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station provided with a receiver. Because the base station is provided with the data processing unit, the received position data can be processed and the wave height and current direction and speed in the point where the floating body is floating can be calculated.

Another GPS system for measuring the wave height and current direction and speed in accordance with the present invention is composed of a GPS device for measuring the wave height and current direction and speed, comprising a floating body capable of floating on a fluid such as seawater, fresh water, and the like, a GPS antenna for receiving GPS signals, a GPS receiver for processing the GPS signals received by the GPS antenna and measuring the three-dimensional position, a data recording unit for recording the position data relating to the three-dimensional position measured by the GPS receiver, a data processing unit for processing the position data and calculating the wave height and current direction and speed in the point where the floating body is floating, and a transmitter for transmitting the computed data relating to the wave height and current direction and speed, wherein the GPS antenna, the GPS receiver, the data recording unit, the data processing unit and the transmitter are installed on the floating body, and a base station equipped with a receiver for receiving the computed data transmitted from the transmitter.

With such a GPS system for measuring the wave height and current direction and speed, because the GPS device for measuring the wave height and current direction and speed, comprises the GPS antenna, GPS receiver, data recording unit, data processing unit, and transmitter, the computed data obtained by conducting observations with the GPS system and calculating the wave height and current direction and speed in the point where the floating body is floating are transmitted to the base station provided with a receiver. The received computed data can be immediately used in the base station.

In any of the above-described GPS systems for measuring the wave height and current direction and speed, the data processing unit can have installed therein a processing software for conducting the high-pass filter processing and smoothing processing of the position data for calculating the wave height and current direction and speed. Conducting the high-pass filter processing and smoothing processing of the position data with the processing software makes it possible to remove the GPS ephemeris error, atmosphere delay error, multipath error, and the like, contained in the height data for the floating body measured with the GPS receiver and to increase the accuracy in the height direction obtained by the independent GPS navigation method. In this case, appropriately determining the cut-off frequency of the high-pass filter enables the wave height to be measured with a high accuracy based on the swinging spectrum of the waves in the vertical direction, and appropriately determining the smoothing time (or a cut-off frequency of a low-pass filter) in smoothing processing (or low-pass filter processing) of the data relating to position in a horizontal plane enables the current direction and speed to be measured with a high accuracy based on the current information in a horizontal plane of the waves.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic cross-sectional view illustrating the structure of an embodiment of the GPS device for measuring the wave height and current direction and speed in accordance with the present invention; and

FIG. 2 is a graph illustrating a measurement example relating to wave height measurements conducted with the

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GPS device for measuring the wave height and current direction and speed in accordance with the present invention. FIG. 2-A shows data representing changes in GPS height with time, FIG. 2-B is spectral decomposition of the GPS height data shown in FIG. 2-A, and FIG. 2-C illustrates changes with time in the wave height after error removal.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The GPS device for measuring the wave height and current direction and speed and GPS system for measuring the wave height and current direction and speed in accordance with the present invention will be described below with reference to the appended drawings. FIG. 1 is a schematic view illustrating an embodiment of the GPS device for measuring the wave height and current direction and speed in accordance with the present invention, wherein the inside of the GPS device for measuring the wave height and current direction and speed is shown in the cross section thereof.

With the GPS device 1 for measuring the wave height and current direction and speed (for the sake of simplicity it will be hereinbelow referred to as "measurement device 1") as shown in FIG. 1-A and a measurement system using the measurement device 1, the measurement device 1 floats on the surface of ocean, sea, lake, marsh, river, and the like, without being anchored to the sea bottom or the like. Therefore, the device drifts with the tide or current. Three-dimensional position data obtained with GPS are used as means for measuring the wave height and current direction and speed at the same time. Thus, a GPS receiver 2 processes the GPS signals received with a GPS antenna 3 and measures a three-dimensional position of GPS antenna 3. The three-dimensional position data obtained with the GPS receiver 2 are recorded in a data recording unit 4 connected to the GPS receiver 2. Devices 2-4 are installed in a sealed state inside a floating body 5. If the measurement device 1 is caused to float in any place on the ocean, sea, lake, marsh, river, and the like, the measurement device 1 can move with actual waves or the flow of tide or current. As shown in FIG. 1-B, a data processing unit 6 has installed therein processing software 7 for conducting high-pass filter processing or the like. Three-dimensional position data recorded by the data recording unit 4 are processed with the processing software 7 in the data processing unit 6, the height of waves and the direction and speed of current on which the floating body 5 floats are calculated, and the calculated data are output.

The calculated data that were calculated by the data processing unit 6 and relate to the height of waves and the direction and speed of current on which the floating body 5 floats are directly transmitted from a transmitter 8 installed on the floating body 5 and are received directly or via a relay station by a base station disposed on a ship, aircraft, artificial satellite, ground base, or the like. The measurement device 1 and the base station constitute the GPS system for measuring the wave height and current direction and speed. Transmission with the transmitter 8 may be conducted at constant intervals or can be conducted in a real time mode each time the calculation is made.

In the GPS device 1 for measuring the wave height and current direction and speed and GPS system for measuring the wave height and current direction and speed, the data recording unit 4 is provided in the measurement device 1, but it is not necessary that the units up to the data processing unit 6 shown in FIG. 1-B be provided therein. In this case, the position data recorded by the data recording unit 4 can