DYNAMO — A Scientific Project in the Indian Ocean to Understand Global Climate

As the global climate changes, it becomes more urgent to understand how the oceans and atmosphere work together to regulate the earth's temperature and to respond to its long-term variation. The study of climate aims at quantifying the degree of global temperature changes and their consequences, such as sea-level rise, with increasing detail. This information can be used by national/local governments and society to plan mitigation and adaptation strategies. Such quantitative information requires detailed knowledge of the structures and evolution of the atmosphere and ocean in the tropics.

The Indian Ocean is one of the earth's most sensitive regions where ocean and atmosphere interact to affect the global climate. What happens here sends impulses out over much of the globe via a phenomenon called the Madden-Julian Oscillation, or MJO. The MJO starts over the equatorial Indian Ocean and can have impacts on global weather and climate. In 2011-2012, an group of meteorologists, oceanographers, and climate scientists from the U.S., Japan, Australia, France, India, Indonesia, Maldives, Seychelles, Taiwan, and the UK will gather in the equatorial Indian Ocean for a major scientific project to observe the development of the MJO at its source. This project is called CINDY2011/DYNAMO, which stands for Cooperative Indian Ocean Experiment on Intraseasonal Variability in Year 2011/Dynamics of the MJO. The project is endorsed by the World Climate Research Programme.

Although the atmosphere and the oceans are regularly monitored by satellite, many of the important details cannot be observed from space. To understand the MJO, special observations need to be taken with instruments at the earth's surface. In DYNAMO, specialized instruments will be deployed and operated on ships and islands. Islands far away from mainland provide an ideal platform to make observations from the ground in an otherwise oceanic region. In the equatorial Indian Ocean, the Addu Atoll in the Maldives has the ideal combination of location in the zone of weather that organizes the MJO and physical infrastructure to support complex land-based and airborne observing facilities that are needed for DYNAMO. The observations in the Addu Atoll are very important to the success of this project.

One of the most important types of instruments to be operated during DYNAMO are meteorological radars, which provide information about what is happening inside of the clouds and rainstorms that lead to the development of the MJO. Different kinds of radars are needed to observe clouds that are raining, clouds that are not raining, and moisture in the surrounding clear air. Weather balloons also need to be launched to observe the vertical structure of the

atmosphere in a constant fashion over long periods of time. Surface radiation budget is another critical factor in the earth's climate that needs to be observed. Detailed physics within clouds are to be measured by instrumented research aircraft.

DYNAMO plans to operate about five radars, a balloon sounding unit, a suite of measurements of surface radiation from the US, and a French research aircraft on the Addu Atoll. These instruments will be distributed at three different sites on the atoll and be coordinated with observations being collected on two research aircraft (the other will be based on Diego Garcia), three ships that will be stationed to the east of Gan and Diego Garcia.

The DYNAMO experiment is planned to last six months, from 1 October 2011 to 1 April 2012. Professor Chidong Zhang from the University of Miami in the U.S. is the leader of the project. The project is funded by the U. S. National Science Foundation (NSF), Department of Energy (DOE), Office of Naval Research (ONR), National Oceanic and Atmospheric Administration (NOAA), and National Aeronautics and Space Administration (NASA). International support comes from Japan India, France, the Maldives, and other countries.

The results of DYNAMO will help researchers better understand and forecast the weather and climate of the equatorial Indian Ocean and around the world. An improvement in the climate prediction will have local benefits (e.g., better projection of sea-level changes) and will form a scientific base useful for decision making on climate adaptation and mitigation locally and globally.