Designing an Ocean Mid-trophic Automatic Acoustic Sampler (MAAS) –

thoughts on how to include echo sounder observatories in ecosystem models

Nils Olav Handegard, Olav Rune Godø, Rudy Kloser, Patrick Lehodey, and Olivier Maury

Introduction

- Ecosystem based Approach to Fisheries management
- Different modeling approaches:
  - Coupled population-, biogeochemical- and ocean-circulation models
  - Lack of data for the mid trophic link
- Potential observations
  - Acoustics
  - Observatories, vessels of opportunities

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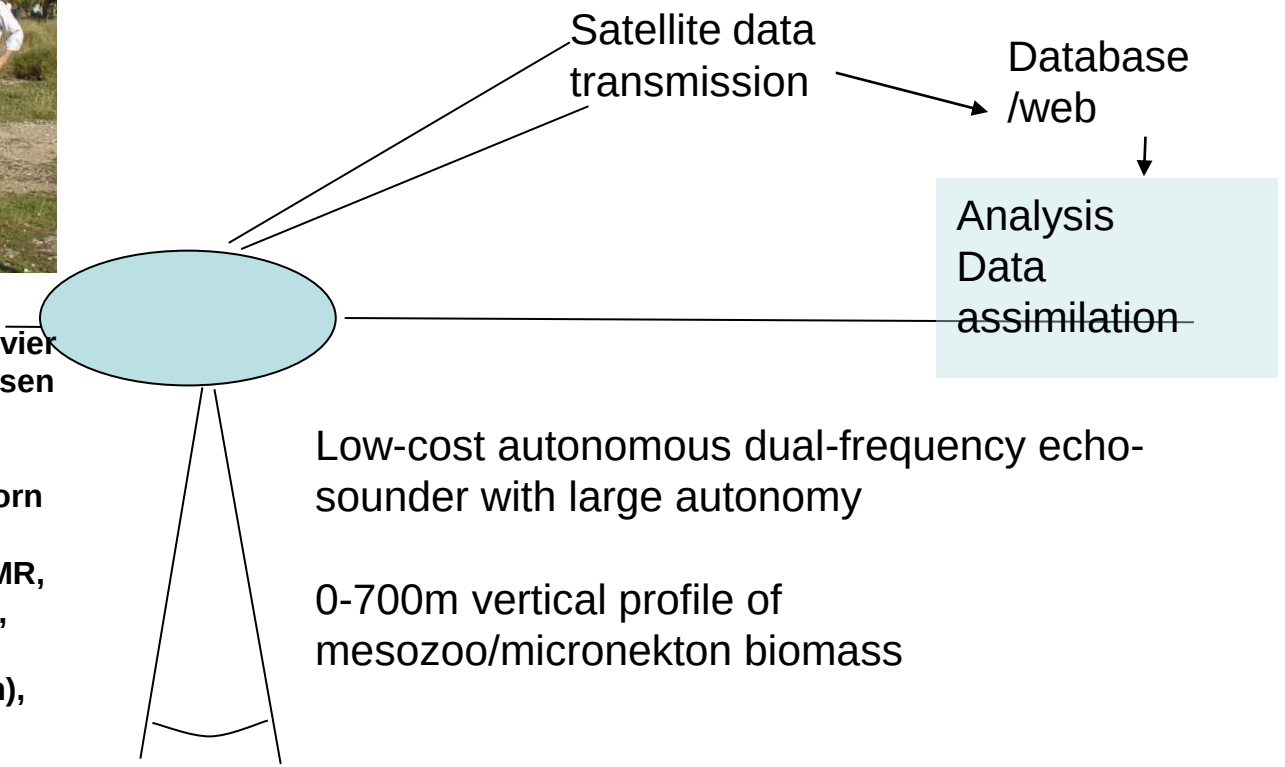


Low-cost autonomous dual-frequency echo-sounder with large autonomy

0-700m vertical profile of mesozoo/micronekton biomass

Progress since last update

- ICES CM paper
  - Important link to the established fisheries acoustics community
- OceanObs09' Community Paper
- OceanObs09' Plenary paper
  - Important for further progress in observatories for the open ocean
- Tech note on how to include acoustics in ARGO drifters

APECOSM

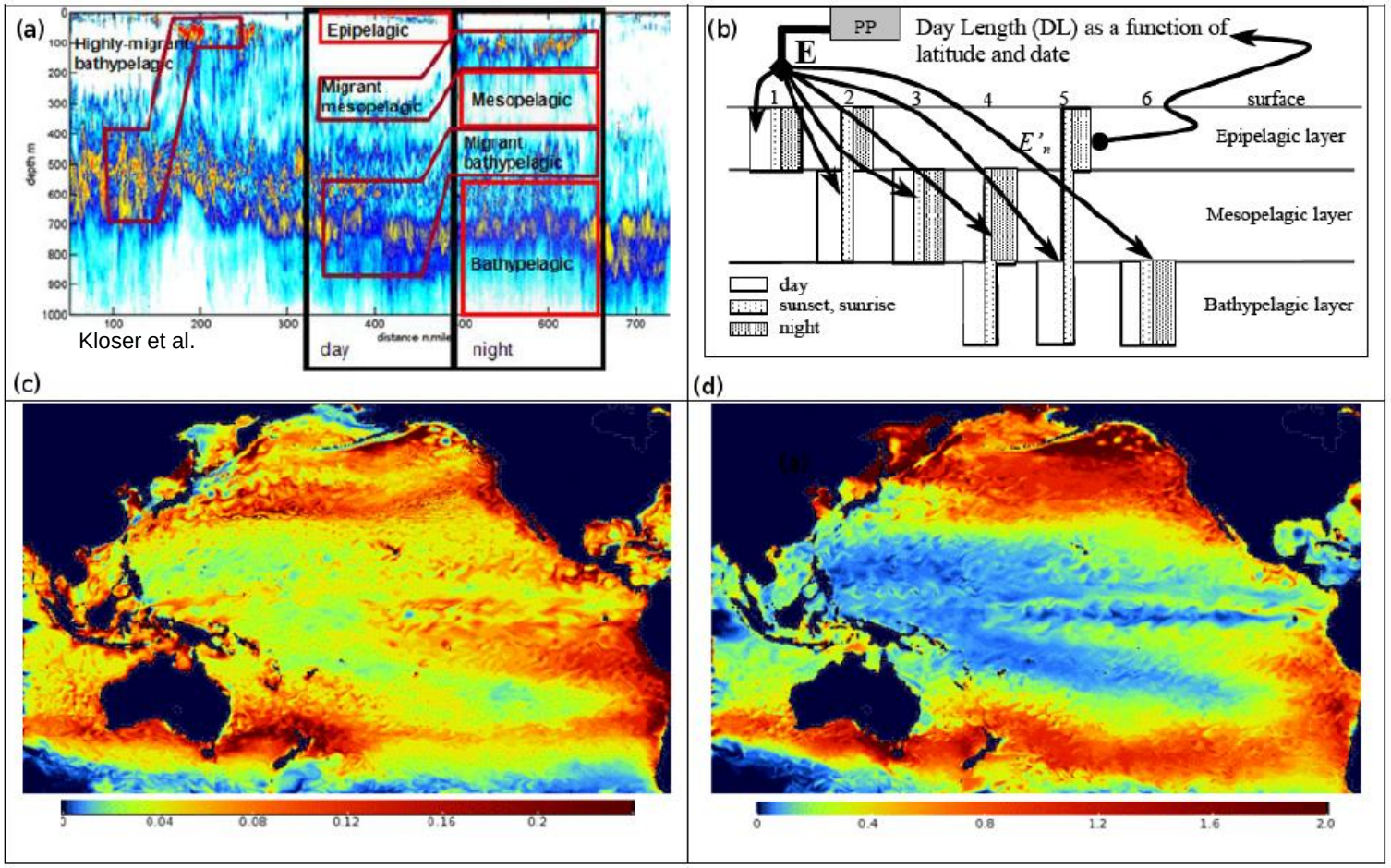
- Basin Scale Spatial model
- Dynamic energy budget theory (Kooijman)
- Size dependent predation
- Pelagic community is divided into mesopelagic and epipelagic groups
- Focus species are represented in more detail (Tuna)

Maury et al. (2007)

SEAPODYM

- Spatial age-structured population model
  - Advection-diffusion-reaction model
- Mid trophic level (MTL) submodel
  - 6 mid trophic functional groups
  - Models the total energy transfer to the MTL
  - Models the relative energy distribution between the functional groups
- Applied to Tuna in the Pacific

SEAPODYM



Production of the epi-pelagic group

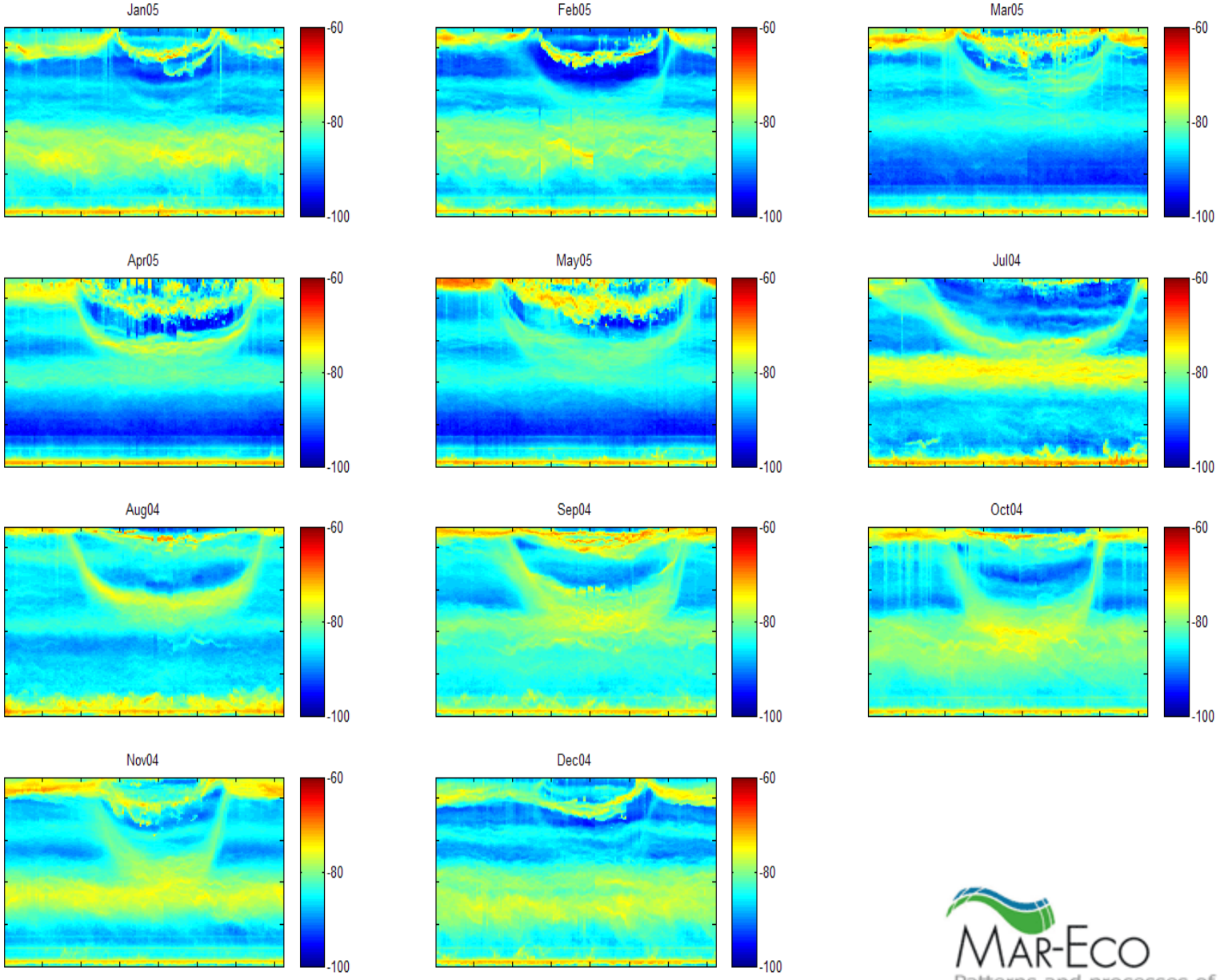
Biomass of the epi-pelagic group

MarEco lander

- Collected data over one year
- Looking upwards from 910 m
- Resolution 20 cm and 4 seconds
- Acoustic releaser

MAR-ECO
Patterns and processes of the eco-systems of the northern mid-Atlantic

CENSUS OF MARINE LIFE



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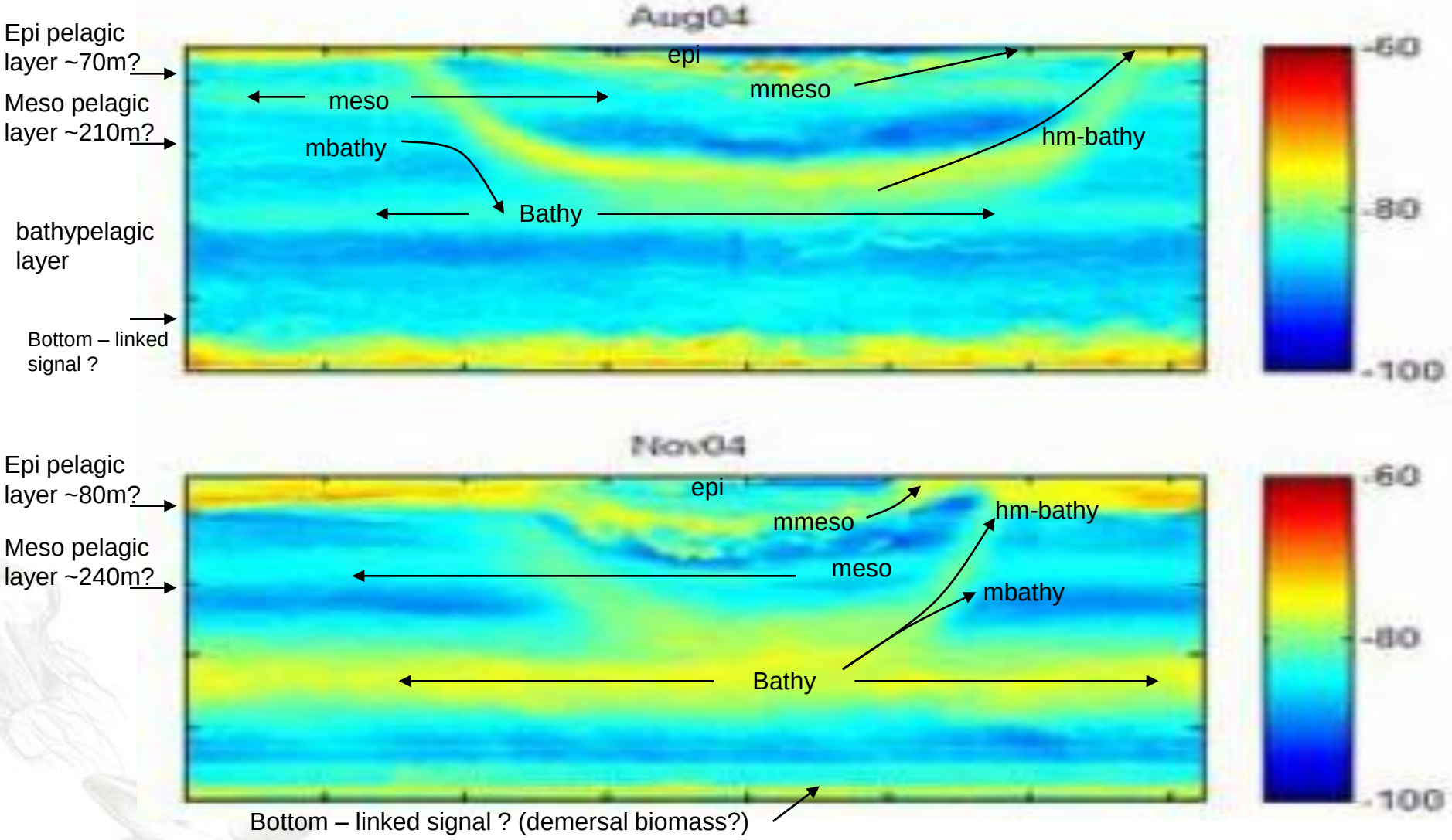
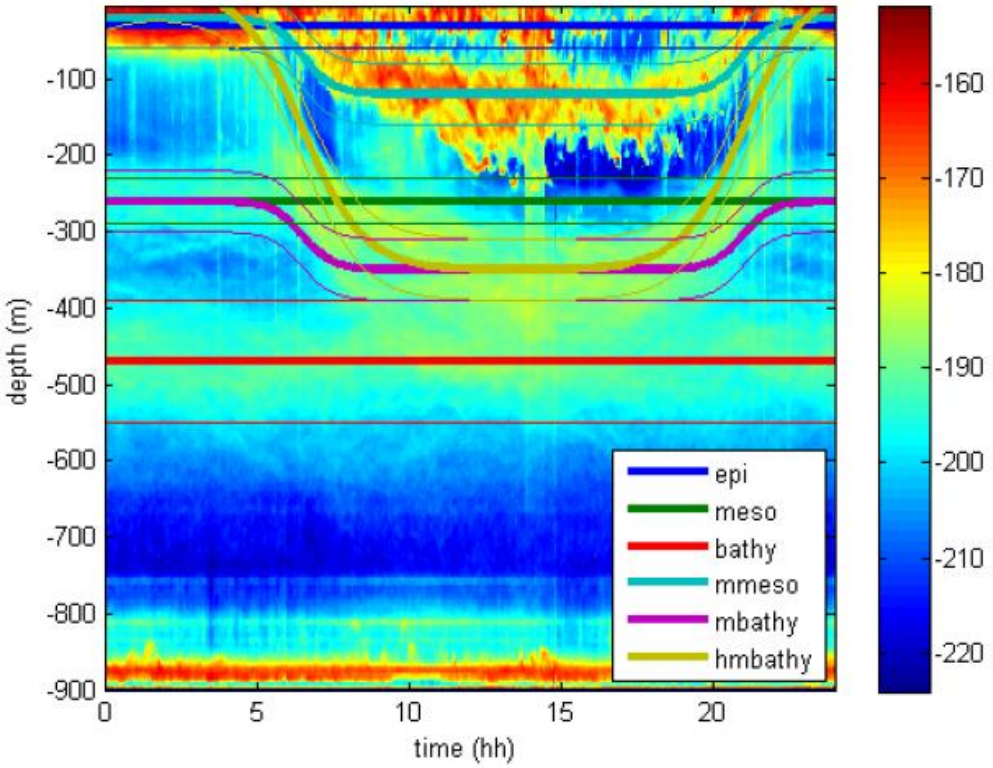
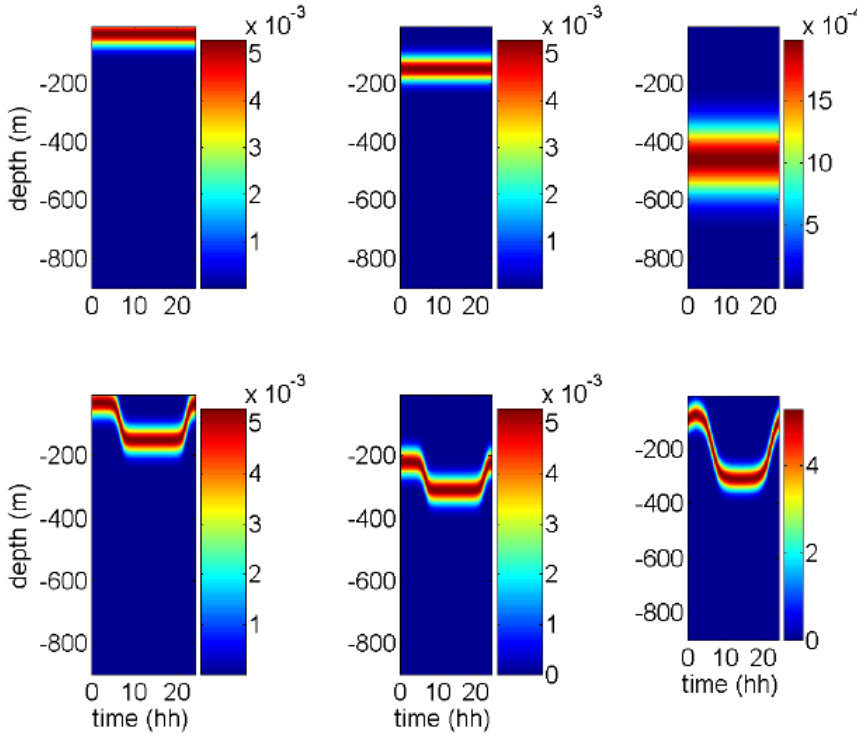


There are big changes between summer and winter pictures that should help us for parameterisation!

Comparing model predictions and data

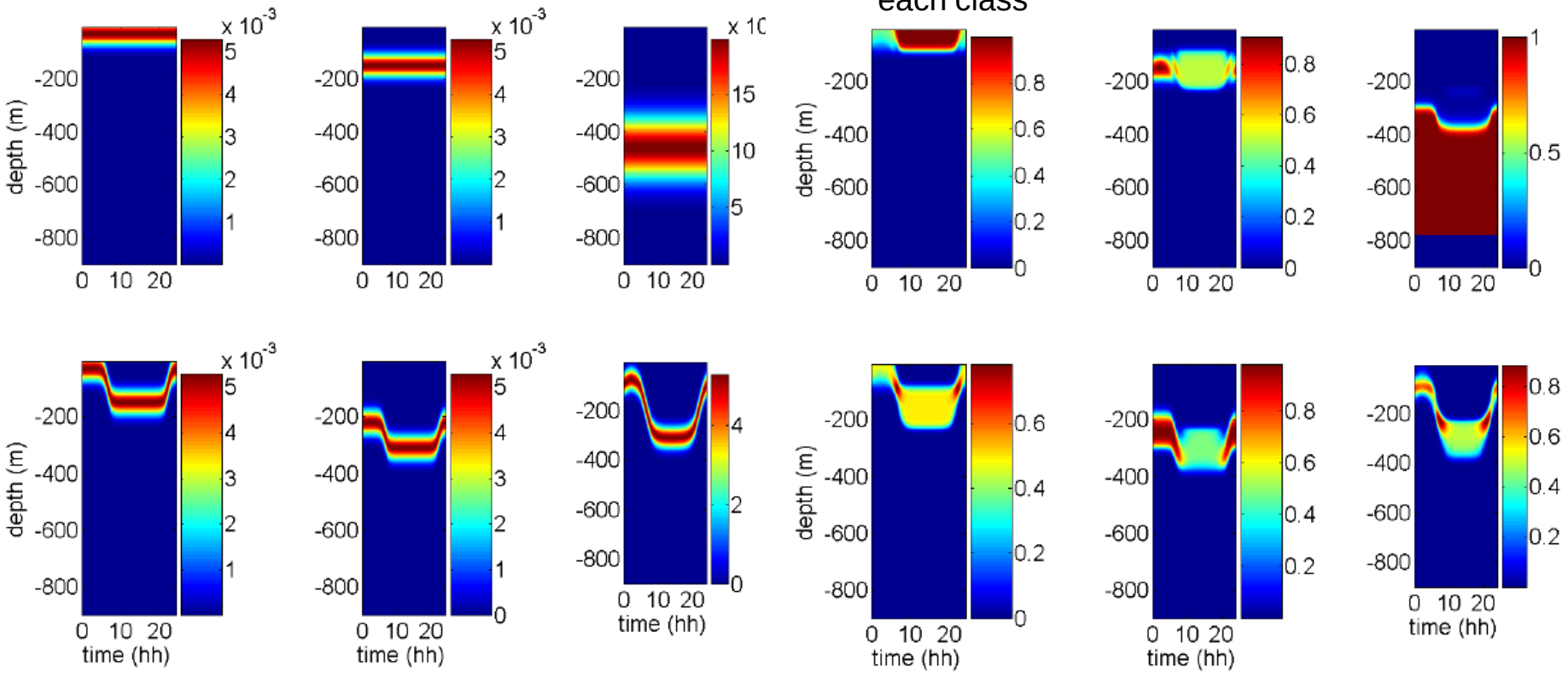




Comparing model predictions and data

The depth distribution og the functional class

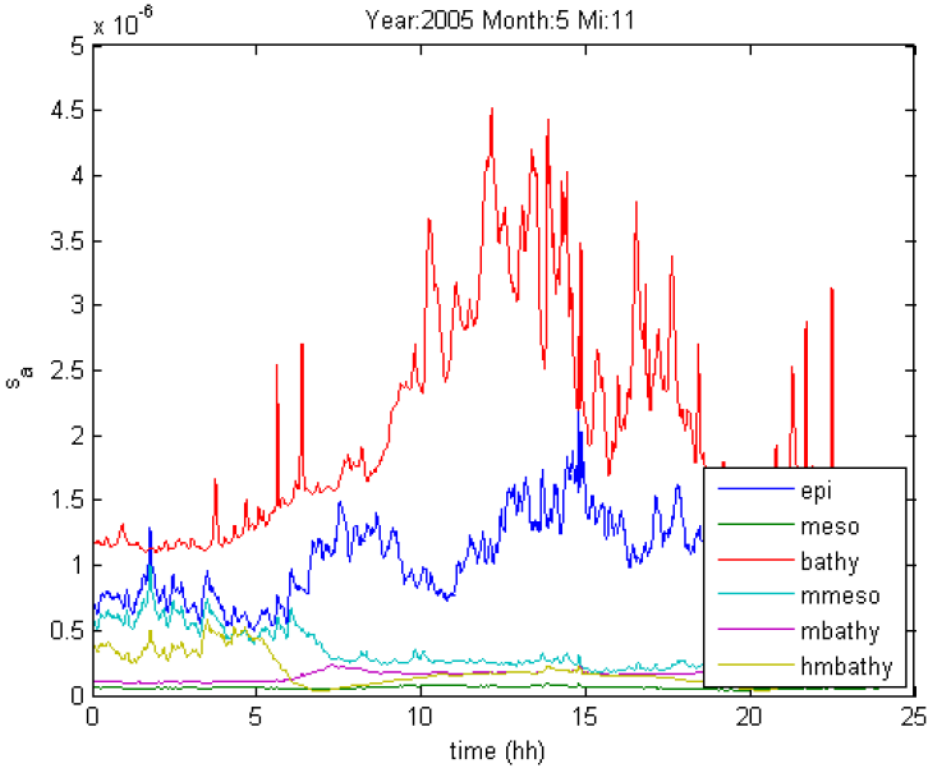
The fraction of the acoustic energy allocated to each class

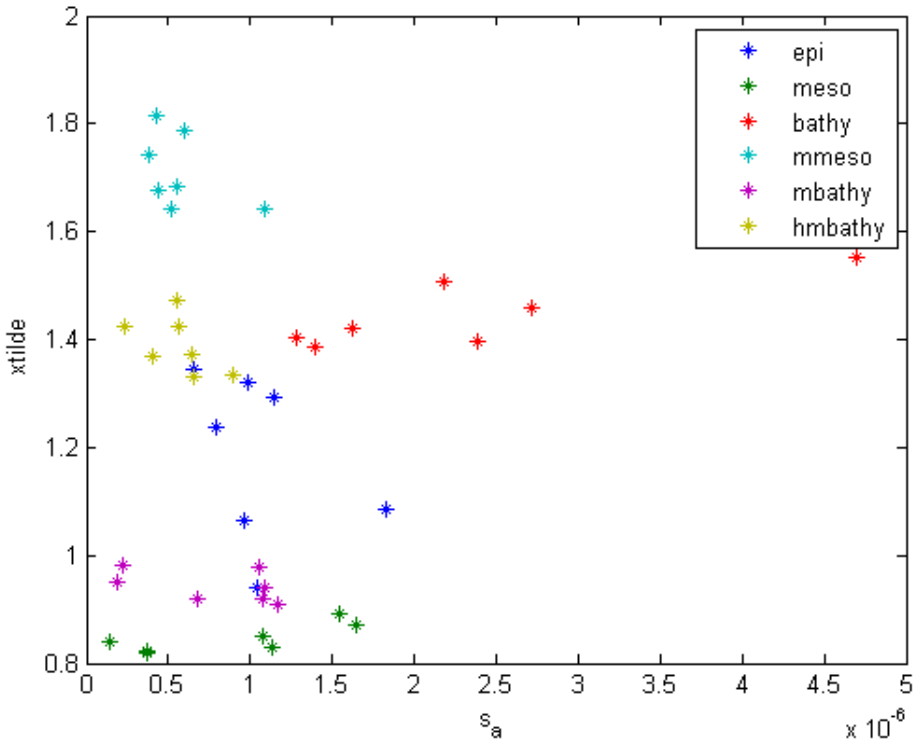


When more classes overlap, we define the relative weights between the classes by

$$p(t,z;m,c) = \frac{w(t,z;m,c)}{\sum_c w(t,z;m,c)}, \qquad (3)$$

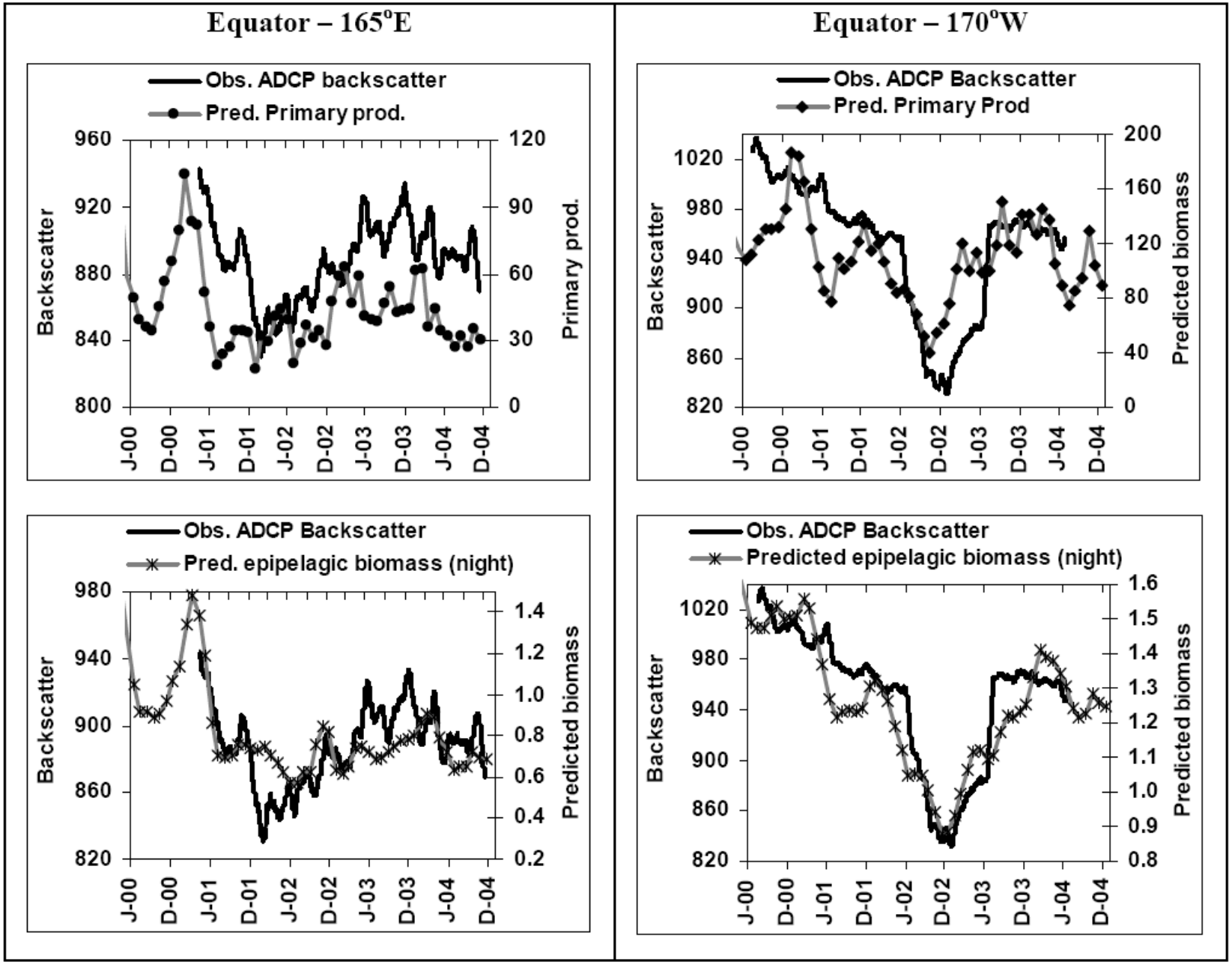
Comparing model predictions and data





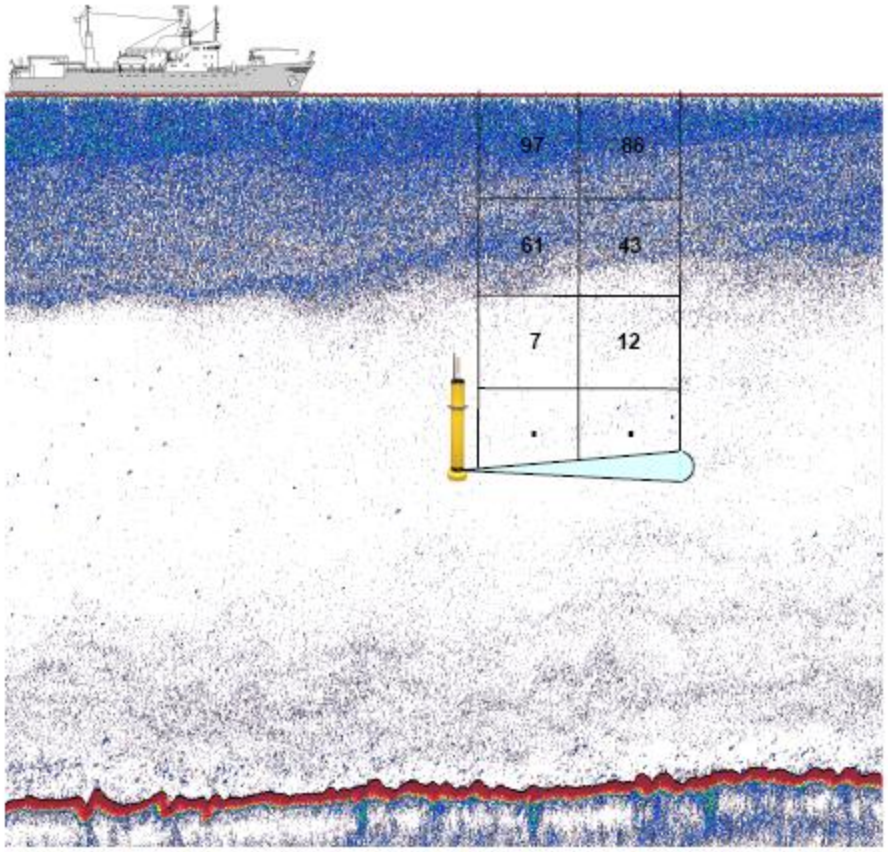
Discussion

- Classes not weighted by sigma
- Diel variation in target strength not taken into account
- Ridge system – not ”open ocean”
- Short time series



Lehodey et al, in press

EURO-ARGO



- Acoustic systems to measure zooplankton from new generation ARGO floats
- Challenge: Power

Report to EURO-ARGO program
Atle Totland

WP4.2 Technology of acoustic sensors for zooplankton measurements from floats

Recent publications

Handegard, NO et al. Acoustic data from platforms of opportunity as fuel for ecosystem models, J. Acoust. Soc. Am. (122). **2007**

Totland, A. WP4.2 Technology of acoustic sensors for zooplankton measurements from floats. ***Techreport*** *Insitute of Marine research,* **2008**

Claustre, H. et al. Expanding and enhancing the system for observing biogeochemical and ecosystem variables in the open ocean: new observations and capabilities in the decade ahead *OceanObs09' Plenary Community White Paper,* **2009**

Handegard, N. O.; Demer, D.; Kloser, R.; Lehodey, P.; Maury, O. & Simard, Y. Toward a global ocean ecosystem Mid-trophic Automatic Acoustic Sampler (MAAS). *OceanObs09' Community White Paper,* **2009**

Recommendations

- Develop models that fit to the data
- Continue deploy existing platforms for method development
- Further develop the coupling between the models and observations
- Ensure technical development
- Large scaled deployment of hydroacoustic sensors