

## GLOSSARY

### A

acoustic propagation = the transmission of acoustic energy through a medium, such as seawater.

acoustic remote sensing of the ocean = scientific methods for obtaining information about the properties of the ocean from sound transmissions through it, giving information on ocean temperature, water velocities, etc., between the acoustic sources and receivers, rather than the properties of the ocean at the instruments.

acoustic thermometry = a method for obtaining information about the temperature field in the ocean from precise measurements of the travel time of sound pulses transmitted through the ocean; a special case of the more general technique of ocean acoustic tomography.

air standard = the reference pressure for measuring airborne sound (20 microPascals).

algorithm = a formula for solving a problem.

ambient noise = the background noise in the ocean due to wave action, rainfall, biologics, etc.

atoll = a coral reef in the shape of a ring or horseshoe enclosing a lagoon.

audiogram = graphical representation of an animal's hearing ability; based on measured data.

### B

basalt = black or dark gray rock of volcanic origin

bathymetry = the surface features of the seafloor, such as seamounts, ridges, trenches and underwater volcanoes; underwater topography

benthic = of or found on the seafloor

broadband level = total acoustic power level over a specified bandwidth (e.g., the bandwidth between 100 Hz and 200 Hz).

### C

coaxial cable = an electrical cable consisting of a conducting tube surrounding a central conductor and separated from it by an insulating material.

constrain computer models = to use data obtained from the observation of natural processes to update computer models which simulate the process (e.g., weather forecasts are generated using computer models of the atmosphere that are routinely updated using data obtained from the worldwide network of weather stations)

cylindrical spreading = the rate at which acoustic intensity decreases for acoustic energy that has filled the water column from the seafloor to the sea surface and is now traveling away from

the sound source in only two dimensions; this is a simple approximation for acoustic propagation from a sound source when the range from the source is greater than the depth of the water in that area. See spherical spreading.

## **D**

decibel = a unit used to express the relative difference in acoustic power between signals, equal to ten times the common logarithm of the ratio of the two signal intensities.

duty cycle = the percentage of time an instrument is on.

## **E**

electromagnetic wave = a wave propagated through a medium (such as air or seawater) by simultaneous periodic variation in the electric and magnetic field intensity at right angles to each other and to the direction of propagation. The electromagnetic spectrum includes radio waves, microwaves, infrared, visible and ultraviolet radiation, X rays, gamma rays, and cosmic rays (in order of decreasing wavelength).

expendable bathythermograph (XBT) = an instrument dropped from ships and aircraft to measure ocean temperature as a function of depth at one location.

El Niño/Southern Oscillation (ENSO) = a combined oceanographic and atmospheric phenomenon which results in unusually warm surface water in the eastern tropical Pacific off the coast of South America

Eulerian arrays = arrays of instruments, such as moored temperature sensors and current meters, which are located at fixed positions on the Earth; see also surface mooring.

## **F**

## **G**

gyre = the wind-driven ocean circulation is divided into large gyres that are roughly circular or elliptical in shape and stretch across the entire ocean: subtropical gyres extend from the equatorial current system to the maximum westerlies in the wind field near 50° latitude, and subpolar gyres extend poleward of the maximum westerlies

gyre scale = ocean-basin size (on the order of a few thousand kilometers or nautical miles).

## **H**

## **I**

infrared radiation = electromagnetic waves of length greater than visible light but less than microwaves (between  $7.6 \times 10^5$  cm and 0.1 cm). Infrared radiation is perceived as heat and is used in some cooking devices, for therapeutic heat treatments, and for photography in fog or darkness. See microwave.

infrasonic noise = sounds below the spectrum of human hearing (i.e., less than 20 Hz)

interannual = occurring between years (e.g., “interannual variations” are changes which occur from one year to the next.)

internal waves = wave motions occurring in the ocean interior, rather than at the ocean surface, in which water particles move up and down in wavelike motions relative to a fixed depth; internal waves occur because the density of the ocean increases with depth, so that a water particle that is displaced from its equilibrium depth experiences a force that tends to return it to that depth

## J

## K

## L

La Niña = an oceanographic phenomenon that is the reverse of El Niño; unusually cold water is present in the eastern tropical Pacific off the coast of South America, while unusually warm water is present in the western tropical Pacific

large-scale acoustic thermometry = the application of acoustic thermometry to measure ocean temperatures on large, ocean-basin scales (on the order of a few thousand kilometers or nautical miles).

LORAN station = a location known by navigators that transmits radio signals to navigate by.

low-frequency, long-range acoustic propagation in the ocean = low frequency refers to sound which is between 1-1000 Hertz; long-range refers to distances on the order of 1,000-5,000 kilometers; acoustic propagation is the transmission of sound energy through a medium, such as seawater

## M

M-sequence waveform = a sine wave with a series of phase reversals

microPascal = the Pascal is the international unit for pressure, analogous to pounds per square inch in English units; 1 microPascal is one-millionth of a Pascal; the reference pressure used for underwater sound is 1 microPascal and for airborne sound is 20 microPascals.

microwave = an electromagnetic wave of wavelength less than 10 m (especially one between 1 m and 1 cm) in the radio-frequency range that are used as carrier waves in telephone and television transmissions. See infrared radiation.

## N

narrowband level = acoustic power level within a “narrow” bandwidth, often 1 Hz, as opposed to broadband (e.g., broadband could refer to a bandwidth between 100 Hz and 200 Hz, whereas narrowband could refer to a bandwidth between 150 Hz and 151 Hz). See spectral level.

## Q

ocean acoustic tomography = a method in which measurements of various properties of acoustic propagation through the ocean are used to infer the temperature, water velocity, and other physical properties of the ocean; a method for acoustic remote sensing of the ocean interior.

## P

Pacific Decadal Oscillation (PDO) = a pattern of sea-surface temperature variability in the North Pacific Ocean, in which approximately decade-long periods when the eastern North Pacific is cooler than normal and the western North Pacific is warmer than normal alternate with decade-long periods when the eastern North Pacific is warmer than normal and the western North Pacific is cooler than normal

Parabolic Equation (PE) models = acoustic propagation models that include the possibility of attenuation or reinforcement of signal propagation paths due to the effects of the transmission medium (sea water) or surrounding features (the most significant of which are the sea bottom and the sea surface).

phase-coded signal = an acoustic signal that has a known series of phase reversals, thereby allowing the signal to be easily extracted with a computer from the background ambient noise when it is received

## Q

## R

ramp-up = an initial period of acoustic source operation during which the signal intensity is gradually increased

root-mean-squared = a measure of the deviation of the values of a quantity from zero

## S

salinity = a measure of the quantity of dissolved salts in seawater. It is formally defined as the total amount of dissolved solids in seawater in parts per thousand by weight when all the carbonate has been converted to oxide, the bromide and iodide to chloride, and all organic matter is completely oxidized.

satellite altimeter = a satellite which measures the height of the sea surface

signal-to-noise ratio (SNR) = the ratio between the received level of the underwater acoustic signal and the surrounding ambient noise level; high SNR allows for easy detection and processing of the desired signal, the opposite applies to low SNR.

signal parameters = the characteristics of an acoustic signal, including such features as source level, duration of the signal, frequency of the signal, etc.

SOFAR channel = sound frequency and ranging channel, which is centered on the ocean depth where the speed of sound is at a minimum (sound channel axis).

sound channel axis = the ocean depth where the speed of sound is at a minimum; above this depth, sound travels faster because the water is warmer, below sound travels faster because the pressures are greater. Thus, acoustic energy is refracted (bent) back toward the axis by this difference in speeds, essentially causing an acoustic waveguide (SOFAR channel) that transmits sounds underwater efficiently over long distances.

sound pressure level (SPL) = twenty times the logarithm of the ratio of the underwater pressure to the reference pressure, in decibels, at a specific point in the ocean; usually measured in decibels referenced to 1 microPascal (root-mean-squared).

sound receiver = an instrument which converts sound energy into electrical energy

sound source = an instrument which converts electrical energy into sound energy

source level = the intensity of a sound source at a range of 1 meter (3.28 ft); usually measured in decibels referenced to the intensity of a signal with a sound pressure level of 1 microPascal

spectral level = acoustic power level within a one-Hertz “slice” of a bandwidth (e.g., the spectral level at 150 Hz is the acoustic power level within the bandwidth between 149.5 Hz and 150.5 Hz).

spherical spreading = the rate at which acoustic intensity decreases for acoustic energy traveling away from a sound source uniformly in all directions; this is a simple approximation for acoustic propagation from a sound source until the range from the source is greater than the depth of the water in that area. See cylindrical spreading.

Subarctic Front = a rapid change in temperature and salinity separating the subtropical ocean gyre from the subpolar ocean gyre, much as a front in the atmosphere separates warm and cold air masses; see also gyre

subsurface drifter = an instrument which is located below the surface of the ocean which moves with the ocean currents and makes measurements of the physical properties of that water body over time

surface drifter = an instrument located at the ocean surface which moves with the ocean currents and makes measurements of the physical properties of that water body over time

surface mooring = a mooring with an anchor on the seafloor and a float on the surface connected by wire rope or other line; instruments attached to a surface mooring are essentially stationary in the ocean and make measurements of the physical properties of the ocean which pass by the instruments

surge channel = a steep-sided, narrow break in a line of coral reef that typically has a sandy seafloor

**T**

test computer models = to compare the output of a computer model which simulates a process with observational data collected on the process

thermocline = the depth range in the ocean over which temperature decreases rapidly from warm, near-surface temperatures to cold, deep temperatures

thermometry = see acoustic thermometry

tomography = see ocean acoustic tomography

**U**

**V**

**W**

water standard = the reference pressure for measuring underwater sound (1 microPascal).

**X**

**Y**

**Z**