

## 4. EMERGING RESEARCH APPROACHES: DATA SYNTHESIS AND MERGING OF OBSERVATIONS AND MODELS

### 4.1 DATA SYNTHESIS

A recurring theme of this review is that the oceans remain disturbingly undersampled in all variables, but especially biogeochemical and biological variables. New sensors, systems, and platforms are improving our ability to study and monitor the oceans. Yet, still too limited resources will be available, requiring judicious deployment of ocean assets and optimal utilization of the precious data sets. Application of the concept of nesting of platforms and model computational grids will be critical. Clearly, end-to-end data management systems will be required for multi-use data sets, quality control of data, data synthesis, and modeling. Ultimately, effective close-knit collaborations among observationalists and modelers will be needed to select key variables and sampling locations and to design sampling arrays. One of the challenging issues will revolve around the idea of more intensive sampling of features or locations, which are perceived (based on data and model simulations) to have extraordinarily great influence globally. Since much of the world ocean is still very poorly sampled (e.g., South Pacific and South Atlantic, Indian Ocean, Southern Ocean), mobile and stationary (mooring) platforms will be necessary even in areas that may presently be thought to be of lesser importance.

The oceanographic community is already beginning intensive efforts to design a global ocean observing system, which will need to satisfy a broad set of interdisciplinary needs and applications in coastal and open ocean environments (e.g., Dickey, 2001b, 2002b; Dickey et al, 2002). Future comprehensive networks must be carefully designed to take fullest advantage of the various platforms. This will likely require formation of cooperative partnerships, which involve governmental agencies at various levels (e.g., local, regional, national, and international), private industry, private foundations, and academic and research institutions.

One of the longstanding problems is sustainability of ocean sampling. An important factor in sustaining ocean observing networks is public interest and demonstration of utility. Again, a good example is the use of the TAO array and complementary satellite observations along with model predictions, which are contributing to the public's knowledge of ENSO and its societal and economic impacts (McPhaden et al., 2001). Clearly, the synthesis and visualization of these data sets and model simulations are critical elements.