ECOSYSTEM MODELLING

Providing indispensable tools to deliver policy relevant projections and predictions

The UK is a global leader in ocean biogeochemical modelling, with PML at the forefront of modelling shelf seas ecosystems. PML's particular emphasis is on coupled hydrodynamic ecosystem models, statistical methods, model skill assessment, climate impact work, ocean acidification and carbon mitigation strategies. Close to 100 PML ecosystem modelling papers have been published in the last five years.

The PML European Regional Seas Ecosystem Model (ERSEM) is a world leading marine ecosystem model and represents a unique capacity in the UK. The ERSEM model has generated over 100 papers by all users internationally since 1995, including papers in 35 journals involving published collaborations with over 100 organisations in the UK, Europe, North America and Australia.

Services provided:

- PML's contributes to NERC's National Capability through marine ecosystem modelling;
- Ocean biogeochemical modelling in support of the NERC Earth Systems Modelling Strategy;
- Ecosystem modelling, assessment of model performance and data assimilation;
- Benthic biogeochemical and ecosystem modelling;
- Global monitoring in the coastal ocean and shelf seas modelling;
- Modelling the production and fate of climatically active marine biogases;
- Understanding the impact of high CO_2: ocean acidification and climate change;
- Modelling uptake of contaminants in marine systems;
- Supporting operational oceanography;
- Advice to government, industry and society on environmental risks of carbon capture and storage;
- Statistical modelling of ecosystem dynamics;
- Modelling of higher trophic level interactions;
- Modelling ecosystem and socio-economic drivers of fisheries;
- Estimating plankton functional types and harmful algal blooms.

Research priorities

- To improve understanding of the role of ocean and seabed biogeochemistry in global biogeochemical cycles and the consequences for climate change;
- To improve understanding of the variability, potential impacts and feedbacks of global change and anthropogenic forcing on the structure, function and dynamics of the ecosystems of the marine environment, and how these affect the capacity to provide marine ecosystem goods and services. To quantify the skill and predictability of marine biological models.

Role in society

Advancing the understanding of the role ocean biogeochemistry in climate change;

Advancing the understanding of ecosystem responses to climatic change;

PML is a strategic partner of the National Centre for Ocean Forecasting (NCOF) and is leading the development of ecosystem forecast systems for shelf seas, together with NOC and the Met Office. Member of the SCOR/IOC Global ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Scientific Steering Committee;

Addressing challenging issues such as assessing the environmental consequences of Carbon Capture and Storage and the deployment of marine renewable energy devices;

Development and coordination of the AMEMR (Advances in Marine Ecosystem Modelling Research) symposia, co-ordinating the 22 partners in the EU MEECE project which aims to explore the responses of marine ecosystems, looking at the impacts of climate and anthropogenic drivers, developing appropriate, knowledge based, management applications.

Delivering for the UK and wider stakeholders

UK collaborations include the BGS, HECToR Research Councils UK Supercomputing, MBA, Met Office National Centre for Ocean Forecasting (NCOF) and Hadley Centre, NOC, SAHFOS, Universities of Edinburgh, Essex, Exeter, Herriot Watt, Leeds, Liverpool, Newcastle, Oxford, Reading, Swansea and the London School of Economics.

International collaborations include:

Universities of Bergen (Norway), Bologna (Italy), Cape Town (South Africa), Hamburg (Germany), Hokkaido (Japan), Louisiana (USA), Massachusetts (USA), the Technical University of Denmark and research institutes such as AZTI (Spain), CCMC Italy, CISRO (Australia), CNRS (France), HCMR (Greece), IEO (Spain), IFM-GEOMAR (Germany), IMARES (Netherlands), Institute of Marine Research Bergen (Norway), IRD (France), KORDI (KOREA), NERSC (USA), NIVA (Norway) and Woods Hole (USA).

Data access and management:

- PML's model code is version controlled and quality assured;
- The storage and management of data is core to the integrity of PML. Data is preserved and managed appropriately to ensure that maximum benefits are derived from data acquired by PML;
- Management of PML data is discussed with the funding customers' Designated Data Centres;
- PML encourages the open exchange of data for research purposes where it is clear that the research will lead to a contribution to knowledge or societal benefit within PML's remit, or to benefits in kind.

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