ERANET BONUS Verbundprojekt
BONUS-73: Baltic Gas Methanemissionen in der Ostsee Vorhaben TP 1
03F0488A

Schlussbericht über den Beitrag des AWI zum BONUS Projekt BalticGas

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Das BONUS-Projekt Baltic Gas startete Anfang des Jahres 2009 mit einem Kick-off Meeting am MPI in Bremen. Die wissenschaftlichen Arbeiten wurden sofort begonnen, obwohl vom Projektträger die Finanzierung der wissenschaftlichen Arbeiten nur für einen Zeitraum von ~2.5 Jahren unterstützt werden konnte. Hierfür haben wir zusätzliche AWI-Eigenmittel (u. a. Dr. Kerstin Jerosch, Dipl.-Ing. T. Gentz) eingebracht.

Unsere Beiträge zum Baltic Gas Projekt untergliedern sich in folgende Aktivitäten:

WP 2: Data mining and GIS-mapping (Lead: GEUS)	Task 2.2: GIS-Mapping (AWI)
WP 5: Modelling and data integration (Lead: DESUU)	Task 5.2 GIS Modelling (AWI)

Weiterhin haben wir zum Work Package 4 beigetragen.
WP 4: Biogeochemistry (Lead MPI) Task 4.2.3: Water column methane and ferry box surface methane measurements - Application of Membrane inlet mass spectrometry and underwater mass spectrometry (AWI)

Unsere Arbeitsschwerpunkte waren:

- Datenrecherche zur Verteilung gasreicher Sedimente in der Ostsee
- Datenrecherche zum Vorkommen von Pockmarks und anderer Indizes die für die Bildung und Freisetzung von Methan und anderen klimarelevanten Gasen von Bedeutung sind
- Integration dieser Daten in ein Geoinformationssystem
- Weiterentwicklung der Geo-Daten-Infrastruktur
- Weiterentwicklung von Verfahren zur in situ Messung und Beprobung von gasreichen (Methan) Sedimenten und Wasserproben
- Aufbau eines Web-Map-Servers (WMS) zur Bereitstellung interaktiver Karten

- Die räumliche Modellierung mittels GIS und Geostatistik zur Erstellung von Vorhersage Karten zum Vorkommen von „freiem Gas“ in Sedimenten der Ostsee

Der vorliegende Abschlussbericht untergliedert sich in die Work Packages und die „AWI-Deliverables“, die im Abschlussbericht des Baltic GAS Projektes enthalten und fristgerecht eingereicht wurden, sowie weitere inhaltliche Ergänzungen.

WP 2: Data mining and GIS-mapping (Lead GEUS)
Task 2.2: GIS-Mapping (AWI)

AWI - Deliverable 2.2.1: Mapping of mined data

GIS-mapping of mined data has so far been focusing on collecting basic map themes from the Baltic Sea like bathymetry, economic zones, bottom water chemistry as well as the spatial distribution of pockmarks. In addition we integrated data into the Geo-Information-System ArcGIS (ESRI) about sedimentology, seafloor properties like slope angles or bottom water currents, as well as -from a process oriented and descriptive perspective- data sets directly related to the presence or the formation of methane in surface sediments (Fig. 1).

The later includes free gas areas observed by seismic surveys, known pockmark sites as well as gas flares released form the accumulation rates of particulate organic matter were compiled and integrated into the GIS (Fig. 2). The entire set of different parameters, geodata compiled within Task 2.1 as well as maps were georeferenced to a common map projection (Equal Area Projections like the Albers projection), suitable for calculations of mass budgets.

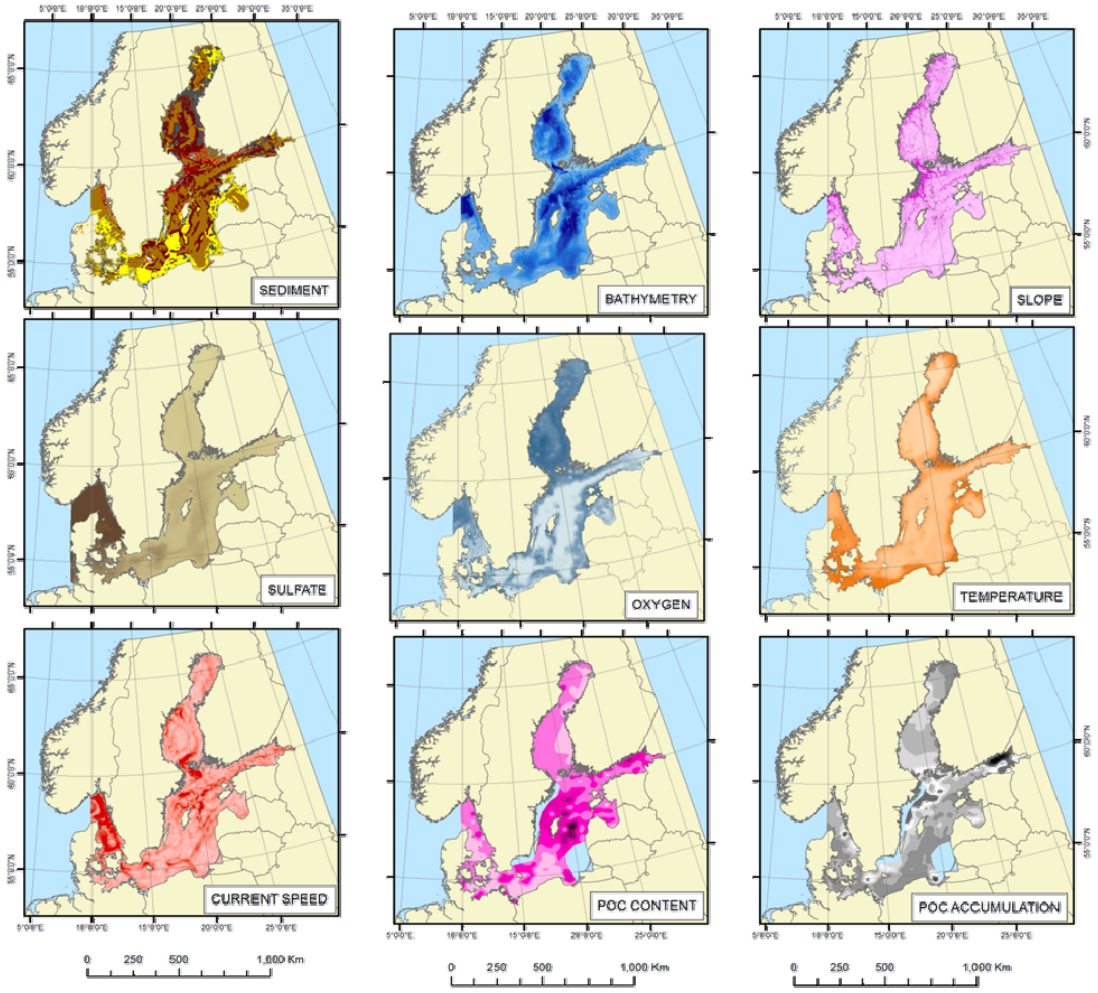

Figure 1: Examples for mined geodata integrated into the GIS.

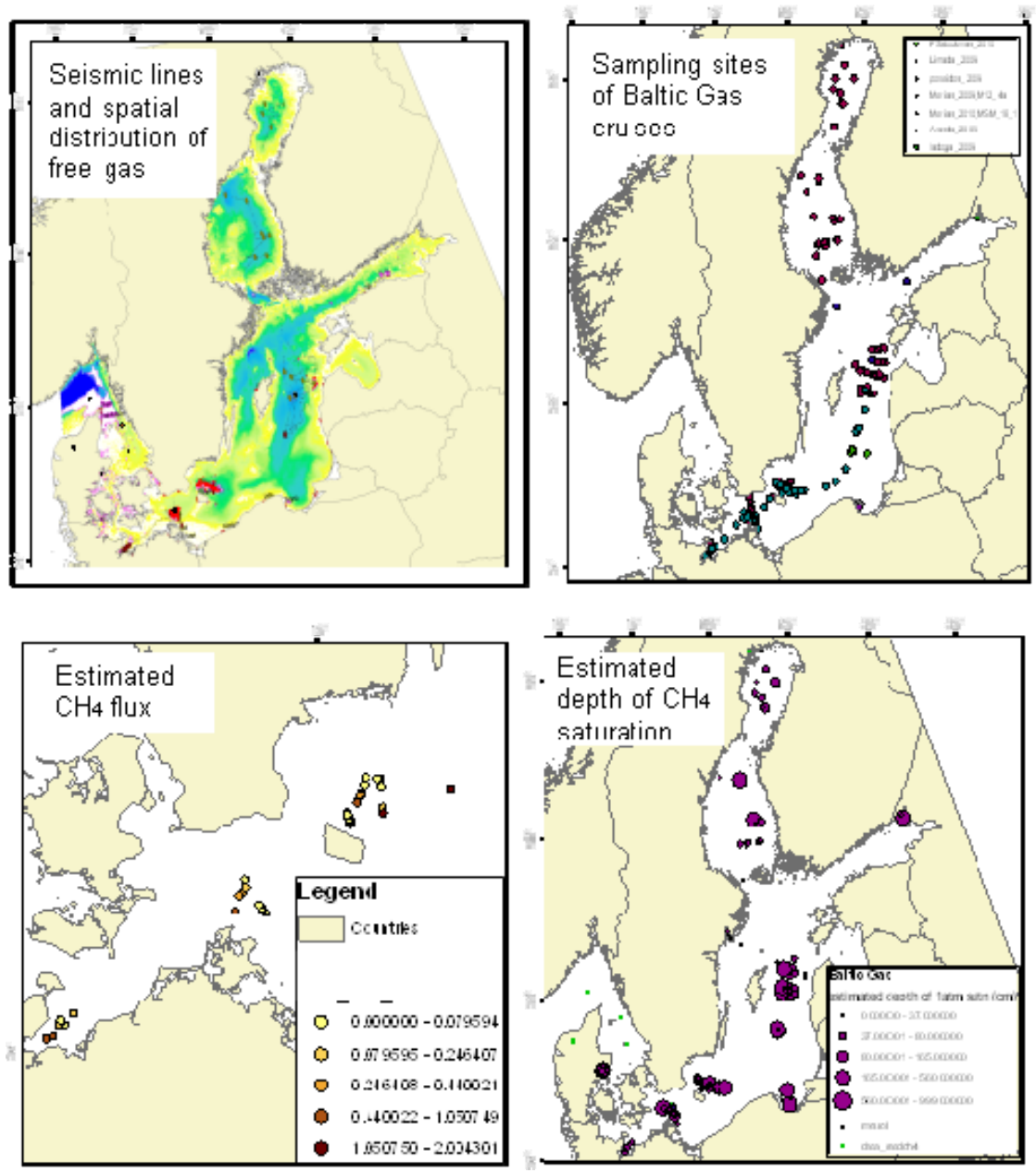

Figure 2: Geodata integrated into the GIS about the spatial distribution of seismic lines and free gas, sampling sites studied during the Baltic Gas cruises, the estimated CH_4 flux through sediments, and the estimated depth of CH_4 saturation in sediments of the Baltic Sea.

For mapping of methane fluxes as well as the distribution of free gas in surface sediments the data derived within Task 2.1, data measured by the Baltic Gas partners during research cruises, information derived from seismic lines as well as geochemical data derived from literature recherché were considered.

For aquatic environments like the Baltic Sea, the transition from the degradation of organic matter by microbial mediated processes driven by agents like oxygen, nitrate or sulfate to the formation of methane by fermentation is indicated by the sulfate-methane-transition-zone (SMTZ). Within the SMTZ the pore water concentration of sulfate is entirely consumed by degradation of organic matter and re-oxidation of methane (Fig. 3).

Production of methane is starting below the SMTZ. In the close vicinity to the SMTZ concentration gradients of sulfate and methane are steep and well defined. From the perspective of biogeochemical analysis and sampling techniques, the depth of the SMTZ can be well defined by pore water studies, whereas measurement of methane fluxes from sediments into the water column or atmosphere are much more demanding. Therefore, the sediment depth of the SMTZ provides a robust – in terms analytical accuracy and data availability- proxy for identification of regions at the seafloor of the Baltic Sea where high or low methane production as well as fluxes of CH_4 into the water column are expected. For example, low SMTZ depths, suggesting high CH_4 concentrations and fluxes into the SMTZ, are mainly observed within mud sediment located in basins and valleys. In these regions the median value of the SMTZ is about 0.2 m. For muddy sediments located in plains, a much wider range (0.2 to 2.2 m) and a median depths of the SMTZ of about 0.6 m were derived (Fig. 4).

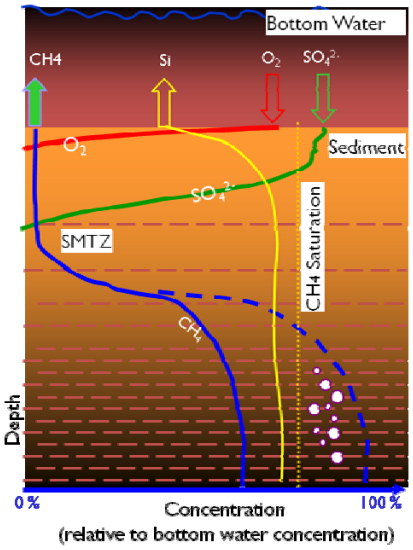

Figure 3: Pore water profiles in sediments related to the Sulfate-Methane-Transition-Zone.