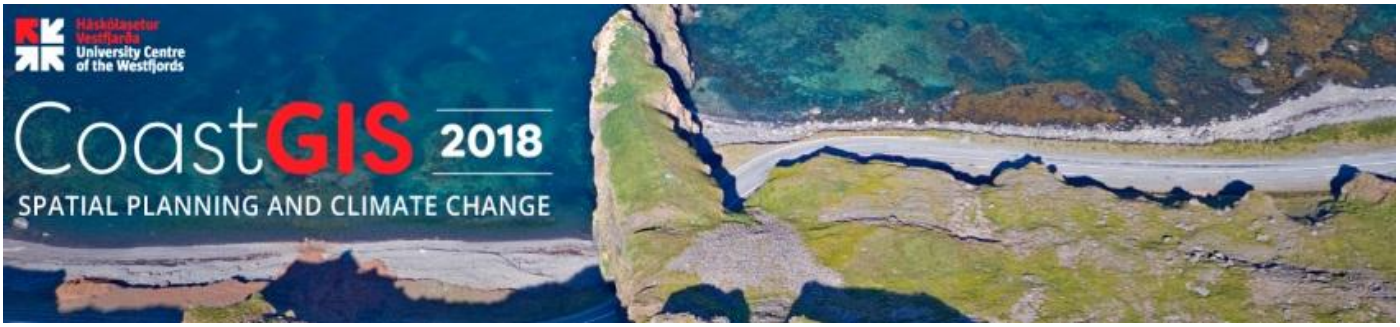

CoastGIS 2018

Spatial Planning and Climate Change

The International Symposium of GIS and Computer Cartography for Coastal Zone Management

Ísafjördur, Iceland September 27-29, 2018

University Centre of the Westfjords

+354 450 3040 | www.uw.is |info@uw.is


ÍSAFJÖRÐUR
Police station
Pharmacy
Hospital
Post office
Centrum
Tourist information
Airport
Camping sites
Toilets
Swimmingpool
ATM
FREE COPY
Aðalstræti
Sindragata
Ásgeirsgata
Suðurgata
Suðurtangi
Árnagata
Kristjánsgata
Njarðarsund
Mjósund
Hafnarstræti
Pollgata
Austurvegur
Norðurvegur
Sundstræti
Brunngata
Skipagata
Fjarðarstræti
Hrannargata
Mánagata
Mjallargata
Túngata
Eyrargata
Skutulsfjarðarbraut
Seljalandsvegur
Urðarvegur
Hlíðarvegur
Torfnes
Krókur

CoastGIS

The CoastGIS International Symposium is usually held once every two years under the joint scientific sponsorship of the Commission on Coastal Systems of the International Geographical Union (IGU/CCS) and the Commission on Marine Cartography of the International Cartographic Association (ICA/CMC).

The first International Symposium on GIS and Computer Cartography for Coastal Zone Management, CoastGIS, took place at University College Cork in Ireland in 1995. The second CoastGIS meeting took place in Aberdeen, Scotland, two years later and, since then, CoastGIS symposia have been held in Brest, France in 1999; Halifax, Nova Scotia in 2001; Genoa, Italy in 2003; Aberdeen again in 2005; Sydney and Wollongong, Australia, in 2006; Santander, Spain in 2007; Santa Catarina, Brazil, in 2009; Oostende, Belgium, in 2011; Victoria, on Canada's West Coast in 2013, and Cape Town, South Africa in 2015. Over the years the CoastGIS events continue to provide a showcase for new developments in information management and technology as well as a learning experience for all involved in coastal zone management, science and research.

CoastGIS 2018 in Ísafjördur, Iceland - hosted by the University Centre of the Westfjords - is the 13th consecutive symposium for an international exchange of knowledge, ideas and experience on how spatial data and information technologies aid marine and coastal zone managers and stakeholders in better understanding and managing coastal space and resources. A wide range of topics have been covered in previous years covering technological advances and progress, and the evolving challenges. This year's theme is Climate Change and Spatial Planning to address recent challenges in managing our coastlines effectively and sustainably.

The International CoastGIS Committee is chaired by Dr. David R. Green, University of Aberdeen.

Thursday 27.09.2018 Program Day 1				
Domestic flight arrives 8:40 - free transport from airport to venue				
08:30		Edinborg Cultural House	Registration opens	
09:30	10 min		Welcoming address by the host	
09:40	35 min		**Invited Speaker: Eydís Líndal Finnbogadóttir -** Director of National Land Survey Iceland: *Arctic Spatial Data Index*	
10:15	20 min		**Invited Speaker: Tom Barry -** Executive Secretary Conservation of Arctic Flora and Fauna (CAFF): *The use of Spatial data to inform Arctic policy and management*	
10:35	20 min		coffee break	
10:55	25 min		**Björn Erlingsson** - Research Affiliate University Center of the Westfjords: *Variations in coastal conditions on different time scales - from 100 minutes to 100 years in GISystems*	
11:20	25 min		**Gunnar Páll Eydal** - Verkís: *Spatial Planning Challenges in Low-lying Areas in the Westfjords*	
11:45	20 min		**Brack Hale -** Franklin University: *Mapping differences in foreign and domestic tourism in coastal areas of the Westfjords*	
12:05	1,5 h		Lunch break - Edinborg Restaurant	
13:30	90 min	University Center of the Westfjords	Session 1 - Room A	Session 2 - Room B
15:00	10 min			
15:10	90 min		Session 3 - Room A	Session 4 - Room B
16:40	20 min		coffee break	
17:00	60 min		Session 5 - Room A	Session 6 - Room B / Session 7 - Room C
18:00			conference day ends	
19 - 21	120 min		**Poster - Meet and Greet** Poster Session at the University Center of the Westfjords, refreshments and finger food; welcoming address ca. 19:30	

Friday 28.09.2018 Program Day 2					
08:30		Edinborg Cultural House	House opens		
09:00			Welcome and announcements		
09:10	35 min		**Invited Speaker: Jim Hansom -** University of Glasgow and Dynamic Coast Scotland lead: *Dynamic Coast: GIS underpinning for coastal collaboration and enhanced resilience*		
09:45	25 min		**Invited Speaker: David R. Green** - University of Aberdeen and Chairman of the International CoastGIS Organising Committee: *Low-Cost Monitoring, Mapping and Modelling of the Coast using UAVs*		
10:10	20 min		**Timothy Webster** - Nova Scotia Community College: *Advances in Topo-Bathymetric Lidar surveys to support Spatial Planning and Climate Change*		
10:30	20 min		coffee break		
10:50	25 min		**Charla M. Burnett, Will McClintock** - Marine Science Institute, University of California Santa Barbara: *SeaSketch's Ideal Process Planning Model: Ensuring Equitable Decision-making in Marine Spatial Planning*		
11:15	25 min		**Rosaline Canessa -** Department of Geography, University of Victoria: *Spatial management tools for vessel traffic in the Canadian Arctic in light of climate change*		
11:40	20 min		**Louis Celliers** - Climate Service Center Germany (GERICS): *Systems thinking and geomatics*		
12:00	1,5 h	Lunch break - Hotel Ísafjörður Restaurant "Við Pollinn"			
13:30	60 min	UW	Session 8 - Room A	Session 9 - Room B	Session 10 - Room C
14:30	30 min	Edinborg Cultural House	coffee break		
15:00-17:00	120 min		ICAN Workshop: *Coastal Web Atlas - Contributions to SDG goals*		
17:00	15 min		Closing Address / Future of CoastGIS		
17:15			conference day ends		
18:30 - 22:00		**Conference Dinner in Suðureyri** The Dinner includes transport to Suðureyri (pickup outside Hotel Ísafjörður 18:30), a culinary walk around the village, a 3 course meal.			

Welcome of the host

When the CoastGIS-committee approached us last year whether the University Centre of the Westfjords able and willing to organise the CoastGIS2018 meeting, the answer was clear:

Of course we were willing. In 2005 UW was founded to attract people to this remote part of the planet – and here you are – WELCOME!

The question was not if we wanted to, but whether we were able to host a conference like that. And indeed, in a region of only 7.000 inhabitants, in a town of only 2.500 inhabitants and with staff of six this is certainly going to be a challenge.

However, CoastGIS compliments what we are doing. UW offers master's programmes in Coastal Management and in Regional Development and focusses accordingly on coastal and marine issues as well as on aspects of planning. CoastGIS2018 evidently fits well.

Located in one of the Arctic Eight, on 66°North, being part of UArctic and its big Arctic network, it seemed natural for us to select the topic *Spatial Planning and Climate Change*. Climate change, today's big topic, will cause endless adaption – and consequently lots of planning. And here, I am sure, GIS will play a big role.

I hope, this conference will give you plenty of opportunities to learn what others are doing and thinking. I also hope, this location in the sparsely populated Westfjords, at the Greenland Sound, might set your own research in a new context, and possibly help stimulate new research. We would be proud of it.

Dr. Peter Weiss

Director of the University Centre of the Westfjords

Invited Speaker: Eydís Líndal Finnbogadóttir

Arctic Spatial Data Infrastructure (Arctic SDI) - Making Arctic Spatial data accessible and reusable

Understanding and responding to the impacts of climate change and human activities in the Arctic requires accessible and reliable data to facilitate monitoring, navigation, research, management and decision making. Access to spatial data is highly important to give an overview of where things are or are happening. To Improve accessibility of authoritative spatial data, The Arctic SDI was established to address the need for readily available spatial data in the Arctic. The Arctic SDI is a multilateral cooperation between the National Mapping Agencies of the Arctic, working with stakeholder organizations such as Arctic Council to make their key data accessible and interoperable.

A key example of the Arctic SDI cooperation is the Arctic SDI Geoportal with an Arctic SDI harmonized basemap, which is produced using the existing data from the Arctic Mapping Agencies. It provides a unified topographic view over the entire Arctic. The Geoportal gives acess to data such as from Arctic Council working groups and Arctic DEM. As Marine components are highly important for the Arctic, a work has started with the Arctic Regional Marine SDI Working Group (ARMSDIWG).

Arctic SDI aims to make more datasets available to allow mash-ups for unanticipated applications, limited only by the imagination of the scientists and stakeholders using the data.

Website:
https://arctic-sdi.org/
https://geoportal.arctic-sdi.org/

Eydís Líndal Finnbogadóttir
Acting Director General, National Land Survey of Iceland
elf@lmi.is

Invited Speaker: Tom Barry

The use of spatial data to inform Arctic policy and management

Worldwide there is an increasing paradigm shift in ocean management that comes from an increasing awareness of the cumulative effects of human activities and the need to take a holistic and integrated approach to management to ensure the sustainability of marine ecosystems. However while little is yet known on patterns of cumulative effects and the changes these effects may cause, spatial data on the distribution and intensity of human activities in marine areas is essential in establishing a more adaptive and ecosystem-based approach to marine environmental management. This talk will provide an overview of how spatial information is being used to inform policy in the Arctic.

Tom Barry
Executive Secretary - Conservation of Arctic Flora and Fauna (CAFF), Iceland
tom@caff.is

Invited Speaker: Dr. James Hansom

Dynamic Coast: GIS underpinning for coastal collaboration and enhanced resilience

Climate change matters, not only because sea levels or flood frequencies are changing, but also because in many countries modern society is built on the assumption that they wouldn't. Yet some of the greatest climate change impacts are anticipated within the coastal zone. Coastal erosion and associated coastal flooding is increasingly emergent as an important factor in determining the future trajectory of sustainable coastal planning and development. To this end, many governments and their agencies are under mounting pressure to produce contingency plans aimed at enhancing the resilience of natural and built assets and infrastructure at the coast and reduce the prospect of increased erosion risk. This project shows how historic and recent mapping can be used within a GIS to rapidly develop a conceptually robust method to establish a 2-D national webmap database of time series erosion rates, together with the location of any shoreward assets, infrastructure and communities impacted (DynamicCoast.com). The changing position of three map series were analysed to quantify changes between the 1890s, 1970s and the modern mapping of Scotland. Where recent erosion rates were greater than mapping error the coastline was projected inland at the recent annual rate to identify assets at risk by 2050. This exposure assessment was compared against the number of assets in proximity of the 'soft' (erodible) coast compared with the 'hard/mixed coast' (unlikely to erode) or 'artificial' (already defended) coast. These assets were monetised to estimate the value of resilient and vulnerable coastal assets. As the data are GIS based, the results can easily be analysed nationally, regionally, locally, or thematically to ensure key partners are able to access bespoke and relevant data. The production of webmaps (available via www.dynamiccoast.com) has greatly increased use of results with over 6,500 unique users accessing the results in the first year from over 80 countries.

Dr. James Hansom
Professor in Geography (adjunct) University of Canterbury, New Zealand Reader, School of Geographical & Earth Sciences, University of Glasgow
Jim.Hansom@glasgow.ac.uk

Alistair Rennie - Scottish Natural Heritage and Scottish Government
James Fitton - Universities of Aalborg and Glasgow

Invited Speaker: Dr. David Green

Low-Cost Monitoring, Mapping and Modelling of the Coast using UAVs

This paper briefly outlines some of the environmental applications of small UAV platforms and sensors for coastal monitoring, mapping, modelling and visualisation. This includes aerial imagery and video of cliffs, beaches, saltmarsh, and sand dunes. An emphasis is placed on the potential of small, low-cost, off-the-shelf platforms and sensors and a number of examples are provided to illustrate. In addition, the paper also explores the potential of such platforms and sensors to capture information about other aspects of the coastal and marine environment, including the use of an underwater drone.

Dr. David R. Green (UCEMM | UoA), Jason J. Hagon (UCEMM | GeoDrone Ltd.), Billy J. Gregory (UCEMM | North58 sea adventures). Dave Scott (UCEMM | Bristow UAS), and Andrew Smith (UoA).
d.r.green@abdn.ac.uk

Risk Mapping for Water Resource Management – Actionable Science and Tools for Climate Change Adaptation and Resiliency at the Philadelphia Water Department

Climate change is altering the water cycle, posing a significant challenge to water utilities around the world who provide life-sustaining services, such as clean drinking water, wastewater treatment and stormwater management. Utilities in the coastal zone must also consider impacts from sea level rise and extreme storms, which can inundate facilities, overwhelm drainage systems, and increase salinity of source waters. To study and plan for these climate impacts and to develop cost-effective adaptation strategies, the Philadelphia Water Department (PWD) started the Climate Change Adaptation Program (CCAP) in 2014.

To date, the CCAP has been focused on creating applicable, actionable science and tools to help with decision-making under deep uncertainty. As part of an inundation analysis, the CCAP considered future flood hazards by estimating water elevations that are likely to occur within the daily tide cycle due to sea level rise as well as less likely extreme water elevations that are associated with storm surge. A customized GIS-based model/screening tool was developed to map flood extent layers depicting the timing, likelihood and potential inundation depth of PWD assets.

The screening tool provides compelling visuals—inundation maps coupled with asset screening tables—that depict how soon and how frequently PWD assets may be at risk of flooding. The tool helps with risk communication within PWD and results provide a starting point to help prioritize subsequent, in-depth analysis of individual assets, particularly those deemed critical. This work is used to inform PWD planning processes and design standards, increasing the resilience of current and future projects.

Abby Sullivan
Environmental Scientist – Climate Change Adaptation Program, Philadelphia Water Department, USA
abby.sullivan@phila.gov

Avery Livengood[1], Julia Rockwell[1], Paula Kulis[2], Mark Maimone[2]
[1] Philadelphia Water Department, Philadelphia, PA, USA
[2] CDM Smith, USA

Combining low-cost sonar and high-precision GNSS for river and estuarine bathymetry

Bathymetry surveys are essential to provide data to keep navigation charts updated, and to obtain insights in water body bottom dynamics and processes and for hydrodynamic modelling. Regular bathymetry monitoring has become particularly important in a time of changing climate, which may affect hydrodynamics in yet unknown ways. These data are however often scarce, because bathymetric surveys are generally expensive and often complicated. A methodology combining a low cost single beam sonar with a dual-frequency differential high-precision GNSS (Global Navigation Satellite System) is presented. Sonar depth measurements and GNSS positions were integrated using the GPS time of the two devices for synchronisation. This way no physical, electronic link between both devices is needed and precise depth-position values can be obtained without the often applied and less reliable tide correction. The methodology was developed and successfully tested in estuaries and rivers. Depth measurements were corrected according to water temperature. The precise survey position was calculated considering the off-set between the sonar and GNSS antenna. Given the low depths and calm waters in the test areas, effects of boat pitch, roll and yaw were neglected, though an inertial measurement unit (IMU) can easily be coupled with the GNSS to extract ship motion data and correct bathymetries accordingly. Data from several surveys were compiled, analysed, interpolated and mapped in a GIS, providing information on local bathymetry and its dynamics. The proposed method is simple and affordable, allowing for more frequent surveys and a better coverage of dynamic systems such as rivers and estuaries.

Ana Maria Ferreira Bio
Interdisciplinary Centre of Marine and Environmental Research (CIIMAR/CIMAR), University of Porto, Portugal
anabio@ciimar.up.pt
J. A. Gonçalves [1,2], J. Pinheiro[1]; L. Bastos [1,2]
[1] Interdisciplinary Centre of Marine and Environmental Research (CIIMAR/CIMAR), University of Porto, Portugal
[2] Department of Geosciences, Environment and Spatial Planning, Faculty of Sciences, University of Porto, Portugal

Maintaining currency and reliability for information services relevant to coastal zone management

COINAtlantic has developed several on-line tools to promote the sharing of data to support integrated coastal and ocean management and marine spatial planning. The COINAtlantic Search Utility (CSU) is an online interactive mapping tool built with Open Source software that enables the user to search the internet for spatial data resources in Open Geospatial Consortium (OGC) formats (i.e. WMS and KML). The tool also permits the user to search a local database of spatial data resources that has been built from the results of other user's internet searches and those resources added manually using the "Add WMS layer" feature of the tool. COINAtlantic has also used the CSU to build customized versions for specific types of data and applications. The presentation will look under the hood of the CSU and feature: 1. the service reliability index for the spatial data resources held in the local data base; and 2. the automated production from publically accessible data of searchable metadata and web mapping services. The presentation will also describe several customized versions of the CSU including the coastal characterization of the Island of Newfoundland, biological occurrence data hosted in the OBIS Canada IPT, the Bay of Fundy project information for Gulf of Maine Initiative and the Sydney Harbour Atlas. The presentation will include plans for enhancing the COINAtlantic tool set.

Andrew Sherin[1], Alexi Baccardax Westcott[1], Jeff McKenna[2]
Director COIN Atlantic Secretariat, Canada
a.sherin@dal.ca

[1] COIN Atlantic Secretariat, Canada
[2] Gateway Geomatics

Reprise on the COINAtlantic Data Accessibility Self-Assessment Tool: Adding FAIRness

In 2011, Canada's Commissioner of the Environment and Sustainable Development stated in her report "Solid, objective, and accessible information is essential to identify and respond to the quickening pace and complexity of environmental change, in Canada and globally." Responding to the Commissioner's message and in support of COINAtlantic's priorities for the sharing of data and information for coastal zone management, COINAtlantic has developed the Data Accessibility Self-Assessment Tool (CDAST). The CDAST can be used internally by organizations to track improvement in their data accessibility policies and procedures. The tool incorporates principles from the OECD and governmental open data initiatives in the USA and Canada. An earlier version of the tool has been presented at CoastGIS 2013 (Victoria, Canada) and CoastGIS 2015 (Cape Town, South Africa). In Cape Town, a workshop was held to solicit comments on the tool. This presentation will describe the changes to the tool instigated by the 2015 workshop and more recent changes incorporated in the tool to reflect the FAIR principles promoted for the Horizon 2020 initiative in Europe.

Andrew Sherin, Alexi Baccardax Westcott
COIN Atlantic Secretariat, Canada
a.sherin@dal.ca

Copernicus land monitoring service for coastal zones

Copernicus land monitoring service for coastal zones Copernicus is the Programme for the establishment of a European capacity for Earth Observation. European Environment Agency (EEA) is a European Union public body that has been delegated the implementation of the pan-European and local components of the Copernicus Land monitoring service. Preparation for production of Very High Resolution Land cover/Land use dataset for coastal zones, reference year 2018, has been recently initiated. First results are expected by 2020. The main parameters of the product are described by geographic coverage of 39 countries that cooperate with EEA, mapping of 10 km wide land area adjacent to the sea coastline (derived from EU-hydro), total area ca 0.68 Mkm2, tailored coastal zone land cover/land use mapping nomenclature, minimum mapping unit 0.5 ha, and ≥ 85 % overall classification accuracy. The new service will employ synergies with existing Copernicus land monitoring products, such as Urban Atlas (coastal cities), Riparian zones (riverine discharge areas) and Natura 2000 areas (inside coastal zone) and will aim at update frequency of 6 years (possibly less). Cooperation with Copernicus marine environment monitoring service as applies to coastal waters is also in development. The new coastal zone data product will be disseminated via Copernicus land monitoring service website https://land.copernicus.eu/.

Andrus Meiner
Land systems - Head of Group, EU Environment Agency, Denmark
andrus.meiner@eea.europa.eu

Wetland Mapping in New Brunswick (Canada) with Landsat-8 OLI, Alos-1 PALSAR L-band, Sentinel-1 C-band, and Lidar Data

The long-term wetland management strategy of the Province of New Brunswick (Canada) requires a careful mapping of the wetlands across the province of New Brunswick, particularly the coastal wetlands. The current wetland map is a combination of the forested wetland map and of the wetland map that are produced by the Province of New Brunswick Department of Natural Resources (NBDNR), mainly from interpretation of aerial photographs, and needs to be updated. This study used a combination of Landsat-8 OLI, Alos-1 PALSAR L-band and Sentinel-1 C-band dual-polarized, as well as Lidar data to map wetlands in New Brunswick (Canada). The images were acquired both during leaf-off and leaf-on seasons as well as during high and low water levels in the wetlands. Thousand polygons distributed among 22 classes (11 wetland classes and 11 non-wetland classes) were used as training areas. These training areas were first used to compute the Jeffries-Matusita (J-M) distance with all the datasets to measure how each class is spectrally different from each other. All the J-M distances were higher than 1.90, which means that there was a very good separability between classes. The training areas were then used in a non-parametric supervised classifier (Random Forests) to classify the combination of all the datasets. The overall classification accuracy was higher than 90%. The resulting maps were then compared to validation sites, which were located at a different location than the trainings polygons. This comparison achieved an overall mapping accuracy higher than 90% for the 11 wetland classes. Funding was provided by partners of the Eastern Habitat Joint Venture. The Landsat-8 OLI images were available from USGS (United States Geological Survey) EROS (Earth Resource Observation and Science) Data Center. The Alos-1 PALSAR images were provided by the ASF (Alaska Satellite Facility). The Sentinel-1 images were downloaded from the ESA (European Space Agency), using the Copernicus Open Access Hub. The Lidar data was downloaded from the GeoNB website of Service New Brunswick.

Dr. Armand LaRocque[1] - Research scientist - larocque@unb.ca
Dr. Brigitte Leblon[1] – Professor / Director - bleblon@unb.ca
Kevin Connor[2], Alan R. Hanson[3], Raymond Jahncke[4]
[1] Remote Sensing Laboratory, Faculty of Forestry and Environmental Management, University of New Brunswick, Canada
[2] Fish and Wildlife Branch, Department of Natural Resources, Government of New Brunswick, CA
[3] Canadian Wildlife Service, Environment and Climate Change Canada
[4] Department of Geography and Environmental Studies, St-Mary's University, Canada

Contextual Data for Marine Spatial Planning in Fjarðabyggð

GIS datasets were compiled to provide context for marine spatial planning in the Fjarðabyggð municipality, E-Iceland, and displayed in an interactive web map where all the data is easily accessible. Multiple government agencies were approached to find relevant data. The presentation will describe this and how the local authority could control or influence the land uses in coastal and marine areas.

Ásta Kristín Óladóttir
Alta, Iceland
arni@alta.is

Integrating Benthic Habitat Mapping, Landscape Ecology and Marine Protected Area Design

As human impacts continue to threaten coastal habitats, marine benthic habitat and substrate mapping have become key components of conservation and management initiatives. Advances in seafloor mapping have allowed for the production of fine-scale seafloor landscape (i.e. benthoscape) maps that are essentially analogous to terrestrial land cover maps. Benthoscape maps provide the foundation for assessing the spatial configuration of broad-scale biophysical seafloor features, which is important for structuring habitat and supporting movement processes for many organisms, understanding habitat preferences of benthic species and species-benthoscape interactions. While many species rely on large, well connected habitat patches for foraging and migration, these components are difficult to incorporate into Marine Protected Area (MPA) design. By integrating benthoscape mapping, connectivity-fragmentation analyses and reserve design algorithm, we developed a novel method that considers the spatial arrangement of benthic habitat patches in MPA design. We applied our approach to the Eastport MPA and surrounding region in Newfoundland, Canada. This small, no-take coastal MPA aims to protect American lobsters but does little to protect habitats and biodiversity representative of the broader region. To explore potential adaptive management scenarios, the benthoscape adjacent to the MPA was mapped using multibeam echosounder and seafloor videos. The composition and configuration of benthoscape classes was then quantified using patch size and connectivity metrics. Using a reserve design algorithm, we compared outputs that included and excluded the prioritization of benthoscape connectivity. Results illustrate the impact of considering benthoscape configuration in MPA design scenarios, an approach offering potential benefits for the conservation of coastal and marine regions.

Beatrice Proudfoot
Graduate Student - [1]Geography Department, Memorial University of Newfoundland, St. John's, Canada
bproudfoot@mun.ca
Presented by Dr. Rodolphe Devillers[1]

Craig Brown[2], Yolanda Wiersma[3], Evan Edinger[1]
[2] Applied Oceans Research, Nova Scotia Community College, Dartmouth, Canada
[3] Biology Department, Memorial University of Newfoundland, St. John's, Canada

Variations in coastal conditions on different time scales - from 100 minutes to 100 years in GISystems

The mapping of geophysical variables in GIS systems in reference to time is challenging. In coastal areas exposed to open sea, the probability that storm surges coincide with spring tide is an important aspect to consider. Especially due to storms increasing in intensity and frequency, as a result of global warming. How to address the impact on design parameters for coastal structures in the lowland once sea level statistical parameters emerge? Long term variations have different meanings for different type of constructions. The lifetime of regional planning is usually for 100 years, whereas the lifetime of houses and coastal infrastructure are planned with a much shorter perspective. How do we address the 100-year predictions of sea level rise in this context, and which scenario should we refer to in the planning?

The storm surge assessment for Skutulsfjardareyri (Isafjordur) is shown as an example for addressing this challenge. The assessment uses the difference in the extent of a 10-year and a 100-year mean re-occurrence flooding, with respect to 10-year land subsidence and sea level rise. Another challenge of giving insight into variable conditions, is in the field of weather forecast information. Specifically, when the forecasted fields (as often is in Iceland) move across the map or scope of reference with respect to the forecast timing. An example of a typical weather forecast browser is reviewed, with the design principles using a time-series of variables, for a time browsing interface for maps and field animations in 2D geographical maps. How do we address 10-year fluctuations in annual signals when the diurnal variations exceed the annual variations? This third and last challenge comes from coastal flow fields, where the main players of variations are the tide, and the seasonal variations in solar radiation and storminess. An example of coloring the flow is used, in accordance with temperature and salinity as markers of distinct water types, and mixtures there off in the fjord flow field. A coastal flow model output from the Skutulsfjordur flow fields are shown to demonstrate how otherwise obstructed processes can be made visible in the flow field by this method.

Björn Erlingsson
Research Affiliate University Center of the Westfjords
bjorn.erlings@gmail.com

Kevin Dubois
Student - SeaTech School of Engineering, University Tulon, France
kevin.dubdol@gmail.com

Mapping differences in foreign and domestic tourism in coastal areas of the Westfjords

Tourism is an important activity in coastal zones around the world, bringing with it economic development as well as environmental impacts. In the Westfjords of Iceland the local topography limits most societal infrastructure to low elevation sites near the coast. As with other areas in Iceland, tourism has seen large increases in recent years. A previous study by the author found that most foreign tourists in the Westfjords do not venture far from the main roads, suggesting they also remain primarily in the coastal zone. Future management of these areas will require a good understanding of the pressure put on them by foreign tourists as well as Icelanders. This study uses geotagged photos from social media within a GIS project to identify and analyze patterns of tourism in the Westfjords. Specifically, it will examine if and how visitation differs between foreign tourists and Icelanders within the coastal zone. Further, it will use an index of ecological sensitivity to examine whether any difference between the two groups also reflects different potentials for environmental impacts.

Dr. Brack Hale
Professor, Franklin University Switzerland, Switzerland
bhale@fus.edu

Mapping eelgrass beds in New Brunswick (Canada) using WorldView 2 optical images

Eelgrass (Zostera marina L) is a marine angiosperm plant that grows throughout coastal areas in Atlantic Canada. It provides numerous ecosystem services such as providing nursery grounds, sediment retention, and food for a diverse range of organisms, including commercially harvested species. While eelgrass meadows have been acknowledged as important habitats, their location, extent and health in Atlantic Canada are poorly understood. This study uses WorldView-2 satellite optical data to map eelgrass cover in Tabusintac, New Brunswick. The WorldView-2 satellite optical data were atmospherically corrected and several vegetation indices were computed such as the difference vegetation index, the green difference vegetation index, the green normalized difference vegetation index, the normalized difference vegetation index, the normalized green index, the normalized red index, the normalized near infrared index, the ratio vegetation index, and the green ratio vegetation index. The images were classified using the Random Forests non-parametric classifier into three classes: sand, eelgrass, and optically deep water. The Jeffries-Matusita distance between classes was above 1.98, indicating high class separabiltiy. The overall accuracy of the classification was above 87.7% and class accuracies were above 90% for the eelgrass class, 80% for the deep water class, and 82% for the sand class. This project is one part of a larger initiative funded by Environment Canada and lead by the Southern Gulf of St. Lawrence Coalition on Sustainability (Coalition-SGSL), which will develop a bay-scale cumulative effects monitoring program for eelgrass in Atlantic Canada.

Dr. Brigitte Leblon
Professor / Director – [1] Faculty of Forestry and Environmental Management, University of New, Brunswick, Canada,
bleblon@unb.ca

David Forsey[1], Armand Larocque[1], Angela Douglas[2], Marc Skinner[3]

[2] Southern Gulf of Saint-Lawrence Coalition on Sustainability
[3] Stantec Consulting Ltd.

A method for quantifying the vertical uncertainty of less-than full coverage hydrographic survey areas

The National Oceanographic and Atmospheric Administration (NOAA) has been responsible for the production and upkeep of the United States nautical charts since the nineteenth century. These charts are critical for the safe navigation of marine traffic. Essential to effective charting is curating accurate and up-to-date bathymetric information through cyclical and timely hydrographic surveys. Currently, incoming NOAA hydrographic surveys are attributed with a CATZOC (or Categorical Zone of Confidence) level determined by the limiting factor between survey coverage and vertical uncertainty requirements. Through these categories, each survey area is attributed with a CATZOC level that only truly pertains to areas of the seafloor that were ensonified. This practice can lead to the underestimation of vertical uncertainty associated with less-than full coverage hydrographic surveys, ultimately introducing biases on the chart and skewing chart health model results. Here we describe a method to constrain and quantify the true vertical uncertainty of unsurveyed seafloor within less-than full coverage survey areas along the central East Coast of the U.S. with the intention to incorporate in hydrographic health models.

Cassandra Bongiovanni
Graduate Researcher – [1]Center for Coastal and Ocean Mapping, University of New Hampshire, USA
cbongiovanni@ccom.unh.edu

Thomas Lippmann[1], Brian Calder[1]

SeaSketch's Ideal Process Planning Model: Ensuring Equitable Decision-making in Marine Spatial Planning

Since launching five years ago, SeaSketch has been used in approximately 30 large-scale projects and over 200 educational and research projects, distributed over 40 countries. Seasketch is primarily used to support marine spatial planning (MSP) initiatives led by government agencies in countries such as Montserrat, Curacao, Barbuda, New Zealand, Canada, and the Cook Islands. Through practical experience and research, the authors of this paper argue that the success and sustainability of marine spatial planning is not necessarily inherent in the GIS technologies itself but in the skills and expertise of the project administrators. Even SeaSketch is highly dependent on the process planning model used and the ability and of the facilitator (Reed 2008). This paper highlights essential elements of the "ideal" planning process model that is to be used alongside SeaSketch. Drawing from the literature on public participatory geographic information systems (PPGIS), this paper outlines various external constraints that are not within the control of the facilitator but must still be addressed throughout the process.

Charla M. Burnett, Dr. Will McClintock,
Marine Science Institute at the University of California Santa Barbara, USA
Charla.burnett001@umb.edu

How to improve the regional risk assessment of coastal events? Lessons learned from the risc-kit project

Managing coastal storm risk at the regional scale requires a prioritization of resources along the shoreline. Advanced modelling assessment and open-source tools are now available to support transparent and rigorous risk assessment and to inform managers and stakeholders in their choices. However, the issues lay in data availability and data richness to estimate coastal vulnerability and impacts.

The Coastal Risk Assessment Framework (CRAF) has been developed as part of the Resilience Increasing Strategies for Coasts Toolkit (RISC-KIT). The framework provides two levels of analysis. A coastal index approach is initially applied to narrow down the risk analysis to a reduced number of potential hotspots. Then, an integrated modelling approach improves the regional risk assessment by assessing the disruption of storm events using matrix-based approach and network analysis. The framework was tested on various European Coastal case studies. A data quality score approach has permitted an analysis highlighting the needs in data collection for feeding the different models. Certain countries are very poor data for any of the indicators, others more advanced in their flood assessment practices only require to consolidate their knowledge in particular aspect. Specific indicators such household displacement or insurance penetration are poorly surveyed for instance and limits the understanding on long-term social impacts and spatial analysis. The assessment of systemic impact is also often limited due to the absence of information on network such as important business supply chain and critical infrastructures, yet essential to better understand potential cascading effects and large scale impacts.

Dr. Christophe Viavattene
Research Fellow - Middlesex University, Uk
c.viavattene@mdx.ac.uk

An innovative GIS tool for decision-making on coastal erosion and flood risk along the St. Lawrence Estuary, Eastern Canada

Coastal hazards in Eastern Canada are mainly associated to storm conditions: storm surge and high waves generate coastline erosion and flooding. There is a critical need to develop effective tools for coastal management as sea ice reduction and sea level rise will likely impact future coastal hazards. In recent years, a simple and operational methodology to quantify the coastal risk level has been developed in collaboration with the Quebec Ministry of Public Security (Canada). Ultimately, an operational GIS tool for data visualization and decision-making has been created. Coastal erosion rate was acquired from field measurements and historical shoreline analysis. Flood simulations of multiple return periods were generated using the morphodynamic model Xbeach in 2D hydrodynamic mode. XBeach was first validated with waves and water level measurements, and simulated floods were compared with real-case scenario. The risk analysis is based on different variables relating erosion and flood hazard (probability of water depth + waves + storm surge + relative sea level rise), stakes and the possible presence of coastal defenses. Each variable was given a score between 1 and 5 according to its propensity to increase (5) or not (1) the vulnerability of the various issues. Vulnerability was calculated for each building, road segment and water and wastewater structures. A synthetic index was produced for each 500 m stretch of coast along a 30 km coastline near Rimouski (Qc). The GIS tool enables managers to quickly locate the most vulnerable elements, but also to identify potential hotspots, high density area where specific solutions are needed. As the development of the approach was entirely done in collaboration with governmental officials to best meet their needs, the management tool comes out as operational as possible.

David Didier
Coastal Geoscience Research Chair, Centre for northern studies, Québec-Océan, Université du Québec à Rimouski, Canada[1]
david_didier@uqar.ca

Susan Dreijza (Susan_drejza@uqar.ca)[1], Pascal Bernatchez (pascal_bernatchez@uqar.ca)[1]

Geospatial Technologies to Understand and Communicate Coastal Hazards

Since 1995, Wisconsin Sea Grant (WISG) and partners have developed a wide range of geospatial applications to better understand and communicate the impacts of dynamic Great Lakes coastal processes. Beginning in 2015, WISG led an interdisciplinary team of investigators to explore the impact of changing Lake Michigan water levels on coastal bluffs in eight communities north of Milwaukee, Wisconsin. This Great Lakes Water Levels Integrated Assessment identified, reviewed and synthesized existing data and reports and developed over 60 possible options to help local officials and property owners adapt to a changing coast. One of the three themes of options included mapping tools to promote outreach and education about coastal processes. This presentation will provide a retrospective of the coastal hazards geospatial applications developed by WISG and explore emerging applications that promote community resilience to coastal hazards.

Dr. David Hart
Assistant Director for Extension - University of Wisconsin Sea Grant Institute, USA
dhart@aqua.wisc.edu

Regional seafloor mapping & species distribution modelling based on crowd-sourced bathymetry

Seafloor habitat mapping is becoming an integral part of marine spatial planning, sustainable resource development, and conservation of biodiversity. While most mapping exercises focus on small areas where high-resolution multibeam bathymetry is available, many management decisions require information at the regional level. This presentation will demonstrate how crowdsourced single beam bathymetry (Olex) can be leveraged to fill this information gap. Olex data is collected by thousands of commercial fishing vessels using on-board single-beam echosounders. The information is integrated, cleaned, and shared back to all vessels equipped with an Olex system. For this study, Olex XYZ points for Newfoundland and Labrador waters were interpolated using Empirical Bayesian Kriging to generate a raster surface covering 690,725 km2. The resulting 75m bathymetric grid has 100+ times finer spatial resolution than previously available for most of the study area with >95% correlation to independent bathymetry provided by Fisheries and Oceans Canada (DFO). Machine learning models (Boosted Regression Trees) were used to predict the distribution of substrate type, fish diversity, and habitat for species of interest, based on the relationship between Olex bathymetry, derived geomorphology, and in-situ samples provided by the Geological Survey of Canada and DFO. Sourcing bathymetric data from vessels-of-opportunity helped produce high-resolution sea floor maps useful for marine management and ecological research at very little cost. Our results represent the best shelf-wide bathymetric maps currently available for Newfoundland and Labrador, Canada and the first ever shelf-wide substrate and benthic habitat maps for this study area.

Emilie Novaczek,
PhD Student - [1]Memorial University of Newfoundland, St. Johns, Canada
enovaczek@mun.ca

Benjamin Misiuk[1], Dr. Rodolphe Devillers[1]

Adaptation to coastal hazards in the context of climate change: the example of a research-action program developing useful tools for coastal municipalities in Quebec (Canada)

The coasts of the Estuary and the Gulf of St. Lawrence are subject to coastal erosion and flooding. They concentrate the majority of villages, roads and infrastructures of Eastern Quebec because of the history of settlement of this Canadian province. In the context of climate change and sea level rise, increased exposure of these coasts is expected. Therefore, adaptation solutions must be identified. An interdisciplinary research-action program has been initiated to reduce the vulnerability of coastal communities and ecosystems to coastal erosion, to develop tools to improve land-use planning and ecosystem protection in coastal areas, and to facilitate the selection of climate change adaptation solutions. We first established a precise portrait of the needs of local and regional stakeholders relating to public safety and infrastructure protection and to coastal ecosystems conservation (427 people were met in 35 workshops). Participants expressed a strong need for information. As a result, we will develop communication and awareness tools. Furthermore, baseline data is currently being generated and integrated into a GIS for the 5,000 km coastline of Southern Quebec, in order to produce the adaptation tools requested. The mapping of buildings and infrastructure exposed to coastal erosion, including a precise cartography of these stakes and an analysis of the historical evolution of the coast in a GIS, is thus in progress. The mapping of coastal and intertidal ecosystems by semi-automated remote sensing will, in particular, characterize the most vulnerable ecosystems and the ones that will be given priority for conservation. Their ecological services will also be evaluated. The mapping of uses, activities and places of interest on all of Quebec's maritime coasts, especially based on interactive mapping with residents, is also underway. Combined with 640 interviews with coastal citizens, all these data will be used to develop vulnerability indices, to prioritize future interventions, assess resilience and ecological services. The identification of the best adaptation solutions, carried out with the assistance of all coastal stakeholders (municipalities, ministries, elected officials, residents, associations, engineering consulting firms…), while taking these uses into account, will eventually increase the resilience of coastal communities.

Guillaume Marie, Ph.D.
Professeur de géographie des zones côtières, [1]Université du Québec à Rimouski.
Guillaume_Marie@uqar.ca

P. Bernatchez[1], S. Drejza[1], C. Fraser[1], M. Lapointe St-Pierre[1], P. Sauvé[1]

Spatial Planning Challenges in Low-lying Areas in the Westfjords

The landscape in the Westfjords of Iceland is characterized by steep mountains and limited amount of low-lying areas. Most towns have developed on these more accessible low-lying areas with good access to the sea. However, these areas are threatened by coastal flooding and rising sea levels. In addition, land use is restricted in certain areas below steep mountains due to avalanche hazard.

Climate change has become a major issue in policy making in Iceland. In September 2018, the Icelandic government launched a climate change action plan. Municipalities are increasingly taking climate change into account in their planning, both by providing mitigation measures and through adaptation plans. This is particularly relevant and evident in the Westfjords.

Examples of problems and challenges in land use planning in the low-lying areas of the Westjords are given in the presentation. In particular, the focus is on restrictions on land use in these areas. The notion is that municipalities need more sophisticated information on land use restrictions due to see floods and rising sea level. The use of GIS gives an opportunity to provide such information and improve the quality of planning. An example of the use of avalanche risk assessment in land use planning is introduced in comparison.

Gunnar Páll Eydal (MRM)
Verkís Consulting Engineers
gpey@verkis.is

Nutrient capturing wetlands

The presentation talks about a spacial data project I did with some collaborators at Novia UAS, concerning the possible construction of 2 wetlands located in a farm (Västankvarn) located East of Raseborg area in Finland. The development of the project consisted in designing the wetlands, deciding their placement according to the farms economic interests and also so the wetlands could capture the large amounts of nutrient runoff coming from from the nearby agricultural fields. The design of the wetlands was done using Google Earth Pro. Later these designs were exported to GIS to calculate excavation volumes and flooded areas. The catchment areas were calculated using GIS and later exported to Google earth pro for the final presentation.

Hernán Abad Ortega
Project Researcher - Novia University of applied Science, Finland
hernan.abad84@gmail.com

Can vulnerability models be validated? A comparison between models based on spatial analysis and in situ beach erosion assessment after storm surge events

Along the last decades several methodologies have been proposed seeking the identification of coastal sectors more likely to be affected by sea level rise and extreme events. Most approaches are index-based and rely on the integration of spatial data in GIS and on map algebra to calculate a final single value for each assigned coastal segment. Although quantitative, these assessments remain highly context specific and attempts at spatial model validation have been particularly lacking. Considering it, this research performed in situ surveys after storm-surge events that highly impacted a subtropical beach in southern Brazil and compared results to five different coastal vulnerability models previously available for the area. Along its 5 km length, Ingleses Beach was inspected and, when any significant change was noticed, the damage pattern induced by recent events was computed. Descriptors of beach erosional state were ranked in three levels of damage severity and resulting classes were statistically compared to vulnerability levels previously proposed. Results revealed that both CVI and Geoindicator models agreed well with real impact, being the discrepancies basic a function of beach evolution characteristics. Moreover, we noticed that the usual segmented representation of the shoreline prevents a more realistic expression of reality, being proposed the adoption of fuzzy mapping as an alternative to express the incremental characteristic of vulnerability.

Dr. Jarbas Bonetti
Associate Professor - Coastal Oceanography Laboratory, Federal University of Santa Catarina, Brazil
jarbas.bonetti@ufsc.br

Thales Vargas Furtado[1], Irlanda da Silva Matos[1], Oxana Sytnik[1], Nelson Rangel-Buitrago[2]
[1] Federal University of Santa Catarina, Brazil
[2] Universidad del Atlántico, Colombia

Monitoring human impact along the coastal environment; Re-calculation of 'Anthropogenic Intensity' based on climate change influence

Coastal areas face many challenges due to their unique features. If no efficient control, the human activities (and their geographic expression, the land uses) could drive towards a less sustainable balance between the natural and the man-made environment. The need for spatial planning seems to be inescapable. In parallel, the study of coastal areas through indicators is strongly recommended by all international bodies devoted to spatial planning and integrated coastal management. In this context, 'Anthropogenic Intensity' (AI) is a recently proposed indicator which aims to monitor the human impact along the land part of coastal areas, by calculating the 'mean height' of each land use infrastructure, in relationship to their distance from the shoreline. The critical point is not only the choice of the appropriate land uses' classification, but, as well, the weights with which each of the land use will be endowed. Several case studies have proved (with the help of GIS tools) that AI is able to act as a reliable carrying capacity alert, especially at local level, in the service of decision makers. After a rather comprehensive theoretical approach, this paper is focusing on the way the climate change could change the already used nomenclature of land uses and/or the relevant weights. A further, very ambitious goal is to calculate the percentage of the AI value due to climate change.

Dr. John Kiousopoulos
Professor - University of West Attica, Greece
kionas@teiath.gr

Cumulative Impact Assessment and Climate Change in Swedish Marine Spatial Planning

Ecosystem-based marine spatial planning (MSP) requires an understanding of the environmental impact from users of marine space. Preferably such analyses should be holistic and of quantitative nature. Moreover, for the results to be integrated with the MSP process it must be comprehensible for both planners and stakeholders. In Sweden, the responsible governmental body for MSP has applied a scientific method and developed a tool (Symphony) for the integration of cumulative impact assessment within MSP. The tool is based on produced maps of 41 human pressures and 32 ecosystem components and allows for scenario analyses. Hence, the projected outcome of different plan options can be compared during the planning process. Baseline results show that, currently, trawl fishing, eutrophication, pollution and shipping are the main contributors to cumulative environmental impact in the Swedish North Sea. In the Swedish Baltic Sea, eutrophication and pollution dominates even more in proportion. The general spatial pattern indicate that coastal areas are more impacted than offshore areas, where the most impacted areas are typically those exposed to frequent trawling. Results from the MSP scenarios show that the drafts developed by planners may cause relatively small changes to environmental impact at strategic level although significant changes, both positive and negative, are expected on local level. It is concluded that substantial amounts of new resource extraction such as offshore wind power and gravel extraction can be proposed by the plan without necessarily challenging environmental status. Thoughtful localization is important. To reduce environmental impact, however, the MSP would have to be more influential on the spatial distribution of fishing and shipping. The ongoing MSP process has and continues to consider and respond to the results. Moreover, first inquiries on the role of future climate change in this context point at paramount impacts in relation to existing pressures. Ongoing research in collaboration with the Swedish Meteorological and Hydrological Institute and the Geological Survey of Sweden the will refine the modelling of climate change pressures to better account for their effects in Swedish waters and in the MSP process.

Linus Hammar
Process Leader – [1] Swedish Agency for Marine and Water Management
linus.hammar@havochvatten.se
Gustav Kågesten[2], Duncan Hume[2], Jonas Pålsson[1], Jan Schmidtbauer Crona[1]
[2] Geological Survey of Sweden

Systems thinking and geomatics

The complexity of climate data transformation at the edge between science and society requires a new set of tools that are relevant for adaptation science. The use of trans-disciplinary and participatory process, systems dynamics, and agent-based modelling are likely to provide analytical capabilities of complex socio-ecological system. In fact, the complexities of local communities can only be understood as a system, and so analysed. System Dynamics (SD) modelling is an analytical method to describe, model, simulate and analyse dynamically complex issues and/or systems in terms of the processes, information, organizational boundaries and strategies. The integration of temporal and spatial models involves complex issues that need to be technically addressed e.g. creating dynamic relationships between pre-processed spatial inputs to an SD modelling to identify the changes in the spatial features in time. The results of the temporal dynamic analysis are then visualized and additional analysis. Creating these dynamic relationships between SD modelling and GIS can be done using different programming languages such as python or C+, or software tools such as CRS that do not require the use of conventional programming languages. Within EU H2020 IMPREX research project ("IMproving PRedictions and management of hydrological EXtremes") we are developing a family of system dynamics (SD) hydro-economic models. These are intended to advise regional and local decision making on climate adaptation in several European case study areas. In particular, this is being done using multi-scalar Standardised Precipitation-Evapotranspiration Index (SPEI) drought index for the Júcar River Basin, Spain for different time scales. The SPEI will resolve types of drought (meteorological, agricultural, hydrological and other types of drought). Technically, the SPEI layers were computed with the help of R scripts and subsequently incorporated into QGIS. It is planned to incorporate drought damage functions in a spatially resolved regional economic SD modelling. Ultimately, this type of modelling combined with inputs from GIS analysis will allow estimation and mapping of monetized future drought-related risks under conditions of climate change.

Louis Celliers
Senior Scientist: Coastal Climate Services
[1] German Climate Service Centre, Helmholtz-Zentrum Geesthacht
louis.celliers@hzg.de

Dmitrii Kovalevsky[1], Eulalia Gómez-Martín[1], Arne Kriegsmann[1], María Máñez Costa[1]

Digital 3D mapping and reconstruction of coastal heritage sites in the Westfjords region of Iceland from aerial (UAV) and ground photos

The goal of this small-scale project is to create a digital 3D archive of various coastal heritage sites of the Westfjords region of Iceland, or sites with potential heritage value – remote lighthouses, stranded shipwrecks, old fishing stations - using UAV (drone) mapping and photogrammetry, while at the same time testing different approaches and workflows suited to the task.

Preliminary results show that mapping from aerial and ground photos can be a viable and reasonably cheap, fast and accurate method for creating 3D maps and digital models of the coastal sites and may be a feasible alternative to LiDAR mapping in some research, conservation and, possibly, commercial projects.

The 3D maps and models could be used for various purposes – digital archives and preservation of coastal heritage sites or references for VR tours. They may also be imported into a GIS and processed further (calculate distances, surfaces, volumes etc).

During the presentation, some of the current 3D output will be shown, and the methods, challenges, and further potential applications will be discussed.

Lucian Reniţă
MRM Coastal and Marine Management - University Center of the Westfjords, Iceland
renitsa@gmail.com

High resolution 3-D hydrodynamic behaviors, as inputs for Marine Spatial Planning (MSP) of fjords in Icelandic coastal water

Fjords in Icelandic coastal waterare bustling with cruise, fishing and cargo vessels as well as aquaculture and recreational activities. However, the hydrodynamic conditions of the fjords are still unknown in many ways. Aims at enhancing insight for engineering and management purposes, this research deals with 3-Dimensional (3D) numerical simulations of current and seawater temperature and modeling of seabed. The research is carried out throughout Önundarfjörður, in the northwest of Iceland. One-year modeling is conducted by MIKE3 Flow Model (FM) with respect to tidal forcing and temperature's function. The output of the model, were calibrated and validated by measured in-situ data. The research indicates that the seawater temperature is generally below 11 °C during the year and northern shoreline of the fjord experiences higher temperatures. The simulation reveals that, the fjord is tidal dominated. During flood, current flows into Önundarfjörður over th e bottom layers, while high velocity currents prominently flank alongshore towards the month of the fjord during ebb. The results furthermore show contribution as spatial preferences to implement a proper MSP in order to increase sustainability and reduce conflicts of maritime activate in the fjord.

Majid Eskafi
[1] University Center of the Westfjords, Iceland
mae47@hi.is

Majid Eskafi[1], Ragnar Ásmundsson[2], Steingrímur Jónsson[3]
[2] Heat Research and Development, Iceland
[3] University of Akureyri, Marine and Freshwater Research Institute, Iceland

Improving Empirical Approaches of Satellite Derived Bathymetry

Although empirical Satellite Derived Bathymetry (SDB) models are simple to implement and perform well in some environments, they can be inefficient at extracting bathymetry in areas of heterogeneous substrate reflectance. Using very high resolution imagery along with ship-based surveys as training and validation datasets across multiple Canadian coastal environments test sites, we evaluate and improve upon the more commonly used empirical logarithm band ratio SDB models.

The method centers on the creation and use of a multi-dimensional Look-Up-Table (LUT). First, the n dimensional spectral distribution of water penetrating bands is assessed using the training subset of pixels for which depth is known. The n dimensional distribution is then gridded along all dimensions to create the LUT. Individual cells (or bins) of the LUT represent a combination of band values for which the median depth is computed. The LUT is then re-applied to the image by assigning the median depth computed for the bin with minimum distance to individual pixels' combination of band values. Results show that given a sufficient number of training points, the method can outperform the empirical logarithm band ratio model, generating sub-meter accuracy in various conditions.

This new approach promises to extend the usability of SDB in zones which can be problematic for traditional SDB methods and to generate more accurate SDB surfaces. In so doing, SDB becomes an even more interesting tool to chart and monitor coastal environments.

Marc-André Faucher
Physical Scientist - Fisheries and Oceans Canada - Canadian Hydrographic Service, Canada
marc-andre.faucher@dfo-mpo.gc.ca

A GIS application for under water wildlife corridors - Compensation and restoration of marine habitats in Environmental Impact Assessment at Kiel Bay, Germany

Kiel Bay and Kiel Canal belong to the busiest waterways in the world. The shore area of the Inner Kiel Fjord as well as of Kiel Canal is dominated by anthropogenic structures, and the deeper underwater areas are predominated by muddy biotopes with a reduced species variety. Nevertheless, there are valuable underwater habitats which deserve protection, and which should even be extended in size if possible.

In Germany, environmental legislation requires compensation for environmental interferences within an environmental impact assessment. This procedure only leads to reasonable environmental effects when suitable areas for compensation measurements can be found. Due to the intense use of Kiel Bay, suitable areas in shallow waters are rare.

A GIS application was developed for the management of valuable biotopes and to find areas which could be part of effective mitigation measures. Basic element is an assessment scheme for every type of biotope.

The results of a multitude of divers' observations were compiled to a spatial survey resulting in a map of underwater biotopes. One suggestion for compensation planning is to create wildlife corridors between isolated biotopes: step stone habitats which enable and strengthen resettlement and genetic exchange of species.

Martina Mühl
Biologist – [1] Coastal Research and Management, Germany
martina.muehl@crm-online.de

Martina Muehl[1], Monika Kock[1], Karl-Heinz Kweton †, Verena Sandow[1], Peter Krost[1]

Improving GIS-learning for higher education programs on coastal management

Higher education studies (BSc, MSc) focusing on the management and development of the coast are characterized by their interdisciplinary nature. A geographic information system (GIS) is an essential tool bringing together the main areas of knowledge that take part of these kind of programs. In this context, it could be expected that undergraduate and graduate students on coastal programs had a broad knowledge of GIS. However, our small-scale research carried out with students from the last two years of the Bachelor of Sustainable Coastal Management at Novia University (Finland) showed that they have not had (23%) or have had very little (62%) prior knowledge in GIS. The objective of this research was to investigate the causes of this unexpected result and propose solutions to improve the educational practices of GIS in a context of higher education studies on coastal programs. One of the most remarkable results is that more than half of the respondents would have wanted to learn about GIS before beginning their degree. One of the main benefits of having previous GIS basic knowledge would be that students could further refine their skills in GIS and apply then directly to specific and realistic coastal management issues. Therefore, one of the actions proposed in this study is changing the education-based curricula in lower educational levels to introduce GIS in early academic years. This type of action together with others such as the improvement of GIS teaching techniques, will contribute to a more efficient and practical approach for GIS learning, eventually benefiting the career prospects of the students.

Paloma Lucena-Moya Ph.D
Lecturer - Novia University of Applied Sciences, Finland
paloma.lucena.moya@novia.fi

CERA2.0: An improved GIS-based application for coastal erosion risk assessment

CERA (Coastal Erosion Risk Assessment) aims to provide coastal managers with a tool that allows an accurate evaluation of coastal erosion risk, without the need for large amounts of data or intricate processes. Its development started in 2014, by combining open source GIS technology (QGIS) with a previous coastal risk classification methodology, developed by Coelho (2005). This step towards a first GIS-based tool for assessing coastal erosion risk (Narra et al., 2017) paved the way for the development of an original methodology and the advancement of an accessible and open source GIS tool, aiming coastal erosion risk classification and map representation.

The follow up tool, CERA2.0, considers the risk assessment divided into 4 pre-evaluations: susceptibility; value; exposure; and hazard. These individual assessments require some georeferenced data, which is possible to gather from public sources or from digitization and interpretation of aerial images. The integration with GIS also got significant upgrades. The present QGIS plugin does not require the creation of individual classification maps for each indicator, as CERA1.0 required. Instead, with some exceptions, the tool requires vector shape files for the identification of features (e.g. shoreline position) or raw data (e.g. topographic data or population density). This work shows the application of CERA2.0 to a coastal transect in Quintana Roo coastline, in Mexico, using mostly publicly available data, such as data from INEGI, to show the potential of the tool to assess coastal erosion risk without the need to invest considerable resources, and thus, helping coastal management and planning.

Pedro Narra[1]
PhD student – RISCO and Civil Engineering Department, University of Aveiro, Portugal
pedronarra@ua.pt

Carlos Coelho[1], Francisco Sancho[2]
[1] RISCO and Civil Engineering Department, University of Aveiro, Portugal
[2] Laboratório Nacional de Engenharia Civil

Accessibility and Usability of Data on Commercially Harvested Brown Algae in the northern Atlantic Ocean (A Case for Promotion of Open Data & Software Solutions)

Ascophyllum nodosum (rockweed) and Laminaria digitata (oarweed), common brown algae of the northern Atlantic Ocean have long been at the juncture of commercial seaweed harvesting, conservation and tourism. Using recent experience regarding harvesting in Western Iceland (Breiðafjörður) and Eastern Canada (Nova Scotia), we provide an overview of the accessibility and usability of relevant global and regional data holdings, some public and some not. Increasing wild harvests' affect on data volume and complexity are then given as a basis for promoting and leveraging open data, open software, and open standards. The presentation concludes with a sketch of ongoing COINAtlantic efforts to develop and support open data and software based decision making.

Robert M. Branton[1,2]
Data Scientist – Kiely Cove Marine Enterprises, Canada
Bob.Branton@gmail.com

Glyn Sharp[1] and Andrew Sherin[2]
[1] Kiely Cove Marine Enterprises
[2] COIN Atlantic Secretariat

Assessing climate change impacts and vulnerability of coastal zones: the case study of the Greater Dublin Region in the framework of Urb-ADAPT project

Evidence of global warming poses a growing threat to human population, environment and economies. Implications of climate change will be more and more evident in the next future, with ever-increasing global population residing in urban areas. Moreover, it is well known that coastal cities are associated with larger concentrations of human settlements and socio-economic activities. Therefore, such urban areas require particular attention as they will have to adapt quickly and adopt response plans to minimize climate risks. Focusing on the Greater Dublin Region, EPA-funded Urb-ADAPT project aims to identify possible current and future climate risks for the population. In combination with stakeholders and decisional makers, we perform an integrated approach aiming to define spatial and temporal variations in levels of vulnerability to urban climate changes. For this purpose, current and future levels of exposure to coastal inundation, temperature and precipitation changes are assessed, and ad-hoc Climate Vulnerability Indices (CVI) are developed to support adaption strategies and planning for the region of interest. The outcomes of this project will provide the ground to estimating current and future economic losses due to climate change conditions, vulnerabilities and impacts. Moreover, the main conclusions of this work will facilitate and support decision makers in understanding when and where adaptation might be required.

Roberta Paranunzio Ph.D
Post-Doc Researcher - [1]MaREI Centre for Marine and Renewable Energy, Environmental Research Institute, University College Cork, Ireland
roberta.paranunzio@ucc.ie

Paul Alexander[1], Marco Guerrini[1], Barry O'Dwyer[1]

GIS tools for mitigating the impacts of ocean noise on marine mammals in coastal waters

The global growth in maritime traffic is causing a gradual increase in ocean noise. Noise has a variety of impacts on marine life and can, in particular, alter whales' behaviors and health. This talk will present some of the work conducted in the NEMES (Noise Exposure to the Marine Environment from Ships) project that studied the relationship between ocean noise and whale populations in Canada's Pacific and Arctic waters. More specifically, we will discuss how satellite automatic identification system (S-AIS) data helped quantify maritime vessel traffic patterns, information that in turn helped estimate vessel-noise levels in the coastal waters of the Salish Sea, Canada. When combined with maps of the summer distribution of the Southern Resident Killer Whale (Orcinus orca), a population listed as endangered in Canada and the US, we were able to identify geographic areas presenting a higher risk of noise exposure for whales. Such data can help inform management strategies aiming at minimizing those impacts. In collaboration with Esri Canada, this process was implemented into a software tool working in the ArcGIS Pro environment. The tool helps decision-makers explore the potential impacts of noise created by different types of vessels on different groups of whales as well as assess how alternative shipping routes could help reduce the risk of noise exposure for whale populations.

Dr. Rodolphe Devillers,
Professor - Memorial University of Newfoundland, Canada
rdeville@mun.ca

Simone Cominelli[1], Michael Leahy[2]

[1] Memorial University of Newfoundland, Canada
[2] ESRI Canada

Spatial management tools for vessel traffic in the Canadian Arctic in light of climate change

Climate change is causing an increase in ice-free periods and a decrease in ice thickness in the Canadian Arctic. As a result, this region is becoming more accessible to marine vessels. In turn, this can increase the susceptibility of impacts to marine mammals, such as the locally-important bowhead and beluga whales, due to noise, ship strikes and pollution. Managing vessel traffic in the Arctic to protect susceptible cetacean species presents a challenge to regulators. While a multi-pronged approach is necessary, this presentation focuses on spatial management options, related to protected marina areas. These include mandatory and voluntary exclusion zones, vessel re-routing and transit separation routes. We explore the utility of spatial management scenarios using automatic identification system (AIS) data of vessel traffic (2012-2017) and GIS analysis for a study site containing recently designated marine protected areas in the eastern Beaufort Sea and Amundsen Gulf in the Canadian Arctic. We assess the distribution and intensity of vessels tracks and delineate areas generally used by vessels in relation to important areas for marine cetaceans and buffer zones around marine protected areas.

Dr. Rosaline R. Canessa
Professor - Department of Geography, University of Victoria, Canada
rosaline@uvic.ca

Lauren H. McWhinnie[1], William D. Halliday[2], Stephen J. Inlsey[2], R. Casey Hilliard,
[1] Department of Geography, University of Victoria
[2] Wildlife Conservation Society Canada
[3] Institute for Big Data Analytics, Dalhousie University, Canada

Shorelines: The Coastal Atlas of Ireland

Work is currently underway on *Shorelines: The Coastal Atlas of Ireland**, a 500-page, 34-chapter compendium of the Irish Coast. The publication involves the work of over 20 authors and is due to be published by Cork University Press in 2019 as part of the atlas series from the Department of Geography at University College Cork. Although there are existing guides about Ireland's coastal geology, physical geography and landscapes, these are fragmented and mostly of a local nature. There is no single text looking at the shaping of the coastline of Ireland as a whole, from both the physical and human environmental perspectives. *Shorelines: The Coastal Atlas of Ireland* aims to fill this gap. Visually stunning, accessible and an academic *tour-de-force*, the atlas will resonate with everyone who has a connection to Ireland and anyone interested in the coastal landscape of this island. This presentation/poster aims to arouse public interest in the upcoming publication. It will provide an overview of the atlas and a 'taster' of content, including the presentation of accompanying maps and graphics from selected chapters. For the CoastGIS audience, some of the challenges of collating datasets spanning two countries on a single island will be discussed by the atlas's official cartographer.

Dr. Sarah Kandrot
Cartographer & Postdoctoral Researcher - MaREI Centre for Marine and Renewable Energy, Environmental Research Institute, University College Cork, Ireland
sarah.kandrot@ucc.ie
*Edited by Robert Devoy, Val Cummins, Barry Brunt, and Darius Bartlett, with cartography by Sarah Kandrot and digital production by Maxim Kozachenko

Adaptation to a Rapidly Changing Coast: Southeast Iceland

The objective of this paper is to discuss the climatic and environmental processes (tectonics, extratropical storm events, etc.) that are impacting the southeast coast of Iceland and how communities living along those coasts have been responding to those changes. Iceland is unique worldwide in that it has been undergoing a considerable amount of extreme and rapid geomorphological change throughout history brought about by tectonic, paraglacial and oceanic processes. Although as a society, Icelanders are aware of the terrestrial hazards their communities face, little is known about the impact of rapid coastal change south of Vatnajökull. Nonetheless, erosion that has compromised infrastructure, as well as the rapid glacier melting that contributes to the emergence of land both horizontally and laterally have been noted along this coast. Geomorphological observations of rapid change along the southeast coast of Iceland will result in the mapping of two coastal areas of significance using aerial photographs in a Digital Shoreline Analysis System (DSAS) software program which computes rate-of-change statistics from multiple historic shoreline positions The long-term intention is to provide Icelandic communities living along the southeast coast with a comprehensive perspective of the coastal change occurring along their shores that might enhance effective policy decision making in the face of climate change in future years to come.

Sheridan Thompson
PhD Student - Memorial University of Newfoundland, Canada
sheridanthompson@hotmail.com

Advancing Oregon Estuarine Habitat Mapping with the Coastal and Marine Ecological Classification Standard

At CoastGIS 2015 we presented on "Applying the Coastal and Marine Ecological Classification Standard to Oregon Estuaries", which was phase I in an effort to remap Oregon estuary habitats with modern data and GIS tools. In this presentation, we will report on phase II of the CMECS mapping effort, where we have broadened our data integration efforts to include multiple new data types and sources. Examples include various field biological sampling data, remote sensing products, and high-resolution bathymetry, both of which drastically improved the coverage of our habitat maps in intertidal and subtidal areas.

Our phase II work has been an interesting journey, where we have worked out automated solutions to reoccurring field-to-map data processes, bumped into interesting challenges in integrating large numbers of data sources with overlapping geographies, and struggled to design a data system that could handle the emerging data complexity while still being usable by our local level planners. Ultimately, we aim to build a living habitat map product that is directly usable in Oregon's local comprehensive planning process, and a higher detail database product that is suitable for conservation planners and estuarine scientists. We hope to put in place continual update processes so that the map products produced remain current and become a key tool in coastal resource management into the future.

Tanya C. Haddad
Information Systems Specialist - Oregon Coastal Management Program, USA
tanya.haddad@state.or.us

Advances in Topo-Bathymetric Lidar surveys to support Spatial Planning and Climate Change

The nearshore zone between the land and deeper water is highly productive, energetic and is challenging to map using traditional land or marine based techniques. Topo-bathymetric lidar sensors are well suited to survey this land-sea boundary and provide seamless elevation and imagery across this boundary. The Applied Geomatics Research Group (AGRG) within the Nova Scotia Community College (NSCC) operates a shallow water airborne topo-bathymetric lidar sensor and 60 MPIX RGB+NIR camera, the Leica Geosystems Chiroptera II, and have flown missions since September 2014. The turbidity of the water plays a major role in determining how deep the green laser will penetrate the water column and the fidelity of the reflected signal. In addition to monitoring the past and predicted weather, we deploy buoys equipped with real-time turbidity sensors to allow the nearshore water clarity conditions to be determined prior to flights. This approach to turbidity management increases our operational efficiency for successful data collection. An automated workflow has been designed that strings together several functions of different software packages to produce classified point clouds and derived elevation and reflectance surfaces. In addition to elevation products near-shore benthic habitat maps and shoreline composition maps are also generated from these data. The derived products have been used in marine spatial planning for aquaculture site suitability analysis and input into storm surge coastal inundation models and sea-level rise predictions from climate change.

Tim Webster
Research Scientist - Applied Geomatics Research Group Nova Scotia Community College, Canada
tim.webster@nscc.ca

The Potential of ASCAT 12.5 km Coastal Observations for Offshore Wind Farm Site Selection in Irish Waters

The offshore wind industry has seen unprecedented growth over the last few years, which resulted in a growing need for accurate, reliable, met-ocean data to identify suitable sites, and to support preliminary design and investment decisions. This study shows the potential of hyper-temporal satellite remote sensing data in generating relevant information for optimal site selection of marine renewable energy infrastructure. Five years of the ASCAT 12.5 km wind product were validated against in situ weather buoys and showed a strong correlation with a Pearson coefficient of 0.95. An operational frequency map and a maximum yield frequency map were produced based on the ASCAT wind product, using GIS and Python technologies. The operational frequency map showed that frequency of wind speed within the cut-in and cut-off range of wind turbines was between 92.4% and 97.2%, while the maximum yield frequency map ranged between 40.6% and 59.5%. The results showed that the hype!

ASCAT 12.5 km wind speed product is representative of in situ measurements, and that its ability to depict temporal and spatial variability can assist in the decision-making process for offshore wind farm site selection in Ireland. This research is relevant to the CoastGIS 2018 conference as it is aligning with several thematic goals by illustrating the use of remote sensing and GIS technology to map offshore wind resources, and exploring relevant decision support for marine spatial planning and management in the context of climate change mitigation measures to reduce greenhouse gases emissions.

Tiny Remmers
Research Assistant - MaREI Centre for Marine and Renewable Energy, Environmental Research Institute, University College Cork, Ireland
tiny.remmers@ucc.ie

Natural protection of the coast: mapping coastal protection service provided by nearshore marine habitats

Given the global climatic changes, coastal zones are more vulnerable to sea level rise and climate extreme events. Nearshore marine habitats, such as sand dunes and salt marshes, have the ability to naturally provide protection to floods, storm waves and erosion, which has been considered as an important ecosystem service. The NW of Portugal is part of the Iberian Peninsula ecoregion, receiving the influence of three oceanic water masses. Its coast features rocky and sandy beaches and several estuaries, some of them under environmental protection. This area is highly urbanized, hosting the second major city of Portugal (Porto) and supporting several human activities, with tourism exponentially growing over the last decade. The coastal zones are prime real estate areas and new tourism economic opportunities are growing fast, stressing the need to manage human activities without compromising ecosystem health and the maintenance of ecosystem services, namely coastal protection. Integrated in the MarRISK project, different modelling tools will be combined to assess coastal protection provided by the natural habitats, like sand dunes and salt-marshes of NW Portugal. Using different habitat features, as bathymetry, topography and waves data obtained within the MarRISK project, with vegetation and land-cover profiles, the protection service provided by sand dunes and salt-marshes will be assessed. Output maps will represent the amount of avoided erosion or inundation along the NW-Portuguese coast, in the presence/absence of the nearshore marine habitats. These maps will be important to help decision-makers understand the importance of protecting these natural habitats.

Ana Maria Ferreira Bio
Interdisciplinary Centre of Marine and Environmental Research (CIIMAR/CIMAR), University of Porto, Portugal
anabio@ciimar.up.pt

Sandra Ramos[1,2], Jacinto Cunha[1], Ana Bio[1], Eva Amorim[1], Michael Elliott[2]
[1] Interdisciplinary Centre of Marine and Environmental Research (CIIMAR/CIMAR), University of Porto, Portugal
[2] Institute of Estuarine and Coastal Studies, University of Hull, United Kingdom

First steps towards a long-term monitoring of storm impact on the coastal morphology of the Reykjanes Peninsula

This contribution aims to provide an overview of the topo-morphological monitoring conducted on the SW coast of the Reykjanes Peninsula since 2014. The survey is achieved on 13 sites where supratidal high energy deposits have been emplaced by storm waves. 9 sites are dealing with cliff-top storm deposits (CTSDs), and 3 sites with beach boulder ridges. In this case, boulders are specifically considered as a proxy for the survey of the morphological dynamics related to extreme meteo-oceanic forcing, notably the impact of storm waves on the coastal fringe. In addition, the survey has been extended to a large dune field to compare the hydro-morphological processes operating between these different types of morpho-sédimentary environments within the same geographical area.Between May 2014 and May 2018, a yearly topo-morphological survey was carried out using airborne methods (kite aerial photography, drone) and field DGPS measurements. The results indicate that boulder deposits are reworked every year with major or minor morphological changes which depend of the winter meteo-oceanic conditions. However, comparisons made with morphological surveys achieved in lower latitudes (i.e. along the Brittany coast) indicate the morphological changes on Reykjanes Peninsula are more significant in terms of boulders movements and morphodynamic processes related to storm waves. By considering the global change including sea level rise and the potential increase of the Atlantic storm frequency and intensity for the next decades, this kind of survey is a big challenge for future coastal management. The boulder ridges were subject to broader morphological changes, materialized by a strong longshore drift. These observations need now to be cross-referenced with the analysis of the meteo-oceanic conditions to better understand the transport patterns of boulders, the hydrodynamic processes conducting these morphological changes and the impact of a potential change in the wave climate (especially storm events). A video monitoring assessment of the dynamics of the boulder beach under different energetic conditions is being implemented to complement the morphologic data.

Ronan Autret[1], Pierre Stéphan[1], David Didier[2] (presenting), Serge Suanez[1], Bernard Fichaut[1], Sigurdur Sigurdarson[3], Björn Erlingsson[4], Jérôme Ammann[5], Peter Weiss[4], Samuel Etienne[6]

[1] Université de Bretagne Occidentale, CNRS, UMR LETG 6554, Institut Universitaire Européen de la Mer, Plouzané, France
[2] Chaire de Recherche en Géoscience Côtière, Québec-Océan, Centre d'études nordiques, Université du Québec à Rimouski, Rimouski, Canada
[3] Icelandic Road and Coastal Authority, Reykjavik, Iceland
[4] University Centre of the Westfjords, Ísafjörður, Iceland
[5] CNRS, Université de Bretagne Occidentale, UMR LGO 6538, Institut Universitaire Européen de la Mer, Plouzané, France
[6] Ecole Pratique des Hautes Etudes, PSL Reaserch University, CNRS, UMR LETG 6554, Dinard, France

Spatial Analysis in GIS applied to the mapping of infralittoral and circalittoral zones from sedimentary and micropaleontological indicators

The determination of the infralittoral, shallow circalittoral and deep circalittoral zones extension is essential for understanding seabed dynamics. Their spatial variation as a consequence of climatic and sea level changes affect, among others, the diversity and relative importance of benthic habitats in the continental shelves. Insights into the relative position of these zones also contribute to understand the environmental processes which drive their retreat or spreading through time. Associated quantitative results are also useful to develop predictive models. This study proposes a methodology to recognize the boundaries of infralittoral and circalittoral zones and their spatial variability over time. The approach is based on sedimentary and paleobioindicator data integration through geospatial and statistical analysis techniques. The obtained results for Santa Catarina continental shelf (Brazil) demonstrated that the first dimension extracted by non-metric Multidimensional Scaling (nMDS) based on Euclidian distance matrix (composed by benthic foraminifera species, grain size and biodetrital carbonate content in the sediments) allows to distinguish the infralittoral, shallow and deep circalittoral zonation after spatialization. The efficiency of the model was verified comparing the obtained predictive map with infra and circalittoral zone depths obtained from remote sensing light penetration data and wavebase numerical modelling analysis. A Discriminant Analysis indicated a maximum concordance of 80.6% among results, validating the proposed approach. This work will hopefully give rise to further discussion about the importance of these specific depth zones distribution for marine habitat mapping, specially under a scenario of climate change.

Carla van der Haagen C Bonetti,
[1] Coastal Oceanographic Laboratory, Federal University of Santa Catarina, Brazil
carla.bonetti@ufsc.br
Sara Gil[2], Danae Copoono Erdosi M. Teixeira[1], Carolina Schmanech Mussi[3], Mario Luiz Martins Pereira[4], Jarbas Bonetti[1] (Presenting)
[2] Universidad de la Republica, Montevideo, Uruguay
[3] Universidade do Vale do Itajaí (Univali), Brazil
[4] Instituto Chico Mendes de Conservação da Biodiversidade, Ministério do Meio Ambiente (ICMBio), Brazil

Refining expert knowledge to spatial data for cross-border maritime spatial planning – experience from the Baltic Sea

Maritime spatial planning, as well as in integrated coastal zone management, geographical information systems provide a fundamental tool to analyze and visualize socio-economic and environmental data for the needs of the planning process. We present the work done in the Plan4Blue project (Central Baltic programme), which processes cross-border coastal and marine information between Estonia and Finland to support maritime spatial planning in the Gulf of Finland, Baltic Sea. The project collected expert opinions about the expectations of future development in four sectors of economic activity: renewable energy production, maritime transport, tourism, and aquaculture and sub-sea resources. The experts representing different sectors of the society were asked to indicate in which activities they see potential growth by the year 2050, and in which parts of the project area the growth is likely to occur. The location component of the expert input was presented either as points on a map in an on-line questionnaire, or as points, lines and areas indicated on a map canvas in expert workshops. This challenged us to think about how the expert input should and could be presented as spatial information after it was digitized. We decided to process the input data as generalized spatio-temporal trends rather than as the original data. We discuss the selections made in the process of building these spatial trend layers, and evaluate the results in the contexts of geographical information management and the maritime spatial planning process.

Dr. Harri Tolvanen
Adjunct Professor – University of Turku, Finland[1]
harri.tolvanen@utu.fi

Tapio Suominen[1], Hanna Uusitalo[1], Meeli Roose[1], Tua Nylén[1]

A water balance GIS tool in support of climate adaption

More heavy rains and severe droughts are one of the expected effects of climate change. The provincial government of West-Flanders, who is responsible for spatial planning, wants to be prepared for these effects, which are already occurring today. Inland fluvial floods and long dry periods, such as in the summers of 2017 and 2018, urge us to look differently at the water management issues in the coastal area. Agriculture, tourism, housing, nature management, shipping and industry are the main sectors of importance to the coast. Cleaver spatial planning and water management should prepare us for the future. The province is developing a water balance tool, taking into account all types of water (rain, surface, ground water, effluent) and all types of users in the coastal area, as a policy support tool. This water balance tool must allow to take well informed decisions for water management in for example agriculture, tourism, nature reserves and can provide guidelines for future spatial development. In March 2018, the methodology proposed by Antea group, was approved by a steering committee including all water related stakeholders. From April till July 2018 Antea group analyzed the water use and water needs using the model. The results are be presented in a GIS environment, visualizing the results per user and per type of water. The aim is to have data at a daily scale.

In a next phase, the results will be used to make a prognosis of the water need in 2040 to support long term planning for climate adaptation at the coast. Instruments will be developed to support water allocation choices in time of drought.

Pablo Crespo del Granado[1]; Kathy Belpaeme[2] (presenting)
[1] Antea group, pablo.crespodelgranado@anteagroup.com
[2] Province of West-Flanders, kathy.belpaeme@west-vlaanderen.be

Stakeholder's Value Identification for Adaptive Port Planning, Case Study of Port of Ísafjordur in Iceland

Today, the dynamic nature of ports involves numerous port stakeholders with a wide range of objectives. The port planning process should be aimed at addressing the desired objectives of port stakeholders. However, diversity, ambivalent and sometimes divergent of the objectives, makes the port planning process challenging. Also, the port planning process is beset by many uncertainties, e.g., opportunities and vulnerabilities. To fulfill the heterogeneous port stakeholders' objectives, and deal with confronting uncertainties in the volatile world, Adaptive Port Planning (APP) has received attention in recent years. APP enhances flexibility of a port without losing functionality during its projected lifetime. An ongoing research project applies APP to the third busiest port of call for cruise ships in Iceland, the multipurpose port of Isafjordur, located in the Westfjords region. In this project, an extensive port stakeholders' identification is conducted. A structured approach is applied to discover values of the port master planning for a large group of stakeholders. Several meetings with port stakeholders and interviews are applied as tools to aggregate the values. The findings of this paper facilitate the first step of APP towards formulating a definition of success for the Port of Isafjordur. Value mapping discloses the importance of efficient and effective spatial planning of the port area in order to reduce conflict between port activities as well as increase current port capacity with optimal service in the port master planning.

Majid Eskafi
Faculty of Civil and Environmental Engineering, University of Iceland mae47@hi.is

Majid Eskafi 1, Reza Fazeli 2, Ali Dastgheib 3, Poonam Taneja 4, Guðmundur Freyr Úlfarsson 1
1 Faculty of Civil and Environmental Engineering, University of Iceland
2 Faculty of Environment and Natural Resources, University of Iceland
3 Water Science & Engineering Department, IHE Delft Institute for Water Education
4 Faculty of Civil Engineering and Geosciences, Delft University of Technology

Challenges for a universal vulnerability assessment in a climate change hazard context: a state-of-the-art review

In a climate change scenario, it is a point of paramount significance to determine factors that shape coastal vulnerability and if a common assessment approach can be universally devised. To address these issues, this study attempts to provide an insight into the state-of-the-art of coastal vulnerability assessment through a comprehensive review of existing approaches returning from 151 publications. The search incorporated the descriptors: coast location, hazard, impact, study aim, end results. Retrieved methodological characteristics included specific adopted framework, indicators used per vulnerability domain and assessment target. The results show substantial progress over the last 20 years in the quantity of studies, with over 70% published in the last 5 years. The top three journals: Ocean & Coastal Management, Journal of Coastal Research and Journal of Coastal Conservation account for 48% of all articles. Statistical correspondence analysis reveals that GIS-based indicator/index approaches are the most common, mostly operating on local to regional scales. While vulnerability is often assessed in a single hazard specific manner, multi-hazard approaches are gaining importance, acknowledging that real coasts are often exposed to more than one hazard. The study also uncovers considerable confusion, overlaps and contradictions in the use of central components of vulnerability (sensitivity/susceptibility, exposure, impact and adaptive capacity) as well as mismatches of using assessment metrics and validation strategies.

Oxana Sytnik Ph.D,
Post-Doctoral Researcher - [1]Coastal Oceanographic Laboratory, Federal University of Santa Catarina (UFSC), Brazil
ox.sytnik@gmail.com

Dr. Jarbas Bonetti[1]

Applications of Geoinformatics for Marine Renewable Energy

With an ever-increasing concern for the effects of global climate change due to greenhouse gas emissions, mankind is in search of alternative fuel sources. The emergence of wind farms and solar energy converters over the past few decades is evident worldwide. However, such technologies can only improve humanity's relationship with energy to a certain extent and so experts have started looking at additionally available resources. It is estimated that there is almost double the current global electricity consumption in the world's oceans, but wave and tidal energy are only in the early stages of development. Not everywhere will be suitable for such energy extraction as there are specific locational criteria which need to be met for the deployment of devices which will harness this energy. This poster presentation will be aimed at showing how geospatial technologies will be critical in identifying locations where such devices should be deployed based on academics.

Studies in Geoinformatics undertaken at University College Cork and University of Copenhagen as well as Coastal and Marine Management studies at University Centre of the Westfjords. It is proposed to use an example from the presenter's own work whereby locational criteria were obtained from interviews with leading wave energy developers in Ireland and a spatial analysis subsequently carried out to identify ideal locations for deployment using GIS techniques. An example of the role that remote sensing can play in such spatial analysis is also intended, focusing on the European Space Agency's recently launched Sentinel-1 and Sentinel-3 satellites.

Ross O'Connell
Student - University of Copenhagen / University Centre of the Westfjords
oconnell.ross@yahoo.ie

State of the environment as a determinant of life quality: a local scale approach

Life quality is a complex and interdisciplinary topic in social sciences, which consists of societal, economic and environmental factors. Scientific studies of life quality therefore require a multidisciplinary approach dealing with both objective and subjective assessments of societal and economical matters and the environment.

In previous studies of life quality, the socioeconomic effects (e.g. GDP) are emphasized whereas the impact of environmental quality has been underestimated. My project aims at understanding the relationship between (objective) estimates of the state of the coastal environment with (subjective) survey data on a local detailed scale. The objective environmental data consists of unique detailed assessments of the state of coastal waters, which has been collected in the Raseborg municipality (Finland). The socioeconomic data in the research will be obtained through a survey, where respondents can express their opinions about the state of the environment while I simultaneously receive demographic parameters about these inhabitants. Furthermore, I am using GIS tools for analyzing how variation in land use practice affects coastal water quality and contributes to differences in subjective opinions of the state of the environment and life quality in general. Additionally, I will study how the state of environment is associated with real estate economy (the cost of land) in order to understand the economic benefits of mitigating climate change effects.

The results will provide potential solutions for mitigating climate change effects through changes in land use practice and spatial planning. Thus, the poster presentation of my ongoing Ph.D. research is strongly connected with conference theme goal.

Ruslan Gunko
PhD Student - Novia University of Applied Sciences, Finland
ruslan.gunko@novia.fi

Using High Resolution Satellite Imagery to detect long term changes in Canopy Forming Kelp (Nereocystis leutkeana) in the Salish Sea.

Bull Kelp, Nereocystis luetkeana, is a key foundation species in the nearshore environment of the Salish Sea. It provides numerous ecosystem services including structural habitat, nutrients and protection for a diverse assemblage of fish, invertebrates and mammals. Changing environmental conditions are impacting the abundance and distribution of critical habitats within the Salish sea ecosystem. To understand these environmental effects on kelp habitats, long-term data on distribution and abundance is needed. This research explores methods developed for mapping kelp over large spatial scales using high-resolution satellite imagery. To better identify kelp beds, spectral indices were derived from images and confirmed with in situ spectral analysis. Furthermore, to assess long-term changes in kelp distribution, classification methods were developed from ground-truthed imagery and applied to a database of historical images. Optimizing these nearshore mapping methodologies will improve satellite detection of spatial trends and distribution of important algae species. Ultimately leading to better monitoring of key nearshore habitats and improvements for their future ecological protection.

Sarah Schroeder, Maycira Costa
Masters Student - University of Victoria, Canada
sbs@uvic.ca

Participatory monitoring of the Peale's dolphin (Lagenorhynchus australis) in Patagonian and Fuegian fjords of southern Chile: efforts towards environmental education, citizen science and conservation

It is unquestionable that natural beauty and ecosystems richness are constantly in hand with development of tourism. The current Regional Development Plan for the Chilean Region of Magallanes and Antarctica has identified tourism as one of the main priorities for economic development. The Magellanic sub-Antarctic ecoregion represents one of the last "wild" destinations, and today it is experiencing an explosive growth in the number of visitors: between 2009 (189,810 tourists) and 2016 (345,001 tourists), representing and increment of more than 80% percent in less than a decade. It has been acknowledged that there is a need for long-term and more effective environmental monitoring in the Subpolar and Polar Regions to better understand the diverse impacts of socio-environmental changes, such as growing tourism, on socio-ecological systems and to support management in the face of rapid global change. Our project focuses on filling the gap in knowledge about the Peale's dolphin in Patagonian and Fuegian fjords of southern Chile in order to inform governmental and nongovernmental agencies with the status of this specific cetacean, and the threats that they might face, as a result of the increased presence of tourism in the region. Our goal is to create an online database that will allow us to assess the status of the Peale's dolphin populations in the region. Working together with local communities, Chilean and Canadian researchers we will develop an App (iCetacea) and a Web Map application freely available to facilitate data collection, storage, visualization, analysis and modelling in order to provide local authorities with a tool to support sustainable management of tourism.

Simon Demers, Liliana Perez
Student - Université de Montréal, Canada
simon.demers.3@umontreal.ca, l.perez@umontreal.ca

Notes, Ideas, comments, poems, etc.