Title

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The Real-Time Environmental Information Network and Analysis System (REINAS) supports both real-time and retrospective regional-scale environmental science, monitoring, and forecasting. It is being developed by the University of California at Santa Cruz (UCSC), the Naval Postgraduate School (NPS), and the Monterey Bay Aquarium Research Institute (MBARI)

Users of REINAS observe, monitor, and analyze regional oceanographic and meteorological phenomena; the initial focus is the local Monterey Bay air/ocean phenomena. Unique to REINAS is its emphasis on regional-scale, interactive, real-time measurement and monitoring. The system and data management architecture are both designed to provide members of the oceanographic and meteorological communities with the ability to identify and visualize phenomena as they occur in real-time and to react to emerging phenomena and trends by reconfiguring instruments at sites of interest. For example, through the system, users have the ability to steer a video camera in the direction of an approaching meteorological front over the Bay or increase the sampling rate of remote instrumentation of particular interest. Applying such capability to environmental and coastal science is currently an area of considerable interest to many fields, including environmental assessment, prediction, and protection.

Continuous real-time data is collected from a variety of dispersed sensors and stored in a logically integrated but physically distributed database. An integrated problem solving environment has been developed to support visualization and modeling by users requiring insight into historical, current, and predicted oceanographic and meteorological conditions. REINAS supports both simple-user and collaborative scientific work in a distributed environment.

The visualization environment provides investigators with pictures of environmental features, trends, relationships, and dynamic behavior in a geographic context. Techniques are being developed to fuse data from sensors, the historical database, and models. Automatic methods of alerting users to interesting changes in the environment are being developed.

Instruments are connected to REINAS by both remote radio and land-line links. The system is designed so that new instruments can easily be added and assimilated by the data management and visualization subsystems.

The data management structure is designed around a data architecture integrating data from multiple instrument technologies, which include high-frequency radar instruments designed to measure ocean surface currents (CODARs), radar wind profilers, and meteorological stations (which measure quantities such as wind speed/direction, air temperature, humidity, barometric pressure, solar irradiance, and rainfall). Additional instruments include those deployed on oceanic buoys (such as ADCP, the thermistor chains, and CTD). Satellite images and video are also recorded and stored with the existing data management architecture. Any instrument that can provide a serial output stream or file can potentially be connected to the REINAS system in a real-time fashion.

The wealth of regional data available both in real time and retrospectively has a number of significant implications to the field of environmental protection. For instance, near real-time maps of ocean surface current circulation (based on CODAR data) are available over the Internet within one hour from the time the measurements were made. Such data are therefore accessible to a wide audience quickly and in the event of a spill of oil or other hazardous material, cleanup and containment activities would be greatly assisted by the rapid availability of such information.

Additionally, the standardized interfaces to both real time and retrospective data allow users unique access to information concerning historical events and trends, as well as provide necessary information to run regional nowcasting and forecasting models, which can be both mesoscale oceanographic and mesoscale atmospheric. Both the models and the data that drives them can play an important role in the assessment of the current and

near-future environmental conditions. Such information is of great potential assistance to those concerned about environmental protection.

In addition, to the information collected from sensors of physical phenomena (which are described above), chemical and biological sensors are also easily added into the REINAS system with the existing available architecture. Examples include sensors often associated with environmental protection, such as those designed to measure SO_2, NO, CO, and ozone. This information alone is of value in the identification of pollution hot spots, and it is complemented by the results of nowcasts and forecasts of regional circulation.

The REINAS architecture provides environmental engineers and scientists with a set of system tools designed as a backbone for regional measurements. When coupled with an assortment of regional instrumentation, this system offers unique capabilities to those interested in environmental management, assessment, and protection.