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- earth-centered ellipsoid.** A reference ellipsoid whose geometric center coincides with the earth's center of gravity and whose semiminor axis coincides with the earth's rotational axis.
- earth-fixed coordinate system.** Any coordinate system in which the axes are stationary with respect to the earth. See also INERTIAL COORDINATE SYSTEM.
- earthlight, n.** The faint illumination of the dark part of the moon by sunlight reflected from the earth. Also called EARTHSHINE.
- earth rate.** The angular velocity or rate of the earth's rotation. See also EARTH-RATE CORRECTION, HORIZONTAL EARTH RATE, VERTICAL EARTH RATE.
- earth-rate correction.** A rate applied to a gyroscope to compensate for the apparent precession of the spin axis caused by the rotation of the earth. See also EARTH RATE, HORIZONTAL EARTH RATE, VERTICAL EARTH RATE.
- earth satellite.** A body that orbits about the earth. See also ARTIFICIAL EARTH SATELLITE.
- earthshine, n.** See EARTHLIGHT.
- earth tide.** Periodic movement of the earth's crust caused by the gravitational interactions between the sun, moon, and earth.
- east, n.** The direction 90° to the right of north. See also CARDINAL POINT.
- East Africa Coastal Current.** An Indian Ocean current which originates mainly from the part of the Indian South Equatorial Current which turns northward off the northeast coast of Africa in the vicinity of latitude 10°S. The current appears to vary considerably in speed and direction from month to month. The greatest changes coincide with the period of the opposing northeast monsoon during November through March. This coastal current is most persistent in a north or northeast direction and strongest during the southwest monsoon from May through September, particularly during August. Speed and frequency begin to decrease during the transition month of October. In November at about latitude 4°N a part of the current begins to reverse; this part expands northward and southward until February. The region of reverse flow begins to diminish in March and disappear in April, when the northward set again predominates. Also called SOMALI CURRENT. See also MONSOON.
- East Australia Current.** A South Pacific Ocean current flowing southward along the east coast of Australia, from the Coral Sea to a point northeast of Tasmania, where it turns to join the northeastward flow through the Tasman Sea. It is formed by that part of the Pacific South Equatorial Current that turns south east of Australia. In the southern hemisphere summer, a small part of this current flows westward along the south coast of Australia into the Indian Ocean. The East Australia Current forms the western part of the general counterclockwise oceanic circulation of the South Pacific Ocean.
- eastern standard time.** See STANDARD TIME.
- East Greenland Current.** An ocean current flowing southward along the east coast of Greenland carrying water of low salinity and low temperature. The East Greenland Current is joined by most of the water of the Irminger Current. The greater part of the current continues through Denmark Strait between Iceland and Greenland, but one branch turns to the east and forms a portion of the counterclockwise circulation in the southern part of the Norwegian Sea. Some of the East Greenland Current curves to the right around the tip of Greenland, flowing northward into Davis Strait as the WEST GREENLAND CURRENT. The main discharge of the Arctic Ocean is via the East Greenland Current.
- easting, n.** The distance a craft makes good to the east. The opposite is WESTING.
- East Siberian Coastal Current.** An ocean current in the Chukchi Sea which joins the northward flowing Bering Current north of East Cape.
- ebb, n.** Tidal current moving away from land or down a tidal stream. The opposite is FLOOD. Sometimes the terms EBB and FLOOD are also used with reference to vertical tidal movement, but for this vertical movement the expressions FALLING TIDE and RISING TIDE are preferable. Also called EBB CURRENT.
- ebb axis.** The average direction of current at strength of ebb.
- ebb current.** The movement of a tidal current away from shore or down a tidal river or estuary. In the mixed type of reversing tidal current, the terms *greater ebb* and *lesser ebb* are applied respectively to the ebb tidal currents of greater and lesser speed of each day. The terms maximum *ebb* and minimum *ebb* are applied to the maximum and minimum speeds of a current running continuously. The expression *maximum ebb* is also applicable to any ebb current at the time of greatest speed. The opposite is FLOOD CURRENT.
- ebb interval.** Short for STRENGTH OF EBB INTERVAL. The interval between the transit of the moon over the meridian of a place and the time of the following strength of ebb. See also LUNICURRENT INTERVAL.
- ebb strength.** Phase of the ebb tidal current at the time of maximum velocity. Also, the velocity at this time. Also called STRENGTH OF EBB.
- eccentric, adj.** Not having the same center. The opposite is CONCENTRIC.
- eccentric angle.** See under ANOMALY, definition 2.
- eccentric anomaly.** See under ANOMALY, definition 2.
- eccentric error.** See CENTERING ERROR.
- eccentricity, n.** 1. Degree of deviating from a center. 2. The ratio of the distance between foci of an ellipse to the length of the major axis, or the ratio of the distance between the center and a focus to the length of the semimajor axis. 3. The ratio of the distances from any point of a conic section to a focus and the corresponding directrix.
- eccentricity component.** That part of the equation of time due to the ellipticity of the orbit and known as the eccentricity component is the difference, in mean solar time units, between the hour angles of the apparent (true) sun and the dynamical mean sun. It is also the difference in the right ascensions of these two suns.
- echo, n.** 1. A wave which has been reflected or otherwise returned with sufficient magnitude and delay to be perceived. 2. A signal reflected by a target to a radar antenna. Also called RETURN. 3. The deflection or indication on a radarscope representing a target. Also called PIP, BLIP, RETURN.
- echo box.** A resonant cavity, energized by part of the transmitted pulse of a radar set, which produces an artificial target signal for tuning or testing the overall performance of a radar set. Also called PHANTOM TARGET.
- echo box performance monitor.** See under PERFORMANCE MONITOR.
- echogram, n.** A graphic record of depth measurements obtained by an echo sounder. See also FATHOGRAM.
- echo ranging.** The determination of distance by measuring the time interval between transmission of a radiant energy signal and the return of its echo. Since echo ranging equipment is usually provided with means for determining direction as well as distance, both functions are generally implied. The expression is customarily applied only to ranging by utilization of the travel of sonic or ultrasonic signals through water. See also RADIO ACOUSTIC RANGING, SONAR.
- echo sounder.** An instrument used to determine water depth by measuring the time interval for sound waves to go from a source of sound near the surface to the bottom and back again. Also called DEPTH FINDER, ACOUSTIC DEPTH FINDER.
- echo sounding.** Determination of the depth of water by measuring the time interval between emission of a sonic or ultrasonic signal and the return of its echo from the bottom. The instrument used for this purpose is called an ECHO SOUNDER. Also called ACOUSTIC SOUNDING.
- eclipse, n.** 1. Obscuring of a source of light by the intervention of an object. When the moon passes between the earth and the sun, casting a shadow on the earth, a **solar eclipse** takes place within the shadow. When the moon enters the earth's shadow, a **lunar eclipse** occurs. When the moon enters only the penumbra of the earth's shadow, a **penumbral lunar eclipse** occurs. A solar eclipse is partial if the sun is partly obscured and total if the entire surface is obscured; or **annular** if a thin ring of the sun's surface appears around the obscuring body. A lunar eclipse can be either total or partial. 2. An interval of darkness between flashes of a navigation light.
- eclipse year.** The interval between two successive conjunctions of the sun with the same node of the moon's orbit, averaging 346 days, 14 hours, 52 minutes 50.7 seconds in 1900, and increasing at the rate of 2.8 seconds per century.

- ecliptic**, *n.* The apparent annual path of the sun among the stars; the intersection of the plane of the earth's orbit with the celestial sphere. This is a great circle of the celestial sphere inclined at an angle of about 23°27' to the celestial equator. See also ZODIAC.
- ecliptic diagram**. A diagram of the zodiac, indicating the positions of certain celestial bodies in this region.
- ecliptic pole**. On the celestial sphere, either of the two points 90° from the ecliptic.
- ecliptic system of coordinates**. A set of celestial coordinates based on the ecliptic as the primary great circle; celestial latitude and celestial longitude.
- eddy**, *n.* A quasi-circular movement of water whose area is relatively small in comparison to the current with which it is associated. Eddies may be formed between two adjacent currents flowing counter to each other and where currents pass obstructions, especially on the downstream side. See also WHIRLPOOL.
- effective radiated power**. The power supplied to the antenna multiplied by the relative gain of the antenna in a given direction.
- effective radius of the earth**. The radius of a hypothetical earth for which the distance to the radio horizon, assuming rectilinear propagation, is the same as that for the actual earth with an assumed uniform vertical gradient of a refractive index. For the standard atmosphere, the effective radius is 4/3 that of the actual earth.
- Ekman spiral**. A logarithmic spiral (when projected on a horizontal plane) formed by current velocity vectors at increasing depth intervals. The current vectors become progressively smaller with depth. They spiral to the right (looking in the direction of flow) in the Northern Hemisphere and to the left in the Southern with increasing depth. Theoretically, the surface current vector sets 45° from the direction toward which the wind is blowing. Flow opposite to the surface current occurs at the depth of frictional resistance. The phenomenon occurs in wind drift currents in which only the Coriolis and frictional forces are significant. Named for Vagn Walfrid Ekman who, assuming a constant eddy viscosity, steady wind stress, and unlimited depth and extent, published the effect in 1905.
- E-layer**, *n.* From the standpoint of its effect upon radio wave propagation, the lowest useful layer of the Kennelly-Heaviside radiation region. Its average height is about 70 miles, and its density is greatest about local apparent noon. For practical purposes, the layer disappears during the hours of darkness.
- elbow**, *n.* A sharp change in direction of a coast line, a channel, river, etc.
- electrical distance**. A distance expressed in terms of the duration of travel of an electromagnetic wave in a given medium between two points.
- electrically suspended gyro**. A gyroscope in which the main rotating element is suspended by a magnetic field or any other similar electrical phenomenon. See also GYRO, ELECTROSTATIC GYRO.
- electrical storm**. See THUNDERSTORM.
- electric field**. That region in space which surrounds an electrically charged object and in which the forces due to this charge are detectable. See also ELECTRIC VECTOR.
- electric tape gage**. A tide gage consisting of a monel metal tape on a metal reel (with supporting frame), voltmeter, and battery. The tape is graduated with numbers increasing toward the unattached end. Tidal heights can be measured directly by unreeling the tape into its stilling well. When contact is made with the water's surface, the circuit is completed and the voltmeter needle moves. At that moment, the length of tape is read against an index mark, the mark having a known elevation relative to the tidal bench marks. Used at many long term control stations in place of the tide staff.
- electric vector**. The component of the electromagnetic field associated with electromagnetic radiation which is of the nature of an electric field. The electric vector is considered to coexist with, but to act at right angles to, the magnetic vector.
- electrode**, *n.* A terminal at which electricity passes from one medium into another. The positive electrode is called the anode; the negative electrode is called the cathode.
- electromagnetic**, *adj.* Of, pertaining to, or produced by electromagnetism.
- electromagnetic energy**. All forms of radiant energy, such as radio waves, light waves, X-rays, heat waves, gamma rays, and cosmic rays.
- electromagnetic field**. 1. The field of influence which an electric current produces around the conductor through which it flows. 2. A rapidly moving electric field and its associated magnetic field located at right angles to both electric lines of force and to their direction of motion. 3. The magnetic field resulting from the flow of electricity.
- electromagnetic log**. A log containing an electromagnetic sensing element extended below the hull of the vessel, which produces a voltage directly proportional to speed through the water.
- electromagnetic waves**. Waves of associated electric and magnetic fields characterized by variations of the fields. The electric and magnetic fields are at right angles to each other and to the direction of propagation. The waves are propagated at the speed of light and are known as radio (Hertzian) waves, infrared rays, light, ultraviolet rays, X-rays, etc., depending on their frequencies.
- electromagnetism**, *n.* 1. Magnetism produced by an electric current. 2. The science dealing with the physical relations between electricity and magnetism.
- electron**, *n.* A negatively-charged particle of matter constituting a part of an atom. Its electric charge is the most elementary unit of negative electricity.
- electron gun**. A group of electrodes which produces an electron beam of controllable intensity. By extension, the expression is often used to include, also, the elements which focus and deflect the beam.
- electronic aid to navigation**. An aid to navigation using electronic equipment. If the navigational information is transmitted by radio waves, the device may be called a RADIO AID TO NAVIGATION.
- electronic bearing cursor**. The bright rotatable radial line on the display of a marine radar set, used for bearing determination.
- electronic chart (EC)**. A chart displayed on a video terminal, usually integrated with other navigational aids.
- electronic chart data base (ECDB)**. The master electronic chart data base for the electronic navigation chart held in digital form by the hydrographic authority.
- electronic chart display and information system (ECDIS)**. An electronic chart system which complies with IMO guidelines and is the legal equivalent of a paper chart.
- electronic navigation chart (ENC)**. The standardized electronic data base, a subset of the ECDB, issued by a hydrographic authority for use with an ECDIS.
- electronic cursor**. Short for ELECTRONIC BEARING CURSOR.
- electronic distance measuring devices**. Instruments that measure the phase differences between transmitted and reflected or retransmitted electromagnetic waves of known frequency, or that measure the round-trip transit time of a pulsed signal, from which distance is computed.
- electronic navigation**. Navigation by means of electronic equipment. The expression ELECTRONIC NAVIGATION is more inclusive than RADIONAVIGATION, since it includes navigation involving any electronic device or instrument.
- electronics**, *n.* The science and technology relating to the emission, flow, and effects of electrons in a vacuum or through a semiconductor such as a gas, and to systems using devices in which this action takes place.
- electronic telemeter**. An electronic device that measures the phase difference or transit time between a transmitted electromagnetic impulse of known frequency and speed and its return.
- electrostatic gyro**. A gyroscope in which a small ball rotor is electrically suspended within an array of electrodes in a vacuum inside a ceramic envelope. See also GYRO, ELECTRICALLY SUSPENDED GYRO.
- elements of a fix**. The specific values of the coordinates used to define a position.
- elephanta**, *n.* A strong southerly or southeasterly wind which blows on the Malabar coast of India during the months of September and October and marks the end of the southwest monsoon.
- elevated duct**. A tropospheric radio duct of which the lower boundary is above the surface of the earth.
- elevated pole**. The celestial pole above the horizon, agreeing in name with the latitude. The celestial pole below the horizon is called DE-PRESSED POLE.
- elevation**, *n.* 1. Vertical distance of a point above a datum, usually mean sea level. Elevation usually applies to a point on the surface of the earth. The term HEIGHT is used for points on or above the surface. See also SPOT ELEVATION. 2. An area higher than its surroundings, as a hill.
- elevation angle**. See ANGLE OF ELEVATION.
- elevation tints**. See HYPOMETRIC TINTING.
- elimination**, *n.* One of the final processes in the harmonic analysis of tides in which preliminary values of the harmonic constants of a number of constituents are cleared of residual effects of each other.

- E-link.** A bracket attached to one of the arms of a binnacle to permit the mounting of a quadrantal corrector in an intermediate position between the fore-and-aft and athwartship lines through a magnetic compass.
- ellipse, n.** A plane curve constituting the locus of all points the sum of whose distances from two fixed points called FOCI is constant; an elongated circle. The orbits of planets, satellites, planetoids, and comets are ellipses with the center of attraction at one focus. See also CONIC SECTION, CURRENT ELLIPSE.
- ellipsoid, n.** A surface whose plane sections (cross-sections) are all ellipses or circles, or the solid enclosed by such a surface. Also called ELLIPSOID OF REVOLUTION, SPHEROID.
- ellipsoidal height.** The height above the reference ellipsoid, measured along the ellipsoidal outer normal through the point in question. Also called GEODETIC HEIGHT.
- ellipsoid of reference.** See REFERENCE ELLIPSOID.
- ellipsoid of revolution.** A term used for an ellipsoid which can be formed by revolving an ellipse about one of its axes. Also called ELLIPSOID OF ROTATION.
- ellipsoid of rotation.** See ELLIPSOID OF REVOLUTION.
- elliptically polarized wave.** An electromagnetic wave which can be resolved into two plane polarized waves which are perpendicular to each other and which propagate in the same direction. The amplitudes of the waves may be equal or unequal and of arbitrary time-phase. The tip of the component of the electric field vector in the plane normal to the direction of propagation describes an ellipse. See also CIRCULARLY POLARIZED WAVE.
- ellipticity, n.** The amount by which a spheroid differs from a sphere or an ellipse differs from a circle, found by dividing the difference in the lengths of the semi-axes of the ellipse by the length of the semimajor axis. See also FLATTENING.
- elongation, n.** The angular distance of a body of the solar system from the sun; the angle at the earth between lines to the sun and another celestial body of the solar system. The greatest elongation is the maximum angular distance of an inferior planet from the sun before it starts back toward conjunction. The direction of the body east or west of the sun is usually specified, as greatest elongation east (or west).
- embayed, adj.** 1. Formed into or having bays. 2. Unable to put to sea safely because of wind, current, or sea conditions.
- embayment, n.** Any indentation of a coast regardless of width at the entrance or depth of penetration into the land. See also ESTUARY.
- emergency light.** A light put into service in an emergency when the permanent or standby light has failed. It often provides reduced service in comparison with the permanent light.
- Emergency Position Indicating Radiobeacon.** A small portable radiobeacon carried by vessels and aircraft which transmits radio signals which can be used by search and rescue authorities to locate a marine emergency.
- emergency position indicating radiobeacon station.** As defined by the International Telecommunication Union (ITU), a station in the mobile service whose emissions are intended to facilitate search and rescue operations.
- emission delay.** 1. A delay in the transmission of a pulse signal from a slave (or secondary) station of a hyperbolic radionavigation system, introduced as an aid in distinguishing between master and slave (or secondary) station signals. 2. In Loran C the time interval between the master station's transmission and the secondary station's transmission in the same group repetition interval (GRI). The GRI is selected of sufficient duration to provide time for each station to transmit its pulse group and additional time between each pulse group so that signals from two or more stations cannot overlap in time anywhere within the coverage area. In general, emission delays are kept as small as possible to allow the use of the smallest GRI.
- empirical, adj.** Derived by observation or experience rather than by rules or laws.
- endless tangent screw.** A tangent screw which can be moved over its entire range without resetting.
- endless tangent screw sextant.** A marine sextant having an endless tangent screw for controlling the position of the index arm and the vernier or micrometer drum. The index arm may be moved over the entire arc without resetting, by means of the endless tangent screw.
- enhanced group call (EGC).** A global automated satellite communications service capable of addressing messages to specific areas or specific groups of vessels.
- entrance, n.** The seaward end of channel, harbor, etc.
- entrance lock.** A lock between the tideway and an enclosed basin when their water levels vary. By means of the lock, which has two sets of gates vessels can pass either way at all states of the tide. Also called TIDAL LOCK. See also NONTIDAL BASIN.
- envelope match.** In Loran C, the comparison, in time difference, between the leading edges of the demodulated and filtered pulses from a master and secondary station. The pulses are superimposed and matched manually or automatically. See also CYCLE MATCH.
- envelope to cycle difference.** The time relationship between the phase of the Loran C carrier and the time origin of the envelope waveform. Zero envelope to cycle difference (ECD) is defined as the signal condition occurring when the 30 microsecond point of the Loran C pulse envelope is in time coincidence with the third positive-going zero crossing of the 100 kHz carrier.
- envelope to cycle discrepancy.** An error in a Loran C time difference measurement which results from upsetting the precise relationship between the shape of the pulse envelope and the phase of the carrier wave necessary for an accurate measurement due to some of the large number of frequencies (90-110 kHz) governing the envelope shape being transmitted more readily than others because of the medium over which the groundwave propagates.
- ephemeris (pl. ephemerides), n.** 1. A periodical publication tabulating the predicted positions of celestial bodies at regular intervals, such as daily, and containing other data of interest to astronomers and navigators. The *Astronomical Almanac* is an ephemeris. See also ALMANAC. 2. A statement, not necessarily in a publication, presenting a correlation of time and position of celestial bodies or artificial satellites.
- ephemeris day.** See under EPHEMERIS SECOND.
- ephemeris second.** The ephemeris second is defined as $1/31,556,925.9747$ of the tropical year for 1900 January 0^d 12^h ET. The ephemeris day is 86,400 ephemeris seconds. See also EPHEMERIS TIME.
- Ephemeris Time.** The time scale used by astronomers as the tabular argument of the precise fundamental ephemerides of the sun, moon and planets. It is the independent variable in the gravitational theories of the solar system. It is determined in arrears from astronomical observations and extrapolated into the future, based on International Atomic Time.
- epicenter, n.** The point on the earth's surface directly above the focus of an earthquake.
- epoch, n.** 1. A particular instant of time or a date for which values of data, which vary with time, are given. 2. A given period of time during which a series of related acts or events takes place. 3. Angular retardation of the maximum of a constituent of the observed tide behind the corresponding maximum of the same constituent of the hypothetical equilibrium. Also called PHASE LAG, TIDAL EPOCH. 4. As used in tidal datum determinations, a 19-year Metonic cycle over which tidal height observations are meaned in order to establish the various datums.
- equal altitudes.** Two altitudes numerically the same. The expression applies particularly to the practice of determining the instant of local apparent noon by observing the altitude of the sun a short time before it reaches the meridian and again at the same altitude after transit, the time of local apparent noon being midway between the times of the two observations, if the second is corrected as necessary for the run of the ship. Also called DOUBLE ALTITUDES.
- equal-area map projection.** A map projection having a constant area scale. Such a projection is not conformal and is not used for navigation. Also called AUTHALIC MAP PROJECTION, EQUIVALENT MAP PROJECTION.
- equal interval light.** A navigation light having equal periods of light and darkness. Also called ISOPHASE LIGHT.
- equation of time.** The difference at any instant between apparent time and local mean time. It is a measure of the difference of the hour angles of the apparent (true) sun and the mean (fictitious) sun. The curve drawn for the equation of time during a year has two maxima: February 12 (+14.3^m) and July 27 (+6.3^m) and two minima: May 15 (-3.7^m) and November 4 (-16.4^m). The curve crosses the zero line on April 15, June 14, September 1, and December 24. The equation of

- time is tabulated in the *Nautical Almanac*, without sign, for 00^h and 12^h GMT on each day. To obtain apparent time, apply the equation of time to mean time with a positive sign when GHA sun at 00^h GMT exceeds 180°, or at 12^h exceeds 0°, corresponding to a meridian passage of the sun before 12^h GMT; otherwise apply with a negative sign.
- equator**, *n.* The primary great circle of a sphere or spheroid, such as the earth, perpendicular to the polar axis, or a line resembling or approximating such a circle. The terrestrial equator is 90° from the earth's geographical poles, the celestial equator or equinoctial is 90° from the celestial poles. The astronomical equator is a line connecting points having 0° astronomical latitude, the geodetic equator connects points having 0° geodetic latitude. The expression terrestrial equator is sometimes applied to the astronomical equator. The equator shown on charts is the geodetic equator. A fictitious equator is a reference line serving as the origin for measurement of fictitious latitude. A transverse or inverse equator is a meridian of the plane of which is perpendicular to the axis of a transverse projection. An oblique equator is a great circle the plane of which is perpendicular to the axis of an oblique projection. A grid equator is a line perpendicular to a prime grid meridian at the origin. The magnetic equator or aclinic line is the line on the surface of the earth connecting all points at which the magnetic dip is zero. The geomagnetic equator is the great circle 90° from the geomagnetic poles of the earth.
- equatorial**, *adj.* Of or pertaining to the equator.
- equatorial air**. See under AIR-MASS CLASSIFICATION.
- equatorial bulge**. The excess of the earth's equatorial diameter over the polar diameter.
- equatorial calms**. See DOLDRUMS.
- equatorial chart**. 1. A chart of equatorial areas. 2. A chart on an equatorial map projection.
- equatorial countercurrent**. An oceanic current flowing between and counter to the EQUATORIAL CURRENTS. See ATLANTIC EQUATORIAL COUNTERCURRENT, PACIFIC EQUATORIAL COUNTERCURRENT, INDIAN EQUATORIAL COUNTERCURRENT.
- equatorial current**. See NORTH EQUATORIAL CURRENT, SOUTH EQUATORIAL CURRENT.
- equatorial cylindrical orthomorphic chart**. See MERCATOR CHART.
- equatorial cylindrical orthomorphic map projection**. See MERCATOR MAP PROJECTION.
- equatorial gravity value**. The mean acceleration of gravity at the equator, approximately equal to 978.03 centimeters per second per second.
- equatorial map projection**. A map projection centered on the equator.
- equatorial node**. Either of the two points where the orbit of the satellite intersects the equatorial plane of its primary.
- equatorial satellite**. A satellite whose orbital plane coincides, or almost coincides, with the earth's equatorial plane.
- equatorial tidal currents**. Tidal currents occurring semimonthly as a result of the moon being over the equator. At these times the tendency of the moon to produce a diurnal inequality in the tidal current is at a minimum.
- equatorial tides**. Tides occurring semimonthly as the result of the moon being over the equator. At these times the tendency of the moon to produce a diurnal inequality in the tide is at a minimum.
- equiangular**, *adj.* Having equal angles.
- equilateral**, *adj.* Having equal sides.
- equilateral triangle**. A triangle having all of its sides equal. An equilateral triangle is necessarily equiangular.
- equilibrium**, *n.* A state of balance between forces. A body is said to be in equilibrium when the vector sum of all forces acting upon it is zero.
- equilibrium argument**. The theoretical phase of a constituent of the equilibrium tide.
- equilibrium theory**. A model under which it is assumed that the waters covering the face of the earth instantly respond to the tide-producing forces of the moon and sun, and form a surface of equilibrium under the action of these forces. The model disregards friction and inertia and the irregular distribution of the land masses of the earth. The theoretical tide formed under these conditions is called EQUILIBRIUM TIDE.
- equilibrium tide**. Hypothetical tide due to the tide producing forces under the equilibrium theory. Also called GRAVITATIONAL TIDE.
- equinoctial**, *adj.* Of or pertaining to an equinox or the equinoxes.
- equinoctial**, *n.* See CELESTIAL EQUATOR.
- equinoctial colure**. The great circle of the celestial sphere through the celestial poles and the equinoxes; the hour circle of the vernal equinox. See also SOLSTITIAL COLURE.
- equinoctial point**. One of the two points of intersection of the ecliptic and the celestial equator. Also called EQUINOX.
- equinoctial system of coordinates**. See CELESTIAL EQUATOR SYSTEM OF COORDINATES.
- equinoctial tides**. Tides occurring near the times of the equinoxes, when the spring range is greater than average.
- equinoctial year**. See TROPICAL YEAR.
- equinox**, *n.* 1. One of the two points of intersection of the ecliptic and celestial equator, occupied by the sun when its declination is 0°. The point occupied on or about March 21, when the sun's declination changes from south to north, is called vernal equinox, March equinox, or first point of Aries; the point occupied on or about September 23, when the declination changes from north to south, is called autumnal equinox, September equinox, or first point of Libra. Also called EQUINOCTIAL POINT. 2. The instant the sun occupies one of the equinoctial points.
- equiphase zone**. The region in space within which there is no difference in phase between two radio signals.
- equipotential surface**. A surface having the same potential of gravity at every point. See also GEOID.
- equisignal**, *adj.* Pertaining to two signals of equal intensity.
- equisignal**, *n.* See under CONSOL STATION.
- equisignal zone**. The region in space within which the difference in amplitude of two radio signals (usually emitted by a signal station) is indistinguishable.
- equivalent echoing area**. See RADAR CROSS SECTION.
- equivalent map projection**. See EQUAL-AREA MAP PROJECTION.
- erect image**. See under IMAGE, definition 1.
- erecting telescope**. A telescope with which the observer sees objects right side up as opposed to the upside down view provided by the INVERTING TELESCOPE. The eyepiece in the optical system of an erecting telescope usually has four lenses, and the eyepiece in the optical system of an inverting telescope has two lenses.
- erg**, *n.* The work performed by a force of 1 dyne acting through a distance of 1 centimeter. The erg is the unit of energy or work in the centimeter-gram-second system. It corresponds to 10⁻⁷ joule in the International System of Units.
- ergonomics**. The science of making mechanical and electronic devices easily usable by humans; human factors engineering.
- error**, *n.* The difference between the value of a quantity determined by observation, measurement or calculation and the true, correct, accepted, adopted or standard value of that quantity. Usually, the true value of the quantity cannot be determined with exactness due to insufficient knowledge of the errors encountered in the observations. Exceptions occur (1) when the value is mathematically determinable, or (2) when the value is an adopted or standard value established by authority. In order to analyze the exactness with which the true value of a quantity has been determined from observations, errors are classified into two categories, random and systematic errors. For the purpose of error analysis, blunders or mistakes are not classified as errors. The significant difference between the two categories is that random errors must be treated by means of statistical and probability methods due to their accidental or chance nature whereas systematic errors are usually expressible in terms of a unique mathematical formula representing some physical law or phenomenon. See also ACCURACY.
- error budget**. A correlated set of individual major error sources with statements of the percentage of the total system error contributed by each source.
- error ellipse**. The contour of equal probability density centered on the intersection of two straight lines of position which results from the one-dimensional normal error distribution associated with each line. For the 50 percent error ellipse, there is a 50 percent probability that a fix will lie within such ellipse. If the angle of cut is 90° and the standard deviations are equal, the error figure is a circle.
- error of collimation**. See COLLIMATION ERROR.
- error of perpendicularity**. That error in the reading of a marine sextant due to non-perpendicularity of the index mirror to the frame.
- escape velocity**, *n.* The minimum velocity required of a body at a given point in a gravitational field which will permit the body to escape from the field. The orbit followed is a parabola and the body arrives

- at an infinite distance from the center of the field with zero velocity. With respect to escape velocities characteristic of the major bodies of the solar system, this is defined as escape from the body's gravitational field from the surface of the body in question. Escape velocity equals circular velocity times the square root of 2. Also called **PARABOLIC VELOCITY**.
- escarpment**, *n.* An elongated and comparatively steep slope separating flat or gently sloping areas. Also called **SCARP**.
- established direction of traffic flow**. A traffic flow pattern indicating the directional movement of traffic as established within a traffic separation scheme. See also **RECOMMENDED DIRECTION OF TRAFFIC FLOW**.
- establishment of the port**. Average high water interval on days of the new and full moon. This interval is also sometimes called the **COMMON** or **VULGAR ESTABLISHMENT** to distinguish it from the **CORRECTED ESTABLISHMENT**, the latter being the mean of all high water intervals. The latter is usually 10 to 15 minutes less than the common establishment. Also called **HIGH WATER FULL AND CHANGE**.
- estimate**, *v., t.* To determine roughly or with incomplete information.
- estimated position**. The most probable position of a craft determined from incomplete data or data of questionable accuracy. Such a position might be determined by applying a correction to the dead reckoning position, as for estimated current; by plotting a line of soundings; or by plotting lines of position of questionable accuracy. If no better information is available, a dead reckoning position is an estimated position, but the expression *estimated position* is not customarily used in this case. The distinction between an estimated position and a fix or running fix is a matter of judgment. See also **MOST PROBABLE POSITION**.
- estimated time of arrival**. The predicted time of reaching a destination or waypoint.
- estimated time of departure**. The predicted time of leaving a place.
- estimation**, *n.* A mathematical method or technique of making a decision concerning the approximate value of a desired quantity when the decision is weighted or influenced by all available information.
- estuarine sanctuary**. A research area which may include any part or all of an estuary, adjoining transitional areas, and adjacent uplands, constituting to the extent feasible a natural unit, set aside to provide scientists and students the opportunity to examine over a period of time the ecological relationships within the area. See also **MARINE SANCTUARY**.
- estuary**, *n.* 1. An embayment of the coast in which fresh river water entering at its head mixes with the relatively saline ocean water. When tidal action is the dominant mixing agent, it is usually called **TIDAL ESTUARY**. 2. the lower reaches and mouth of a river emptying directly into the sea where tidal mixing takes place. Sometimes called **RIVER ESTUARY**. 3. A drowned river mouth due to sinking of the land near the coast.
- etesian**, *n.* A refreshing northerly summer wind of the Mediterranean, especially over the Aegean Sea.
- Eulerian current measurement**. The direct observation of the current speed or direction, or both, during a period of time as it flows past a recording instrument such as the Ekman or Roberts current meter. See also **LAGRANGIAN CURRENT MEASUREMENT**.
- Eulerian motion**. A slight wobbling of the earth about its axis of rotation, often called polar motion, and sometimes wandering of the poles. This motion which does not exceed 40 feet from the mean position, produces slight variation of latitude and longitude of places on the earth.
- European Datum**. The origin of this datum is at Potsdam, Germany. Numerous national systems have been joined in a large datum based upon the International Ellipsoid 1924 which was oriented by a modified astrogeodetic method. European, African, and Asian triangulation chains were connected. African arc measurements from Cairo to Cape Town were completed. Thus, all Europe, Africa, and Asia are molded into one great system. Through common survey stations, it was possible to convert data from the Russian Pulkova 1932 system to the European Datum, and as a result the European Datum includes triangulation as far east as the 84th meridian. Additional ties across the Middle East have permitted connection of the Indian and European Datums.
- evaporation**, *n.* The physical process by which a liquid or solid is transformed to the gaseous state. The opposite is **CONDENSATION**. In meteorology, the term evaporation is usually restricted in use to the change of water vapor from liquid to gas, while **SUBLIMATION** is used for the change from solid to gas as well as from gas to solid. Energy is lost by an evaporating liquid, and when no heat is added externally, the liquid always cools. The heat thus removed is called **LATENT HEAT OF VAPORIZATION**.
- evection**, *n.* A perturbation of the moon depending upon the alternate increase or decrease of the eccentricity of its orbit, which is always a maximum when the sun is passing the moon's line of apsides and at minimum when the sun is at right angles to it.
- evening star**. The brightest planet appearing in the western sky during evening twilight.
- evening twilight**. The period of time between sunset and darkness.
- everglade**, *n.* 1. A tract of swampy land covered mostly with tall grass. 2. A swamp or inundated tract of low land, as used locally in the southern U.S.
- excess of arc**. That part of a sextant arc beginning at zero and extending in the direction opposite to that part usually considered positive. See also **ARC**, definition 2.
- existence doubtful**. Of uncertain existence. The expression is used principally on charts to indicate the possible existence of a rock, shoal, etc., the actual existence of which has not been established. See also **VIGIA**.
- ex-meridian altitude**. An altitude of a celestial body near the celestial meridian of the observer to which a correction must be applied to determine the meridian altitude. Also called **CIRCUM-MERIDIAN ALTITUDE**.
- ex-meridian observation**. Measurement of the altitude of a celestial body near the celestial meridian of the observer, for conversion to a meridian altitude; or the altitude so measured.
- expanded center PPI display**. A plan position indicator display on which zero range corresponds to a ring around the center of the display. expanded sweep. Short for **EXPANDED TIME BASE SWEEP**.
- expanded time base**. A time base having a selected part of increased speed. Particularly an **EXPANDED TIME BASE SWEEP**.
- expanded time base sweep**. A sweep in which the sweep speed is increased during a selected part of the cycle. Usually shortened to **EXPANDED SWEEP**, and sometimes to **EXPANDED TIME BASE**.
- explement**, *n.* An angle equal to 360° minus a given angle. See also **COMPLEMENT**, **SUPPLEMENT**.
- elementary angles**. Two angles whose sum is 360°.
- explosive fog signal**. A fog signal consisting of short reports produced by detonating explosive charges.
- exponent**, *n.* A number which indicates the power to which another number is to be raised.
- external noise**. In radio reception, atmospheric radio noise and man-made noise, singly or in combination. Internal noise is produced in the receiver circuits.
- extragalactic nebula**. An aggregation of matter beyond our galaxy, large enough to occupy a perceptible area but which has not been resolved into individual stars.
- extrapolation**, *n.* The process of estimating the value of a quantity beyond the limits of known values by assuming that the rate or system of change between the last few known values continues.
- extratropical cyclone**. Any cyclonic-scale storm that is not a tropical cyclone, usually referring only to the migratory frontal cyclones of middle and high latitudes. Also called **EXTRATROPICAL LOW**.
- extratropical low**. See **EXTRATROPICAL CYCLONE**.
- extreme high water**. The highest elevation reached by the sea as recorded by a tide gage during a given period. The National Ocean Survey routinely documents monthly and yearly extreme high waters for its control stations. See also **EXTREME LOW WATER**.
- extreme low water**. The lowest elevation reached by the sea as recorded by a tide gage during a given period. The National Ocean Survey routinely documents monthly and yearly extreme low water for its control stations. See also **EXTREME HIGH WATER**.
- extremely high frequency**. Radio frequency of 30,000 to 300,000 megahertz.
- eye guard**. A guard or shield on an eyepiece of an optical system, to protect the eye from stray light, wind, etc., and to maintain proper eye distance. Also called **EYE SHIELD**, **EYE SHADE**, **SHADE**.
- eye of the storm**. The center of a tropical cyclone marked by relatively light winds, confused seas, rising temperature, lowered relative humidity, and often by clear skies. The general area of lowest atmospheric pressure of a cyclone is called **STORM CENTER**.

eye of the wind. Directly into the wind; the point or direction from which the wind is blowing. See also IN THE WIND.

eyepiece, *n.* In an optical device, the lens group which is nearest the eye and with which the image formed by the preceding elements is viewed.

eye shade. See EYE GUARD.

eye shield. See EYE GUARD.