

# Chapter 89

## Coastal Atlas Interoperability

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### ABSTRACT

*This chapter defines the coastal web atlases interoperability problem, introduces interoperability standards, and describes the development of a semantic mediator prototype to provide a common access point to coastal data, maps and information from distributed coastal web atlases. The prototype showcases how ontologies and ontology mappings can be used to integrate different heterogeneous and autonomous atlases (or information systems), using international standards such as ISO-19139 for metadata encoding and the Open Geospatial Consortium’s Catalogue Service for the Web specification. Lessons learned from this prototype will help build regional atlases and improve decision support systems as part of a new International Coastal Atlas Network (ICAN).*

### INTRODUCTION

Advances achieved in Web mapping technologies are allowing a much wider audience to develop and use Web geographic information systems and, in particular, coastal web atlases (CWAs), which were discussed in Chapter 1. While multiple benefits are derived from these tailor-made atlases (e.g., speedy access to multiple sources

of coastal data and information, economic use of time by avoiding individual contact with different data holders), the potential exists to derive added value from the interoperability of disparate CWAs, to optimize decision-making at a variety of levels and across themes.

Within the context of coastal Web atlases, interoperability can be briefly defined as the ability of several autonomous, heterogeneous and distributed CSWs to communicate and exchange resources (information, metadata, data or maps)

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or be used together despite their differences. In a wider context, interoperability has been defined in ISO 2382-1 (ISO/IEC, 1993) as the “capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units.”

Interoperability of coastal web atlases will help to unify the discovery and access of information to users (e.g., scientist, coastal resource managers) and categorize results using a convenient vocabulary. Data discovery relies on documentation provided as part of metadata (notably discovery metadata), such as the dataset title, abstract, extent, keywords, etc. In the context of distributed resources, this information is present in different heterogeneous formats, and systems, according to several existing metadata models and standards. While various efforts exist to provide a unified common form to harmonize different standards (see section 4.3), problems still arise with metadata semantics.

Metadata terms may be agreed upon within an organization or a region, but not necessarily between or among other organizations or regions. Use of the word “seabed” in Europe versus use of the word “seafloor” to describe the same feature in North America is a good example of this scenario. From both human and computational standpoints, users need assurance that the concepts, terminology, even the abbreviations that are shared between two or more individuals, systems, or organizations are understood by all to mean the same thing. In this way the quality of data retrieval and subsequent data integration are greatly increased, as they are based on meaning rather than on mere keywords.

Several communities including the database, artificial intelligence and geosciences communities have studied interoperability methodologies in the past two decades. These include database integration (e.g., Yétongnon *et al.*, 2006) and mediation (e.g., Wiederhold, 1992) approaches. Several mediation systems and prototypes have

also been developed: examples of such systems are TSIMMIS (Garcia-Molina *et al.*, 1997), PICSEL (Goasdoue *et al.*, 2000), Information Manifold (Kirk *et al.*, 1995), and AGORA (Manolescu *et al.*, 2001).

This chapter discusses standards and tools, defines and proposes solutions on the use of controlled vocabularies and ontologies, and provides an overview of the International Coastal Atlas Network (ICAN) prototype. The solution proposed here is based on ontology mediation and on information that is shared via web services.

## **INTEROPERABILITY: WHY IT MATTERS**

In recent years significant momentum has occurred in the development of Internet resources for decision makers, scientists and the general public who are interested in the coast, where worldwide, 20% of humanity live within a 25 km range, and 39%, or 2.2 billion people, live within a 100 km range (e.g., Wright 2009). Given that no CWA functions alone as an island, and is often part of a larger universe of resources that is needed for effective marine spatial planning, resource management, and emergency planning, CWAs must build a common approach toward managing and disseminating the coastal data, maps and information that they contain (Wright *et al.*, 2007). Sometimes more than one CWA may be needed in order to address regional problems such as hazard mitigation, climate change, intergovernmental marine spatial planning, etc. As an example, if there is a dataset missing in one atlas, it may be immediately located within another. Often, similar datasets from different atlases cover different areas and can be combined in order to build a dataset that covers a wider area. For instance local high-resolution bathymetry data from different atlases one can participate in building a regional high-resolution bathymetry dataset.

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