating the effect of glacial meltwater in the Uummannaq Fjord (West-Greenland) 34

L. Holinde, O. Zielinski; Institute for Chemistry and Biology of the Marine Environment, University of Oldenburg (DE).

Sediment in the water column can significantly influence the penetration depths of light in natural waters. Especially in fjordal systems glacial meltwater is rich in very fine sediment layers floating in the upper watercolumn. This work evaluates the influence of this glacial flour on the underwater light field in the fjord. [6964]

09:40-10:00

A Versatile Tool for Radiative Transfer Simulations in the Coupled Atmosphere-Ocean System: Introducing c-disort capabilities 36

K. Stamnes[1], S. Stamnes[1], B. Hamre[2], J.J. Stamnes[2]; [1]Department of Physics and Engineering Physics, Stevens Institute of Technology (US), [2]Department of Physics and Technology, University of Bergen (NO).

Reliable, accurate, and efficient modeling of the transport of electromagnetic radiation in turbid media has important applications in the study of the Earth's climate by remote sensing. For example, such modeling is needed to develop forward-inverse methods used to quantify types and concentrations of aerosol and cloud particles in the atmosphere, the dissolved organic and particulate biogeochemical matter in lakes, rivers, coastal, and open-ocean waters. It is also needed to simulate the performance of remote sensing detectors deployed on aircraft, balloons, and satellites as well as radiometric detectors deployed on buoys, gliders and other aquatic observing systems. Accurate radiative transfer modeling is also required to compute irradiances and scalar irradiances that are used to compute warming/cooling and photolysis rates in the atmosphere and primary production and warming/cooling rates in the water column. [6956]

10:00-10:20 STUDENT PRESENTATION

Measurements and modelling of upwelling light field in coastal waters 38

V.B. Sundarabalan, P. Shanmugam; Indian Institute of Technology Madras, Department of Ocean Engineering (IN).

Numerical simulations of radiance distribution in coastal waters are a complex problem, but playing a growingly important role in remote sensing applications and optical oceanography. The present study aims to present a modified radiative transfer equation (MRTE) which involves more appropriate boundary conditions such as the phase function, effective reflectance of the bottom and its slope condition, solar zenith angles and material reflectance. For this computation a modified Fournier Forand phase function model is used which varies along the depth. [6947]

10:20-10:50 Coffee break

Room: Oceaanzaal

10:50-12:10 **SESSION IV: RADIATIVE TRANSFER AND MODELLING** (ctd.)

Chair: H. van der Woerd, VU University (NL)

NOTES

10:50-11:10
Atmospheric correction and calibration of OCM sensor data 39
P. Shanmugam, M. Tholkapiyan, M. Suresh; Indian Institute of Technology Madras, Department of Ocean Engineering (IN).
The radiometric calibration coefficients that are required to enhance the preflight calibration coefficients to improve the performance of the Ocean Colour Monitor (OCM2) onboard the Indian Remote Sensing Satellite (IRS) are determined using in-situ measurements in coastal and relatively clear waters around southern India. These coefficients were applied to the OCM2 data acquired over coastal waters of the Palk Strait, and are compared with those included in the SeaDAS software and those derived by the Space Application Centre (SAC), India. [6942]

11:10-11:30
Climate-induced changes in the vertical attenuation of light in coastal waters 40
M.A. Eleveld[1], H.J. van der Woerd[1], S.W.M. Peters[1,2]; [1]Vrije Universiteit Amsterdam, Institute for Environmental Studies (VU-IVM) (NL), [2]Water Insight (NL).
Bio-optical modelling shows that vertical diffuse attenuation in coastal waters will change, particularly in the blue wavelengths, for viable conditions predicted under the IPCC SRES and new RCP scenarios. Change in near-surface Suspended Particulate Matter concentrations (SPM) will control the vertical diffuse attenuation (Kd) in optically complex coastal waters. [6939]

11:30-11:50 STUDENT PRESENTATION
Springs-Neaps Patterns in Daily Total Seabed Irradiance 42
E.M. Roberts, D.G. Bowers, A.J. Davies; Bangor University, School of Ocean Sciences (GB).
The tide can have an amplifying or a reducing effect on daily total seabed irradiance. The magnitude of the effect is determined by: tidal range; water clarity; time of low water; and daylength. Springs-neaps patterns are thus observed in the daily totals. These patterns vary seasonally and geographically, and modulate benthic growth. [6932]

11:50-12:10
The Solar Radiation Budget at the Wavy Air-Sea Interface 44
M. Hieronymi; Institute of Coastal Research, Helmholtz Centre Geesthacht (HZG) (DE).
The lensing effect of waves at the water surface causes remarkable fluctuations of the availability of light in water. A radiative transfer model is used to characterize fluctuations of the underwater light field, i.e. down- and upwelling irradiance, irradiance reflectance, and water leaving radiance. [6929]

12:10-13:30 Lunch break

13:30-15:50 **SESSION V: MARINE BIO-OPTICS AND REMOTE SENSING**

Chair: O. Zielinski, University Oldenburg (DE)

13:30-13:50
Initial results with automated ship-borne reflectance measurements and data processing in near-coastal waters in the Western Channel 46
V. Martinez-Vicente[1], S.G.H. Simis[2], R. Alegre[1], P.E. Land[1], S.B. Groom[1]; [1]Plymouth Marine Laboratory (GB), [2]Finnish Environment Institute SYKE (FI).
In-situ hyperspectral remote-sensing reflectance data (<15 km from the shore) from an unsupervised moving platform, processed using an automated method, are compared with concurrent Aqua-MODIS and Suomi-NPP-VIIRS satellite data. [6971]

13:50-14:10 STUDENT PRESENTATION
Optical properties of high-altitude lakes: Lake Namtso in Tibet,China 48
X. Cirennima[1,2], J.J. Stamnes[1], Ø. Frette[1], B. Hamre[1], L. Zhao[1]; [1]Department of Physics and Technology, University of Bergen (NO), [2]Natural Science Faculty, Tibet University (TAR CN).
Preliminary results are presented of the absorption and scattering characteristics of Lake Namtso, which is the highest-situated large lake in the world. [6957]

Room: Oceaanzaal

14:10-14:30
Measuring and modeling of bioluminescence in coastal waters 50
A. Simon, P. Shanmugam; Department of Ocean Engineering, Indian Institute of Technology Madras (IN).
In-situ optical properties of bioluminescence were measured in Indian waters and the result of measurement was compared with the simulation results from a hydrolight module. Samples of different dinoflagellates and bacteria were collected, cultured and their optical properties were analyzed for mechanical, chemical and thermal stimulations in laboratory. [6940]

14:30-14:50
Water masses, mixing and the export of dissolved organic carbon from the Irish Sea 52
D.G. Bowers[1], E.M. Roberts[1], M. White[2]; [1]Bangor University, School of Ocean Sciences (GB), [2]NUI Galway, Earth and Ocean Sciences (IE).
Optical measurements of coloured dissolved organic matter (CDOM) are used as a tracer for water masses in a coastal water body. Three water masses are identified in the Irish Sea and mixing between them can be quantified. It is also possible to estimate fluxes of dissolved carbon. [6926]

14:50-15:10
Remote sensing of turbid waters. A closer look at the SWIR 54
E. Knaeps[1], K. Ruddick[2], A. Dogliotti[3], D.Doxaran[4], S. Sterckx[1], D. Raymaekers[1], B. Nechad[2]; [1]Flemish Institute for Technological Research (VITO), Remote Sensing Unit (TAP) (BE), [2]Management Unit of the North Sea Mathematical Models (MUMM), Royal Belgian Institute for Natural Sciences (RBINS) (BE), [3]Instituto de Astronomía y Física del Espacio (CONICET-UBA) (AR), [4]Laboratoire d'Océanographie de Villefranche UMR 7093 – Centre National de la Recherche Scientifique/Université Pierre et Marie Curie (FR).
An ASD spectrometer is used to measure the water reflectance in the SWIR for some highly turbid rivers. Some example spectra are presented for the Gironde river showing a significant increase in reflectance between 950 and 1150 nm and a clear correlation between the reflectance at 1071 nm and the TSM concentration. [6922]

15:10-15:30
Assimilation of MERIS SPM data into a 3D sediment transport model 56
M. Blaas[1], M. Eleveld[2], H. van der Woerd[2], S. Gaytan[1], K. Cronin[1], W. Borst[3], O. Van Tongeren[3], Gh. El Serafy[1,4]; [1]Deltares (NL), [2]VU University Amsterdam, Institute for Environmental Studies (IVM) (NL), [3]Port of Rotterdam Authority (NL), [4]Delft University of Technology, Inst. of Applied Mathematics (NL).
This paper discusses the development of the Delft3D SPM transport model, addresses the retrieval of surface SPM from ESA's MERIS sensor by VU-IVM's HYDROPT algorithm and evaluates the assimilation of the remote sensing data into the transport model by Ensemble Kalman Filtering. [6936]

15:30-15:50
Visibility of oil dispersed in seawater in windy conditions 58
Z. Otremba[1], O. Zielinski[2], C. Hu[3]; [1]Gdynia Maritime Univ., Physics Department (PL), [2]Univ. of Oldenburg, Institute for Chemistry and Biology of the Marine Environment (DE), [3]Univ. of South Florida, College of Marine Science (US).
Pollution of natural waters by oil represents a serious threat for ecosystems, and timely assessment of the degree of pollution requires measurement strategies including remote sensing and modeling. Here the Michelson contrast of sea area polluted by an oil-in-water emulsion under various wind conditions is determined through Monte-Carlo modeling, and an optimal direction of observation in windy weather is proposed. [6963]

16:00-17:30 Poster Session & Coffee break

19:30-22:00 Conference Dinner

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Room: Oceaanzaal

09:00-10:30 **SESSION VI: INNOVATIVE SUB-SEA OPTICAL TECHNIQUES AND INSTRUMENTATION**

Chair: M. Wernand, Royal Netherlands Institute for Sea Research (NL)

09:00-09:30 **INVITED TALK**

From Optical Remote Sensing of the Earth to Non-Invasive Diagnostics of Skin Cancer 60

J.J. Stamnes[1], K. Stamnes[2]; [1]Department of Physics and Technology, University of Bergen (NO), [2]Department of Physics and Engineering Physics, Stevens Institute of Technology (US).

Key challenges in optical satellite remote sensing of coupled atmosphere-ocean systems are reviewed with particular emphasis on simultaneous retrieval of aerosol and marine parameters in coastal waters from satellite measurements of reflected solar radiation at selected wavelengths (ocean color data). Then it is discussed how such methods that were developed for optical satellite remote sensing can be used for non-invasive optical detection of skin cancer. [6959]

09:30-09:50 STUDENT PRESENTATION

ft-PSICAM: A new approach for determining water constituents absorption continuously 62

J. Wollschläger, M. Grunwald, R. Röttgers, W. Petersen; Helmholtz-Zentrum Geesthacht, Institute of Coastal Research (DE).

The performance of a new device (flow through-PSICAM) for the continuous measurement of spectral absorption coefficients has been evaluated. Furthermore, during several cruises in 2010 and 2011, the relationship of absorption and fluorescence measurements to the chlorophyll-*a* concentration in the water is described. [6935]

09:50-10:10 STUDENT PRESENTATION

An optofluidic microchip for phytoplankton species identification 64

A. Schaap[1], T. Rohrlack[2], Y. Bellouard[1]; [1]Eindhoven Univ. of Technology, Mechanical Engineering (NL), [2]Norwegian Univ. of Life Sciences, Hydrology/Limnology (NO).

We present a glass microchip-based approach to classifying phytoplankton species in water, using microfluidics with an integrated optical waveguide. The device is able to categorize into species the individual phytoplankton in a mixture of five species, and to distinguish *Cyanothece* from detritus. [6965]

10:10-10:30

Lidar-radar for underwater detection and communication: Experimental demonstration and simulation. 66

P. Feneyrou[1], L. Leviandier[1], G. Pillet[1], R. La[1], D. Dolfi[1], G. Kervern[2]; [1]Thales Research & Technology (FR), [2]Thales Underwater Systems (FR).

The benefit of high frequency modulation of pulsed Lidar for underwater detection and communication is demonstrated through both experimental measurements in a diffusive water tank and numerical simulations accounting for multiple scattering and fluctuating density of scatterers. [6967]

10:30-11:00 Coffee break

11:00-13:10 **SESSION VII: UNDERWATER IMAGING**

Chair: J. Schulz, University of Oldenburg (DE)

11:00-11:30 **INVITED TALK**

Underwater hyperspectral imagery for identification, mapping and monitoring of bio-geo-chemical features on the sea floor 68

G. Johnsen[1,4], M. Ludvigsen[2,4], A.J. Sørensen[2,4], M.A. Moline[3,4]; [1]Norwegian University of Science and Technology (NTNU), Dept. of Biology (NO), [2]Norwegian University of Science and Technology (NTNU), Dept. Marine Technology (NO), [3]University of Delaware, School of Marine Science and Policy, College of Earth, Ocean, and Environment (US), [4]Applied Underwater Robotics laboratory (AUR-Lab), NTNU (NO).

This paper describes the use of an underwater hyperspectral imager (UHI) system deployed on a remotely operated vehicle (ROV) for automated identification, mapping and monitoring of seafloor habitats from surface to 1000 m depth. We describe the benefits using an UHI system compared to other optical and acoustic techniques. [6960]

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Room: Oceaanzaal

11:30-11:50
Extraction of contour based features for the discrimination of planktonic groups 70
J. Schulz, A. Mentges; University of Oldenburg, ICBM - Institute for Chemistry and Biology of the Marine Environment (DE).
The extracted contour line of imaged plankton specimens contains useful taxonomic information for automated classification. Here we investigate two new approaches for the numerical extraction of significant, group-specific information from the silhouette representation, decomposable by multivariate analyses. [6980]

11:50-12:10
Ergonomic digital holography for oceanographic applications 73
F. Ghiglieno, L.F. Baldasso, C.G. Goçalo, N. de Aquino, R.M. Lopes; University of São Paulo, LAPS/IOUSP (BR).
We present a compact digital in-line lensless holography (DIH) setup integrated with an ergonomic and fast processing interface with autofocus and digital zoom facilities, for the detection of microplankton and larger targets. Our results were in good agreement with 2D imaging techniques, with the additional advantages of a focus-free DIH tool. [6931]

12:10-12:30
Digital Holographic System for the Imaging and analysis of living marine plankton interrelational Behavior 75
E.N. Kamau, P. Huke, R.B. Bergmann; Bremer Institut für angewandte Strahltechnik (BIAS) (DE).
In this work we describe a novel automated system for the in-situ observation of marine plankton, their interrelational behavior and sediments research as well as for other biological applications. The system combines digital holographic imaging and highly automated data processing to facilitate applications in the laboratory e.g. during high see research expeditions. We present first laboratory results showing the applicability of the system in the analysis of zooplankton with sizes in the micrometer range. [6925]

12:30-12:50
Smart Underwater Three Dimensional Imaging System Using Agile Spatial Processing 77
N.A. Riza, M. Junaid Amin; University College Cork, Department of Electrical and Electronic Engineering (IE).
A novel underwater laser based remote Three Dimensional (3D) imaging system is presented using an Electronically Controlled Variable Focal Length Lens (ECVFL) and smart spatial processing. The 3D imager design features the highest transverse spatial resolution for 3-D sensing of underwater objects. [6923]

12:50-13:10
Color Digital Holographic Microscopes for Monitoring Waterborne Microorganisms 79
Sz. Tokes[1,2]; L. Orzo[1], M. Kiss[1], B. Wittner[1]; [1]MTA SZTAKI, Cellular Sensory and Optical Wave Computing Laboratory (HU), [2]Faculty of Information Technology, Pazmany Peter Catholic University (HU).
H-We have developed different versions of color digital holographic microscopes for monitoring waterborne microorganisms. The architectural versions, methods to improve the quality of numerically reconstructed images are compared. Our final goal was to have appropriate images for recognition and classification. Morphological databases have been built for various water bodies, for freshwater and for see water species. [6988]

13:10 **STUDENT AWARD CEREMONY & FAREWELL**

13:30 **END OF EOS TOPICAL MEETING**

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Tuesday, 19 March

16:00-17:30 **POSTER SESSION**

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Blue Photonics 6930_001
Fluorescence of oil dispersed in the water 82
E. Baszanowska[1], O. Zielinski[2], Z. Otremba[1], H. Toczek[1]; [1]Gdynia Maritime University, Physics Department (PL), [2]University of Oldenburg, Institute for Chemistry and Biology of the Marine Environment (DE).
Water polluted by oil-in-water emulsion was studied with the objective to estimate differences in three-dimensional fluorescence spectra. Studies included various types of oils and oil concentrations.

Blue Photonics 6934_002
Seawater vs. oil-in-water emulsion: differences between inherent optical properties 84
Z. Otremba; Gdynia Maritime University, Physics Department (PL).
Inherent Optical Properties (IOPs) of natural seawater are compared with IOPs of water polluted by oil-in-water emulsion. Differences significant for above water radiance distribution formation are indicated.

Blue Photonics 6951_003
Mobile fluorescence sensing for citizen observatories 86
R.H. Henkel[1], R. Heuermann[2], K. Munderloh[2], O. Zielinski[1]; [1]Institute for Chemistry and Biology of the Marine Environment, University of Oldenburg (DE), [2]TriOS Mess- und Datentechnik GmbH (DE).
The objective of environmental crowdsourcing is to include citizens in ecosystem monitoring, fostering their responsibility and increasing at the same time the amount of available data for scientists and policy makers. Among these approaches, the utilization of mobile devices is of increasing interest especially due to the fast evolving camera technology. This work is focusing on fluorescence observations for marine environmental parameters using internal light sources from commercial smartphones as well as their in-built cameras.

Blue Photonics 6952_004
Determination of inherent optical properties in the field 88
H. van der Woerd; VU University, Institute for Environmental Studies (NL).
In this presentation an attempt is made, based on HydroLight simulations, to summarize the origin and magnitude of errors introduced in these measurements by geometry of the ambient light field, including the influences of the solar zenith angle, sun glitter at the air-water interface, waves and lens effects, and rapid changes in cloud cover. The multiple protocols for optical measurements (FU-scale, Secchi Disk, water-leaving radiance, turbidity and fluorescence) have always concentrated on the prescription of the exact deployment of these instruments to minimize the impact of the environmental conditions. This work can be seen as complementary to these protocols to support the derivation of inherent water properties from all field measurements.

Blue Photonics 6953_005
Optical sensing of PAHs within bilge and process waters 90
D. Voß[1], H. Lehmann[2], R. Heuermann[3], D. Meier[1], K. Munderloh[3], O. Zielinski[1]; [1]Institute for Chemistry and Biology of the Marine Environment, University of Oldenburg (DE), [2]Institute of Photonic Technology (DE), [3]TriOS Mess- und Datentechnik GmbH (DE).
The pollution with oil, especially polycyclic aromatic hydrocarbons (PAHs), poses a serious threat for (marine) ecosystems and human health. Environmental awareness increases the requirements of reliable oil-monitoring systems. Especially regarding dissolved components within ship applications, as bilge water discharge or industrial process waters. Optical methods offer an excellent opportunity for PAH sensing with high accuracy supporting already existing systems in these application areas. We present a set-up and first laboratory results from a new detection system for dissolved PAHs based on special polymeric coating and fibre optical technology.

Tuesday, 19 March | 16:00-18:00

Blue Photonics 6958_006
Spectrophotometric study of Baltic surfactants – results from a November 2012 research cruise 92
V. Drozdowska[1], K. Rudz[2], A. Marchwińska[1], P. Pakszys[1], D. Gutowska[1], P. Makuch[1], P. Markuszewski[1], J. Piskozub[1]; [1]Institute of Oceanology Polish Academy of Science, Physical Oceanography Department (PL), [2]Gdynia Maritime University, Faculty of Marine Engineering (PL).
To find the source of surfactants (suface active agents) in the sea and their concentration and distribution in the surface layers – the spectrophotometric measurements of water samples and the spectra analysis and discussions were carried out.

Blue Photonics 6962_007 STUDENT PRESENTATION
Optical measurement of surface ocean waves 94
D. Kiefhaber[1,2], R. Rocholz[2], P. Bauer[1,2], B. Jähne[1,2]; [1]University of Heidelberg, Institute of Environmental Physics (DE), [2]University of Heidelberg, Heidelberg Collaboratory for Image Processing (HCI) (DE).
Two new optical instruments for the measurement of surface ocean waves have been developed and deployed to two experiments in the Pacific Ocean. By combining different measurement techniques, information on the whole spectrum of waves can be obtained.

Blue Photonics 6966_008 STUDENT PRESENTATION
Spatial Variability of Chlorophyll A in the Baltic Sea as a Proxy for Validation Suitability 96
P. Groetsch[1,2], M. Eleveld[1], S. Simis[3], S. Peters[1,2]; [1]VU University Amsterdam, Institute for Environmental Studies (IVM) (NL), [2]Water Insight (NL), [3]Finnish Environment Institute SYKE (FI).
Ship-of-opportunity in situ measurements are widely used for validation of remote sensing products of the Baltic Sea. Changing environmental situations along transects result in highly variable correlations between the two data sources. Spatial variability can be used to predict which parts of a transect are suitable for validation.

Blue Photonics 6969_009 STUDENT PRESENTATION
Modelling the influence of oil content on optical properties of seawater in the Baltic Sea 98
K. Rudz[1], M. Darecki[2], H. Toczek[1]; [1]Gdynia Maritime University, Department of Physics (PL), [2]Institute of Oceanology of Polish Academy of Sciences (PL).
Oil content in Baltic Sea varies from several ppb in the open sea to several ppm in estuaries or ship routes. The measurements of inherent optical properties of oil-in-water emulsion have been used to model the remote sensing reflectance of polluted seawater. Such model can be further used in remote sensing of water pollutants.

Blue Photonics 6989_011
A wavelet approach to estimate optically active constituents from high spectral resolution data in complex waters 100
E.M. Ampe[1,2], D. Raymaekers[2], E.L. Hestir[3], E. Knaeps[2], O. Batelaan[1,4]; [1]Department of Hydrology and Hydraulic Engineering, VUB (BE), [2]VITO, Flemish Institute for Technological Research (BE), [3]CSIRO, Land and Water (AU), [4]School of the Environment, Flinders University (AU).
We present a wavelet based approach to quantify optically active constituents from Hydrolight high spectral resolution data. Wavelets have the advantage to detect both narrow and broad spectral features. The wavelet analysis enables us to reduce the influence of the confounding factors in the prediction of an optically active constituent.

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