Using Real-World Data to Train the Next Generation of Scientists through the New & Improved AMS Ocean Studies

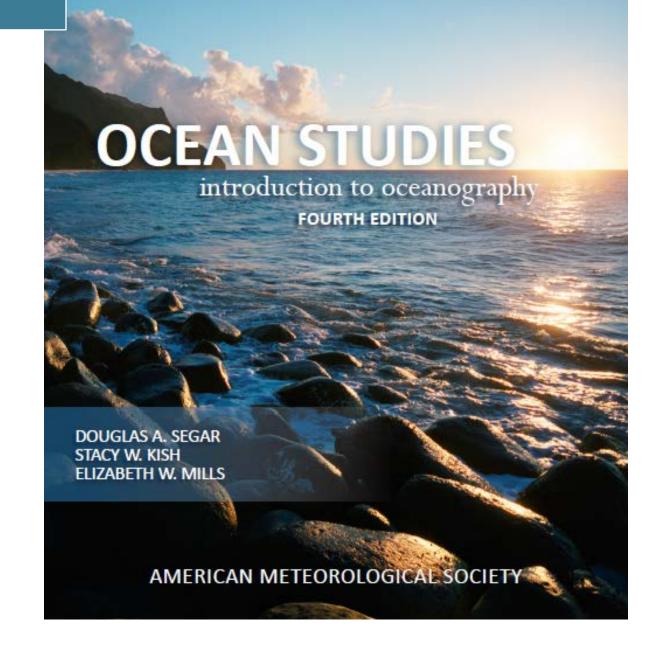
The Education Program of the American Meteorological Society (AMS) has been helping to educate the next generation of atmospheric, oceanic, and hydrologic scientists for over 20 years. Throughout that time, the Education Program has incorporated real-world events and data into all learning materials, including those for AMS Ocean Studies. AMS Ocean Studies is an introductory, undergraduate-level curriculum package that provides students with a comprehensive study of physical oceanography while simultaneously providing pedagogically appropriate investigations focused on web-delivered real-world data. AMS Ocean Studies consists of a textbook, investigations manual, and access to the RealTime Ocean Portal.



For Further

Exploration Essays

Doug A. Segar



Elizabeth W. Mills

Ocean Studies: 4th Edition

- Explores the role of the ocean in the Earth system
- Figures replaced & upgraded
- New, expanded, or significantly revised topics include:
 - Hydrothermal vent systems & communities
 - Hot spot volcanism
 - Climate change ramifications (ocean acidification & deoxygenation)
 - Natural coastal features and human alterations
 - Atmospheric rivers

• Serve as a jumping off point for more in-depth or advanced content

Stacy W. Kish



ocean. The density of ocean water increases with decreasing temperature and increasing salinity. More dense water tends to sink while less dense water rises. Thermohaline circulation transports heat energy, salt, and dissolved gases, like carbon dioxide and oxygen, over great distances and to great depths in the ocean. This process plays an important role in Earth's climate system. In the North Atlantic, for example, a warm surface ocean current flows north and eastward from the Florida Strait. At high latitudes, the surface water cools, sinks, and flows southward as cold bottom water. This heat transporting mechanism is a key component of the ocean's *meridional overturn circulation* (MOC) discussed in section 4.6.

Kira A. Nugnes

Scientific Visualization Studio

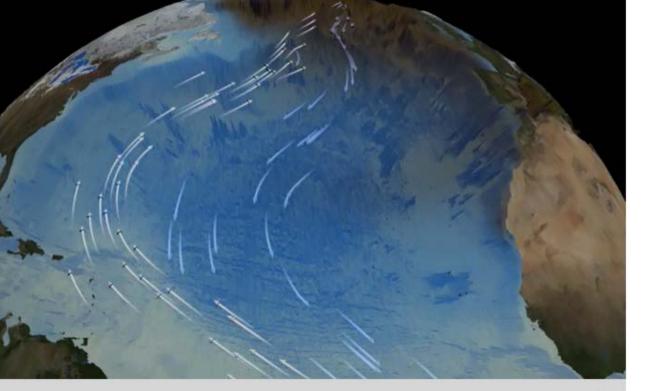
rather than actual data. The thermohaline circulation is a very slow moving current that can be difficult to distinguish from general ocean circulation. Therefore, it is difficult to measure or simulate.



http://ametsoc.org/amsedu/OTIDS/4.5.html

4.5.2 Heat Transport by Air Mass Exchange

The movement of air masses transports sensible heat from the tropics into m high latitudes. An **air mass** is a volume of air covering thousands of square kil is relatively uniform in temperature and humidity. The properties of an air mas depend on the characteristics of the surface over which it formed (its *source re* travels (Figure 4.18). Air masses that form at high latitudes, often over snow of covered surfaces, are relatively cold. Air masses that form at low latitudes are i warm. Air masses that develop over the ocean are humid and those that form o relatively dry. Hence, there are four basic types of air masses: cold and humid, dry, warm and humid, and warm and dry.



Katie L. O'Neill

This animation first depicts thermohaline surface flows over surface density, and illustrates the sinking of water in the dense ocean near Iceland and Greenland. The surface of the ocean then fades away and the animation pulls back to show the global thermohaline circulation.

• Address in-depth specific topics that complement a concept covered in the narrative

For Further Exploration

IraW. Geer

For Further Exploration

ESSAY 14.1: Dams and Marine Ecosystems

ESSAY 2.1: Investigating the Ocean Floor

Oceanographers gather information about the ocean floor using a variety of techniques; some rela-

A dam is a barrier constructed across a watercourse that impounds water in an upstream reservoir (Essay 14.1 Figure 1). It alters the flow of water and sediment in a river or stream and may disrupt coastal river and marine ecosystems by reducing river flow.

• Harmful algal blooms & dead zones

Wendy E. Abshire

- o Ocean life zones
- Ocean sediments & stratigraphy
- Ocean instrumentation
- Toxic substances and the ocean
- Recent ocean and climate policies
- o **Geoengineering**
- And much more!

Adoption of AMS Ocean Studies is an investment

into AMS professional

development opportunities for K-12 teachers

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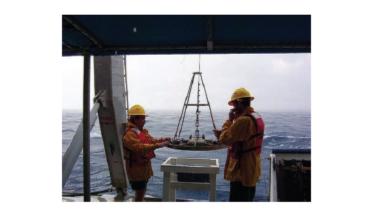
Ocean Studies Investigations Manual

- Introduces users to tools that enable them to explore, analyze, and interpret the workings of Earth's ocean
- Composed of 30 self-contained investigations (2/week)

Investigations draw from real-world ocean observations and events and build on each previous investigation to form a comprehensive understanding of Earth's ocean environment

tively simple, such as devices that scoop up rock and sediment samples from the ocean floor, whereas others, such as acoustic and gravimetric instruments, are more sophisticated. Some measurements are made in situ (immersed in the medium being measured) whereas others depend on remote sensing methods. This essay focuses on direct sampling of rocks and sediments on the ocean floor.

The most straightforward way to sample the surface of the ocean floor is with a *grab sampler* (Essay 2.1 Figure 1). This mechanical device operates much as a human hand grasping an object. More often, scientists require a vertical section of the sediment that has collected on the ocean floor. For that, a weighted coring tube is lowered a few meters above the ocean floor and allowed to fall. The weight of the tube drives it into a thick blanket of ocean sediments. The sediment core, retrieved when the tube is brought to the surface, reveals a record of sedimentation in the area through time.



Essay 2.1 Figure 1 A Young Modified Van Veen grab sampler ("Young Grab") is being lowered over the side of a ship. When it reaches the ocean bottom, the grab sampler will scoop sediment from a 0.4 m² (4.3 in.²) area. The Young Grab digs down about 10 cm (4 in.) and scoops up the top layers of sediment along with the organisms living in the sediment (infauna). Most benthic infauna live in the top 5 cm (2 in.) of sediment. [Courtesy of NOAA Ocean Explorer]



Essay 14.1 Figure 1 Dexter Dam on the Middle Fork of the Willamette River (a tributary of the Columbia River) in Oregon. [Courtesy of NOAA/NMFS West Coast Region]



AMS Ocean Studies Learning File

 Weekly Ocean News
 Last Week's Ocean News

 (Some links may have been discontinued by source

 Supplemental Information...In Greater Depth

Welcome to Winter Break! All of Fall 2017 COS can be found in the Archives or the Previous Week's Learning Files link. Spring 2018 will begin on January 15.

Previous Week's Learning Files

Chapter 13, 14, and 15 Current Ocean Studies

Ocean Studies eInvestigations Manual

Images Web Addresses

AMSEDU Bookstore, Student Resources, Additional Links

 Textbook Chapter Progress Questions

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COMET Modules



RealTime Ocean Portal

- Contains a plethora of real-world information including recent ocean-related news and oceanographic data on tides, salinity, bathymetry, fishes, and much more
- Current Ocean Studies weekly activity available on the Portal that expands on concepts within the textbook and Manual using
 recent oceanographic data



AMS Ocean Studies Information

Earth System				
NOAA Ocean Explorer	NOAA World Ocean Atlas 2013	NOAA Satellite Imagery		
NASA Earth Observatory	NASA Gateway to Astronaut Photography	ASTER Satellite Picture Gallery		
USGS Earthshots	The World Factbook	NRL Satellite Imagery		
Additional Earth System Links Back to Top				

Physical & Chemical				
NOAA CoastWatch	NOAA Global Ocean Nowcasts/Forecasts (temperatures, salinity, heights, currents)	Gulf Stream Current		

For more information: amsedu@ametsoc.org @AMSeducation Like AMS Education on Facebook



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