Reconstructing the Changing Impact of the Danube on the Black Sea and Coastal Region (ReCoReD)

Area: **NW Black Sea**

Research Vessel: **RV Mare Nigrum, GeoEcoMar, Romania**

Chief scientist: **Andrew Tyler, University of Stirling, UK, https://www.stir.ac.uk/**

Co-chief scientist (if any): **Jana Friedrich, HZG, Germany, https://www.hzg.de/index.php.de**

Other project partners: University of Hamburg, https://www.uni-hamburg.de/en; GeoEcoMar, http://www.geoecomar.ro/website/en/index.html

Date: 4 May – 11 May 2016

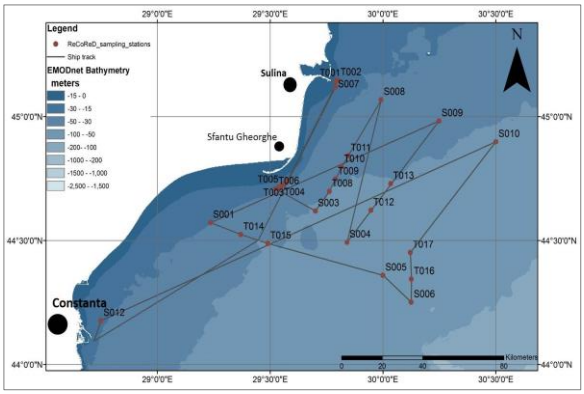
RV Mare Nigrum

ReCoReD Research Team

Professor Andrew Tyler
University of Stirling, United Kingdom
Aim and Main Objectives

"EUROFLEETS2 made possible what would otherwise have been very difficult to achieve, using state of the art science and technology to develop a comprehensive conceptual model of the transfer of sediment and associated contaminants from the Danube to the Black Sea and assess the environmental and ecological implications"

Prof Andrew Tyler, Chief Scientist for the ReCoReD Survey Area:



ReCoReD Survey Area: Danube Delta – Black

Main objectives

Aim: To reconstruct the changing impact of the Danube on the Black Sea and Coastal Region and assess the recovery of the north-western Black Sea shelf. The data will be fundamental in building a conceptual model in understanding the flux and impact of sediment and associated contaminants transfer from the Danube to the Black Sea and assess the environmental and ecological implications.

Objectives:

i) Using Earth observation methods for the reconstruction of sediment plumes and eutrophication events
   a. Optical and hydrographical characterisation of the Western Black Sea Shelf waters
   b. Validation of remote sensing data. The focus was on the use of the Copernicus service (ESA missions Sentinel 2 and 3), but also Landsat 8 and MERIS.
   c. Time series and spatial analysis of SPM and chlorophyll a, and pelagic primary production

ii) Reconstructing the variation of Danube sediment fluxes into the Black Sea through sediment coring to assess: Hypoxia drivers, impact and ecosystem recovery and N-cycling in the Danube estuarine transition zone

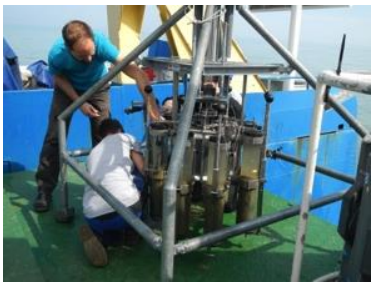
Work progress and main achievements

ReCoReD brings together leading scientists from Germany, the UK and Romania, including the excellent GeoEcoMar support team on board the R/V Mare Nigrum, to provide a multidisciplinary approach that encompasses the next generation satellite capability from ESA's Copernicus Programme with state of the art in-situ and laboratory analysis of water and sediment. We collected samples to reconstruct sediment and associated particle flux from the Danube into the Black Sea from a series of sediment cores, dated with high-resolution ^{210}Pb and ^{137}Cs dating to reconstruct the chronology of sediment supply over the last ca. 100 years. In addition, we collected samples to examine the pelagic system; to assess the present influence of the Danube River on productivity and particle turnover. Real time Earth and archived (Coastcolor MERIS) observation (Sentinel 2 and 3; Landsat 8) data are also used to reconstruct the sediment pulses and eutrophic events in the Romanian coastal region. In-situ radiometric measurements were made to calibrate and validate Sentinel 3 satellite data, also as part of ESA's Sentinel 3 validation team. These data along with samples and incubation experiments, are being used to provide measures of phytoplankton biomass and primary production in the coastal zone.

The ReCoReD project deployed a SEAGAURD sensor-equipped mooring to monitor the benthic oxygen regime over the hypoxia-prone season, while sediment cores are used to reconstruct past hypoxia events on the Romanian Shelf Sea environment, and relate these episodes and the system recovery to natural and anthropogenic drivers. While the long-term mooring looks at seasonality of hypoxia events, assessment of system recovery is based on longer-term historical measurements. These measurements are being used to assess the changing impact of the Danube and that of hypoxia on the sediment in terms of benthic oxygen uptake and nutrient recycling. From surface water and bottom sediment samples we will also assess the processes of nitrogen cycling in the Danube transition zone using $^{18}O\text{-}NO_3$ to $^{15}N\text{-}NO_3$ fractionation ratios and identify the microbial species responsible for nitrate uptake. From sediments cores we will also reconstruct eutrophication history using sedimentary ^{15}N records and relate these measures to ^{210}Pb dated chronologies and satellite reconstructions of eutrophic events.

Together, these data are being used to develop and validate 3D hydrodynamic models of water and sediment dynamics the Danube Delta and Black Sea environment.

Deploying Optics Cage to measure Inherent Optical Properties (Absorption, Attenuation and Backscattering)



Multi-corer for sediment sampling

CTD Rosette System, with twelve five sample bottles

For more information:

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Co Chief Scientist, Dr Jana Friedrich: Helmholtz-Zentrum Geesthacht

Projects :

Danubius-RI : H2020 ESFRI Preparatory Phase Project : www.danubius-ri.eu

GloboLakes : UK NERC Consortium Project : www.globolakes.ac.uk