Field Techniques for Sea Ice Research

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FIELD TECHNIQUES FOR SEA ICE RESEARCH. H. Eicken, R. Gradinger, M. Salganek, K. Shirasawa, D. Perovich, and M. Lepparanta. Fairbanks: University of Alaska Press, 2009. 566 pp. $65.00 (hardcover). ISBN 978-1-60223-059-0.

Over the past two decades, the editors of this book have conducted a series of graduate and undergraduate field courses on sea ice. Since I and several of the editors came of age in the era of apprenticeship and on-the-job training in sea ice research in the 1970s and 1980s, "at the knees of the masters" (in my case, Willy Weeks), the presence of sea ice field courses is, in itself, an epochal change in how the field has evolved. Not to speak of the small numbers of students that were actually working (or interested) in the field who would be available to take a course then, a dramatic increase roughly in inverse proportion to the decline of Arctic summer sea ice extent, as seen in recent years. This increasing interest in polar science, particularly in sea ice change as a concrete manifestation of global warming, and the International Polar Year (2007–2009) as a period of both intensive activity and engagement of the public through education and outreach components motivated the editors/authors to develop what they call a handbook on sea ice measurement techniques. It is much more than that, however.

I approached the review of the book from two perspectives: the first is whether it would provide new and old researchers in the field some shortcuts to conducting fieldwork in their own specialties, so that they could avoid some of the pitfalls that most of us have encountered. These are all too numerous to recount, but some examples are pens that don't write in the cold and power augers that rotate in the wrong direction for certain ice drills, to more esoteric problems like computer screens that freeze up and materials that differentially contract and expand on temperature cycling (leading to puzzling and intermittent outages in some cases). The second approach is whether the book provides overviews on other specialties' techniques and goals so that, for example, an ice physicist can see what the biologists are after, and vice versa, and lead to perhaps better interdisciplinary connections in sampling or providing post field analyses.

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The first two sections, while short, are of interest to all readers and even to those with only general interest in the polar regions. Some first-person experiences with sea ice are recounted by a former icebreaker captain, a marine ecologist, an indigenous whale hunter, a career researcher, and a policy analyst, followed by description of a sea ice systems framework. In the sea ice systems framework, policy issues, from the effects of sea ice change for the provisioning of indigenous peoples, to transportation-related problems such as search and rescue, to oil and gas resource development and oil spill cleanup issues, to effects on climate and sea ice ecosystems, are placed into four categories for sea ice systems services: Regulating, Provisioning, Cultural, and Supporting. These categories have their spatiotemporal scales for sampling rates and sampling areas that sometimes overlap but also have unique requirements as well. This chapter gives a context to the utility of separate categories of Arctic sea ice research and also to how they might interact in future under various policy scenarios such as a global free-for-all; or an adaptive future with treaties, environmental protection, sustainable development; or a fortress frontier where national interests dominate through exclusive economic zones and restricted passageways.

The substance of the book, however, is the eighteen chapters in Section 3, covering almost 500 pages and devoted to specific and overview topics in sea ice research. The first few hundred pages of that section with chapters on snow measurements, ice thickness, ice properties (structural, strength, and optical) provide basic knowledge on equipment, sampling, and techniques. The remainder gives overviews of topics like modeling, remote sensing, ice observations from vessels, and automatic measurement systems, for more general information. In relation to my first perspective, avoiding past pitfalls, I particularly enjoyed Christian Haas and Matthew Druckenmiller's Tips and Tricks in the chapter on "Ice Thickness and Roughness Measurements." These tips were divided into several categories, but a couple of illustrations from mechanical drill-hole measurements showed that they have either learned from experience or listened well from others' experiences (myself included). For example, "make sure couplings are tight, …many flights have been lost to the sea floor" (hmmm); or "watch your hands when touching flights …cuts have been reported" (yup), or "watch clothing (e.g. scarves) which can get wound up and strangle you" (not yet, but thanks for the warning!). Straight-forward advice that is absolutely crucial for the success of a field research program, that is, take care of your equipment and take care of yourself. The review chapter on "Measurements and Modeling of the Ice-Ocean Interaction" by Kunio Shirasawa and Matti Lepparanta both nicely explains the theory of oceanic boundary layers and the various techniques of measuring the properties of the ice-ocean interface. It provides some of that interactive quality to place those measurements in the context of an interdisciplinary sea ice study so that other specialists, on ice properties, for example, can contribute and interact well with the ocean fluid dynamicists in interdisciplinary field studies. Two chapters are truly innovative and provide recent experiences in the co-joining of scientific information on sea ice and traditional knowledge on sea ice from indigenous peoples. These are on "Studying Seals in their Sea Ice Habitat" and "Community-Based Observation Programs and Indigenous and Local Sea Ice Knowledge." Brendan Kelly's account in the studying seals chapter on how he trains his Labrador retrievers to find seal dens is also a delight for dog lovers everywhere. It would be particularly appealing to use educationally for younger students, giving them, along the way, a great perspective on

conducting field research and the unique habitat that sea ice provides for marine mammals.

There is also an accompanying DVD with the volume that provides a particularly good device for pre-field training or general background on sea ice research. It contains demonstrations of equipment, interviews with some of the scientists, and animations of the technologies used, such as how electromagnetic induction works to measure sea ice thickness. We used the DVD recently in a short course on polar sciences for K–12 teachers and it was particularly useful for conveying the realities of sea ice research (even during Texas summer) and understanding how these technologies are applied to this research to that group.

While achieving its goal of providing a handbook (and a good one at that) on field measurement techniques, the editors and authors have also given us a nice lasting outcome of International Polar Year—that of setting a standard for what sea ice measurement programs should look like in the future, and how interdisciplinary science, traditional knowledge, and a multiplicity of sea ice measurement applications varying from climate to resource development to whale-hunting, can be best understood.

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