1998 CLIMATE STUDIES WITH THE *R/V RON BROWN*'S NEW C-BAND DOPPLER RADAR

In the spring and summer of 1998 NOAA will be cooperating with the National Science Foundation, the Department of Energy, and the National Aeronautics and Space Administration in a series of three scientific investigations in equatorial regions of the Indian and Pacific Oceans. Although the specific applications will be different, the new C-band Doppler radar on the Brown will be a key instrument in each of these studies. Although it is intended primarily for research, the Doppler capability makes the *Brown's* radar the seagoing equivalent to the weather service's WSR-88D Doppler radars, which were recently deployed in a network around the US to improve aviation safety and severe weather forecasts. Conventional radars provide information on location and intensity of precipitation from the strength of the radar return; the Doppler capability provides additional information on the wind structure of the storm. The ship will also be instrumented with numerous other measurements systems to observe the atmosphere and ocean. These will include measurements of atmospheric profiles of wind, temperature, humidity, aerosols, clouds, and precipitation plus related profiles in the ocean (temperature, salinity, currents). A remarkable suite of radiometric instruments will be aboard to measure microwave, infrared, and solar radiative fluxes coming from the atmosphere and ocean.

The first study will be the Joint Air-Sea Monsoon Investigation (JASMINE) which is sponsored by NOAA and NSF. The study will be conducted in April and May in the vicinity of the Bay of Bengal between 5 S and 15 N latitude. The principal participants are the NOAA Environmental Technology (ETL) and Pacific Marine Environmental Laboratories (PMEL), the Universities of Colorado, Hawaii, Washington, and the Commonwealth Scientific and Industrial Research Organization of Australia. Monsoons are periods of heavy rainfall associated with strong land-sea surface temperature contrasts that occur twice a year. JASMINE will evaluate similarities and differences of storms in the Indian Ocean with other regions that have been more heavily studied (e.g., the equatorial Pacific and N. Atlantic) and investigate how the storms and their associated strong winds, sun-blocking clouds, and precipitation interact with the ocean to modify the sea surface temperature and the surface current structures. Climate models must be able to capture these coupled interactions to successfully generate short-term forecasts of interannual climate variations, such as El Nino and the intensity of the monsoon. The *Brown's* radar will be the principal observing system to characterize the spatial structure of the precipitation systems and to provide quantitative values for the rain rates over a large area of the ocean. Heavy rain is thought to play an important role in stabilizing the upper 10's of meters of the ocean so that it tends to trap solar heat (analogous to an oceanic greenhouse effect).

Following the JASMINE mission, the Brown will proceed to its second mission in this series. In June and July 1999 ETL will host a joint NOAA/DOE (Department of Energy) campaign designated *Nauru-99* near the island of Nauru in the tropical Western Pacific as part of a series of DOE Atmospheric Radiation Program climate studies of cloud-radiation interactions. For Nauru-99, the *Ronald Brown* will use an the most impressive array of atmospheric and near-surface oceanographic sensors ever assembled on a ship. This mission is a follow-on to two previous investigations conducted aboard NOAA research vessels in the North Atlantic in 1992 and near Papua New Guinea in 1996. Nauru-99 will concentrate on comparisons and synergism with a similar set of observations to be made by DOE's instrumented site on Nauru and on the Japanese Marine Science and Technology Center's new research vessel *Mirai*. Please visit web site http://www.etl.noaa.gov/nauru99 to learn more about the mission plans and the instrument suite. Besides ETL, participants will include the other NOAA laboratories, the University of Miami, Pennsylvania State University, the Max Planck Institute of Hamburg, Germany, and the DOE Brookhaven National Laboratory. Because the *Mirai* also has a C-band Doppler radar, joint operations by both ships will allow us to make so-called *dual-Doppler* measurements that will permit unambiguous determinations of vertical motion in the storms, the single most important variable associated with storm dynamics. These observations will allow us to test and improve climate model parameterizations that relate vertical motions to the balance of cloud water drops, ice particles, rain, and snow produced at various locations in the storm. This partitioning affects the growth/decay of the storms and how much sunlight the region reflects, absorbs, or transmits.

Following Nauru-99, the *Brown* will support a joint NOAA/NASA effort to study tropical rainfall near the island of Kwajalein, dubbed *KWAJEX*. The primary objective of KWAJEX is to provide surface-based

precipitation measurements of various kinds of rainfall to validate satellite radar measurements made by the joint Japanese/U.S. Tropical Rainfall Measurement Mission (TRMM) satellite. The combined measurements will help future satellites better measure rainfall, on a global scale. Data from the mission will also be used to test climate models and improve their prediction of rainfall, through better understanding of cloud dynamics over the tropical ocean.