



Book review

Arc Marine – GIS for a Blue Planet

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The subtitle of *Arc Marine*, referring to the ‘Blue Planet’, immediately exposes the fact that Geographic Information Systems (GIS) currently are mainly used to manage the immediate human habitats on terra firma; this by and large neglects the majority of Earth’s surface. Accordingly, a volume that systematically discusses approaches to collect, organize, apply analytical processes, and communicate geospatial information about oceans is timely, needed, and is certain to be much sought after.

Arc Marine, written by an interdisciplinary team of experienced researchers, offers a hands-on, practice-oriented approach to leverage the potential of Geographic Information Science, Technology and Systems for research and monitoring in a marine environment. A framework for a universal marine data model is the centerpiece and main thrust of the book. This makes it immediately accessible, even to readers with little or no background in oceanography.

Beyond geospatial science, *Arc Marine* is directed at resource managers for deep water, open ocean areas, as well as coastal environments. The latter, of course, require some interfacing with terrestrial and ‘amphibian’ GIS setups, providing interesting challenges for managers and GIS specialists alike. Overall, though, this volume offers an entry level to intermediate approaches to marine GIS with a clear focus on data modeling.

One of its strengths, perhaps also a weakness, is that *Arc Marine* clearly is built on the Environmental Systems Research Institute (ESRI)’s ArcGIS software architecture. While this somewhat constrains the practical value for readers working in different environments, it becomes all the more useful for the many ESRI users around the world. Still, the demonstrated data models are generic approaches to organize and manage information, and are fully valid and applicable when working with alternative architectures.

After a wide-ranging introduction, Chapter 2 steps right into a discussion of ‘Common Marine Data Types’ organized into thematic data layers as the main building blocks for data models. Then a quick overview is given of data types, subtypes, and various features types particularly needed in marine environments, including multidimensional fields and multimedia data.

Chapter 3 addresses ‘Marine Surveys’ and is based on two United States Geological Survey (USGS) projects that demonstrate both the huge volume and diversity of marine data acquisition, and the value of starting with a well-defined data model. Characteristics of marine data collection are demonstrated, such as survey cruises, tracks and profiling, and the temporal dimension. A discussion of basic object-relational data modeling is directed at the uninitiated among intended readers.

Chapter 4 demonstrates use of the Arc Marine data model through five case studies. Tracking marine animals through their environments requires advanced modeling skills and calls upon lessons learned from the introductory sections. Readers are taken through concise but complete workflows; the value of a well-defined data model is evident from the point data are recorded, through analysis, and on to visual presentation. Like other chapters, this one finishes with a set of class definitions that summarize new building blocks for the model, and offers extensive references pointing the reader to published resources.

Dealing extensively with 3D data, Chapter 5 adds another dimension by ‘Implementing Time Series and Measurements’. Recognizing that oceans are highly dynamic environments, the fourth dimension of temporal data is considered an integral part of a marine data model, and requires advanced capabilities to visualize as well. Like many other sections in this book, this discussion of temporal modeling is extremely valuable to ‘terrestrial’ researchers as well, and provides an easily accessible and well-structured treatment of an important topic.

Regarding the ‘terrestrial interfacing’ mentioned above, Chapter 6 addresses ‘nearshore and coastal/shoreline analysis’. Additional elements and tools for data modeling are introduced. Readers will imperceptibly be drawn deeper into the waters of data

modeling and spatial analysis by moving through yet another defined topical application domain.

Chapter 7, 'Model Meshes', and Chapter 8, 'Multidimensional GIS', should be required reading for everyone that works with multidimensional application domains of GIS, from atmospheric sciences to subsurface geology. Many GIS architectures and tools do not 'yet' fully support 3D spaces, and the concept of 'meshes' and its use in dynamic modeling demonstrates a plausible solution, at least until full 3D support becomes inherent to geodatabases and analytical environments.

The volume's Epilogue references earlier attempts at marine data modeling, and acknowledges the role and importance of the Open Geospatial Consortium's work on interoperability – one of the core topics in each and every geospatial data modeling initiative. Portals, various formats, and tools are briefly mentioned, but not discussed substantively, (e.g. metadata) pointing to the fact that a marine Spatial Data Infrastructure (SDI) should be the main theme of a sequel volume.

Data model(s) introduced in *Arc Marine* are well tested, and have been applied and discussed within the community for a number of years. Most of this work can therefore be considered mature and 'safe' for use by practitioners around the world. One major strength is that this publication offers a head start into data modeling for marine environments as a prerequisite for well-organized data collection, analysis and visualization.

Another key asset is its companion website maintained by Dawn Wright at <http://dusk.geo.orst.edu/djl/arcgis>. This site details how the Arc Marine data model actually was a community effort; it provides useful materials and links (e.g. the ESRI data model support site offering templates and discussion forums). As such, this book is a well-structured entry point and gateway to a wider range of evolving resources offered online.

Publication within the ESRI Press applications series ensures the book is well-produced with numerous color illustrations, and is edited for a broad audience. It comes highly recommended to marine researchers and resource managers involved with data collection, analysis and decision support; it will also benefit a broader audience interested in geospatial data modeling in general. Initial browsing will motivate the reader to go beyond 'sticking one's toe into the waters' of marine GIS applications to discover the benefits of organizing the volumes of oceanographic data into a well-defined data model that follows a well-argued geospatial paradigm.

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