MERIKA

Marine Energy Research Innovation and Knowledge Accelerator

MERIKA Scientific Advisory Board Meeting

Inverness, Scotland

19th November 2015

10.00-14.00

merikafp7.eu

merikafp7@uhi.ac.uk

HIE Highlands and Islands Enterprise

The MERIKA Project has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 315925.

University of the Highlands and Islands
Oilthigh na Gàidhealtachd agus nan Eilean

Eddy Generation and Shedding in a Tidally Energetic Channel

Philip Gillibrand

Theme Leader, Renewable Energy and the Environment,

Environmental Research Institute, North Highland College,

The University of the Highlands and Islands

MERIKA Science Advisory Board, 19 Nov 2015

ERI Renewable Energy and the Environment Research Theme

"*The ERI is a centre of aspiration that seeks to be internationally recognised for distinctive and innovative environmental science…. With easy access to outstanding natural resources in the Pentland Firth and Flow Country, and a range of analytical and field equipment, the ERI seeks to address emerging issues related to improving our understanding of the natural environment.*"

RESEARCH PRIORITIES

- Assessing available resources of marine renewable energy (tidal current, wave and offshore wind) around Scotland
- Understanding the effects of marine renewable energy devices on the environment
- Assessing the vulnerability of offshore installations to extreme weather
- Achieving an integrated view of energy generation, energy saving and society
- Understanding the inter-relationships of climate change, energy consumption and generation

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ERI Renewable Energy and the Environment Research Theme

SUB THEMES:

MARINE ENERGY - RESOURCE AND RISK

- Tidal resource assessment; wave climate assessment
- Device-environment physical interaction (measurement and modelling)
- Modelling (including turbulence & array effects)
- Climatology including Weather windowing (for installation & maintenance)

MARINE ENERGY – ENVIRONMENTAL AND ECOLOGICAL INTERACTIONS

- Fish habitat use and migrations (focus on salmonids i.e. Pentland Salmon Initiative)
- Seabird ecology
- Benthic interactions
- Bio-fouling and non-native species
- Underwater noise

ERI Mobility Programme: Scientific Objectives

The overall objective of the MERIKA mobility programme within ERI is to initiate collaborative research programmes with our European partners, with the eventual intention that these will lead to new funding proposals to the EU within the lifetime of the project.

- **NUIG**
  - Physical oceanography and hydrodynamic modelling of marine renewable energy (MRE) devices, and the application of land-based radar systems to observe current and wave conditions in coastal environments (Prof. Mike Hartnett).
  - MRE impacts on benthic assemblages and benthic cover including sponges (Dr Grace McCormack).
  - Bio-fouling of marine infrastructure and the dispersal of non-natives (Dr Maeve Kelly).
- **WavEC**
  - Bio-fouling of marine infrastructure and the dispersal of non-natives using MREs, in particular wave energy convertors (Dr Teresa Simas and Ms Ines Machado).
  - Benthic habitat mapping and baseline surveys (Ms Ines Machado).
- **NTNU**
  - Seabird ecology and interactions with MREs (Prof. Eivin Roskaft and Dr Bard Stokke).
  - Salmon migration and interactions with MREs (Dr Jan Davidsen).

Hydrodynamic Modelling at ERI

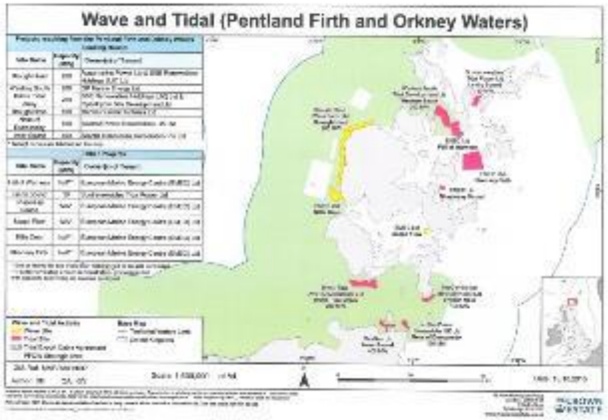
Objectives:

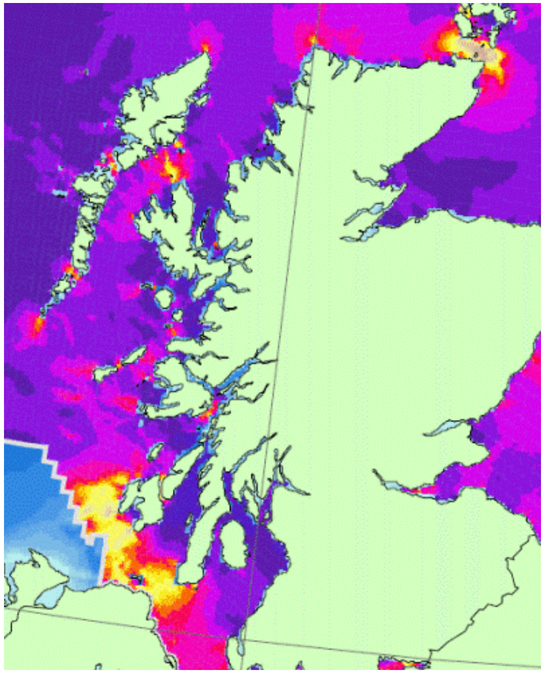
1. To (re-)develop a hydrodynamic modelling capability at ERI, with a particular focus on marine energy and the Pentland Firth;

2. To couple the model to SWAN to investigate wave-current interactions;

3. To explore the potential hydrodynamic effects of tidal turbine arrays in the Pentland Firth;

4. To couple the physical models to ecological models to investigate ecological interactions of marine energy.





Hydrodynamic Modelling at ERI

The Model:

- River and Coastal Ocean Model (RiCOM);
- Proprietory code developed by Roy Walters (formerly NOAA and NIWA);
- Uses mixed finite element/finite volume methods on unstructured grids;
- Solves the Reynold-averaged Navier Stokes equations, using hydrostatic and Bousinesq approximations;
- Employs semi-implicit and semi-lagrangian techniques to solve the free surface and momentum equations;
- Model is fast, robust and accurate, ideal for use on desktop computers and small clusters;
- Previously applied to tsunami, storm surge and tidal modelling;
- Recently applied to tidal energy problems in Canada and New Zealand.

References

Walters, R. A. (2005). Coastal ocean models: two useful finite element methods. *Continental Shelf Research*, *25*(7), 775-793.

Walters, R. A., Gillibrand, P. A., Bell, R. G., & Lane, E. M. (2010). A study of tides and currents in Cook Strait, New Zealand. *Ocean dynamics*, *60*(6), 1559-1580.

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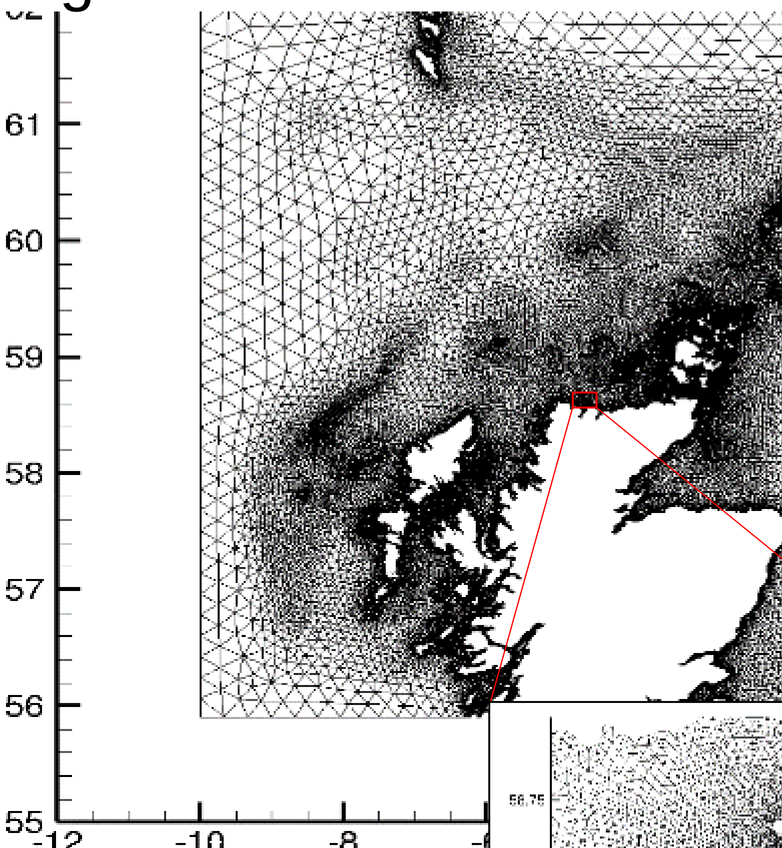
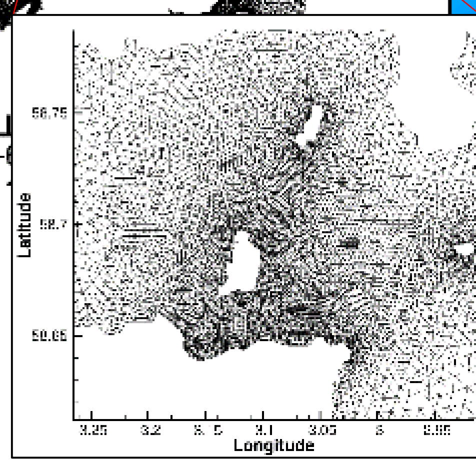
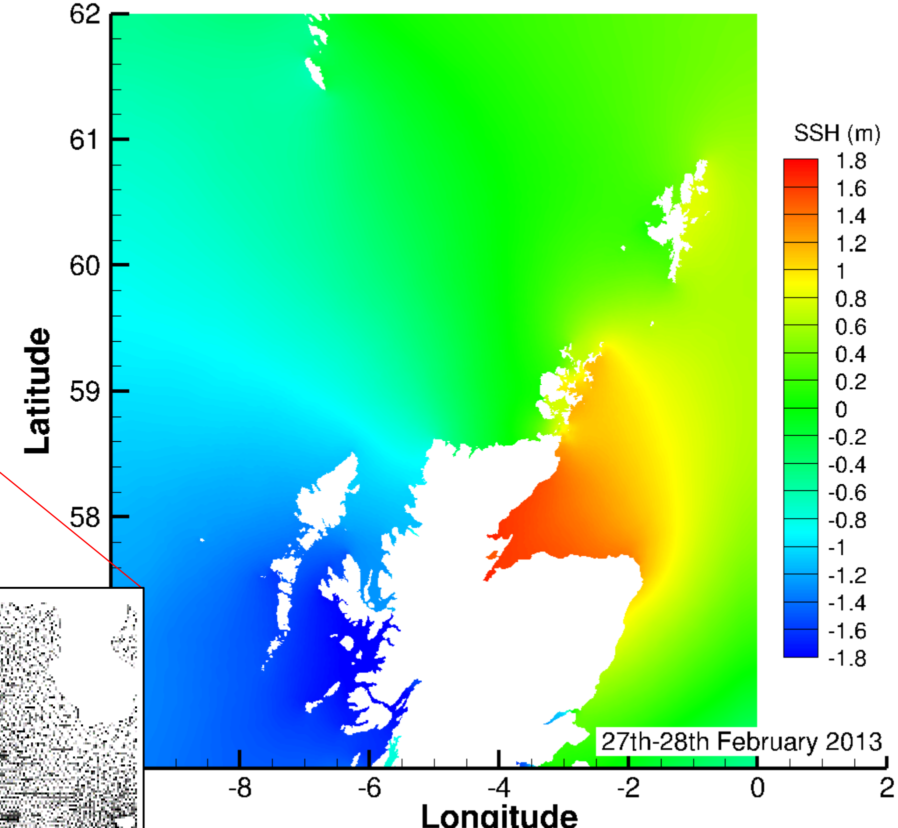
Eddy Generation and Shedding in a Tidally Energetic Channel



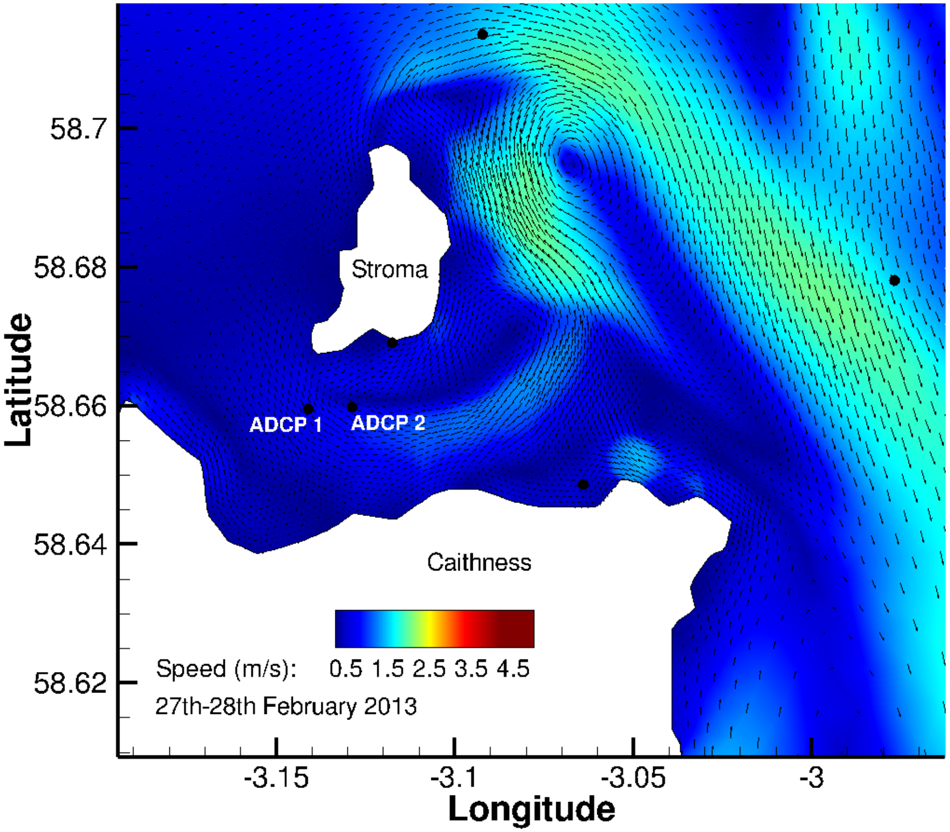


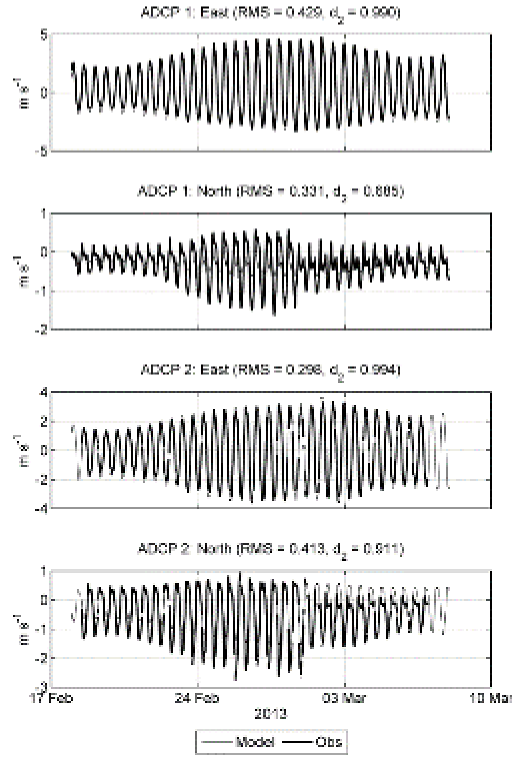


Model Domain:

Grid spacing: 20 km – 40 m
No. Nodes: 167963
No. Elements: 80378
Drag coeff C_D = 0.004
Time step: 36 s
34 days takes: ~ 80 mins (2D)
(8 cores) ~ 6 hrs (3D)

Boundary Forcing:
7 tidal constituents: M_2, S_2, N_2, O_1, K_1, Q_1, M_4
Reconstructed sea level along open boundary from OTPS (OSU)





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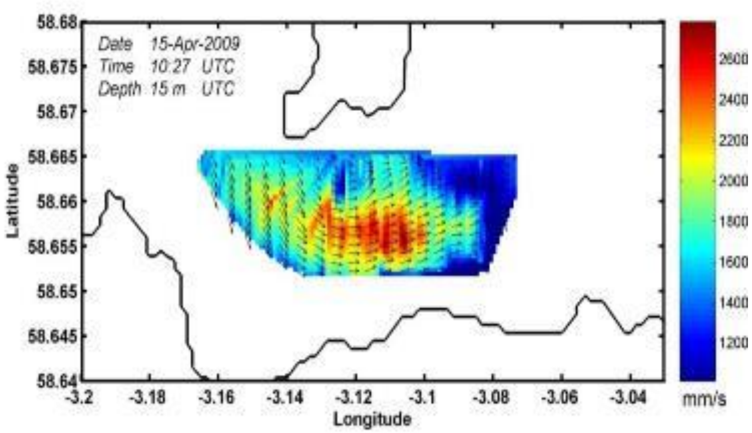

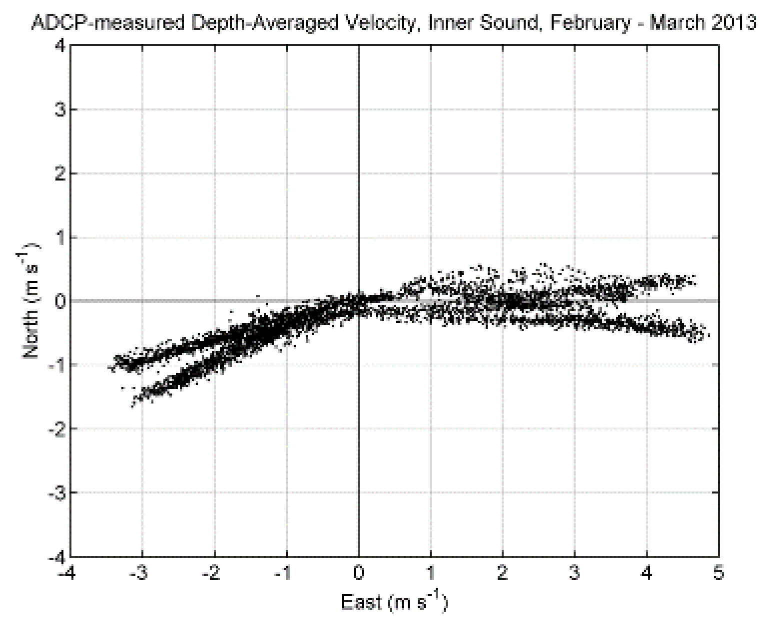

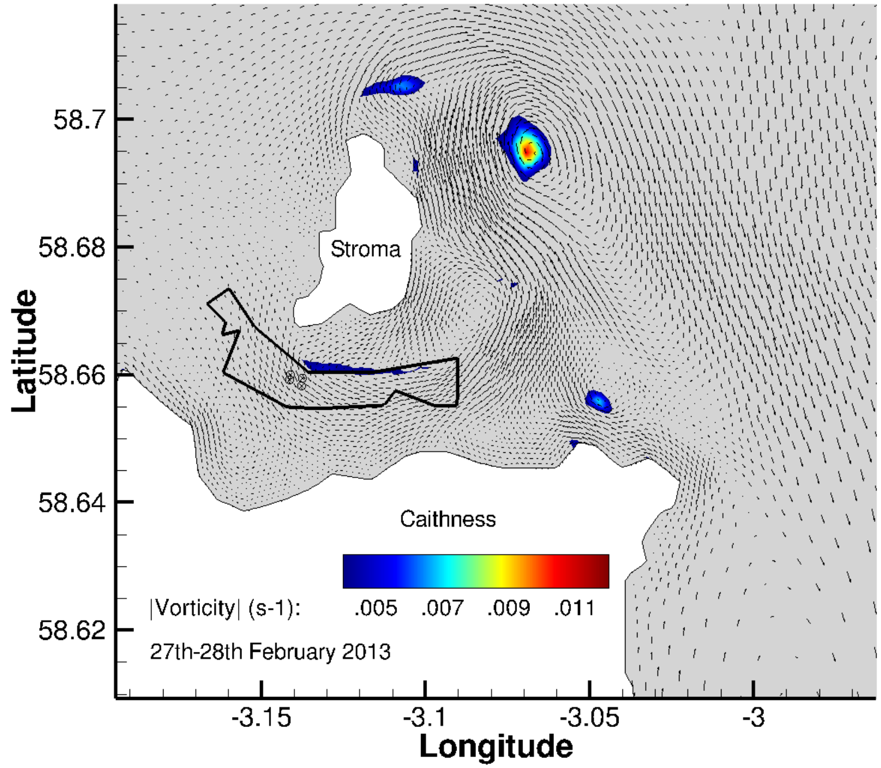

Modelled absolute vorticity through the Inner Sound on 27th – 28th February 2013. Values less than 0.005 s^{-1} are not coloured, to highlight eddies and high shear zones. The Meygen lease area (solid line) and the locations of the initial four turbines planned for 2016 (hatched circles) are shown.

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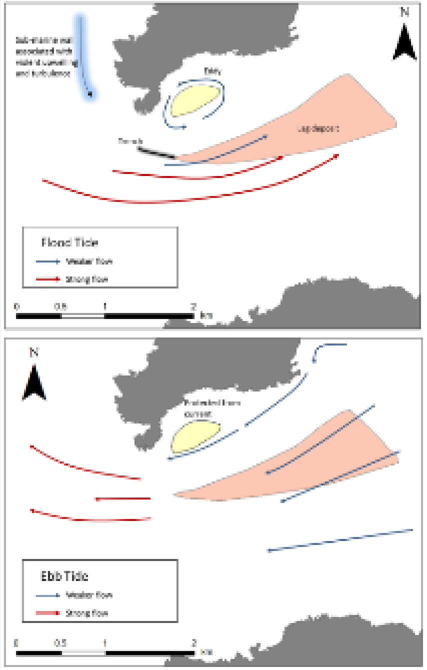
Sediment Dynamics

The pattern and strength of tidal current flow within the inner sound has sorted the available sediment into distinct sediment banks (right). A sharply defined sand bank lies beneath the trapped eddy, whereas a bed of shell fragments are found in the higher current area. Sediment dynamics in the area may be inferred from the combined modelling and observations (far right).



Left: Sand and shell banks to the south of Stroma, mapped by multi-frequency side scan sonar. Right: Inferred sediment dynamics on flood and ebb tides.

Planned Work

Physics

- Ongoing calibration, against tide gauge, ADCP and new data;
- Describe detailed flow in the PF/Inner Sound (island wakes, eddies etc);
- Implementation of turbines to examine deployment effects on flow;
- Coupling with wave model (SWAN, Philippe Gleizon);
- Explore data fusion with new technology (X-band radar);
- Sediment distributions and dynamics;
- Proposals:
  - Rapid-response radar system, with NUIG (Hartnett), MSS (Turrell), NMI, Faroe, Iceland (NPA).
  - EPSRC Supergen proposal (radar + trad obs + modelling) with NOC, UoL, HWU
- Explore FVCOM (for use on larger clusters and integration with Scottish modelling community).

Ecology

- PhD studentship application to look at potential dispersal of non-native species in Scottish waters, using marine energy installations as “stepping stones” (with Jen Loxton);
- Build links to ecological models to model salmon (and possibly diving seabirds) movements (with Diego del Villar, Liz Masden).

Biofouling and benthic interactions associated with marine renewable energy devices in Europe

Dr Jennifer Loxton

MERIKA Science Advisory Board
Thursday 19th November 2015

Research areas

- **Biofouling of renewable energy devices**

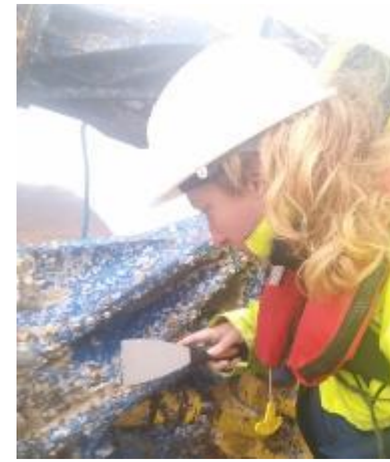
- **The Non-native Invasive Species (NNIS), *Schizoporella japonica,* on renewable energy devices**

- **Potential effects of tidal energy extraction on the biogeochemistry of maerl reefs in Orkney.**

Biofouling of renewable energy devices

Scrapes

- Species list (device and/or site specific)
- Indicative of expected biomass
- Can be used to roughly inform antifouling strategies



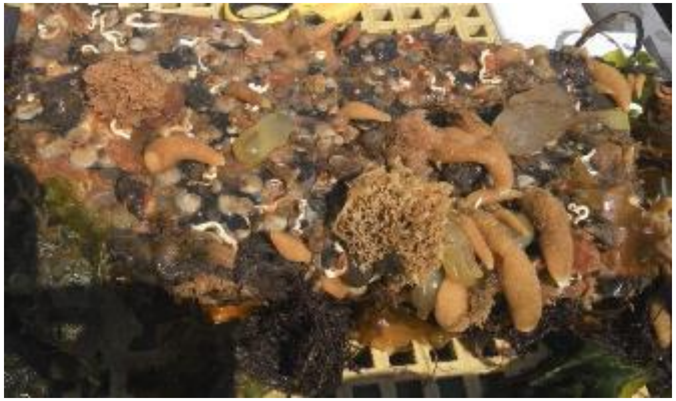
Expected output: peer reviewed paper in international journal.

SAMPLING COMPLETED	PLANNED IN 2016
Scotrenewables SR250 (tidal, Orkney)	Aquamarine Power (wave, Orkney)
Pelamis (wave, Orkney) WindFloat (floating wind, Portugal) Pico Plant (wave, Azores) AlbaTERN (wave, W Scotland)	Scotrenewables SR2000 (tidal, Orkney) SmartBay (Ireland) Pelamis (wave, Orkney)

Biofouling of renewable energy devices

Settlement panels

- Species list (device and/or site specific)
- Quantitative measure of biomass
- Seasonality of settlement
- Differential biofouling on different device surfaces
- Growth rates during different seasons
- Can be used to intelligently structure antifouling strategies
- First data expected Spring 2016



Expected output: peer reviewed paper in international journal, eventually….

PANELS INSTALLED	PLANNED IN 2016
WaveRoller (wave, Portugal)	Scotrenewables SR2000 (tidal, Orkney)
Pico Plant (wave, Azores) SmartBay (test site, Ireland) AlbaTERN (wave, W Scotland)	Statoil HyWind (floating wind, Scotland)

Biofouling of renewable energy devices

Settlement panels – installation

- Minimum of three replicate panels (20cm x 15cm) at each site.
- Either installed on the device or at the energy site
- Changed seasonally, at least 3 x per year.
- Installed in the top 1m of water for floating devices; installed at varying depths using SCUBA for bottom mounted devices.

Settlement panels – challenges

- Installation method is different between sites and devices, dependent on energy of site.
- High energy sites (e.g. WaveRoller) make installation difficult and risk of experiment loss higher (lost 2 complete sets of panels due to weather in 2015)
- No control over the experiments when the panels are installed at a remote site owned by a developer (lost 2 complete sets of panels due to unexpected maintenance at the WaveRoller site during 2015)

PhD project: An Examination of Floating Wind Farms as Vectors for the Spread of Invasive Non-Native Species in Scottish Territorial Waters

Objectives

- Baseline existing bio-fouling communities at HyWind floating wind site.
- Install bio-fouling monitoring experiments on floating turbines at HyWind.
- Monitor any changes in bio-fouling communities during the initial operation of the floating wind turbines.
- Prepare advice for the industry on potential mitigation measures to prevent commercial scale floating wind turbines increasing the spread of INNS in Scottish waters

Supervisors: Jen Loxton (ERI), Elizabeth Cook (SAMS), Andrew Blight (St Andrews)

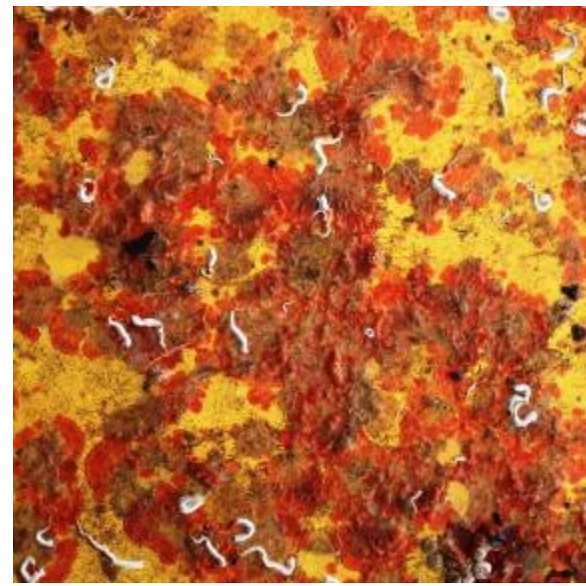
The NNIS, *Schizoporella japonica,* on renewable energy devices

Background

- A non-native bryozoan first found in Scotland in 2011
- Since been found on the following renewable energy devices in Scotland: Pelamis, Scotrenewables SR250, Albatern "squid"

Approach

- Biogeography of *Schizoporella japonica* in Europe.
- Life history of *Schizoporella japonica* and larval transport



Additional funding

- MASTS PECRE grant

Collaborators

Saint Petersburg State University

NATURAL HISTORY MUSEUM

THE MARINE BIOLOGICAL ASSOCIATION Est. 1884 Incorporated by Royal Charter 2013

HERIOT WATT UNIVERSITY

environmental research institute

NUI Galway OÉ Gaillimh

Biogeography of *Schizoporella japonica* in Europe.

Zootaxa 3780 (3): 481–502
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3780.3.3
http://zoobank.org/urn:lsid:zoobank.org:pub:E8B88941-65A4-44F8-8D93-D2F7B541152D

First occurrence of the non-native bryozoan *Schizoporella japonica* Ortmann (1890) in Western Europe

JOHN S. RYLAND[1,6], ROHAN HOLT[2], JENNIFER LOXTON[3,4,5], MARY E. SPENCER JONES[4] & JOANNE S. PORTER[3,4]

- Collation of marina and harbour survey data from:
    - Heriot-Watt University (Scotland, Norway)
    - Marine Biological Association (Wales, England, France)
    - Environmental Research Institute – Chris Nall. (Scotland)
- Personally conducted surveys of missing harbours and marinas in Scotland, Northern Ireland and Ireland (79 sites).
- Collection of samples for genetic analysis (conducted by Heriot-Watt University)
- Habitat “niche” modelling using presence and absence data and environmental parameters from 238 sites.

Expected output: peer reviewed paper in the Journal of Biogeography - in prep

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NUI Galway
OÉ Gaillimh

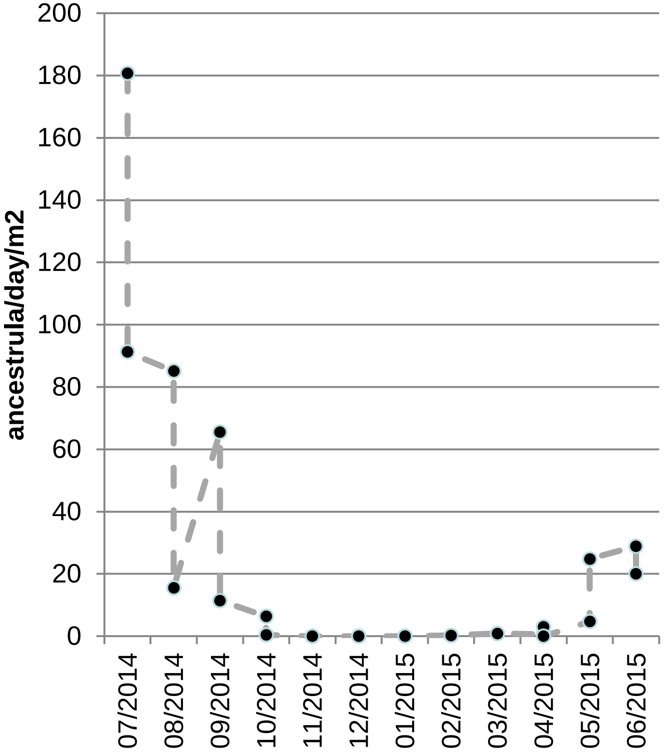
Life history of *Schizoporella japonica* and larval transport

Approach

- Settlement panels in Orkney to investigate seasonality of settlement

Progress

- 18 months of study completed



Life history of *Schizoporella japonica* and larval transport

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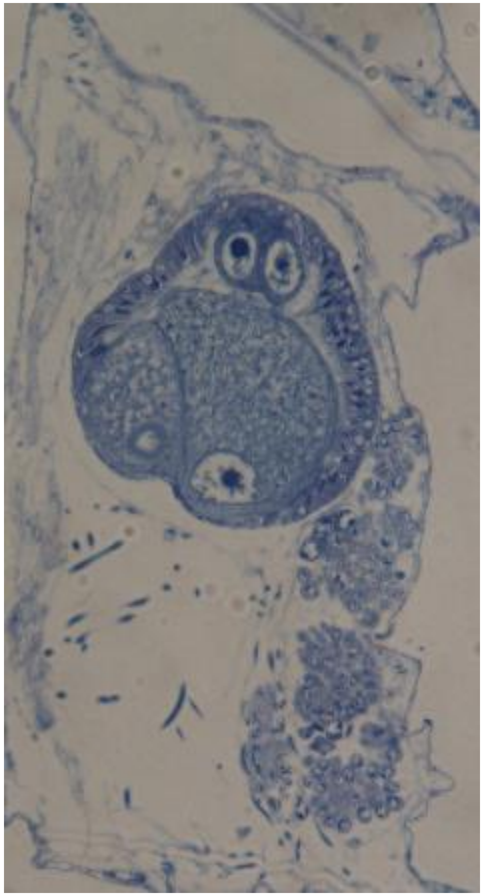
- Examination of reproductive structures



Progress

- Study completed in St Petersburg
- Species found to be simultaneously hermaphroditic
- Conveyor belt of larval production
- Larvae with large yolk stores

Life history of *Schizoporella japonica* and larval transport

Approach

- Settlement panels in Orkney to investigate seasonality of settlement
- Examination of reproductive structures
- Larval release and swimming studies
    - Release triggers
    - Swimming speeds
    - Swimming duration
    - Metamorphosis success rates after forced swimming.

Progress

- First round of swimming trials complete
- Larval release triggered by light and positively phototaxic
- Larvae can swim for up to 5 days although metamorphosis success rate reduces after 24 hours
- Larvae swim at average speeds of 3.6m/hr

Life history of *Schizoporella japonica* and larval transport

Approach

- Settlement panels in Orkney to investigate seasonality of settlement

- Examination of reproductive structures

- Larval release and swimming studies
  - Release triggers
  - Swimming speeds
  - Swimming duration
  - Metamorphosis success rates after forced swimming.

- Cumulative panels to investigate:
  - Growth rates
  - Age at which sexual maturity achieved
  - Competition with other species

In progress

Expected output: peer reviewed paper

Potential effects of tidal energy extraction on the biogeochemistry of maerl reefs in Orkney.

- Protected habitat in the UK
- Maerl reefs are extensive around Orkney
- Rely on strong currents and clear water to thrive
- Important carbon sinks

<u>Question:</u>
Will the removal of tidal energy from Orkney waters impact maerl reefs?

<u>Approach:</u>
Examine 4 maerl reefs within the Wyre Sound marine protected area (MPA), Orkney, which have naturally different levels of flow.

Quantify and compare:

- Biogeochemistry (ERI)
- Environmental parameters (ERI + Heriot-Watt)
- Ecological measures (Heriot-Watt)

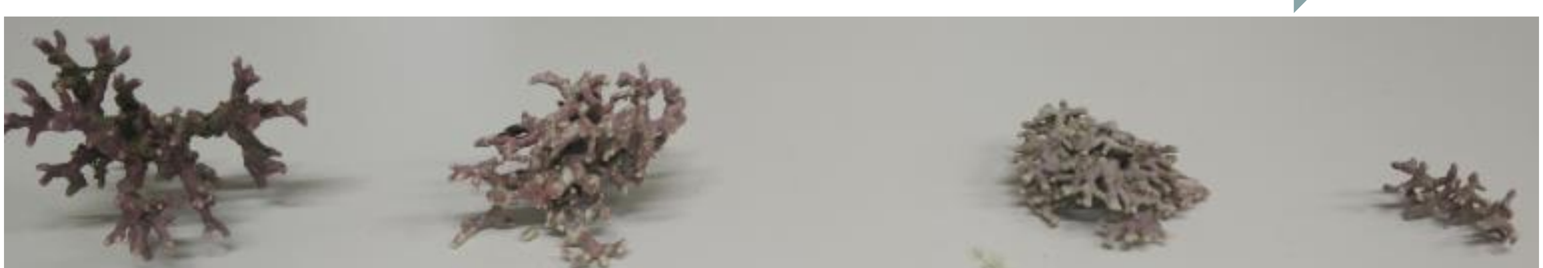
Potential effects of tidal energy extraction on the biogeochemistry of maerl reefs in Orkney.

Progress:

- SCUBA diving and sample collection completed June 2015
- Colour sonar and ADCP survey complete Nov 2015

BIOGEOCHEMISTRY MEASURES	ENVIRONMENTAL PROFILE
Total organic: inorganic carbon	Nutrient analysis of water samples
Maerl shape, size, surface area Composition and solubility Carbonate chemistry of water samples Carbon dating to age reefs **In situ photosynthesis rates** **Maerl density**	**Near bottom current loggers** **Temperature, salinity, pH etc** **Turbidity profiles** **Colour sonar map** **ADCP profile**

FLOW



Questions?

Spatial distribution of waves in coastal waters

MERIKA TSG 19/11/2015, Inverness

Research update

Arne Vogler, Lews Castle College - UHI

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The MERIKA Project has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 315925

Scientific Research Questions

[Mobility programme]

- **Technical University Hamburg (TUHH)**
  - Short term wave forecasting (Higher Order Spectral Method)
  - Analysis of radar data to output wave height and period in real time across the spatial domain
  - Rogue waves and stochastic data analysis
  - Sea state characterisation, wave structure interaction

- **Norwegian University of Science and Technology (NTNU)**
  - Impact of local wind and wave field on currents
  - Statistical characterisation of sea states and individual waves
  - Hydrodynamic Impact of kelp (Laminaria Hyperborea)
  - Wave structure interactions

LCC Research Themes and Objectives

- To derive robust parametric descriptions of wave climate statistics (for various water depths and timescales)
- Develop a tool to derive individual wave data in real time across the spatial domain from X-Band radar
- Enhance the understanding of the impact of turbulence with WECs and TECs in high energy environments
- Analysis of wave-current interactions at marine energy sites
- Wave driven beach morphology

13 November 2011, Dalmore

University of the Highlands and Islands
Lews Castle College


17 March 2012, Dalmore
University of the
Highlands and Islands
Lews Castle College

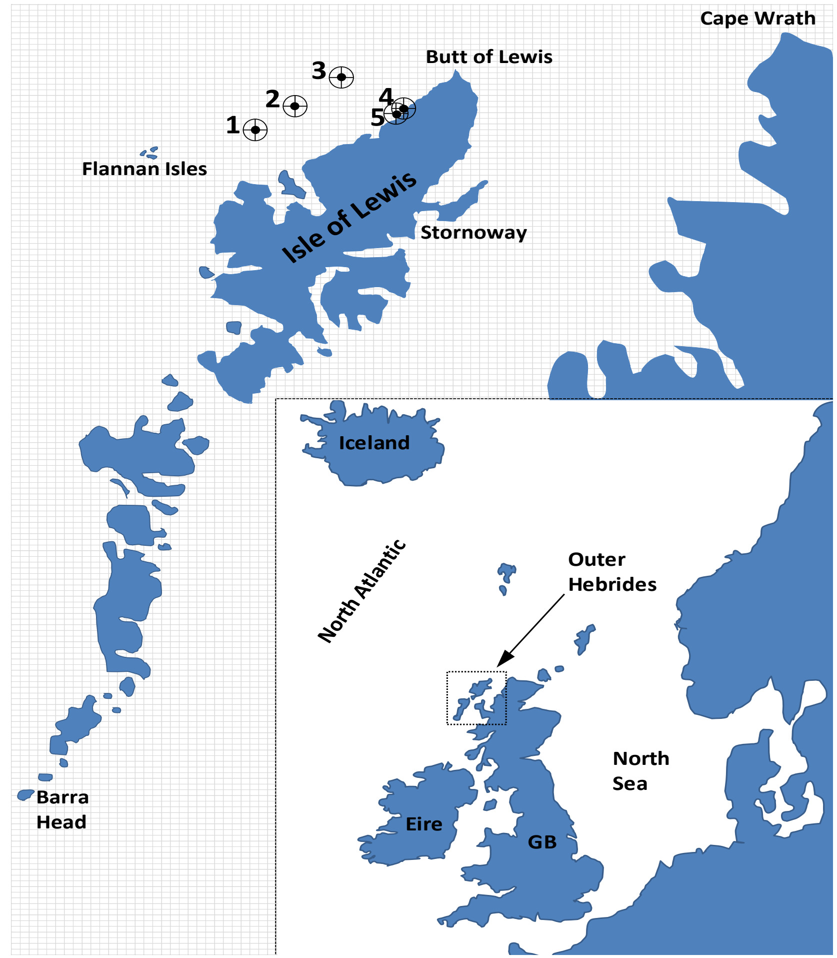
02 October 2011, Bragar

University of the Highlands and Islands
Lews Castle College

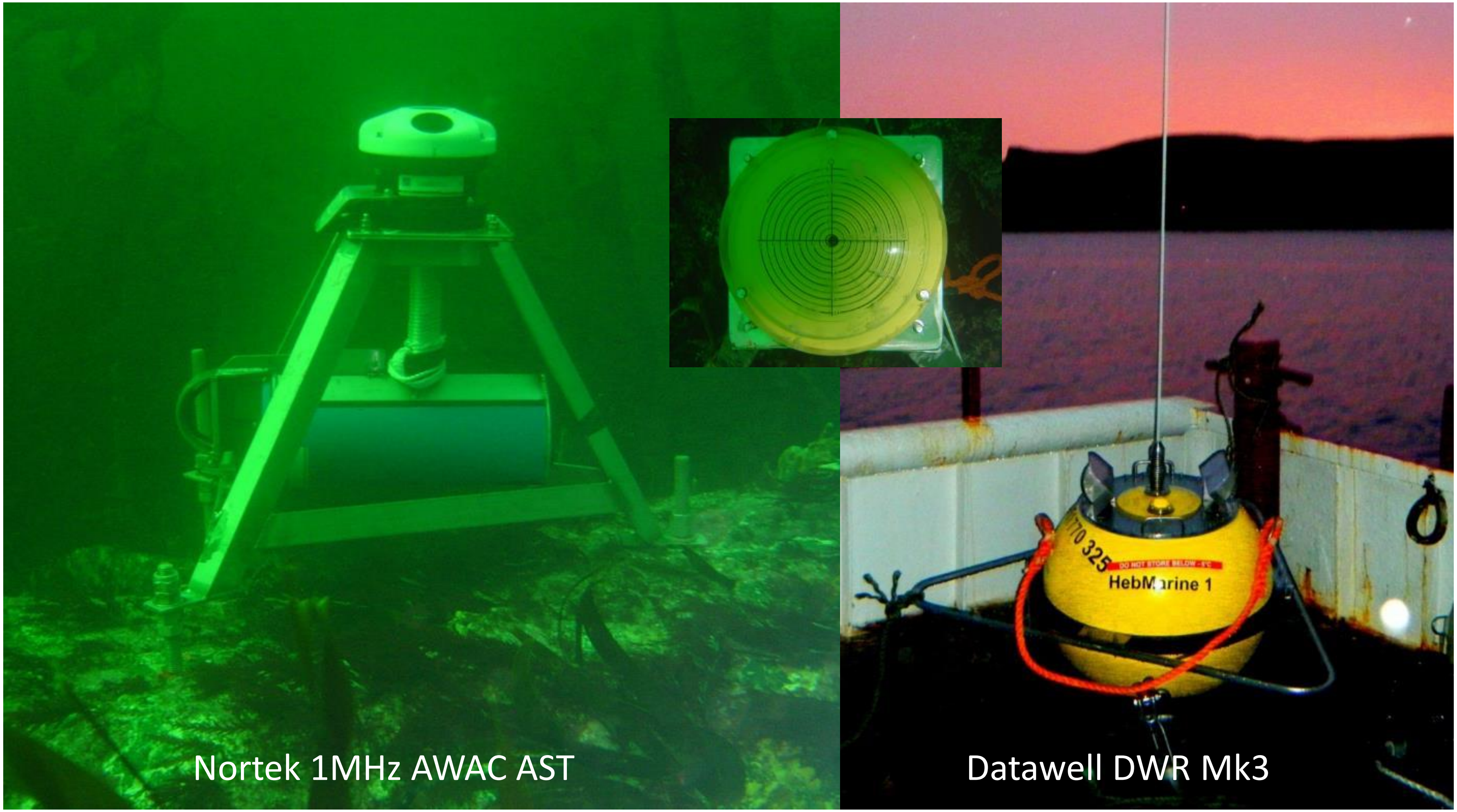
18 March 2012, Bragar

Study Site: Outer Hebrides of Scotland

- North-western coast of Isle of Lewis
- Alternative energy resources: Wave Power
- High energy sea areas are not too well understood, unless high presence of oil/gas/fisheries
- Resource assessment



Data Acquisition Network



Nortek 1MHz AWAC AST

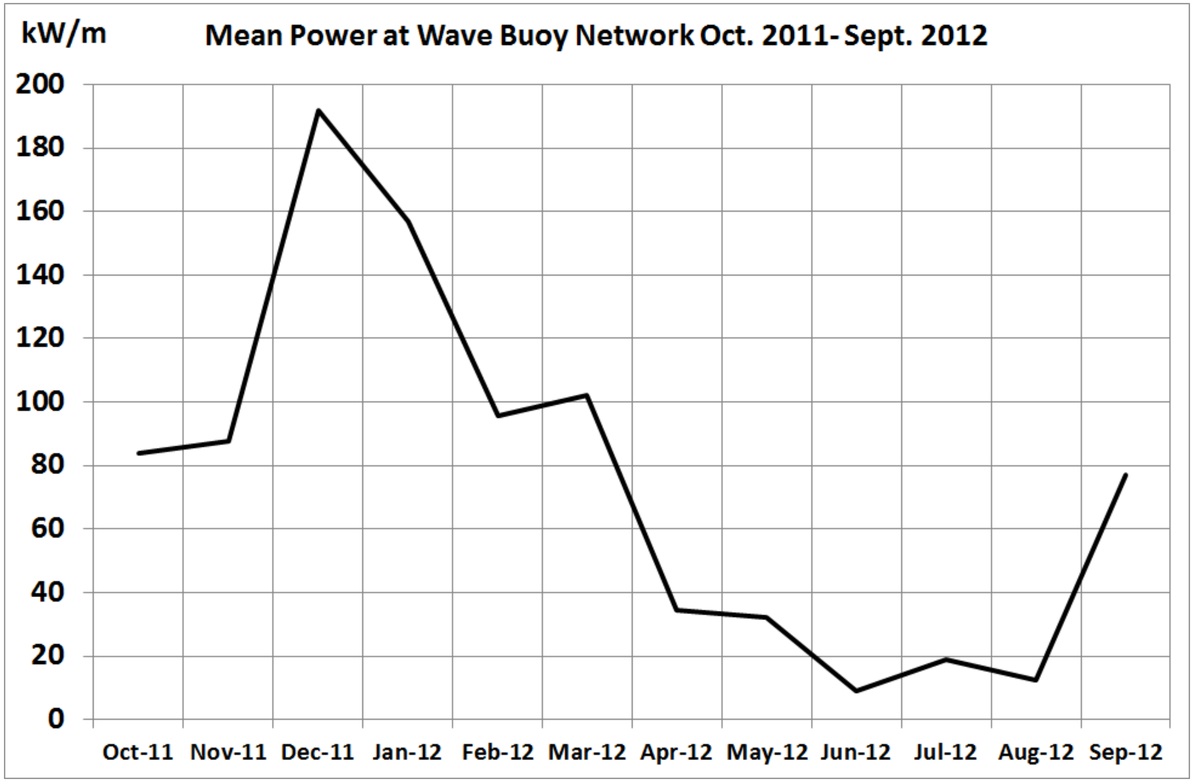
Datawell DWR Mk3

University of the Highlands and Islands
Lews Castle College

Observations and Analysis

Monthly Mean Wave Power averaged for the Buoy locations

High fluctuation over the year based on 1 year observation period



Requirement for long term (multiple years) data sets to obtain good averages

[e.g. Dec 2011 P = 192kW/m, but Dec 2012 P = 72kW/m]

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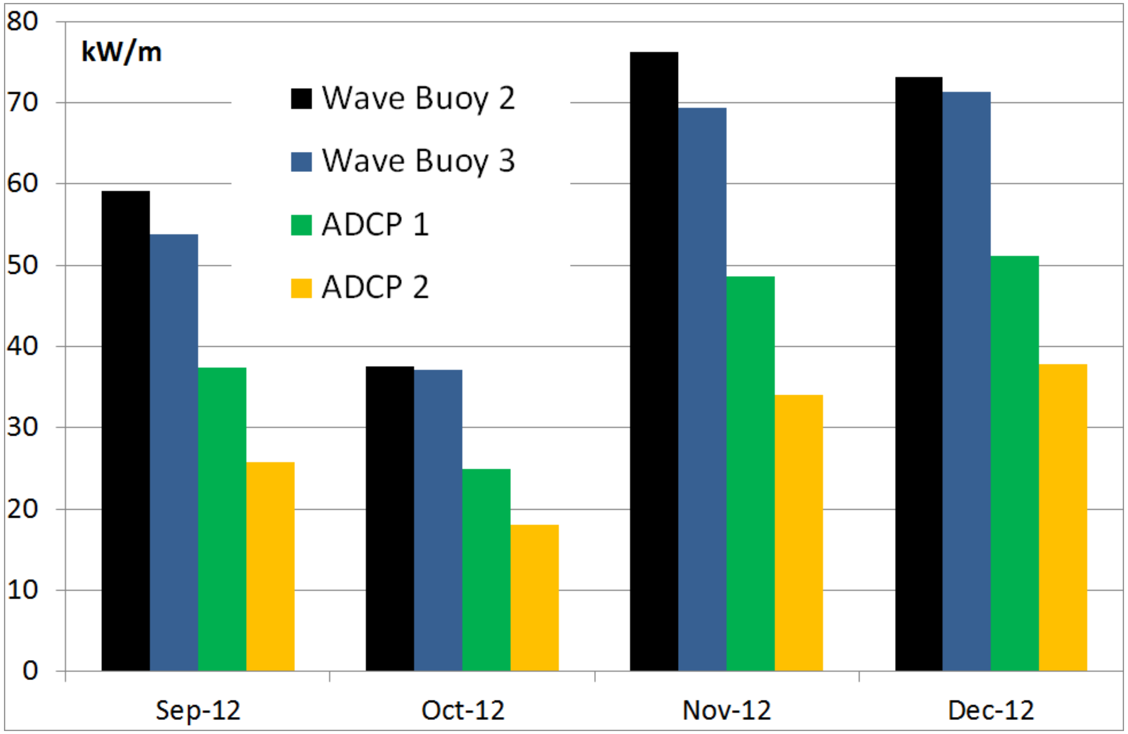
Observations and Analysis

Wave power approximation by: $$P \approx \rho g \frac{Hm0^2}{16} C_g(Te,d)$$

where $$C_g(Te,d) = \frac{1}{2}\left[1 + \frac{2kd}{\sinh 2kd}\right]\sqrt{\frac{gL}{2\pi}\tanh(kd)}$$



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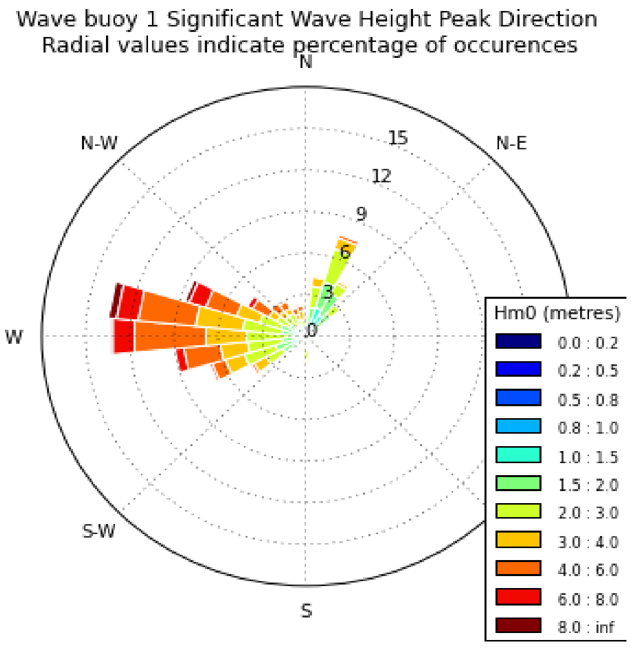
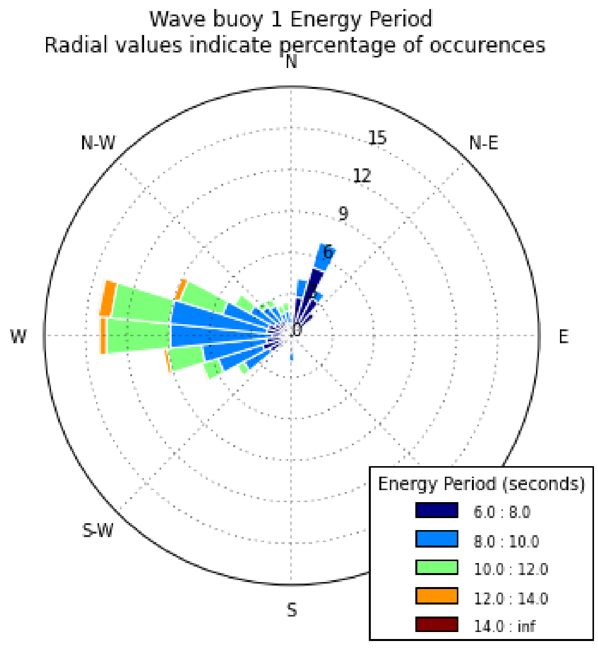
Lews Castle College

Observations and Analysis

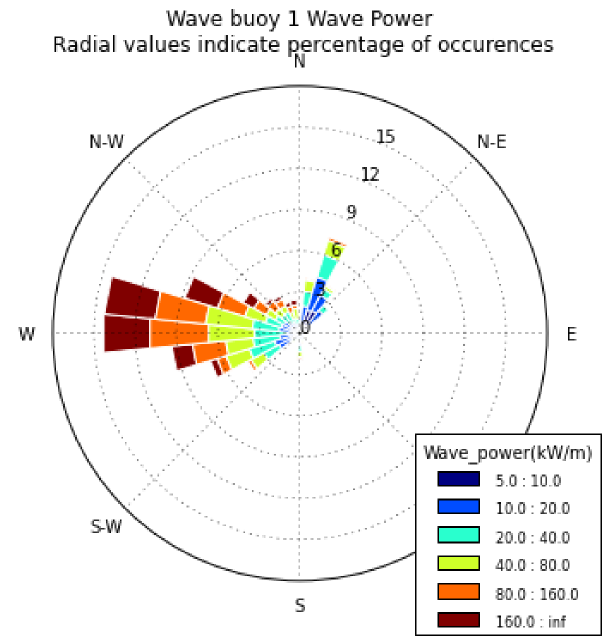
Wave Roses for ‘Wave Buoy 1’ for 12 month period Oct2011-Sept 2012



Significant wave height
Hm0[m]



Energy period
Te[s]

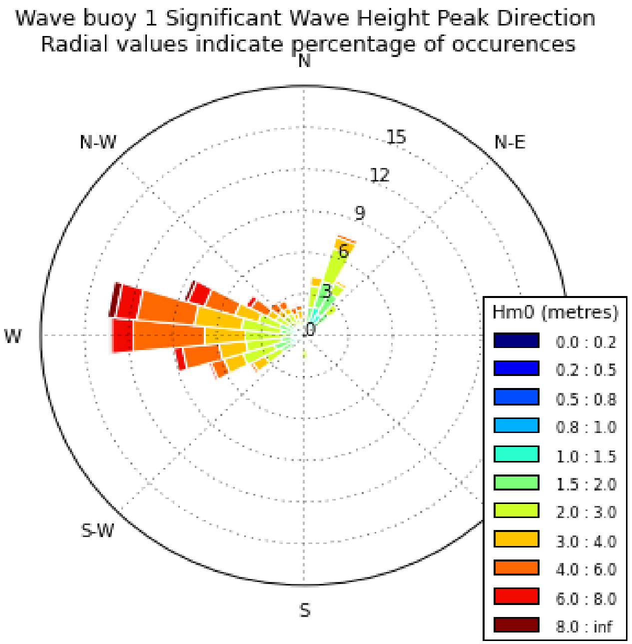


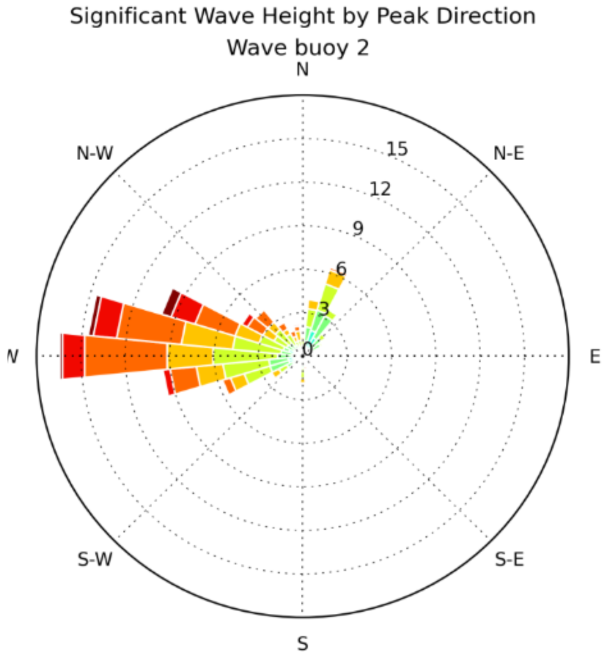
Wave power
P[kW/m]

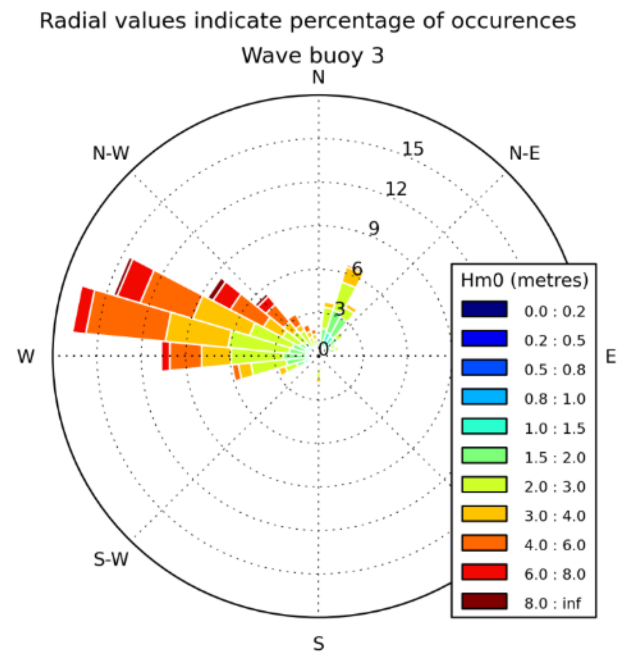
Observations and Analysis

Wave Roses for three buoys for 12 month period Oct2011-Sept 2012

Bias in wave direction towards N for northerly buoys







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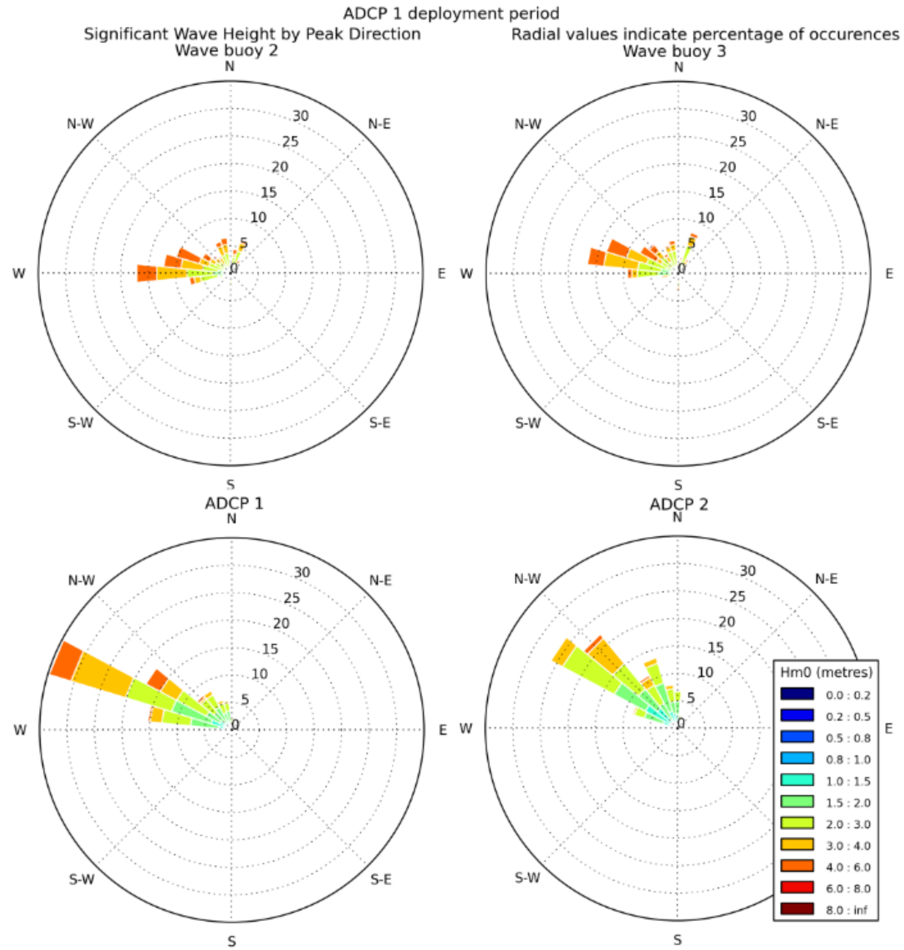
Observations and Analysis

Comparison of wave buoys 2 and 3 against ADCPs 1 and 2 for three month period (Sept – Dec 2012) shows a more focussed directionality in the nearshore zone

Considerable differences between both ADCPs over a distance of only 500m

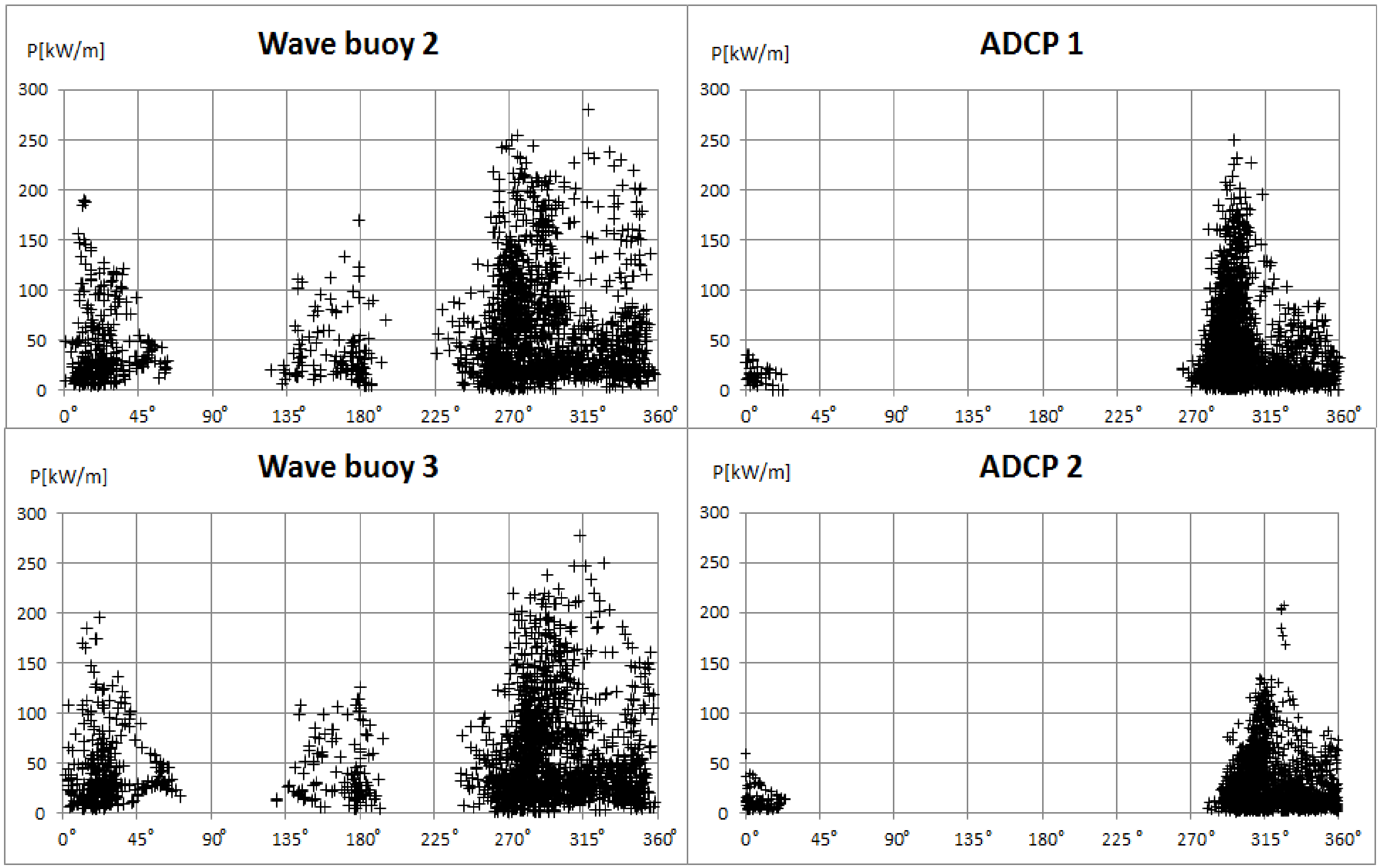
Importance of careful selection of energy 'hotspots' for wave power extraction



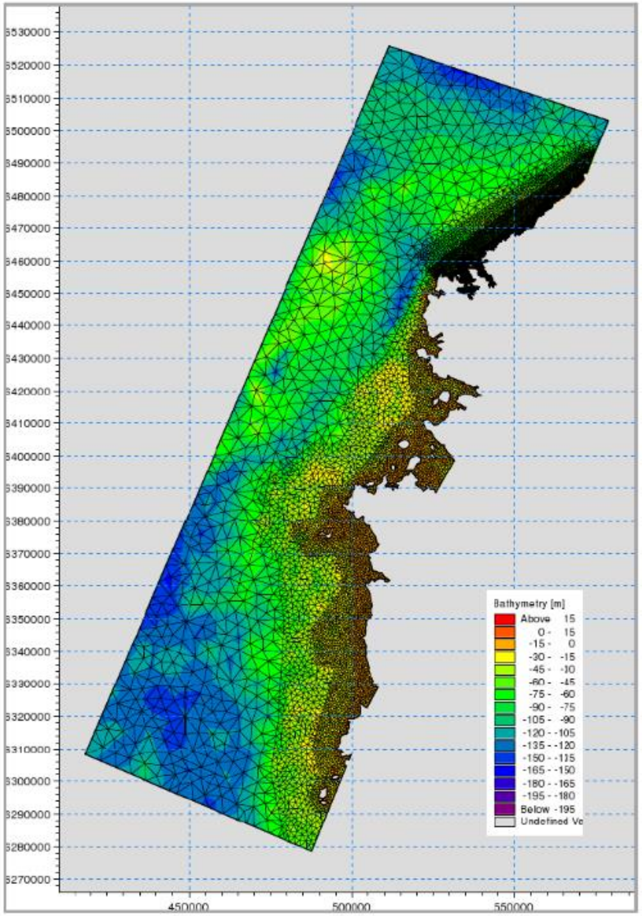
Observations and Analysis

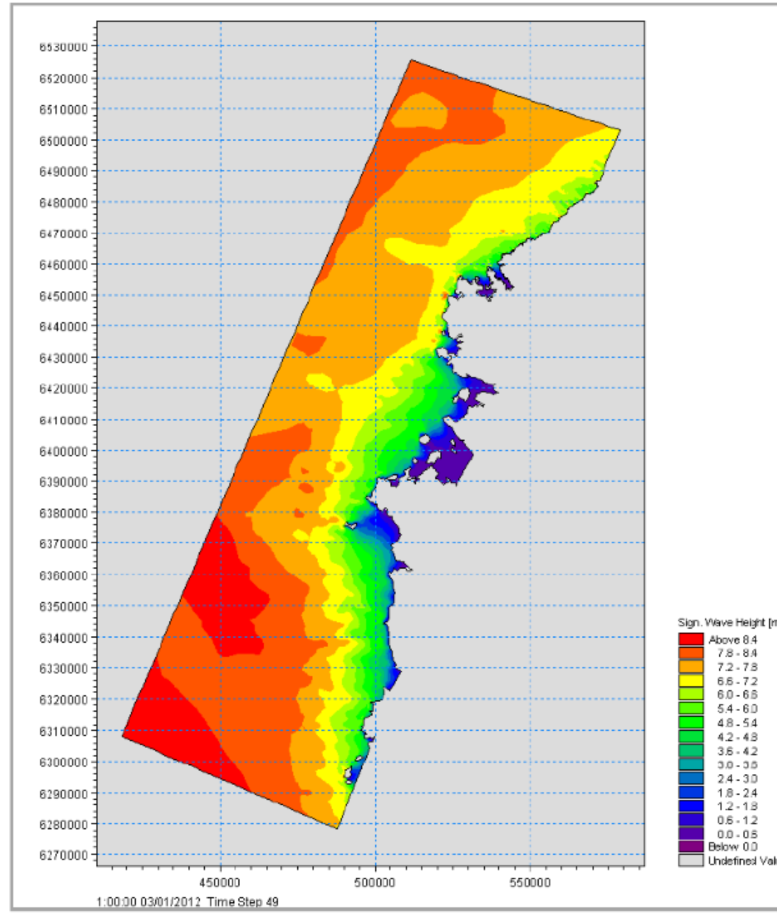
Wave power against Direction(M), 19/09-12/12/2012

Shallow water more focussed than intermediate depth



Hebridean Spectral Wave Model (DHI)





Model extent >200km covering entire west coast of the Outer Hebrides (Butt to Barra)

10 year hindcast model run in preparation

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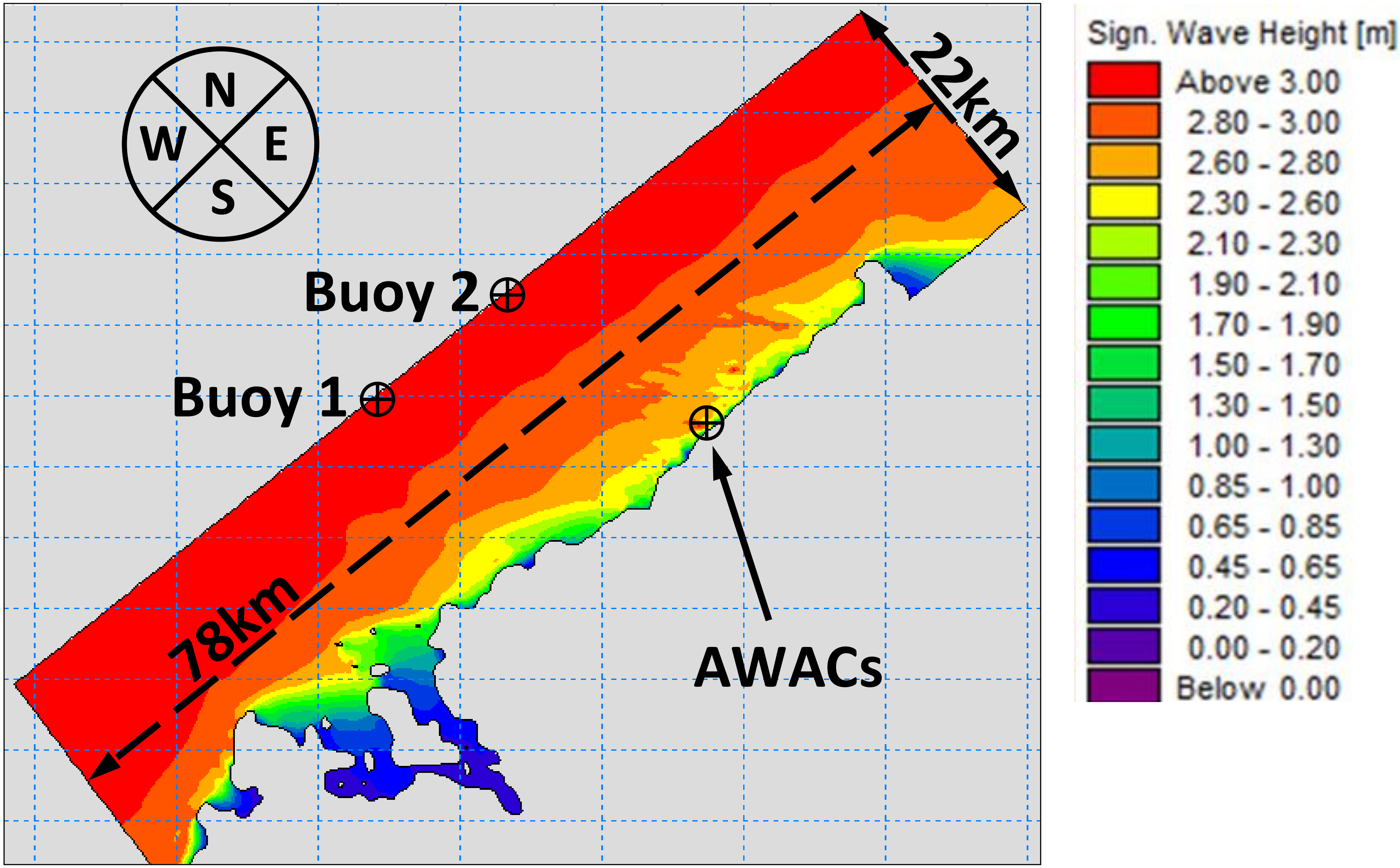
Isle of Lewis Spectral Wave Model



Distribution of the significant wave height across the domain at Hm0 = 3m, Tp =7s and Dirp = 270° at buoy boundary line.

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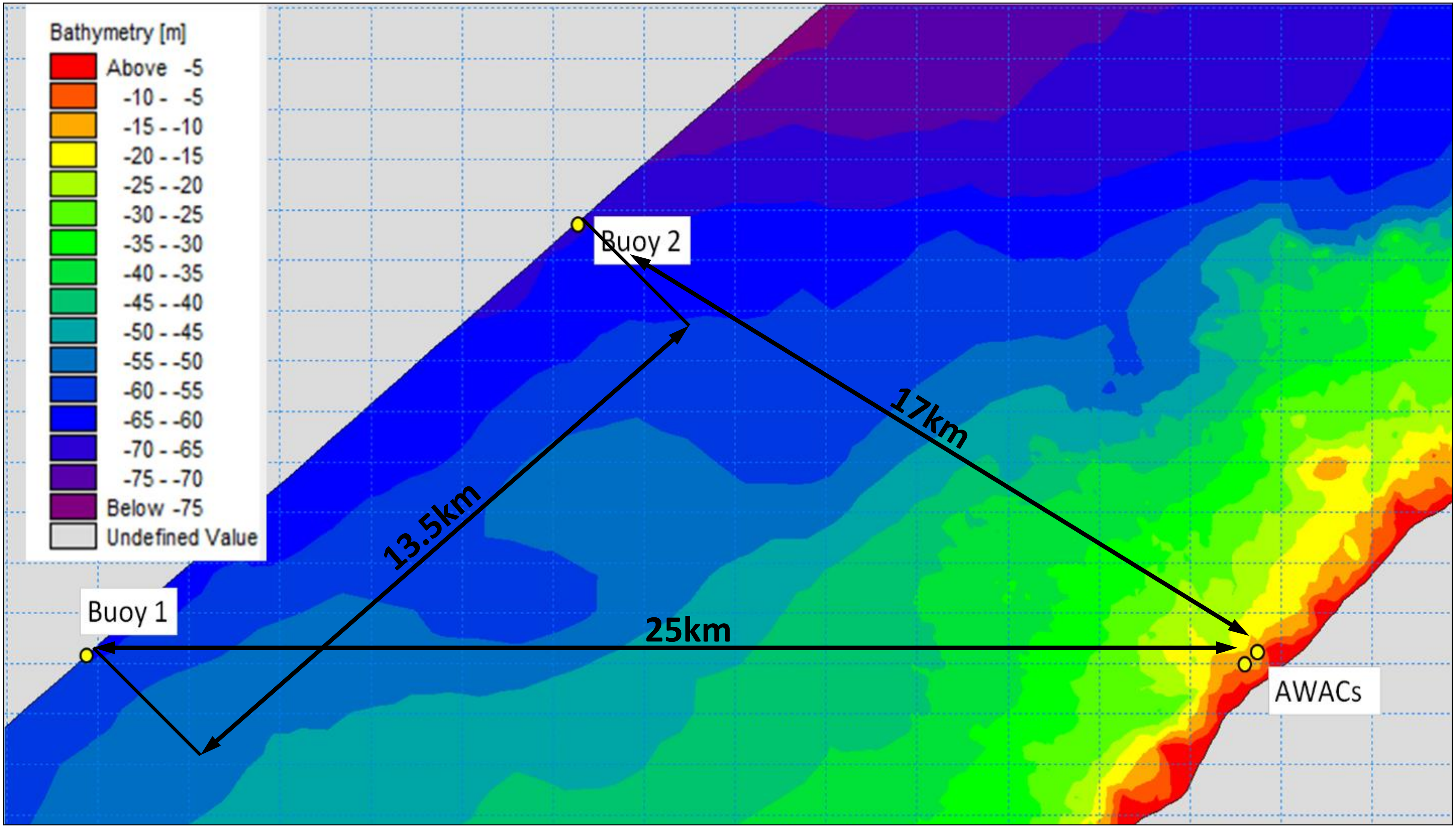
High resolution Model (DHI)

Use of small domain size to identify localised effects



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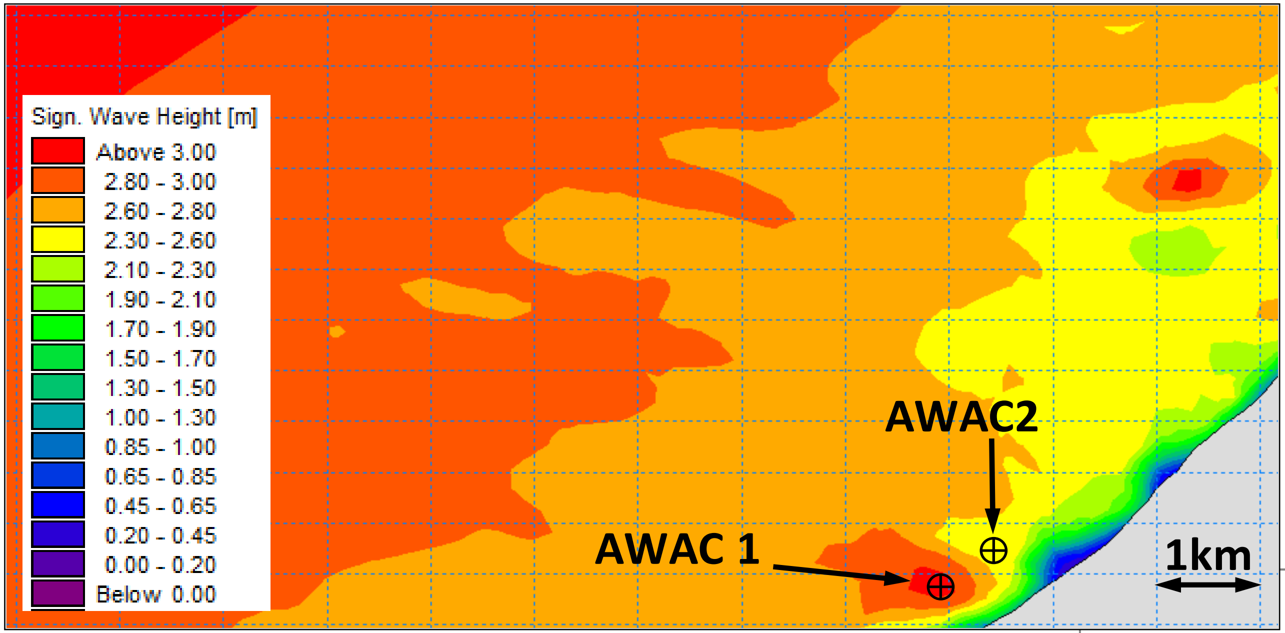
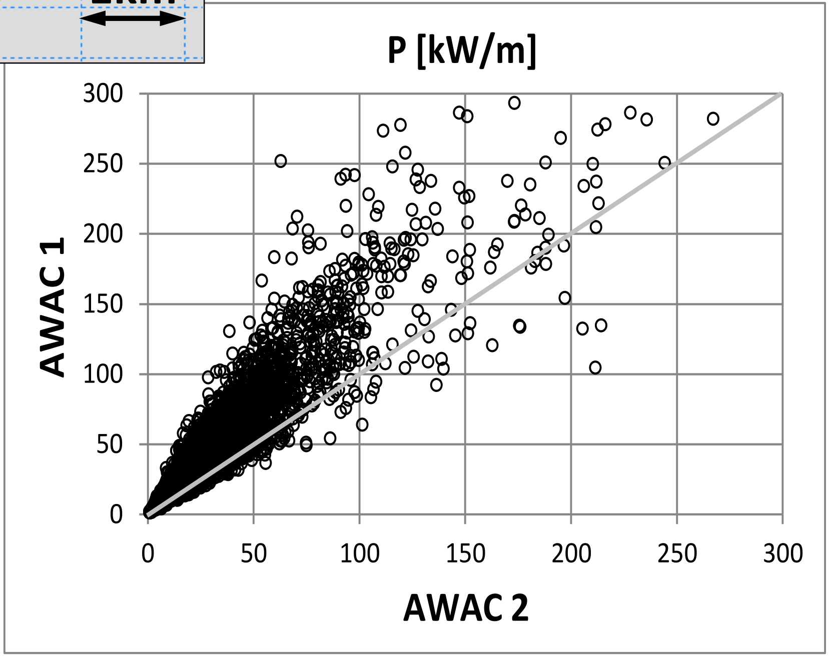
Energy 'Hotspot' detection



Mike 21 SW model at 200m mesh size. Close up of the AWAC location clearly confirms the energy hot spot 580m SW of AWAC2 at AWAC1. An additional hotspot is visible 3.5km to the NNE of the AWACs.



Confirmation of hot spot at AWAC 1 location compared against AWAC 2. Shown is wave power based on measured data in kW/m for an 8 month period Sept.2012 – June 2013.

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Model calibration and validation

Model calibration and validation based on individual spot sensors:

- Can we use X-band radar to obtain full spatial coverage of sea state parameters?
- Can we use X-band radar to obtain wave-by-wave data across the domain in real time?

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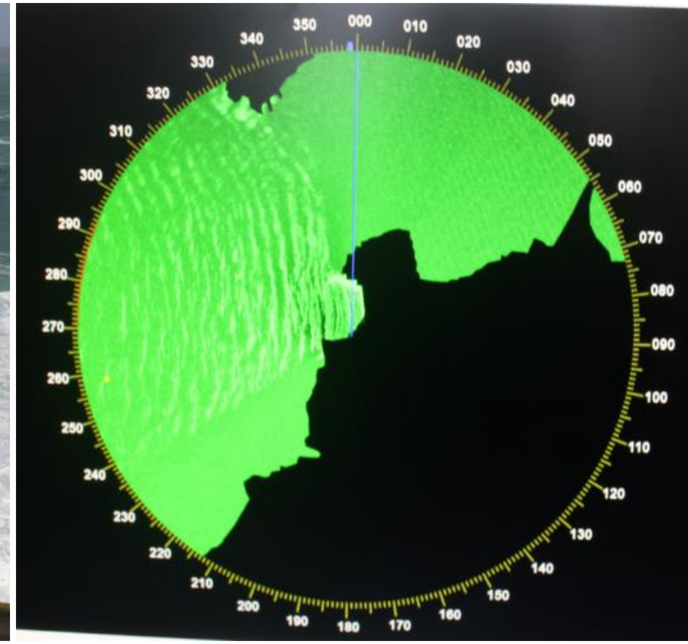
Getting started with X-Band Radar



- **Challenging file size of raw data: 1.36MBs^{-1}**
  → close to 1GB in 10 minutes or 118GB per day
- Analysis based on backscatter return of radar at 42.857RPM or 0.714rev/s.
- 360° observation area split into 4,096 sectors of 0.08789°
- Data returns only for 800 evenly distributed sectors per revolution (~1in5)
- Backscatter intensity based on Wave height and steepness

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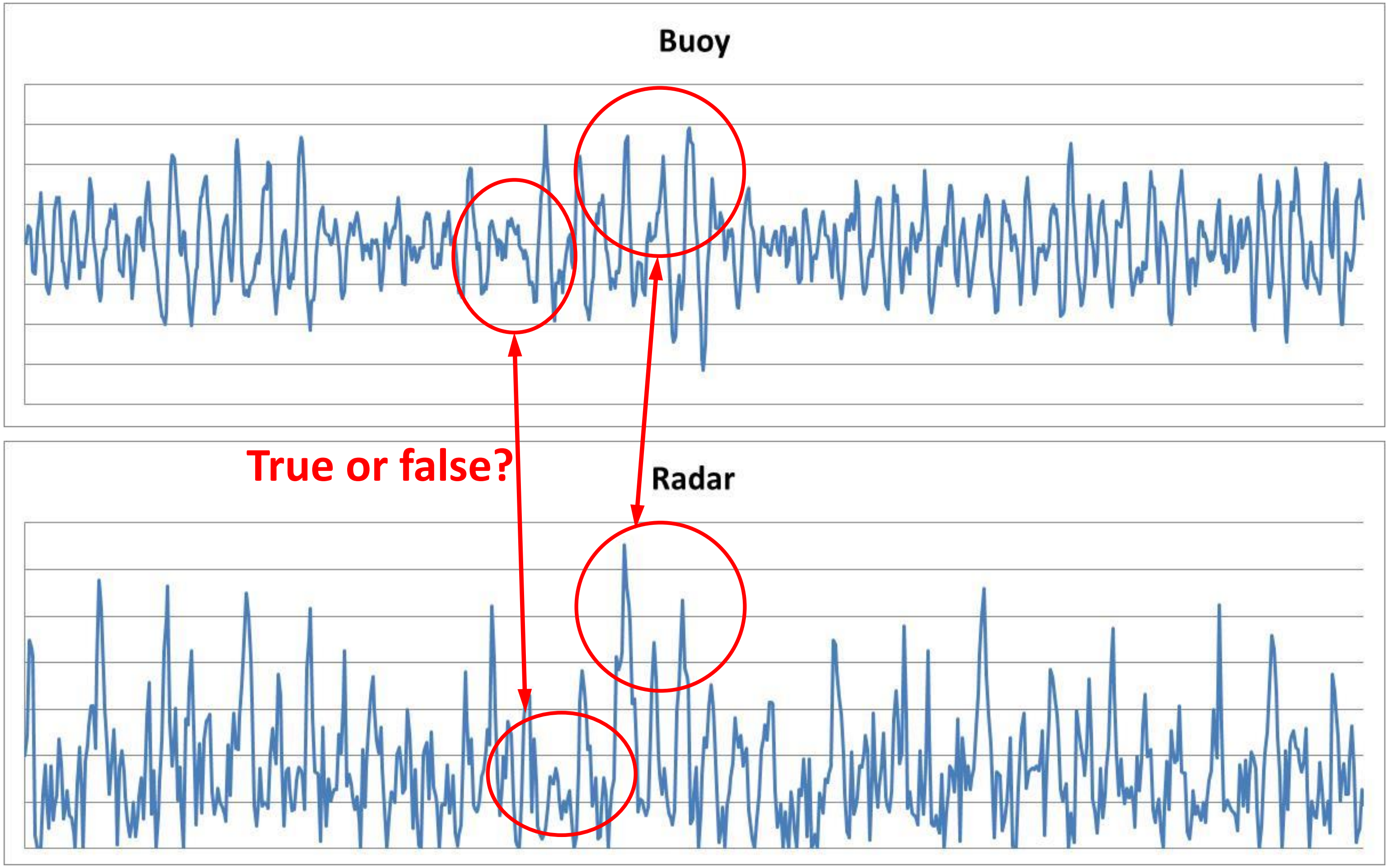
Getting started with X-Band Radar

Time series analysis of radar backscatter and wave buoy



Taransay deployment, 22/10/2015, 6km range, Hm0 = 4.5m

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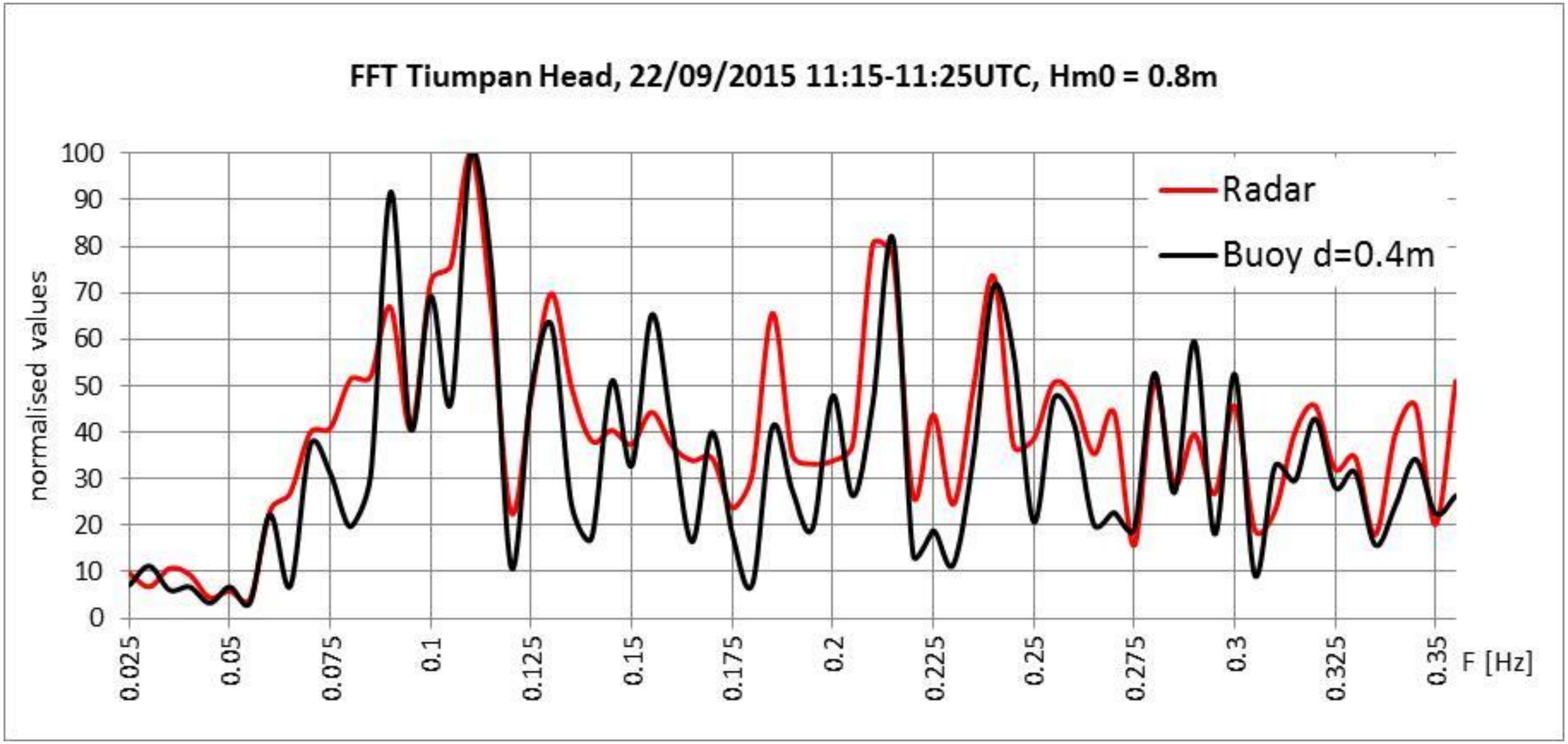
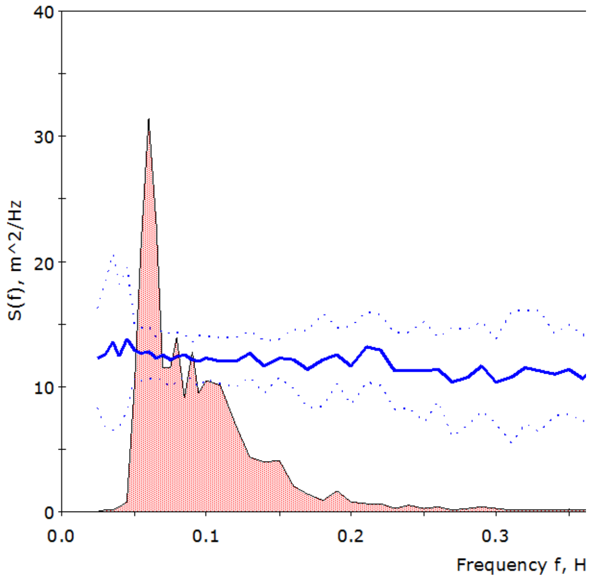
FFT Analysis: X-Band and Wavebuoy

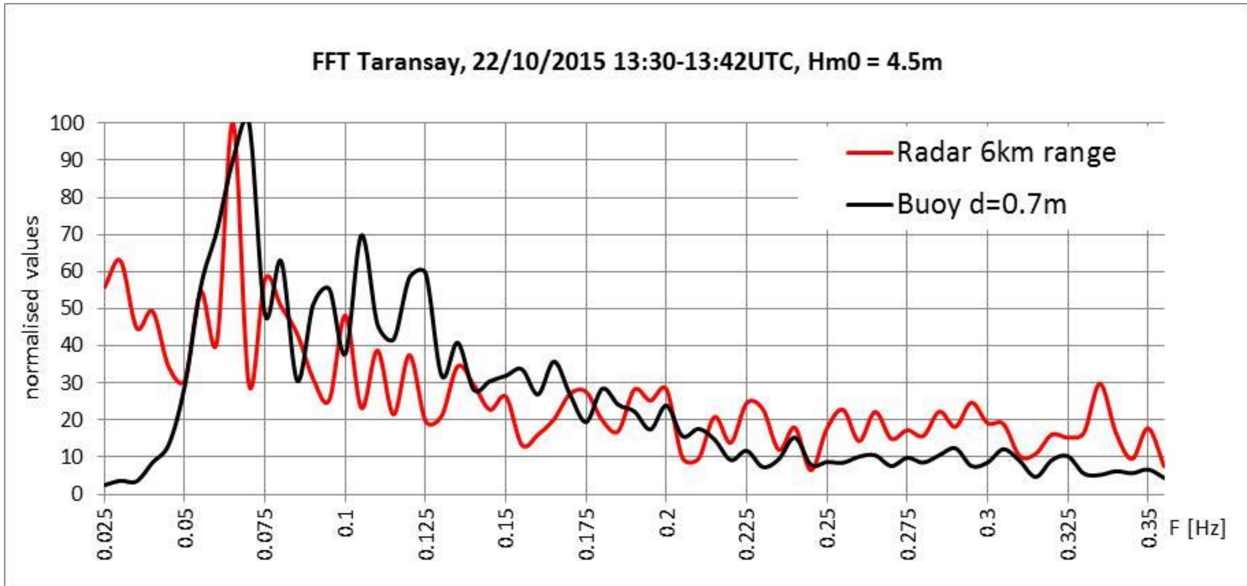
Initial Analysis based on time series comparison of radar backscatter and displacement of Waverider buoy

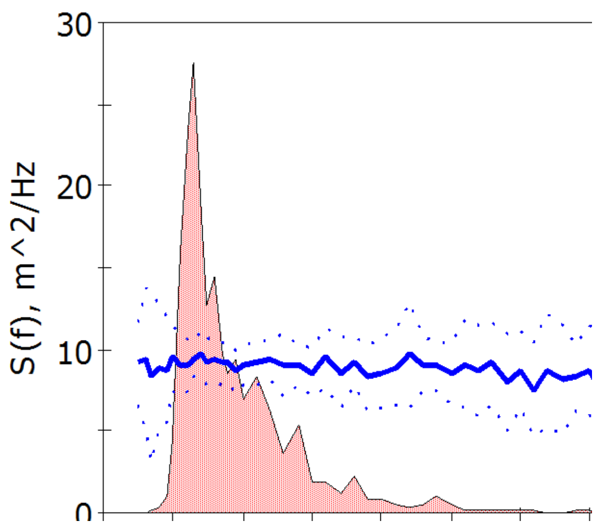


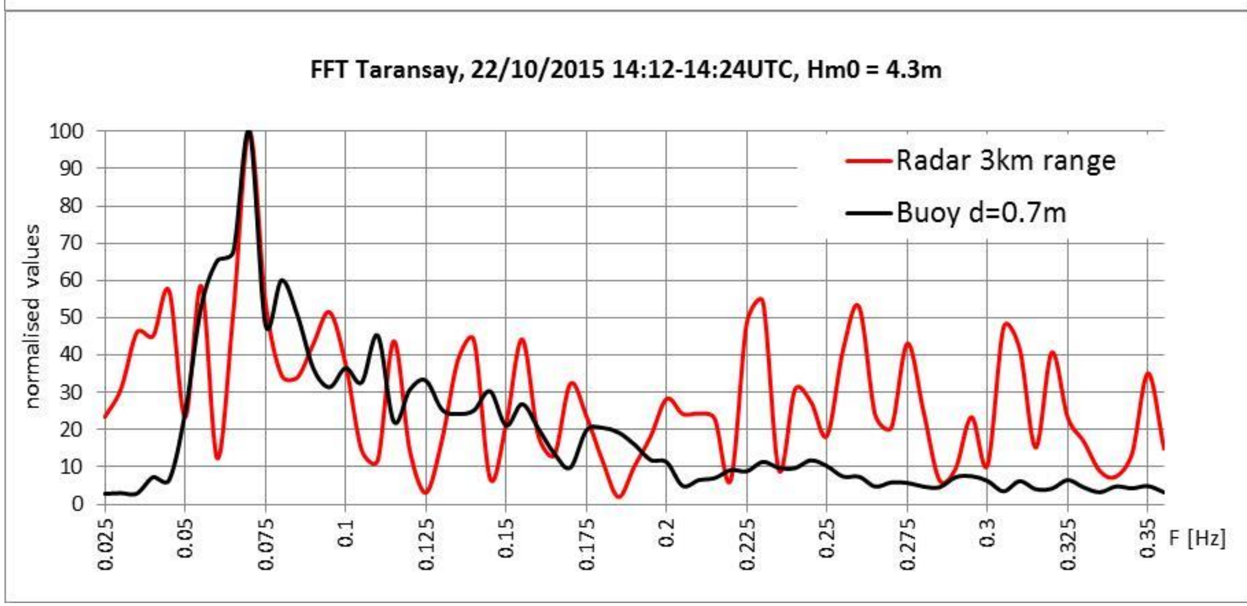
Next step: Fourier Transform to compare frequency spectra

FFT Analysis: X-Band and Wavebuoy









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Lews Castle College | Colaisde a' Chaisteil

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Thank you

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HIE Highlands and Islands Enterprise Iomairt na Gàidhealtachd 's nan Eilean

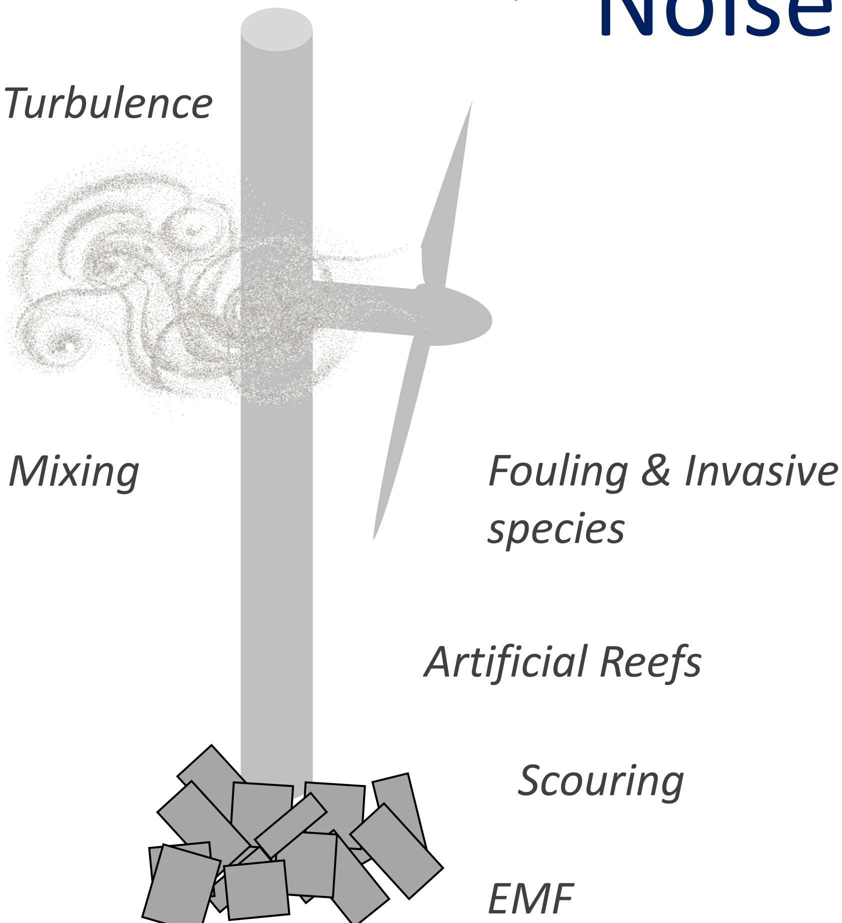
The MERIKA Project has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 315925

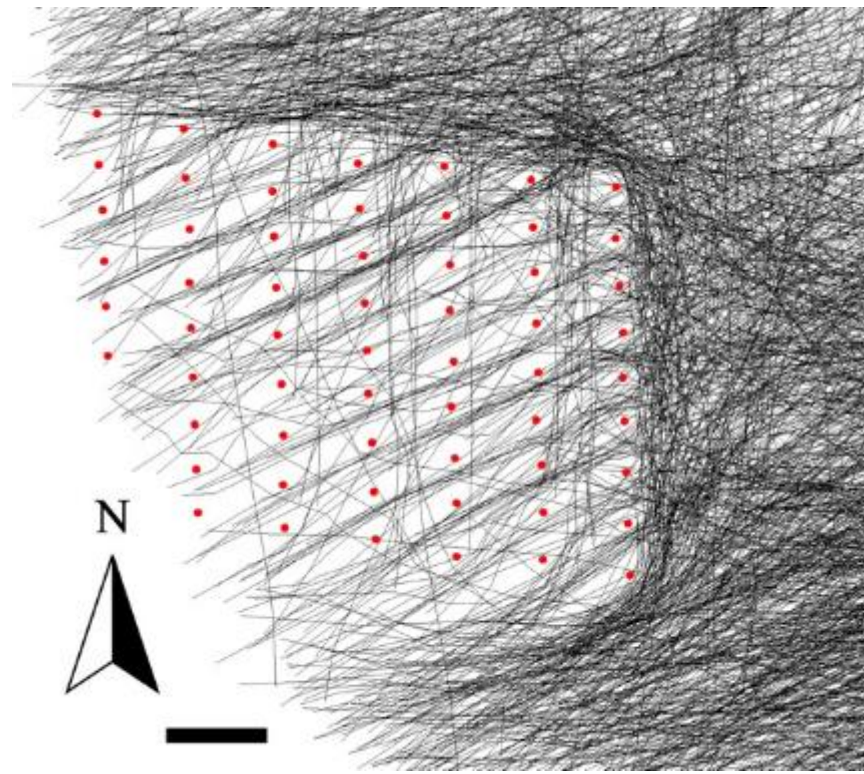
Ambient noise measurements in relation to marine renewables – what do we need to measure and why?

Denise Risch, Steven Benjamins, Paul Lepper, Jim Elliott, Ben Wilson, Brett Marmo

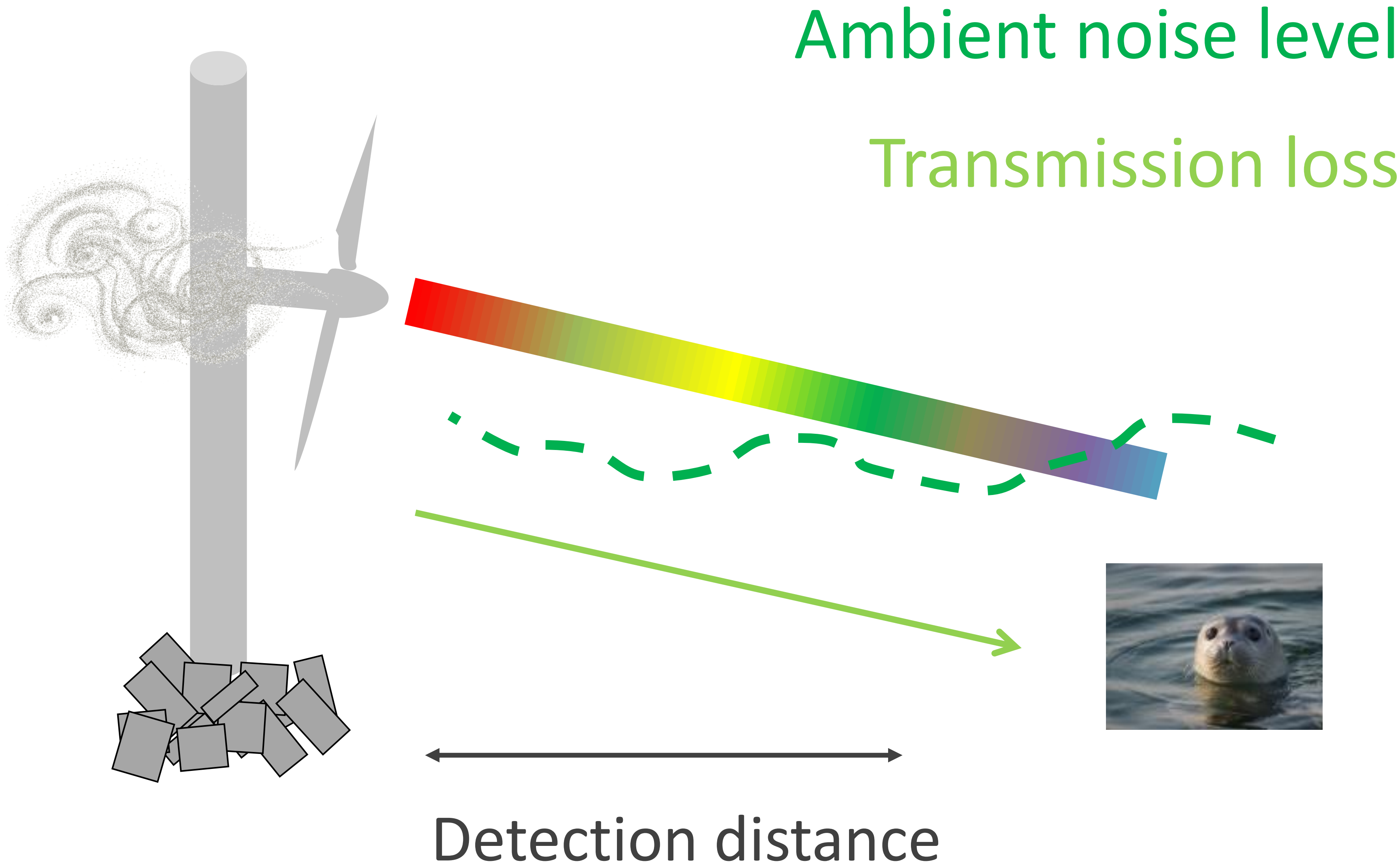
Collisions   Avoidance

Noise





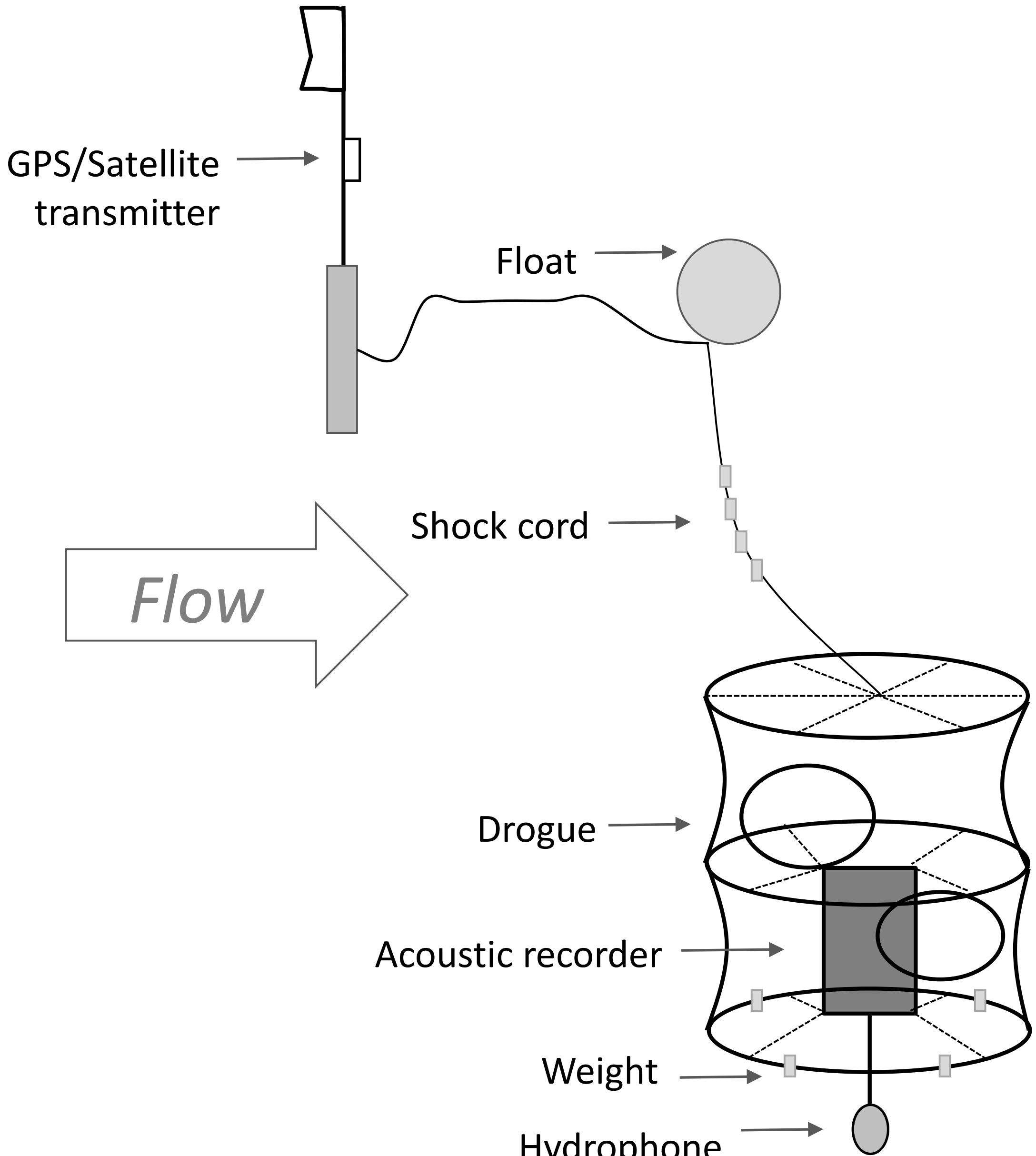
Desholm & Kahlert (2005) Avian collision risk at an offshore wind farm, *Biol. Lett.* 1, 296–298

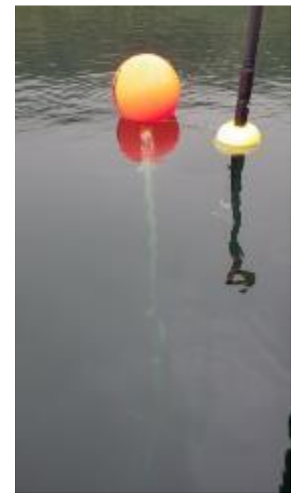

Ambient noise level
Transmission loss
Detection distance

KEY RESEARCH QUESTIONS

1. How loud are individual turbines under varying operational conditions?
2. How variable are ambient noise levels in tidal areas?
3. How far does turbine noise propagate and at what distances are turbines detectable for marine mammals?


HUMBER
SUZUKI
TRITONIA


GPS/Satellite transmitter
Float
Shock cord
Flow
Drogue
Acoustic recorder
Weight
Hydrophone



KEY RESEARCH QUESTIONS

1. How loud are individual turbines under varying operational conditions?
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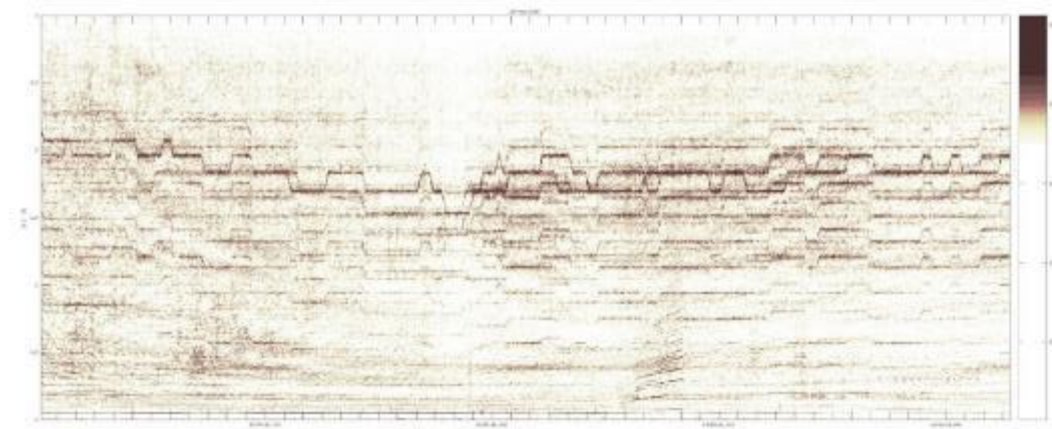
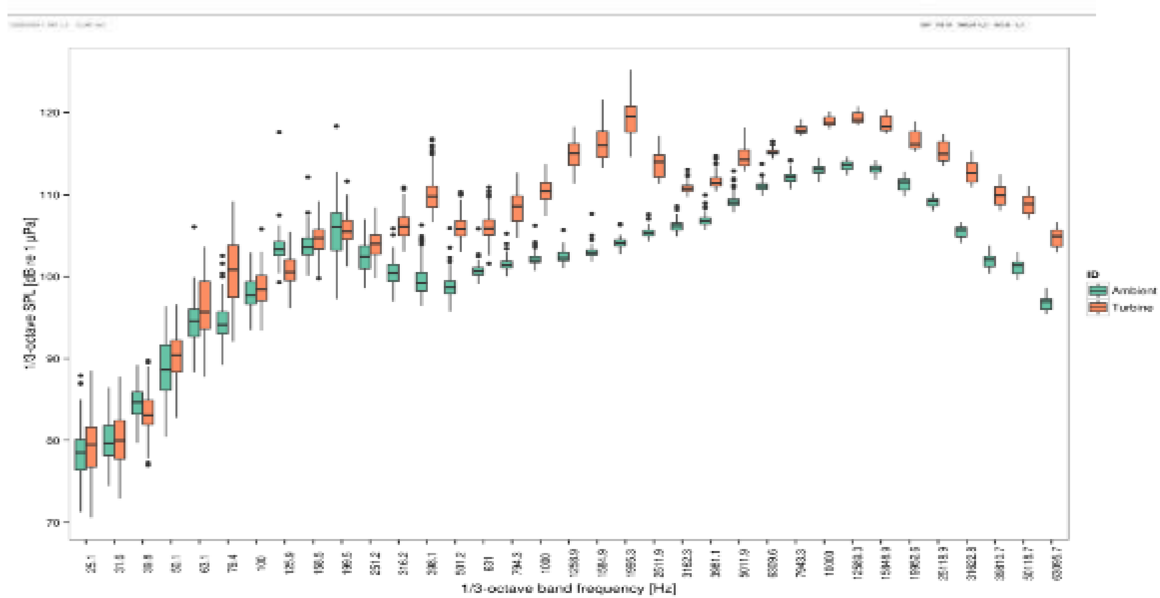
PLAT-O – Isle of Wight

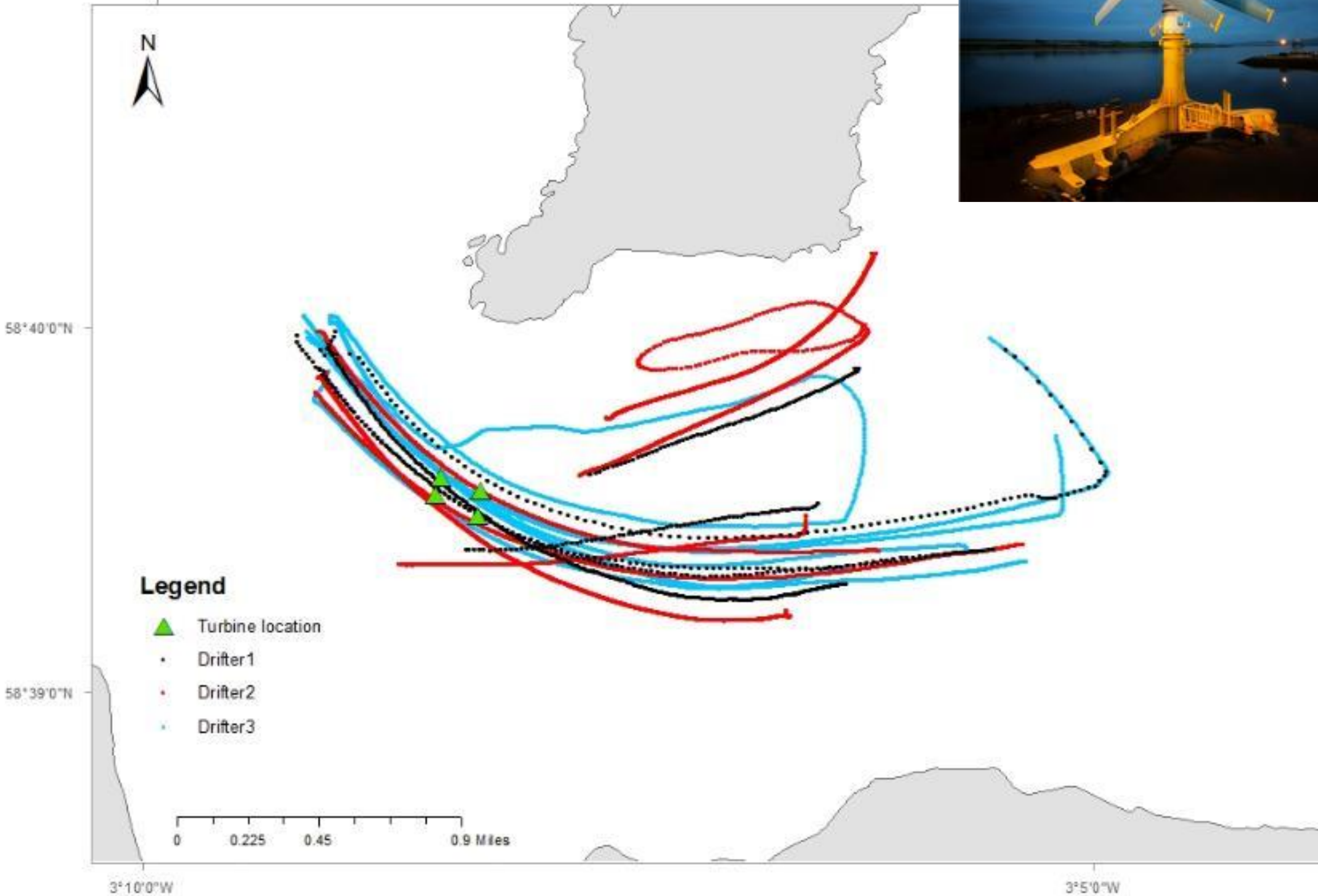


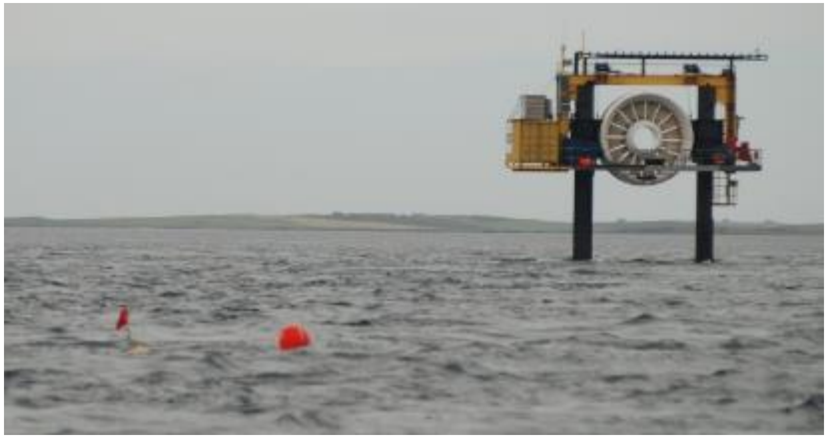


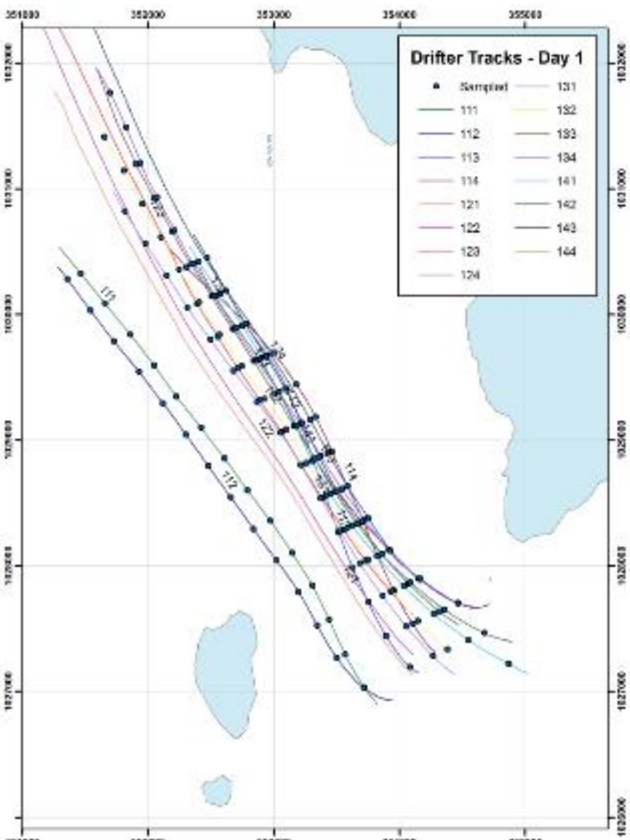
KEY RESEARCH QUESTIONS

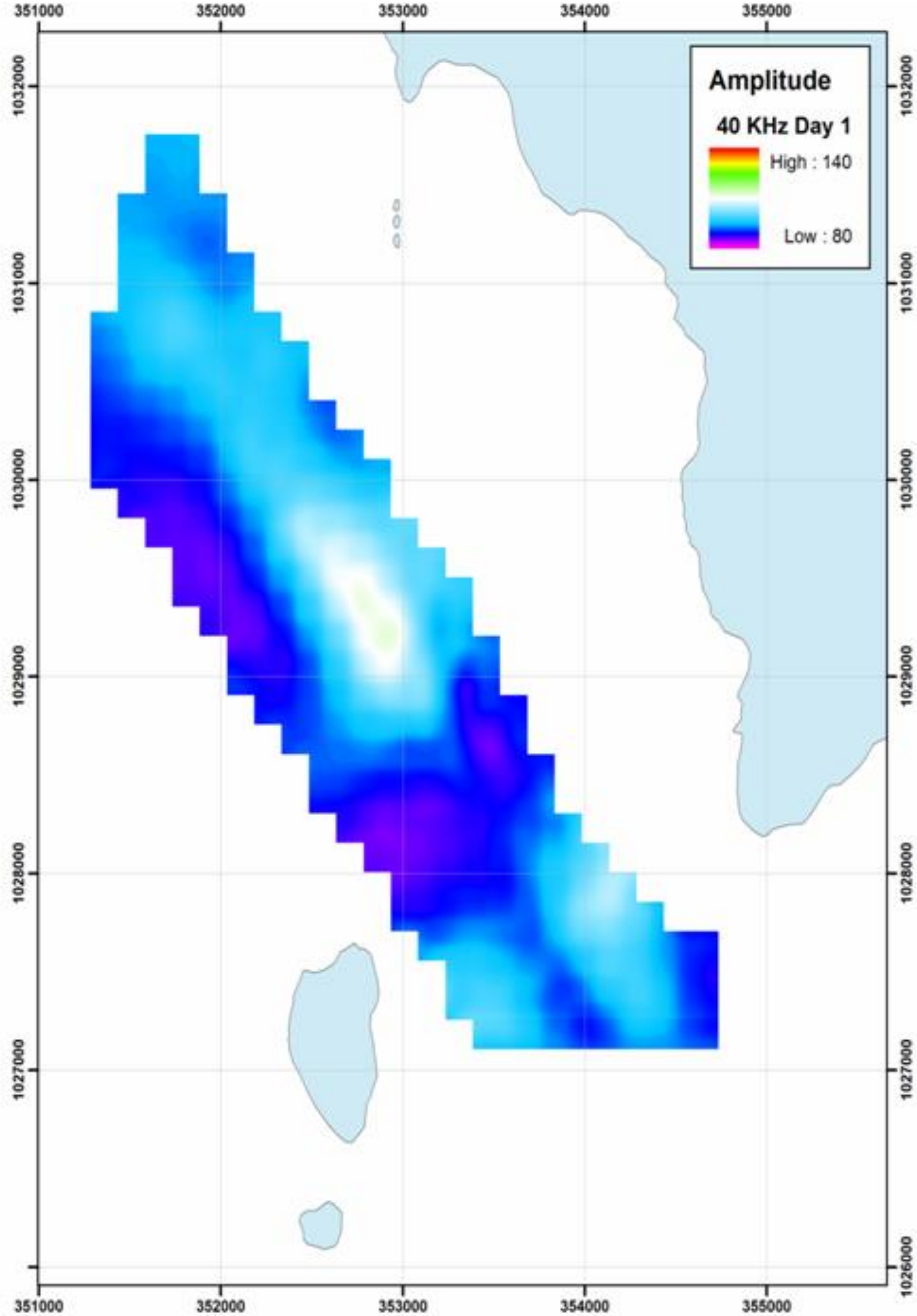
1. How loud are individual turbines under varying operational conditions?
2. **How variable are ambient noise levels in tidal areas?**
3. How far does turbine noise propagate and at what distances are turbines detectable for marine mammals?

MeyGen – Pentland Firth

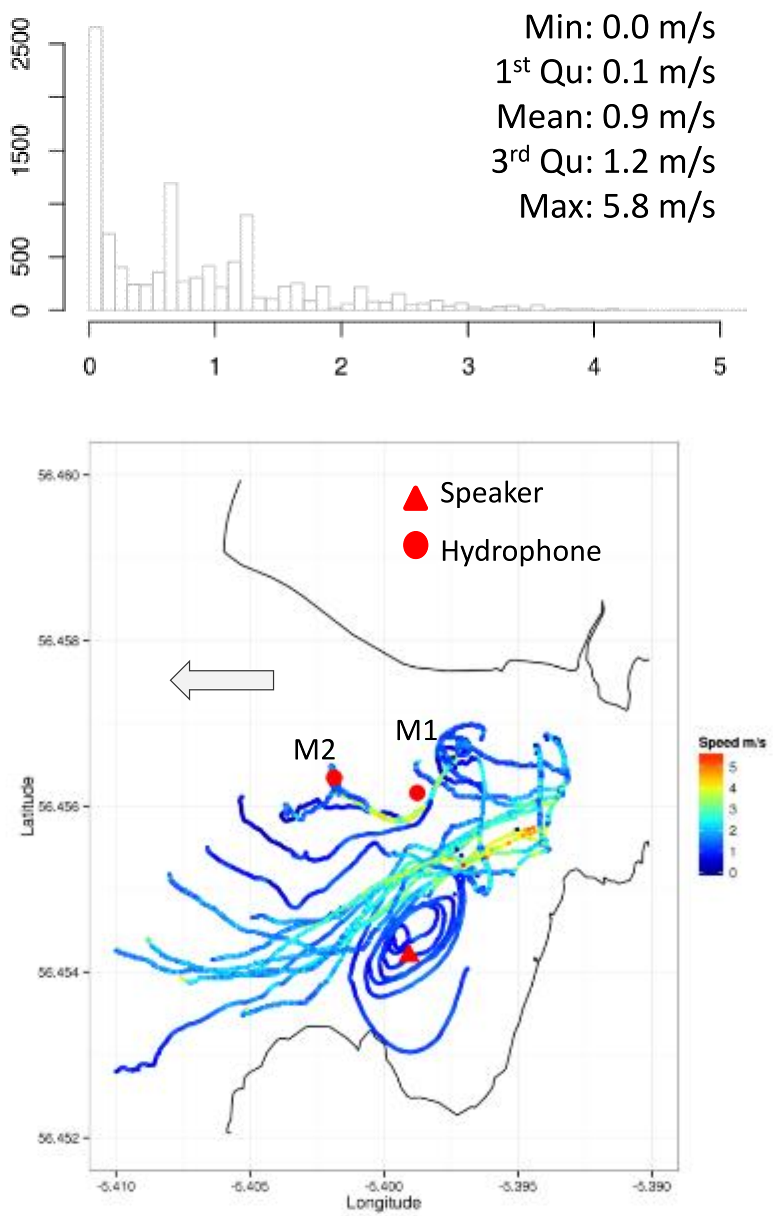




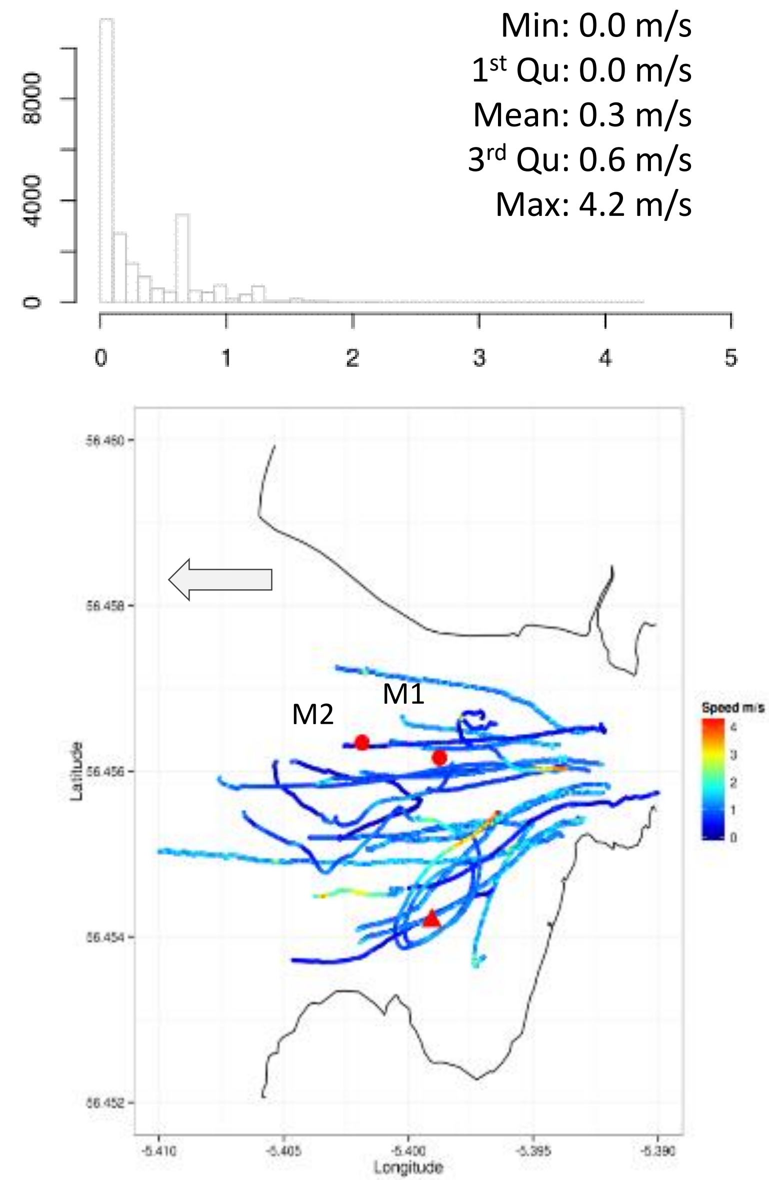

Drifter Tracks - Day 1
Sampled
111
112
113
114
121
122
123
124
131
132
133
134
141
142
143
144


Amplitude
40 KHz Day 1
High : 140
Low : 80
351000
352000
353000
354000
355000
1026000
1027000
1028000
1029000
1030000
1031000
1032000

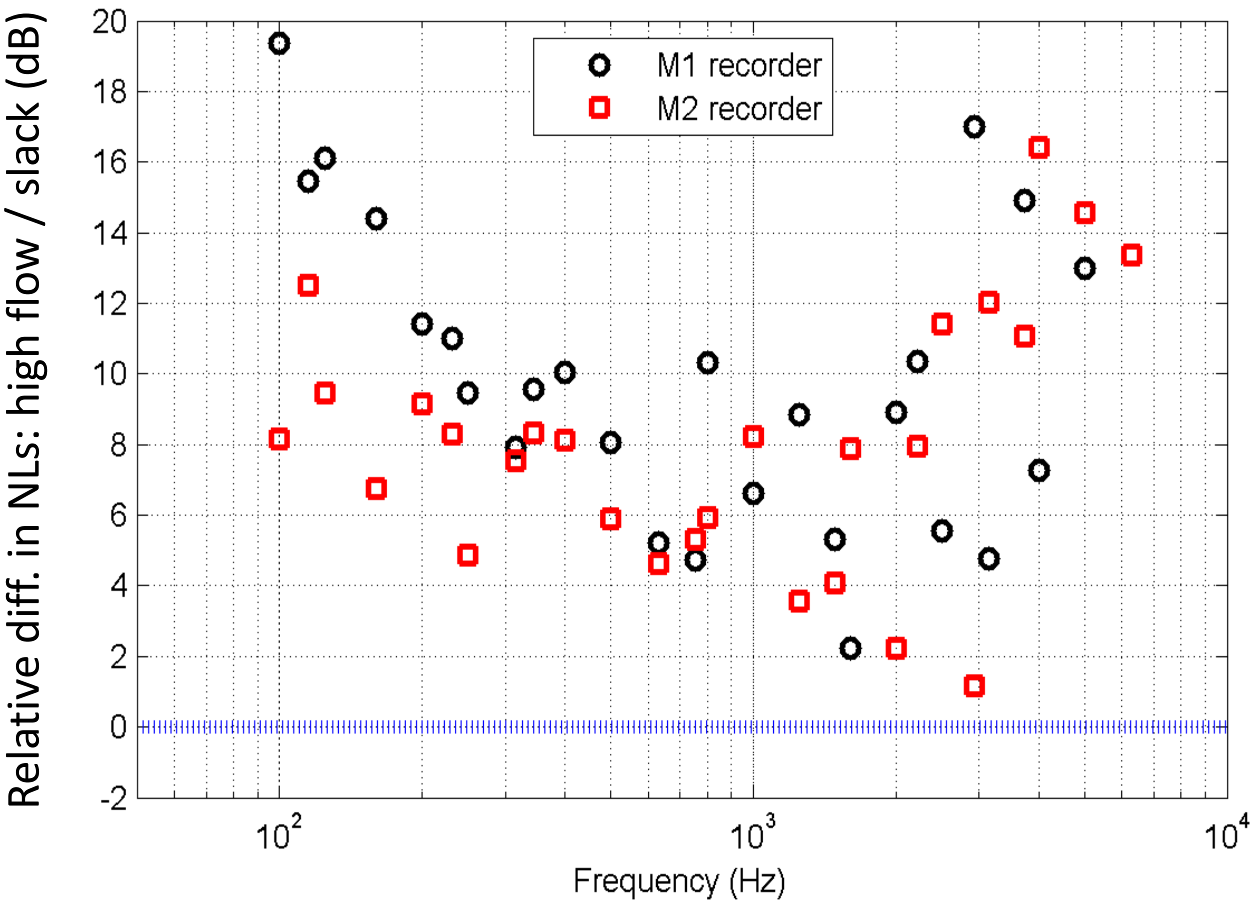
Spring ebb tide; High Flow

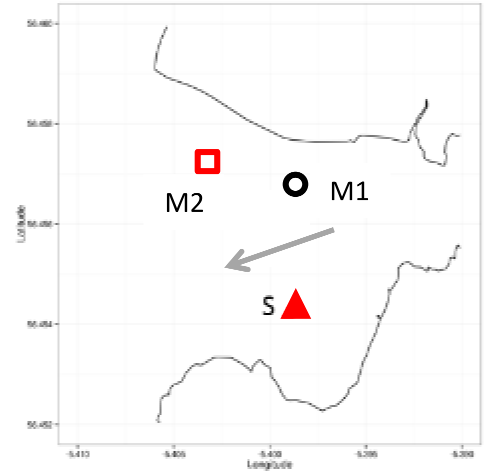


Neap slack tide; Low Flow

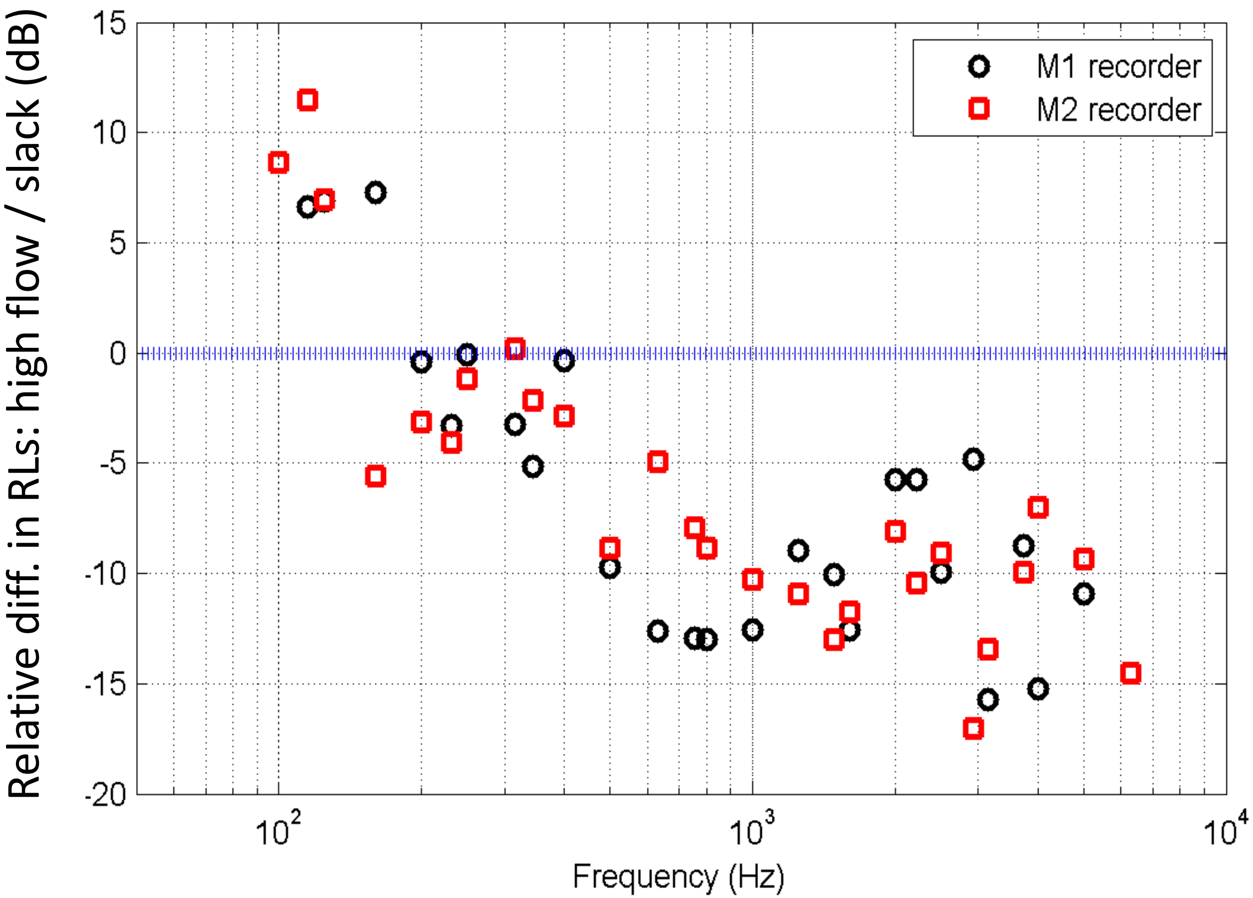


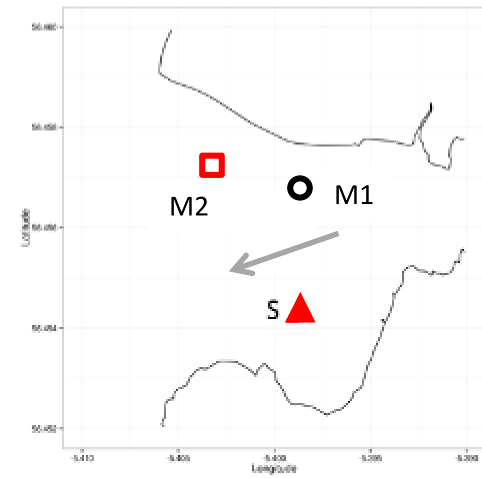
Higher ambient noise during high flow periods





Propagation varies by frequency





- Higher **ambient noise** levels during high flow periods
- **Propagation** shown to vary by 5-15 dB between high flow and slack periods
  - < 200 Hz: Lower received levels during slack flow
  - > 200 Hz: Lower received levels during high flow
- Significant variation in received signal due to **both** increased ambient noise and varying propagation
- **Variation** in propagation across tidal streams currently not accounted for in EIAs

KEY RESEARCH QUESTIONS

1. How loud are individual turbines under varying operational conditions?
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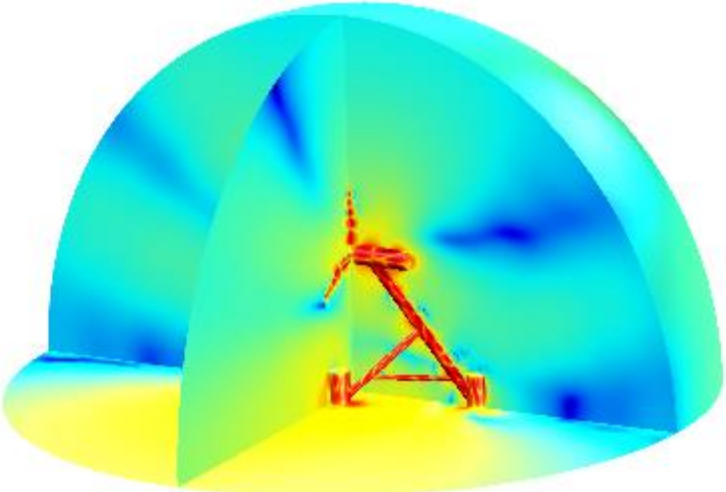
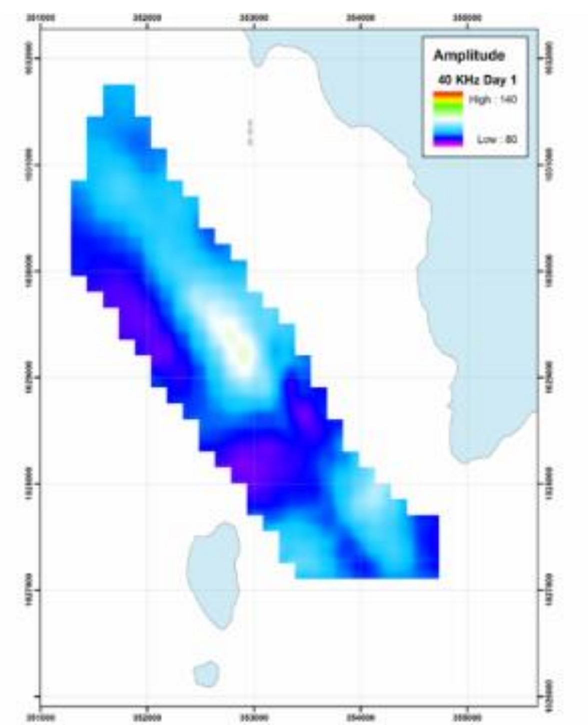
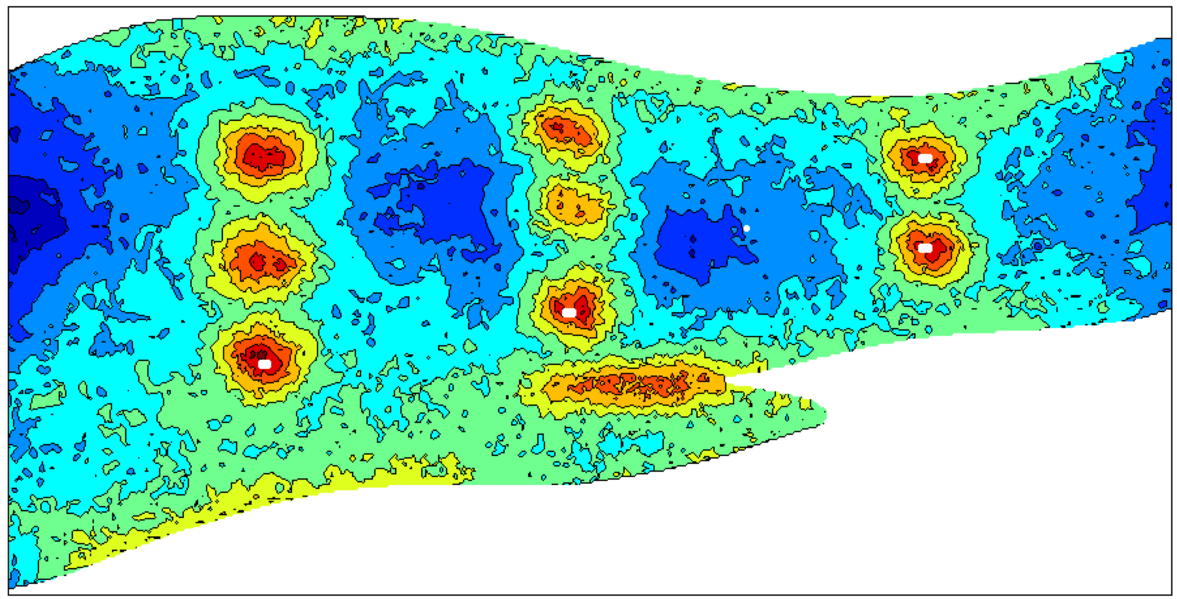
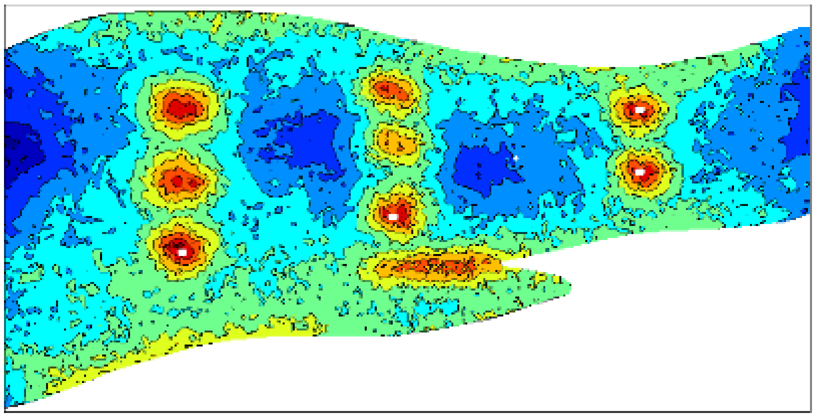
3. How far does turbine noise propagate and at what distances are turbines detectable for marine mammals?

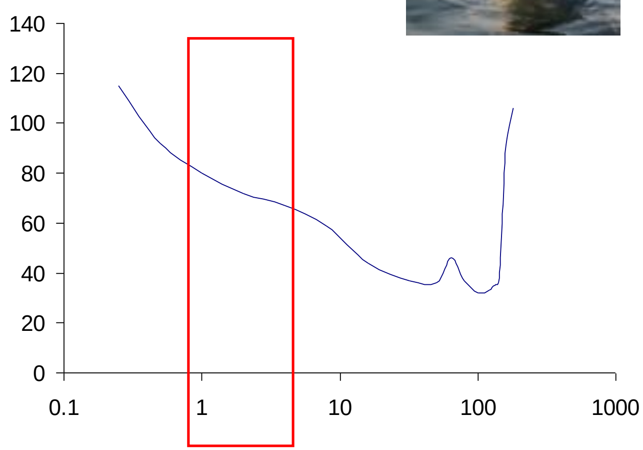




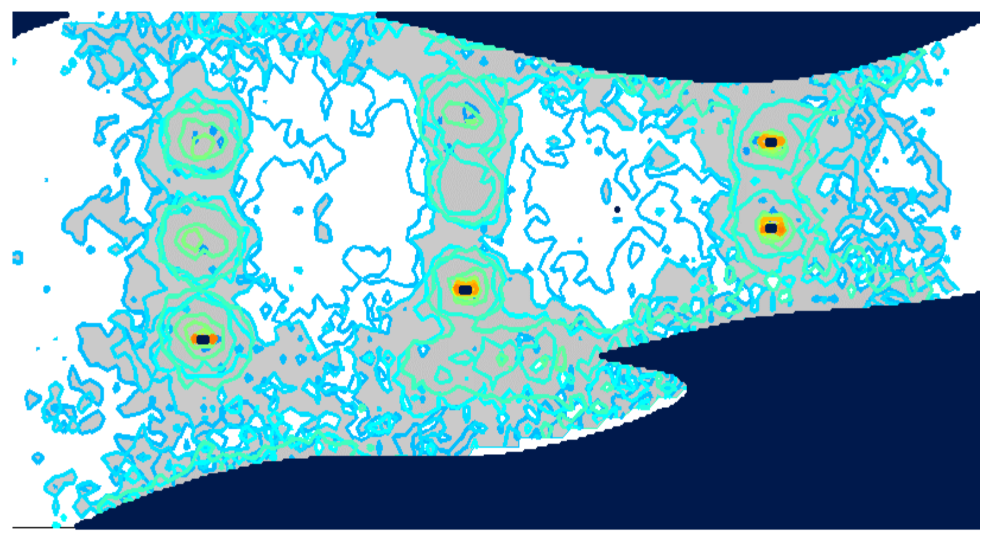
SPL at 250 Hz 20m below surface







Detection limit for Habour Seal 20m below surface



- **“Noise”** is not just about hearing damage
- **Perception** important for collision avoidance
- **Ambient noise** is very **variabl**e and is dependent on tidal state as well as frequencies
- Noisy machines are good(ish)?
- If perception distances too large, **barrier effects** possible (large arrays!)?
- Better **integration** of noise measurements and marine mammal data necessary for **EIAs?**

Acknowledgements

- John Hartley
- Stuart Anderson
- Ed Rollings (MeyGen)
- UK Department of Energy and Climate Change (DECC)
- Phil Gillibrand, Jason McIlvenny (ERI)
- Sustainable Marine Energy Ltd
- Caroline Carter

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SAMS

Society & the Sea

SAMS MERIKA SOCIAL SCIENCE TEAM ACTIVITIES 2014-2015

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OUTLINE

- **SAMS MERIKA Themes**
  - Environmental impacts & ambient noise
  - Communities
  - Ecosystem services
  - Marine policy & spatial planning
  - Evaluating energy policies


- **Mobility highlights**


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Communities

Grant applications on cultural values

- Northern Periphery and Arctic programme preparatory grant, with Orkney College, University of Nordland, QUB, UCC on mapping cultural values of the coast, securing them amidst development, and harnessing them as an asset for development. To be submitted 2016

- Building on NPA work, second grant application in development on developing a framework for risk assessment to cultural heritage for H2020 2017 call, with HZG.

Communities

Paper: 'Wind & Opposition: Patterns, Spill-overs and Drivers across three European jurisdictional frameworks.'

1. Research paper investigating the spatial patterns of onshore wind power planning refusals.
2. Aim: to identify crowd-out effects due to on-shore wind farms failed bids, and to understand what the offshore industry could do differently for mitigating similar spatial-economic patterns.
3. Developed in partnership with NUI Galway and TU Darmstadt using state-of-the-art national databases.
4. First paper combining both diffusion of innovations schools of thought in Europe.
5. Paper to be submitted by June 2016 (Target Journal: TBD with partners).

Communities

Other outputs

- Book chapter on Marine and Coastal Stewardship (in parallel with concept of Landscape Stewardship)

Ecosystem services

NERC CORPORATES KE project

- "Cooperative participatory assessment of the impact of renewable technology on ecosystem services"
- Collaboration with Univ Aberdeen, Marine Scotland Science, James Hutton Institute & Seagreen, Mainstream & Repsol
- Developing a participatory decision support tool to integrate ES knowledge into marine planning around MREs

Ecosystem Services

Subjective well-being values

- Understanding the value of cultural ecosystem services in non-monetary terms using psychometric approaches (e.g. ‘therapeutic’, ‘social bonding’, ‘spiritual’, ‘place identity’ values)
- Developing a standardised instrument
- Potential for integration with monetary valuation (e.g. hedonic methods, choice experiments)
- MSc and honours projects over past year; ¾ PhD funding committed by Marine Conservation Society – looking for match funds

Ecosystem services

Outputs

- Chapters in Routledge Handbooks of Ecosystem Services & Handbook of Ecological Economics on deliberative monetary & non-monetary valuation
- 5 lead author & 6 co-author papers in special issue of ecosystem services on 'shared, plural and cultural values', to be published August 2016.

Grant applications

- ESRC Centre for Complexity Evaluation
- Valuing Nature Programme on ES impacts of marine pathogens & toxins
- Two ESRC bids in prep (follow on from VNP bid & bid on deliberative ES valuation)

Policy and planning

Marine Renewable Energy in Seychelles and SIDS

- Report for the Commonwealth Secretariat into the feasibility of a marine renewable energy in the Seychelles
- Extension of project to include general report for the development of MRE in Small Island Developing States
- Possible further work as part of a road-map to the Blue Economy in SIDS.

The Commonwealth

Policy and planning

MASTS Marine Planning and Governance Forum

- On-going running of activities of the MASTS MP&G Forum
- Small Grant round awarding £3k to MSP-related projects
- Workshop at the MASTS Annual Science conference (Oct)
- Developing larger workshop focussed on MSP June 2016 jointly with SCOT LINK, and involving MERIKA partners

Marine Alliance for Science and Technology for Scotland
a marine partnership for Scotland

http://www.masts.ac.uk/research/research-forums/marine-planning-forum/

Policy and planning

Strategic Engagement

- Ocean Energy Forum Steering Group – developed draft Road Map with the consenting / environmental steering group

- On-going work through the World Ocean Council MSP Working Group, session chair and presentation on Marine Spatial Planning at the World Ocean Council (WOC) Sustainable Ocean Summit, Singapore, Nov 2015

Policy and planning

Outputs

- Book chapter Governance Challenges in Marine Spatial Planning
- Joint papers in prep with partners
    - MSP and the Ecosystem Approach, EBM, ICZM – a conceptual comparison
    - MSP and EIA

Grant applications

- NERC Knowledge Exchange grant application on co-location of renewables and aquaculture
- Grant application to the Norwegian Research Council with MERIKA partner University of Nordland on governance of ocean acidification

Evaluating energy policies

Paper: '*Diffused Inclusive Community Entrepreneurial Paradigm*'

- New paradigm for the Scottish Highland and Island region (HIR) and replicable in other remote, resource-rich regions.
- Aim: to link transition towards low-carbon, MREs economy with localized uses of energy for industrial and commercial ventures.
- Policy analysis and previous works suggest tools exist to initiate this paradigm with current level of resources at devolved level.
- Paper to be submitted by the end of 2015 (Target Journal: Energy Policy), presented at the RSAI 2014 Winter Conference.

Evaluating energy policies

Other outputs

- Paper on bottom-up vs top-down energy planning (to be submitted end 2015, target journal: Energy Policy).

Grant applications

- Carnegie & RSAI grant applications on integrating policy analysis, participatory scenario analysis, and CGE modelling for enabling an equitable and sustainable transition to MREs in the Scottish Western Isles
- Modelling the economic impact of off-shore wind energy in the UK, through the pathway of on-shore wind power industry.

Mobility highlights

- Logistical & financial issues leading to cancellation of some planned exchanges in 2014-15; plans adjusted and 'new' partner added (NUI-Galway) to meet targets
- Two outbound exchanges in 2014-15 exploring community themes common to Northern Norway and Scotland
- 1-week workshop with reps from IMARES, NUI-Galway, Nordland, HZG, ORCA & SAMS developing paper and grant application outlines, laying ground for future work.
- 3 exchanges planned with NUIG to develop proposal on addressing social barriers to MRE (incl offshore wind) roll-out.
- MRE / aquaculture co-location workshop planned at SAMS forJune 2016.

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THANKS FOR LISTENING!

www.sams.ac.uk/lmc

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