

Earth System Science Theme Third Theme Action Plan

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- 1. Introduction**
- 2. Theme Overview**
- 3. Actions**
 - Greenhouse Gas Emissions and Feedbacks (Climate and ESS)**
 - Implementing Earth System Modelling Strategy (Climate and ESS)**
 - Mantle Control on the Habitable Planet**
 - Shelf Sea Biogeochemistry**

Revised Earth System Science Theme

- Major Revision as part of the NERC Strategy Refresh.
- Previous wide ranging theme with 11 challenges now focussed on 2 challenges.
 - 1.Understanding the biogeochemical forces and feedbacks that drive the Earth System.
 2. Understanding the long term development of the Earth and its habitability.
 - Controls on subduction, mantle convection and volcanism.
 - How deep-Earth processes influence the surface environment.
 - Links between biological evolution and environmental change.
 - The ways in which the past can be used to predict the future of the Earth system.

Recent ESS Theme Investments

TAP 1

Ocean Acidification £7.7m + DEFRA/DECC £4.7m (ESS + Biodiversity)

Methane Network £0.3m

Sustainable support for summer schools £0.2m

Joint Climate Research Programme £0.8m (ESS + Climate)

TAP 2

Ice Sheet Stability £7.4m (ESS + Climate)

Evolution of Life and the Planet £4m

Joint Climate Research Programme £0.9m (ESS + Climate)

Arctic £15m (ESS + Climate, Biodiversity, and Natural Hazards)

Macronutrients £9.5m (ESS + Biodiversity, EPHH, SUNR and Technologies)

TAP 3 Proposed Investments

Greenhouse Gas Emissions and Feedbacks.

- **Joint Action led by the climate theme.**
- **Greenhouse gas fluxes are obviously key for climate theme, but almost all the natural factors regulating concentrations are biogeochemical and hence fall under Challenge 1 of ESS “Understanding the biogeochemical forces and feedbacks that drive the Earth System”.**
- **Research in this area is critically important to improve future climate predictions.**
- **Proposed programme will focus on improving;**
 - the quantification of UK emissions of the main GHGs,**
 - exploitation of satellite data,**
 - understanding land/atmosphere GHG exchange’**
 - quantification of ocean/atmosphere CO₂ exchange.**

TAP 3 Proposed Investments

Towards implementation of the Earth System Modeling strategy

- Joint action led by Climate theme.
- This flows from the ESS and Climate sponsored review of NERC Earth System Modelling Strategy and will include modelling of biogeochemical forcing and feedbacks and thus fall within ESS Challenge 1.
- These improved models are central to efforts to improve predictions of longer term climate change.
- Action will focus on;
 - Exploiting ESMs for IPCC AR5,
 - Integrating observations into ESMs,
 - Improving global biogeochemical models, particularly ocean biogeochemistry and atmospheric chemistry,
 - Seabed process modelling.

TAP 3 Proposed Investments

- **Mantle Control on the Habitable Planet**

- **Directly addresses Parts 1 & 2 of ESS Challenge 2**

Understanding the long term development of the Earth and its habitability;

Controls on subduction, mantle convection and volcanism

How deep-Earth processes influence the surface environment.

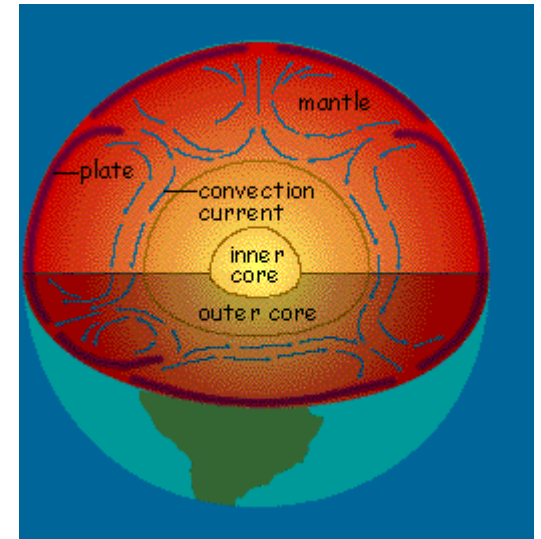
- **This proposed action is consistent with proposals from the BGS/NERC led community meeting early in 2010 developed further in a workshop in autumn 2010.**

Mantle Control on the Habitable Planet

This action will aim to improve our understanding of fundamental questions of how the earth is differentiated, how it loses heat and how the mantle drives plate motions and convection.

The specific focus of this action is currently being developed.

Delivery will probably be through highly interdisciplinary programme including geophysics, geochemistry, mineral physics and petrology, and involving fieldwork, laboratory studies and computer modelling. There is considerable potential for international partnerships and some of the options for major field campaign may only be realistic with such partnerships.



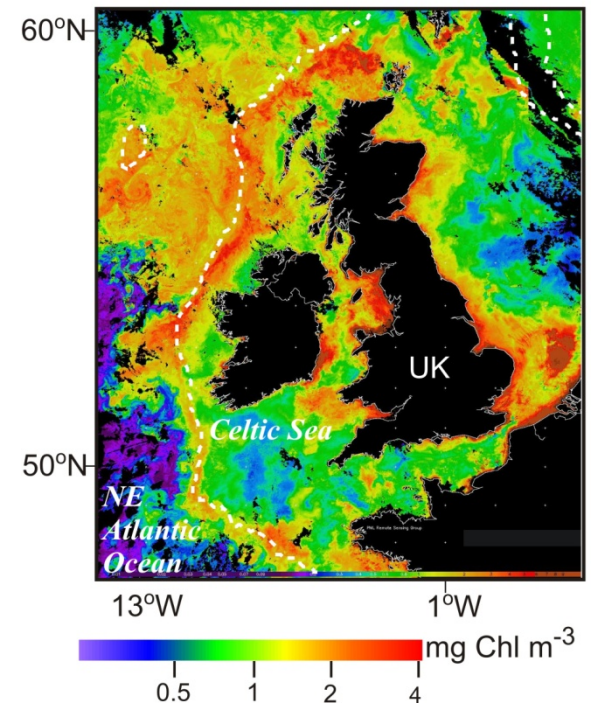
TAP 3 Proposed Investments

- Shelf Sea Biogeochemistry
- **Directly contributes to ESS Challenge 1**
Understanding the biogeochemical forces and feedbacks that drive the Earth System.
- **The shelf seas represent a critical interface within the Earth system which has been under studied and where exciting new ideas, opportunities and techniques are available.**
- **The shelf seas have been proposed as the most valuable habitat on the Earth and the UK shelf is particularly important for the UK.**

Shelf sea Biogeochemistry

- The proposed programme aims to fundamentally improve our understanding of shelf sea systems via a study focussed on the N.W. European Shelf.

The action will address a series of specific research questions around the cycling and fate of carbon and nutrients (N, P, Si and Fe) in shelf systems, how this relates to primary and secondary production and how these functions may change under global change pressures.



Shelf Sea Biogeochemistry

- **Delivery will be through a highly integrated interdisciplinary programme of fieldwork and modelling involving marine biology, chemistry and physics, areas in which the UK is world leading.**
- **The programme will link to the other NERC programmes particularly Macronutrients and Shelf-Ocean Physical Exchange and hopefully to existing UK and European observatory systems.**

Earth System Science Theme Third Action Plan

Proposed Actions

Greenhouse Gas Emissions and Feedbacks (Climate and ESS)

**Implementing Earth System Modelling Strategy
(Climate and ESS)**

Mantle Control on the Habitable Planet

Shelf Sea Biogeochemistry

Earth System Science Theme

Third Action Plan

- **Possible Future Actions;**
- **Ocean/atmosphere and land/atmosphere biogeochemical exchange,**
- **Further development of ESM modeling strategy,**
- **Paleo records and ESMs,**
- **IODP Research Programme.**

We welcome ideas from the community, so please do feel free to contact theme



Thank you