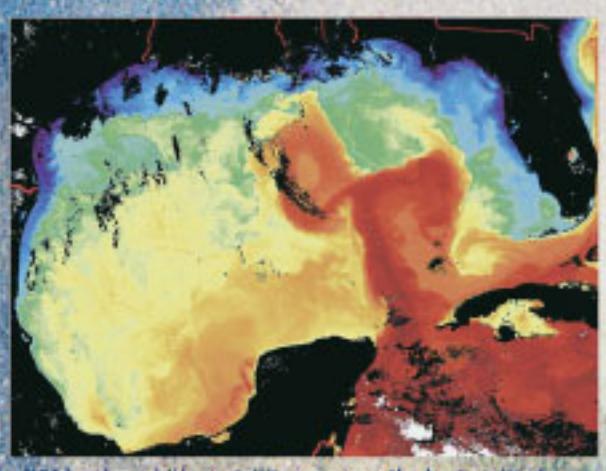
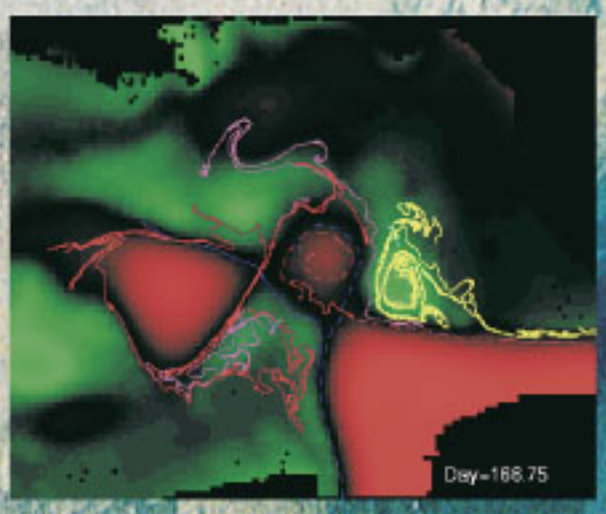
MATHEMATICS and the OCEAN



NOAA polar-orbiting satellites measure the heat emitted by the ocean surface. This image was created by combining imagery acquired over several days and keeping data from ocean areas not covered by clouds. The red, or "warm," area shows the Loop Current in the Gulf of Mexico. There is also a small circulation feature north of the western end of Cuba.
– Johns Hopkins University/Applied Physics Laboratory
http://fermi.jhuapl.edu/avhrr/gallery/sst/gulf_of_mexico.html



Effective invariant manifolds plotted for eddies detaching from the Loop Current of the Gulf of Mexico in June 1998. The manifolds delineate the eddies and orchestrate the transport in and out of their cores.
– From Kuznetsov et al.
http://www.cfm.brown.edu/people/leonid/GULF

Our scientific understanding of the ocean rests on the use of mathematics. Dominating the Earth's surface, the ocean is an essential element of the physical environment that supports life on Earth. Ocean activity, from breaking waves on sandy shores to currents that sweep the globe, is felt everywhere on Earth, even far inland.

The ocean is a principal driving force of the Earth's climate. We harvest the ocean for food, and we use it for transportation and recreation. Its vast extent, the wide range of its interacting processes, and the paucity of available data combine to make the ocean a complex object of study and have created the need for a mathematical framework.

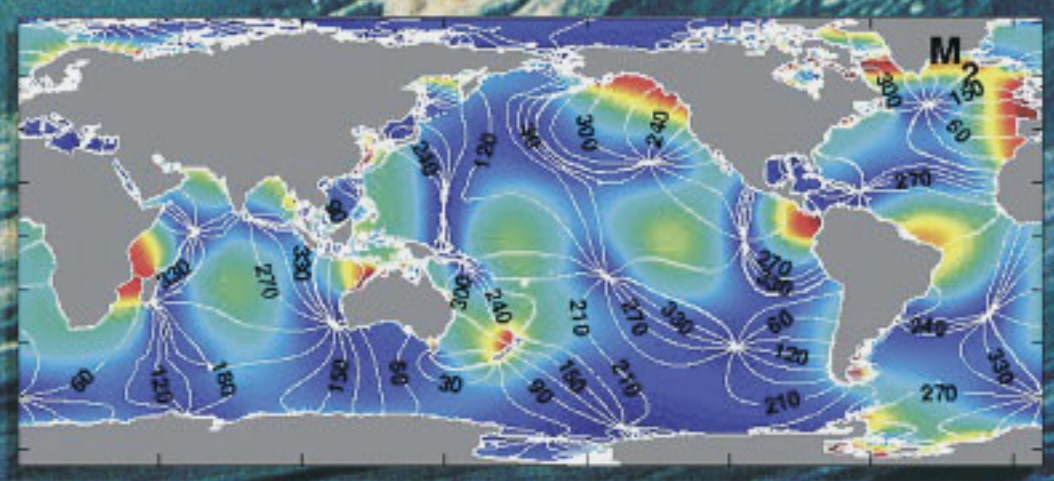
That mathematics threads through all of the ocean sciences can be seen at many levels:

- Physical modeling (fluid and thermodynamic equations and their computational solutions)
- Predictions and studies of complex motion (dynamical systems theory)
- Data collection and analysis (statistics and signal processing)
- State estimation and verification (inverse and control theories)

Balancing important results obtained at each of these levels is a fascinating set of challenges for interdisciplinary scientists, present and future.

This year's Mathematics Awareness Month program will supply resources to both the scientific and the educational communities for exploring the intriguing world of oceanography and the central role of mathematics in understanding that world.

http://mathforum.com/mam/01



Tidal amplitude (in color, increasing from blue to red) and phase lines from a global least-squares best-fit to the Laplace Tidal Equations and TOPEX/Poseidon satellite altimeter data.
– Oregon State University/College of Oceanic and Atmospheric Sciences
http://www.oce.orst.edu/po/research/tide/index.html

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