Baltic-C: Building predictive capability regarding the Baltic Sea organic/inorganic carbon and oxygen systems

Baltic-C kick off
November 2008

The goal:

Building predictive capability regarding the Baltic Sea organic/inorganic carbon and oxygen systems

that:

1. explicitely includes the formation of organic matter and the interaction with the CO_2 system;

- **formation organic carbon is not sufficiently characterized by nutrient consumption, consistency with the CO_2 budget must be achieved;**
- **the CO_2 system controls the biogenic formation of $CaCO_3$;**
- **the CO_2 system determines whether the Baltic Sea is a sink or source for atmospheric CO_2;**
- **the cycling of many trace elements depends on both the availability of particulate organic carbon and pH;**

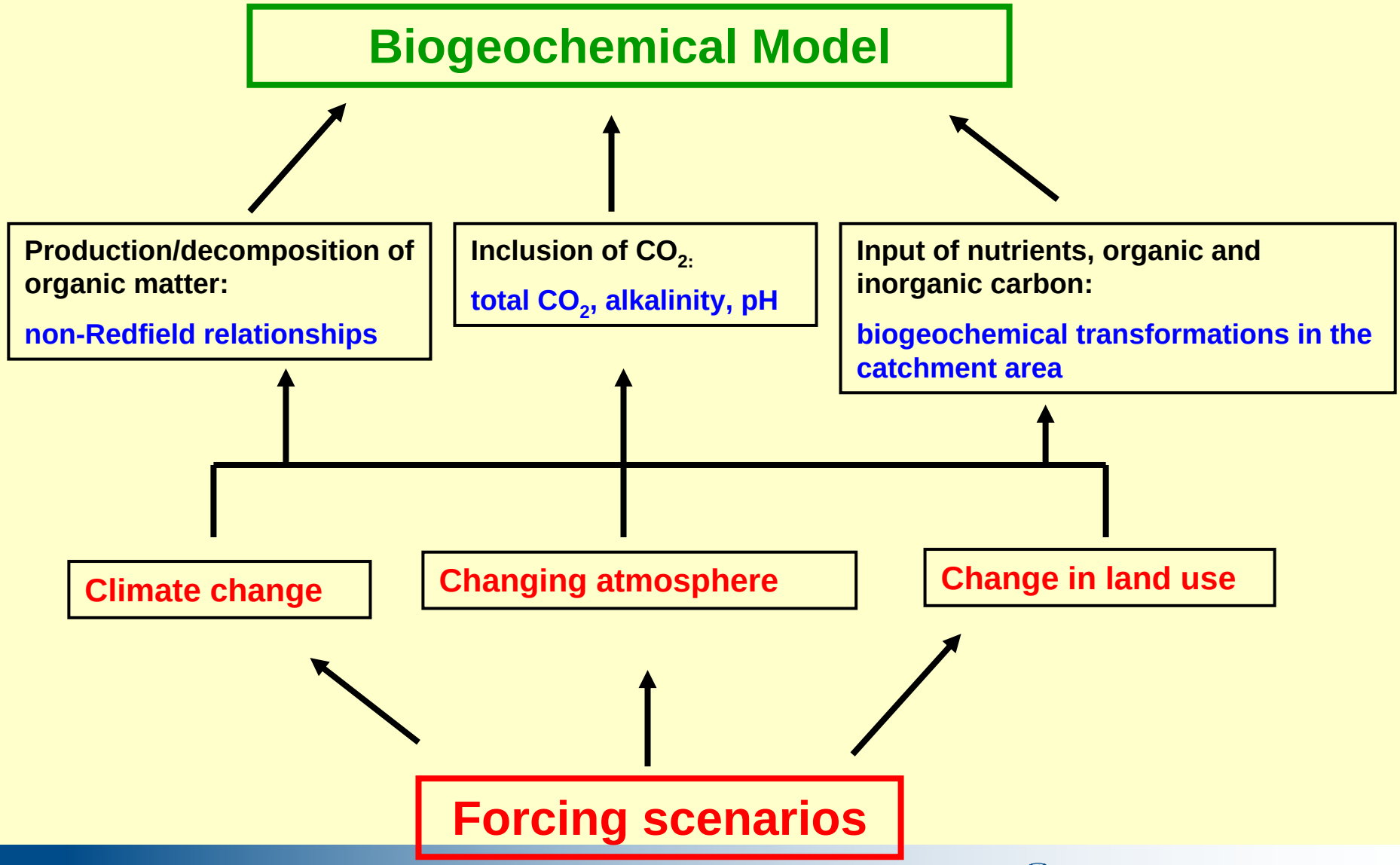
2. integrates the relevant processes in the catchment area;

- **the riverine input of organic carbon, total CO_2, alkalinity and nutrients constitutes the major chemical forcing for the Baltic Sea carbon cycle;**

3. is designed to simulate future changes of the Baltic Sea carbon cycle and its ecological and biogeochemical implications;

- **„ocean acidification“ by inceasing atmospheric CO_2;**
- **changing alkalinity input due to increasing CO_2 and acidic precipitation;**
- **increasing organic matter input due to climate change;**
- **changes in the nutrient inputs due to antropogenic activities;**

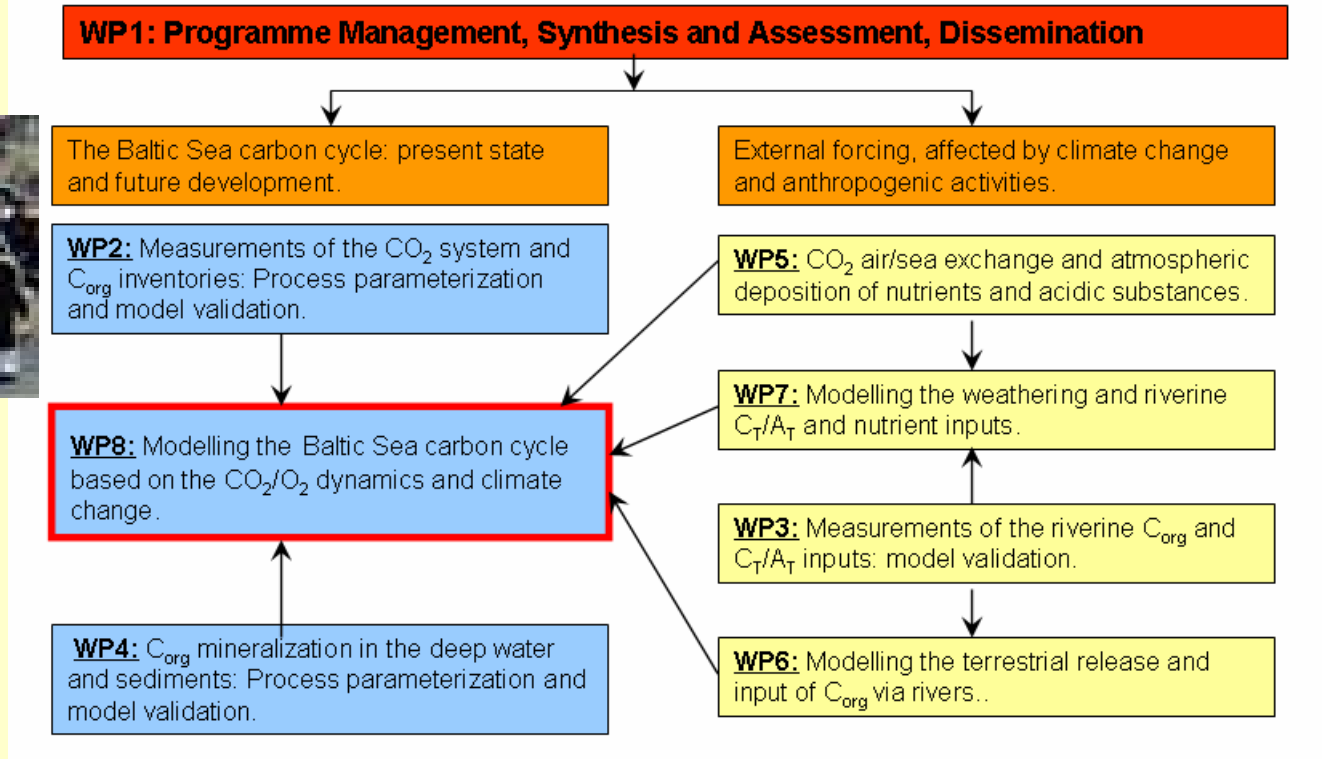
What is new?


Biogeochemical Model
Production/decomposition of organic matter:
non-Redfield relationships
Inclusion of CO_2:
total CO_2, alkalinity, pH
Input of nutrients, organic and inorganic carbon:
biogeochemical transformations in the catchment area
Climate change
Changing atmosphere
Change in land use
Forcing scenarios

WP1. Programme management, synthesis and assessment, dissemination (Anders Omstedt, University of Gothenburg, Sweden, and participant code 1).

Anders Omstedt

David Rayner



WP1. Programme management, synthesis and assessment, dissemination (Anders Omstedt, University of Gothenburg, Sweden, and participant code 1).

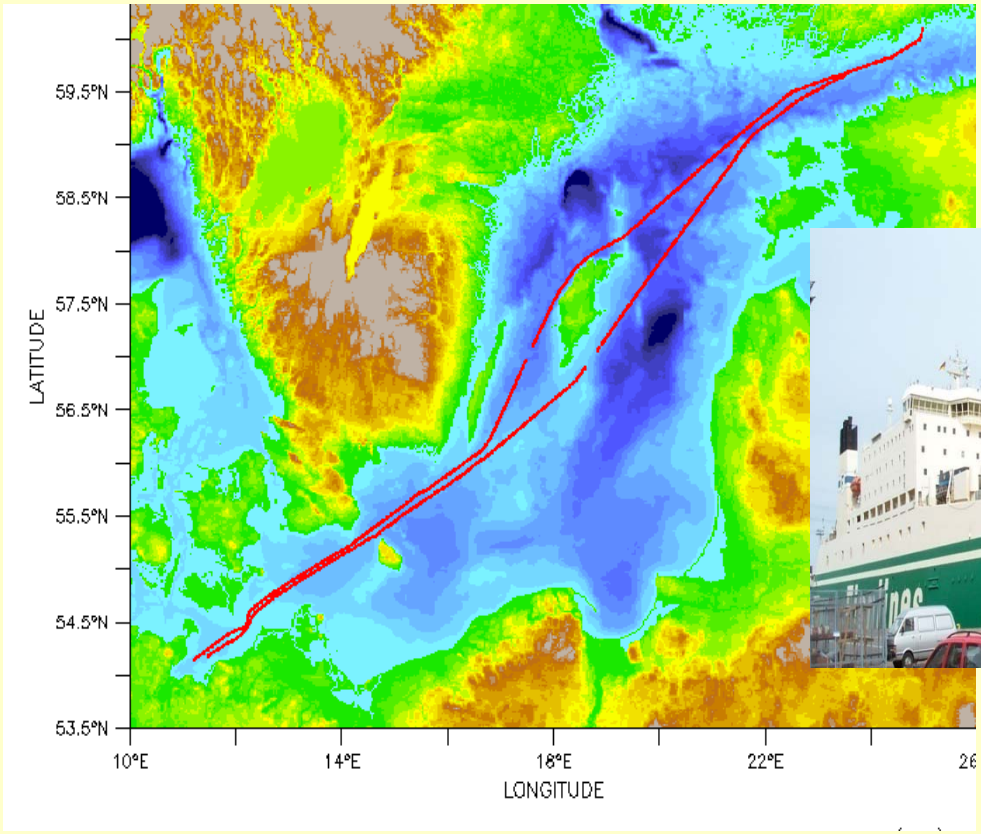
- ***Task 1.1:*** *Programme management.*
- ***Task 1.2:*** *Workshop and estimated environmental economics aspects.* Due to budget cuts this workshop will be organized outside the Baltic-C program and at a later phase.
- ***Task 1.3:*** Synthesis and assessment of Baltic Sea CO_2 system.
- ***Task 1.4:*** *Dissemination.*

WP2. Measurements of the Baltic Sea CO_2 system and carbon inventories (Bernd Schneider, Baltic Sea Research Institute, Germany; participant code 2).

Bernd Schneider

Anne Loeffler

Bernd Sadkowiak



WP2. Measurements of the Baltic Sea CO_2 system and carbon inventories (Bernd Schneider, Baltic Sea Research Institute, Germany; participant code 2).

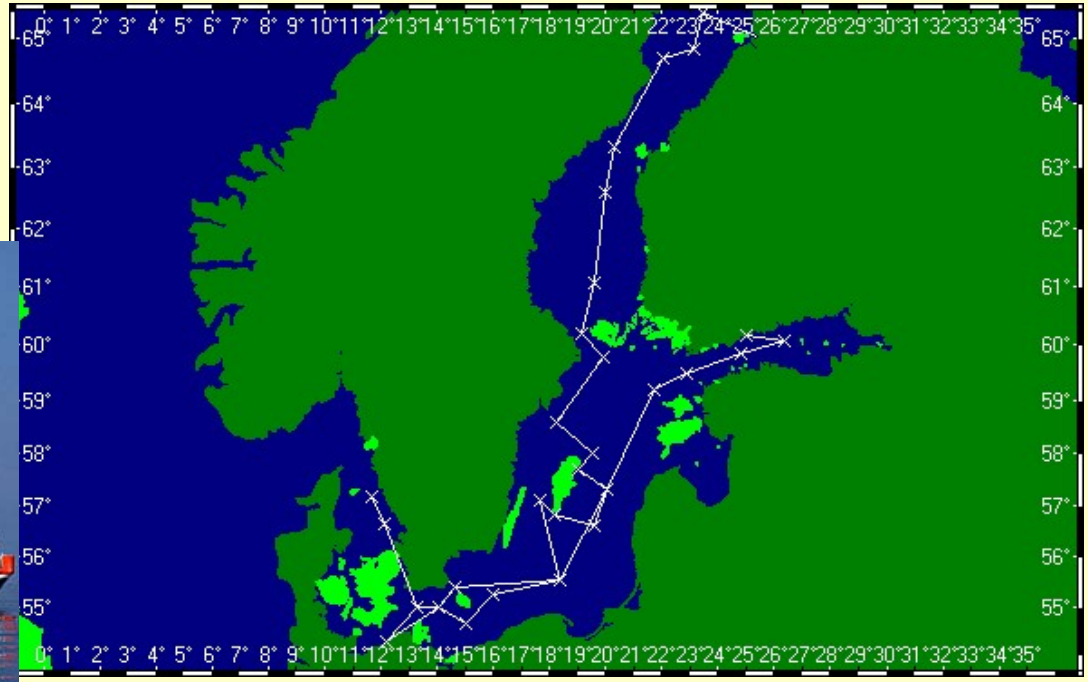
- ***Task 2.1:*** *Recording surface water pCO_2 and O_2 using a fully automated measurement system deployed on VOS "FINNMAID".*

- ***Task 2.2:*** *Determining the organic/inorganic carbon and oxygen pools in different Baltic Sea sub-regions.*

- ***Task 2.3:*** *Compiling and evaluating CO_2/carbon data collected by previous research and monitoring programmes.*

WP3. Inventory of river runoff data (Matti Pertillä, Finnish Institute of Marine Research, Finland; participant code 3).

Matti Pertillä



Baltic-C cruise 12.1 – 7.2.2009

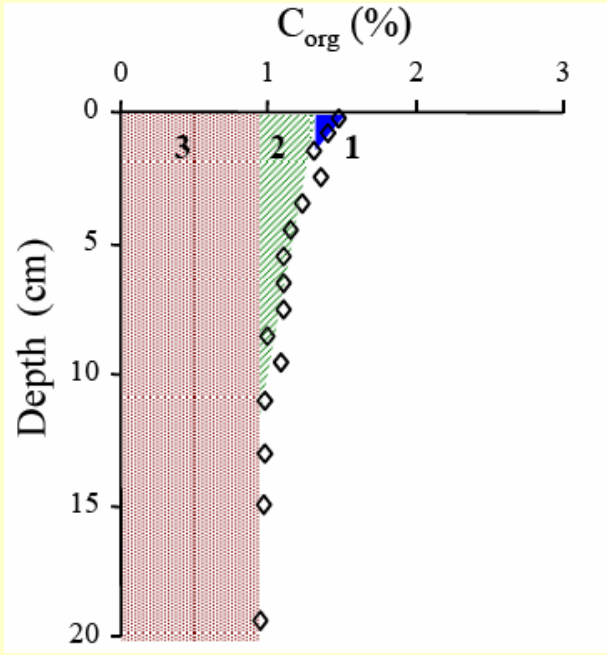
WP3. Inventory of river runoff data (Matti Pertillä, Finnish Institute of Marine Research, Finland; participant code 3).

- ***Task 3.1:*** *Evaluating the river input concentrations from existing monitoring and research data.*
- ***Task 3.2:*** *Evaluating river concentrations from marine data.*
- ***Task 3.3:*** *Measuring input concentrations.*

WP4. Mineralization of organic material, deepwater–sediment interaction (Janusz Pempkowiak, Institute of Oceanology, Polish Academy of Sciences, Poland; participant code 4).

Janusz Pempkowiak

Karol Kuliński



WP4. Mineralization of organic material, deepwater–sediment interaction (Janusz Pempkowiak, Institute of Oceanology, Polish Academy of Sciences, Poland; participant code 4).

- ***Task 4.1:*** *Establishing remineralization rate constants for organic matter based on existing data.*

- ***Task 4.2:*** *Collecting new experimental data to improve and extend the rates provided in task 4.1*

- ***Task 4.3:*** *Establishing loads of carbon species passing across the sediment–water interface over the entire Baltic.*

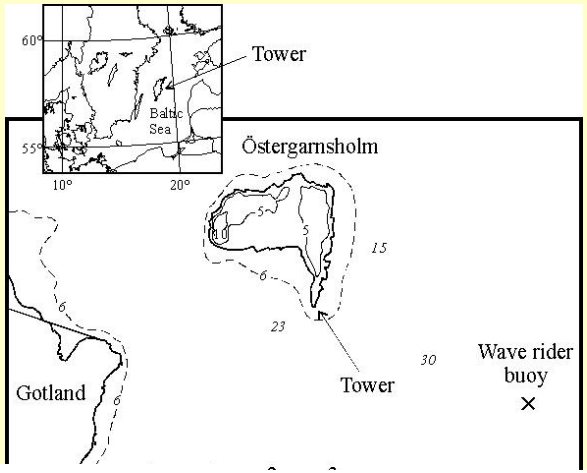
Task 4.4: *Determining remineralization rate constants at the sediment surface and in the water column, based on CO_2 concentrations in Gotland Sea deep water*

WP5. Atmospheric forcing (air–sea interaction, scenarios) (Anna Rutgersson, Uppsala University, Sweden; participant code 5).

Annna Rutgersson

Björn Carlsson

Maria Norman



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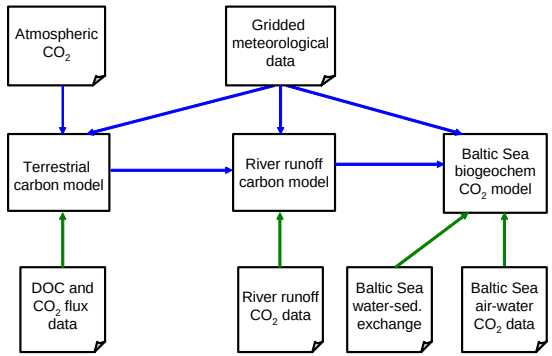

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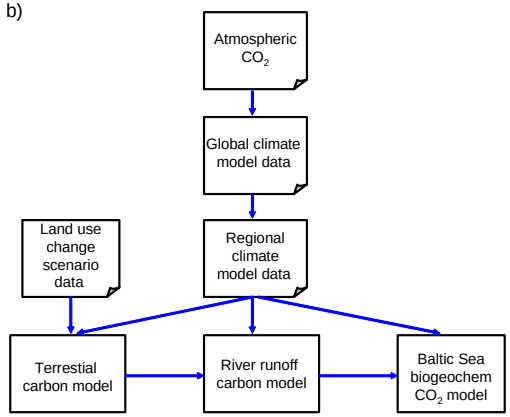
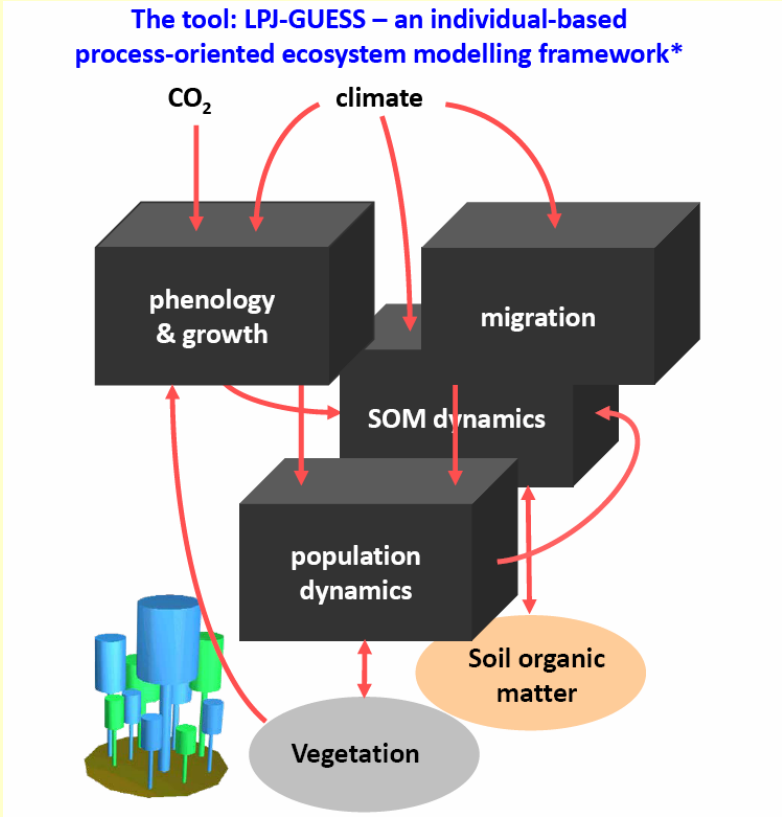


WP5. Atmospheric forcing (air–sea interaction, scenarios) (Anna Rutgersson, Uppsala University, Sweden; participant code 5).

- ***Task 5.1:*** *Air–sea interaction.*
- ***Task 5.2:*** *Acid deposition.*
- ***Task 5.3:*** *Climate scenarios and land-use data*

WP6. Modelling the organic matter input from terrestrial vegetation and soils (Benjamin Smith, Lund University, Sweden; participant code 6).

Benjamin Smith



WP6. Modelling the organic matter input from terrestrial vegetation and soils (Benjamin Smith, Lund University, Sweden; participant code 6).

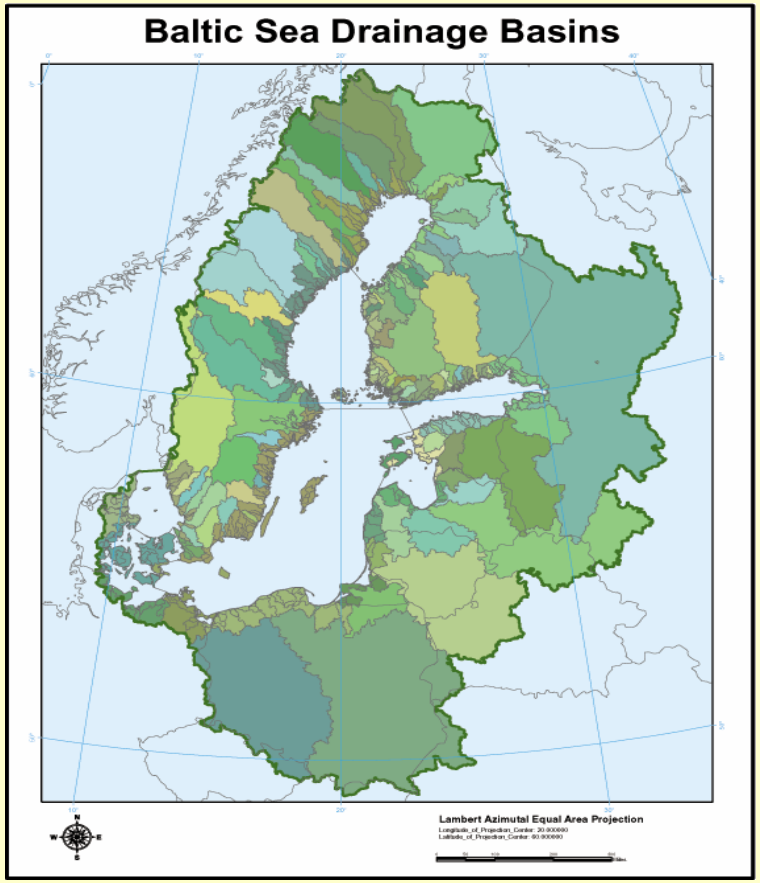
- ***Task 6.1:*** *Terrestrial carbon model setup, validation, and coupling to the river runoff carbon model (WP7).*

- ***Task 6.2:*** *Modelling present and past changes in vegetation structure and functioning and in dissolved organic carbon export.*

- ***Task 6.3:*** *Modelling possible future changes in vegetation structure and functioning and in dissolved organic carbon export.*

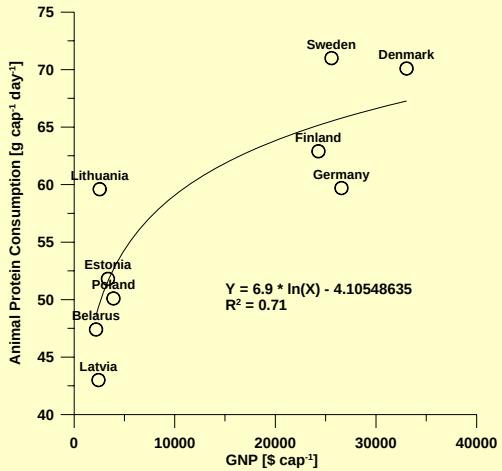
WP. 7. Modelling the input A_T, C_T, Ca, and C_{org} from all rivers to the Baltic Sea (Christoph Humborg, Stockholm University, Sweden; participant code 7).

Christoph Humborg



CSIM model

87 major catchments and 21 costal strips



WP. 7. Modelling the input A_T, C_T, Ca, and C_{org} from all rivers to the Baltic Sea (Christoph Humborg, Stockholm University, Sweden; participant code 7).

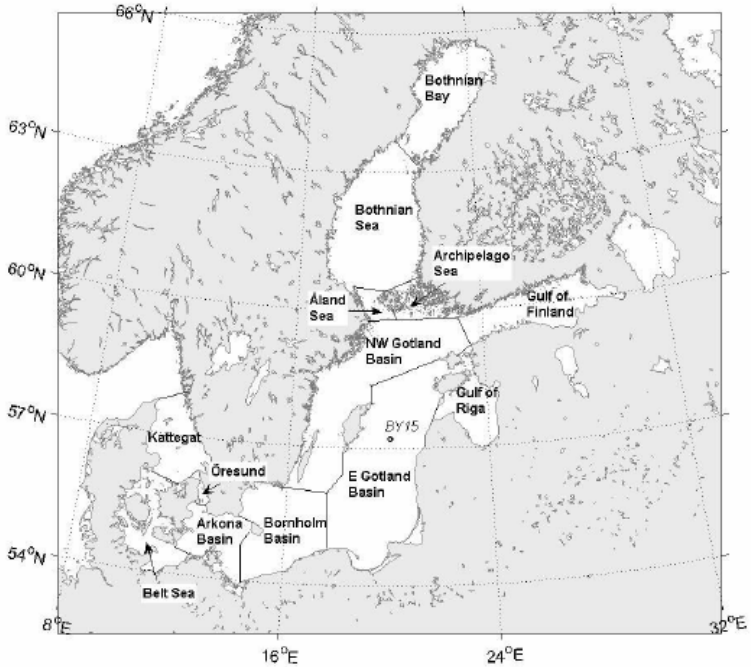
- ***Task 7.1:*** *Compilation of river chemistry and hydro-meteorological forcing data*.
- ***Task 7.2:*** *Model calibration and validation of A_T, C_T, Ca and Corg inputs.*
- ***Task 7.3:*** *Scenario analyses of A_T, C_T, Ca and C_{org} inputs as a function of land cover change and changes in river discharge as an effect of regional climate change.*
- ***Task 7.4:*** *Scenario analyses on effects of regional climate change on N and P fluxes from 83 major watersheds forming the Baltic Sea catchment*.
- ***Task 7.5:*** *Scenario analyses on changes in land cover types (agricultural vs. forest vs. wetlands) and land use patterns (changes in fertilizer use and livestock density) on N and P fluxes from 83 major watersheds forming the Baltic Sea catchments.*

WP8. Modelling the Baltic Sea physical-biogeochemical system based on the CO_2/O_2 dynamics and climate change (Anders Omstedt, University of Gothenburg, Sweden, and participant code 1).

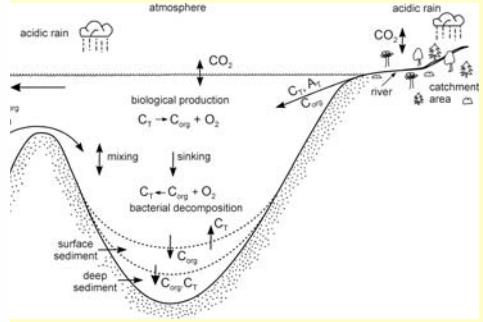
Moa Edman

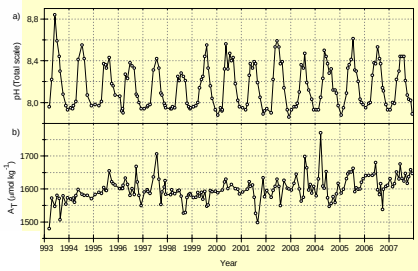
Erik Gustafsson

Karin Wesslander



PROBE-Baltic model





WP8. Modelling the Baltic Sea physical–biogeochemical system based on the CO_2/O_2 dynamics and climate change (Anders Omstedt, University of Gothenburg, Sweden; participant code 1).

- ***Task 8.1:*** *Modelling present and past changes of the Baltic Sea CO_2 system*.

- ***Task 8.2:*** *Modelling possible future changes in the Baltic Sea CO_2 system*.