Decoding Models

WAY BACK, before the dawn of supercomputers and clusters, models of the oceans were simple equations with analytical solutions, or spinning tanks, appropriately scaled to represent the depth and width of a basin. Oceanographers have evolved from creating simple representations (models) to using numerical solutions of coupled equations to understand the complex interactions of the ocean and its forcing and ecosystems. Before, we sought to understand the structure of the ocean circulation systems; now, we seek to predict Earth's climate (its atmosphere, ocean, ecosystems, and cryosphere coupled appropriately in physics and numerics) or forecast the next phytoplankton bloom. As computational power has increased to the point where your desktop word processor has more power than the 1970 main frame, the field of computational oceanography has grown in sophistication and complexity.

Practitioners of virtually every discipline boast their own language and terms of art. Computational oceanographers, or ocean modelers (as we refer to them) are no exception. For the uninitiated, a typical modeling article in a technical journal appears, at first and perhaps second blush, to be written in gibberish. Readers require decoders for terms such as "data-assimilative hybrid isopycnal sigma-pressure coordinate ocean model" and "zero mean-random process exponentially decorrelated in time"—not to mention "discretization," "parameterization" and "3-D eigen decomposition." What seems perfectly sensible and precise to a scientist within the discipline may be utterly incomprehensible to an outsider, even a well-trained, highly intelligent outsider.

More and more, a new generation of scientists weaves together numerical representations of the oceanic systems and the data that captures the essence of the system at a particular time and place. The use of data and models together allows scientists to project what has been and what will be. To further this field, observationalists need to understand how ocean modelers use the data they collect ("data assimilation"), just as modelers need to understand how ocean observations are made and where uncertainties exist in the data they use. All scientists also need to keep up with fast-moving information technology trends, driven largely by outside forces. What worked best for the ocean sciences community yesterday may not be ideal tomorrow. In this magazine issue, our colleagues describe several new and exciting ocean models and modeling approaches and forecast future developments. The contributors and editors have done their best to decode modeling language for a broader audience, to facilitate important cross-disciplinary communication. While these translations are no doubt imperfect, this issue should provoke some exciting discussions.

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