

The protection of coastal areas

Coasts and estuaries are vulnerable areas with rare biotopes threatened by industrial activity, maritime transport and also tourism. To protect them effectively we need a better knowledge of how ecosystems work and improved methods of assessing water quality. Belgium has acquired expertise in this field, due in particular to imaging spectroscopy that offers an interesting alternative to laborious and costly sampling campaigns, sometimes in areas of difficult access. Fine spatial resolution permits a more precise discrimination between the biogeochemical compounds present in sea water, brackish water and intertidal sediments by identifying their spectral signature.

SCHELDT

Water quality in the Scheldt estuary

The project was concerned with the Scheldt estuary and plume, the coastal zone where the estuarine waters continue their dilution with sea water. In this very particular transitional ecosystem, significant variations in water quality and composition reflect the intense pressure of human activity and the tidal system. The research project looked at the potential of imaging spectroscopy in detecting the biogeochemical parameters reflecting water quality. A statistical analysis of a large number of parameters and spectra made it possible to derive correlations between classic ground truth measurements and the hyperspectral information provided by the CASI sensor. On the basis of the relations found, synoptic maps of biochemical parameters were drawn up: coloured dissolved organic matter (CDOM), dissolved organic carbon (DOC), dissolved inorganic carbon (DIC) and partial CO₂ pressure. These encouraging results could be further refined, to include in particular physical models incorporating the bathymetric effect.

Coordinator

- Signal and Image Centre, RMA

Partners

- Laboratorium voor Protistologie en Aquatische Ecologie, UGent
- Océanographie Chimique et Géochimie des Eaux, ULB
- GHER, ULg
- Unité d'Océanographie Chimique, ULg

BRADEX

Detection in shallow waters

For shallow coastal and inland waters, there is scope for improvement in estimating some parameters thanks to optical remote sensing data. In such waters, adjacency effects produced by the proximity of land ("environmental straylight") disrupt the observations used to estimate concentrations of chlorophyll and suspended matter. The BRADEX project looked at the possibility of detecting the effects of environmental straylight, achieving undeniable progress in improving the scientific bases of image processing for these particular zones. A large quantity of radiometric data obtained from satellite (MERIS, MODIS, CHRIS) or airborne (AHS) sensors, instruments on board vessels (TriOS) or manual measurements (ASD), combined with atmospheric measurements (CIMEL photometer) and field measurements (CHL, TSM), were collected simultaneously to compile a reference database that made it possible to produce a detection algorithm for pixels affected by adjacency effects. This algorithm could ultimately be integrated into the MERIS image processor used by the European Space Agency. The database also proved very useful in detecting blooms of Noctiluca, a luminous variety of phytoplankton.

Coordinator

- MUMM

Partner

- Université du Littoral de la Côte d'Opale, France

TIDESSED + SEDOPTICS

Finely characterising sediments

Very rich ecologically, the Scheldt estuary is home to one of the largest wading bird populations in Western Europe and has several rare biotopes, such as freshwater tidal marshes. As the estuary is also the site of industrial activity and an important commercial shipping route, managing the zone is a delicate matter that could certainly be made easier with a better understanding of its ecosystems.

The same applies to sites like the nature reserve "De IJzermonding" at the mouth of the Yser or the "Plaat van Walsoorden" and "Molenplaat" in the Western Scheldt.

A number of key biological, chemical and physical processes are at work within the large expanses of soft sediments exposed at low tide, such as photosynthesis by unicellular microphytobenthos (the first link in the food chain) and erosion or deposition of sediments.

The goal set and achieved by the projects was to use hyperspectral measurements obtained by the HyMap and AHS sensors to quantify the principal biological and physical parameters.

For the Scheldt estuary, maps of chlorophyll *a* content, grain distribution and size, and water and organic matter content were produced. The coastal management authorities were also provided with a map of primary production, a classification of ecotopes and a sediment stability map.

Research confirmed the importance of the visible and near infrared in analysing sediments in tidal zones.

Coordinator

- Afdeling Hydraulica, K.U.Leuven

Partners

- Onderzoeksgroep mariene biologie, UGent
- TAP, VITO
- Laboratorium voor Protistologie en Aquatische Ecologie, UGent
- Nederlands Instituut voor Ecologie, Netherlands
- Laboratoire de Planétologie et Géodynamique, Université de Nantes, France

KABAR

Preserving coral reefs

With nearly 600 species of coral reefs, Indonesia is home to the world's richest coral diversity. The Tanimbar archipelago, located in eastern Indonesia, is part of a site recognized by the World Conservation Monitoring Centre as being exceptionally rich in endemic maritime species. Yet it is a site threatened by pollution, tourism, environmental changes (bleaching), sedimentation and destructive fishing methods, such as the banned practices of blast and cyanide fishing. Mapping the coral distribution is a vital prerequisite for any attempt to preserve these exceptional ecosystems. The project looked at the potential of hyperspectral imaging (airborne and satellite) for obtaining measurements of sufficiently high spectral and spatial resolution for the precision mapping of coral reef varieties and health, as well as of the sea depth. For date, the study zone, is a small island which is home to both fringing reefs (off a non-coral coast) and a large patch reef (isolated circular reef within a lagoon). By combining CASI data, atmospheric and bathymetric data and field samples, the project was able to draw up a bathymetric map and a classification of coral reefs based on their geomorphological characteristics up to a depth of 30 metres. These are a valuable aid to international programmes for the protection of natural resources as well as for the economic survival of an island that is highly dependent on its marine environment.

Partners

- TAP, VITO
- Vakgroep Geografie, UGent
- Agency for the Assessment and Application of Technology for Natural Resources (BPPT), Indonesia



ORMES

The Port of Antwerp more accessible

The Port of Antwerp, the fourth largest cargo port in the world and Europe's biggest, is one of the principal sources of Belgium's prosperity. It provides direct or indirect employment for more than 140,000 people, is visited by 15,000 vessels every year and handles 167 million tons of cargo. The challenge for the future is to ensure that the port remains accessible to container ships that are becoming bigger all the time. For this, continuous dredging of the shipping channels in the River Scheldt is vital.

Dredging today must respect increasingly strict environmental standards. At the same time, it is possible to limit maintenance dredging volumes by identifying the best dumping locations. This is where a knowledge of the movement and behaviour of sediment concentrations in both time and space can help.

The ORMES project chose the Scheldt Estuary as the study site due to its dynamic complexity. The private partner in the project, a consultancy office that advises on subjects including water management and dredging works, needs information of this kind for the services it offers its clients. Among other things, it uses data on fluctuations in the turbidity of the Scheldt waters as an aid in identifying the optimal dredging location to ensure that any backflow of the sediment to the channels and harbour is kept to a minimum. Earth observation data, obtained using airborne sensors at various stages of the tidal cycle, are ideal for this purpose. Thanks to the project, staff at the private partner now have access to software that permits easy mapping of sediment data.

Partners

- TAP, VITO
- International Marine and Dredging Consultants

