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Scientists design virtual library for world coasts

Scientists have developed a classification system to help international government agencies organise vast stores of data used to understand and manage world coastal zones.

Using a combination of biological, geographical and chemical data, the classification system will help resource management agencies, industry groups and coastal communities understand the effects of natural and human influences on coastal zone areas. Dr Bob Buddemeier, an environmental scientist at the University of Kansas, says the team has developed applications for a computer program, known as DISCO, to access and classify vast amounts of coastal data.

"The tool utilises information that is globally available from existing environmental databases, such as remotely sensed data about sea temperatures, nutrients, salinity and rainfall. DISCO allows us to collate and organise diverse information sources from satellites, computers and field samples. It provides a basis to compare changes in the ecosystem health of different coastal regions," said Dr Buddermeier.

"Our approach is a bit like organising a vast library catalogue of coastal data. There's loads of diverse information sources but they need to be systematically organised for people to access and use," he said.

A major objective is assessing the uptake and release of nutrients in coastal zone regions worldwide. The tools being used are bio-geochemical budgets of nitrogen and phosphorus for specific sites - primarily bays, estuaries, and lagoons - in the coastal zone, together with an objective classification, or 'typology', of environmental and human variables.

"We are trying to map the world coastal zone into land, coast and sea 'cells' and will fill those cells with data on dozens of variables, ranging from air temperature to population density, and from bathymetry to soil texture. The data are made available through a series of international workshops," said Dr Buddermeier.

The cells are then statistically clustered to identify similarities and differences, which are then in turn examined for their ability to describe the type of biogeochemical budgets in the coastal database. Once the data are organised in a set of typologies that can predict the budgets, scientists can then extrapolate coastal zone function at regional and global scales.

Overall, the process is reminiscent of the classical approach to scientific investigation – observing, collecting and assimilating large amounts of information and then looking for trends, explanations and specific phenomena. A bit like what Charles Darwin did before writing his seminal work *The Origin of the Species*.

Dr Bruce Maxwell, a colleague of Buddermieier at Swarthmore College, says the ability of modern sensor systems to generate data on a global scale far outpaces the ability of experts to analyse, characterise and understand relationships within the data.

“As we set out to study the human impacts on global climate change, we need better web-based tools to identify relationships and extract information,” he said. “We have used Biogeoinformatics of Hexacorals and the KGSMapper at the University of Kansas, and LOICZView and DISCO at Swarthmore College.”

“The data tools have been used by researchers across a spectrum of scientific research and continue to incorporate new data and capabilities. They are essential to LOICZ’s goal of describing and understanding the interactive physical, chemical, and biological processes that regulate the Earth’s system,” explained Maxwell.

At the science meeting, Maxwell said the tools for data mining have been recently used to link scientific analysis to vulnerability assessments for an estuary eutrophication project undertaken by the US National Oceanographic and Atmospheric Administration. The tools have also been successfully used to derive the environmental characteristics of habitat in Korea and potential impacts of climate change to flora and fauna.

“We recognise there are many ways to classify and extrapolate coastal characteristics, such as sediment dynamics, hydrology and nutrient exchange,” said Dr Buddermeier. “But our choice is the LoiczView geospatial software package. The software runs on UNIX and LINUX platforms, and has been adapted for the internet.”

Dr Buddermeier and Dr Maxwell presented the LOICZView and DISCO database and software tools to more than 300 scientists at the Land-Ocean Interactions in the Coastal Zone scientific meeting, held in The Netherlands (27-29 June 2005). The meeting was funded by a multiplicity of international organisations, the UN, and the Netherlands Science Foundation and Royal Academy of Sciences and contributes to the global change research of the International Geosphere-Biosphere Programme and the International Human Dimensions Programme on Global Environmental Change. The scientists highlighted future scenarios of coastal change and how science is being used to help communities adapt to change.

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