Current Measurements

Introduction

- The simplest method of determining the velocity of a current involves an observer, a floating object or drifter, and a timing device. The observer stands on an anchored ship with a timer. He or she then places the drifter (such as a piece of wood) into the water and measures the amount of time the drifter takes to move along the length of the ship. He or she then stops the timer after the object has traveled some distance, and measures that distance, noting the direction in which the object moved.

The observer then divides the distance the object traveled by the time it took the object to travel that distance, which equals the speed of the current.

- Ocean currents typically are measured in knots.
- The term “knot”, in reference to currents, is defined as one nautical mile per hour and is used to measure speed. A nautical mile is slightly more than a standard mile.
- 1 nautical mile = 1.15 miles = 1.85 kilometers

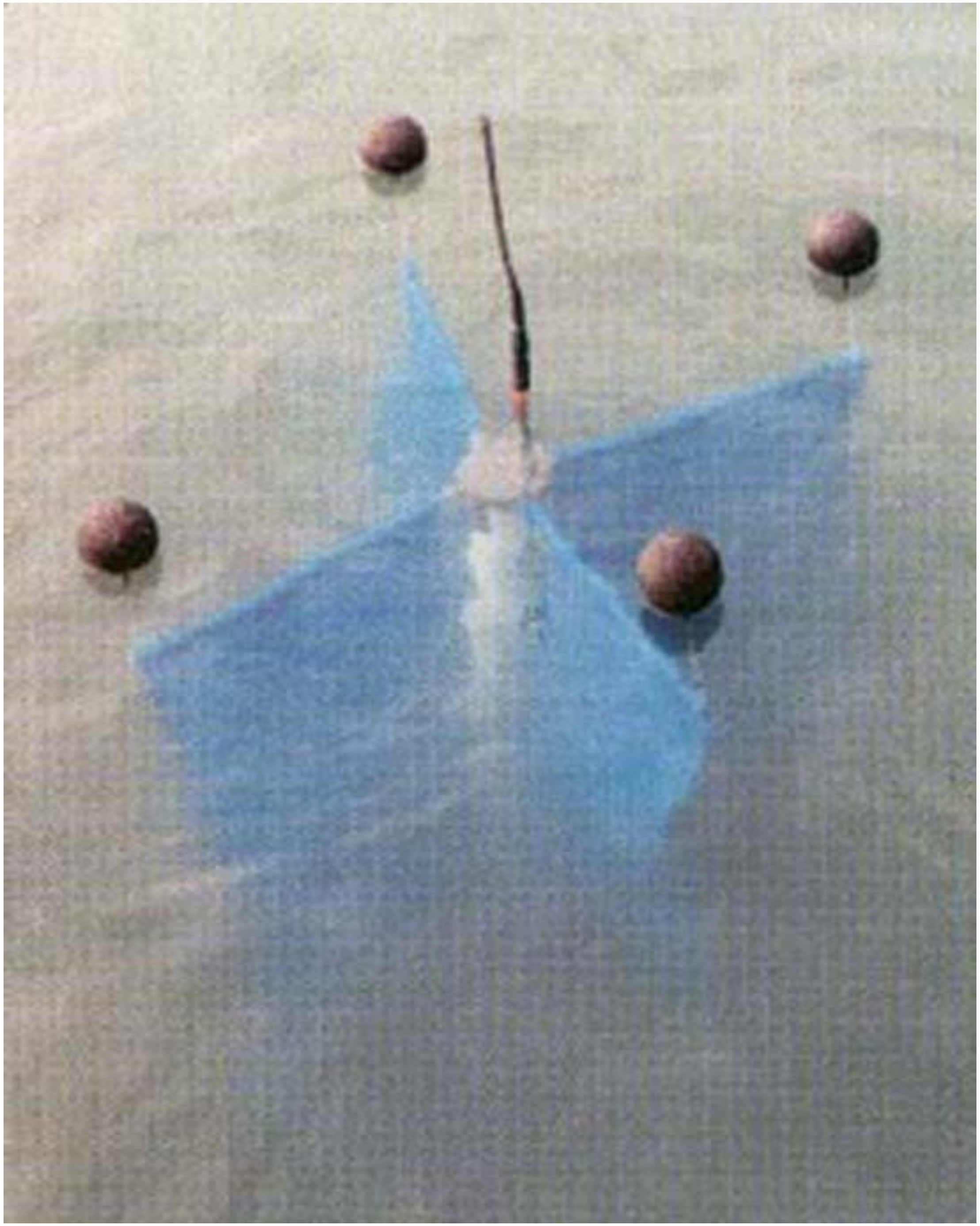
  1 knot = 1.15 miles per hour = 1.85 kilometers per hour

  1 knot = 20.251969 inches per second = 51.44 centimeters per second

Shallow Water Drifter

It is an instrument designed to measure wind-driven surface currents. It has four major components:

(1) body,
(2) sails,
(3) floats, and
(4) a data collection/transmitter package.

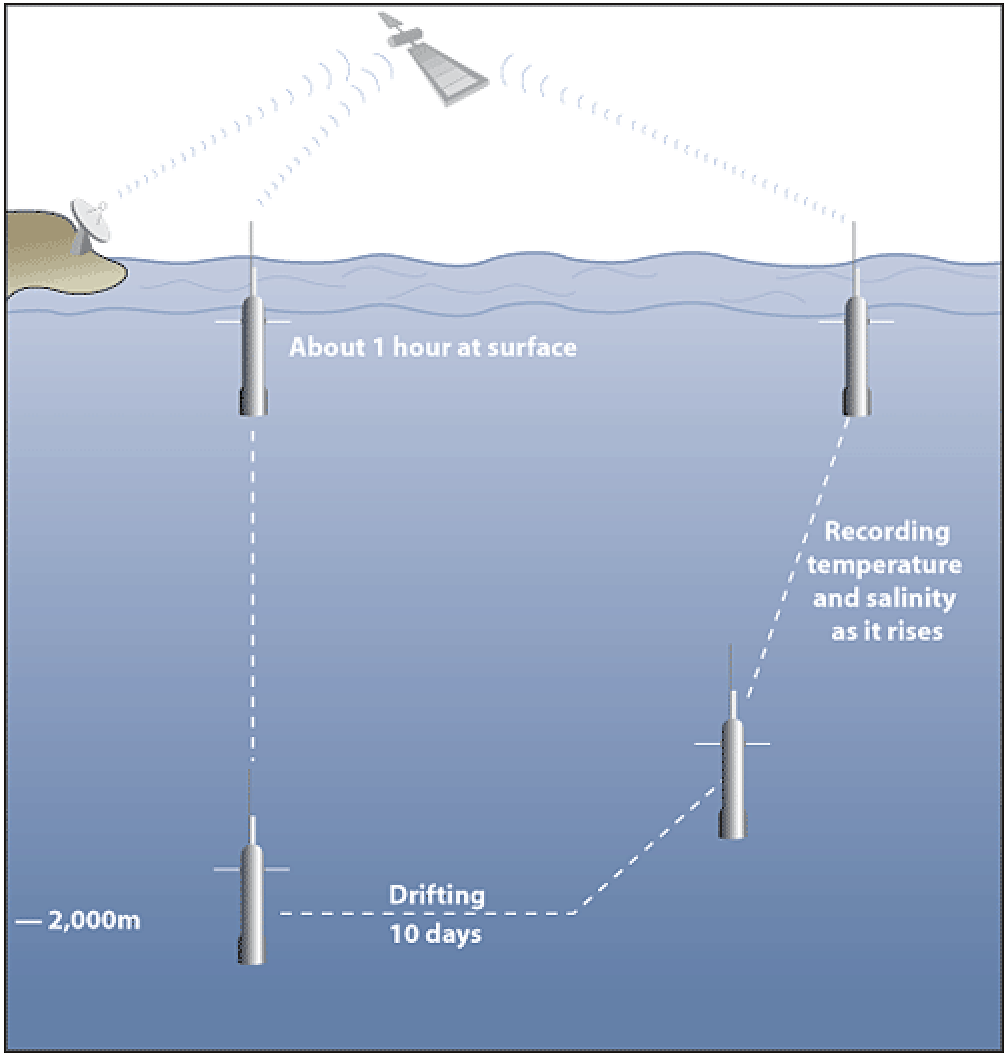


The body, which is a waterproof tube about 3 feet long and 10 inches wide, holds the collection/transmitter package. The sails extend out from the body as four pairs of cloth or vinyl “arms” with about 3 square feet of total sail area. The sails move the drifter along with the prevailing currents. The four floats are attached by ropes to the body of the drifter, keeping it suspended a few feet beneath the surface so that the drifter is not directly affected by the wind or waves.

The drifter’s transmitter sends signals to a polar orbiting satellite that calculates its position and relays this information to a receiving station. A typical drifter will transmit data for about one year before its power supply expires.

Deep Ocean Drifter(profiling floats)

While Davis drifters remain at the ocean surface during their deployment, profiling floats are programmed to sink to a particular depth and remain there for a specific period of time. At that depth, which scientists call a "parking depth", the profiling float drifts with the prevailing current. After the pre-programmed time period, the profiling float begins to rises to the ocean surface. As the profiling float ascends, it can be programmed to take a series measurements from the surrounding water, which may include the water's temperature, salinity, and pressure. When the profiling float reaches the surface, it transmits its data to an orbiting satellite to determine the profiling float's position, and begin to receive the profiling floats data. The satellite also receives information about the path the float has taken while it was drifting. When all of the float's data has been transmitted, the float sinks again to drift and the cycle is repeated. Floats are designed to make about 150 such cycles.


About 1 hour at surface
Recording temperature and salinity as it rises
Drifting 10 days
2,000m

ADCP (Acoustic Doppler Current Profiler)

An Acoustic Doppler Current Profiler (ADCP) measures ocean currents using the principle of "Doppler shift." An ADCP follows the premise of the Doppler effect. It emits a series of high-frequency pulses of sound that bounce off of moving particles in the water. If the particle is moving away from the instrument, the return signal is at a lower frequency. If the particle is moving toward the instrument, the return signal is at a higher frequency. Because the particles move at the same speed as the water that carries them, the speed of the water's current can be determined.

An ADCP is usually equipped with four acoustic transducers that emit and receive signals from four different directions. This allows the instrument to measure currents at different depths simultaneously. On large research vessels, the ADCP is often permanently mounted on the ship's outer hull and operates continuously. In very deep areas, they can be lowered on a cable from the surface.

Current Meters

1. **Ekman current meter**- contain propeller or horizontal wheel
2. **Shore-based Current Meters-** Shore-based current meters employ **radio antennas and high frequency** (HF) **Radio Detecting and Ranging systems (radar)** to measure surface ocean currents. Following the same premise of the ADCP, these shore-based instruments use the Doppler effect to determine when currents are moving toward or away from the shore.

If a **wind-driven current is moving toward the shore**, the **return signal is at a high frequency**. If the wind-driven current is moving away from shore, the return signal is at a low frequency. Scientists also use these measurements to determine the velocity of the current. **When two or more radar antennas are used, a scientist can calculate an entire field of surface current velocities** for thousands of points. Using this data, the scientist can produce a **"map" of surface currents for a large coastal area.**

This antenna uses high frequency radar to measure the direction and speed of ocean surface currents.

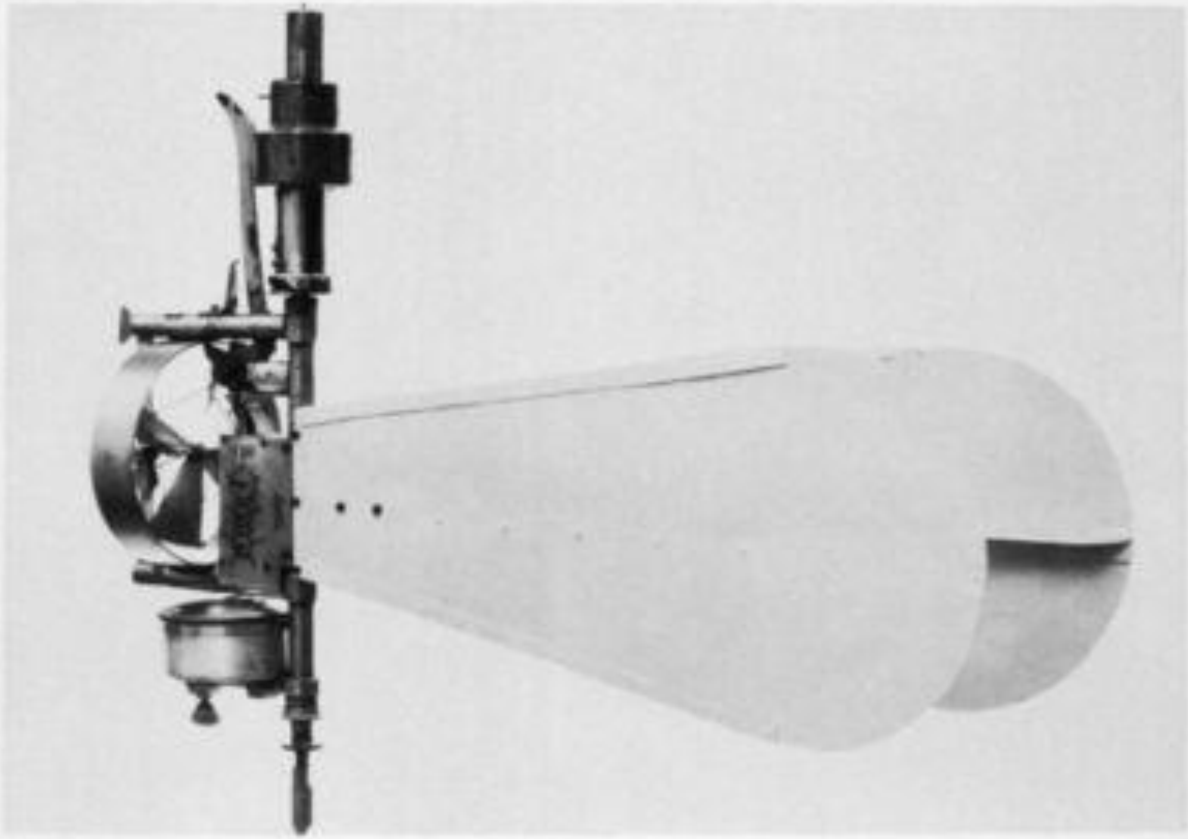


Figure 31. – Mesureur de courant de V.W. Ekman (n° 99 0613) (photo Y. Berard)

THANK YOU