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RECENT WORK ON WAVES, TIDES AND CURRENTS

G. Deacon

In introducing Sir George Deacon, FRS, who has recently retired as Director of the U.K. National Institute of Oceanography (NIO), Dr. W. J. Gibbs commented on the esteem in which Sir George is held throughout the world, and stressed, in particular, his work on the early (circa 1930) "Discovery" cruises to the Southern Ocean, which is still of vital importance today in any studies of that region.

Sir George opened his talk by briefly outlining the history and development of the marine sciences. He pointed out that, although a knowledge of the sea has been important from the earliest times, the marine sciences have lagged a little in the explosion of scientific research which has characterised the 19th and 20th centuries. This has been due particularly to the difficulties in conducting such research at sea, rather than in small laboratories, which even today remains very expensive in terms of ships, equipment and personnel. Sir George said that it was really the occurrence of natural and man-made disasters which had provided, and continued to provide, the greatest stimulus to research in marine science. Marine biology had developed first because of over fishing of certain fish species, while physical oceanography had received stimulus from such disasters as the sinking of the 'Titanic', World War II, and oil spillages at sea.

While pointing out that meteorology had developed initially from a concern for the safety of ships at sea, Sir George said that the emphasis in this field had shifted somewhat in later years, though the UK Meteorological Office still maintained a Marine Division. He said that the National Institute of Oceanography had been set up in 1949, and that systematic studies of the sea are now advancing as seamen and others gradually realised the value of such work.

In outlining recent work in wave research, Sir George said that until about 1944 work had centred on very simplified classical concepts of wave motion. However, the stimulus provided by World War II had aided in the development of spectral descriptions of the sea surface. Initially, workers had utilised the dispersion relationship of the various sea wave spectral components to locate distant wave sources through measurement of arrival times. Today the work has advanced to a state where comparisons made between predicted and observed three-dimensional sea-wave spectra during the passage of a cold front gave a clear indication that the winds were stronger than those inferred from the atmospheric pressure pattern over the sea.

In reviewing the instruments used for measuring waves, Sir George said that the ones most in use by the National Institute were pressure recorders placed some distance below the surface. However, these were fairly delicate instruments suitable mainly for research and not always for general or engineering purposes. These pressure recorders included one which could be used from a ship, but which unfortunately required the ship to be stationary to give accurate results. The most robust and generally useful instruments were the wave buoys developed by the Dutch, which incorporated accelerometers to measure two dimensional motions. The NIO also possessed an airborne instrument which utilised phase shifts in a 3 cm radar altimeter to give a wave profile.

Turning to work on ocean currents Sir George pointed out that knowledge of currents existed today mainly as averages over both space and time, but that these averages did not give any indication of day to day or small scale variations. Most currents are very dependent on wind systems, particularly on the eastern sides of oceans, and these currents also incorporate many small-scale eddies giving considerable daily variations even in such well defined flows as the Gulf Stream. In illustrating the effects of wind on currents, Sir George said that the oil from the "Torrey Canyon" was moved away from the English coast by a north-easterly wind against the average current chart. He said that deep currents were extremely complicated, and that, although very difficult to measure, there appeared to be one deep-sea current which travelled from the North Atlantic to the North Pacific via the Southern Ocean. Most of such measurements were now made using current meters moored from the bottom.

While metioning some of the work in marine biology, Sir George said that there were recent biological advances associated with better and more quantitative sampling using acoustic telemetry to control nets and to monitor their performance, but the main studies needed work on a long time scale and are not easy to fund.

In contrast to other ocean work, however, it was pointed out that studies of the sea floor were advancing quite rapidly. This was because the sea floor was relatively unchanging, and more readily amenable to study by universities and similar institutions. Because of this, much of modern geology and geophysics was now dependent on studies of the sea floor. An example of this was the work on continental drift.

In concluding his talk, Sir George mentioned that the volume and complexity of data now being accumulated about the marine environment required something more than just hand analysis. He said that this put an extra requirement on instruments to acquire data in digital form for machine processing. Sir George said that instruments such as satellites and Loran and Decca radar systems were aiding in more accurate navigation (down to 0.1 mi using satellite fixes), which in its turn led to a better knowledge of surface currents.

Among a number of questions which then followed, Mr R. De la Lande asked if Sir George knew whether buoys larger than the Dutch buoys were being used for oceanographic and meteorological data collection, and if so, with what degree of reliability. Sir George replied that some were in continuous use in the Bay of Biscay, for measuring deep currents with 70 to 80 per cent reliability. Dr W. Gibbs commented that finance may be available to purchase such instruments if the reliability of buoys could be demonstrated. Sir George said that he thought that the Norwegian firm Simrad had developed a reliable and fairly inexpensive buoy suitable for surface data collection.

In reply to a question on the establishment in Australia of an institute similar to the NIO, Sir George said that he thought it was a good idea to have theoreticians and experimentalists in related disciplines working together. However, he stressed that such an institution should not become too large (greater than 200 workers), and that if interest in one particular aspect of the work grew too large, then an additional group should be set-up as a separate organisation to supplement the continuing joint studies.

In answer to a question by Dr K. Spillane, Sir George said that many different authorities were now engaged in ship routing in different parts of the world. He said that ideally, however, such work should be done, initially at least, by

authorities which had the necessary communications facilities. He made particular reference in this regard to national meteorological services.

In moving a vote of thanks to Sir George, Dr. C.H.B. Priestley mentioned the great advances which had been made in knowledge of the sea in the last thirty or forty years, and again stressed the large part Sir George Deacon himself had played in these advances.

P.E.D.