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VII. Marine Resources

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The papers presented in the marine session may be broadly grouped into several classes: microwave region instruments compared to infrared and visible region sensors; satellite techniques compared to aircraft techniques; open ocean applications compared to coastal region applications; and basic research and understanding of ocean phenomena compared to research techniques that offer immediate applications. The fact that no papers were based on operational applications to the marine environment was not surprising since the instrumentation was designed for terrestrial applications and/or marine research. Nevertheless, the ensemble of papers has clear and direct impact on the Nimbus-G and Seasat-A research platforms planned by NASA for observational capability in 1978.

In this summary, overall implications of the marine session papers will be presented. First, the Landsat series of satellites has a greater role in coastal applications beyond that of serving as a surveillance tool and for general circulation observations (M-5, vol. I-C). The need for establishing a standard technique for measuring the linear distance of coastlines was illustrated (M-13, vol. I-C). Variations of two to one were found in the measured value depending on the agency making the measurement; automatic techniques using Landsat offer a systematic means of making this measurement on a time scale sufficient to show changes in the linear definition of the coastline.

Continuing with Landsat applications, a comparison of the information derived from the Skylab S190 and S192 experiments suggests that water penetration in tropical waters to depths of approximately 20 meters can be achieved (M-10, vol. I-C). This finding suggests that an operational Landsat system could have improved application to shallow water areas by including more of the blue-green portion of the visible spectrum. Further, it was illustrated (M-9, vol. I-C) that a rapid turnaround time of Landsat data, using onsite analysis of high-data-rate Landsat images at the NASA Goddard Space Flight Center coupled with low-data-rate facsimile transmissions by way of Applications Technology Satellite 3, can support oceanic applications in field survey data collection using in situ techniques. The implications of this possibility are important from needs expressed (M-8, vol. I-C) in relation to game fish and the work of the National Marine Fisheries Service in establishing relationships between water clarity and the locations of specific schools of fish. Near-real-time information potentially could support fishing vessel operations keyed to the 18-day Landsat repeat cycle or could extend the applications of the Nimbus-G coastal zone color scanner (CZCS) to immediate field utility and to circulation activities (M-5, vol. I-C).

The CZCS system was described (M-6, vol. I-C) in conjunction with performance of measurements using a breadboard scanner flown on an NASA U-2. Numerous implications are found concerning the measurement of ocean color. Also, such sensitive parameters as atmospheric and Sun-angle effects, which have been previously described as theoretical, are now being measured empirically and will soon be measured quantitatively. The use of the blue region has been demonstrated together with requirements for reducing atmospheric effects. This CZCS system will provide data on a more routine basis and will extend some suggested applications (M-7 and M-11, vol. I-C).

The oceanic use of active and passive microwave sensors from space was demonstrated in the Skylab S193 experiment. The altimeter portion and results from Experiment S193 were described (M-1, vol. I-C). This altimeter has been fundamental in the development of the third Geodynamics Experimental Ocean Satellite, launched in April 1975, and will be used for both instrument and experiment design for Seasat-A. This S193 experiment was one of the most successful Skylab oceanic experiments with the measurement of many large geoidal features to a resolution of ±1 meter.

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Two prime oceanographic variables for which reliable data are needed to improve safety at sea (surface roughness and wind) were discussed in papers M-2 and M-3 (vol. I-C). Both papers have direct bearing on the research and demonstration experiments planned for Seasat-A. Of particular note in paper M-2 is the possible parameterization of the wind field in terms of the wave spectrum by means of a nondimensional determination of the total energy. This approach may significantly reduce the computer time required by forecasting models. The usefulness of 1.4-gigahertz radiometers for measuring surface salinity in brackish water having salinity greater than 5 to 10‰ was demonstrated (M-12, vol. I-C). Spatial resolution limitations prevent development of this technique for satellite applications in the near future, but it could be implemented on an operational basis from aircraft.

The importance of monitoring the interface between the land and the sea was exemplified (M-14, vol. I-C). The marshland, vital to many forms of marine life, is being subjected increasingly to pressure from population expansion. The ability to monitor and observe changes in vegetation and vegetation health becomes increasingly important. Multispectral techniques for monitoring salinity-level effects on vegetation using aircraft scanners were described in this paper. Although the areas involved in some regions are large, relatively narrow bands of salinity-dependent vegetation may exist. Therefore, existing satellite resolutions may not be sufficient to classify all marshlands. It appears this technique could also be implemented on an operational basis from airborne platforms. It is noted that the 1.4-gigahertz-radiometer salinity measurement forms an excellent complementary tool for tracking brackish water characteristics near and within wetland areas free of immediate vegetation.

In summary, the papers included in the marine session were both timely and appropriate. Ten papers dealt primarily with coastal activity, an area that will receive increasing attention during the next decade as a result of both national and international needs. National needs are most strongly identified through the Outer Continental Shelf program involving the development of offshore facilities and international needs through the attention being given to extending jurisdictions from 12 to 200 nautical miles offshore. Studies of the global aspects of the ocean, reported in four papers, will lead to improved environmental forecasts both in the coastal states and in the open ocean. Safety at sea will become increasingly important as larger cargo and tanker vessels operate on the high seas and in the coastal region. Remote-sensing technology appears to be keeping pace with national and international needs; the problem is to translate and integrate the demonstrated technology into operational capability.