Establishing Priorities for Interdisciplinary Arctic Ocean Science

Arctic in Rapid Transition (ART) Initiation Workshop; Fairbanks, Alaska, 7–9 November 2009

PAGE 144

The Arctic is undergoing rapid environmental and economic transformations. Recent climate warming, which is simplifying access to oil and gas resources, enabling trans-Arctic shipping, and shifting the distribution of harvestable resources, has brought the Arctic Ocean to the top of national and international political agendas. Scientific knowledge of the present status of the Arctic Ocean and a process-based understanding of the mechanisms of change are required to make useful predictions of future conditions throughout the Arctic region.

A step toward improving scientists' capacity to predict future Arctic change was undertaken with the Second International Conference on Arctic Research Planning (ICARP II) meeting in 2005 (http://web.arcticportal.org/iasc/icarp). As the ICARP II process came to a close, the Arctic in Rapid Transition (ART) initiative developed out of an effort to synthesize the several ICARP II science plans specific to the Arctic marine environment.

The ART initiative is an integrative, international, interdisciplinary, long-term pan-Arctic program to study changes and feedbacks among the physical and biogeochemical components of the Arctic Ocean and their ultimate impacts on biological productivity. The ART process has been unique, in large part because the steering group is composed almost entirely of early-career scientists.

The first ART workshop was held at the International Arctic Research Center (IARC) in Fairbanks, Alaska, with 58 participants from nine countries. More than half of the participants were early-career scientists. The workshop began with six keynote speakers from various disciplines, which set the stage for working group meetings that took place on the first and second days.

Three major questions emerged from workshop discussions that will form the basis for an ART science and implementation plan: (1) How are recent transitions in sea ice connected to energy flows, carbon cycling, biodiversity, and biological productivity, and how do these compare to past and projected shifts? (2) How will biogeochemical cycling respond to transitions in terrestrial, gateway, and shelf-to-basin fluxes? (3) How do Arctic organisms and ecosystems respond to changes in temperature, vertical stratification, seasonal ice zones, and pH associated with current environmental transitions?

The goal of the forthcoming ART science and implementation plan is to integrate, update, and develop priorities for Arctic marine science over the next decade. More specifically, the ART initiative will focus on bridging gaps in knowledge not only across disciplinary boundaries (e.g., biology, geochemistry, geology, meteorology, physical oceanography) but also across geographic boundaries (e.g., shelves, margins, central Arctic Ocean, international borders) as well as temporal boundaries (e.g., paleorecords, current observations, future modeling). The approach of the ART initiative will provide a means to better understand and predict future change in the Arctic Ocean system, with a particular focus on the ultimate consequences for biological productivity.

The ART workshop was sponsored by the U.S. National Science Foundation, Arctic Ocean Sciences Board/International Arctic Science Committee, IARC, Research Council of Norway, Fisheries and Oceans Canada, Association of Polar Early Career Scientists, and Leibniz Institute of Marine Sciences at University of Kiel (IFM-GEOMAR). More information and updates on the ART initiative can be found at www.aosb.org/art.html.

—KAREN E. FREY, Graduate School of Geography, Clark University, Worcester, Mass.; E-mail: kfrey@clarku.edu; JEREMY T. MATHIS, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks; and CAROLYN WEGNER, IFM-GEOMAR

Addressing Scientific Challenges for Air Quality Forecasting

International Workshop on Air Quality Forecasting Research; Boulder, Colorado, 2–3 December 2009

PAGE 145

The past decade has seen explosive growth of emissions-based air quality (AQ) forecasting from a fledgling enterprise practiced by a few dedicated groups to a global network of daily AQ forecasts provided on local to global scales. These forecasts are used by health, environmental, and meteorological agencies in a host of AQ-related services. The provision of daily operational AQ forecasts, however, comes with challenges different from those faced by the weather forecasting or regulatory AQ modeling communities. A loosely knit group of practitioners has worked to address these scientific challenges, resulting in improvements to AQ forecast skill and reliability over time.

The International Workshop on Air Quality Forecasting Research (IWAQFR) was established in response to the emerging need for a regular series of scientific meetings to promote the science required to support AQ forecasting around the globe. The organizers (Jim Meagher and Paula Davidson, U.S. National Oceanic and Atmospheric Administration (NOAA); Mike Howe, Véronique Bouchet, and Craig Stroud, Environment Canada (EC); and Greg Carmichael, University of Iowa) envisioned the workshop as a venue for presenting current science issues and advancements related to AQ forecasting. The organizers hope to build a more formal community of researchers whose primary focus is improving operational AQ forecasts. The IWAQFR target audience includes developers of operational AQ forecast models, researchers who specifically support these forecasts, scientists improving predictive capabilities of particular interest to AQ forecasting, and operational users of these models.

IWAQFR 2009 consisted of 29 oral and 33 poster presentations organized around the following five themes (chairs are shown in parentheses): Challenges in particulate matter forecasting (Jerome Fast, Pacific Northwest National Laboratory); Treating intermittent sources in forecast models (Stuart McKeen, NOAA); Air quality and weather forecasts: Two-way interactions (Véronique Bouchet); Post processing of air quality forecasts (Mike Moran, EC); and Chemical data assimilation in air quality forecasts (Greg Carmichael).

Workshop discussions identified some common needs and goals of the AQ forecasting community. Improvements to model components, input data availability, and forecast products aim to provide more accurate daily forecasts over the domain of interest. The emerging use of fully coupled online meteorological and AQ models enables the investigation of feedbacks between meteorology, reactive gases, and particulate matter. The community is also improving forecasting skill by using an array of statistical postprocessing methodologies, model ensembles, and data assimilation. All of these efforts require a high density of timely observations at the surface and aloft, particularly of chemically speciated particulate matter, and near–real time information on intermittent emissions sources such as fires and dust storms.

Sponsored by NOAA and EC, IWAQFR 2009 was the first of what organizers hope will become an annual event. A list of participants, presentations, and a full report of the discussions is available at http://www.esrl.noaa.gov/csd/events/iwaqfr/.

—GREGORY J. FROST, University of Colorado, Boulder; and NOAA, Boulder, Colo.; and JAMES F. MEAGHER, NOAA, Boulder, Colo.; E-mail: gregory.j.frost@noaa.gov