Baltic Earth Working Group "Marginal Seas – Humans and Environment" Minutes of the Second Meeting (TEAMS) Jan 29, 2025, 09:00 - CET

1. Participants:

Cátia Milene Ehlert von Ahn (CvA), Germany; Peter Arlinghaus (PA), Germany (temporary); Helge Arz (HA), Germany; Hayley Cawthra (HC), South Africa; Peter Clift (PC), UK; Joanna Dudzinska-Nowak (JDN), Poland; Gary Greene (GG), USA; Matthias Gröger (MG), Germany; Jan Harff (JH), Poland (protocol); Katarzyna Koziorowska-Makuch (KKM), Poland; Karol Kulinski (KK), Poland; Markus Meier (MM), Germany (temporary); Marcus Reckermann (MR), Germany; Ralf Weisse (RW); Jinpeng Zhang (JZ), China, Wenyan Zhang (WZ), Germany

2. Preface:

The meeting on Jan 29, 2025, was the second since the BE Working Group was established on Oct 1, 2024. At its first meeting on Oct 24, 2024, a general strategy and road map was discussed. It was proposed that processes to be studied, the variables and methods for trans-regional and interdisciplinary comparisons of marginal seas be put on the agenda of the second meeting. As the basis for discussion the second WG meeting started with prepared contributions to shed light on those comparisons, considering the interaction of climate, geo-, eco, and socio-economic systems. Corinna Schrum agreed to take over responsibility for the ecosystem and biodiversity of marginal seas, but due to overlapping commitments she was not able to join the second meeting of the WG. She will present a corresponding lecture within the framework of the Szczecin Marginal Seas Webinar series on June 5, 2025.

3. Agenda

Introduction J.Harff: WG's road map, objectives of the meeting

Prepared contributions

A) Processes, variables and proxies

H. Arz: Structures, sedimentary archives and paleo-environmental proxies.

M. Meier: Hypoxia in marginal seas.

K. Kulinski: The carbon cycle as integration for research in marginal seas.

W. Zhang: Sediment transport, hydrodynamics and carbon storage.

R. Weisse: Climate, sea level, waves.

J. Dudzinska-Nowak: Coastal specifications.

J. Harff: Marginal seas - Isostatic adjustment and relative sea level change.

P. Clift: Control of the influence on the evolving sediment supply to marginal seas: Example from the Gulf of Mexico.

Break

B) Natural and human drivers

- M. Reckermann: Multiple drivers in Earth systems of the Baltic Sea region Past and future aspects.
- E. Fisher: Migration of Hominins via coastlines.

C) Data

M. Gröger: From local to global (ground to space observation) vs./plus modeling (paleo- to future scenarios).- (ppt file submitted by email)

Break

Discussion

- Goals of the WG
- Marginal Seas definition
- Classification parameters (variables) in terms of climate, geosystem, ecosystem, and socioeconomic system.
- Management aspects (cause-effect network of variables)
- Publications (contributions to scientific congresses, printed results)

Summary and conclusion (J. Harff)

4. Results

- Goals of the WG

For the time being, JH used a preliminary formulation that describing the goals as "contributions to a marginal seas classification system supporting standardized management strategies for sustainable development". The discussion of this topic is ongoing.

- Terminological definitions of marginal seas

It was agreed that the terminology must be determined by the scientific task (MM, RW). The question of whether coasts or basins of marginal seas are the focus of the working group's objectives led to the proposal of RW, MR, KL to **replace** the term **marginal seas by coastal seas**. (This question has not been finally resolved.)

HA gave a comprehensive presentation of various definitions of marginal seas. Given the working group's objectives a definition should consider three aspects: **1) spatial frame** provided by the physiographic description (HA) to be supplemented by the **2) time frame** of the processes to be investigated. EF and JH suggested the period from the prehistoric appearance of Homo sapiens **300.000 BC to 2100 AD**, the limit of reliable future climate projections. The reference parameters of the intersection of climate, geo-, eco- and socio-economic system (variables) provide **3) scientific** (disciplinary) frame to solve a management task with regard to improve the environment and optimal use of the resources of marginal seas.

- Classification parameters in terms of climate, geosystem, ecosystem, and socioeconomic system

In their prepared contributions, the speakers presented **parameters and variables to decribe them** for the classification of marginal seas and their coasts from various disciplinary perspectives.

HA described the **facies and architecture of sediment sequences** in the context of geosystems for the classification of marginal seas and mentioned possibilities for data acquisition by measurements, interpretation of proxy variables and derivation of secondary data through modeling. PC presented an example from the Mississippi Delta, showing how sediment supply is affected by agricultural activities and climate variation in the source regions of the sediments, such as the Appalachians. This can be reconstructed by interpreting proxy variables by **provenance analysis**. MM focused on **hypoxia** occurring in the **marginal sea basins** essential for ecosystems, and their relationship to **temperature**, **salinity and deep water residence time**. The land-based **discharge of nutrients** acts as a driver for the development of hypoxia, with which KK specified the relationship to the **carbon cycle** when he highlighted the marginal seas as important carbon sinks for climate dynamics. WZ underlined this importance with his models of balancing carbon storage in Holocene sediments of the Baltic Sea.

For the development of coasts, the parameters are weighted differently than for the basins. RW explained how extreme values of sea level rise, storms and winddriven waves and tidal waves determine the morphogenesis of coasts. JDN described the interaction with anthropogenic activities using the southern Baltic coast as an example. JH described the influence of climate-ruled cycles such as GIA and relative sea-level change on coastal environments and thus on human habitats. EF specified this effect on human migration behavior by depicting prehistoric migration pathways of the species Homo sapiens.

Due to technical problems, the contribution of MG "From local to global (ground to space observation) vs./plus modeling (paleo- to future scenarios)" was not presented during the meeting on Feb 29. The author submitted the ppt-file by email on Feb 30, 2025. In his presentation MG referred to **gridded global oceanographic and climate data sets** which are available for numerical studies as to be discussed by the Marginal Seas WG.

- Management aspects (cause-effect network of variables)

MR presented systematical efforts by the *Baltic Earth* working group "**Multiple drivers of Earth system changes in the Baltic Sea region**" to link environmental changes and relevant drivers within the Baltic Sea. As well the "impact matrix" (Reckermann et al. 2022, https://doi.org/10.5194/esd-13-1-2022, 2022) as the linkage plot of drivers and impacted parameters (Climate Change in the Baltic Sea 2021 Fact Sheet, https://www.researchgate.net/publication/354338918) exemplify cause-effect relations of marine environmental variables and natural and anthropogenic drivers as base for management strategies' elaboration. It was suggested that the chances for generalization and quantification of the methods developed for the Baltic Sea should be checked with regard to applicability by the *MargSeas* working group. A direct discussion within the *Baltic Earth* working group is recommended (JH).

- Publications (contributions to scientific congresses, printed results)

The participants agreed that more discussions are needed to specify the program and road map of the MargSeas WG. It was proposed to use the BSSC 2025 conference (Sopot, May 26-30, 2025) as another occasion for a WG meeting rather than for the presentation of scientific results. At the next meeting the form of a final publication of the WG should also be debated. As an "added value" a white paper is recommended which requires a higher scientific integration than separate research papers bundled as a special issue of a scientific journal. "Earth Systems Dynamics" (IF 7.94) offers the optimal framework for such a white paper (MR, KK, GG, RW, JH). Results to be published in this white paper should be presented at the 6th Baltic Earth conference in 2026.

- Next meeting

JH proposes a hybrid onsite/online meeting during the Baltic Sea Science Congress at Sopot, Poland, May 26-30, 2025.

protocol: J. Harff, Feb 14, 2025