

5. METHODS

(i) Bathymetry

Naval systems are best suited to continue bathymetric work, although Landsat also appears to be useful in determining topography for depths less than 15 m or so. Landsat would be particularly useful in delineating areas that dry at low water.

(ii) Meteorology

Although there appears to be a need for automatic weather stations in more remote areas of the reef (especially north of Cairns), the validity of the Bureau's $3^{\circ} \times 3^{\circ}$ grid mean sea level pressure analyses for the determination of surface (10 m) winds and pressures at selected points remains to be examined. Should the data prove sufficiently accurate, then the time and expense involved in deploying and maintaining automatic weather stations would be minimized.

There appears to be a need to compile a general climatology of the Reef region from existing data in order to rationalise further the need for weather stations.

(iii) General Hydrography and Large Scale Circulation

A sound knowledge of the general seasonal features of the Coral Sea is already available, however, at any particular time and location, these cannot be adequately predicted and measurements would need to be

taken with CTD instruments for any particular experiment. As for the Coral Sea, general features of the hydrography in the Lagoon are also known, but there appears to be a need for more work examining the seasonal dependence of the hydrographic structure from the Lagoon to the Coral Sea as a function of latitude.

Long time series of sea level, temperature, salinity, nutrients, O_2 from pairs of instruments on both sides of the Reef (or from CTD casts) are useful in estimating permeability of the reef, and mixing rates on the inflowing and outflowing tide.

Satellite observations of sea-surface temperature, water colour (chlorophyll) and turbidity would aid hydrographic studies particularly in the vicinity of reefs and at various stages of the tide. In addition, aerial colour photography in conjunction with a passive tracer (rhodamine) might be used to study horizontal mixing in the reef and Lagoon areas, particularly in determining the role of flow through channels and across reefs in the dispersion of tracers.

On a smaller scale, the mixing studies outlined earlier have only just begun to highlight the importance of these mesoscale mixing processes, and much more work needs to be done in these areas before they can be said to be properly understood. In addition to CTD measurements, current mapping by ground based radar (Coastal Ocean Surface Radar, or COSRAD) is a potentially useful tool for these smaller scale studies.

(iv) Tidal Currents and Heights

The most important and effective methods appear to be the following:

Make and maintain a data register of current data.

Make a systematic program of simultaneous data observations on the coast, in the Lagoon, immediately inside and outside the reef, and in the Coral Sea. These data observations should include sea level, current, weather and ocean temperature, for the larger scale studies. Coastal ocean surface radar would help identify smaller scale effects of tidal currents.

Encourage analytical and numerical models as aids to understanding and as predictive tools.

(v) Long Period Currents and Heights

As for tides, current and sea level fluctuations of subseasonal period can best be examined by long time series of current and sea level data, ideally at locations inside and outside the reef. In particular, wind stress measurements are required for full analysis of these motions since they are predominantly wind driven (see Meteorology). In addition, for an analysis of flow within the reef, imposed pressure gradients (geopotential anomalies in the Coral Sea) would ideally be required and these would be obtainable from sea level measurements at the outer reef and in the Coral Sea. While there is substantial knowledge of shelf

waves in some regions of the reef, the role of other coastally trapped waves (Kelvin waves, edge waves, baroclinic waves in the Coral Sea), has not been resolved. Also there has been no very large scale study examining the coherence of propagation of such waves along the entire length of the reef.

Baroclinic motions in the Coral Sea appear to be important in raising deeper, nutrient rich water to a level where it can be advected onto the continental slope. While current moorings on the steeper parts of the slope (greater than 45°) are a difficult proposition, CTD measurements from vessels can determine a great deal about the climate of internal waves and intrusive effects. Little is known of inertial effects which may also be studied using current, height and CTD measurements.

The general hydrography and the baroclinic current field are closely related.

Numerical and theoretical models should be encouraged as an aid to understanding measurements.

(vi) Wind and Waves and Swell

Investigate swell wave dissipation by reefs and swell wave penetration through reefs by a combination of controlled laboratory experiments and field observation.

Supplement these studies with numerical hindcasting/forecasting of the wave field to build up a picture of offshore wave climatology.

Encourage the Beach Protection Authority to extend their regular monitoring program further offshore.

(vii) Tropical Cyclones

These might best be studied using techniques implemented by Imberger and Steedman on the north west shelf, and require relatively dense arrays of instrumentation before, during and after the passage of a Tropical Cyclone.